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7 October 2019

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED NEW SUBDIVISION
278 CLEVEDON-KAWAKAWA ROAD
CLEVEDON

Prepared For:
Stratford Properties Limited
PO Box 62-611
Greenlane
Auckland 1546

KGA Geotechnical Group Limited
Supporting the Construction Industry since 1990

7A William Pickering Drive | Albany | Auckland
P O Box 302 361 | North Harbour | Auckland 0751
09 478 6655

Unit 3, 201 Opawa Road | Hillsborough | Christchurch
P O Box 7630 | Sydenham | Christchurch 8240
www.kga.co.nz 03 343 5302

REPORT ISSUE AUTHORISATION

Geotechnical Investigation Report
Proposed New Subdivision
278 Clevedon-Kawakawa Road
Clevedon

Prepared by:



Giovanni Pradel

BSc, MSc (Geology)
Geologist

Reviewed by:



Gary Tang

BSc (Hons), MEngNZ, CGeol, FGS
Lead Engineering Geologist

Authorised by:



R. J. Hutchison

BE, MSc, DIC, MICE, CEng(UK), FEngNZ, CPEng
Principal Geotechnical Engineer

EXECUTIVE SUMMARY

Geotechnical Investigation Report
Proposed New Subdivision
278 Clevedon-Kawakawa Road
Clevedon

SUBSOIL CONDITIONS (See borehole logs for details)	Geology	Tauranga Group Alluvium
	Lithology	Clayey SILT / Silty CLAY, sandy SILT / Silty SAND with minor fine to medium gravels
	Groundwater depth	Between 1.3m and 3.8m below ground level
	Shrink/swell classification (AS2870:2011)	Class 'M' (moderately reactive)
	Soil classification as per NZS 1170.5:2004	Class 'C'
SITE STABILITY COMMENT	<ul style="list-style-type: none"> • Provided the recommendations in section 12 are followed, slope stability is not considered a concern for the site. 	
SITE FORMATION CONSTRAINTS	<ul style="list-style-type: none"> • Provided that excavations no greater than 0.5m are undertaken within natural soils, they are expected to be temporarily stable. All excavations are recommended to be covered with GAP20 or similar hardfill to prevent the soils from drying out. 	
FOUNDATION RECOMMENDATIONS (see Section 12 for complete text)	<ul style="list-style-type: none"> • Provided that the structure is located a minimum of 4.5m away from the edge of slopes with gradients 1:4 or steeper, an NZS 3604:2011 type structure, founded on conventional shallow foundations is considered to be appropriate. • For shallow foundations, an ultimate unfactored bearing capacity of 300kPa may be adopted. • Where the building platforms are located within 4.5m of slopes with gradients 1:4 or steeper or comprises heavy construction materials, specific geotechnical engineering input is required. 	
REPORT DISTRIBUTION	<p>A full copy of this report must be provided to all relevant parties involved in the project. This should include, but not be limited to, owner, architectural designers, engineers (civil and structural) and the earthworks/building contractor.</p>	

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Attachments:-

Sheet 1	Site Plan
Sheet 2	Geological Cross Section A-A'
Sheet 3	Geological Cross Section B-B'

Appendix A: Draft Concept Plans and Survey Drawings (Greenwood Associates & Lands and Survey)

Appendix B: Subsurface Investigation Records (Hand Auger Boreholes and CPTs)

Appendix C: Slope Stability Analysis

Appendix D: Liquefaction Assessment Results

1. INTRODUCTION

At the instruction of Stratford Properties Limited, we have carried out a geotechnical engineering investigation for a proposed residential subdivision at 278 Clevedon-Kawakawa Road, Clevedon. The scope of our investigation was to conduct a detailed site walkover inspection and to explore subsurface conditions using hand operated equipment and cone penetrometer testing. The information obtained has been used to assess ground conditions, review site stability, determine the presence of a safe and stable building platforms and access to it and provide preliminary geotechnical considerations for future development.

This report presents our findings and conclusions and has been prepared in support of a Resource Consent application.

2. SITE DESCRIPTION

No. 278 Clevedon Kawakawa Road, Clevedon is legally described as Lot 1 DP 146882 and has a total plan area of 51.7 ha. The Lot is approximately rectangular in shape, and is located to the south of Wairoa River and to the north of Clevedon-Kawakawa Road, with access via a private driveway from no 272 Clevedon-Kawakawa Road. The site is bound to the east and west by farm land properties.

The proposed development area (herein referred to as 'the site') is located within the southern portion of the property, towards Clevedon-Kawakawa Road, where an irregular shaped raised knoll and an elevated strip along the road front are located. The strip along the road front slopes gently to the north reaching a maximum gradient of 1 Vertical on 10 Horizontal (1V:10H). The surface of the raised knoll, which is located approximately 200m north of the road is relatively flat to gently sloping with the sides of the knoll gently to steeply sloping reaching a maximum gradient of 1V:3H.

The site consists almost entirely of open green pastures with some minor bushes and trees located along the southern fence line. The surrounding low lying areas below the knoll and southern strip have all been designated as flood plains, truncated by several overland flow paths.

The property is not currently serviced by a public stormwater or sewer network. An indication of the current topography and existing features is shown on the Site Plan (Sheet 1).

3. PROPOSED DEVELOPMENT

Drawings provided to us by Greenwood Associates titled “Stratford Properties - 278 Clevedon-Kawakawa Road Clevedon, Auckland” drawing No. 912/1 and 912/2 dated 14 January 2019 (Appendix A) detail a proposed residential subdivision which will have individual onsite waste water disposal fields. Lot boundaries had not been confirmed at the time of preparing this report, however we understand that there will be in the order of 11 to 12 Lots proposed across ‘the site’. A new shared accesway is also proposed off Clevedon-Kawakawa Road with private driveways off the main accesway providing access to each property.

4. BACKGROUND INFORMATION AND SITE OBSERVATIONS

4.1 Historical Site Development

An assessment of aerial photographs between 1940 and 2017 indicate the site has undergone very little to no development since 1940, with the site primarily used for grazing for livestock.

4.2 Site Reconnaissance

During our site reconnaissance we have noted the following;

- The topography raises gently to moderately along the west, south and southeastern edges of the knoll but to the north and northeast the slope dips moderately to steeply.
- The slope to the north of the knoll has clear indicators of some previous surficial failure movements.
- The proposed development area along the top of the knoll is nearly flat to gently sloping.
- The development area adjacent to Clevedon-Kawakawa Road is gently sloping to the north.
- A number of shallow stormwater trenches are visible in the low lying areas of 278 Clevedon-Kawakawa Road.
- A number of reeds/tall grasses are visible in the low lying areas suggesting groundwater may be shallow at places.
- The overland flow paths are generally present in the low lying areas and between the development sites

5. GEOLOGY

The regional geology of the site and its surrounding area is detailed on the Geological Map of the Auckland Area Sheet 3 of the Geological Map Series (Scale 1:250,000), published by the institute of Geological and Nuclear Sciences in 2001. This shows the site to be underlain by pumiceous sand, silt, and clay, with interbedded gravel and peat associated with the Taranga Group of Pleistocene and Holocene age. Therefore, it is anticipated that the superficial deposits will comprise predominately alluvial deposits of the Tauranga Group.

Three major published faults, the Lower Wairoa Fault, the Waikopua Fault and the Wairoa North Fault are located around the proposed development site. The Lower Wairoa Fault is located approximately 1km to the northwest of the proposed site and dips to the southeast with information provided from GNS Geoscience website indicating the fault is currently inactive. The Waikopua and Wairoa North Fault are located approximately 2.5km and 2.3km to the southwest respectively and dip to the southwest with information provided from GNS Geoscience website indicating that these faults are both active. During our site reconnaissance, though some minor surficial surface movement of the soils were observed, no evidence of any major fault movements was observed over the proposed site development area

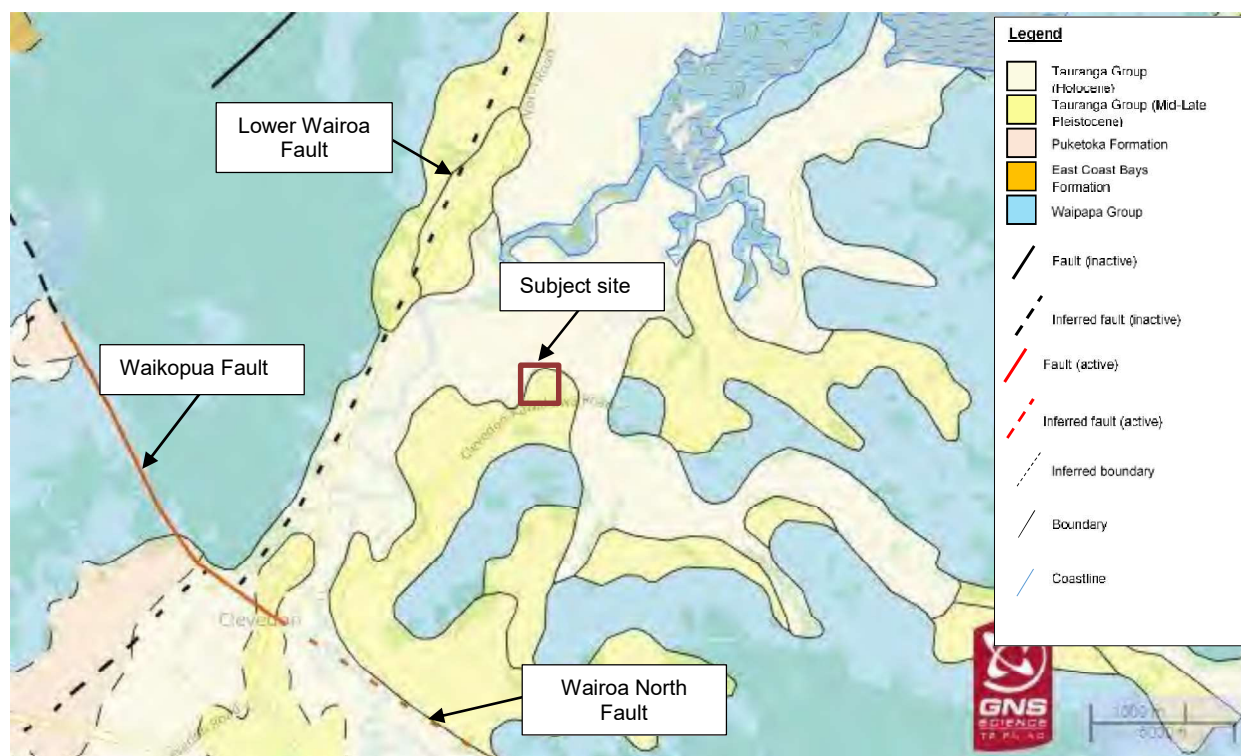


Figure 1: Geology map (Extracted from GNS 1:250 000 Map)

6. FIELD EXPLORATION

6.1 Hand Auger Boreholes

The subsurface conditions at the site were explored by drilling 8 no. hand auger boreholes (AH1 to AH8) on 14, 15 and 18 February 2019, at the locations shown on our Site Plan. The subsurface conditions encountered during drilling were logged in general accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes', December 2005 as outlined by the NZ Geotechnical Society Guidelines.

A calibrated shear vane, used in accordance with New Zealand Geotechnical Society Guideline for Hand Held Shear Vane Test, 2001 was used at regular depths in the drilled holes to measure soil strengths, both in situ and remoulded. The vane shear strengths shown on the attached logs have been corrected in terms of BS 1377.

Scala penetrometer testing was subsequently undertaken through the base of each borehole with a view to establishing a general indication of soil resistance for a further 2m beyond the base of each borehole, or until effective refusal was encountered, whichever being encountered first.

The site was subsequently revisited on 19 February 2019 in order to check for standing groundwater after the effects of drilling had dissipated. Where encountered, the measured depths to standing groundwater level are marked on the relevant borehole logs.

6.2 Cone Penetration Test (CPT)

Two CPTs (CPT1 and CPT2) were undertaken by Ground Investigation Limited on 14 February 2019. The CPTs were intended to be advanced to a depth of 20m below present ground level, or until effective refusal, whichever was encountered first. The primary purpose of the probes was to provide information on the ground profile and provide data for liquefaction analysis.

The CPTs were undertaken with a 1 tonne Pagani TG63-150 rig, using a cone with a cross-sectional area of 10cm². Continuous measurements of pore pressures were undertaken during testing. The tests were undertaken in accordance with ASTM Standard 5778-12 procedure.

7. SUBSURFACE CONDITIONS

The subsurface ground conditions encountered in each borehole and CPT are briefly described and summarised below in Table 1. For details of particular investigations, reference should be made to the attached investigation logs in Appendix B as shown on the Site Plan. Where CPT probes were undertaken, they did not return any samples. However, inferences have been drawn from the results to the materials logged in nearby investigation points. Subsoil conditions have been interpolated between the boreholes and the CPTs. It must be accepted that soil conditions are inherently variable and no investigation can be exhaustive to the extent that all soil conditions are revealed. A representative site specific geological cross section is attached as Sheet 2 and 3.

The following is the general description of the materials encountered:

7.1 Topsoil

A surface veneer of topsoil up to approximately 0.3m was encountered in all boreholes and was found to comprise typical organic topsoil materials. Topsoil is expected to be continuous across the site, not including paved areas, however, it must be appreciated that topsoil thicknesses may vary across the site. No shear vane readings were taken within this material.

7.2 Tauranga Group Alluvium - Flood Plain Deposits (a₁)

Alluvium flood plain deposits of the Tauranga Group were encountered underlying the topsoil to the target depth within boreholes AH3, AH6 and AH8. The soils here comprised predominately soft to very stiff clayey SILT / silty CLAY and in some rare instances layers of sandy SILT with some to minor fine to coarse gravels observed in AH6. Vane shear strengths within the soils measured ranging from 28kPa to greater than 198kPa.

7.3 Tauranga Group Alluvium - Terrace Deposits (a₂)

Alluvium terrace deposits of the Tauranga Group were encountered underlying the topsoil to the target depth within boreholes AH1, AH2, AH4, AH5 and AH7. The soils here comprised stiff to very stiff silty CLAY / clayey SILT, sandy SILT / silty SAND with some to minor fine to medium clasts. Vane shear strengths with the soils measured ranging 54kPa from to greater than 198kPa.

Alluvium terrace deposits is also inferred to be present below the topsoil in all CPT logs up to a maximum depth of 9.4m. The soil type classification output generally inferred similar material types to what was found within the nearby investigation points. The CPT sounding typically shows a resistance of less than 2MPa to 12MPa.

7.4 Tauranga Group Alluvium - Dissected Terrace Remnants (a₃)

The Cone resistance plots of the CPTs indicate a sudden increase in cone resistance after 9.4m likely as a result of encountering densely compacted alluvium materials. The soil behaviour type classification of CPT generally inferred these materials being ‘sandy SILT / silty SAND’ and clean SAND. Here these deposits have been interpreted as dissected terrace deposits of the Tauranga Group.

7.5 Scala Penetrometer testing

The scala penetrometer testing encountered effective refusal in boreholes AH5 and AH6 between 3.2m and 5.0 meters below ground level (mbgl). Effective refusal was not encountered within the rest of the hand auger boreholes. Interpretation of these results suggests that dense soils are likely at variable depths across the site.

Table 1 Summary of Subsurface Information

Hole ID	Topsoil (m)	a ₁ (m)	a ₂ (m)	a ₃ (m)	Scala Penetrometer Depth Range (m)
AH1	0.0 – 0.2	n/a	0.2 – 5.0*		5.0 – 6.9 Δ
AH2	0.0 – 0.2	n/a	0.2 – 4.5*		4.5 – 5.9 Δ
AH3	0.0 – 0.3	0.3 – 3.5*	n/a		3.5 – 5.95 Δ
AH4	0.0 – 0.2	n/a	0.2 – 3.85*		3.85 – 6.30 Δ
AH5	0.0 – 0.3	n/a	0.3 – 3.55*		3.55 – 5.0
AH6	0.0 – 0.2	0.2 -2.0*	n/a		2.0 – 3.2
AH7	0.0 – 0.2	n/a	0.2 – 2.6*		2.6 – 4.6 Δ
AH8	0.0 – 0.2	0.2 – 5.0*	n/a		5.0 – 6.9 Δ
CPT1	0.0 – 0.3	n/a	0.3 – 7.1	7.1 – 20.0*	n/a
CPT2	0.0 – 0.3	n/a	0.3 – 9.4	9.4 – 20.0*	n/a

Note, all depths indicated are in mbgl
n/a – not applicable

* = Terminated depth of borehole/testing
Δ = Scala penetrometer refusal not encountered

7.6 Groundwater

Groundwater levels were measured in all boreholes at the time of drilling and on a return trip on the 19 February 2019. Groundwater was found to be present in all boreholes, excluding AH7 and CPT1, at depths of between 1.65m and 3.8mbgl. An indication of the groundwater levels is represented in Table 2. Groundwater levels do fluctuate and it must be appreciated that higher groundwater levels may be encountered following periods of prolonged or heavy rainfall.

Table 2 Groundwater measurements

Hole ID	Groundwater Levels (mbgl)	
	Day of Drilling 14-18/02/2019	Remeasured 19/02/2019
AH1	2.3	2.93
AH2	2.0	2.5
AH3	1.45	1.65
AH4	2.5	2.61
AH5	3.1	3.1
AH6	1.1	1.3
AH7	2.0	Dry
AH8	1.3	2.52
CPT1	5.7	Hole collapsed
CPT2	5.8	3.8

8. SITE CLASSIFICATIONS

8.1 Expansive Soils

Based on experience of similar soils elsewhere, the near surface clayey silt materials of the Tauranga Group alluvium, as noted in the boreholes, are susceptible to swelling and shrinking under seasonal variations of water content. For the purposes preliminary of design, the proposed development area may be designated as moderately reactive (Class M) in accordance with AS2870:2011. Shrink swell testing should be carried out once site formation works are complete to confirm the shrink swell class.

8.2 Site Subsoil Class

From findings in the boreholes, the subsurface comprise alluvial deposits for more than 5m and material with undrained shear strength of greater than 12.5kPa. Therefore, the site may be classified as subsoil Class C – Shallow Soil Site, in accordance with NZS 1170.5:2004, Section 3.1.3.

9. GEOTECHNICAL DESIGN PARAMETERS

Geotechnical design parameters for the main geological materials have been assessed using measured in situ shear vane strengths and based on our experience of similar soils across the Auckland area.

The parameters adopted for use in our stability analysis are provided in Table 4 below:

Table 4: Geotechnical Parameters used in stability analyses

Stratum	Bulk Unit Weight γ (kN/m ³)	Effective Stress Parameters	
		Cohesion c' (kPa)	Angle of Friction, ϕ'
Colluvium	18	2	20
Alluvium Floodplain Deposits (a_1)	18	3	28
Alluvium Terrace Deposits (a_2)	18	5	30

10. SLOPE STABILITY

As indicated in Section 2 and 4 of this report, slopes on the north and northeast edges of the knoll are moderately to steeply sloping, with surficial surface movement observed over this area.

To assess the stability of the northern knoll slope, a representative cross section (A – A') was selected for computer analysis based on the topographical information from survey plans from Lands and Survey (Appendix A). The location of the cross section is shown on the Site Plan, attached as Sheet 1. Details of the analyses are contained in the Appendix C. The analyses were undertaken using the computer based program "SLIDE" Version 6.039 by Rocscience.

The analyses, were undertaken based on the following load cases:

1. Static case measured groundwater conditions,
2. Static case raised groundwater conditions (modelled to reflect a possible raised groundwater following a period of prolonged, intense rainfall), and,
3. A seismic scenario, modelled using measured groundwater conditions with a seismic horizontal acceleration coefficient of 0.12g, (based on a 150yr earthquake return period as per NZS1170.5:2004).

