Waiotahe Drifts Subdivision, Stage 5a

Geotechnical Completion Report

Prepared for Maven Associates Ltd.

Project 48749 - 25/05/2022

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Limitations of Report

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Our opinions and recommendations are based on our comprehension of the current regulatory standards and must not be considered legal opinions. For legal advice, please consult your solicitor. This opinion is not intended to be advice that is covered by the Financial Advisors Act 2010.

The recommendations and opinions contained in this report are based on our visual reconnaissance of the site, information from geological maps and upon data from the field investigation as well as the results of in situ testing of soil. Inferences are made about the nature and continuity of subsoils away from and beyond the exploratory holes which cannot be guaranteed. The descriptions detailed on the exploratory hole logs are based on the field descriptions of the soils encountered.

This report includes Appendices. These appendices should be read in conjunction with the main part of the report and this report should not be considered complete without them.

CONTENTS

1.0 INTRODUCTION

Engineering Design Consultants Ltd (EDC) was engaged by Maven Associates Limited (Maven) to monitor the subdivision earthworks and provide a Geotechnical Completion Report (GCR) as part of the development of the subdivision site at Waiotahe Drifts.

It is proposed to subdivide the existing land parcel into 107 new residential lots, consisting of 3 stages (Stage 5 – 7). To date Stage 5A has been completed (referred to below as 'the site'), with road and reserves to vest.

The proposed development plans, provided by Maven Associates forms Appendix A.

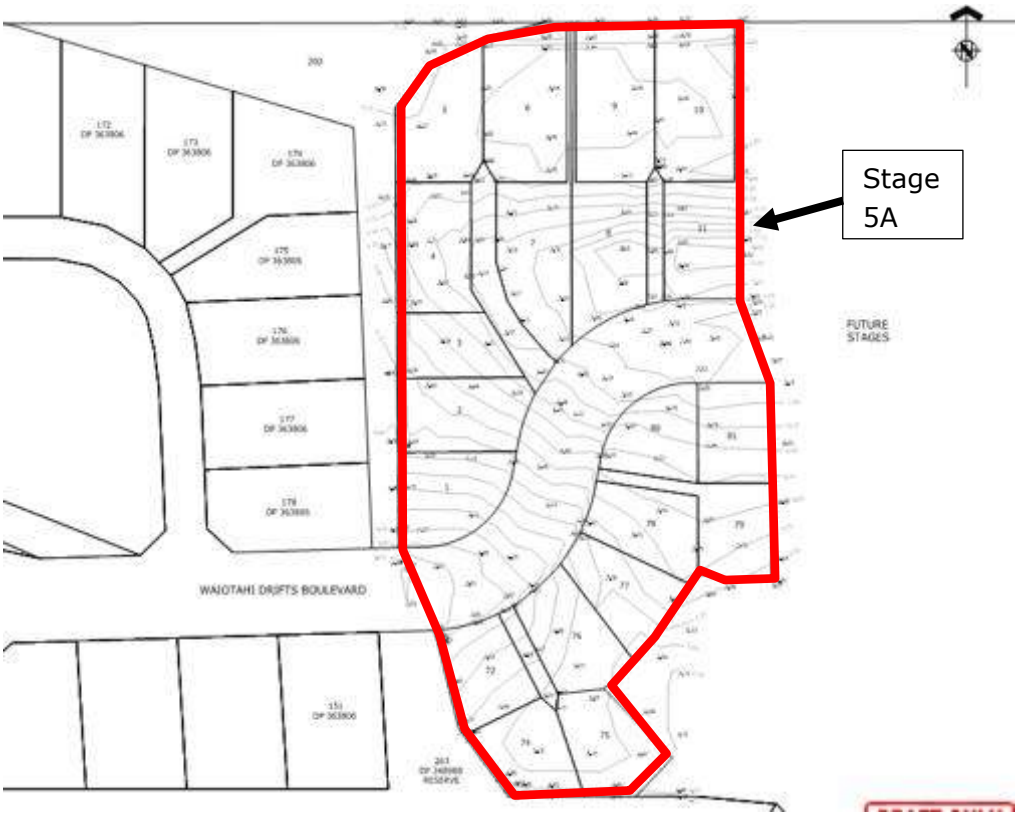

Figure 1: Subdivision plan for Stage 5A

To our understanding no geotechnical investigation or reporting has been undertaken in this area or the subdivision to attain resource consent.

1.1 Legal Description & Topography

The greater site is located at the eastern end of Waiotahe Drifts Boulevard, with a legal description of Lot 315 DPS 363806 with an area of 11.5620ha. It is an undulating coastal zone site with dunes.

The greater site location and an aerial image are included in the following figures.

Figure 2: Site Location (Courtesy of BOPRC Maps)

Figure 3: Aerial Photo of the Greater Subdivision (Courtesy of BOPRC Maps)

1.2 Site Geology

The GNS published geological maps indicate that the site is located in an area of Holocene shoreline deposits, consisting of beach deposits consisting of 'marine gravel, sand, and mud on modern beaches'.

2.0 DEVELOPMENT OVERVIEW

The development undertaken has resulted in the formation of 107 new lots. The first stage (5A) has been completed, resulting in 20 available lots.

Earthworks were undertaken to re-shape the land to allow the formation of suitable residential lots (Lots 1 – 11 and 73 - 81). The earthworks involved stripping of the topsoil/organics and forming level platforms by cutting the high ground and using it as fill for the low-lying areas. The As Built cut & fill plan by Maven have also been included in Appendix A.

The completed new Lots 1 – 11 & 73 - 81 are listed below:

Created Parcels	Area
Lot 1 Deposited Plan	525m^2
Lot 2 Deposited Plan	539m^2
Lot 3 Deposited Plan	503m^2
Lot 4 Deposited Plan	460m^2
Lot 5 Deposited Plan	572m^2
Lot 6 Deposited Plan	724m^2
Lot 7 Deposited Plan	677m^2
Lot 8 Deposited Plan	636m^2
Lot 9 Deposited Plan	719m^2
Lot 10 Deposited Plan	719m^2
Lot 11 Deposited Plan	543m^2
Lot 73 Deposited Plan	437m^2
Lot 74 Deposited Plan	424m^2
Lot 75 Deposited Plan	459m^2
Lot 76 Deposited Plan	480m^2
Lot 77 Deposited Plan	455m^2
Lot 78 Deposited Plan	456m^2
Lot 79 Deposited Plan	476m^2
Lot 80 Deposited Plan	419m^2
Lot 81 Deposited Plan	429m^2

Table 1: Table of Lots

At the time of preparing this GCR, all bulk earthworks for Stage 5A have been completed.

2.1 Earthworks Specification

The 'Project Specification – Waiotahe Dunes' Document produced by Maven. forms the basis of the Earthworks Specification and forms Appendix B. Several changes to the Project Specification have been approved by Maven to adapt to site conditions and due to specialist contractor availability as follows:

1. All earth fill consists of clean beach sand, and as such compaction testing was undertaken using a Scala Penetrometer. The target fill compaction is 'Good Ground' in accordance with NZS3604:2011.

2. Basecourse compaction for JOAL's & road carriageways was undertaken using a Clegg Hammer. Target Clegg Impact Values (CIV) were provided by Maven:

    2.1. JOAL AP65 basecourse CIV minimum value of 25 and an average of >28.

    2.2. Road Carriageway AP65 Subbase CIV minimum value 35 and an average of >38.

3. Benkelman beam testing was undertaken on the finished AP40 road basecourse, with a maximum defection of 1.2mm.

4. Fill slopes not exceeding 1.5m high on the western boundary of Lots 2, 3 & 4 and the south/western boundaries of Lots 73, 74 & 75 on the proposed fill plan exceed the recommended fill slopes. Maven have accepted that suitable compaction cannot be achieved on these slopes, and Specific Engineered Design will be required for foundations within 5m of these boundaries.

3.0 EARTHWORKS DETAILS

The bulk earthworks and civil works were undertaken by Delta Contracting from September 2021 to April 2022. The earthworks consisted of stripping the topsoil from across the site and cutting the high ground located near the northern and southern boundary of the site, including cutting into a slope south of the pond and using the clean sand material as fill for the low-lying areas to create flat individual subdivided lots.

The earthworks contractor was required to compact the soils as set out in NZS4431 in order to provide a geotechnical Ultimate Bearing Capacity of 300kPa (150kPa Dependable) for all cut & fill areas on-site. The JOAL's and road subgrade were designed to a subgrade with a CBR of 5% & 7% respectively.

An estimated 8567m^3 of stripped topsoil soil has been removed, with a total of 2725m^3 topsoil respread. An estimated total volume of 17,601m^3 of cut to fill from the site was used. The estimated total volume of cut to waste was 1280m^3. The cut material (reused as fill) was mainly dune sand. No lime or cement stabilisation was used during filling.

The following earthworks equipment was used by Delta Contracting Ltd. on-site during the construction period:

- 2 x 14 tonne excavators
- 1 x 5 tonne excavator
- 1 x 12 tonne vibrating roller
- 1 x 5 tonne vibrating roller
- 1 x Jumping jack compactor
- 3 x 10m^3 tip trucks
- 1 x 14,000-liter water truck plus sprinklers

The bulk filling was conducted in a controlled manner, including moisture control by visual assessment before compacting with a vibrating smooth roller in layers of generally 150 – 200mm thickness.

The As-Built Cut and fill plan, by East Bay Surveyors forms Appendix A.

4.0 CONSTRUCTION SUPERVISION

4.1 EDC Site Visits

EDC conducted a total of 17 site inspections during the subdivision earthworks between October 2019 & April 2022. In addition to visual inspection, compaction testing was undertaken using Scala Penetrometer, Clegg Hammer and Mexe probe testing. Our observations during the construction confirm an earth-fill complying with NZS:4431, and the fill should be considered suitable for residential development subject to a site-specific bearing capacity assessment.

The new public road and JOAL's 1 - 3 subgrade in Stage 5A was formed by cutting and filling using sands from other sections of the site. Civil engineering design required a minimum CBR of 7%. Testing conducted on the subgrade indicates this subgrade achieved this target ratio in both cut and fill areas below the road and this will increase further over time.

Below is a summary of all EDC's site visits during the construction supervision of Stage 5A.

Date	Lot/s Investigated	Formation Inspection	Compaction /CBR/CIV	Reason/s for failure
15/10/2021	4 - 11	Passed	Failed	Poor compaction due to poor moisture content and excessive layer thickness.
19/10/2021	1 - 3	Passed	Failed	Insufficient compaction
19/10/2021	73, 74, 75 & 104	Passed		
22/10/2021	11, 73 – 75 & 104		Lots 11, 74, 75 Failed	Insufficient compaction – moisture control
05/11/2021	73 – 76, 104 & 105		Failed – 74, 104 & 105	Insufficient compaction
09/11/2021	78 & 80	Failed		Buried topsoil
09/11/2021	73 – 75, 104 & 105		Passed	
11/11/2021	78 & 80	Passed		
18/11/2021	1 – 4, 7, 8 & 11		3 & 7 failed	Insufficient compaction
22/11/2021	3 & 7		Passed	
22/11/2021	77	Passed		
18/01/2022	JOAL's 1 - 3		Failed	Insufficient compaction
18/01/2022	77, 78 & 80		78 Failed, 77 & 80 Passed	Insufficient compaction on Lot 78
09/02/2022	79 & 81	Passed		
16/02/2022	Roading Subgrade	Passed		

	between Lots 73 and 82			
22/02/2022	Remaining Road and JOAL's Subgrade	Passed		
02/03/2022	Roading and JOAL's Basecourse		JOAL's failed	Failed to achieve a CIV reading of 28
15/03/2022	JOAL's 1 & 3		Partially failed	Areas identified where the CIV reading was less than 28
15/03/2022	79 & 80 (retest due to disturbance from roading construction)		Passed	
21/03/2022	JOAL 3		Passed	
22/03/2022	JOAL 1		Passed	
27/03/2022	All of the lots in stage 5A		Passed	

Table 2: Summary of EDC's site visits during Stage 5A

4.2 EDC Inspection Summary

The initial compaction methodology and difficulties attaining sufficient moisture content in the earth fill resulted in insufficient compaction. Additional compaction equipment & sprinkler system installation improved performance and all areas of earth fill (except the fill on the western and south-western boundaries – see below), roading subgrade and base coarse in Stage 5a are considered to meet the Maven Fill Specification. EDC's Site Inspection Notes form Appendix C.

Fill compaction adjacent to the slopes on the western boundary of Lots 2, 3 & 4 and the south-western boundaries of Lots 73, 74 & 75 does not meet the fill specification. In addition, without on-going maintenance, erosion is likely to occur. As such it is recommended that foundations on these lots, within 5m of the subdivision boundary (shown on Figure 4), should be specifically engineer designed to mitigate these risks.

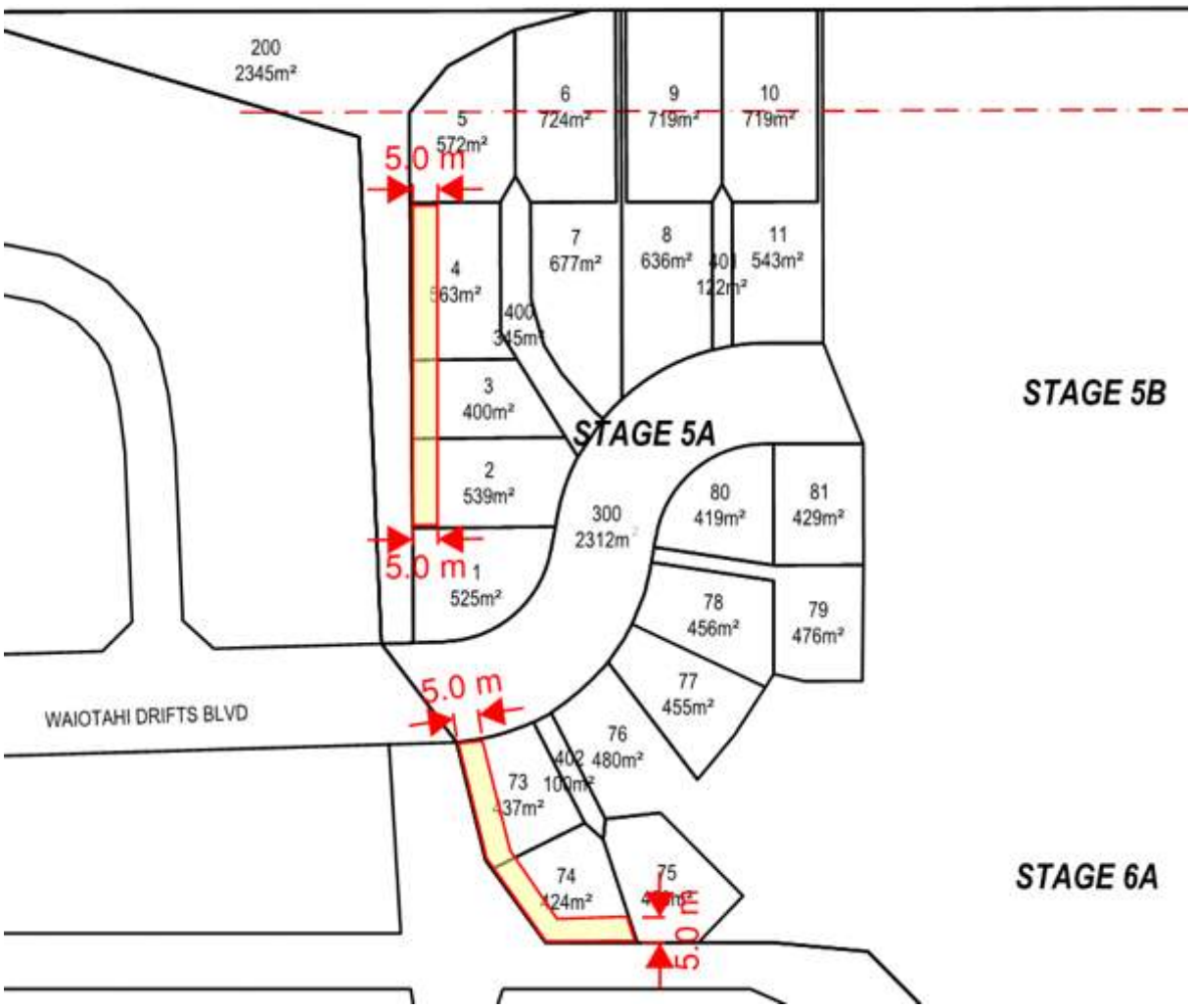

Figure 4: Area of SED Foundation Requirement

4.3 Benkelman Beam Testing

Benkelman Beam testing on the public road has been conducted by IANZ accredited Laboratory (GeoLab Ltd.) on the compacted basecourse surface. Acceptable deflections of less than 1.2mm have been recorded by the Benkelman Beam testing. The test results are included in Appendix D.

4.4 Imported Material

Imported hardfill was required for construction on of the JOAL's and road. Both AP65 & TNZ M4 AP40 were used in accordance with the Project Specification. Laboratory test results for these materials form Appendix E.

4.5 Site Photographs

February 2022

February 2022

April 2022

Figure 5: Images from October 2021 – April 2022

5.0 SITE CLASSIFICATION

5.1 Post Construction Testing

Post construction testing consisted of Scala Penetrometer (SC) testing in each individual lot. The approximate locations of the SC's are indicated in Figure 6.

At the end of November 2021, new guidance was issued by MBIE in relation to assessing the risk to sites from earthquake induced ground liquefaction. As a result of this new guidance, CPT's have also been undertaken for Stage 5A to assess the liquefaction susceptibility.

Cone Penetration Testing (CPT), comprising 3 holes (CPT's 1 - 3), were undertaken by Topdrill on 15/03/2022. All three CPT reached the target depth of 20.0m.

The approximate locations of the CPT's are indicated in Figure 6. Logs of the Normalised Soil Behaviour Type (SBT) for the CPT results are shown in Appendix F.

Test Ref.	Date	Location	Depth (m)	Comment
CPT01	02/05/2022	Lot 74	20m	CPT Hole collapsed (dry) at 2.7m. Estimated groundwater depth of 6.0m begl.
CPT02	02/05/2022	Lot 3	20m	CPT Hole collapsed (dry) at 3.7m. Estimated groundwater depth of 4.7m begl.
CPT03	02/05/2022	Lot 81	20m	CPT Hole collapsed (dry) at 4.5m. Estimated groundwater depth of 5.5m begl.

Table 3: Intrusive Investigation Summary

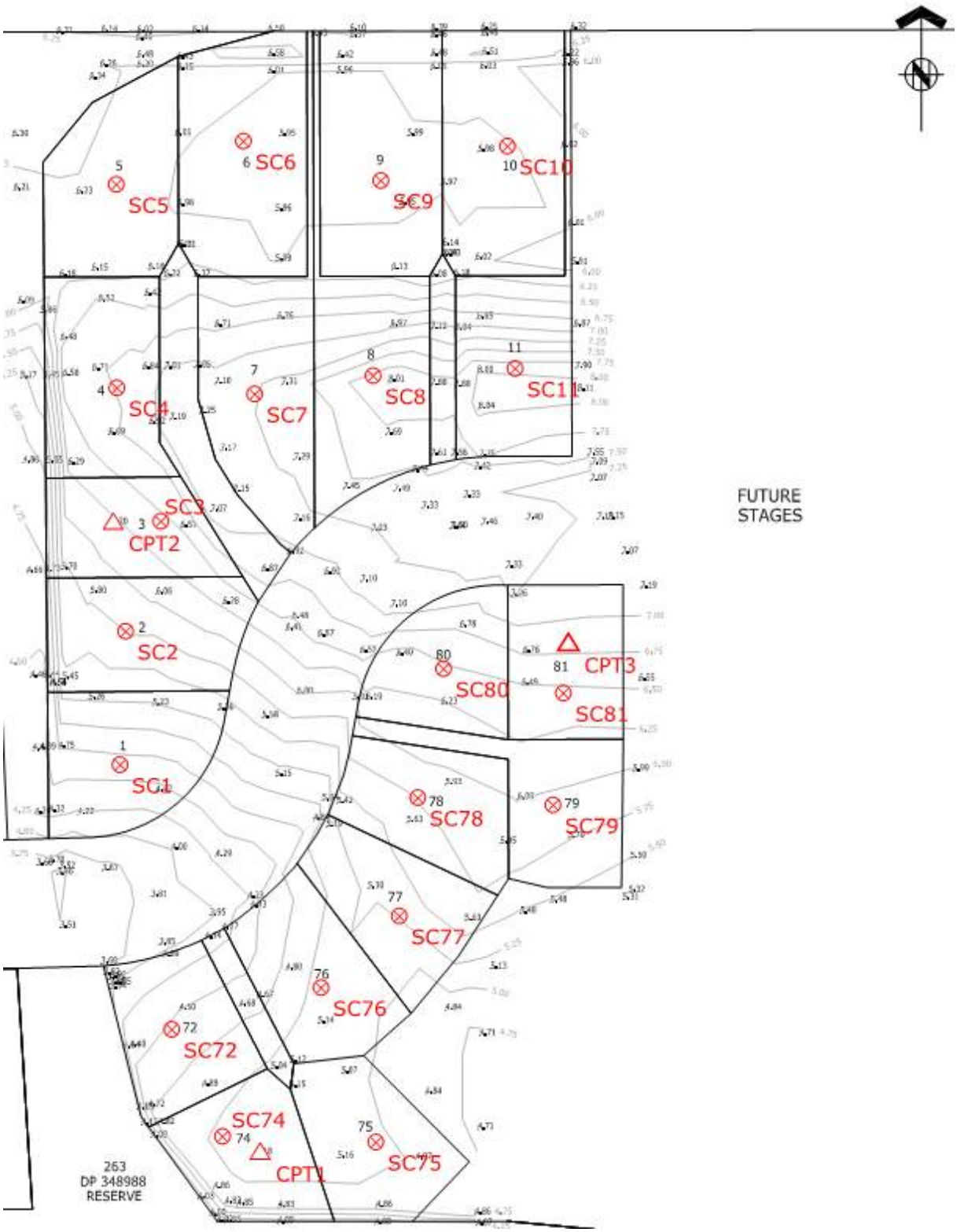

Figure 6: Intrusive Investigation Approximate Locations

5.2 Quantitative Liquefaction Analysis

In accordance with the 'Planning and engineering guidance for potentially liquefaction-prone land' (MBIE/MfE, November 2021), we have undertaken a quantitative liquefaction analysis based on our on-site deep testing.

5.2.1 Calculation Methods

Liquefaction analysis to assess estimated free-field ground settlement (i.e., not including shear-induced deformations in the soil relating to structural loads) has been undertaken using the data from the CPT's and the following methods with the Geologismiki Software:

Assessment	Method
Liquefaction triggering & lateral spreading	Boulanger & Idriss (2014)
Fines Correction	Robertson & Wride (1998)
Post liquefaction settlements	Zhang et al (2002)

Table 4: Liquefaction Analysis Methods

5.2.1 Analysis Scenarios

The following seismic scenarios have been analysed for the purpose of assessing future ground performance, in accordance with the MBIE Guidance:

Serviceability Limit State (SLS) – The SLS design case is a load, or combination of loads, that a building or structure is likely to be subjected to more frequently during its design life. If properly designed and constructed, there may be minor damage to building fabric that is readily repairable, possibly including minor cracking, defection and settlement that do not affect the structural, fire or weathertightness performance of the building.

MBIE Guidance - 'Planning and engineering guidance for potentially liquefaction-prone land', recommends that estimated ground damage in a 100-year return period earthquake is used to help determine the site liquefaction susceptibility category.

Ultimate Limit State (ULS) - The ULS design case is an extreme action, or extreme combination of actions, that the building needs to withstand. A building is expected to suffer moderate to significant structural damage, but not to collapse, when it is subjected to a ULS load.

The parameters used in these analyses are shown on Table 7:

Seismic Scenario	Return Period (years)	Earthquake Magnitude (Mw)	Peak Ground Acceleration (g)
SLS	25	6.1	0.11
MBIE	100	6.1	0.22
ULS	500	6.1	0.44

Table 5: Liquefaction Analysis

No hand auger boreholes were conducted on-site to determine the depth of the groundwater, however, the CPT data indicated that the pore pressure appears to increase at approximately 4.7m to 6.0m depth. Therefore, these have been assumed as the groundwater levels (although ground water in this area will be tidally influenced). A groundwater level increase of 0.5m has been assumed during an earthquake scenario for the liquefaction analyses.

5.2.1 Estimated Free-Field Ground Settlement

The graphical results sheets for each of the analyses are included in Appendix F. The following table summarises the results of estimated free-field settlements (Index Settlement refers to the upper 10m of the subsoil only):

CPT Test Ref.	CPT Depth (m)	Estimated Free-Field Settlement (mm)					
		SLS Scenario		100 Year return period		ULS Scenario	
		Index	Full CPT Depth	Index	Full CPT Depth	Index	Full CPT Depth
CPT01	20.0	0	0	24	61	67	157
CPT02	20.0	0	0	38	62	76	127
CPT03	20.0	0	0	37	44	75	112

Table 6: Summary of Estimated Liquefaction-Induced Settlement

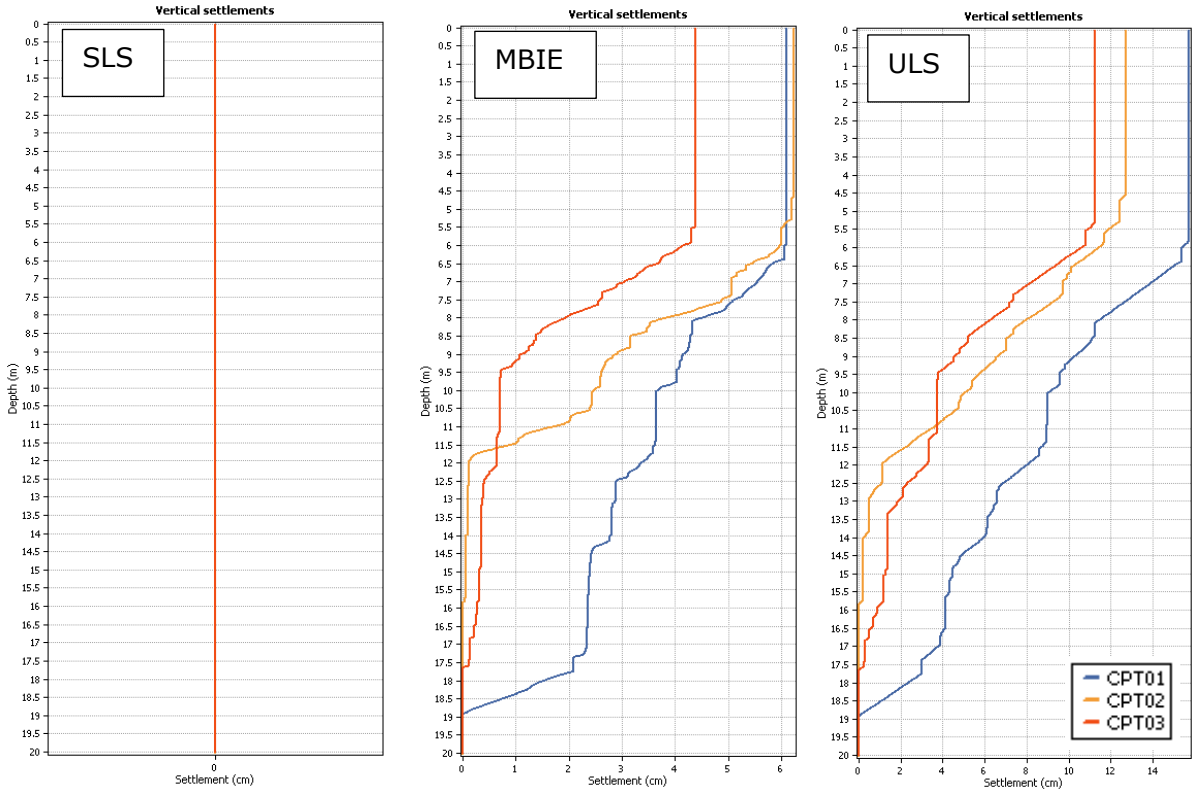

Figure 7: Estimated Total Vertical Settlement under SLS, MBIE 100yr and ULS Conditions

The on-site CPT analyses indicate:

Under SLS conditions, negligible settlement is to be expected, under MBIE conditions up to 62mm of settlement is to be expected and up to 157mm of settlement is to be expected under ULS conditions.

The soils from analysed ground water depth (4.2-5.5m) are generally liquefiable to a depth of 13-19m where soil become clay like and non-liquefiable.

5.2.1 Ground Damage

The Liquefaction Severity Number (LSN) is a parameter that predicts the occurrence of damaging liquefaction by recognising that damaging liquefaction is related to the depth at which liquefaction occurs. The LSN's for the CPT analyses are shown below:

CPT ref.	Estimated LSN		
	SLS Scenario	MBIE Scenario	ULS Scenario
CPT 01	0	5	15
CPT 02	0	7	15
CPT 03	0	6	13

LSN Key
0 – 10 = Little to no expression of liquefaction,
10 – 20 = Minor expression of liquefaction,
20 – 30 = Moderate expression of liquefaction,
30 – 40 = Moderate to severe expression of liquefaction,
40 – 50 = Major expression of liquefaction,
>50 = Severe damage.

Table 7: Summary of Estimated Liquefaction-Induced Ground Damage

The above indicates that in an SLS event, no expression of liquefaction expected. Under the MBIE 100-year return period scenario little to no liquefaction ejecta is expected and under ULS conditions, minor expression of liquefaction is anticipated.

5.2.2 MBIE Technical Foundation Category

Foundation Technical Category	Future land performance expectations from liquefaction	Nominal SLS land settlement (mm)	Nominal ULS land settlements (mm)	Nominal lateral stretch (mm)
TC1	Liquefaction damage is unlikely in a future large earthquake.	0-15	0-25	Generally not expected
TC2	Liquefaction damage is possible in a future large earthquake.	0-50	0-100	<50
TC3	Liquefaction damage is possible in a future large earthquake	>50	>100	>50

Table 8: MBIE Technical Foundation Category

Based on the analysis of the likely settlements following a design earthquake event, we consider that the land falls within the TC 2 Foundation Technical Category.

5.2.3 Lateral Spreading

The site is located >100m from any significant water course with no evidence of lateral movement on-site and as such, in accordance with the MBIE guidance, lateral spreading analysis has not been undertaken.

5.3 Liquefaction Susceptibility

In accordance with the 'Planning and engineering guidance for potentially liquefaction-prone land' (MBIE/MfE, 2017), we have undertaken a risk-based liquefaction risk assessment. Please refer to Appendix G for the assessment matrix and further information.

Based on the desk-based information, deep intrusive investigation, and area wide Liquefaction assessment, we make the following assessment of the site using Table 3.7 of the MBIE/MfE Guidance:

- The site falls within the 'Urban Residential Development' category;
- Although the liquefaction assessment indicates up to 160mm of liquefaction induced settlement is estimated to occur on-site under ULS conditions, this settlement occurs at depth (5m to 13m) and is unlikely to result in significant surface deformation.
- As such, the liquefaction vulnerability category is considered to be 'Low' - "There is a probability of more than 85 percent, that liquefaction-induced ground damage will be none to minor for 500-year shaking".

Based on this and the MBIE Foundation Technical Category criteria we recommend a TC2 foundation system (Ministry of Business, Innovation and Employment, 2015).

5.4 NZS 3604 "Good Ground" Assessment

In accordance with NZS 3604: 2011 "Good Ground" is defined as *"Any soil or rock capable of permanently withstanding an ultimate bearing capacity of 300kPa (i.e. an allowable bearing pressure of 100kPa using a factor of safety 3.0)".* It excludes expansive soils, topsoil or organic rich soils, uncompacted loose gravel and any ground likely to experience ground movements of 25mm or more.

The soils at the site do not meet the NZS 3604 definition of 'Good Ground' due to the potential for liquefaction induced settlement.

6.0 CONCLUSIONS

The subdivision earthworks for Stage 5a of the Waiotahe Drifts Subdivision were undertaken by Delta Contracting from October 2021 to May 2022 and consisted of stripping the topsoil/organics across the site and cutting/filling to create flat individual subdivided lots. The cut material (reused as fill) was dune sand.

The bulk filling was conducted in a controlled manner and compacted with a smooth vibrating roller in layers of generally 150 – 200mm thickness. EDC supervised the earthworks and undertook compaction testing using Scala Penetrometer and Mexe Probe testing. Our observations during the construction confirm the earth fill complies with the Maven Fill Specification (taking into account the amendments discussed in Section 2.1), with the exception of some areas on the western and south-western boundaries (see below).

Fill compaction adjacent to the slopes on the western boundary of Lots 2, 3 & 4 and the south-western boundaries of Lots 73, 74 & 75 does not meet the fill specification. In addition, without ongoing maintenance, erosion is likely to occur. As such it is recommended that foundations on these Lots, within 5m of the subdivision boundary (shown on Figure 4), should be specifically engineer design to mitigate these risks.

Based on the desk-based information, deep intrusive investigation, and area wide liquefaction assessment, we consider the liquefaction vulnerability category to be 'Low'.

The soils at the site do not meet the NZS 3604 definition of 'Good Ground' due to the potential for liquefaction induced settlement.

Based on this and the MBIE Foundation Technical Category criteria, we recommend TC2 foundation systems (Ministry of Business, Innovation and Employment, 2015) for each of the individual lots.

The subdivision earthworks are considered suitable for residential development subject to a site-specific bearing capacity assessment on each individual lot for Building Consent. An individual Lot Summary forms Appendix H.

In addition, the JOAL and roading subgrade and basecoarse in Stage 5a are considered to meet the Maven Specification.

APPENDIX A

SUBDIVISION SCHEME PLAN & AS BUILD CUT AND FILL PLAN BY MAVEN ASSOCIATES

PUBLIC ROAD
LEGAL ROAD
(20.12m)

RIMU RIMU KEY

WAIOTAHI DRIFTS BLVD

KUKUMOA KEY

PAKIHIKURA KEY

ARAKOTIPU BLVD

ESPLANADE RESERVE

HUNTRESS CREEK

STAGE 5A

STAGE 5B

STAGE 6A

STAGE 6B

STAGE 6C

STAGE 7A

STAGE 7B

Lot 170 DP 363806
Lot 171 DP 363806
Lot 172 DP 363806
Lot 173 DP 363806
Lot 174 DP 363806
Lot 175 DP 363806
Lot 176 DP 363806
Lot 177 DP 363806
Lot 178 DP 363806
Lot 258 DP 363806
Lot 154 DP 363806
Lot 153 DP 363806 857m²
Lot 152 DP 363806
Lot 151 DP 363806
Lot 263 DP 348988
Lot 117 DP 348988
Lot 118 DP 348988
Lot 119 DP 348988
Lot 120 DP 348988
Lot 126 DP 348988
Lot 127 DP 348988
Lot 125 DP 348988
Lot 124 DP 348988
Lot 121 DP 348988
Lot 122 DP 348988
Lot 123 DP 348988
Lot 128 DP 348988
Lot 129 DP 348988
Lot 130 DP 348988 628m²
Lot 134 DP 348988
Lot 131 DP 348988
Lot 133 DP 348988
Lot 132 DP 348988
Lot 4 DP 8663 52249m²

200 2345m²
1 525m²
2 539m²
3 400m²
4 563m²
5 572m²
6 724m²
7 677m²
8 636m²
9 719m²
10 719m²
11 543m²
12 542m²
13 719m²
14 719m²
15 542m²
16 542m²
17 719m²
18 719m²
19 608m²
20 805m²
21 500m²
22 504m²
23 703m²
24 718m²
25 542m²
26 542m²
27 719m²
28 718m²
29 542m²
31 719m²
32 718m²
33 597m²
34 673m²
35 752m²
36 800m²
37 616m²
38 482m²
39 470m²
40 498m²
41 500m²
42 496m²
43 446m²
44 455m²
45 451m²
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87 456m²
88 461m²
89 428m²
90 553m²
91 426m²
92 434m²
93 457m²
94 462m²
95 436m²
96 436m²
97 461m²
98 461m²
99 436m²
100 449m²
101 440m²
102 497m²
103 417m²
104 477m²
105 455m²
106 451m²
107 482m²
108 462m²
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118 508m²
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120 457m²
121 455m²
202 8865m²
203 7651m²
205 2391m²
206 456m²
207 493m²
300 2312m²
301 2234m²
302 2346m²
303 1590m²
304 1996m²
305 1662m²
306 4003m²
308 512m²
800 16817m²
400 345m²
401 122m²
402 480m²
403 119m²
404 119m²
405 100m²
406 100m²
407 114m²
408 114m²
409 103m²
410 103m²
411 119m²
412 119m²
413 120m²
414 302m²
415 92m²
416 432m²
417 265m²
1591 542m²
Crown Land
(under action)
Survey Office Plan 2809
121940m²

ACCESS 2
ACCESS 8
ACCESS 12
JOAL 3
JOAL 4
JOAL 5
JOAL 6
JOAL 7
JOAL 8
JOAL 9
JOAL 10
JOAL 11
JOAL 12
JOAL 13
JOAL 14
JOAL 15
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Notes

1. All areas, easements and dimensions are subject to a full legal survey and approval by Land Information NZ.

Legend

- EX BDY
- PR BDY
- BUILDING LINE RESTRICTION

E	RC - Update Pack	GS	04/2021
D	RFI SEC 127	RK	03/2019
C	RC	CA	01/2019
B	S.127	CA	12/2018
Ref	Revisions	By	Date

	By	Date
Survey	-	-
Design	RK	07/18
Drawn	RM	12/2018
Checked	BV	07/18

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Project

WAIOTAHE DUNES
DEVELOPMENT
WAIOTAHE
FOR
EQUINOX

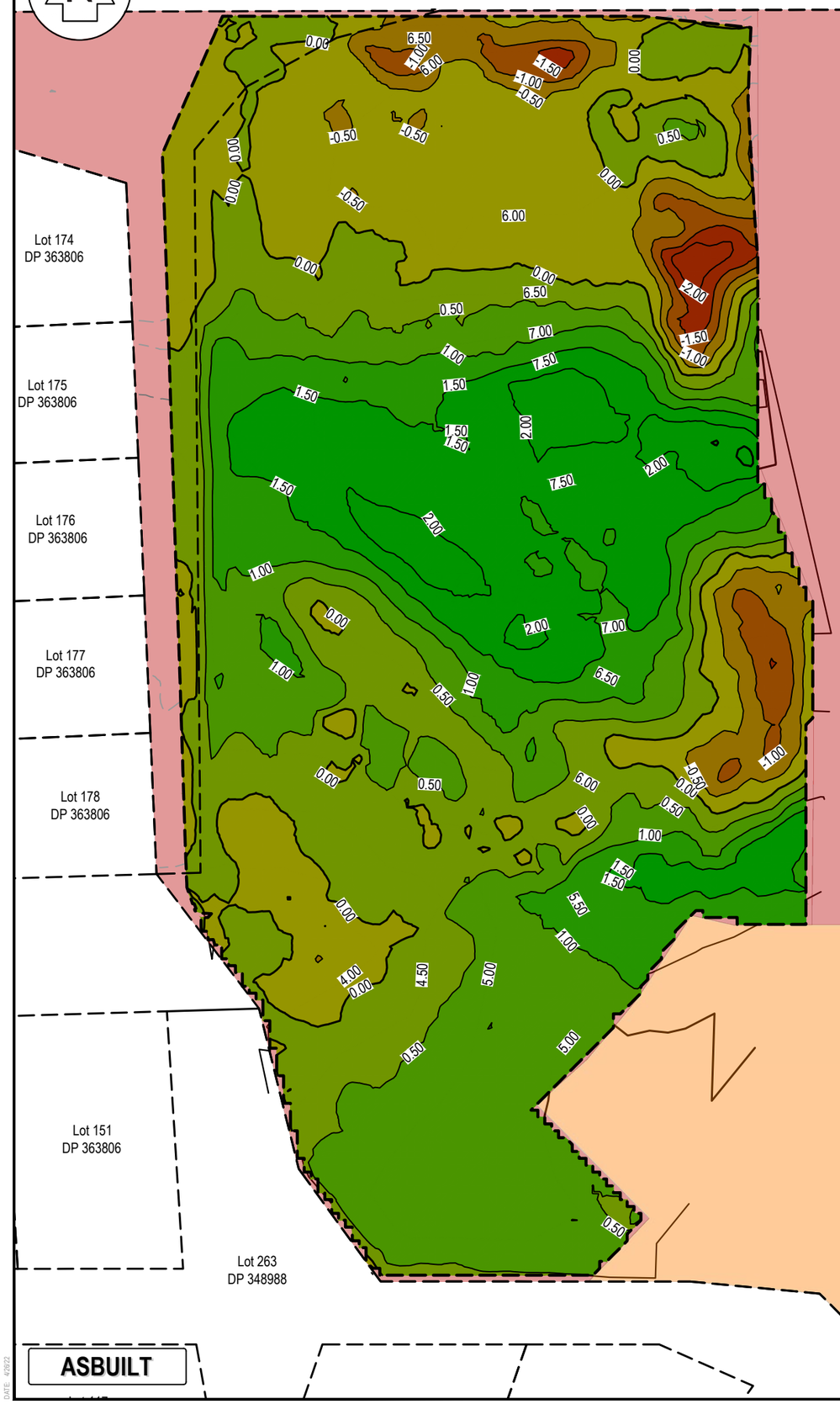
Title

SCHEME PLAN
OVERVIEW

Project no.	105006		
Scale	Not To Scale		
Cad file	105006-150 scheme		
Drawing no.	C150	Rev	E