For all scenarios modelled we have assessed potential circular surfaces using the Spencer method. The geotechnical parameters used in the analyses are summarised in Table 3 of Section 9.

A summary of the Factor of Safety results from the analyses are presented in Table 4 below. Output of the slope analyses is enclosed in Appendix C.

Table 5: Factor of Safety obtained in Stability Analysis

Cross Section	Factor of Safety		
	Measured Groundwater	Raised Groundwater	Seismic
A - A'	2.1 ✓	2.1 ✓	1.7 ✓
Accepted by Council	1.5	1.3	1.2

✗ = unsatisfactory result,

✓ = satisfactory result

We have carried out slope stability for the proposed subdivision on the current topographic profile. It is our professional opinion that slope stability of the current ground profile is not a concern for the site provided the recommendations in Sections 12 are followed.

11. LIQUEFACTION ASSESSMENT

To address the potential of liquefaction at the site, the CPT results were analysed using CPT liquefaction software 'Cliq', by Geologismiki Geotechnical Software. The software includes normalisation of the data for overburden pressure and is considered to provide indications of liquefaction potential. We point out that the CPT sounding was advanced to a depth of 20.7m and hence liquefaction analysis does not account for any susceptible layers below this depth.

The liquefaction analyses were completed for both Serviceability Limit State (SLS) and Ultimate Limit State (ULS) design criteria, using CPT results. Calculations were performed over the full depth of investigation. This section presents the potential of liquefaction in terms of Factor of Safety (FoS) used to assess the liquefaction vulnerability of the site.

The triggering of liquefaction was assessed using Boulanger and Idriss (2014) procedure as suggested in NZGS Earthquake Geotechnical Engineering Practice ‘Module 3: Identification and Assessment of Liquefaction Hazards’. The following design parameters are used for the determination of Peak Ground Acceleration (a_{max}):

Table 5: Peak Ground Acceleration design parameters

Design Life (years)	Importance Level	ULS Return Period	SLS Return Period	Seismic Site Class	Magnitude M_w	Site Response Factor, f	$C_{0,1000}$
50	2	1/500	1/25	C	6.0	1.33	0.15g

For estimating the liquefaction potential at the site, the NZGS Module 1 Section 5.1 is referred in calculating the corresponding design peak ground acceleration (a_{max}). The following a_{max} were adopted in the assessment.

- a_{max} for ULS is 0.15g, M_w is 6.0
- a_{max} for SLS is 0.04g, M_w is 6.0

Under ULS conditions several layers within the upper 20m returned FoS readings of 1 or below within logs CPT1 and CPT2. The estimated accumulative settlement, based on CPT1, is less than 35mm and lateral displacement is less than 350mm. The estimated accumulative settlement, based on CPT2, is less than 40mm and lateral displacement is less than 500mm. For both CPTs, no liquefaction is expected under SLS conditions. Therefore, the liquefaction potential of the Tauranga Group Alluviums at the site is negligible under SLS and low under ULS conditions. Furthermore, liquefaction in the top 10m occurs in layers of limited thickness (approximately less than 10%) and results in relatively small lateral displacements and vertical settlements. The results of the Cliq analyses are appended as Appendix D.

12. PRELIMINARY DEVELOPMENT RECOMMENDATIONS

The preliminary recommendations provided below assume that the building typically comprises a NZS3604:2011, lightweight type structure and that minor platform formation earthworks will be undertaken. It is our professional opinion that the building platform area shall remain safe and stable following development, provided that the recommendations below are adhered to.

12.1 Site Formation Works

At the time of preparing this report, the extent of the earthworks and detailed design drawings were not available. As such, we consider that it will be necessary to review future drawings to confirm the recommendations made in this report.

The site formation works are expected to be limited to a topsoil strip for the formation of the building platforms and vehicular accessway. Care must be taken during the topsoil strip to identify any buried features or soft ground. Any unsuitable material excavated as part of the formation works should be disposed of accordingly off site.

Any potential excavations into natural ground (up to 0.5m vertical height) are expected to be temporarily stable, provided they are left unsupported for the shortest possible duration. If they are to be left unsupported during prolonged wet weather, appropriate temporary support measures must be put in place. Work must be undertaken to ensure that surface water is not allowed to pond and infiltrate the ground surface on or immediately above any excavated face. Where any excavations greater than 0.5m are proposed, geotechnical input will be required at the Building Consent stage.

With potentially expansive sites, it is very important that the soils at slab subgrade are not permitted to dry out as they will re-swell on wetting (in the months after pouring the slab), exerting significant swelling pressures and potentially causing damage to the floor slab. We therefore recommend that the prepared pad be promptly covered with at least 100mm of GAP20 type material or similar and that the area is periodically wet down for at least one week prior to slab placement. Similarly, it is essential that footing trenches are not permitted to become desiccated over time, and these should be protected with at least 50mm of site concrete within 1 day of excavation. These measures will reduce the risk of 'hogging' and cracking of the slab. Cracking cannot be totally eliminated and it must be recognised that most concrete slabs can and do crack for many different reasons.

12.2 Preliminary Foundation Recommendations

The foundation requirements at the site are subject to the building materials, heavy loads, earthworks and location within the proposed subdivision. Provided the proposed structures are located at least 4.5m away from the crest of slopes with a gradient 1:3 or steeper, we consider that NZ3604:2011 type structures are appropriate for the development on each Lot.

The building platform should be located on ground cleared of any topsoil and soft soils. Fill up to 0.5m may be suitable for the site and should comprise compacted GAP40 aggregate. Where fill greater than 0.5m is proposed, further geotechnical input will be required

For shallow foundations, the natural in situ soils are able to provide an unfactored ultimate bearing capacity of 300kPa.

If any of the proposed developments are located within 4.5m of the crest of slopes with a gradient 1:3 or steeper or comprises heavy construction materials, specific engineering investigation design is required.

Irrespective of the above, the detailed development drawings for the new subdivision should be submitted to a suitably qualified engineer for review to confirm requirements at Building Consent stage.

13. ACCESSWAY

Based on our experience of similar subgrade soils and testing taken across the proposed accessway, a design CBR value of 3% would be appropriate for the underlying in situ subgrade soils located above elevations of 4.4m. Areas located below an elevation of 4.4m, a CBR value of 1% should be adopted.

During scala penetrometer testing a stiff crust was observed across the low lying areas (Elevation of less than 4.4m) to a depth of approximately 0.5mbgl. We suggest that any excavations across these areas are limited to avoid exposing any soft material. A geogrid, such as a Tensor TriAx geogrid, should also be placed between the natural soil and fill to provide additional support in these low lying areas.

14. STORMWATER

Stormwater from dwellings and all hard standing area must be collected and discharged in a manner in accordance with current Council requirements. To ensure that stormwater does not adversely affect site stability, it is important that all stormwater runoff from roof, deck, driveway and other sealed areas, together with discharges from perforated draincoils behind retaining walls, is collected by means of sealed pipes or swale and discharged accordingly offsite in a controlled manner. Under no circumstances is stormwater allowed to discharge directly onto the steep slopes below the building platforms or into soakpits.

15. DRAWING REVIEW

This report has been prepared specifically for the development proposal stated within Section 3 of this report as part of a Resource Consent application. We recommend that, when Building Consent drawings become available, we are allowed to review the drawings to ensure that the preliminary recommendations of this report remain valid. Additional Lot specific investigation boreholes may need to be drilled and further analyses may be required to ensure that the proposed formation works will not negatively impact slope stability.

16. LIMITATIONS

The conclusions made in this report are based upon the results of hand auger holes and CPTs spaced about the site as appeared appropriate at the time the field exploration was carried out. We also point out that the holes were extended as deep as reasonably possible with hand operated equipment but they could not and did not penetrate into the underlying slightly weathered materials. We are therefore not able to report on the potential of any deep-seated bedding plane defect or other adverse lithological feature in the underlying parent rock.

The report was prepared in the context defined in Section 1 above and must not be relied upon by any other party other than that for whom it was prepared and the relevant Territorial Authority. It has been compiled with respect to the brief given to us, and must not be relied upon in any other context or recreated for any other purpose.

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APPENDIX A

Draft Concept Plans and Survey Drawings (Greenwood Associates & Lands and Survey)



greenwoodassociates | Landscape Architecture

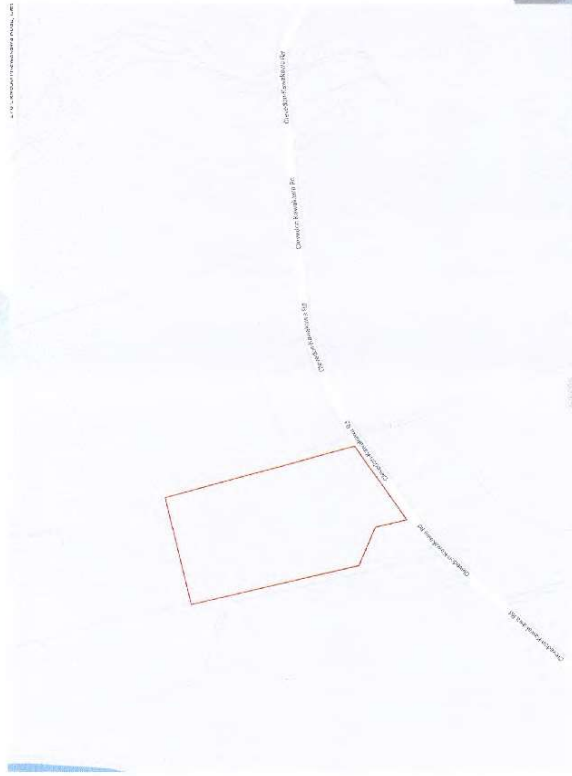
Landscape Plan Set for

Stratford Properties

278 Clevedon-Kawakawa Road Clevedon, Auckland

912/1 - Masterplan with Aerial
912/1 - Topographical Plan

14/01/19
14/01/19



greenwoodassociates.co.nz



HOUSE

GARAGE

FOREST

PLANTING

HEDGE

8M CANOPY TREE

4M CANOPY TREE










GRASS BERM

TURNING CIRCLE

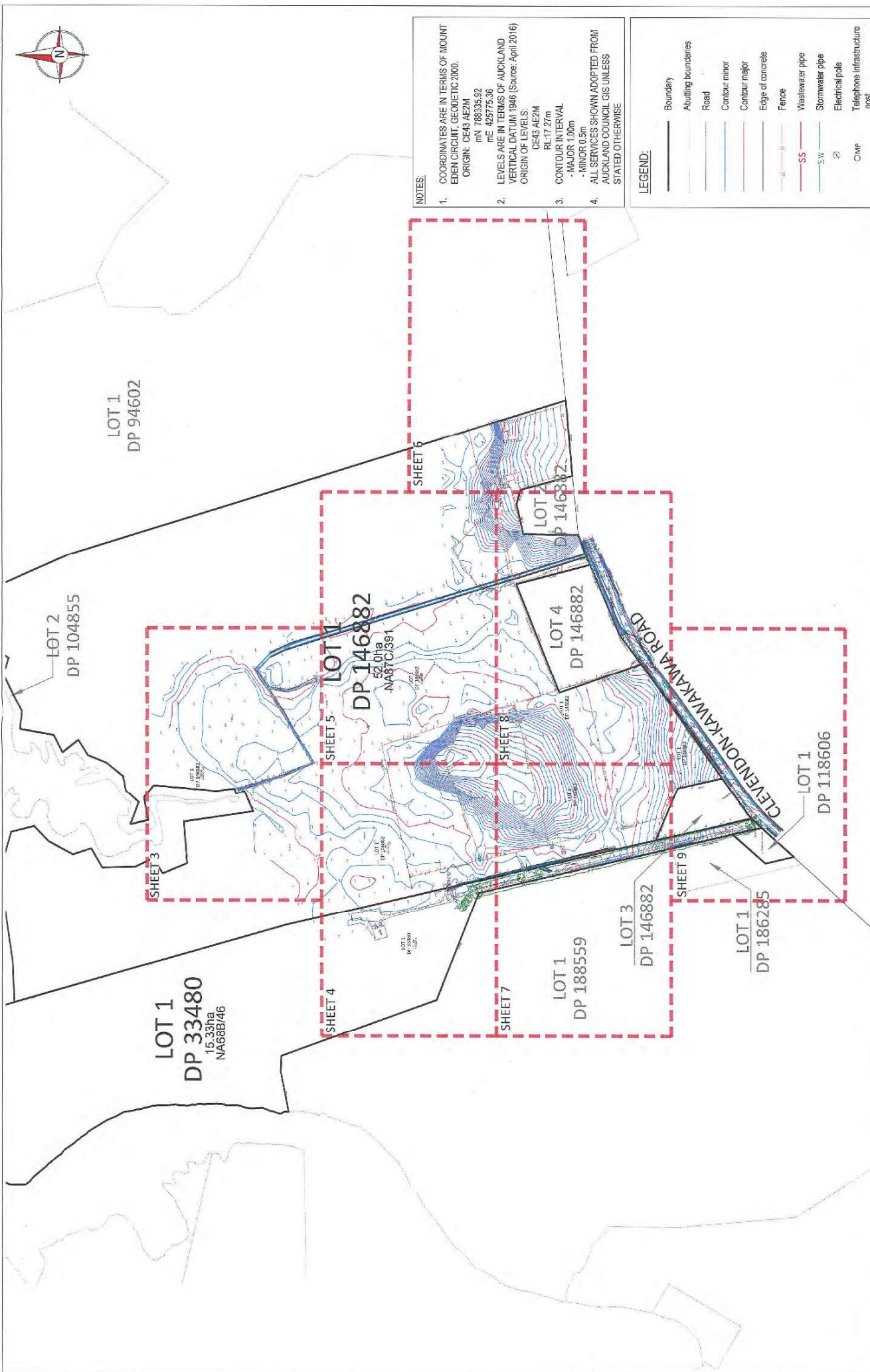


BUILDING ZONE
> RL 4.4m



- HOUSE 
- GARAGE 
- FOREST 
- PLANTING 
- HEDGE 
- 8M CANOPY TREE 
- 4M CANOPY TREE 
- GRASS BERM 
- TURNING CIRCLE 





NOTES:

- COORDINATES ARE IN TERMS OF MOUNT EDEN CIRCUIT, GEODETIC 2000.
ORIGIN: CE43 AE2M
M: 788335.92
N: 426775.36
- LEVELS ARE IN TERMS OF AUCKLAND VERTICAL DATUM 1946 (Source: April 2016)
ORIGIN OF LEVELS:
CE43 AE2M
RL: 17.27m
- CONTOUR INTERVAL
- MAJOR 1.00m
- MINOR 0.5m
- ALL SERVICES SHOWN ADOPTED FROM AUCKLAND COUNCIL GIS UNLESS STATED OTHERWISE

LEGEND:

- Boundary
- Abutting boundaries
- Road
- Contour minor
- Contour major
- Edge of concrete
- Fence
- Wastewater pipe
- Stormwater pipe
- Electrical pole
- Telephone infrastructure post
- OWP

SCALE (A3) 1:5000

SCALE BAR

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CLIENT NAME:

STRATFORD PROPERTIES LIMITED

DRAWING TITLE:

TOPOGRAPHICAL SURVEY SHEET 2/13

CLIENT ADDRESS:

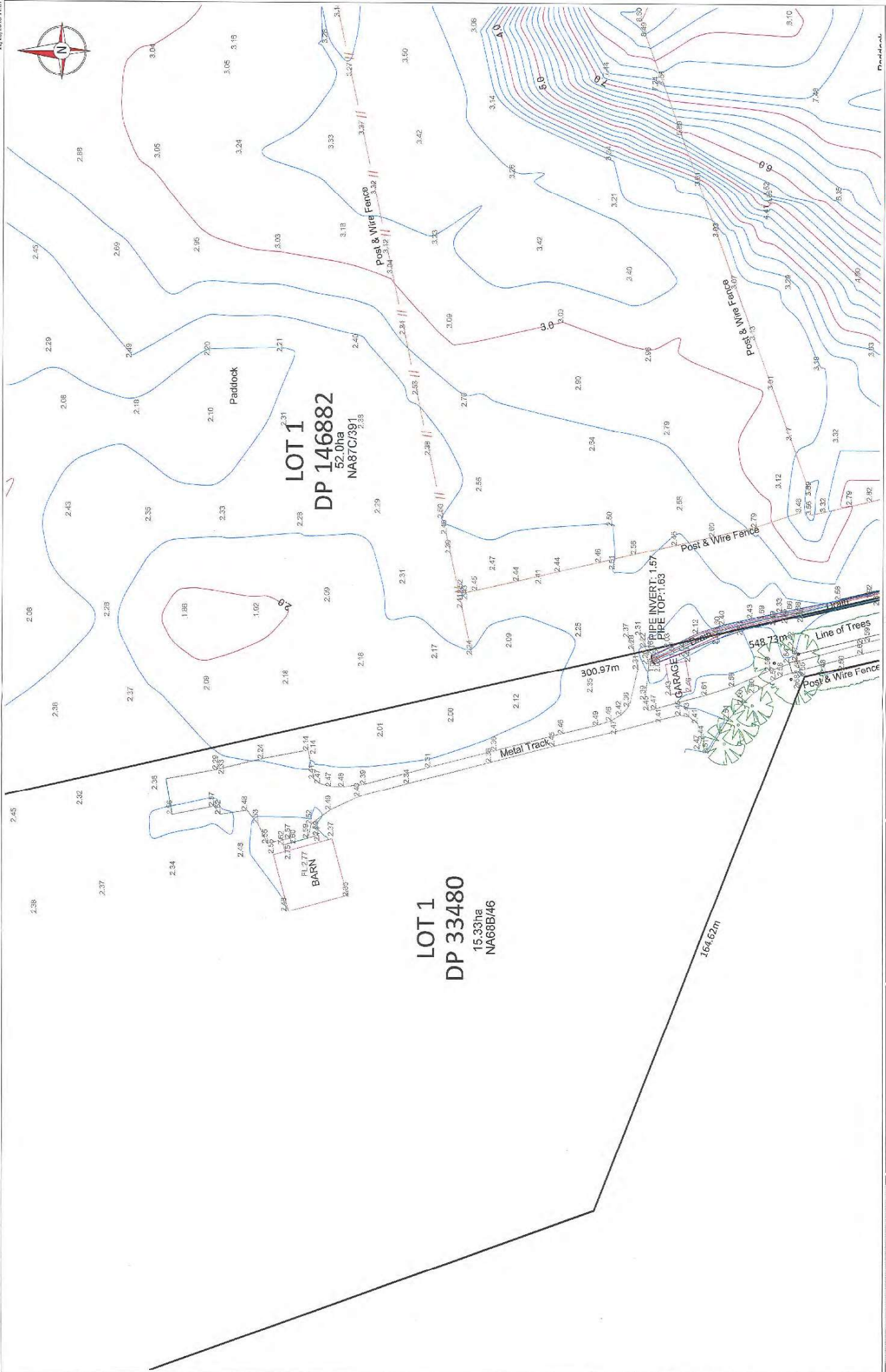
**LOT 1 DP 33480
272-278 CLEVENDON-KAWAKAWA ROAD, CLEVENDON**

REV	DESCRIPTION	BY	DATE
A	ORIGINAL ISSUE	AW	20/12/18
B	ADDITIONAL SURVEY ADDED		

DRAWING REFERENCE: 117536-001

REV: B

SURVEYED	DESIGNED	PG	12/18
		PG	12/18
		AW	20/12/18
		KH	20/12/18
		REV	B



SURVEYED		PG 17/18
DESIGNED		PG 17/18
BY DATE	DRAWN	APPROVED
BY DATE	BY DATE	BY DATE
BY DATE	BY DATE	BY DATE
DRAWING REFERENCE		REV
117536-001		B

CLIENT ADDRESS:
LOT 1 DP 33480
272-278 CLEVENDON-KAWAKAWA
ROAD, CLEVENDON

DRAWING TITLE:
TOPOGRAPHICAL SURVEY
SHEET 4/13

CLIENT NAME:
STRATFORD
PROPERTIES LIMITED

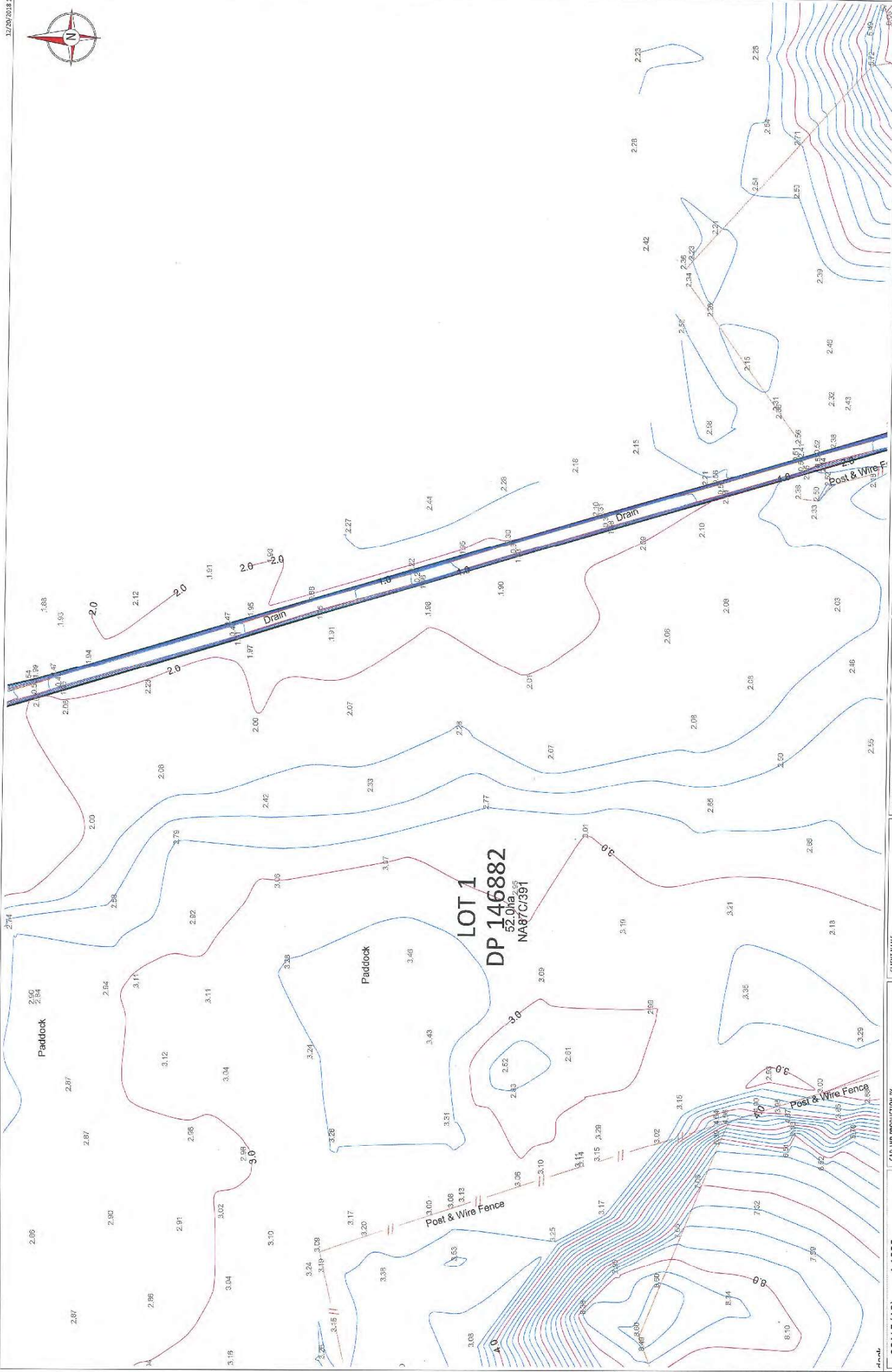
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SCALE (A3) 1:1000

SCALE BAR 0 10 20 30 40 50m

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SURVIVED		PG 12/18
DESIGNED		PG 12/18
DRAWN		AV 20/12/18
APPROVED		KH 20/12/18
DRAWING REFERENCE		117536-001
KEY		B

FINAL	
REV	DATE
A	20/12/18
B	20/12/18
DESCRIPTION	
A - ORIGINAL ISSUE	
B - ADDITIONAL SURVEY ADDED	

CLIENT ADDRESS:
LOT 1 DP 33480
272-278 CLEVENDON-KAWAKAWA
ROAD, CLEVENDON

DRAWING TITLE:
TOPOGRAPHICAL SURVEY
SHEET 5/13

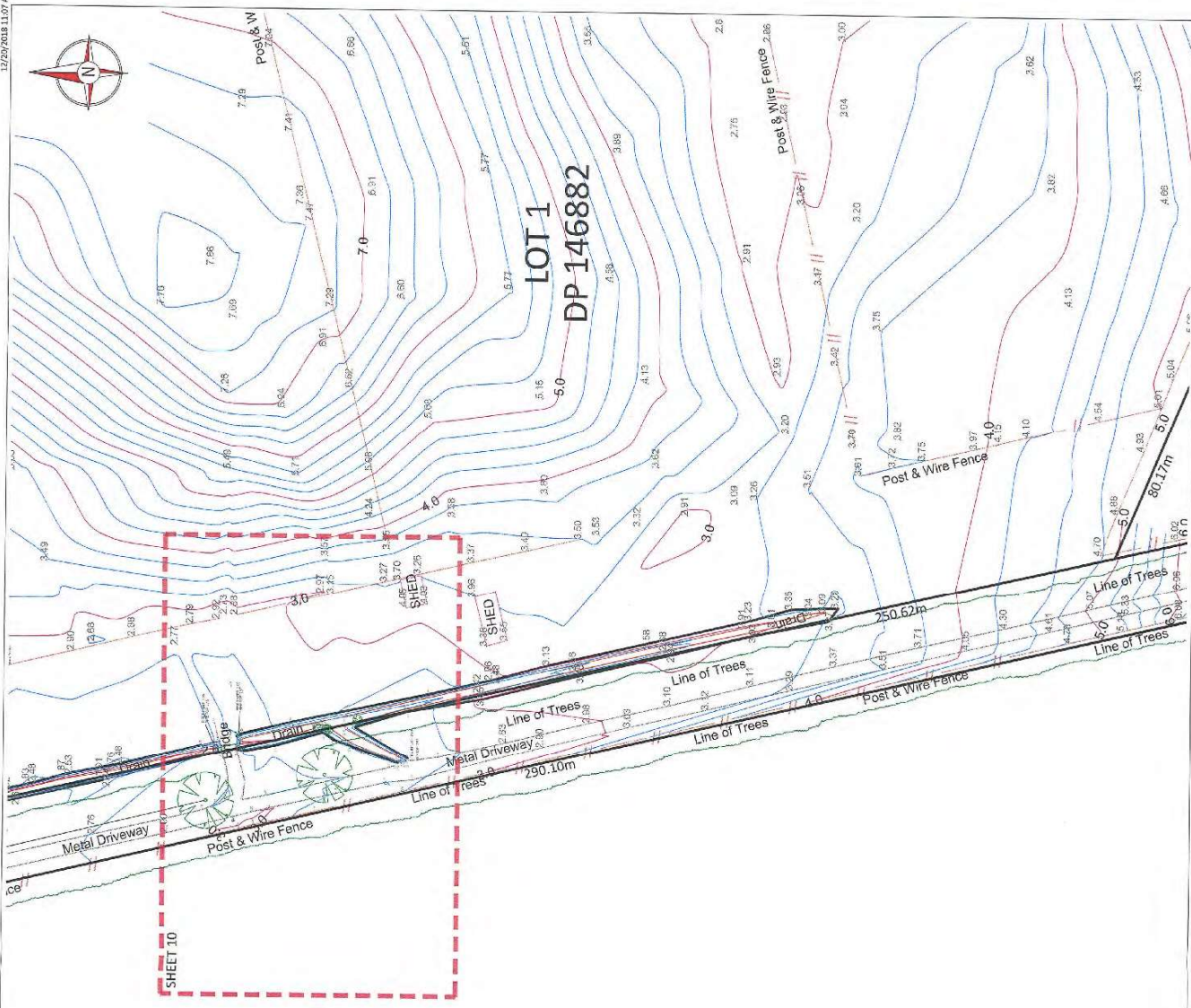
CLIENT NAME:
STRATIFORD
PROPERTIES LIMITED

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CONSULTANTS ENGINEERS ARCHITECTS
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 www.landsandsurvey.co.nz

SCALE (A3) 1:1000

SCALE BAR
 0 20 40 60 80 100m

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SURVEYED	PG 12/18
DESIGNED	PG 12/18
DRAWN	MY 20/12/18
APPROVED	KH 20/12/18
DATE	MY 23/11/18
BY	MY 23/11/18
DESCRIPTION	ADDITIONAL SURVEY ADD'D
ORIGINAL ISSUE	
ADDITIONAL SURVEY ADD'D	
DRAWING REFERENCE	117536-001
REV	B

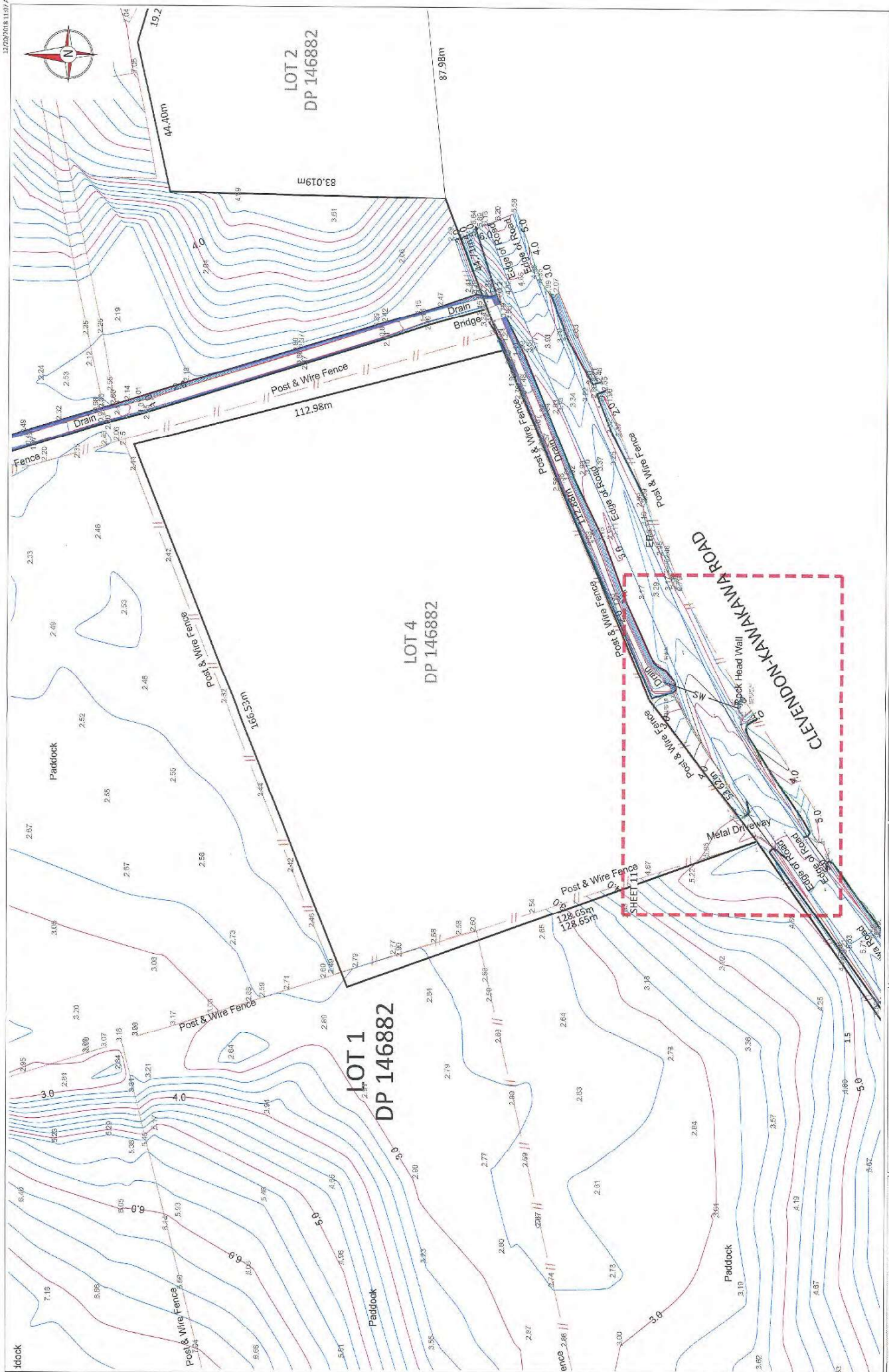
CLIENT ADDRESS:	LOT 1 DP 33480 272-278 CLEVEDON-KAWAKAWA ROAD, CLEVEDON
DRAWING TITLE:	TOPOGRAPHICAL SURVEY SHEET 7/13
CLIENT NAME:	STRATFORD PROPERTIES LIMITED

CAD AND PRODUCTION BY:	LANDS & SURVEY
Available in:	Whangarei Christchurch Invercargill
PH 080 SURVEY	www.landsandsurvey.co.nz

SCALE (A3)	1:1000
SCALE BAR	0 10 20 30 40 50m
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SCALE (A3)	1:1000
SCALE BAR	0 10 20 30 40 50m
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SCALE (A3)	1:1000
SCALE BAR	0 10 20 30 40 50m
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SURVEYED	PG	12/18
DESIGNED	PG	12/18
DRAWN	MY	20/12/18
APPROVED	KI	20/12/18
DRAWING REFERENCE		117536-001

FINAL

REV ORIGINAL ISSUE DESCRIPTION
 A 20/12/18
 B ADDITIONAL SURVEY DATA

CLIENT ADDRESS:
LOT 1 DP 33480
272-278 CLEVENDON-KAWAKAWA ROAD, CLEVENDON

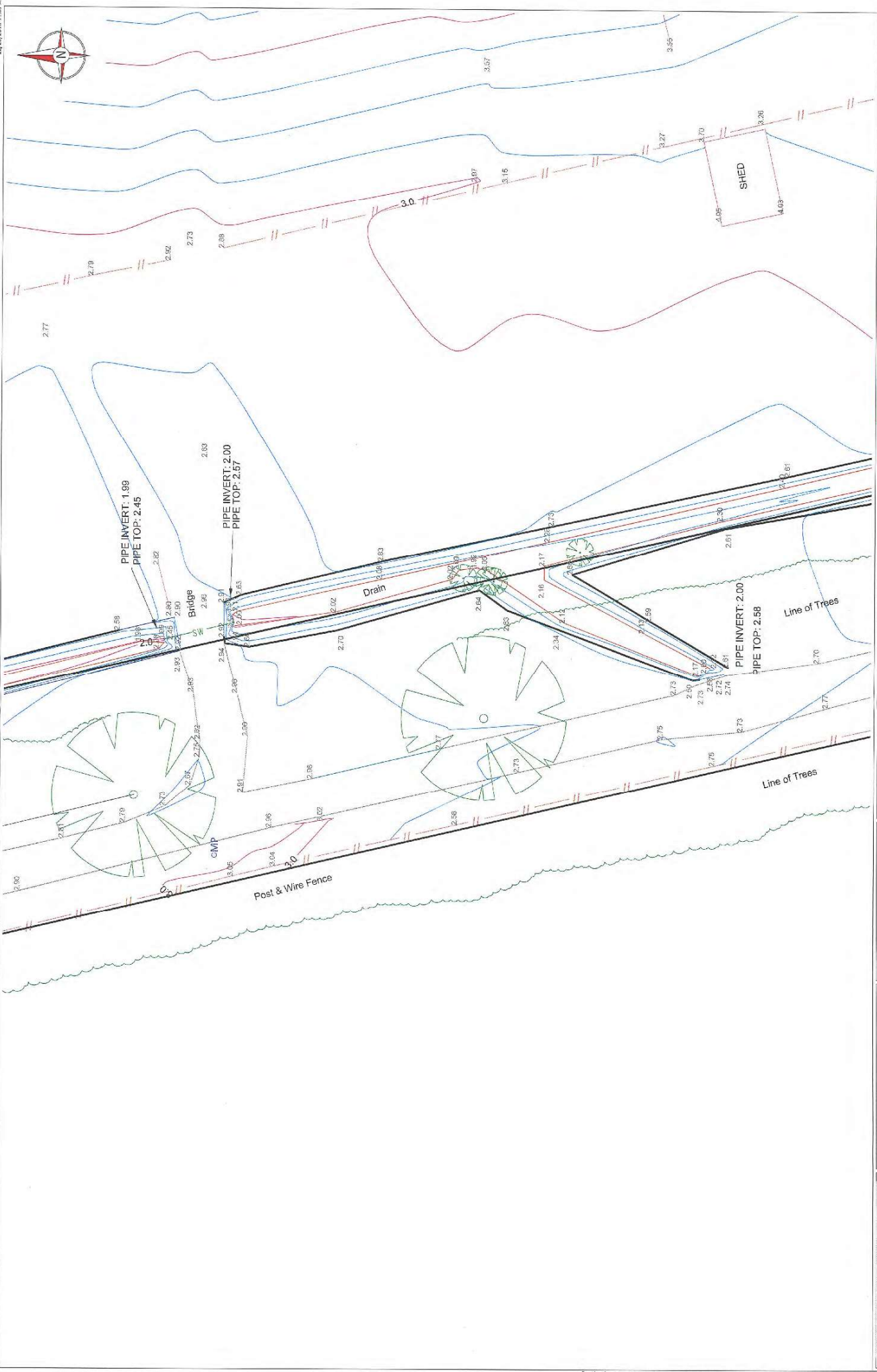
DRAWING TITLE:
TOPOGRAPHICAL SURVEY
SHEET 8/13

CLIENT NAME:
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SCALE (A3) 1:1000
 SCALE BAR 0 10 20 30 40 50m

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REVISION	DATE	BY	DESCRIPTION
A	20/12/18	MV	ORIGINAL SURVEY
B	20/12/18	KH	ADDITIONAL SURVEY ADDED