DATE: 4/22/21
FILE: 105006-150 Scheme B.dwg

INITIAL SURFACE SURVEYED BY MAVEN
FINAL SURFACE PROVIDED BY EAST BAY SURVEYORS AS COMPLETED CIVIL WORKS ASBUILT 8/04/22 - DOES NOT INCLUDE 40MM HOTMIX TO THE ROAD SURFACE



Notes
1. LEVELS ARE IN TERMS OF MOTURIKI DATUM ORIGIN OF LEVELS BMGA19 (ABW8) RL 2.67
2. COORDINATES ARE IN TERMS NZGD2000, POVERTY BAY CIRCUIT
3. BOUNDARIES SHOWN ON THIS PLAN ARE FROM LAND INFORMATION NZ DCDB AND HAVE NOT BEEN SURVEYED, A BOUNDARY DEFINITION SURVEY SHOULD BE CARRIED OUT TO ESTABLISH EXACT BOUNDARY POSITIONS ON SITE.
4. SURVEY DATA COLLECTED BY GPS METHOD AND AS SUCH. ACCURACY +/- 0.02m POSITION +/- 0.03M LEVEL

Legend
- EX BDY
- AB BDY
- AB WORK EXTENT

Elevations Table

Number	Minimum Elevation	Maximum Elevation	Area	Color
1	-2.46	-2.00	35.12	
2	-2.00	-1.50	87.07	
3	-1.50	-1.00	303.34	
4	-1.00	-0.50	636.17	
5	-0.50	0.00	2904.92	
6	0.00	0.50	3228.86	
7	0.50	1.00	2980.12	
8	1.00	1.50	1428.92	
9	1.50	2.00	1823.52	
10	2.00	2.65	421.96	

EARTH WORKS (SURFACE AS-BUILT GROUND LEVEL COMPARISON WITH SURFACE EXISITING GROUND LEVEL)

CUT VOLUME	1584.26 m³
FILL VOLUME	8803.62 m³
NET FILL	7219.36 m³
EARTHWORKS AREA	= 13850 m² / 13.85 Ha

NOTE: NO ALLOWANCE FOR SERVICES TRENCHES, VOLUMES AREA UNFACTORED AND IN SITU

Rev	Description	By	Date
A	AS-BUILT	AFC	04/2022

	By	Date
Survey		
Design	AFC	04/2022
Drawn	AFC	04/2022
Checked	GS	04/2022

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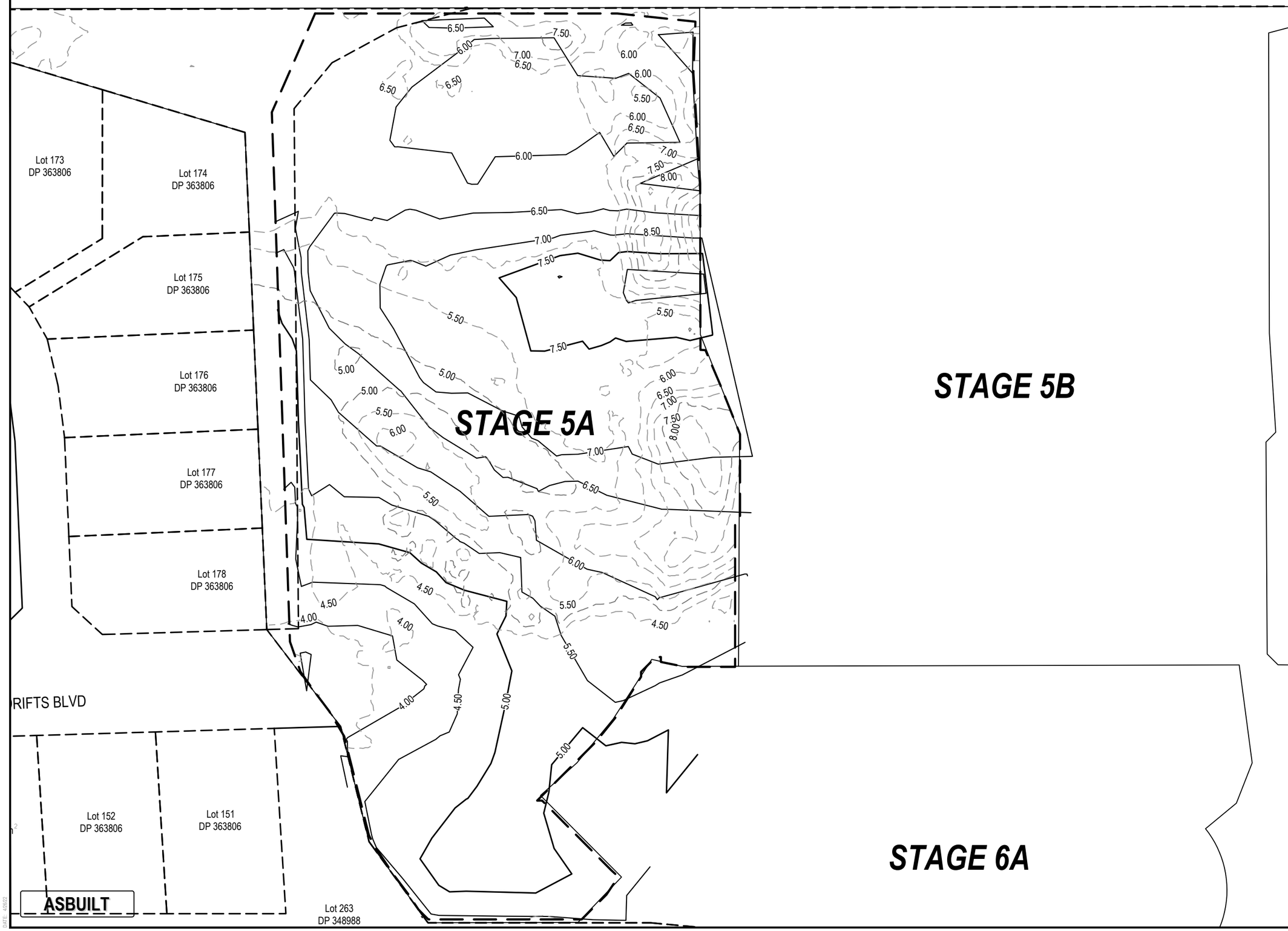
Project
WAIOTAHE DUNES DEVELOPMENT WAIOTAHE FOR EQUINOX

Title
AS-BUILT CUT/FILL PLAN

Project no.	105006		
Scale	1:750 @ A3		
Cad file	105006 - GROUND LEVEL AS BUILT.DWG		
Drawing no.	C921	Rev	A

DATE: 4/2022



Notes

1. LEVELS ARE IN TERMS OF MOTURIKI DATUM ORIGIN OF LEVELS BMGA19 (ABW8) RL 2.67
2. COORDINATES ARE IN TERMS NZGD2000, POVERTY BAY CIRCUIT
3. BOUNDARIES SHOWN ON THIS PLAN ARE FROM LAND INFORMATION NZ DCDB AND HAVE NOT BEEN SURVEYED, A BOUNDARY DEFINITION SURVEY SHOULD BE CARRIED OUT TO ESTABLISH EXACT BOUNDARY POSITIONS ON SITE.
4. SURVEY DATA COLLECTED BY GPS METHOD AND AS SUCH. ACCURACY +/- 0.02m POSITION +/- 0.03M LEVEL

Legend

- EX BDY
- AB BDY
- EX MAJOR CONTOUR
- EX MINOR CONTOUR
- AB MAJOR CONTOUR
- AB MINOR CONTOUR
- AB EXTENT WORK

Rev	Description	By	Date
A	AS-BUILT	AFC	04/2022

	By	Date
Survey		
Design	AFC	04/2022
Drawn	AFC	04/2022
Checked	GS	04/2022

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Project
WAIOTAHE DUNES DEVELOPMENT WAIOTAHE FOR EQUINOX

Title
ASBUILT CONTOURS PLAN

Project no.	105006		
Scale	1:750 @ A3		
Cad file	105006 - GROUND LEVEL AS BUILT.DWG		
Drawing no.	C922	Rev	A

DATE 04/2022

APPENDIX B

PROJECT SPECIFICATION BY MAVEN ASSOCIATES

Appendix D

PROJECT SPECIFICATIONS

WAIOTAHE DUNES

PROJECT SPECIFIC SPECIFICATIONS AND STANDARDS.

Unless otherwise identified in the Drawings provided for Construction, the Contractor shall adhere to the following Specifications:

- Opotiki District Council Code of Practice – Subdivision and Development, Version 1.0 Sept 2001

GENERAL SPECIFICATIONS AND STANDARDS.

Other requirements that the Contractor shall adhere to include, but are not limited to:

- Health and Safety at Work Act 2015
- Health and Safety in Employment Act 2015
- Health and Safety in Employment Regulations 2015
- Department of Labour codes of practice, approved codes of practice and guidance publications
- Resource Management Act (RMA)
- Best Management Practice guidelines on Sediment and Dust Management, Spills and
- Emergency Management, Works Within Watercourses, Working in and around Trees, and Dewatering.
- Construction Contracts Act
- Utilities Access Act
- NZUAG National Code of Practice for Utilities' Access to Transport Corridors
- NZTA Code of Practice for Temporary Traffic Management
- New Zealand Standards referred to within the Contract Document
- Land Development and Subdivision NZS 4404
- Regional/ District Plans
- New Zealand Building Code

Where not expressly identified in the Project Specific Specifications and Standards above, all materials and workmanship shall comply with the following standards and documents:

NZS 4404:2010	LAND DEVELOPMENT AND SUBDIVISION ENGINEERING
NZS 4402.4.1.1:1986	METHODS OF TESTING SOILS FOR CIVIL ENGINEERING PURPOSES.
NZS 4431:1989	CODE OF PRACTICE FOR EARTHFILL FOR RESIDENTIAL DEVELOPMENTS
NZTA F/2:2013	SPECIFICATION FOR PIPE SUBSOIL DRAIN CONSTRUCTION.
NZS 4404:2010	LAND DEVELOPMENT AND SUBDIVISION ENGINEERING
NZS3109	CONCRETE CONSTRUCTION
NZS3116	CONCRETE SEGMENTAL PAVING
TNZ B/02	CONSTRUCTION OF UNBOUND GRANULAR PAVEMENT LAYER
TNZ M/01	ROADING BITUMEN

TNZ M/4	SPECIFICATION FOR BASECOURSE AGGREGATE
TNZ M/10	ASPHALTIC CONCRETE
TNZ M/13	ADHESION AGENTS
TNZ P/9	CONSTRUCTION OF ASPHALTIC CONCRETE PAVING
TNZ P/3	FIRST COAT CHIPSEAL
TNZ P/4	RESEALING
TNZ T/1	PAVEMENT MARKING
TNZ P/12	BENKELMAN BEAM DEFLECTION MEASUREMENTS
TNZ F/2	PIPE SUBSOIL CONSTRUCTION
AS/NZS 4058:2007-	PRECAST CONCRETE PIPES (PRESSURE AND NON-PRESSURE)
NZS 4442:1988-	WELDED STEEL PIPES AND FITTINGS FOR WATER, SEWAGE AND MEDIUM PRESSURE GAS.
AS/NZS 2032:2006 -	INSTALLATION OF PVC PIPE SYSTEMS
NZS 7643:1979-	CODE OF PRACTICE FOR THE INSTALLATION OF UNPLASTICIZED PVC PIPE SYSTEMS
AS/NZS 1254:2002	PVC PIPES AND FITTINGS FOR STORMWATER AND SURFACE WATER APPLICATIONS
AS/NZS 1260:2002	PVC PIPES AND FITTINGS FOR DRAIN, WASTE AND VENT APPLICATIONS
BS 437:1978-	SPECIFICATION FOR CAST IRON SPIGOT AND SOCKET DRAIN PIPES AND FITTINGS
AS/NZS 2033:2008	INSTALLATION OF POLYETHYLENE PIPE SYSTEMS
AS/NZS 4130:2003	POLYETHYLENE (PE) PIPES FOR PRESSURE APPLICATIONS
AS/NZS 4129:2008	FITTINGS FOR POLYETHYLENE (PE) PIPES FOR PRESSURE APPLICATIONS.
WIS 4-32-08	FUSION JOINTING POLYETHALENE PRESSURE PIPELINE SYSTEMS USING PE80 AND PE100 MATERIALS AND WIS 4-32-11, 16 AND 18 AS APPLICABLE
AS/NZS 1477:2006	PVC PIPES AND FITTINGS FOR PRESSURE APPLICATIONS.
BS 5154:1991-	SPECIFICATION FOR COPPER ALLOY GLOBE, GLOBE STOP AND CHECK AND GATE VALVES.
BS 5163-1 & 2:2004-	VALVES FOR WATERWORKS PURPOSES

Special Technical Specifications

Where not expressly identified in the Project Specific Specifications and Standards above or the General Specifications and Standards, all materials and workmanship shall comply with the following standards and documents identified below.

Site Clearance and Earthworks

Earthworks General

Once site clearance and topsoil stripping has been undertaken within the earthworks area the ground shall be inspected by the Engineer to identify any unsuitable materials/areas. Unsuitable areas shall be excavated and backfilled with approved material as part of the bulk filling. Allowance of screening up to 20mm in size of tree roots is to be allowed. The Contractor shall under no circumstances remove unsuitable material without first obtaining approval from the Engineer.

All materials apart from that classed as unsuitable by the Engineer, shall be placed and compacted to the standards specified including any drying/mixing work required to meet this standard. Any areas disturbed to depth (ie stump removal) shall be worked and compacted to standard before any fill is placed above.

Work over or near existing drains/services shall be undertaken carefully to ensure they are not damaged; open culverts/manholes/service pits shall have mesh screens to prevent to entry of debris into the system.

Earthworks Classification of Materials

Materials to be excavated shall be classified as one of the types below:

Should the contractor want material to be classified as other than “Soil” adequate notice shall be given to the Engineer so that a classification may be determined.

Unsuitable Material

Material that due to excessive natural water content, soil type and/or organic content is determined by the Engineer as unsuitable for use as compacted earth fill material.

Soils and Rock

Soils applicable for use as certified earth fill are defined as material which can be excavated with feasible efficiency by current excavating plant.

Soft rock shall be defined as material which requires loosening by means of ripping equipment which can be subsequently removed by excavating plant.

Hard rock shall be defined as solid material which cannot be reasonably loosened and prepared for excavation by means of a heavy duty ripper and which requires to be broken up by means of explosives or heavy duty rock breakers before it can be handled by mechanical equipment.

Where hard rock is encountered, extra payment will be made for its excavation. Rock shall be defined as solid unfractured material which cannot be excavated by normal machine methods but requires blasting or the use of rock breakers. Boulders of less than one quarter of a cubic metre in size will not be considered as rock.

Should agreement on classification of soft rock and hard rock material not be reached, ripping trials shaft be carried out using suitable plant, to establish the classification as described above. If the Contractor does not have suitable plant onsite, the cost for transporting plant to site shall be reimbursed if the classification claimed by the Contractor is correct.

Mass Earthmoving

Cut and fill operation shall be planned to make best use of the materials available onsite including mixing and drying of less suitable materials with good "soil" to the satisfaction of the Engineer. Work shall be completed in accordance with the drawings and formation levels required.

Material onsite shall be worked to the optimum moisture content prior to compaction by drying and/or blending. Large lumps of material shall be broken down to less than 100mm size and spread uniformly before being compacted to the specified density and strength. With the approval of Engineer crushed material to a certain size may be disposed of within the Contract area.

Compaction equipment for fill placement shall comprise of "Sheepsfoot Rollers" unless specified otherwise, spreading and transportation equipment is not considered compaction equipment. The contractor shall uniformly compact each layer of material placed, the roller shall make sufficient passes to achieve the required specification for strength and density. The thickness of each layer shall also be limited and even to ensure adequate compaction is achieved for the full depth of layer.

The Contractor shall interrupt his operations as necessary to permit the Engineer to carry out, with safety, content tests on the fill. Should wet weather be forecast the earthworks area shall be sealed to prevent saturation of soil.

If drying of material is required to achieve compaction, the full depth of layer shall be disc allowing it to dry evenly. Contractor shall ensure that this is only done as weather allows with sufficient time to compact and seal before precipitation. If material is too dry either water truck and/or sprinkler system shall be used to increase moisture content, no pooling of water shall occur. Contractor shall mix and disc before compacting in place.

The Contractor shall familiarise itself with soil and moisture conditions and no extra payment shall be made for drying wet material or wetting dry material unless agreed to by the Engineer before work is carried out.

Works shall be completed by the Contractor to the designated profiles provided, should over excavation occur the Contractor shall make good under direction from the Engineer at his cost. The finished surface levels and location shall be in accordance with provided drawings/construction setout data issued. The surface should be free from depressions that hold water.

Roadway reserves shall be trimmed to subgrade level in accordance with design information provided, road subgrade shall be trimmed 500mm behind the kerb face.

Tolerances

Final tolerances shall be the following:

- Road Reserve: Plus 0mm minus 10mm (10mm over 3m Straight Edge)
- Building Platforms: Plus 0mm minus 10mm (10mm over 3m Straight Edge)
- General Earthworks: Plus 0mm minus 50mm. (No area shall hold water)

Haul Roads

No haul road shall be constructed without the approval of Engineer and located such that they will not be cut/filled over later in the project. Haul roads shall be maintained in good condition and included within the site Environmental Management Plan.

Benching

Slopes with gradients steeper than 1 in 3 shall be benched prior to bulk filling. Benches shall as far as possible be the width of a machine (but not less than 2.5m); shall have a slight fall inwards to allow for the control of water, and shall have a longitudinal fall that will ensure adequate drainage and discharge of crater. The rate for bulk earthmoving shall include all such preparatory beaching and the Contractor shall allow for such in his bulk earthworks rates.

Batters

All batters constructed in fillings more than six metres high or otherwise directed shall be benched at approximately the levels indicated on the Drawings (as per above note). While constructing the filling, the Contractor shall endeavour to use the hardest material available at bench levels to help reduce erosion. Should the batter be deemed prone to erosion or shallow scale instability the engineer may direct the Contractor to protect the face with Polythene Sheeting.

The face of every fill batter shall be compacted by rolling/tracking with an approved machine to the satisfaction of the Engineer. Upon completion of batter construction, the Contractor shall sow grass and/or mulch as directed by the Engineer.

Cuttings

All formation of cuttings shall be true to grade and cross section as shown in drawings and no steeper than that detailed. The Contractor shall be responsible for maintaining this batter until end of maintenance period has expired. If large movements/slips occur beyond the control of Contractor work shall be remediated under contract rates as an extra.

Site Visits

During the earthworks, site visits shall be undertaken by the nominated geotechnical testing company on a regular basis to assess compliance with NZS 4431 and any project specific recommendations and specifications including:

- Adequate topsoil stripping;
- Removal of organic materials;
- Placement and compaction of earth fills.

Quality Control Criteria

Due to the varying soil types being used for engineered fills, the compaction control criteria of minimum allowable shear strength, maximum allowable air voids and maximum dry density shall be used for quality assurance purposes. Approved compacting machinery shall be used and achieve the following specification unless specified otherwise by the engineer:

Maximum Dry density (measured by Nuclear densometer – NZS 4402)

Soil Type	% Compaction Required	Fill Areas	Road Reserves
Clay and Silty Clays		95%	98%

Sands and Gravels	97%	100%

Minimum Shear Strength (Measured by hand held shear vane - calibrated using NZGS 2001 method) and Maximum Air Voids Method (As defined in NZS 4402)

	Fill Areas	Road Reserves:
Air Voids Percentage average value* less than	10 %	8 %
Air Voids Percentage maximum single value	12 %	10 %
Undrained Shear Strength average value* not less than	170 kPa	140 kPa
Undrained Shear Strength minimum single value	140 kPa	110 kPa

*The average value is determined over any ten consecutive tests

Typical water content shall be in accordance with the below and any specific recommendations from the geotechnical engineer:

Soil Type	Allowable Variations	Below	Above
Heavy & Silty Clay		4%	2%
Sandy Clay		3%	2%
Sandy Silts & Silty Sands		2%	1%
Gravel/Sand/Clay/Silt Mixtures		3%	Nil

Volcanic Ash/Clays - To be determined for each project by geotechnical Engineer

Filling material shall be compacted within the above water content criteria to ensure efficient compaction. Should the engineer in control of the site find that material is outside the above criteria works shall stop until the moisture content has been corrected.

Where drying is required the full depth of top layer shall be disc allowing the layer to dry uniformly, this shall only be carried out if weather permits and re-compacted and shaped before rainfall.

Should material become too dry to achieve optimum compaction wetting using sprinkling equipment (ensuring uniform distribution of water) shall be carried out. Contractor shall ensure that no ponding or saturation occurs in specific areas, upon completion and before compaction material shall be disked to provide and even distribution of water through the layer.

Once wetting or drying has been completed the material shall be re-compacted and reshaped, no extra payment will be made for drying wet material or wetting dry material unless instruction has been issued by the Engineer before completing the work.

Quality Assurance Testing

Regular in situ density, strength and water content tests shall be carried out on all areas of the engineered filling at or in excess of the frequency recommended by NZS 4431. Where test results do not meet the specification outlined above, retests shall be carried out at the same level. These areas shall be clearly recorded and marked on plans.

Drainage lines and any other excavations requiring backfill shall also be tested in compliance with the above specification.

Topsoil - Strip Existing to Stockpile

Topsoil shall be defined as the layer of material, which may include vegetation, turf and other organic matter immediately below the ground surface and which is unsuitable for use in compacted earth fills.

All topsoil as defined by the Engineer including grass within the earthworks area shall be removed and stockpiled in a planned manner (location approved by Engineer). All areas with heavy grass vegetation shall be placed on the bottom of stockpiles, with clean material being placed on top. During sorting all unsuitable material i.e. concrete, stumps etc shall be stockpiled as directed by Engineer. No extra payment will be made to the contractor for double handling material.

Topsoil - Re-spread from stockpile

On completion of earthworks to the satisfaction of the Engineer including subgrade surface such that water does not pond, topsoil shall be re-spread from stockpiles to a minimum depth of 150mm, or other such depths as the Engineer may direct.

The topsoil shall be prepared so that the top 20mm in free of clods and is open textured and ready for the application of the seed mixture. The remaining topsoil layer should be firmly compacted.

Final finished levels shall be plus or minus 50mm but overall thickness shall not be less than 100mm, topsoil shall be sufficiently compacted to the satisfaction of Engineer.

Cut to Fill / Landscape Fill / Existing Selected Pavement Material

The standard of compaction and method of determination shall be as set out in NZS 4431. Where NZS 4431 is not applicable, the methods and standards of compaction shall be specified by the Engineer.

Stabilise Fill

Prior to works onsite the existing material shall be tested to confirm its strength in order to determine application rates of stabilization agents, testing will be either shear strength, Maximum Dry Density, Air voids, CBR testing or beam testing as directed by the Engineer.

All work shall be in accordance with TNZ B/5:2008 Specification for In-Situ Stabilisation of Modified Pavement Layers.

The Contractor shall inform the Engineer of the nominated type of equipment to be used and insure that weather conditions are suitable for application of stabilization agents this includes precipitation, wind and temperature. If conditions are not suitable work shall be stopped until conditions improve.

Stabilised material must be compacted within the following timeframes

- Cement 2hours
- Lime 4hours

The stabilising agent shall be uniformly spread at the specified application rate, with Mat tests (1m2 canvas) completed every 400m2. The test results shall be within 0.5kg/m2 of the specified rate. The contractor shall provide these test results to Engineer upon completion of work. Slacking of burnt lime shall be completed ensuring thorough water penetration, precautionary measure should be taken to ensure that public will not be exposed to blown agents. Should any discharge occur to the stormwater system the Engineer and the environmental authority for the region shall be notified immediately.

The Contractor shall ensure the depth of stabilising is as requested by the Engineer, depth of cut shall be measured on the drum at 200m intervals or if less than this distance the start and finish. The depth shall not vary by more than plus 15mm minus 5mm. Longitudinal joins shall be overlapped minimum 100mm of half the layer thickness using whichever is greater.

All joints including those to existing unstabilised pavement shall be mixed, compacted and finished so the final surface does not have permeable or loss patches. Upon completion of stabilising the material shall be compacted ensuring the layer is in a uniform, dense, stable condition. The final compaction targets shall be determined by completing laboratory tests in accordance NZS 4402: test 4.1.3 from representative sample onsite. During construction the maximum dry density (MDD) and optimum water content established from Lab testing shall be used to check compaction. The Contractor shall achieve 92 to 95% MDD on Subbase and 95 to 98% on basecourse layers.

The final surface finish shall present a tightly consolidated surface when swept which, the large aggregate is held in place with a matrix of smaller aggregates. The smaller aggregates are held firmly in place by fine material, and the matric does not displace under normal trafficking or sweeping. The standard of sweeping shall be sufficient to remove all loose aggregate, dirt, dust, silt and other deleterious material. The completed surface profile shall be in accordance with design documents and provide no more than 10mm over 3m straight edge, longitudinal profile shall match into any existing pavement.

Cut to Waste / Surplus Material from Stockpile

The tendered rate shall allow for identification of all material in cut areas, access and haul roads, uplifting (including top loading) of the cut material, benching, loading of material for removal offsite, carting to certified cleanfill site.

The Engineer shall determine which materials are “unsuitable” as noted under General Earthworks section, where any material has become unsuitable due to Contractor neglectful operation of the site i.e. poor surface drainage or excess tracking the excavation and disposal along with backfilling shall be completed at the contractor’s expense. Materials classified by the Engineer as being unsuitable and not suitable for use onsite shall be disposed of to an approved, authorized tip site.

All unsuitable material located within areas to be filled shall be removed prior to commencement of filling, the extent and measure up of material shall be confirmed onsite by the Engineer. No unsuitable material shall be buried or deposited on the Contract site unless agreed with the Engineer. The Contractor shall pay careful attention shall be made to mucking out gullies and old watercourses, ensuring that unsuitable material is not mixed with fill material.

Material which is unsuitable due to high water content only shall be spread, dried, mixed and placed as fill, if full specification can’t be achieved this material can be placed in general reserve areas with agreement from the Engineer.

Roading

Roading General

This Specification applies to flexible pavements construction which shall be carried out to the alignments and standards detailed in the approved drawings and with the specified materials so as to provide the intended design life. This includes conventional metal sub-base and basecourse material, Bitumen, Chipseal, Asphaltic Concrete, concrete pavers, kerb and channels, ducts, cables, driveways,

footpaths, road berms and streetlights. This specification refers to multiple standards and TNZ specifications in all cases the latest revisions or amendments at time of tender shall be used.

The Contractor shall ensure all existing features are protected and not damaged during construction, any damage that does occur shall be repaired at the Contractors cost. Construction of the roadway excavation to subgrade level shall be incorporated into the overall site bulk earthworks, and any soft spots made good to specification. Scala penetrometer and Benkelman Beam testing shall be completed along with a site walkover with Engineer present to inspect the trimmed subgrade. Trimming material shall be disposed of onsite under direction from Engineer. Areas below design specification strength shall be improved and re-tested before final inspection of the completed subgrade surface is carried out.

The subgrade shall be prepared with suitable equipment to a smooth consistent surface with care taken around any sensitive soils, the finish tolerance shall be plus 0mm minus 10mm (10mm over 3m straight edge). The Contractor is responsible for the protection and maintenance of the subgrade throughout the construction of the pavement layers. Under no circumstances shall the subgrade be left exposed to suffer damage by weather, construction traffic or any other cause. Should any weakness develop within the pavement the Contractor under instruction from the Engineer shall repair at his cost.

Underchannel drains shall be installed and connected to stormwater reticulation under no circumstances shall they be left unconnected to saturate subgrade in the event of rainfall. Drains to be bedded in free draining drainage media and wrapped in geotextile cloth unless noted otherwise.

Ducts shall be installed and where crossing carriageway hardfill backfilled with well compacted GAP65 material, asbuilt data shall be recorded and supplied to the engineer of their locations along with markings on the kerb. The Contractor shall be responsible for any costs to locate and expose ducts incorrectly marked/recorded. Clearance between ducts and other services shall be in accordance with local/regional/service provider specifications. The ends of all ducts shall be temporary plugged to stop egress of water/sediment and an approved draw cable installed.

Trim and Prepare Subgrade

Before any subbase material is placed onsite the trimmed subgrade surface shall be inspected by the Engineer and Local/Regional authority, the contractor shall supply a copy of scala penetrometer testing and beam testing completed. Should the material not meet the required specification the engineer will instruct improvement works.

Undercut and Backfill with Granular Material (Pavement).

The Engineer shall determine which materials are “unsuitable” as noted under General Earthworks section, where any material has become unsuitable due to Contractor neglectful operation of the site i.e. poor surface drainage or inadequate protection of the subgrade the disposal along with backfilling shall be completed at the contractor’s expense. Materials classified by the Engineer as being unsuitable and not suitable for use onsite shall be disposed of to an approved, authorised tip site.

All unsuitable material located within the identified soft spots within the subgrade shall be removed to the depth specified by the Engineer, and either disposed of onsite or removed to waste as directed by the Engineer. The extents shall be clearly measured and recorded along with copy of subgrade testing completed.

Geogrid and Geotextile

Fabric shall be free of rips and laid smooth on the surface, joins shall have minimum of 1m overlap with Bidium A19 geotextile or similar.

Grid shall be free of rips and laid smooth on the surface, joins shall have minimum of 1m overlap with TX160 (or similar approved) as directed by the Engineer.

Pavement Construction, Parking Bays, Turnarounds - Subbase

Unless specified otherwise GAP65 which complies with local/regional authority requirements shall be used. Compaction shall be achieved to minimum/maximum of 92-95% Dry Density or better, the Engineer may also request further testing either using Clegg Impact or Benkelman Beam testing. The finished tolerance shall be plus 0mm minus 10mm (10mm over 3m straight edge). Contractor shall not proceed with next layer until Engineer has given written instruction.

Pavement Construction, Parking Bays, Turnarounds - Basecourse

Unless specified otherwise TNZ M4 which complies with local/regional authority requirements shall be used. Compaction shall be achieved to minimum/maximum of 95-98% Dry Density or better, the Engineer may also request further testing either using Clegg Impact or Benkelman Beam testing. The finished tolerance shall be plus 0mm minus 10mm (10mm over 3m straight edge). Contractor shall not proceed with next layer until Engineer has given written instruction.

General Paving Guidelines

The finished surface of new roads shall have a NAASRA roughness satisfying the Local Authorities standards at the time of construction. No abrupt or abnormal deviations shall occur and no areas shall pond water. The surface shall be of uniform texture expected by best trade practice and satisfy density standards applicable to the surfacing being used. The skid resistance and surface texture of roads where design speeds exceed 70 km/h, shall comply with NZTA specification T/10 and its accompanying notes. Finished surface profile shall have no more than 10mm difference over a 3m straight edge.

Where hard surfacing is required for areas that are not movement lanes, alternative materials and porous pavements that achieve the durability, maintenance, and amenity requirements are acceptable with the approval of the Local Authority.

Road Surfacing Materials

All materials used in road surfacing shall comply with the appropriate NZTA specifications. The following surfacing options will be acceptable for roads covered by the Standard.

<u>First and second coat chip seals</u>

For first coat seals the chip size shall generally be grade 3 on all roads unless specified otherwise by Engineer.

For second coat seals the chip size shall generally be grade 4. Cycle and parking lanes shall be grade 6 unless specified otherwise by Engineer.

Double wet lock coat

First and second seals may be constructed in one operation with asphaltic cutback to NZTA M/1 and P/3 specifications.

The binder application rate for the seals shall be designed to suit the conditions and chip size.

Acceptable and compatible chip sizes are:

Local roads

First coat: grade 4, second coat: grade 6

Other roads

First coat: grade 3, second coat: grade 5 or 6.

Contractor shall ensure before placement that the engineer has inspected the basecourse surface, and that the finish, moisture content and temperature are suitable. The waterproofing seal coat, using asphaltic binder or emulsion, and grade 4/6 (first coat/second coat) chip, with the requirement that the seal coat comprises a minimum of 1.0 L/m2 of residual penetration grade bitumen, shall be laid prior to surfacing with asphaltic concrete of 50 mm or lesser thickness.

Hot laid asphaltic concrete surfacing

Hot laid asphaltic concrete surfacing shall comply with NZTA specification M/10 or equivalent approved by the TA. The mix used shall be appropriate to the end use and thickness being placed. A waterproofing seal coat, using asphaltic binder or emulsion, and grade 5 chip, with the requirement that the seal coat comprises a minimum of 1.0 L/m2 of residual penetration grade bitumen, shall be laid prior to surfacing with asphaltic concrete of 50 mm or lesser thickness. No cut back shall be used in such coats as it can cause lushing of the asphalt overlay. When using NZTA specification M/10 compliant mixes on roads of connector/collector class, NZTA guidelines on skid resistance and surface texture shall be incorporated in the mix design.

Contractor shall ensure before placement that the engineer has inspected the chipseal surface, and that the finish, moisture content and temperature are suitable. The final finish shall be smooth, to grade and not hold any water (ponding), and surface defects shall be remedied at the contractor's cost. The final mix and thickness shall be specified on the construction drawings.

Other asphaltic mixes

For special uses other asphalt-based hot mixes may be used such as open grade porous asphalt or macadam wearing mix. When used they shall be placed over a waterproof under layer and shall be designed according to current specifications and guides. In no case shall the laid thickness be less than 25 mm.

Concrete

All concrete for roads shall come from a special grade plant as defined in NZS 3109. Concrete of not less than 30 MPa 28-day strength shall be used for any road or crossing slabs. Concrete for kerbs and channel shall be of not less than 20 MPa, 28-day strength.

Concrete pavers

Design and material standards shall comply with NZS 3116. Paver thickness shall be as defined in NZS 3116 for the appropriate traffic loading classification.

When used in roads the basecourse underlayer shall be given a waterproofing seal coat before the sand and pavers are laid, except where part of a porous pavement is approved by the TA.

When used for bus stops or at raised crossings the basecourse shall be cement stabilised under the raised zone and for at least 3 m on either side of the raised zone.

Pavers shall be laid to 5 mm above the lips of channels and other draining features.

KERBING

Kerb and channel may be either cast in situ or extruded. For cast in situ kerb and channel, formwork shall be clean dressed timber or steel sections adequately oiled or otherwise treated to allow ease of striking without staining or damaging of the stripped concrete surface. No formwork shall be stripped until at least 2 days have elapsed from time of pouring concrete.

For extruded kerb and channel, concrete used shall be of such consistency that after extrusion it will maintain the kerb shape without support. The extrusion machine shall be operated to produce a well compacted mass of concrete free from surface pitting. The contractor shall allow within his rate to construct vehicle crossing dropdowns, pram crossings and stormwater cesspit aprons and surrounds.

Concrete used in kerbs and channels shall be of at least 20 MPa, 28-day strength. Finished tolerances and standards shall satisfy the design standards. Kerbs less than 1% gradient shall be setout with an electronic theodolite.

All curves both horizontal and vertical shall be tangential to straights and the lines and levels of kerbs shall be such as to give the finished kerbs smooth lines free of kinks and angles. Construction joints shall be placed in all unreinforced kerb and channel at 10 m centres.

Workmanship standards shall be such that, on straights, kerbing shall not deviate from a straight line by more than 6 mm in any length of 3 m. Similar standards shall apply to the gradient line. No visible ponding in new channels shall occur.

The exposed faces of the kerb and channel shall present smooth, uniform appearance free from honey-combing or other blemishes to at least U3 standard in NZS 3114.

UNDERCHANNEL DRAIN

Subsoils shall be constructed in accordance with NZTA F/2:2013 with High Density Polyethylene smooth bore perforated corrugated drainage pipe complying with requirements specified in NZS 7604:1981 “High Density Polyethylene Drain and Sewer Pipe and Fittings”. Pipes shall be class 500 and identifiable by either a visible continuous red line or legible lettering on both sides at approximately 1m intervals specifying brand name and TNZ F/2 Class 500. The drain shall be encased with a geotextile which complies with the following performance requirements of NZTA F7.

The manufacturers jointing system shall be used and terminated to either piped stormwater systems, or open air and set in concrete collar such that sedimentation/blockage of outlet does not occur.

Trenches shall be cut in such manner that pipes are laid true to the depths, grades and lines shown on drawings. The width shall not exceed the specified dimensions, unless otherwise specified the trenches shall have:

- trenches shall have gradient of not less than 1:100
- Vertical sides from trench bottom to a minimum of 300mm above the pipe
- minimum depth of 750mm for unsealed roads/embankment conditions/construction equipment, 600mm for sealed roads and 450mm for areas not within roadways (as per AS/NZS 2566:1998)
- surplus material shall be placed at least the excavation depth away from trench and surplus material shall be disposed of as directed by engineer

Pipes shall be bedded on a continuous cushion of the filter material with no less than 75mm under the pipe, and a minimum of 150mm above the pipe or as specified in contract drawings. Bedding material shall be in accordance with NZS 3111.1986, and grading curve shall comply with NZS4402, Part 2:1986.

Footpaths, Accessways, Paving

The finished depth, finish and concrete strength shall be in accordance with the local/regional standards or those specified within the construction drawings.

The concrete paths shall be laid with construction joints at intervals of not greater than 3m. If paths are constructed by continuous pour techniques, clean, true, well-oiled 5 mm thick steel strips at least 40mm deep shall be inserted at 3 m intervals to facilitate controlled cracking. These strips shall be carefully removed after the concrete has set. Alternatively, the joints may be cut by means of a concrete-cutting saw. In this case the cutting shall be carried out not more than 48 hours after pouring and shall be to a depth of 40 mm. These joints may also be typically tooled into the concrete when the concrete is still plastic.

Concrete used in footpaths shall be of at least 20 MPa, 28-day strength. Concrete for crossings shall be 30 MPa, 28-day strength.

Where required, vehicle and pedestrian crossings shall be constructed in accordance with the local/regional authority standard details. Tactile pads may be required at pedestrian kerb crossings.

Concrete paths and accessways shall be finished with a crossfall to shed water and an even non-skid brush surface to finish U5 in NZS 3114. The surface of other paths/accessways shall be of uniform texture as would be expected from best trade standards for the surfacing used. Crossfalls of 2% shall be provided.

The surface of all paths/accessways shall not deviate by more than 6 mm from a 3 m straight edge at any point and no abrupt changes in line or level shall occur. No path/ accessway shall pond water.

Marking

Prior to commencing work under this contract, the contractor shall nominate in the Contractor's QA plan, the brand and designation of the material intended for use. A type and class of material may be nominated by the Engineer in the specific contract documents. TNZ P/12:2000 SP/SP12:010201 SPECIFICATION FOR PAVEMENT MARKING Page 3 of 18 Pages The material used shall not be changed from that nominated in the QA plan without the written approval of the Engineer.

Before commencing roadmarking the contractor shall set out all markings with paint spots or other appropriate methods to ensure start, finish, and orientation is defined. These spots shall be at a spacing of 10 m or less.

Freshly completed markings shall be protected by cones or other markers approved by the Engineer until the roadmarking is dry, and the beads securely held. Any markings on adjoining pavement caused by mishap, or the transfer of wet marking material by tyres of passing vehicles shall be removed, with the Contractor being fully responsible for their removal.

Drainage

General

All drainage work to comply with current Local/ Regional authority standards. Contractor to ensure that all Engineering and Local/ Regional authority inspections required for compliance are completed.

The construction of pipelines shall be carried out in accordance with the requirements of AS/NZS 2032 (PVC), AS/NZS 2033 (PE), AS/NZS 2566 Parts 1 and 2 (all buried flexible pipelines), or AS/NZS 3725 (concrete pipes).

The Contractor shall be responsible for the correct setting out of all the Works from the survey reference information provided in accordance with the Contract. No alterations in the alignment, level or location of the drains are to be undertaken unless authorised by the Engineer.