STATUS	DATE	BY
SURVEYED	12/18	PG
DESIGNED	12/18	PG
DRAWN	20/12/18	MV
APPROVED	20/12/18	KH

DRAWING REFERENCE	117536-001
KEY	B

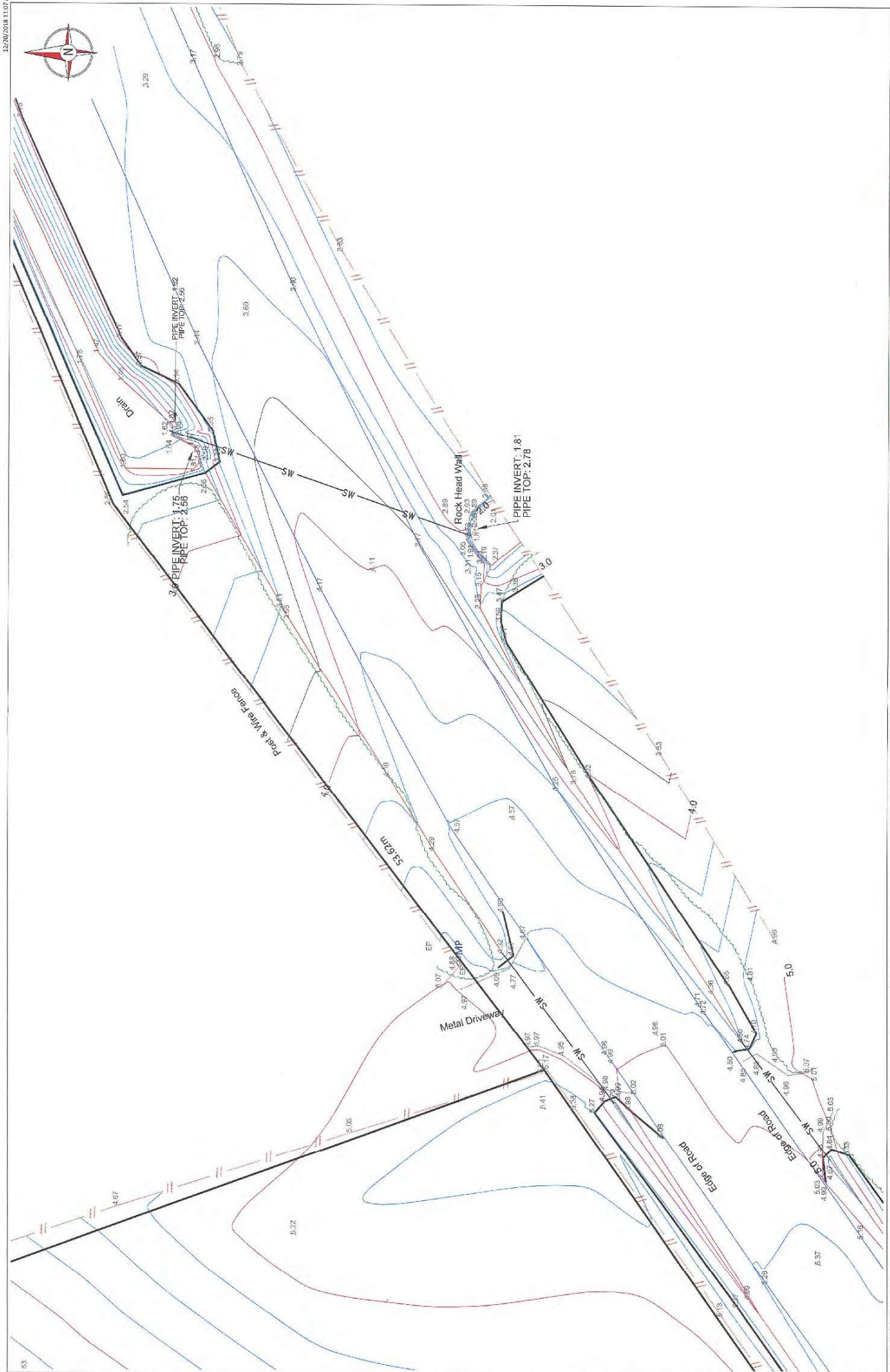
CLIENT ADDRESS:
LOT 1 DP 33480
272-278 CLEYENDON-KAWAKAWA
ROAD, CLEYENDON

DRAWING TITLE:
TOPOGRAPHICAL SURVEY
SHEET 10/13

CLIENT NAME:
STRATFORD
PROPERTIES LIMITED

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CAD AND PRODUCTION BY:
SCALE (A3) 1:250
 0 2.5 5 7.5 10 12.5m
 SCALE BAR
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REV	DESCRIPTION	DATE	BY	APP'D
A	ORIGINAL SURVEY	20/12/18	AV	KH
B	ADDITIONAL SURVEY ADDED	20/12/18	AV	KH

DATE	BY	APP'D
12/18	AV	KH
12/18	AV	KH
20/12/18	AV	KH
20/12/18	AV	KH

FINAL

CLIENT ADDRESS:
LOT 1 DP 33480
272-278 CLEVENDON-KAWAKAWA
ROAD, CLEVENDON

DRAWING TITLE:
TOPOGRAPHICAL SURVEY
SHEET 11/13

CLIENT NAME:
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SCALE (A3) 1:250

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DRAWING REFERENCE
117536-001

REV
B



Lot 1 DP33480 & Lot 1 DP 118606

SCALE (A3) 1:250

SCALE BAR: 0, 2.5, 5, 7.5, 10, 12.5m

SCALE: 1:250

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CLIENT NAME:
STRATFORD PROPERTIES LIMITED

DRAWING TITLE:
TOPOGRAPHICAL SURVEY SHEET 13/13

CLIENT ADDRESS:
**LOT 1 DP 33480
272-278 CLEYNDON-KAWAKAWA ROAD, CLEYNDON**

REV	DESCRIPTION	DATE	BY
1	ORIGINAL ISSUE	17/11/18	AM
2	ADDITIONAL SURVEY ADDED		

SURVEYED	DESIGNED	DRAWN	APPROVED	DRAWING REFERENCE
12/18	12/18	20/12/18	20/12/18	117536-001
PG	PG	BY	REV	



APPENDIX B

Subsurface Investigation Logs

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH1
 Date: 15/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)					Scala Penetrometer (blows / 50mm)			
						50	100	150	200	Values	Depth (m)	Blows		
		Topsoil. [TOPSOIL]		TOP SOIL							5.05	1		
0.5		SILT with some clay. Orange mottled light grey, very stiff to hard, dry, low plasticity. [ALLUVIUM] Clayey SILT. Orange mottled light grey, very stiff to hard, dry, moderately plastic. [ALLUVIUM]		TAURANGA GROUP ALLUVIUM (Pleistocene deposits)						198+	5.10	1		
													5.15	1
													5.20	1
													5.25	1
													5.30	1
													5.35	1
													5.40	1
1.0		Silty CLAY. Orange mottled light grey, very stiff to hard, dry to moist, highly plastic. At 1m; Becomes very stiff, moist and light grey mottled orange. [ALLUVIUM]										139	5.45	1
												57	5.50	2
													5.55	1
													5.60	2
													5.65	1
1.5		1.6m: Moist to wet.										124	5.70	2
												59	5.75	2
													5.80	2
											5.85	1		
											5.90	2		
2.0		1.9m: Becomes orange and light grey.								141	5.95	2		
		CLAY with some Silt. Orange mottled light grey, very stiff, moist to wet, highly plastic. [ALLUVIUM]								74	6.00	2		
											6.05	2		
											6.10	3		
2.5		Silty CLAY. Light grey mottled orange, stiff, moist to wet, highly plastic. [ALLUVIUM]								99	6.15	2		
										48	6.20	3		
											6.25	2		
											6.30	2		
											6.35	2		
3.0		3m: Becomes wet, very stiff with occasional organics (<2mm).								127	6.40	3		
										48	6.45	2		
											6.50	2		
											6.55	2		
											6.60	2		
3.5		Clayey SILT with minor fine sand. Orange mottled light grey and dark orange, stiff, wet, moderately plastic. [ALLUVIUM]								99	6.65	2.5		
										42	6.70	2.5		
											6.75	2.5		
											6.80	2.5		
4.0		Silty CLAY with some fine to medium sand. Orange mottled light grey and dark orange, very stiff, wet, highly plastic. [ALLUVIUM]								116	6.85	2.5		
										57	6.90	2.5		
4.5										127				
										45				
5.0		5m: End of Borehole								62				
										20				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water
 ▼ Standing Water Level
 ▽ Water Level At Time Of Drilling

Shear Vane
 Corrected as per NZGS Guidelines
 Vane No.:GEO1596 is 1.414
 UTP = Unable To Penetrate
 + = Peak Exceeded
 - = No Result

Other Comments
 Flat, Field. Hole data is for a set location only.

SOIL DYNE LTD
 AUCKLAND
 M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH2
 Date: 15/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)					Scala Penetrometer (blows / 50mm)	
						50	100	150	200	Values	Depth (m)	Blows
		Topsoil. [TOPSOIL]		TOP SOI							3.05	1
0.5		Clayey SILT. Orange, very stiff, dry, low to moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]		TAURANGA GROUP ALLUVIUM (Pleistocene deposits)							3.10	1
		Silty CLAY. Orange mottled light grey, very stiff, dry to moist, moderate to highly plastic. [WAIPAPA GROUP / COLLUVIUM ?]								141	3.15	1
		0.9m: Becomes moist.								28	3.20	1
											3.25	1
											3.30	1
											3.35	0.5
											3.40	0.5
											3.45	1
										184	3.50	2
										62	3.55	1
											3.60	2
											3.65	2
											3.70	2
											3.75	2
											3.80	3
											3.85	2
											3.90	3
											3.95	2
											4.00	3
									4.05	1.5		
									4.10	1.5		
									4.15	1.5		
									4.20	1.5		
									4.25	2		
									4.30	2		
									4.35	2		
									4.40	3		
								Scaled	4.45	6		
									4.50	6		
									4.55	7		
									4.60	6		
									4.65	4		
									4.70	4		
									4.75	4		
									4.80	4		
									4.85	5		
									4.90	5		
									4.95	5		
									5.00	5		
									5.05	5		
									5.10	6		
									5.15	5		
									5.20	6		
									5.25	5		
									5.30	6		
									5.35	6		
									5.40	7		
									5.45	7		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water
 Standing Water Level
 Water Level At Time Of Drilling

Shear Vane
 Corrected as per NZGS Guidelines
 Vane No.: GEO1596 is 1.414
 UTP = Unable To Penetrate
 + = Peak Exceeded
 - = No Result

Other Comments
 Near Level, Field. Hole data is for a set location only.

SOIL DYNE LTD
 AUCKLAND
 M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH3
 Date: 14/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)					Scala Penetrometer (blows / 50mm)			
						50	100	150	200	Values	Depth (m)	Blows		
0.0		Topsoil. [TOPSOIL]		TOPSO							3.55	0.5		
0.5		Clayey SILT. Grey mottled orange with brown staining, very stiff, dry, moderately plastic. [ALLUVIUM]		TAURANGA GROUP ALLUVIUM (Holocene deposits)							3.60	0.5		
		Silty CLAY. Orange and light grey, very stiff, dry to moist, highly plastic. At 0.6m; Moist. [ALLUVIUM]											3.65	0.5
		1m: Becomes stiff with occasional plant fibers.											3.70	0.5
		1.2m: Moist to wet.											3.75	0.5
		1.5m: Wet.											3.80	0.5
		1.7m: Becomes grey.											3.85	0.5
		Organic Silty CLAY. Dark brown, stiff, wet, moderate to highly plastic. At 2m; Firm. [ALLUVIUM]											3.90	0.5
		Clayey SILT. Grey, firm, wet to saturated, moderately plastic. [ALLUVIUM]											3.95	0.5
		2.5m: Becomes stiff with poor recovery and some contamination from above.											4.00	0.5
		3m: Fully saturated.											4.05	0.5
		3.5m: End of Borehole, high suction											4.10	0.5
													4.15	1
													4.20	1
													4.25	1
													4.30	2
													4.35	1
													4.40	1
													4.45	1
													4.50	1
											4.55	1		
											4.60	2		
											4.65	1		
											4.70	2		
											4.75	1		
											4.80	1		
											4.85	1		
											4.90	1		
											4.95	1		
											5.00	2		
											5.05	1		
											5.10	2		
											5.15	2		
											5.20	2		
											5.25	2		
											5.30	2		
											5.35	2		
											5.40	2		
											5.45	1		
											5.50	2		
											5.55	2		
											5.60	2		
											5.65	2		
											5.70	2		
											5.75	1		
											5.80	2		
											5.85	2		
											5.90	2		
											5.95	2		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level ▽ Water Level At Time Of Drilling	Corrected as per NZGS Guidelines Vane No.:GEO1596 is 1,414 UTP = Unable To Penetrate + = Peak Exceeded - = No Result	Flat, Field. Hole data is for a set location only.

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AUCKLAND

M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH4
 Date: 18/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)					Scala Penetrometer (blows / 50mm)				
						50	100	150	200	Values	Depth (m)	Blows			
		Topsoil. [TOPSOIL]		TOP SOIL							3.90	1			
		SILT with minor clay. Orange, very stiff to hard, low plasticity. [WAIPAPA GROUP / COLLUVIUM ?]		TAURANGA GROUP ALLUVIUM (Pleistocene deposits)							3.95	1			
		Clayey SILT. Orange mottled light grey, very stiff to hard, dry, low to moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]										4.00	1		
0.5			Silty CLAY. Orange mottled light grey, very stiff, dry to moist, moderate to highly plastic. [WAIPAPA GROUP / COLLUVIUM ?] 0.9m: Becomes moist and highly plastic.									198+	4.05	1	
												-	4.10	1	
		1.2m: Moderate to highly plastic.											4.15	1	
													4.20	1	
		Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]											4.25	1	
													4.30	1	
1.0		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. At 1.8m: Moist to wet. [WAIPAPA GROUP / COLLUVIUM ?]										170	4.35	1	
													71	4.40	1
		2.3m: Becomes light grey mottled orange and moist.											4.45	1	
													4.50	1	
		Clayey SILT with minor fine sand. Light grey mottled orange, very stiff, wet, moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]											4.55	1	
1.5													116	4.60	1
		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. At 1.8m: Moist to wet. [WAIPAPA GROUP / COLLUVIUM ?]											57	4.65	2
														4.70	1
2.0		2.3m: Becomes light grey mottled orange and moist.											4.75	1	
													102	4.80	1
		Clayey SILT with minor fine sand. Light grey mottled orange, very stiff, wet, moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]											45	4.85	1
														4.90	2
		SILT with CLASTS (<3mm), some fine sand and minor to trace of clay. Light brown mottled orangey brown and light grey, very stiff, wet, low plasticity. At 3m; With Clasts (<5mm), wet to saturated and orange and light grey. [WAIPAPA GROUP / COLLUVIUM ?]									5.00	2			
												5.05	2		
2.5		Fine to medium, loose Sandy SILT with Clasts (<5mm) and minor clay. Orange, wet to saturated, low plasticity. [WAIPAPA GROUP / COLLUVIUM ?]									158	5.10	3		
												71	5.15	2	
		Silty CLAY. Orange mottled light grey and dark orange, stiff, wet, highly plastic. [WAIPAPA GROUP / COLLUVIUM ?]										5.20	2		
												5.25	2		
3.0		Silty (Fine to coarse, loose) SAND with Clasts (<7mm) and minor clay. Light grey mottled orange, wet to saturated, low plasticity. [WAIPAPA GROUP / COLLUVIUM ?]									156	5.30	2		
												28	5.35	3	
		Silty CLAY. Light grey and orange, stiff, wet, moderate to highly plastic. [WAIPAPA GROUP / COLLUVIUM ?]										5.40	2		
												5.45	3		
3.5		3.85m: End of Borehole, high suction										5.50	2		
												99	5.55	3	
											42	5.60	2.5		
												5.65	2.5		
												5.70	2.5		
4.0												5.75	2.5		
												5.80	2.5		
												5.85	2.5		
												5.90	3		
												5.95	3		
												6.00	3		
												6.05	3		
												6.10	3		
												6.15	3		
												6.20	3		
												6.25	3		
												6.30	3		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water
 ▼ Standing Water Level
 ▽ Water Level At Time Of Drilling

Shear Vane
 Corrected as per NZGS Guidelines
 Vane No.: GEO1596 is 1.414
 UTP = Unable To Penetrate
 + = Peak Exceeded
 - = No Result

Other Comments
 Near Level, Field. Hole data is for a set location only.

SOIL DYNE LTD
 AUCKLAND

M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH5
 Date: 14/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)					Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows	
0.0		Topsoil. [TOPSOIL]		TOPSOIL							3.60	5	
0.5		Clayey SILT. Orange mottled light grey, hard, dry, low to moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]		TAURANGA GROUP ALLUVIUM (Pleistocene deposits)						UTP	3.65	4	
		Silty CLAY. Orange mottled light grey, hard, moist, highly plastic. [WAIPAPA GROUP / COLLUVIUM ?]									-	3.70	4
		1m: Very stiff.									141	3.75	4
		1.2m: Moist to wet.									57	3.80	5
		1.5m: Stiff.										3.85	6
		Clayey SILT with minor fine sand. Light grey mottled orange, stiff, moist to wet, moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?]										3.90	4
		SILT with Clasts (<3mm<25%), some fine sand and minor clay. Orange, light grey and dark orange, stiff, moist to wet, low plasticity. At 2m; Hard. At 2.2m; With some clasts (<4mm). [WAIPAPA GROUP / COLLUVIUM ?]										3.95	5
		2.4m: With some clay and wet.										4.00	3
		Fine to medium, medium dense to dense Sandy SILT with clasts (<4mm) and minor clay. Orange mottled light grey and dark orange, wet, low plasticity. [WAIPAPA GROUP / COLLUVIUM ?]										4.05	4
												4.10	3
												4.15	4
												4.20	4
												4.25	5
											99	4.30	7
											31	4.35	6
										4.40	8		
										4.45	9		
									UTP	4.50	4		
									-	4.55	4		
										4.60	5		
										4.65	4		
										4.70	7		
										4.75	10		
									UTP	4.80	11		
									-	4.85	11		
										4.90	11		
										4.95	14		
									UTP	5.00	14		
									-				
3.5		Silty (Fine to medium, medium dense to dense) SAND with Clasts (<5mm<30%) and minor to trace of clay. Orangey brown, wet, very low plasticity. [WAIPAPA GROUP / COLLUVIUM ?]											
		3.55m: End of Borehole, unable to penetrate											

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level ▽ Water Level At Time Of Drilling	Corrected as per NZGS Guidelines Vane No.:GEO1596 is 1.414 UTP = Unable To Penetrate + = Peak Exceeded - = No Result	Flat, Field. Hole data is for a set location only.

SOIL DYNE LTD
AUCKLAND

M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: , ,

Hole No.: AH6
 Date: 14/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)					Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows	
		Topsoil. [TOPSOIL]		TOP SOIL							2.05	1	
0.5		Clayey SILT. Grey mottled orange and brown, very stiff, dry, low to moderately plastic. At 0.4m; Becomes moderately plastic, dry to moist and light grey mottled orange. [ALLUVIUM]		TAURANGA GROUP ALLUVIUM (Holocene deposits)						144	2.10	2	
		Silty CLAY. Orange and grey with brown staining, very stiff, moist, highly plastic. [ALLUVIUM]								31	2.15	2	
		0.9m: With some clasts (<3mm), moist to wet with occasional organics (<3mm). At 1m; Extra sensitive.										2.20	2
		Fine to medium, loose Sandy SILT with Clasts (<5mm), Gravels (<20mm) and some clay. Grey mottled orange and brown, wet, low plasticity. At 1.5m; With GRAVELS (30-40%) and light grey mottled orange. [ALLUVIUM]										2.25	2
		Medium dense to dense CLASTS (<5mm), GRAVELS (<20mm), Silt, fine to medium Sand and a trace of clay. Light grey and orange, wet to saturated, no plasticity. [ALLUVIUM]										2.30	3
1.0		Silty CLAY. Bluish grey, hard, moist to wet, highly plastic. [ALLUVIUM]										2.35	3
		2m: End of Borehole, high suction / granular material from above prevents extraction										2.40	4
												2.45	4
												2.50	4
												2.55	6
1.5											2.60	7	
											2.65	7	
											2.70	7	
											2.75	7	
											2.80	8	
											2.85	9	
											2.90	9	
											2.95	10	
2.0											3.00	10	
											3.05	11	
											3.10	11	
											3.15	12	
											3.20	11	

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

▼ Standing Water Level

▽ Water Level At Time Of Drilling

Shear Vane

Corrected as per NZGS Guidelines
 Vane No.: GEO1596 is 1,414
 UTP = Unable To Penetrate
 + = Peak Exceeded
 - = No Result

Other Comments

Near Level, Field. Hole data is for a set location only.

SOIL DYNE LTD
 AUCKLAND

M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH7
 Date: 14/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)					Scala Penetrometer (blows / 50mm)	
						50	100	150	200	Values	Depth (m)	Blows
		Topsoil. [TOPSOIL]		TOP SOIL							2.65	5
		SILT with some clay. Orange mottled brown, very stiff to hard, dry, low plasticity. [WAIPAPA GROUP / COLLUVIUM ?]		TAURANGA GROUP ALLUVIUM (Pleistocene deposits)						198+	2.70	6
0.5		Clayey SILT. Orange mottled light grey, very stiff to hard, dry, low to moderately plastic. [WAIPAPA GROUP / COLLUVIUM ?] 0.7m: Moderately plastic.								-	2.80	4
		0.9m: Becomes moist. 1m: Becomes hard.								UTP	2.85	4
		SILT with some clay, some clasts (<3mm) and some fine sand. Orange mottled light grey, hard, moist, low plasticity. At 1.3m; With minor clay.								-	2.90	4
		At 1.5m; With Clasts (<4mm<25%), minor to trace of clay and orange mottled brown, black, light grey and dark orange. [WAIPAPA GROUP / COLLUVIUM ?]								UTP	2.95	5
		Fine to medium, medium dense Sandy SILT with Clasts (<3mm) and minor to trace of clay. Dark orange mottled orange, moist to wet, very low plasticity. At 1.9m; Wet. [WAIPAPA GROUP / COLLUVIUM ?]								-	3.00	6
2.0		Silty (Fine to medium, medium dense to dense) SAND with Clasts (<4mm) and a trace of clay. Light brown, orangey brown, orange and dark orange, wet, no plasticity.								UTP	3.05	4
		At 2.4m; With Clasts (<5mm). [WAIPAPA GROUP / COLLUVIUM ?]								-	3.10	5
		SILT with some fine sand, some clasts (<5mm) and a trace of clay. Orangey brown mottled orange and brown, hard, moist to wet, no plasticity. [WAIPAPA GROUP / COLLUVIUM ?]								UTP	3.15	4
		2.6m: End of Borehole, unable to penetrate								-	3.20	4
									3.25	2		
									3.30	2		
									3.35	3		
									3.40	4		
									3.45	6		
									3.50	6		
									3.55	7		
									3.60	8		
									3.65	7		
									3.70	8		
									3.75	7		
									3.80	8		
									3.85	4		
									3.90	4		
									3.95	6		
									4.00	7		
									4.05	6		
									4.10	7		
									4.15	4		
									4.20	4		
									4.25	4		
									4.30	5		
									4.35	5		
									4.40	6		
									4.45	7		
									4.50	8		
									4.55	6		
									4.60	7		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level ▽ Water Level At Time Of Drilling	Corrected as per NZGS Guidelines Vane No.:GEO1596 is 1.414 UTP = Unable To Penetrate + = Peak Exceeded - = No Result	Flat, Field. Hole data is for a set location only.

SOIL DYNE LTD
AUCKLAND

M: 027 368 8832

E: soil.dyne@yahoo.com



SOIL DYNE LTD

HAND AUGER LOG

Job No.: 190051

Client: KGA Geotechnical Group Ltd
 Project: 272-278 Clevedon-Kawakawa Road, Clevedon
 Location: See Site Plan
 Coordinates: ,

Hole No.: AH8
 Date: 14/02/2019
 Logged By: SR
 Sheet: 1 of 1

Ground Level: -

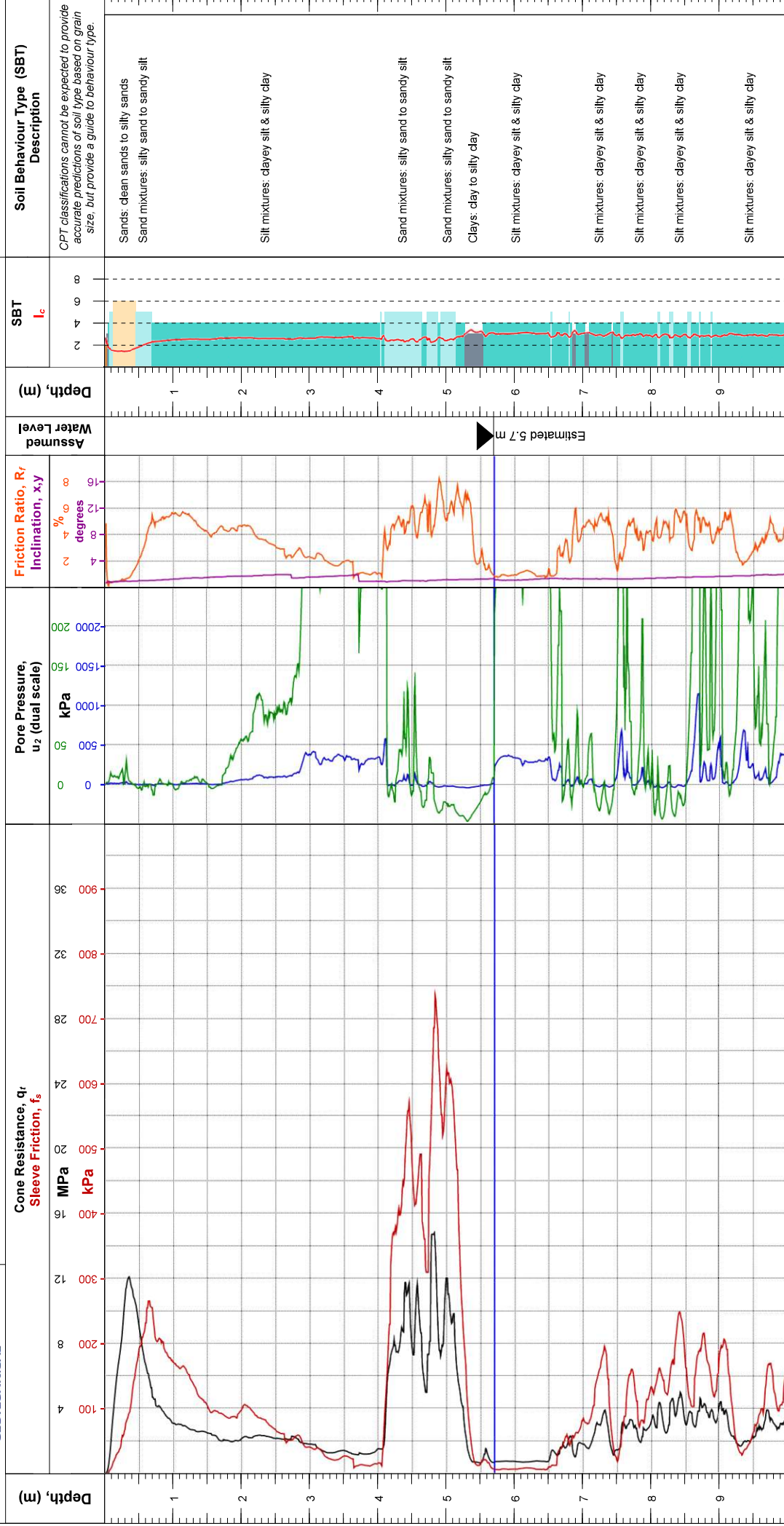
Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)					Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows	
		Topsoil. [TOPSOIL]		TOP SOIL	TS						5.05	1	
		SILT some clay. Orange mottled grey, very stiff, dry, low plasticity. [ALLUVIUM]		TAURANGA GROUP ALLUVIUM (Holocene deposits)							5.10	1	
		Clayey SILT. Light grey mottled orange, very stiff, dry to moist, moderately plastic. [ALLUVIUM]										5.15	0.5
0.5		Silty CLAY. Orange mottled light grey and dark orange, very stiff, moist, highly plastic. At 0.8m; Becomes grey mottled orange. At 0.9m; With a trace of fine sand and moist to wet.								170		5.20	0.5
		At 1m; Becomes stiff and light grey mottled orange. [ALLUVIUM]										5.25	0.5
		SILT with loose CLASTS (<4mm) and some fine sand and minor clay. Light grey mottled orange, wet, low plasticity. [ALLUVIUM]	14/02/2019									5.30	0.5
		At 2m; Stiff. [ALLUVIUM]										5.35	1
		Clayey SILT. Orange mottled light grey, stiff, wet, moderately plastic. [ALLUVIUM]										5.40	2
1.0		Silty CLAY. Light grey mottled orange, stiff, wet, highly plastic. [ALLUVIUM]								82		5.45	2
		At 1.8m; With some clasts (<4mm) and orange mottled light grey and dark grey plus wet.								40		5.50	2
		At 2m; Stiff. [ALLUVIUM]										5.55	1
		Clayey SILT. Orange mottled light grey, stiff, wet, moderately plastic. [ALLUVIUM]	19/02/2019									5.60	2
1.5		Silty CLAY with minor clasts (<3mm). Orange and light grey, very stiff, moist to wet, highly plastic.										5.65	2
		At 1.8m; With some clasts (<4mm) and orange mottled light grey and dark grey plus wet.								105		5.70	2
		At 2m; Stiff. [ALLUVIUM]								17		5.75	3
		Clayey SILT. Orange mottled light grey, stiff, wet, moderately plastic. [ALLUVIUM]										5.80	4
2.0		Silty CLAY. Light grey mottled orange, stiff, wet, highly plastic. [ALLUVIUM]								59		5.85	4
		At 2m; Stiff. [ALLUVIUM]								25		5.90	5
		Clayey SILT. Orange mottled light grey, stiff, wet, moderately plastic. [ALLUVIUM]										5.95	8
		Silty CLAY. Light grey mottled orange, stiff, wet, highly plastic. [ALLUVIUM]										6.00	9
		At 2m; Stiff. [ALLUVIUM]										6.05	8
2.5		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]							99		6.10	7	
		At 2m; Stiff. [ALLUVIUM]							28		6.15	4	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.20	4	
		At 2m; Stiff. [ALLUVIUM]									6.25	7	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.30	8	
		At 2m; Stiff. [ALLUVIUM]							59		6.35	10	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]							20		6.40	10	
		At 2m; Stiff. [ALLUVIUM]									6.45	8	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.50	9	
		At 2m; Stiff. [ALLUVIUM]									6.55	10	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.60	10	
		At 2m; Stiff. [ALLUVIUM]									6.65	9	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.70	10	
		At 2m; Stiff. [ALLUVIUM]									6.75	9	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.80	5	
		At 2m; Stiff. [ALLUVIUM]									6.85	5	
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]									6.90	8	
		At 2m; Stiff. [ALLUVIUM]											
4.0		3.5m: Very poor recovery, difficult Id, firm and pushing down.							34				
		At 2m; Stiff. [ALLUVIUM]							14				
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff, saturated, moderately plastic. Poor recovery. [ALLUVIUM]											
		At 2m; Stiff. [ALLUVIUM]											
		Clayey SILT. Light grey and orange, stiff											



CONE PENETRATION TEST (CPT) LOGS



CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT) Description
 CPT classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

Sands: clean sands to silty sands
 Sand mixtures: silty sand to sandy silt

Silt mixtures: clayey silt & silty clay

Sand mixtures: silty sand to sandy silt

Sand mixtures: silty sand to sandy silt

Clays: clay to silty clay

Silt mixtures: clayey silt & silty clay

Silt mixtures: clayey silt & silty clay

Silt mixtures: clayey silt & silty clay

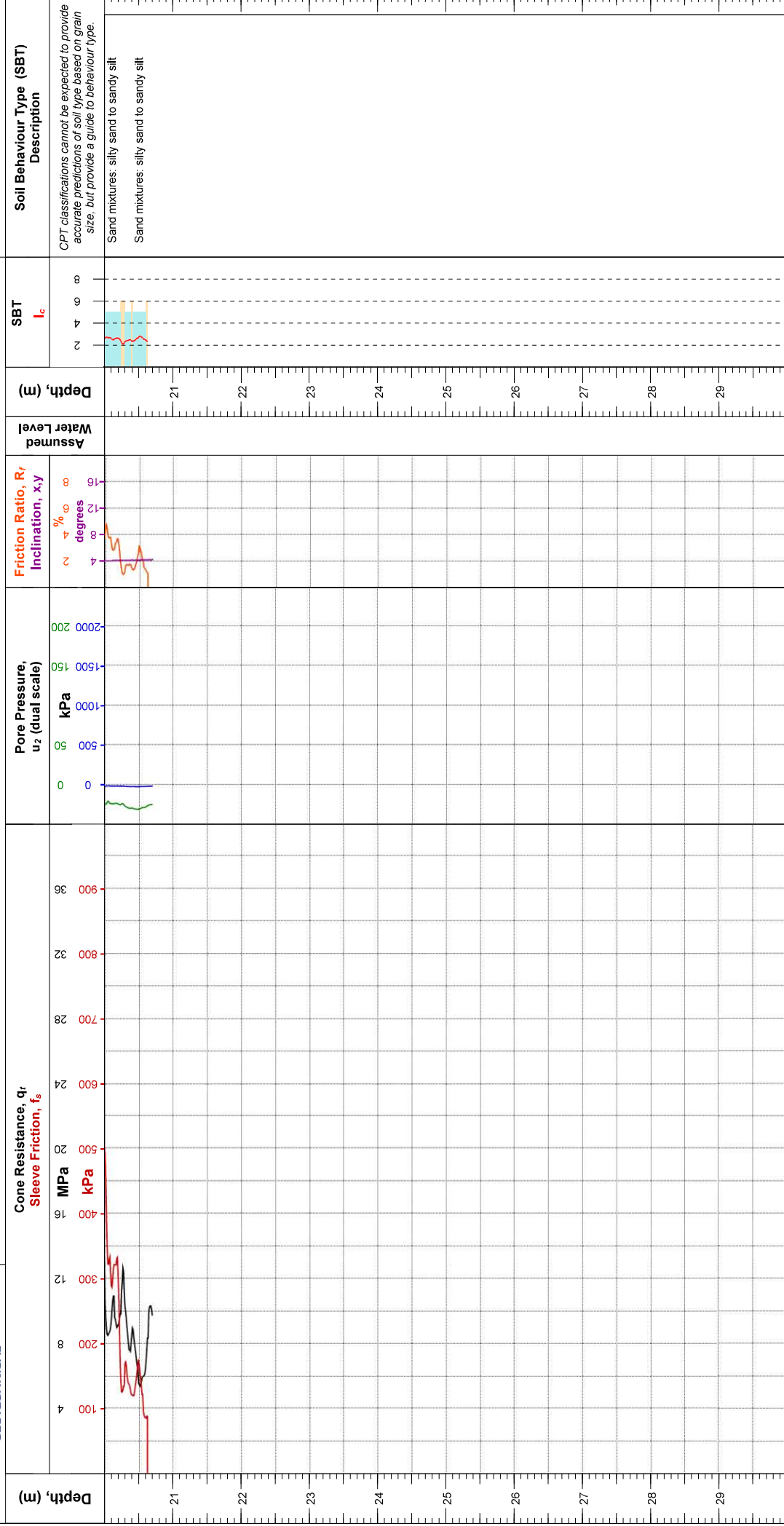
Silt mixtures: clayey silt & silty clay

Silt mixtures: clayey silt & silty clay

Client Job Ref:	Client Job Ref: Unknown	
Date of Test:	Date of Test: 14/02/2019	
Depth (m):	Depth (m): 20.70	
Pre-Drill (m):	Pre-Drill (m): N/A	
Elevation (m):	Elevation (m): Unknown	
WGS84, (deg):	WGS84, (deg): -36.975712, 175.059529	
Location Method:	Location Method: Handheld GPS	
Surveyor:	Surveyor: N/A	
Termination Reason:	Termination Reason: Target depth	
Operator:	Operator: Marcelo Martinez	
Cone Ref:	Cone Ref: MKJ540	
Cone Type:	Cone Type: 10 cm ² Compression	
Area Ratio:	Area Ratio: 0.8	
Filter Type:	Filter Type: u2	
Client:	Client: KGA Geotechnical Ltd. Auckland	
Project:	Project: 272 & 278 Clevedon-Kawakawa Road	
Location:	Location: Clevedon, Auckland	
Engineer:	Engineer: Giovanni Pradel	
Contractor:	Contractor: Ground Investigation Ltd. www.g-i.co.nz	
Remarks:	Remarks:	



CONE PENETRATION TEST (CPT) LOG

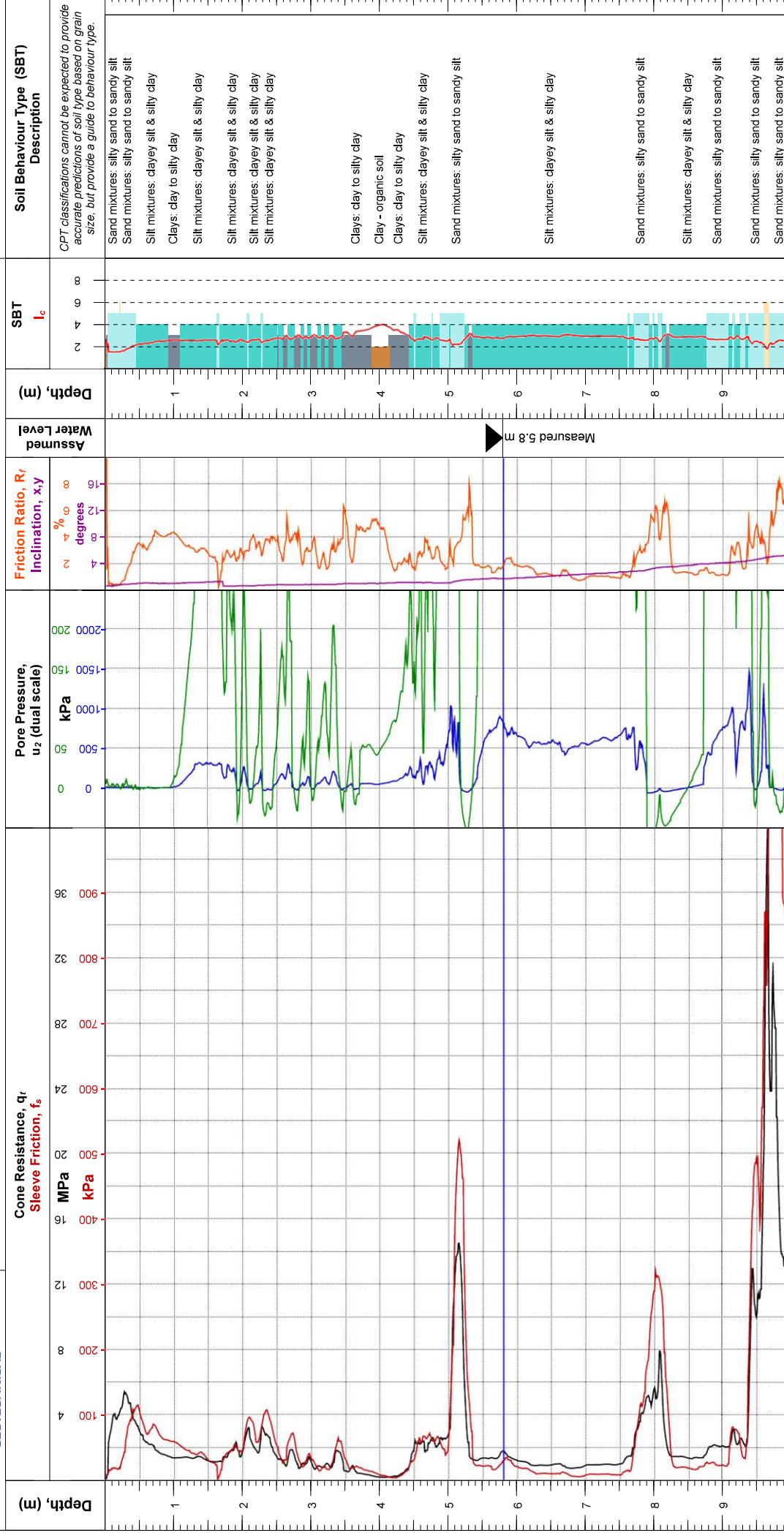


Client: KGA Geotechnical Ltd. Auckland Project: 272 & 278 Clevedon-Kawakawa Road Location: Clevedon, Auckland Engineer: Giovanni Pradel Contractor: Ground Investigation Ltd. www.g-i.co.nz	Operator: Marcelo Martinez Cone Ref: MKJ540 Cone Type: 10 cm ² Compression Area Ratio: 0.8 Filter Type: u2	Operator: Marcelo Martinez Cone Ref: MKJ540 Cone Type: 10 cm ² Compression Area Ratio: 0.8 Filter Type: u2	Client Job Ref: Elevation (m): Unknown Date of Test: 14/02/2019 Depth (m): 20.70 Pre-Drill (m): N/A
Termination Reason: Target depth			Client Job Ref: 19-046