All materials to comply with current Local/ Regional authority standards.

Unless otherwise specified, all concrete used in drainage works shall comply with the requirements of NZS3209 and shall have a minimum compressive strength of 20.0Mpa at 28 days.

Undercut and Backfill with Granular Material

Depth of undercut specified below: (To meet 'good ground' conditions)

- CBR 1 – 400mm
- CBR 2 – 300mm
- CBR 3 – 200mm
- CBR > 3 will not require undercut.

Hardfill Backfill

Hardfill backfill to be GAP65 or similar. The minimum thickness of Hardfill backfill shall be 200mm. Trench width (D+300mm) solid measure.

Extra over item to Pipe laying used under road/accessway carriageways and at pipe crossovers as shown within the Contract Drawings or as directed or specified by the Engineer.

Pipe Laying and Jointing – Open Cut

Contractor to allow for the setting aside of surplus material for reuse or disposal onsite as directed by the Engineer. (to be placed in bulk fill areas) If material is unsuitable/ not required onsite it shall be removed from sit as per unsuitable material from trenches.

Pipeline quantities noted in the Schedule are measured from edge of manhole to edge of manhole, and the final measure-up and payment shall be on this basis.

All pipes shall be laid in accordance with pipe manufacturers recommendation for the class and type of pipe being used at the alignment, level and location within the Contract Drawings. All pipelines shall always during the contract be kept clean and free of all dirt, rubbish, and water.

Minimum cover for pipes and separation distance between crossing pipes and services shall be as per Local/ Regional authority standards or as described in AS/NZS 2566.2 (for buried flexible pipelines) or AS/NZS 3725 (for buried concrete pipes) if not specified.

No backfilling shall be carried out until the section to be backfilled has been approved by the Engineer as passing all the necessary tests and all junctions and house connections have been located by measurement for record purposes.

Backfilling around and above pipes shall be in accordance with the standard drawings in terms of fine material used and depth above pipe. Backfill should be consolidated in 200mm layers.

Trench Improvement

Excavations shall be of sufficient width and depth to permit effective bedding, laying of pipes and installation of manholes and other structures. Excavated materials shall be stacked at least 450mm clear of the edge of any excavation or outside a 45-degree angle from invert of trench. No trenches shall be opened more than 120m ahead.

All pipes shall be laid upon the type of bedding specified or shown on the Contract Drawings, in compliance with the Local/ Regional authority standards. In trenches where good ground is not encountered (CBR < 3) trench improvements are to be completed as directed or specified by the Engineer.

Manhole, Catchpit & Chambers

Contractor shall allow for the setting aside of surplus material for reuse or disposal onsite as directed by the engineer. (to be placed in bulk fill areas) If material is unsuitable/ not required onsite it shall be removed from sit as per unsuitable material from trenches.

Contractor to allow for the connection of all inlet and outlet pipes (excluding existing manholes). All inlet and outlet pipes shall have a flexible joint not more than 600mm outside the manhole wall. Soffits of inlet pipes shall not be lower than the soffit of the outlet pipe.

Manholes, catchpits and chambers shall be constructed as per the Standard Details in the Contract Drawings which are also located within the Local/ Regional authority standards. Standard details are included for manhole base, benching and wall construction.

All benching and haunching to be a smooth finish to accommodate all inlet and outlet pipes. New inlet pipes shall be cut back to the inside face of the MH and provided with a smooth finish. All chambers are to be made watertight with mortar around all openings.

Chamber internal diameter sizes and fall through chambers are as per the Local/ Regional authority standards.

All chambers shall be left with their lids set at a level that is flush with the surrounding ground unless otherwise specified in the drawings.

Drop connections shall be internal drops in accordance with the standard drawings, unless specified otherwise.

Connections - Laterals

Where shown on the plans or directed by the Engineer, junctions shall be provided for house connections, refer to local authority standards for type of junction required. Care shall be taken to ensure that no part of the junction pipe, reinforcing or plastered finish projects into the barrel of the main pipe.

Unless otherwise specified, all house connections shall be constructed at right angles to the main drain and shall be ramped at 45 degrees to within one metre of the ground surface. All connections must extend a minimum of one metre into the relevant lot.

Connections to Existing

The Contractor should allow for all costs to connect the new drainage reticulation to the existing network, by either the Controlling Authority or by the Contractor under Council supervision, as specified in the contract drawings. The new drainage reticulation shall be tested and accepted by the Controlling Authority before connection.

Where the Contractor is to make this connection, they shall be responsible for all required excavation, laying, fittings, backfilling and removal of surplus materials.

Where the Controlling Authority is to make the connection, the Contractor shall lay the pipes to within 1 metre of the connection point and organise the connection directly. Contractor to allow all liaison / applications required for any connection made by the controlling authority. Payment for connection will be made directly to the Controlling Authority by the Developer

The connection of new mains to existing shall be carried out to the methodology and procedural requirements of the Regional/ Territorial Authority.

Water Reticulation

General

that all Engineering and Local/ Regional authority inspections required for compliance are completed.

All parts of the water supply system in contact with drinking water shall be designed using components and materials that comply with AS/NZS 4020.

The Contractor shall be responsible for the correct setting out of all the Works from the survey reference information provided in accordance with the Contract. No alterations in the alignment, level or location of the drains are to be undertaken unless authorised by the Engineer.

All materials to comply with current Local/ Regional authority standards as set out in NZS 4404:201 APPENDIX A – ACCEPTABLE PIPE AND FITTING MATERIALS.

Pipe Laying and Jointing

The Contractor shall allow for the supply, excavation, lay of each length of water supply pipe, trench supports/shield, bedding, joints, backfilling and compaction of that backfill to the required standard and the installation of detector tape.

Contractor to allow for the setting aside of surplus material for reuse or disposal onsite as directed by the engineer. (to be placed in bulk fill areas) If material is unsuitable/ not required onsite it shall be removed from sit as per unsuitable material from trenches.

All pipes shall be laid in accordance with the manufacturer's recommendation for the class and type of pipe being used. Joints shall be tightened sufficiently to provide a watertight seal but not overtightened producing high stresses.

Minimum cover for pipes and separation distance between crossing pipes and services shall be as per Local/ Regional authority standards or as described in AS/NZS 2566.2 (for buried flexible pipelines) or AS/NZS 3725 (for buried concrete pipes) if not specified.

Trenches shall be evenly graded at a sufficient depth to allow sufficient cover from finished ground surface level to the top of the pipes as required by the relevant Regional/ Territorial Authority.

No backfilling shall be carried out until the section to be backfilled has been approved by the Engineer as passing all the necessary tests and all junctions have been located by measurement for record purposes.

Backfilling around and above pipes shall be in accordance with the standard drawings in terms of fine material used and depth above pipe. Backfill should be consolidated in 200mm layers.

Detector tape shall be laid above all trenched watermains constructed from a non-metallic material 150mm above all watermain pipes and rider main pipes, a metallic detector tape marked "Watermain Below"

Tracer wire in the form of a continuous four-millimetre multi strand (minimum 4) polythene sleeved copper cable, shall be installed with all non-metallic pipes to allow detection.

Valves

Sluice and Peet valves shall be resilient seated gate valves which comply with AS 2638.2 2006 "Sluice valves for waterworks purposes" shall be used, and AS 4158 "Thermal-bonded polymeric coatings on valves & fittings" shall be used.

Hydrants

Hydrants shall be mounted on approved types of hydrant tees with risers if necessary, so that the top of each hydrant is no less than 300mm from finished ground level. Each hydrant strait be covered with an approved type of hydrant box and painted lid painted on the top. The Hydrant symbol shall be marked on the road surface opposite the hydrant in accordance with Local Fire Authority requirements.

Meters and Connections

Unless otherwise specified, all house connections should be installed as part of the house construction (not part of the subdivision) and will be undertaken by the Local/ Regional authority.

All house connections shall terminate at a water meter or service valve, shall be constructed at right angles to the principle main, shall extend a minimum of one metre into the relevant lot, shall be laid a minimum of 450mm cover, rising to 250mm cover immediately adjacent to the meter box.

Connections shall be sized in accordance with NZS/AS 3500.1.2003 "Plumbing & Drainage Part 1 Water Services Clause 3.2.2

Connections to Existing

The Contractor should allow for all costs to connect the new drainage reticulation to the existing network, by either the Controlling Authority or by the Contractor under Council supervision, as specified in the contract drawings. The new drainage reticulation shall be tested and accepted by the Controlling Authority before connection.

Where the Contractor is to make this connection, they shall be responsible for all required excavation, laying, fittings, backfilling and removal of surplus materials.

Where the Controlling Authority is to make the connection, the Contractor shall lay the pipes to within 1 metre of the connection point and organise the connection directly. Contractor to allow all liaison /

applications required for any connection made by the controlling authority. Payment for connection will be made directly to the Controlling Authority by the Developer

The connection of new mains to existing shall be carried out to the methodology and procedural requirements of the Regional/ Territorial Authority.

SERVICES

SERVICE TRENCH

Trench width shall be identified within the Contract Drawings or as directed or specified by the Engineer. Common trench width shall be sufficient to install all services meeting clearance requirements as specified by the service authorities.

Placement of fines/shading around services shall be completed to provider specifications.

DUCTING

Ducting for water pipes shall be uPVC. All ducts shall be laid in a straight line with no angles or bends. Joints shall be made in such a manner that the ends of the pipes are prevented from moving.

Trenches shall be evenly graded at a sufficient depth to allow sufficient cover from finished ground surface level to the top of the pipes as required by the relevant Regional / Territorial Authority. A clearance of at least 150mm below the underside of any future watermains should be allowed. Ducts across paths and vehicle crossing shall have a minimum clearance of 50mm below the underside of the concrete.

LANDSCAPING

HYDROSEEDING / GRASSING

Grass establishment shall be timed to take advantage of the local optimum growth period as soon as possible after completion of works. In the absence of other specifications within the Contract documents the following shall be applied or as specified by the Engineer:

Grass Type:

- Perennial Rye Grass 250kg/ha
- Chewings Fescue 300kg/ha
- Browntop/Bent Grass 300kg/ha

Ground preparation shall be in accordance with item 240 and grass shall achieve 90% or better strike, if not achieved the Contractor shall supply and sow additional seed until 90% strike is achieved. Contactor shall allow once growth is sufficient to mow and weed along with making good any depressions which have developed due to insufficient compaction. The Contractor shall allow to maintain the berms and complete a final mowing within 5days of the end of maintenance period.

APPENDIX C

EDC SITE INSPECTION NOTES

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48744	Date: 9/2/2022	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 09:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahe Dunes

Findings

- The formation for Lot 81 & 79 was investigated. All the organic material was removed and clean sand was visible
- A scala Penetrometer test was conducted in Lot 81, the results indicated that the sand was loose from surface to 1.5m begL. From 1.5m begL, 5 blows per 100mm was achieved.
- Recommendation
- The upper 1.3 of sand in Lot 81 must be scrapped off, and the backfilled in maximum of 200mm layers and compacted.
- The sand that is scrapped off can be used to backfill Lot 79.

JB

09/2/2022

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

UNDER THE CHARTERED ENGINEERS ACT (2002), PROFESSIONAL ENGINEERS CAN ONLY REVIEW WORK WITHIN THEIR AREAS OF EXPERTISE.

1. This observation is carried out for our client only and for the purpose stated.
   It should not be relied upon by any third party without our specific written agreement.

2. All weather-tightness and durability issues are excluded. Refer to Architect for all details specifically relating to B2 and E2 of the NZBC.

3. Engineering Design Consultants Ltd will be held blameless to all third parties.

4. All temporary works are the sole responsibility of the Builder / Contractor.

5. Report any discrepancies immediately to the Engineer.

6. Certification of registered building work is based on the understanding that this work is completed by licenced building practitioners holding a current practicing licence.

7. Engineering Design Consultants Ltd does not check set-out or levels. We recommend a licenced Professional Surveyor is engaged to provide this service.

8. By checking any work, Engineering Design Consultants Ltd does not verify that the work does not require a variation from Council. We recommend that this is confirmed in writing from Council Inspector/Engineer.

9. If in doubt, ASK the Engineer.

5 x 5 CHECK

1. STOP - engage brain before you act.
2. LOOK - identify any hazards.
3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48744	Date: 16/2/2022	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 15.00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahi Dunes

Findings

- The road from Lot 73 to Lot 82 was inspected and several Scala penetrometer tests were carried out.
- The SCda results indicated that the upper 0.3m of the soils are loose, but increases with depth from 0.3m to 0.9m begL ~~as~~ a geotechnical UBC of 300kPa is achieved.

Recommendation

- There is no geological reason why construction can not continue.

16/2/2022

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

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9. If in doubt, ASK the Engineer.

5 x 5 CHECK

1. STOP - engage brain before you act.
2. LOOK - identify any hazards.
3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.

ENGINEERING DESIGN CONSULTANTS LIMITED
CIVIL · STRUCTURAL · GEOTECHNICAL · ENVIRONMENTAL · FIRE

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EXPLORATORY HOLE LOG

ADDRESS: Waidene Dunes (Road Inspection)	BOREHOLE / HA No:
	P/N:
DRILLED BY:	DEPTH OF WATER STRIKE:
	DATE: 16/2/22

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @

SCALA START DEPTH.....

	X		X		X		.5		X		X
0.1	X	1.1	X	2.1	X	3.1	.5	4.1	X	5.1	X
	-5		-5		1		2		-5		1
0.2	-5	1.2	-5	2.2	1	3.2	2	4.2	-5	5.2	2
	1		1		1		2		1		4
0.3	1	1.3	1	2.3	2	3.3	3	4.3	2	5.3	3
	2		2		3		3		3		3
0.4	2	1.4	1	2.4	4	3.4	4	4.4	4	5.4	3
	3		2		4		4		3		1
0.5	3	1.5	2	2.5	4	3.5	5	4.5	4	5.5	2
	3		2		5		6		6		2
0.6	3	1.6	3	2.6	5	3.6	—	4.6	6	6.6	3
	2		2		6				—		3
0.7	3	1.7	2	2.7	6	3.7		4.7		5.7	3
	2		3		—						3
0.8	2	1.8	2	2.8		3.8		4.8		5.8	2
	2		3								2
0.9	2	1.9	2	2.9		3.9	—	4.9		5.9	3
1.0		2.0		3.0		4.0		5.0		6.0	
	RD Lot 82		RD Lot 81		Rd Lot 80		Rd Lot 78		Rd Lot 77		Rd Lot 73

ENGINEERING DESIGN CONSULTANTS LTD

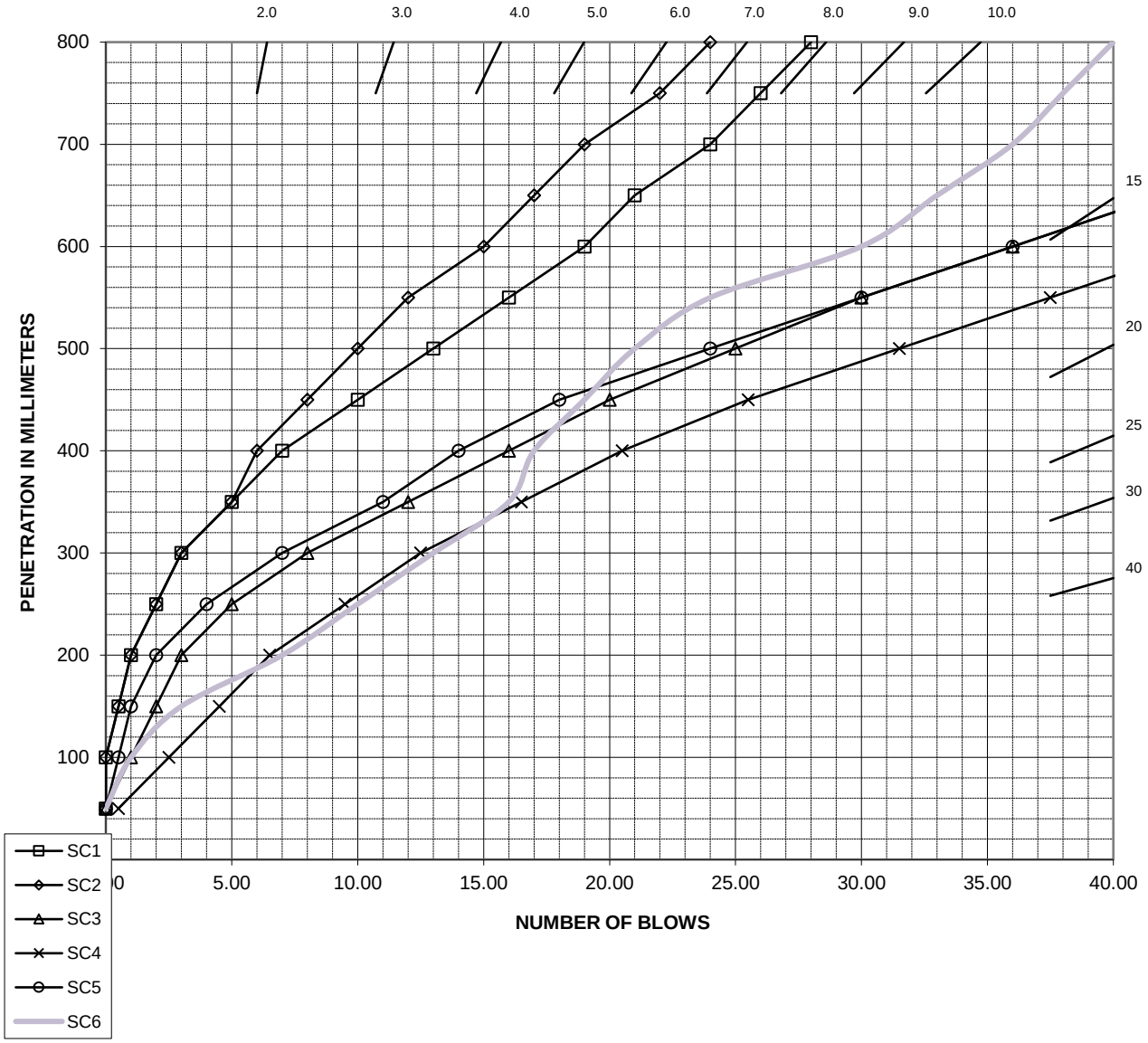
SCALA PENETROMETER TEST

Job No. 48749

Project Waiotahi Drifts Subdivision

Location Waiotahi Drifts

CORRELATION OF SCALA PENETROMETER RESULTS WITH CBR



after Stockwell, M. J., 1977

Test No.	Estimated CBR
SC1	6.5
SC2	7.8
SC3	10+
SC4	10+
SC5	10+
SC6	10+

TESTED BY JGB

DATE 22/02/22

CHECKED BY

DATE

ENGINEERING DESIGN CONSULTANTS LTD

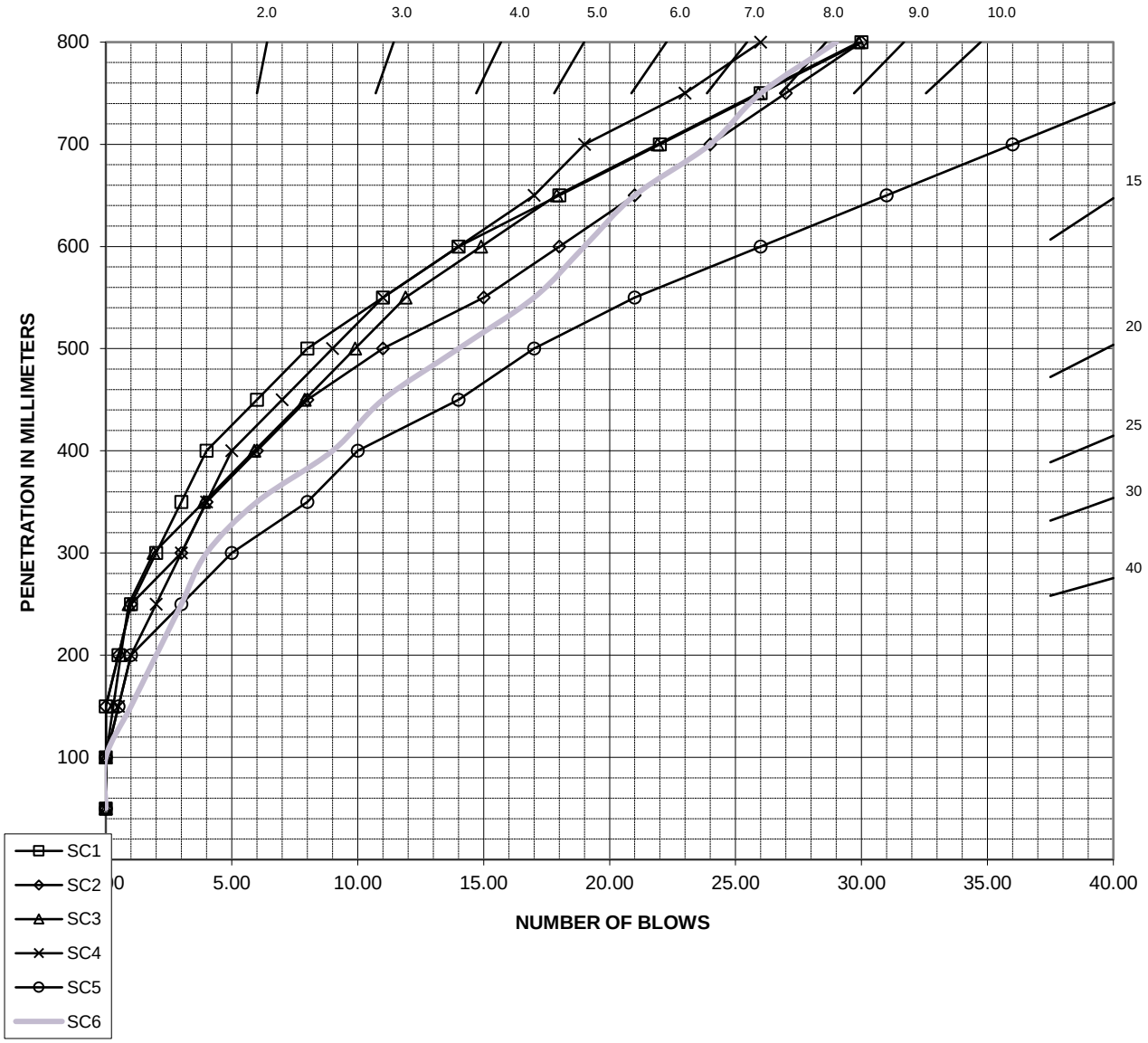
SCALA PENETROMETER TEST

Job No. 48749

Project Waiotahi Drifts Subdivision

Location Waiotahi Drifts

CORRELATION OF SCALA PENETROMETER RESULTS WITH CBR



after Stockwell, M. J., 1977

Test No.	Estimated CBR
SC1	8.5
SC2	8.5
SC3	8.5
SC4	7.2
SC5	10+
SC6	8.1

TESTED BY JGB

DATE 22/02/22

CHECKED BY

DATE

Notes

1. All works to be in accordance with Auckland council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.

Legend

EX BDY
PROP BDY
BLD LINE RESTRICTION

Approximate Location where the Scala Penetrometer tests were conducted for the ROW

Approximate Location where the Scala Penetrometer tests were conducted for the ROW

Approximate Location where the Scala Penetrometer tests were conducted for the road

Approximate Location where the Scala Penetrometer tests were conducted for the ROW

PUBLIC ROAD
LEGAL ROAD
(20.12m)

RIMU RIMU KEY

WAIOTAHI DRIFTS BLVD

KOKUMOA KEY

A	RC	JK	07/18
Ref	Revisions	By	Date

	By	Date
Survey	-	-
Design	JK	07/18
Drawn	JK	07/18
Checked	BV	07/18

Maven Associates
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www.maven.co.nz
12 -14 Walls Road, Penrose

Project
WAIOTAHE DUNES DEVELOPMENT
WAIOTAHE
FOR
EQUINOX

Title
PROPOSED
FOREDUNE PLAN

Project no.	105006		
Scale	1:1500 @ A3		
Cad file	105006-246 EW		
Drawing no.	C280	Rev	A

DATE: 4/23/21
FILE: 105006-280 FOREDUNE ACAD 2018.dwg

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 22/02/2022	Are you entering site alone? (Yes/No) (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 13:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? (Yes/No) (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Wairotahi Drifts

Findings (RoW Phase 1)

- Two Scala Penetrometer tests were carried out on each of the proposed RoW's.
- Each test was carried out in the centre of the RoW.
- The Scala Penetrometer test had to be converted into a CBR reading and a CBR value of 5 was planned.
- After the convertion, the results indicates that a CBR value of more than 5 has been achieved.

Recommendation

- The next stage of road construction can continue.

22/2/2022

H & S Comments: See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

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5 x 5 CHECK

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ENGINEERING DESIGN CONSULTANTS

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Notes

1. All works to be in accordance with Auckland council standards.
2. Co-ordinates in terms of NZ Geodetic Datum Mt Eden 2000
3. Levels in terms of the Auckland Vertical Datum 1946.

Legend

EX BDY
PROP BDY
BLD LINE RESTRICTION

Approximate Location where the Scala Penetrometer tests were conducted for the ROW

Approximate Location where the Scala Penetrometer tests were conducted for the ROW

Approximate Location where the Scala Penetrometer tests were conducted for the road

Approximate Location where the Scala Penetrometer tests were conducted for the ROW

PUBLIC ROAD
LEGAL ROAD
(20.12m)

RIMU RIMU KEY

WAIOTAHI DRIFTS BLVD

KOKUMOA KEY

A	RC	JK	07/18
Ref	Revisions	By	Date

	By	Date
Survey	-	-
Design	JK	07/18
Drawn	JK	07/18
Checked	BV	07/18

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12 -14 Walls Road, Penrose

Project
WAIOTAHE DUNES DEVELOPMENT
WAIOTAHE
FOR
EQUINOX

Title
PROPOSED
FOREDUNE PLAN

Project no.	105006		
Scale	1:1500 @ A3		
Cad file	105006-246 EW		
Drawing no.	C280	Rev	A

DATE: 4/23/21
FILE: 105006-280 FOREDUNE ACAD 2018.dwg

ENGINEERING DESIGN CONSULTANTS LIMITED
CIVIL · STRUCTURAL · GEOTECHNICAL · ENVIRONMENTAL · FIRE

Auckland Office: 1st Floor, Unit 1, 100 Bush Road, Albany 0632, Ph: 09 451 9044 Fax: 09 415 1280
Christchurch Office: 3/22 Ranfurly Street, St Albans, Christchurch 8014. Ph: 03 355 5559
Postal: PO Box 118, Albany Village 0755, Auckland. Email: team@edc.co.nz Web: www.edc.co.nz

EXPLORATORY HOLE LOG

ADDRESS: Waiotahi Drifts		BOREHOLE / HA No:
		P/N:
DRILLED BY:	DEPTH OF WATER STRIKE:	DATE: 22/02/22

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
	ROW inspection (All tests done in centre of ROW	
		/ @
	F = Front of ROW	
	B = Back of ROW	/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @

SCALA START DEPTH..... B F B F

	X		X		X		X		X		X	
0.1	X	1.1	X	2.1	X	3.1	X	4.1	X	5.1	X	
	X		X		3		5		5		1	
0.2	5	1.2	5	2.2	3	3.2	5	4.2	5	5.2	1	
	5		5		3		1		2		1	
0.3	1	1.3	2	2.3	1	3.3	1	4.3	2	5.3	1	
	1		1		2		1		3		2	
0.4	1	1.4	2	2.4	2	3.4	1	4.4	2	5.4	3	
	2		2		2		2		4		2	
0.5	2	1.5	3	2.5	2	3.5	2	4.5	3	5.5	3	
	3		4		2		2		4		3	
0.6	3	1.6	3	2.6	3	3.6	3	4.6	5	5.6	2	
	4		3		3		3		5		2	
0.7	4	1.7	3	2.7	4	3.7	2	4.7	—	5.7	3	
	4		3		4		4				3	
0.8	4	1.8	3	2.8	4	3.8	3	4.8		5.8	3	
	—		3		4		3				3	
0.9		1.9	4	2.9	—	3.9	3	4.9		5.9	3	
			5									
1.0		2.0		3.0		4.0		5.0		6.0		

Lot 6 & 11 ROW | Lots 4 & 7 ROW | Lots 73 & 74 ROW

ENGINEERING DESIGN CONSULTANTS LTD

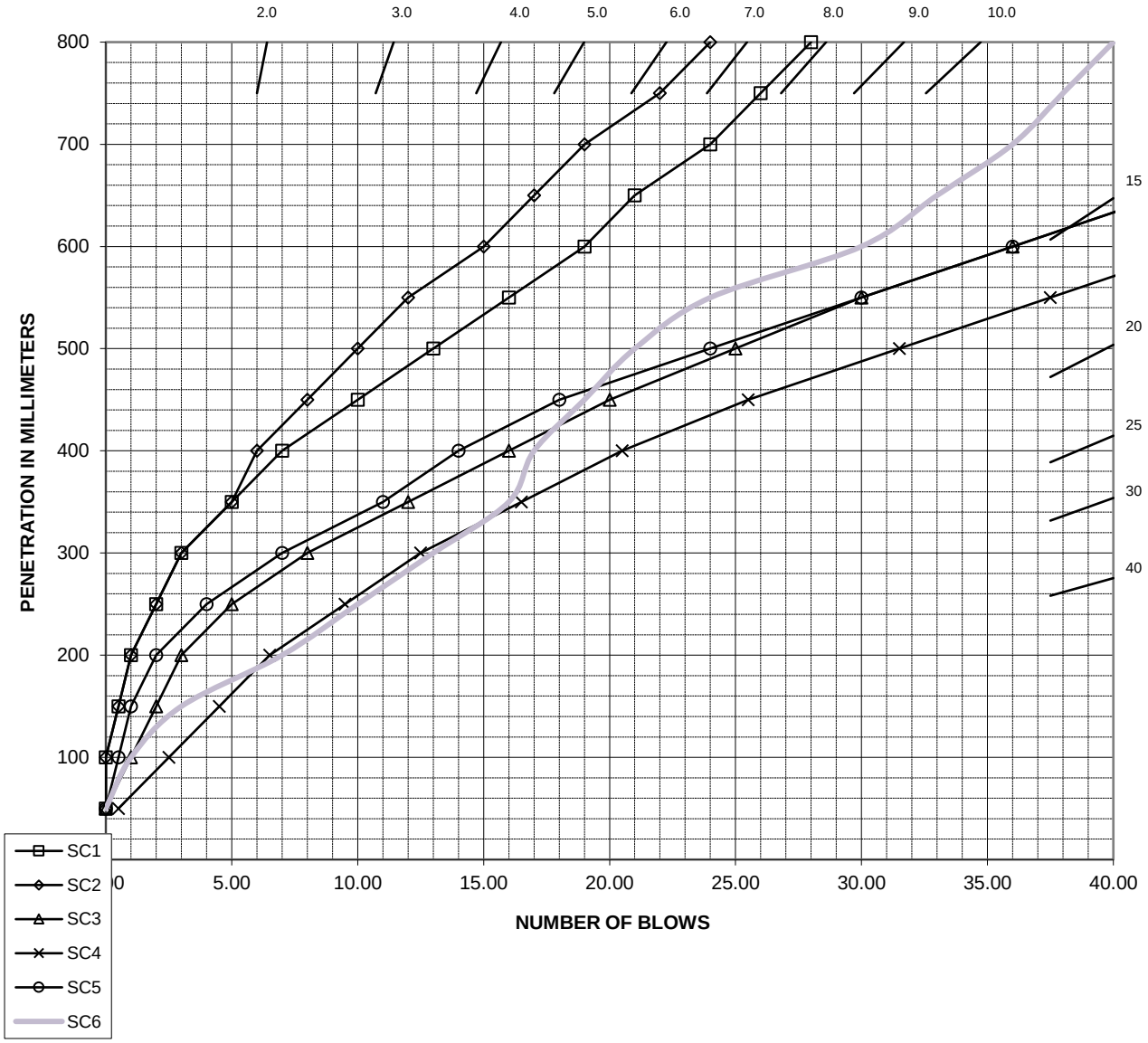
SCALA PENETROMETER TEST

Job No. 48749

Project Waiotahi Drifts Subdivision

Location Waiotahi Drifts

CORRELATION OF SCALA PENETROMETER RESULTS WITH CBR



after Stockwell, M. J., 1977

Test No.	Estimated CBR
SC1	6.5
SC2	7.8
SC3	10+
SC4	10+
SC5	10+
SC6	10+

CBR results for the Road

TESTED BY JGB

DATE 22/02/22

CHECKED BY

DATE

ENGINEERING DESIGN CONSULTANTS LTD

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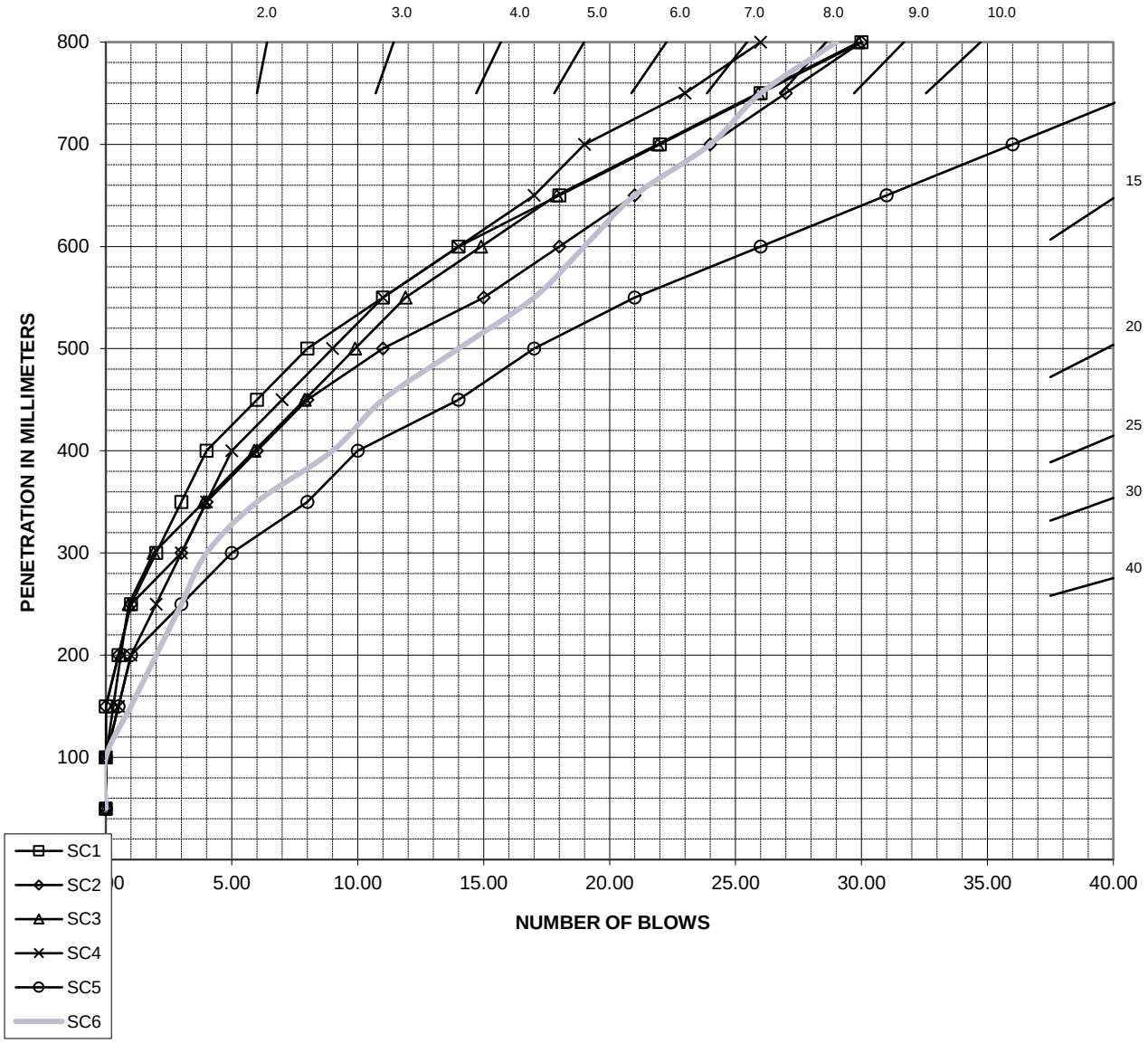

after Stockwell, M. J., 1977

Test No.	Estimated CBR
SC1	8.5
SC2	8.5
SC3	8.5
SC4	7.2
SC5	10+
SC6	8.1

CBR results for the RoW

TESTED BY JGB

DATE 22/02/22

CHECKED BY

DATE

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	F = Front of ROW	
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		/ @
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		/ @
		/ @
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		/ @
		/ @

SCALA START DEPTH..... B F B F

	X		X		X		X		X		X	
0.1	X	1.1	X	2.1	X	3.1	X	4.1	X	5.1	X	
	X		X		3		5		5		1	
0.2	5	1.2	5	2.2	3	3.2	5	4.2	5	5.2	1	
	5		5		3		1		2		1	
0.3	1	1.3	2	2.3	1	3.3	1	4.3	2	5.3	1	
	1		1		2		1		3		2	
0.4	1	1.4	2	2.4	2	3.4	1	4.4	2	5.4	3	
	2		2		2		2		4		2	
0.5	2	1.5	3	2.5	2	3.5	2	4.5	3	5.5	3	
	3		4		2		2		4		3	
0.6	3	1.6	3	2.6	3	3.6	3	4.6	5	5.6	2	
	4		3		3		3		5		2	
0.7	4	1.7	3	2.7	4	3.7	2	4.7	—	5.7	3	
	4		3		4		4				3	
0.8	4	1.8	3	2.8	4	3.8	3	4.8		5.8	3	
	—		3		4		3				3	
0.9		1.9	4	2.9	—	3.9	3	4.9		5.9	3	
			5									
1.0		2.0		3.0		4.0		5.0		6.0		

Lot 6 & 11 ROW | Lots 4 & 7 ROW | Lots 73 & 74 ROW

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 2/3/2022	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 11:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahe Drift

Findings

Row A	Row B	Row C
CIV1 = 26	CIV1 : 28	CIV1 : 22
2 : 29	2 : 25	2 : 24
3 : 30	3 : 31	3 : 24
4 28	4 : 36	4 : 40
	5 : 23	

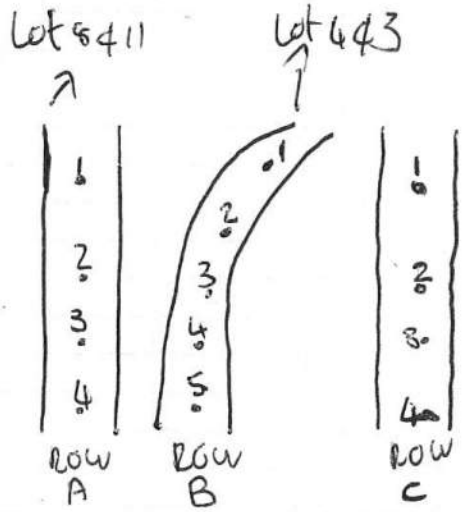
Load

CIV1 : 39 Lot 73
2 : 37 Lot 76
3 : 51 - Lot 77
4 : 48 Lot 78
5 : 40 Lot 80
6 : 37 Lot 80
7 : 37 Lot 80/81
8 : 21 Lot 81

- The Clegg hammer testing for the Row indicate an average reading of 28 per 4 blows
- The results for the road indicated an average of 38 per 4 blows

- Recommendation:

- The acceptable reading for the Row is 28, thus all the Row's needs to be rerolled where a CIV reading of between 25 and 28 was not achieved. (Mainly Row C)



- The areas along the road where a CIV of 40 was not achieved, these areas must be damped and rerolled to achieve a CIV reading of 40.