Remarks:



CONE PENETRATION TEST (CPT) LOG



Client: KGA Geotechnical Ltd. Auckland	Operator: Marcelo Martinez	Elevation (m): Unknown	Client Job Ref:
Project: 272 & 278 Clevedon-Kawakawa Road	Cone Ref: MKJ540	Date of Test: 14/02/2019	CPT Number: CPT-02
Location: Clevedon, Auckland	Cone Type: 10 cm ² Compression	Depth (m): 20.70	
Engineer: Giovanni Pradel	Area Ratio: 0.8	Pre-Drill (m): N/A	
Contractor: Ground Investigation Ltd. www.g-i.co.nz	Filter Type: u2		
Remarks:	Termination Reason: Target depth		
	Surveyor: N/A		G.I. Job Ref: 19-046
	Location Method: Handheld GPS		
	WGS84, (deg): -36.973237, 175.059285		
	NZTM2000 N,E (m): 5906114.85, 1783302.29		
	Assumed Water Level: Measured 5.8 m		



CONE PENETRATION TEST (CPT) LOG

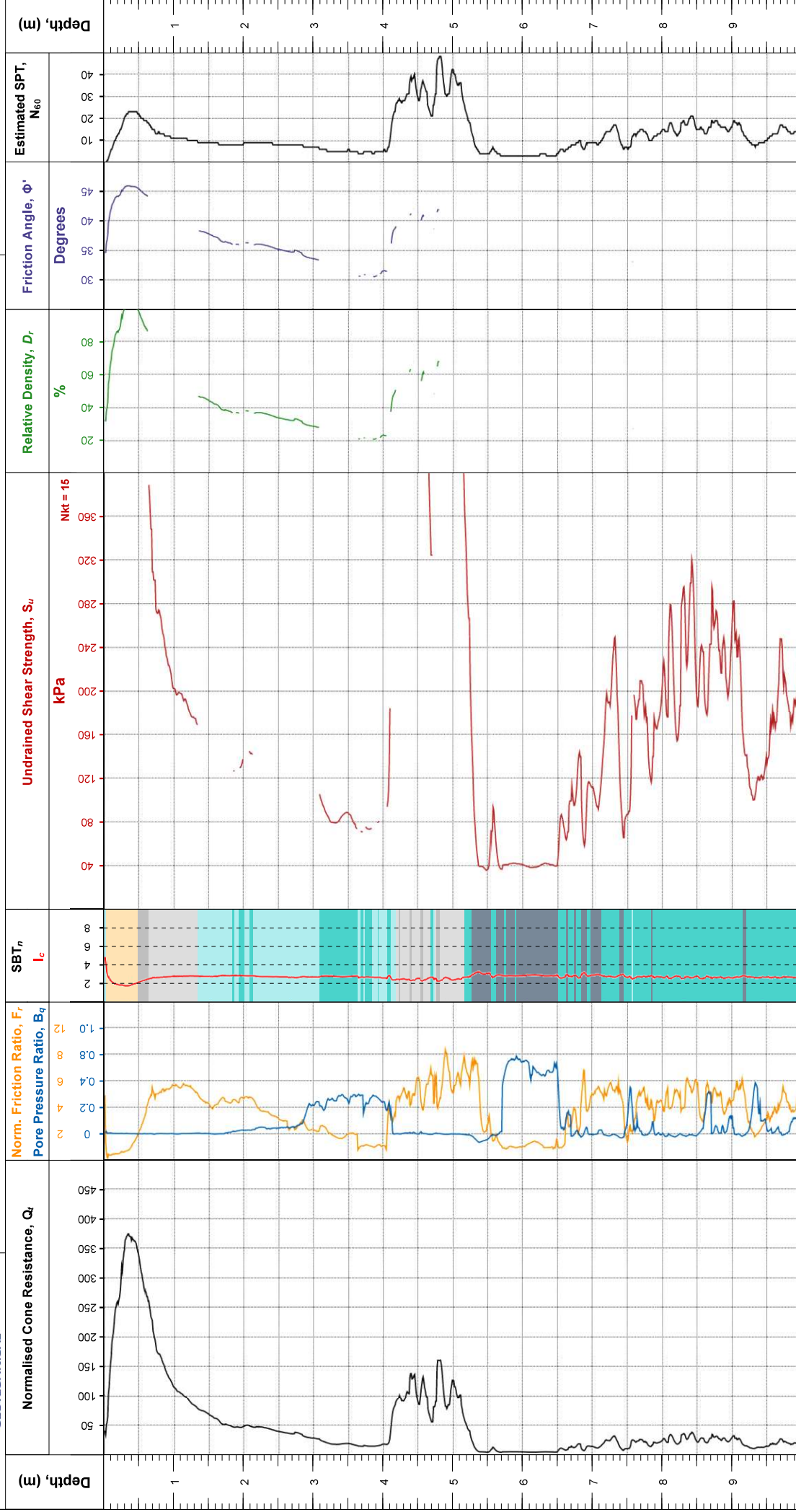


Depth, (m)	Cone Resistance, q_r Sleeve Friction, f_s MPa kPa	Pore Pressure, u_z (dual scale) kPa	Friction Ratio, R_f Inclination, x, y degrees	Assumed Water Level	Depth, (m)	SBT I_c	Soil Behaviour Type (SBT) Description								
21	400	0	8	21	21	3	<p><i>CPT classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.</i></p>								
22	300	0	8	21	22	3									
23	300	0	8	21	23	3									
24	300	0	8	21	24	3									
25	300	0	8	21	25	3									
26	300	0	8	21	26	3									
27	300	0	8	21	27	3									
28	300	0	8	21	28	3									
29	300	0	8	21	29	3									
30	300	0	8	21	30	3									
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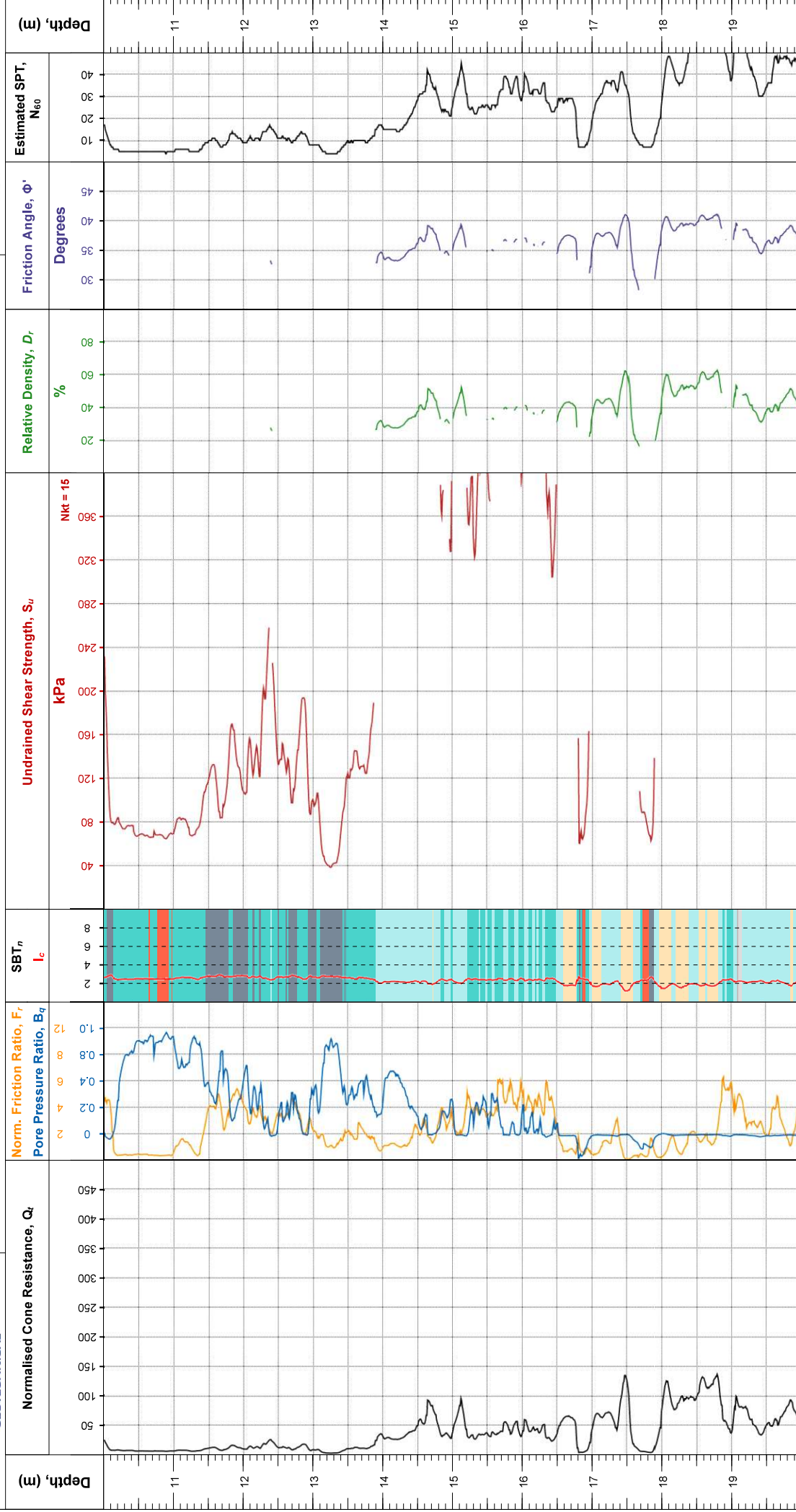
CONE PENETRATION TEST (CPT) PARAMETER LOGS

CONE PENETRATION TEST (CPT) PARAMETER LOG



<p>Client: KGA Geotechnical Ltd. Auckland</p> <p>Project: 272 & 278 Clevedon-Kawakawa Road</p> <p>Location: Clevedon, Auckland</p> <p>Engineer: Giovanni Pradel</p> <p>Contractor: Ground Investigation Ltd.</p>	<p>Soil Behaviour Type (SBTn) - Robertson et al. 1990</p> <table style="width: 100%; border: none;"> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">0</td> <td>Undefined</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">1</td> <td>Sensitive fine-grained</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">2</td> <td>Clay - organic soil</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">3</td> <td>Clays: clay to silty clay</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">4</td> <td>Silt mixtures: clayey silt & silty clay</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">5</td> <td>Sand mixtures: silty sand to sandy silt</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">6</td> <td>Sands: clean sands to silty sands</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">7</td> <td>Dense sand to gravelly sand</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">8</td> <td>Stiff sand to clayey sand</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">9</td> <td>Stiff fine-grained</td> </tr> </table>	0	Undefined	1	Sensitive fine-grained	2	Clay - organic soil	3	Clays: clay to silty clay	4	Silt mixtures: clayey silt & silty clay	5	Sand mixtures: silty sand to sandy silt	6	Sands: clean sands to silty sands	7	Dense sand to gravelly sand	8	Stiff sand to clayey sand	9	Stiff fine-grained	<p>Notes and Limitations: Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010). Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.</p>
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<p>Client Job Ref:</p> <p style="font-size: 1.2em;">CPT Number: CPT-01</p> <p>G.I. Job Ref: 19-046</p> <p>Test Date: 14/02/2019</p>																						

CONE PENETRATION TEST (CPT) PARAMETER LOG



<p>Client: KGA Geotechnical Ltd. Auckland</p> <p>Project: 272 & 278 Clevedon-Kawakawa Road</p> <p>Location: Clevedon, Auckland</p> <p>Engineer: Giovanni Pradel</p> <p>Contractor: Ground Investigation Ltd.</p>	<p>Soil Behaviour Type (SBTn) - Robertson et al. 1990</p> <table style="width: 100%; border: none;"> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">0</td> <td>Undefined</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">1</td> <td>Sensitive fine-grained</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">2</td> <td>Clay - organic soil</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">3</td> <td>Clays: clay to silty clay</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">4</td> <td>Silt mixtures: clayey silt & silty clay</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">5</td> <td>Sand mixtures: silty sand to sandy silt</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">6</td> <td>Sands: clean sands to silty sands</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">7</td> <td>Dense sand to gravelly sand</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">8</td> <td>Stiff sand to clayey sand</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">9</td> <td>Stiff fine-grained</td> </tr> </table>	0	Undefined	1	Sensitive fine-grained	2	Clay - organic soil	3	Clays: clay to silty clay	4	Silt mixtures: clayey silt & silty clay	5	Sand mixtures: silty sand to sandy silt	6	Sands: clean sands to silty sands	7	Dense sand to gravelly sand	8	Stiff sand to clayey sand	9	Stiff fine-grained	<p>Notes and Limitations: Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010). Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.</p>
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CONE PENETRATION TEST (CPT) PARAMETER LOG

Depth, (m)	Normalised Cone Resistance, Q_c	Norm. Friction Ratio, F_r Pore Pressure Ratio, B_p	SBT _n I_c	Undrained Shear Strength, S_u kPa	Relative Density, D_r %	Friction Angle, ϕ' Degrees	Estimated SPT, N_{60}	Depth, (m)
21	50	0.2	2	320	40	35	35	21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29

Client: KGA Geotechnical Ltd. Auckland
Project: 272 & 278 Clevedon-Kawakawa Road
Location: Clevedon, Auckland
Engineer: Giovanni Pradel
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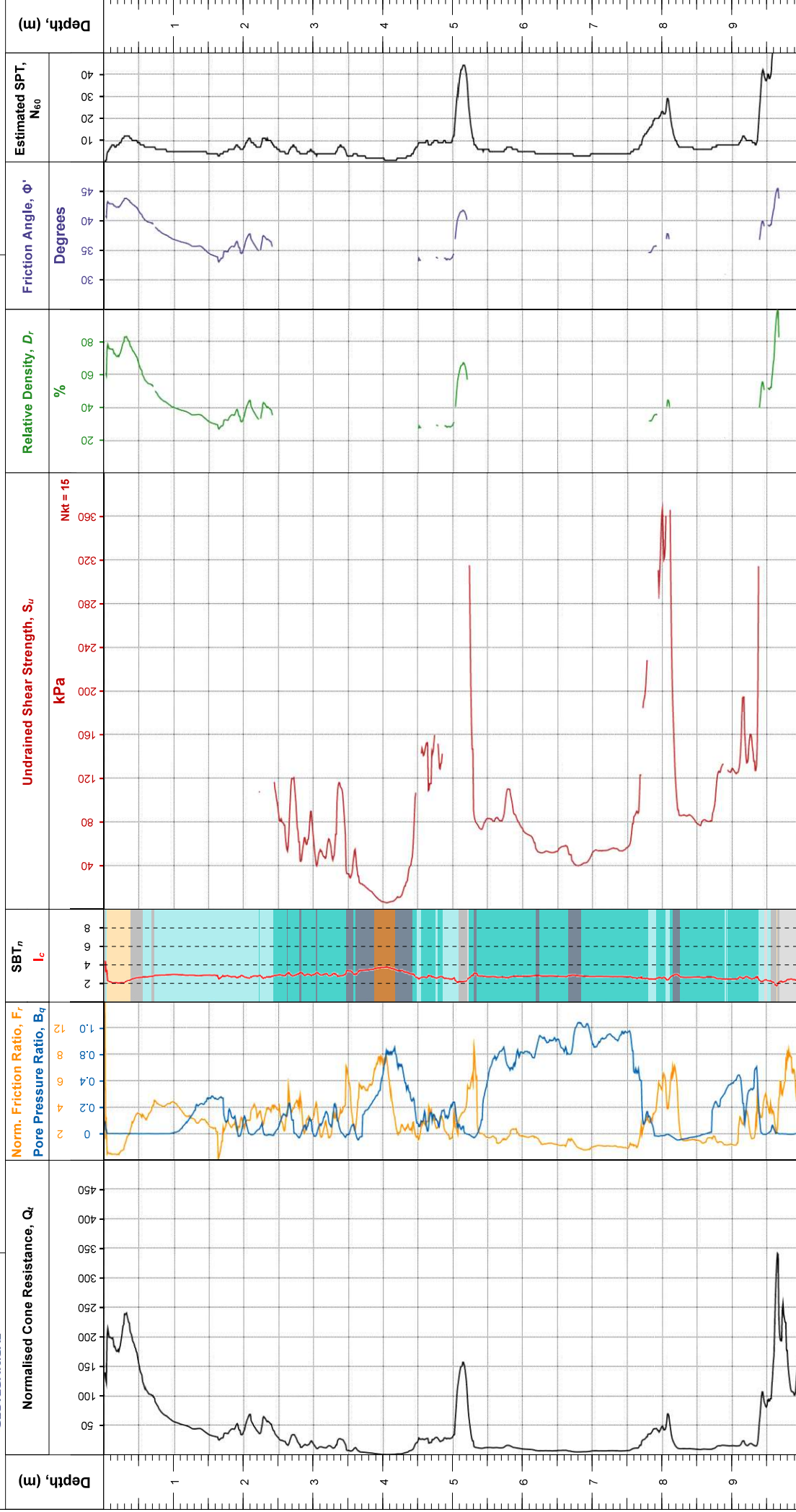
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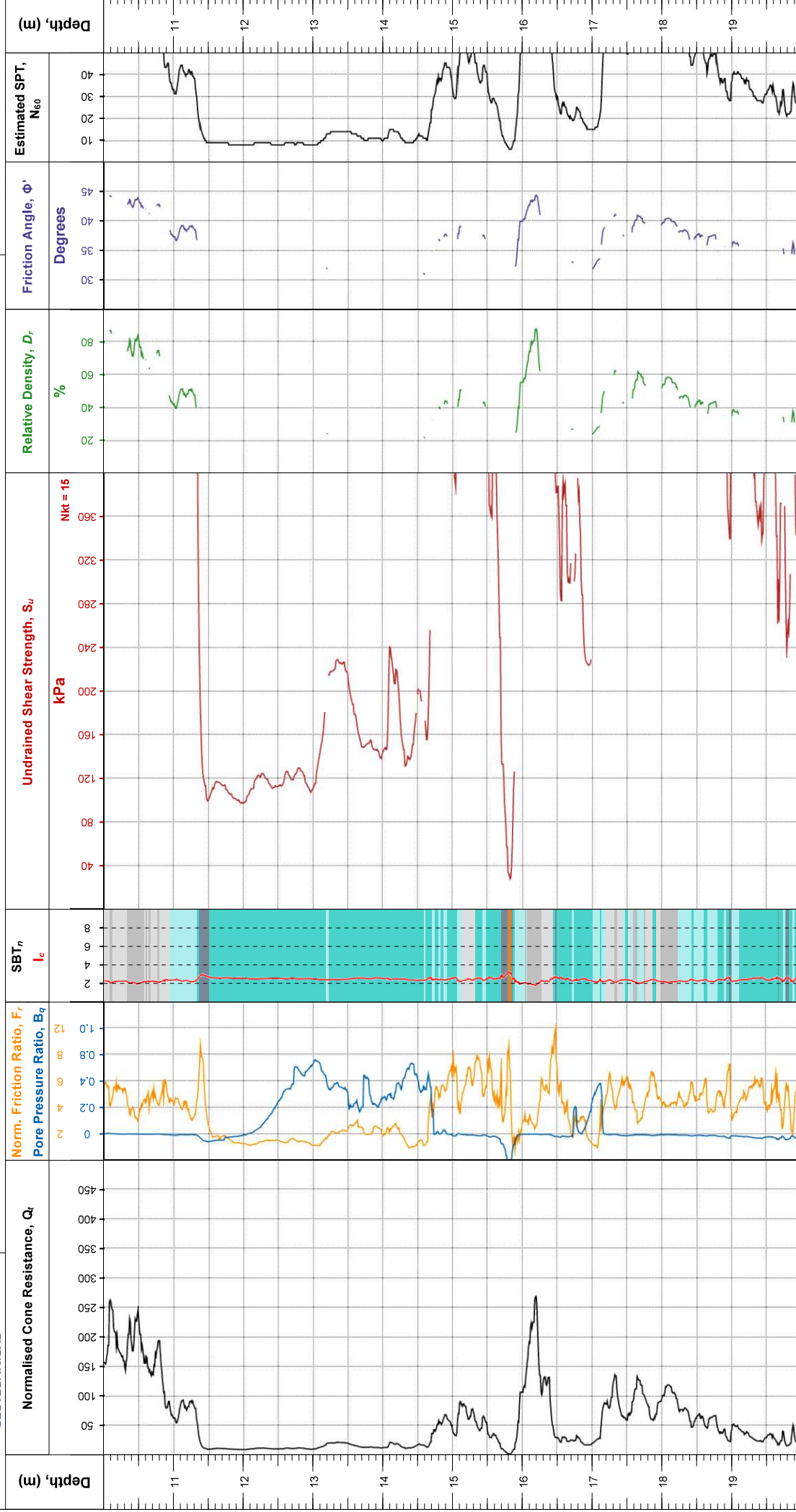
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Project: 272 & 278 Clevedon-Kawakawa Road	CPT Number: CPT-02	
Location: Clevedon, Auckland	G.I. Job Ref: 19-046	
Engineer: Giovanni Pradel	Test Date: 14/02/2019	
Contractor: Ground Investigation Ltd.		