Row 30
Road 45

2/3/2022

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

SCANNED

Photos:

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	5 : 23	

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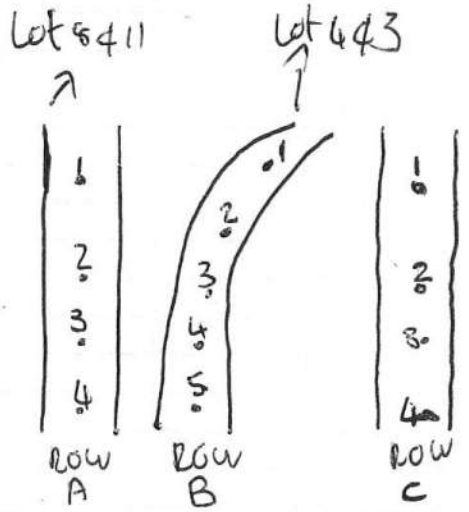

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Row 30
Road 45

2/3/2022

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Photos:

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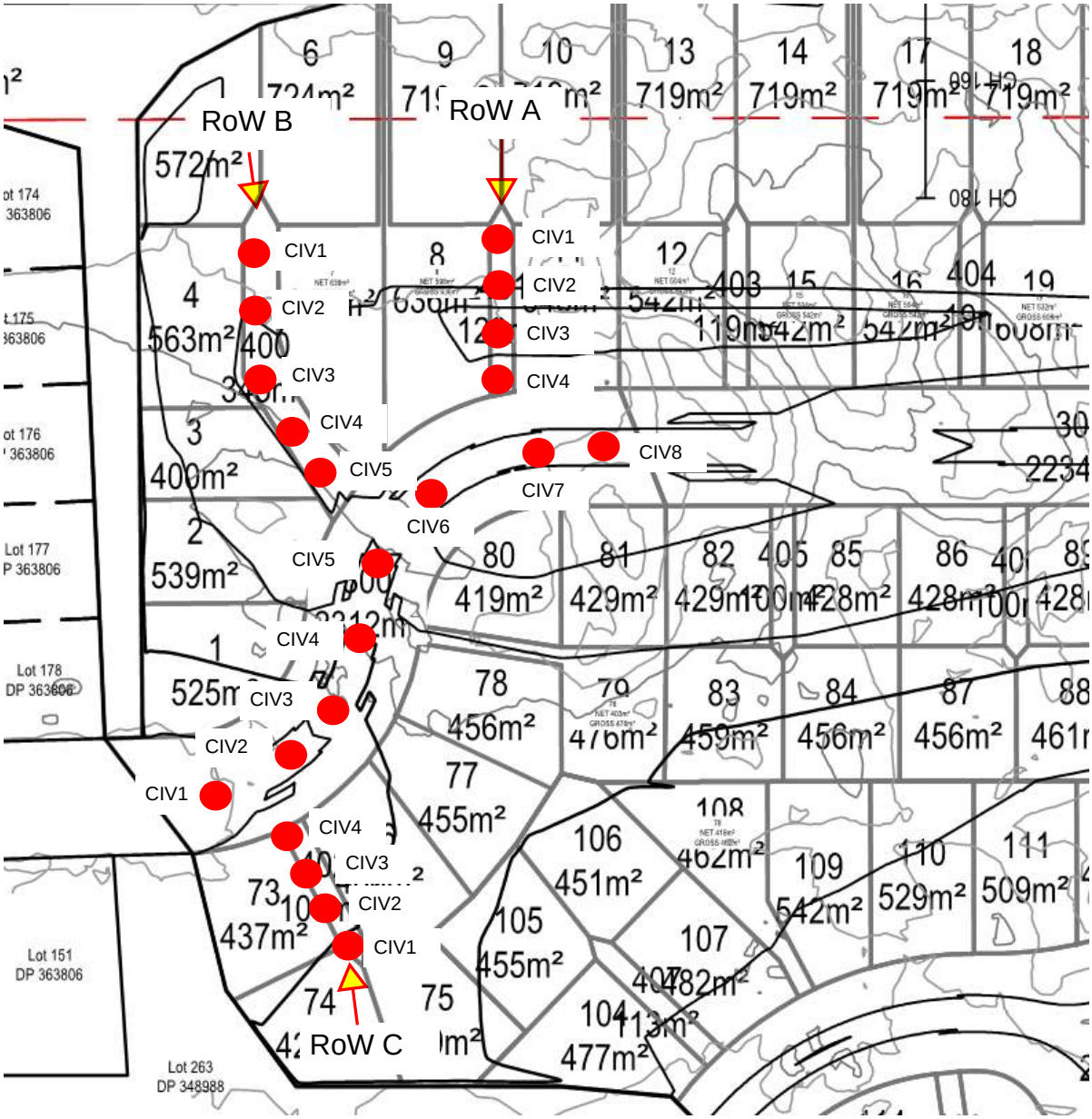
RoW B
RoW A
RoW C
CIV1
CIV2
CIV3
CIV4
CIV5
CIV6
CIV7
CIV8
572m²
563m²
400m²
539m²
525m
437m²
719m²
542m²
529m²
509m²
Lot 151
DP 363806
Lot 263
DP 348988
Lot 177
P 363806
Lot 178
DP 363806

ENGINEERING DESIGN CONSULTANTS

SITE REPORT

EDC File No: 48749 Date: 15/03/22

BC/EPA No:

Time: 2230 PM Weather: Sunny

Inspected by: NW Site Manager: Paul

Site Address: Waiotahi ~~B~~ Subdivision

HEALTH & SAFETY

Are you entering site alone? Yes/~~No~~
(If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)

Induction completed? Yes/~~NO~~
(If 'no' please give reason.....)

Signed in? Yes/~~No~~ Signed out? Yes/~~No~~

Carry out 5 x 5 check? ~~Yes~~/No
(Please refer overleaf for instructions. Identify potential hazards and note below.)

JOAL 3

~~#~~	CIV
1	21
2	25
3	27
4	26
5	35
6	35
7	39
8	41
9	34
10	35
11	33
12	27
13	25
14	27
15	30
16	
17	
18	

JOAL 1

#	CIV
1	14
2	23
3	19
4	31
5	39
6	32
7	
8	
9	

* #5 is near manhole - 200 mm till removed and recompacted

Stage 5A Road

#	CIV
1	38
2	33
3	32
4	36
5	36
6	32
7	35
8	29
9	23
10	24
11	25
12	21

* 8&9 was wet during testing - 270 mm till removed and recompacted

Lot 80 & 2

50	.5	4
100	.5	6
150	1	5
200	1	5
250	2	5
300	2	5
350	3	6
400	3	5
450	4	4
500	5	4
550	5	4
600	5	4
650	5	4
700	6	4
750	bounce	5
800		4
850		5
900		5
950		4
1000		

1	6	
1	5	
1	5	
2	5	
2	5	
2	5	
2	6	
3	5	
3	4	
3	4	
3	4	
3	4	
3	4	
3	4	
3	5	
2	4	
2	5	
2	5	
3	4	

Lot 79 & 2 - see attached plan for testing location

6		
7		
9		X
X	bounce	3
1		2
1		3
3		3
3		3
3		3
4		3
4		3
4		4
3		5
4		5
4		5
5		6
5		5
4		6
7		5
		6
		7
		6

H&S Comments:

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Photos:

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PUBLIC ROAD
LEGAL ROAD
(20.12m)

Stage 5A Road
CIV7-12
This area is wet at time of inspection

JOAL3
CIV1-9

JOAL3
CIV1-9

Stage 5A Road
CIV1-6

SC1

SC2

SC1

SC2

JOAL1
CIV1-6

STAGE 5A

STAGE 5B

STAGE 6A

STAGE 6B

STAGE 6C

STAGE 7A

STAGE 7B

RIMU RIMU KEY

WAIOTAHI DRIFTS BLVD

KUKUMOA KEY

PAKIHIKURA KEY

ARAKOTIPU BLVD

ESPLANADE RESERVE

HUNTRESS CREEK

Crown Land
(under action)
Survey Office Plan 2809
121940m²

Notes

1. All areas, easements and dimensions are subject to a full legal survey and approval by Land Information NZ.

Legend

- EX BDY
- PR BDY
- BUILDING LINE RESTRICTION

E	RC - Update Pack	GS	04/2021
D	RFI SEC 127	RK	03/2019
C	RC	CA	01/2019
B	S.127	CA	12/2018
Ref	Revisions	By	Date

	By	Date
Survey	-	-
Design	RK	07/18
Drawn	RM	12/2018
Checked	BV	07/18

Maven Associates
09 571 0050
info@maven.co.nz
www.maven.co.nz
12 -14 Walls Road, Penrose

Project
WAIOTAHE DUNES
DEVELOPMENT
WAIOTAHE
FOR
EQUINOX

Title
SCHEME PLAN
OVERVIEW

Project no.	105006		
Scale	Not To Scale		
Cad file	105006-150 scheme		
Drawing no.	C150	Rev	E

DATE: 4/22/21

FILE: 105006-150 Scheme B.dwg

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 21/03/22	Are you entering site alone? Yes/~~No~~ (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/~~No~~ (If 'no' please give reason.....)
Time: 11:30	Weather: Heavy Rain	Signed in? Yes/~~No~~ Signed out? Yes/~~No~~
Inspected by: WW	Site Manager: Murray	Carry out 5 x 5 check? ~~Yes~~/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahi Drift Subdivision

Compaction Inspection

Joal 3

#	CIV
1	30
2	23
3	26
4	39
5	35
6	27

Stage 5 Road

#	CIV	#	CIV
1	45	11	44
2	39	12	39
3	42	13	39
4	51	14	41
5	31	15	39
6	41	16	37
7	45	17	44
8	45	18	38
9	37	19	38
10	41	20	36

- The surface of the fill appears smooth and well compacted.
- There has been heavy rain during and prior to inspection.
- The surface is saturated, minor surface ponding was noted.
- See attached plan for testing location
- Mexe probe confirms CBR in excess of 12% is achieved across the fill

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

UNDER THE CHARTERED ENGINEERS ACT (2002), PROFESSIONAL ENGINEERS CAN ONLY REVIEW WORK WITHIN THEIR AREAS OF EXPERTISE.

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2. All weather-tightness and durability issues are excluded. Refer to Architect for all details specifically relating to B2 and E2 of the NZBC.

3. Engineering Design Consultants Ltd will be held blameless to all third parties.

4. All temporary works are the sole responsibility of the Builder / Contractor.

5. Report any discrepancies immediately to the Engineer.

6. Certification of registered building work is based on the understanding that this work is completed by licenced building practitioners holding a current practicing licence.

7. Engineering Design Consultants Ltd does not check set-out or levels. We recommend a licenced Professional Surveyor is engaged to provide this service.

8. By checking any work, Engineering Design Consultants Ltd does not verify that the work does not require a variation from Council. We recommend that this is confirmed in writing from Council Inspector/Engineer.

9. If in doubt, ASK the Engineer.

5 x 5 CHECK

1. STOP - engage brain before you act.
2. LOOK - identify any hazards.
3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.

PUBLIC ROAD
LEGAL ROAD
(20.12m)

Inspected Area

STAGE 5A
STAGE 5B
STAGE 6A
STAGE 6B
STAGE 6C
STAGE 7A
STAGE 7B

RIMU RIMU KEY
WAIOTAHI DRIFTS BLVD
KUKUMOA KEY
PAKIHIKURA KEY
ARAKOTIPU BLVD
ESPLANADE RESERVE
HUNTRESS CREEK

Crown Land
(under action)
Survey Office Plan 2809
121940m²

Notes

1. All areas, easements and dimensions are subject to a full legal survey and approval by Land Information NZ.

Legend

- EX BDY
- PR BDY
- BUILDING LINE RESTRICTION

E	RC - Update Pack	GS	04/2021
D	RFI SEC 127	RK	03/2019
C	RC	CA	01/2019
B	S.127	CA	12/2018
Ref	Revisions	By	Date

	By	Date
Survey	-	-
Design	RK	07/18
Drawn	RM	12/2018
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Title
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Project no.	105006		
Scale	Not To Scale		
Cad file	105006-150 scheme		
Drawing no.	C150	Rev	E

DATE: 4/22/21
FILE: 105006-150 Scheme B.dwg

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 22/3/2022	Are you entering site alone? (Yes)/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/(No) (If 'no' please give reason.....)
Time: 16:15	Weather: Rainy	Signed in? Yes/(No) Signed out? Yes/(No)
Inspected by: JB	Site Manager: Paul	Carry out 5 x 5 check? (Yes)/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiclk Drift

~~Findings~~ - Compaction Inspection

- Joal 31 CIV

1	31
2	33
3	28
4	31
5	37
6	34
7	29
8	30
9	30
10	31
11	29
12	32
13	31
14	27
15	28

- The surface appears to be well compacted
- Severe rain before the testing commences, with surface ponding which is minimum

- The lowest reading is 27 and the overage reading is about 30.

H & S Comments: See Over For Limitations and 5 x 5 Instructions

Photos:

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PUBLIC ROAD
LEGAL ROAD
(20.12m)

RIMU RIMU KEY

WAIOTAHI DRIFTS BLVD

KUKUMOA KEY

PAKIHIKURA KEY

ARAKOTIPU BLVD

ESPLANADE RESERVE

HUNTRESS CREEK

STAGE 5A

STAGE 5B

STAGE 6A

STAGE 6B

STAGE 6C

STAGE 7A

STAGE 7B

Lot 170 DP 363806
Lot 171 DP 363806
Lot 172 DP 363806
Lot 173 DP 363806
Lot 174 DP 363806
Lot 175 DP 363806
Lot 176 DP 363806
Lot 177 DP 363806
Lot 178 DP 363806
Lot 258 DP 363806
Lot 154 DP 363806
Lot 153 DP 363806 857m²
Lot 152 DP 363806
Lot 151 DP 363806
Lot 263 DP 348988
Lot 117 DP 348988
Lot 118 DP 348988
Lot 119 DP 348988
Lot 120 DP 348988
Lot 126 DP 348988
Lot 127 DP 348988
Lot 125 DP 348988
Lot 124 DP 348988
Lot 121 DP 348988
Lot 122 DP 348988
Lot 123 DP 348988
Lot 128 DP 348988
Lot 129 DP 348988
Lot 130 DP 348988 628m²
Lot 134 DP 348988
Lot 131 DP 348988
Lot 133 DP 348988
Lot 132 DP 348988
Lot 4 DP 8663 52249m²

200 2345m²
1 525m²
2 539m²
3 400m²
4 563m²
5 572m²
6 724m²
7 677m²
8 636m²
9 719m²
10 719m²
11 543m²
12 542m²
13 719m²
14 719m²
15 542m²
16 542m²
17 719m²
18 719m²
19 608m²
20 805m²
21 500m²
22 504m²
23 703m²
24 718m²
25 542m²
26 542m²
27 719m²
28 718m²
29 542m²
31 719m²
32 718m²
33 597m²
34 673m²
35 752m²
36 800m²
37 616m²
38 482m²
39 470m²
40 498m²
41 500m²
42 496m²
43 446m²
44 455m²
45 451m²
72 452m²
71 435m²
70 697m²
69 480m²
68 484m²
65 408m²
64 444m²
66 406m²
63 512m²
67 400m²
62 632m²
61 439m²
60 403m²
73 437m²
74 424m²
75 459m²
76 480m²
77 455m²
78 456m²
79 476m²
80 419m²
81 429m²
82 429m²
83 459m²
84 456m²
85 428m²
86 428m²
87 456m²
88 461m²
89 428m²
90 553m²
91 426m²
92 434m²
93 457m²
94 462m²
95 436m²
96 436m²
97 461m²
98 461m²
99 436m²
100 449m²
101 440m²
102 497m²
103 417m²
104 477m²
105 455m²
106 451m²
107 482m²
108 462m²
109 542m²
110 529m²
111 509m²
112 440m²
113 470m²
114 503m²
115 473m²
116 455m²
117 457m²
118 508m²
119 552m²
120 457m²
121 455m²
300 2312m²
301 2234m²
302 2346m²
303 1590m²
304 1996m²
305 1662m²
306 4003m²
308 512m²
800 16817m²
202 8865m²
203 7651m²
205 2391m²
206 456m²
207 493m²
400 345m²
401 122m²
402 100m²
403 119m²
404 119m²
405 100m²
406 100m²
407 114m²
408 114m²
409 103m²
410 103m²
411 119m²
412 119m²
413 120m²
414 302m²
415 92m²
416 432m²
417 265m²
1591 542m²

JOAL 1
JOAL 2
JOAL 3
JOAL 4
JOAL 5
JOAL 6
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JOAL 69
JOAL 70
JOAL 71
JOAL 72
ACCESS 1
ACCESS 2
ACCESS 3
ACCESS 4
ACCESS 5
ACCESS 6
ACCESS 7
ACCESS 8
ACCESS 9
ACCESS 10
ACCESS 11
ACCESS 12

Crown Land
(under action)
Survey Office Plan 2809
121940m²

Notes

1. All areas, easements and dimensions are subject to a full legal survey and approval by Land Information NZ.

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- EX BDY
- PR BDY
- BUILDING LINE RESTRICTION

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D	RFI SEC 127	RK	03/2019
C	RC	CA	01/2019
B	S.127	CA	12/2018
Ref	Revisions	By	Date

	By	Date
Survey	-	-
Design	RK	07/18
Drawn	RM	12/2018
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Title
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OVERVIEW

Project no.	105006		
Scale	Not To Scale		
Cad file	105006-150 scheme		
Drawing no.	C150	Rev	E

DATE: 4/22/21
FILE: 105006-150 Scheme B.dwg

EDC

ADDRESS		P/N	

SCALA PENETROMETER TEST FIELD RECORD

	SC1 lot 3	SC2 lot 2	SC3 lot 1	SC4 lot 73	SC5 lot 74	SC6 lot 75	SC7 105	SC8 104
50	1	1		1		1	X	1
100	X	-5	X	1		1	1	1
150	-5	-5	-5	-5	X	-5	-5	-5
200	-5	1	-5	-5	1	-5	2	1
250	1	2	1	1	1	1	1	2
300	2	2	2	2	1	1	2	2
350	2	2	2	2	3	1	4	2
400	2	3	3	3	2	1	3	4
450	4	3	3	3	3	2	4	3
500	4	3	5	3	3	3	4	3
550	4	3	5	3	3	4	4	4
600	3	4	5	3	3	4	3	4
650	5	3	6	4	3	3	3	5
700	5	4	7	4	2	4	3	5
750	4	4	7	5	3	4	3	4
800	5	4	6	6	3	4	3	6
850	5	4	6	6	2	6	5	5
900	4	5	5	8	2	6	7	7
950	7	1	7	4	3	6	5	6
1000	5	5	4	8	2	4	6	7
1050	4	5	5	9	2	5	7	7
1100	5	5	5	7	3	4	6	9
1150	5	4	4	9	3	4	8	7
1200	6	5	6	10	2	5	10	7
1250	5	4	6	—	3	6	—	8
1300	6	5	7		3	6		7
1350	7	5	bounce		4	8		7
1400	6	8			8	7		8
1450	6	— bench			7	8		7
1500	6				bounce	7		7
1550	5					8		6
1600	5					7		7
1650	7					10		6
1700	6					—		5
1750	7							6
1800	6							5
1850	7							6
1900	6							6
1950								9
2000								

EDC

ADDRESS		P/N	

SCALA PENETROMETER TEST FIELD RECORD

	SC1 lot 11	lot 10	lot 9	SC4 Lot 8	lot 7	lot 6	lot 5	SC8 lot 4
50		X	X	X	X	X	X	X
100	X	X	.5	.5	.2	X	1	.3
150	.5	1	.5	.5	.3	1	1	.3
200		1	1	1	.3	1	1	1
250	1	1	2	2	2	2	2	1
300	1	1	2	2	2	2	1	1
350	2	2	2	2	3	3	2	2
400	2	3	3	3	2	2	2	1
450	2	2	3	2	3	3	4	1
500	3	3	3	3	3	3	3	1
550	3	3	3	3	4	3	3	1
600	3	3	3	4	3	3	4	1
650	3	3	3	3	2	2	4	1
700	3	2	2	3	3	3	5	1
750	3	2	3	3	2	2	5	1
800	2	3	2	3	2	2	5	1
850	2	2	2	2	3	2	6	2
900	2	3	2	3	2	1	5	1
950	3	2	3	3	4	2	7	1
1000	3	2	3	3	2	2	7	2
1050	4	3	3	3	2	2	6	2
1100	3	3	4	3	2	3	6	2
1150	3	3	4	3	1	3	5	2
1200	4	2	4	3	3	5	5	2
1250	3	3	5	3	4	4	5	2
1300	3	3	5	3	4	4	4	2
1350	3	4	4	2	4	4	5	2
1400	3	3	5	3	5	5	5	2
1450	2	3	5	2	4	6	5	2
1500	3	3	5	2	4	5	5	3
1550	4	4	4	3	4	4	6	3
1600	4	3	3	4	3	5	4	4
1650	4	4	2	4	2	5	4	4
1700	4	3	3	4	3	6	5	4
1750	5	3	3	3	2	6	5	3
1800	4	3	3	4	4	6	5	4
1850	4	4	3	4	3	6	5	4
1900	5	4	3	4	4	6	5	4
1950								
2000								

EDC

ADDRESS		P/N	

SCALA PENETROMETER TEST FIELD RECORD

	Slot 77	Slot 73	Slot 76	Slot 78	SC579	SC680	SC781	SC8 ~~Slot 9~~
50	X	1	X	1	1	1	X	X
100	.5	.5	.5	1	X	1	X	X
150	.5	.5	.5	.5	.5	1	.5	.5
200	1	1	.5	.5	.5	1	.5	.5
250	1	1	.5	1	2	.5	1	1
300	1	2	3	1	3	.5	2	1
350	3	3	2	2	2	1	3	2
400	2	3	3	2	3	1	3	3
450	4	3	3	3	4	1	3	2
500	3	4	5	3	5	3	5	3
550	4	5	6	4	4	3	5	3
600	4	6	6	4	5	3	7	3
650	4	4	7	4	4	4	6	4
700	3	5	7	4	6	4	7	3
750	4	5	7	5	5	5	7	3
800	5	5	7	4	6	6	7	2
850	7	6	8	5	6	7	6	3
900	8	5	8	4	6	8	6	3
950	10	5	9	5	6	7	6	2
1000	X	4	8	4	8	7	6	3
1050		4	10	5	6	7	7	3
1100		4	—	4	7	7	7	3
1150		5		5	7	7	8	3
1200		7		4	8	7	7	3
1250		8		5	10	7	9	3
1300		9		6	—	6	10	3
1350		10		6		5	—	3
1400		—		6		4		3
1450				7		4		2
1500				6		7		3
1550				6		7		4
1600				6		8		4
1650				7		8		3
1700				6		8		3
1750				7		7		3
1800				6		8		3
1850				6		8		6
1900				7		7		4
1950						8		4
2000								

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 15/10/2021	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 09.00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

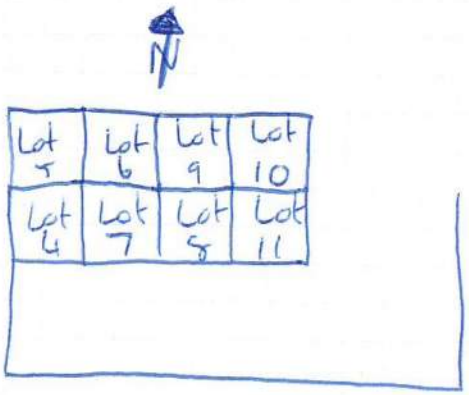
Site Address: Waiotahi Drifts Subdivision

~~Findings~~ (compaction inspection)

- Lots 5, 6, 9 and 10 has not been ~~filled~~ raised and the surface for these sites are covered in weeds and patches of grass.
- Lot 4 is filled with ~~fill~~ sand and raised by approximately 700mm.
- Lots 7, 8 and ~~et~~ 11 has been raised by between 2.0m - 2.2m.
- Scala Penetrometer tests were conducted on each of these Lots and the results indicated that the upper 1.0m of the soils achieved ~~of~~ a UBC of of less than 300kPa, except for Lots 5, and 4 where a UBC of 300kPa has been achieved at 600mm beyL.