Soil Behaviour Type (SBTn) - Robertson et al. 1990	
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CONE PENETRATION TEST (CPT) PARAMETER LOG



<p>Client: KGA Geotechnical Ltd. Auckland</p> <p>Project: 272 & 278 Clevedon-Kawakawa Road</p> <p>Location: Clevedon, Auckland</p> <p>Engineer: Giovanni Pradel</p> <p>Contractor: Ground Investigation Ltd.</p>	<p>Soil Behaviour Type (SBTn) - Robertson et al. 1990</p> <table style="width: 100%; border: none;"> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">0</td> <td>Undefined</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">1</td> <td>Sensitive fine-grained</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">2</td> <td>Clay - organic soil</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">3</td> <td>Clays: clay to silty clay</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">4</td> <td>Silt mixtures: clayey silt & silty clay</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">5</td> <td>Sand mixtures: silty sand to sandy silt</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">6</td> <td>Sands: clean sands to silty sands</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">7</td> <td>Dense sand to gravelly sand</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">8</td> <td>Stiff sand to clayey sand</td> </tr> <tr> <td style="border: 1px solid black; width: 20px; text-align: center;">9</td> <td>Stiff fine-grained</td> </tr> </table>	0	Undefined	1	Sensitive fine-grained	2	Clay - organic soil	3	Clays: clay to silty clay	4	Silt mixtures: clayey silt & silty clay	5	Sand mixtures: silty sand to sandy silt	6	Sands: clean sands to silty sands	7	Dense sand to gravelly sand	8	Stiff sand to clayey sand	9	Stiff fine-grained	<p>Notes and Limitations: Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P. K. Robertson and K.L. Cabal (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use, and should be carefully reviewed by the user. Ground Investigation Ltd does not warrant the correctness or the applicability of any of the geotechnical soil and design parameters shown and does not assume any liability for any use of the results in any design or review. The user should be fully aware of the techniques and limitations of any method used to derive data shown in this report.</p>
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CONE PENETRATION TEST (CPT) PARAMETER LOG

Depth, (m)	Normalised Cone Resistance, Q_c	Norm. Friction Ratio, F_r Pore Pressure Ratio, B_q	SBT _n I_c	Undrained Shear Strength, S_u kPa	Relative Density, D_r %	Friction Angle, ϕ' Degrees	Estimated SPT, N_{60}	Depth, (m)
21	50	0.2	3	180	40	35	25	21
22								22
23								23
24								24
25								25
26								26
27								27
28								28
29								29

Client Job Ref:
CPT
Number: **CPT-02**
G.I. Job Ref: **19-046**
Test Date: **14/02/2019**

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Client: KGA Geotechnical Ltd, Auckland
Project: 272 & 278 Clevedon-Kawakawa Road
Location: Clevedon, Auckland
Engineer: Giovanni Pradel
Contractor: Ground Investigation Ltd.



CPT ZEROS AND DRIFT RESULTS

CPT ZEROS AND DRIFT

272 & 278 Clevedon-Kawakawa Road

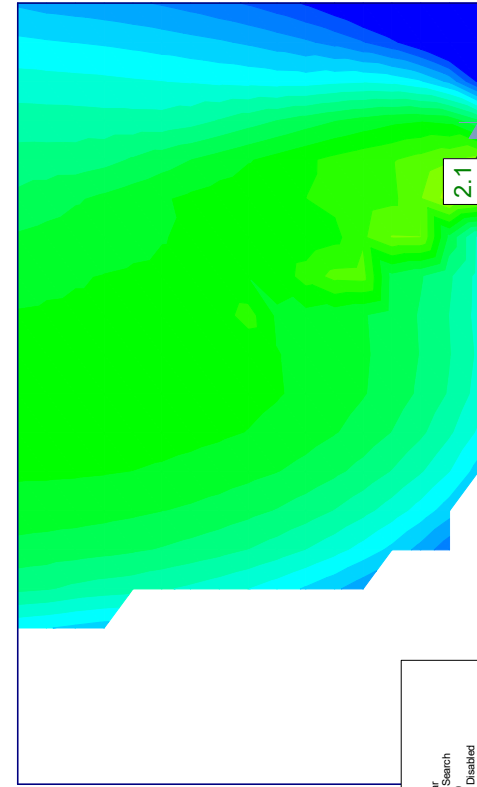
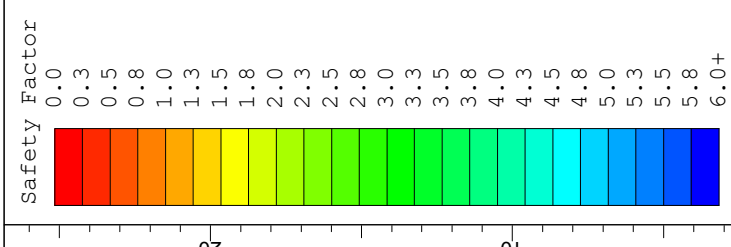
G.I. Ref: 19-046

Cone Reference	CPT Name	Push Number	Tip Resistance			Local Friction			Pore Pressure		
			Initial (MPa)	Final (MPa)	Difference (%)	Initial (MPa)	Final (MPa)	Difference (%)	Initial (MPa)	Final (MPa)	Difference (%)
MKJ540	CPT-02	1	10.612	10.591	0.04	0.129	0.128	0.06	1.444	1.432	0.48
MKJ540	CPT-01	1	10.643	10.596	0.09	0.127	0.127	-0.01	1.441	1.440	0.04

Client: KGA Geotechnical Ltd, Auckland
Project: 272 & 278 Clevedon-Kawakawa Road

Location: Clevedon, Auckland
Engineer: Giovanni Pradel

NOTE: Percentage Zero Difference calculated following ASTM D5778-12. Green indicates a difference between -1% and 1%; yellow shows either -1% to -2% or 1% to 2%; red shows below -2% or over 2%



Results
 Surface Type: Circular
 Search Method: Newton-Raphson
 Radius Increment: 10
 Composite Surfaces: Disabled
 Reverse Curvature: Invalid Surfaces
 Minimum Depth: 0.0
 Minimum Depth: Not Defined
 The 10 surfaces with the lowest factors of safety
 2.1

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Colluvium	[Yellow]	18	Mohr-Coulomb	2	20
Alluvium Floodplain Deposits (a1)	[Green]	18	Mohr-Coulomb	3	28
Alluvium Terrace Deposits (a2)	[Orange]	18	Mohr-Coulomb	5	30

7A William Pickering Dr
 Albany | Auckland
 PO Box 302 361 NHMC
 09 478 6655
 www.kga.co.nz

KGGA
 GEOTECHNICAL

Project 278 Clevedon-Kawakawa Road, Clevedon

Analysis Description Section A-A' - Measured Groundwater - Run 1

Drawn By GP **Scale** 1:250 **Company** KGA Geotechnical Group Ltd

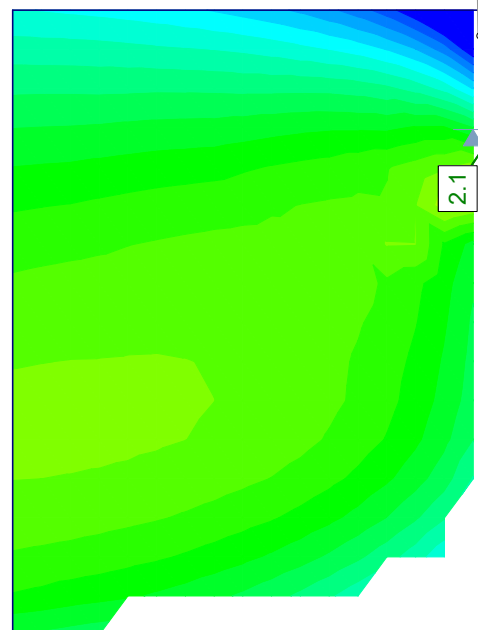
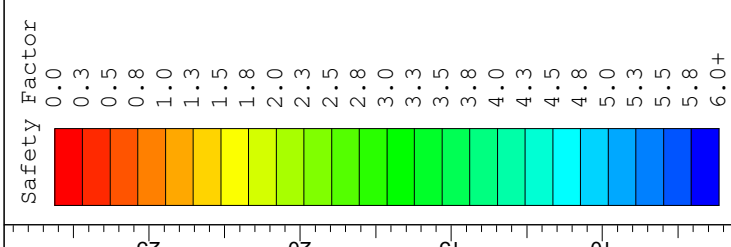
Date 19/03/2019 **File Name** Section A-A' - Measured Groundwater - Run 1.slm

SLIDEINTERPRET 6.039



APPENDIX C

Slope Stability Analysis



Results
 Ignored Types: Circular
 Search Method: Grid Search
 Radius Increment: 10
 Composite Surfaces: Disabled
 Reverse Curvature: Invalid Surfaces
 Minimum Depth: Not Defined
 The 10 surfaces with the lowest factors of safety
 2.1

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (deg)
Colluvium		18	Mohr-Coulomb	2	20
Alluvium Floodplain Deposits (a1)		18	Mohr-Coulomb	3	28
Alluvium Terrace Deposits (a2)		18	Mohr-Coulomb	5	30

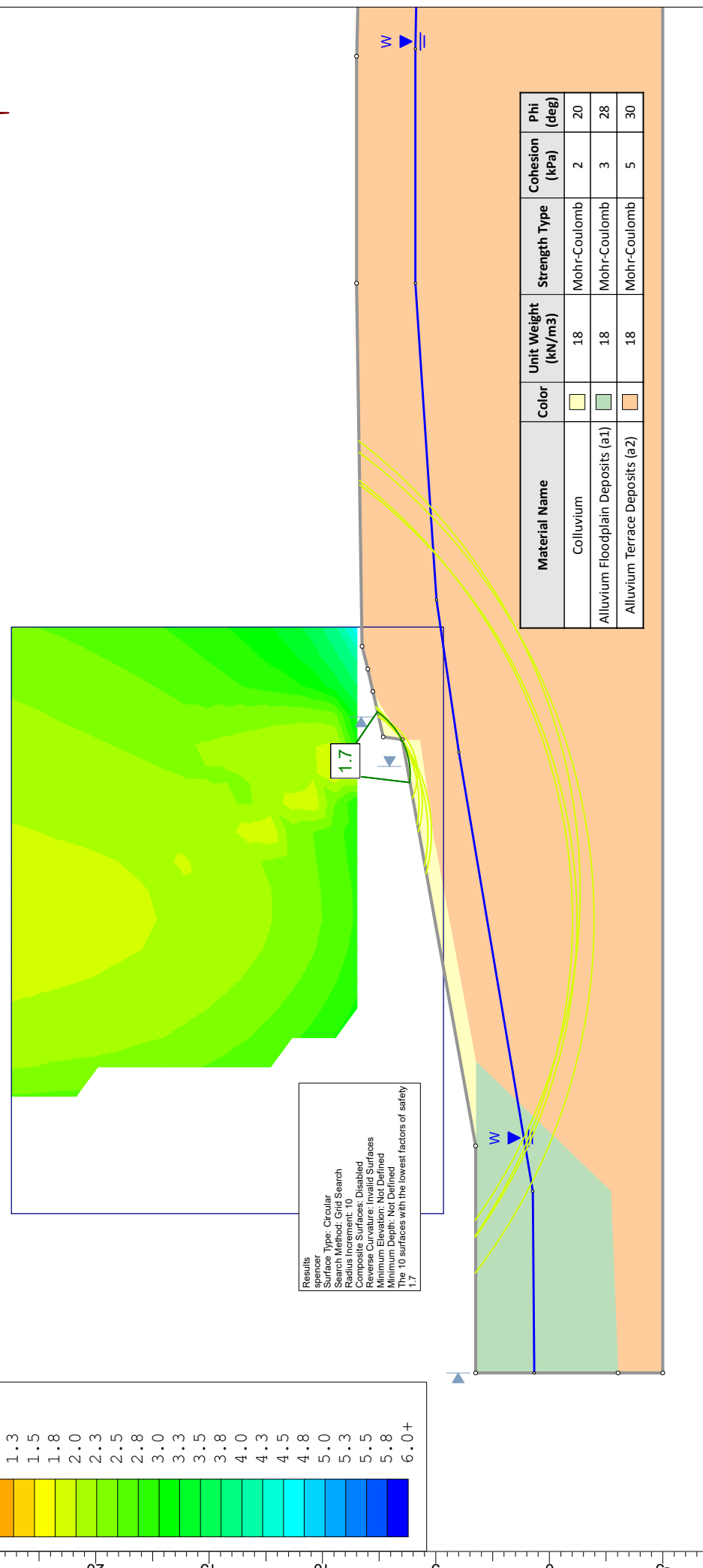
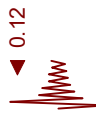
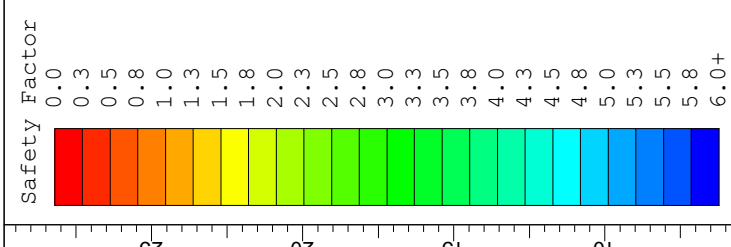


KGGA
 GEOTECHNICAL

7A William Pickering Dr
 Albany | Auckland
 PO Box 302 361 NHMC
 09 478 6655
 www.kga.co.nz

278 Clevedon-Kawakawa Road, Clevedon

Project		278 Clevedon-Kawakawa Road, Clevedon	
Analysis Description		Section A-A' - Raised Groundwater - Run 3	
Drawn By	GP	Company	KGGA Geotechnical Group Ltd
Date	19/03/2019	Scale	1:250
File Name		Section A-A' - Raised Groundwater - Run 3.slim	



Results Spencer
 Surface Type: Circular
 Search Method: Grid Search
 Radius Increment: 10
 Composite Surfaces: Disabled
 Minimum Surfaces: 10
 Minimum Elevation: Not Defined
 Minimum Depth: Not Defined
 The 10 surfaces with the lowest factors of safety
 1.7

Material Name	Color	Unit Weight (kN/m ³)	Strength Type	Cohesion (kPa)	Phi (deg)
Colluvium	[Yellow]	18	Mohr-Coulomb	2	20
Alluvium Floodplain Deposits (a1)	[Green]	18	Mohr-Coulomb	3	28
Alluvium Terrace Deposits (a2)	[Orange]	18	Mohr-Coulomb	5	30

KGGA
 GEOTECHNICAL

7A William Pickering Dr
 Albany | Auckland
 PO Box 302 361 NHMC
 09 478 6655
 www.kga.co.nz

Project		278 Clevedon-Kawakawa Road, Clevedon	
Analysis Description		Section A-A' - Seismic - Run 5	
Drawn By	GP	Scale	1:250
Date		19/03/2019	
Company		KGA Geotechnical Group Ltd	
File Name		Section A-A' - Seismic - Run 5.slm	



APPENDIX D

Liquefaction Assessment Results

LIQUEFACTION ANALYSIS REPORT

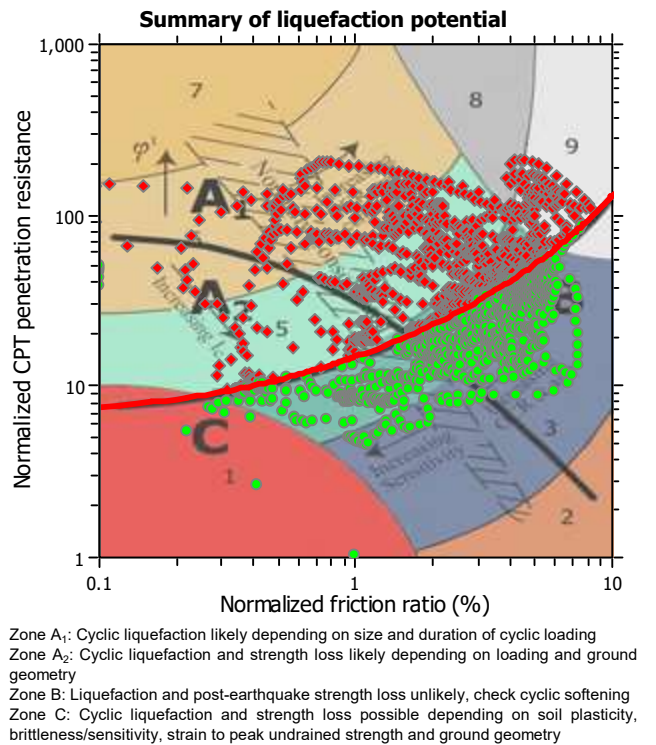
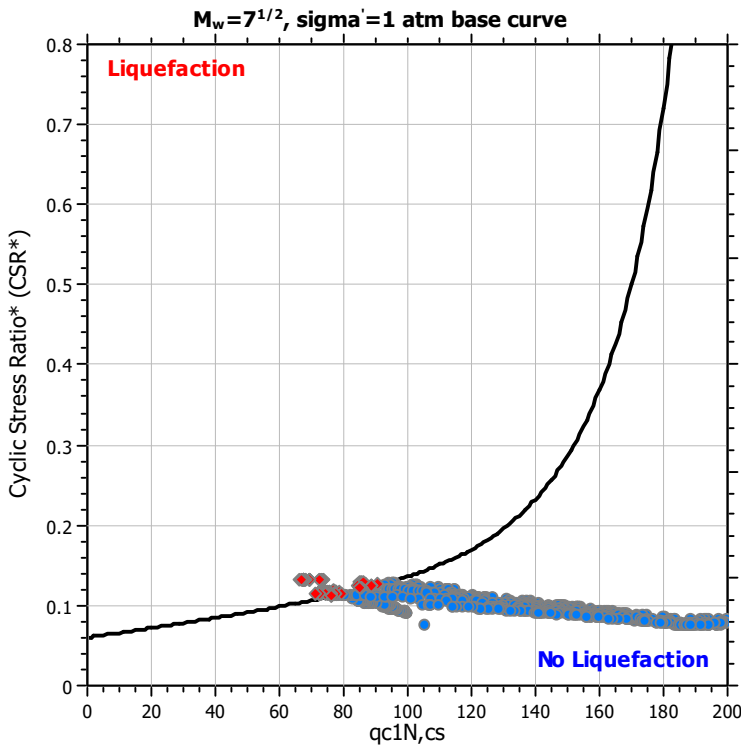
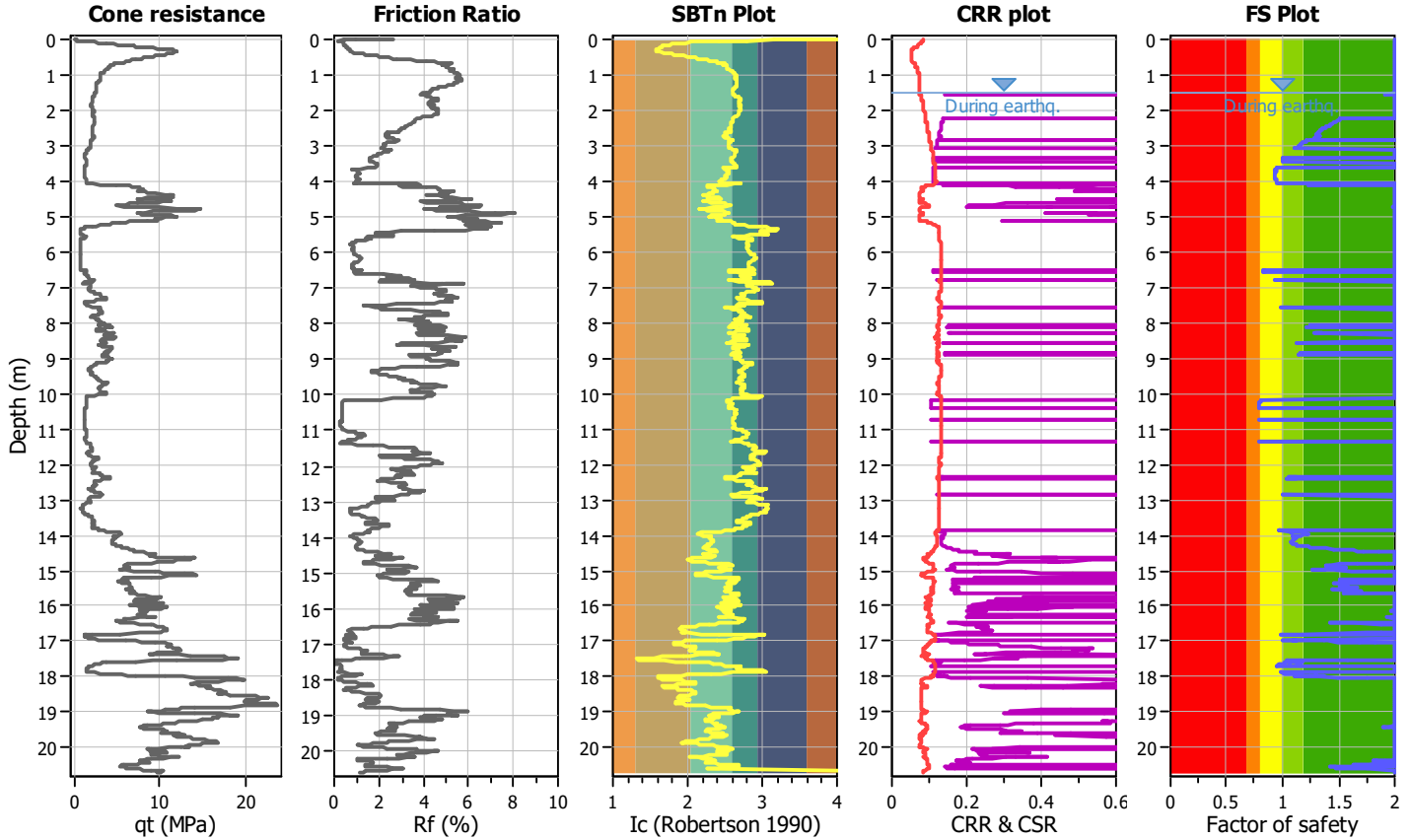
Project title :

Location :

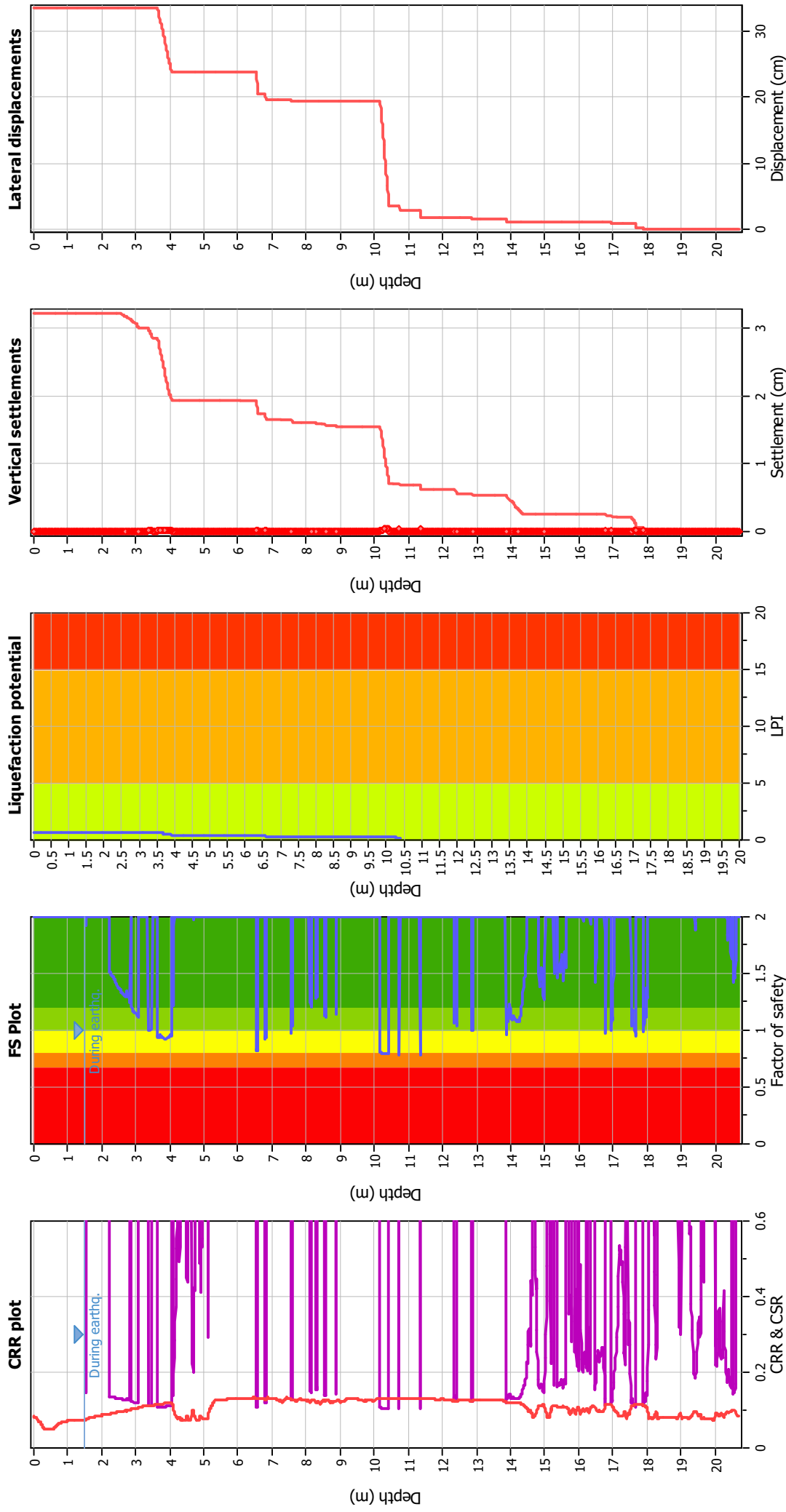
CPT file : CPT-01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.15	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.15
 Depth to water table (insitu): 2.00 m

F.S. color scheme

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

LPI color scheme

Very high risk
 High risk
 Low risk

Depth to GW (earthq.): 1.50 m
 Average results interval: 3
 Ic cut-off value: 2.60
 Unit weight calculation: Based on SBT
 Use fill: No
 Fill height: N/A

Fill weight: N/A
 Transition detect. applied: No
 K_s applied: Yes
 Clay like behavior applied: Sands only
 Limit depth applied: No
 Limit depth: N/A

LIQUEFACTION ANALYSIS REPORT

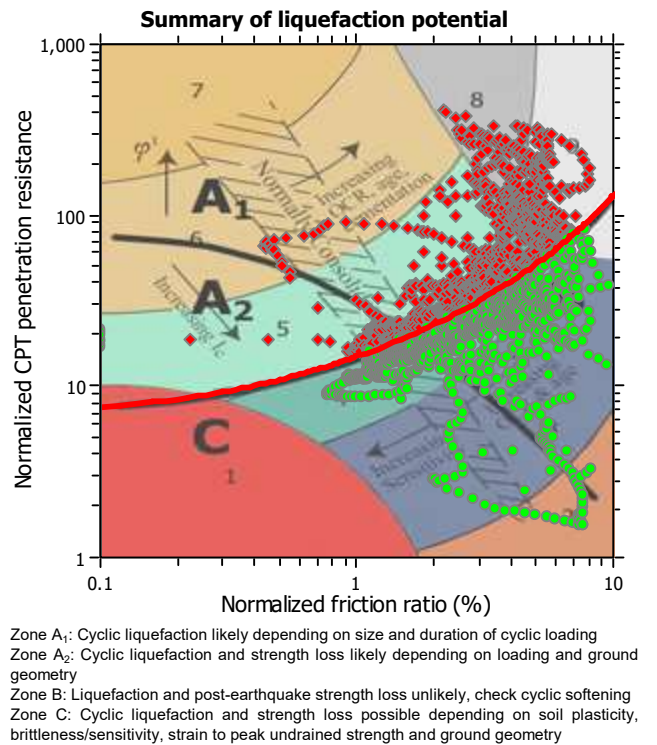
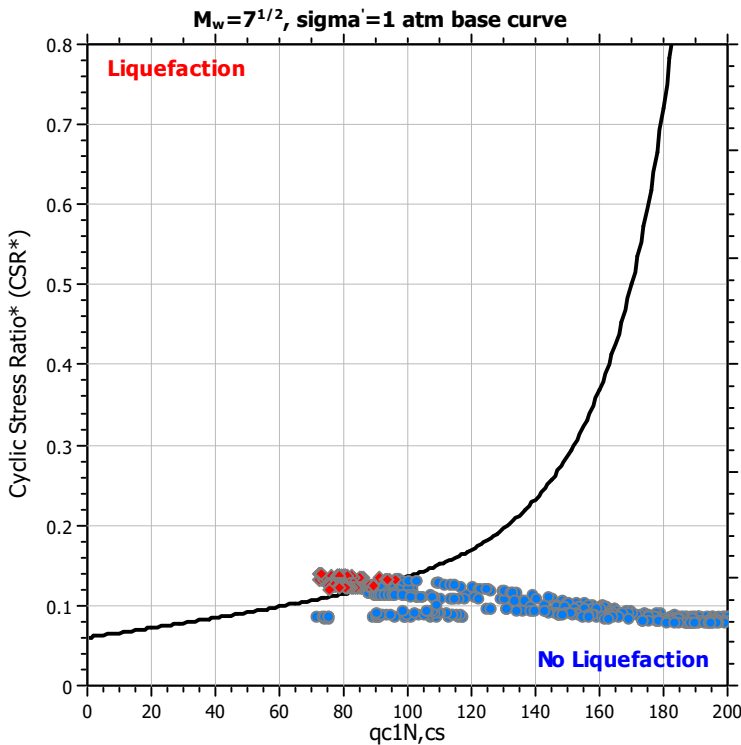
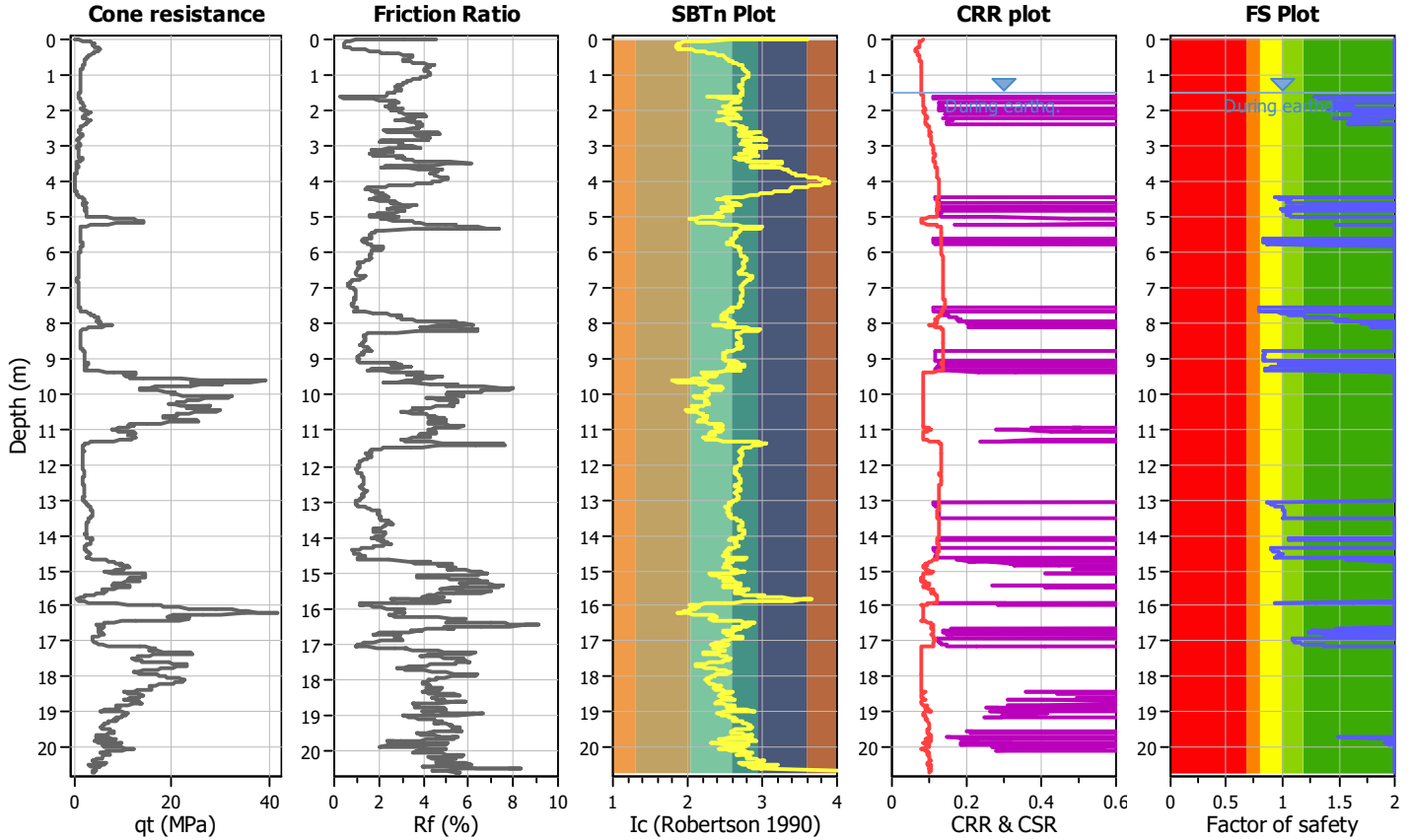
Project title :

Location :

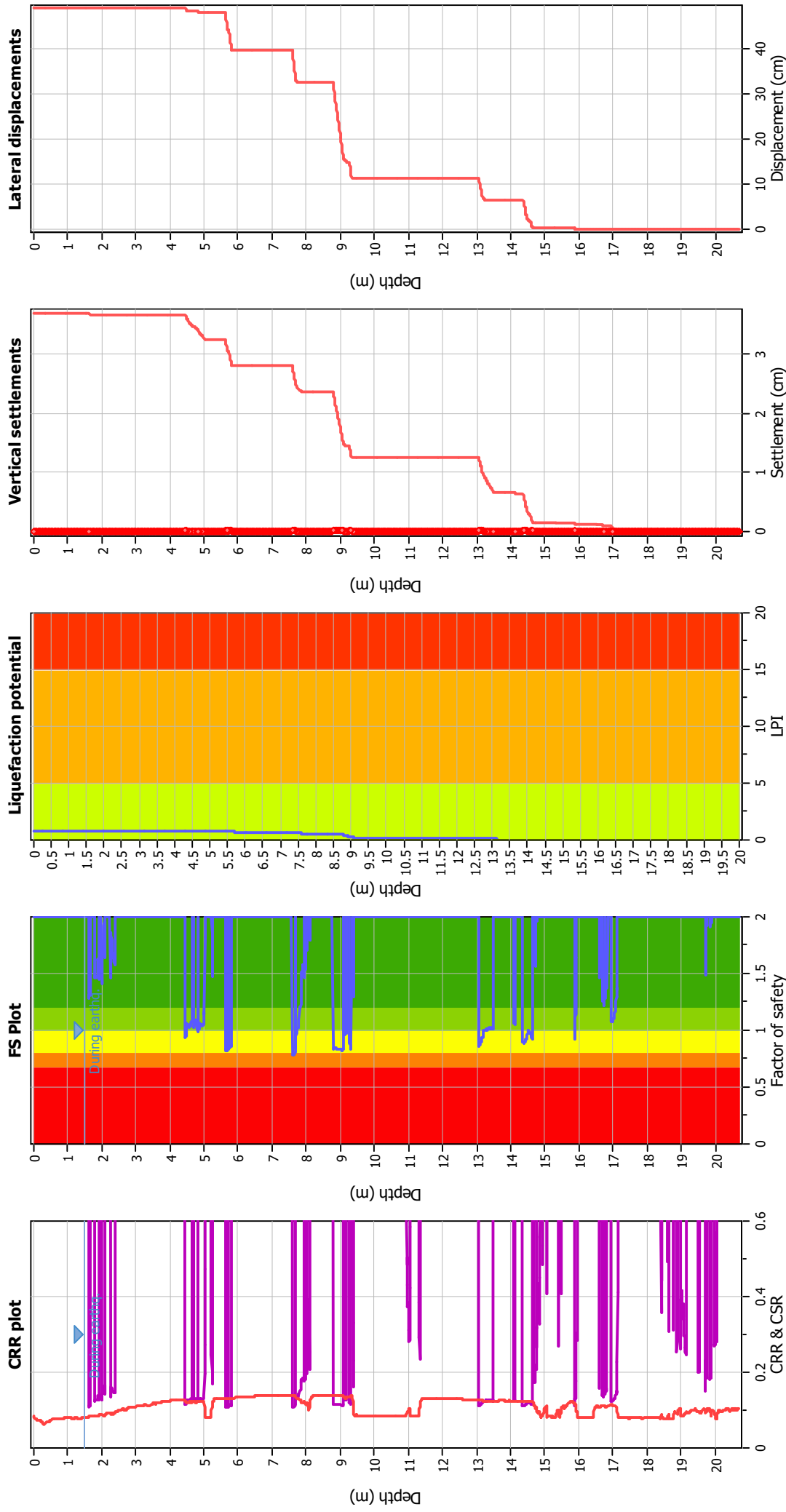
CPT file : CPT-02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	2.00 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.50 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w :	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.15	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		



Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method: B&I (2014)
 Fines correction method: B&I (2014)
 Points to test: Based on Ic value
 Earthquake magnitude M_w : 6.00
 Peak ground acceleration: 0.15
 Depth to water table (insitu): 2.00 m

F.S. color scheme

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

LPI color scheme

Very high risk
 High risk
 Low risk