Recommendation

- The upper 1.0m of the sand needs to be removed and recompacted.
- The soils needs to be watered down to control the moisture content and its recommended that a compaction plant should be established on-site.
- Its also recommended that a smooth double drum roller or something similar to be used for compaction.



H & S Comments:

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Photos:

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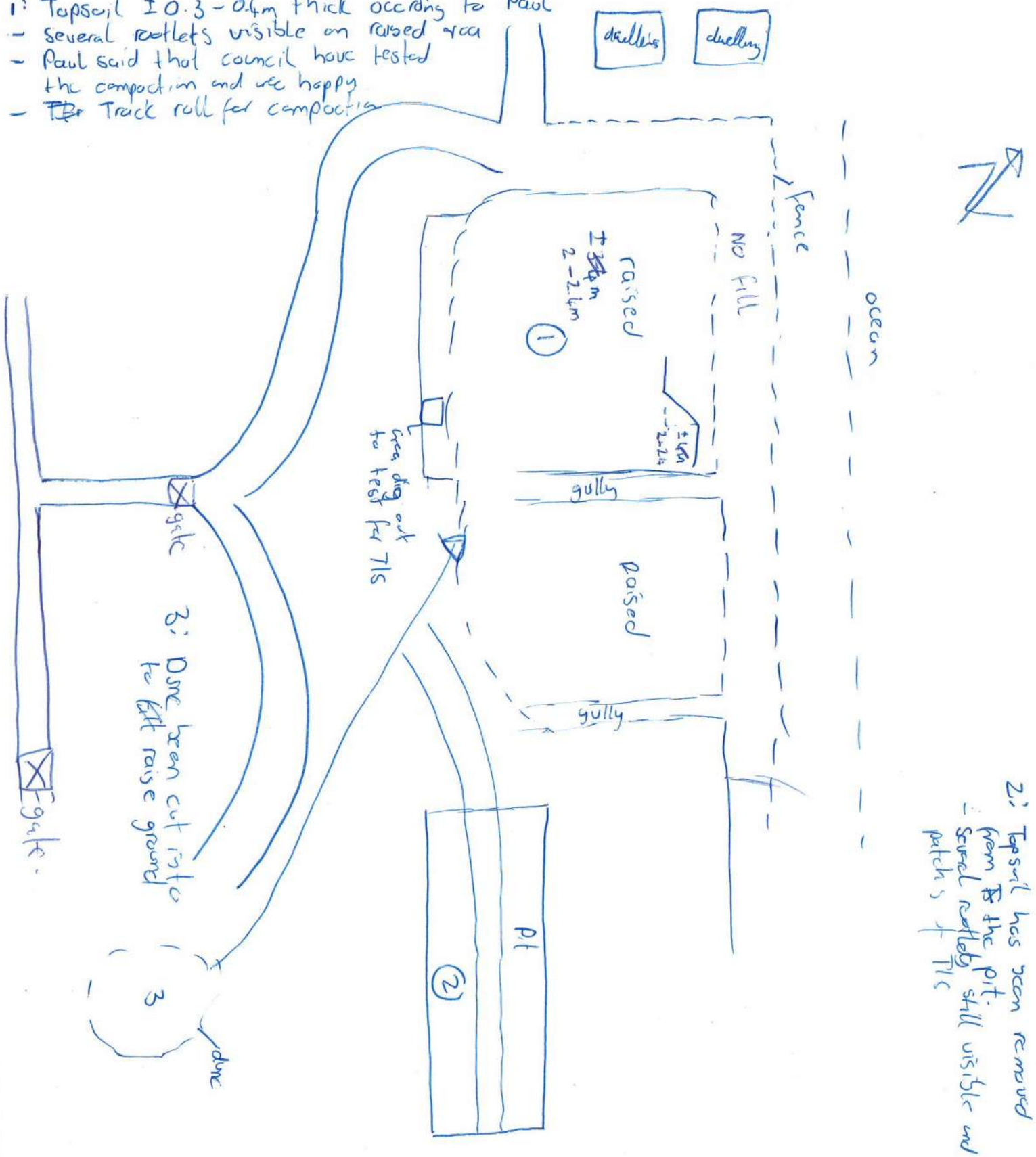
EDC 48749

ADDRESS		P/N	
Waiotahi Dunes	15/10/2021		Lots 5, 6, 9 & 10 (no fill) Lots 4, 7, 8, 11 (±2.2m fill)

SCALA PENETROMETER TEST FIELD RECORD

	Lot 5	Lot 6	Lot 9	Lot 10	Lot 4	Lot 7	Lot 8	Lot 11
	SC1 5	SC2 6	SC3 9	SC4 10	SC5 4	SC6 7	SC7 8	SC8 11
50	1	X	X	X	X	X	X	X
100	1	X	X	X	X	X	X	X
150	1	.5	.5	.3	.5	.5	X	.5
200	1	.5	.5	.3	.5	.5	.3	.5
250	2	2	.5	.3	1	1	.3	.5
300	3	1	.5	1	2	1	.3	.5
350	2	2	2	1	1	1	.75	1
400	3	1	1	1	2	1	.75	.75
450	3	2	1	2	2	2	1	1
500	2	2	2	1	2	1	1	1
550	3	1	1	2	2	1	1	1
600	4	1	2	1	3	1	2	1
650	4	1	2	2	2	.75	1	1
700	4	1	1	2	3	.5	1	1
750	5	1	2	1	3	.5	1	1
800	5	1	1	2	3	1	1	1
850	4	1	1	2	3	1	1	2
900	5	1	1	2	3	1	1	1
950		1	1	2	3	2	1	2
1000		1	1	1	4	3	1	1
1050		1	1	2	2	2	.75	3
1100		2	1	1	3	3	.75	2
1150		3	1	1	2	3	1	2
1200		3	1	1	3	2	1	3
1250		3	1	2	4	2	1	3
1300		3	1	1	4	2	1	2
1350		4	2	2	6	2	1	3
1400		5	2	2	4	3	1	3
1450		5	2	2	5	2	1	4
1500		6	3	3	4	4	1	4
1550		5	2	3	4	2	1	4
1600		6	2	3	4	3	1	4
1650		5	3	3	3	4	3	4
1700		5	3	3	3	3	2	4
1750		4	2	4	3	4	2	3
1800		3	3	4	3	3	3	3
1850		4	3	3	3	2	2	3
1900		4	3	3	3	3	2	4
1950								
2000								

1: Topsoil 10.3 - 0.4m thick according to Paul
- several rootlets visible on raised area
- Paul said that council have tested the compaction and are happy
- ~~TP~~ Track roll for compacting



2: Topsoil has been removed from ~~B~~ the pit.
- Several rootlets still visible and patches of TLS

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 19/10/2021	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 10:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

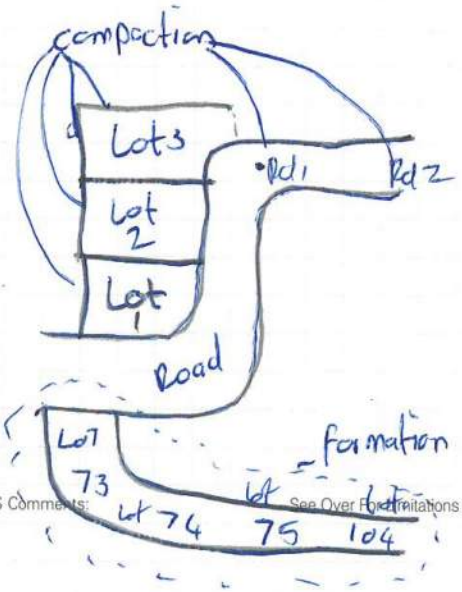
Site Address: Waiotahe Drift Subdivision

Findings (Formation and Compaction Inspection)

- Lots 1-3 and the road behind Lot 7-11 was inspected by the useage of Scala Penetrometer test.
- Formation inspection of Lots 73, 74, 75 and 104 was also inspected.
- During the site walkover, it was noted that the layers of soils being compacted is between 300mm - 400mm thick, The soils appears to be moist.
- The results from the Scala Penetrometer indicates that the upper 500mm of soils are Loose and a UBC of less than 300kPa has been achieved. (3 blows per 100mm). From below 500mm to 1.9m a UBC of 300kPa has been achieved.
-
- All the organic material for Lots 73, 74, 75 and 104 has been removed.

Recommendation
(Lots 1-3)

- The upper 300mm of soils need to be scrapped off, recompacted and backfill in 200mm layers and compacted again.



19/10/2021

- Lots 73, 74, 75 and 104 constat filling and compacted in 200mm layers.

H & S Comments: See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

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5 x 5 CHECK

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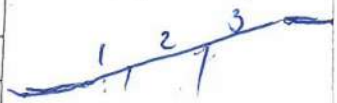
3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.

EDC

ADDRESS: Waitahi Dunes | 14/10/21 | P/N: Dune

Lot 1 Lot 2 Lot 3 Lot 4 SCALA PENETROMETER TEST RECORD

	SC1	SC2	SC3	SC4	SC5	SC6	SC7	SC8
50	4	4	4	4	4			
100	4	4	4	4	4			
150	5	5	4	5	4			
200	5	5	4	5	3			
250	1	1	5	1	3			
300	2	1	5	1	3			
350	1	2	1	2	3			
400	1	1	2	2	1			
450	2	2	2	2	1			
500	1	2	1	3	1			
550	2	1	2	2	1			
600	2	2	2	3	1			
650	3	3	2	3	1			
700	3	2	2	2	1			
750	3	2	3	3	2			
800	2	2	3	3	1			
850	2	2	4	4	2			
900	3	2	4	3	2			
950	4	2	5	3	2			
1000	4	2	5	3	1			
1050	3	2	4	4	2			
1100	2	3	5	5	1			
1150	3	2	4	5	3			
1200	2	2	4	5	3			
1250	2	2	4	5	2			
1300	2	2	4	4	1			
1350	1	3	4	4	3			
1400	2	3	4	5	3			
1450	3	3	3	5	3			
1500	5	4	4	7	3			
1550	7	4	3	7	3			
1600	7	3	4	7	3			
1650	10	4	4	8	3			
1700	9	3	4	8	2			
1750	8	3	5	7	2			
1800	8	3	7	8	3			
1850	8	3	6	7	2			
1900	9	2	6	7	2			
1950								
2000								



ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 22/10/21	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 10:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waidene Drifts

Findings (Formation & Compaction inspection)

Formation

The formation inspection was conducted for Lots 104 and a portion of Lot 77. Half of the lots were already backfilled at the time EDC arrived on-site. Some organic material was identified in the areas where no backfilling has taken place.

Compaction

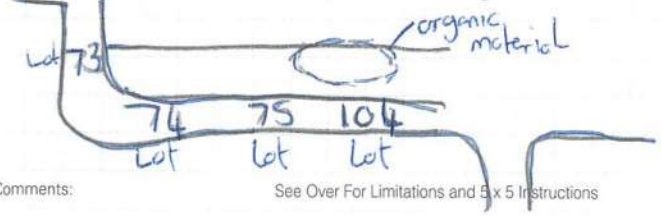
- Scala Penetrometer tests were carried out on Lots 104, 75, 73 and 11. No testing was carried out on Lot 74 as services will go through the site and only 500mm thick layer of backfill has been placed.
- The Scala Penetrometer results indicated that the upper 300mm is still loose, but from below 300mm, 300 kPa is achieved for Lots 104, 75, and 73.

A 1.2m x 1.2m hole has been excavated at Lot 11 and was filled with water on 21/10/21 to look if compaction will increase. SC testing was conducted at the base of the hole, the results indicated that at 550mm 300kPa can be achieved

- The slopes for Lots 104, 75, 73, and 74 is ± 2.1m - 1.7m high and dips at 30° - 38°

Recommendation

- The organic material for Lots 105 and 77 needs to be scrapped off.
- Lot 74 will be tested once it is fully compacted.
- Lot 75, the upper 300mm need to be scrapped off, as it does not have ~~NZS 3604~~ "good ground". Once the 300mm has been scrapped, the base needs to be recompacted and backfilled in 200mm layers and compacted. NZS 3604



SCANNED

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Marvin

Photos:

LIMITATIONS

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5 x 5 CHECK

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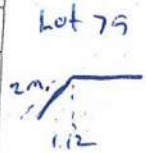
5. SAFELY - complete the task.

EDC

ADDRESS		P/N	
Waiotahe Dunes	22/10/21.		

SCALA PENETROMETER TEST FIELD RECORD

	SC1 Lot 104	SC2 Lot 75	SC3 Lot 76	SC4 Lot 73	SC5 Lot 11	SC6	SC7	SC8
50	x	x		x	1.2: x			
100	- 5	x		- 9	x			
150	- 5	- 3.5		- 5	4			
200	1	- 3.5		1				
250	2	- 3.5		1				
300	1	- 5		2				
350	2	1		2				
400	3	2		3				
450	2	1		2	5			
500	3	2		3	- 5			
550	3	2		3	2			
600	4	2		4	2			
650	4	2		4	2			
700	4	3		6	3			
750	4	2		4	2			
800	4	2		3	3			
850	5	2		4	3			
900	5	2		3	4			
950	5	3		5	4			
1000	5	2		5	4			
1050	6	2		5	4			
1100	9	2		4	4			
1150	9	2		5	4			
1200	9	2		6	4			
1250	10	3		3	3			
1300	10	3		3	3			
1350	—	6		4	3			
1400		5		8	3			
1450		7		9	4			
1500		7		9	4			
1550		9		10	4			
1600		10		10	4			
1650		11		—	4			
1700		—			3			
1750					4			
1800					4			
1850					4			
1900					3			
1950								
2000								



Lot 76 not tested as it will be excavated for services.

Lot 11 re-test

ENGINEERING DESIGN CONSULTANTS LIMITED
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Auckland Office: 1st Floor, Unit 1, 100 Bush Road, Albany 0632. Ph: 09 451 9044 Fax: 09 415 1280
Christchurch Office: 3/22 Ranfurly Street, St Albans, Christchurch 8014. Ph: 03 355 5559
Postal: PO Box 118, Albany Village 0755, Auckland. Email: team@edc.co.nz Web: www.edc.co.nz

EXPLORATORY HOLE LOG

ADDRESS: Waiotahi Downs

BOREHOLE / HA No:

P/N:

DRILLED BY: DT + JB

DEPTH OF WATER STRIKE:

DATE: 5/11/21

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
	Lot 75	/ @
		/ @

76 73 74 104 105

SCALA START DEPTH.....

	X		X		X		X		X		X
0.1	1	1.1	X	2.1	0.5	3.1	1	4.1	X	5.1	X
	1		0.5		0.5		1		0.5		1
0.2	1	1.2	0.5	2.2	1	3.2	1	4.2	0.5	5.2	1
	1		1		2		1				1
0.3	2	1.3	2	2.3	2	3.3	1	4.3		5.3	1
	2		2		2		1		1		1
0.4	2	1.4	2	2.4	2	3.4	1	4.4	1	5.4	2
	3		3		3		1		2		1
0.5	3	1.5	3	2.5	2	3.5	1	4.5	2	5.5	1
	3		3		3		1		1		4
0.6	3	1.6	3	2.6	2	3.6	1	4.6	2	5.6	4
	3		4		2		1		1		5
0.7	3	1.7	5	2.7	2	3.7	1	4.7	2	5.7	5
	4		4		2		1		2		5
0.8	4	1.8	4	2.8	2	3.8	1	4.8	3	5.8	6
	4		4		3		0.5		4		6
0.9	5	1.9	4	2.9	5	3.9	0.5	4.9	4	5.9	7
1.0		2.0		3.0		4.0		5.0		6.0	

EDC ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48744	Date: 9/11/2021	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason)
Time: 13:30	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

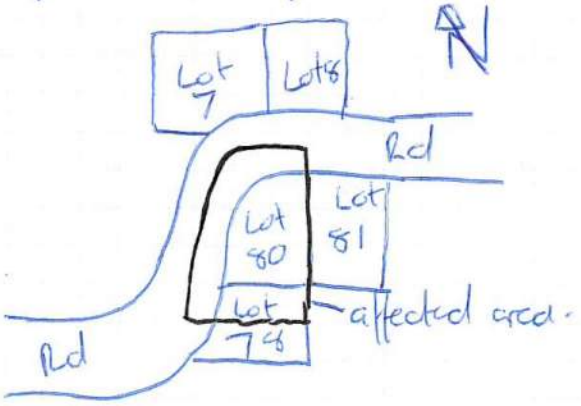
Site Address: Waiotahe Dune

Findings

- A 1.0m thick layer of organic soil was encountered north of the site between the planned road in front of Lot 80 and next (west) of Lot 78 including the entire Lot 80 and the northen half of Lot 78.
- 2 trenches were excavated north to south cutting through Lot 80 and Lot 78 and another trench west to east through Lot ~~78~~ to Lot 70
- What we identified was that the organic material layer became thicker ~~from~~ towards Lot 80 from Lot 78. Another hole was then excavated at the base of Lot 8, but no organic soils were identified.
- No organic material was indentified in Lot 81
- The thickness of organic soils was 0.2m at Lot 78 and increased to 1.1m at Lot ~~8~~80.

- Recommendation

- A surveyor needs to map out the affected area to determine the cost
- ALL the organic ~~so~~soils must be excavated in the affected area (Lots 80 and 78 and the planned road) and backfilled and compacted in 200mm layers
- Lots 104, 105, 75, 74 and ~~73~~73 were tested for compaction and passed. Instruction were given that the above mentioned Lots can be topsoiled and grassed.



10/11/2021

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

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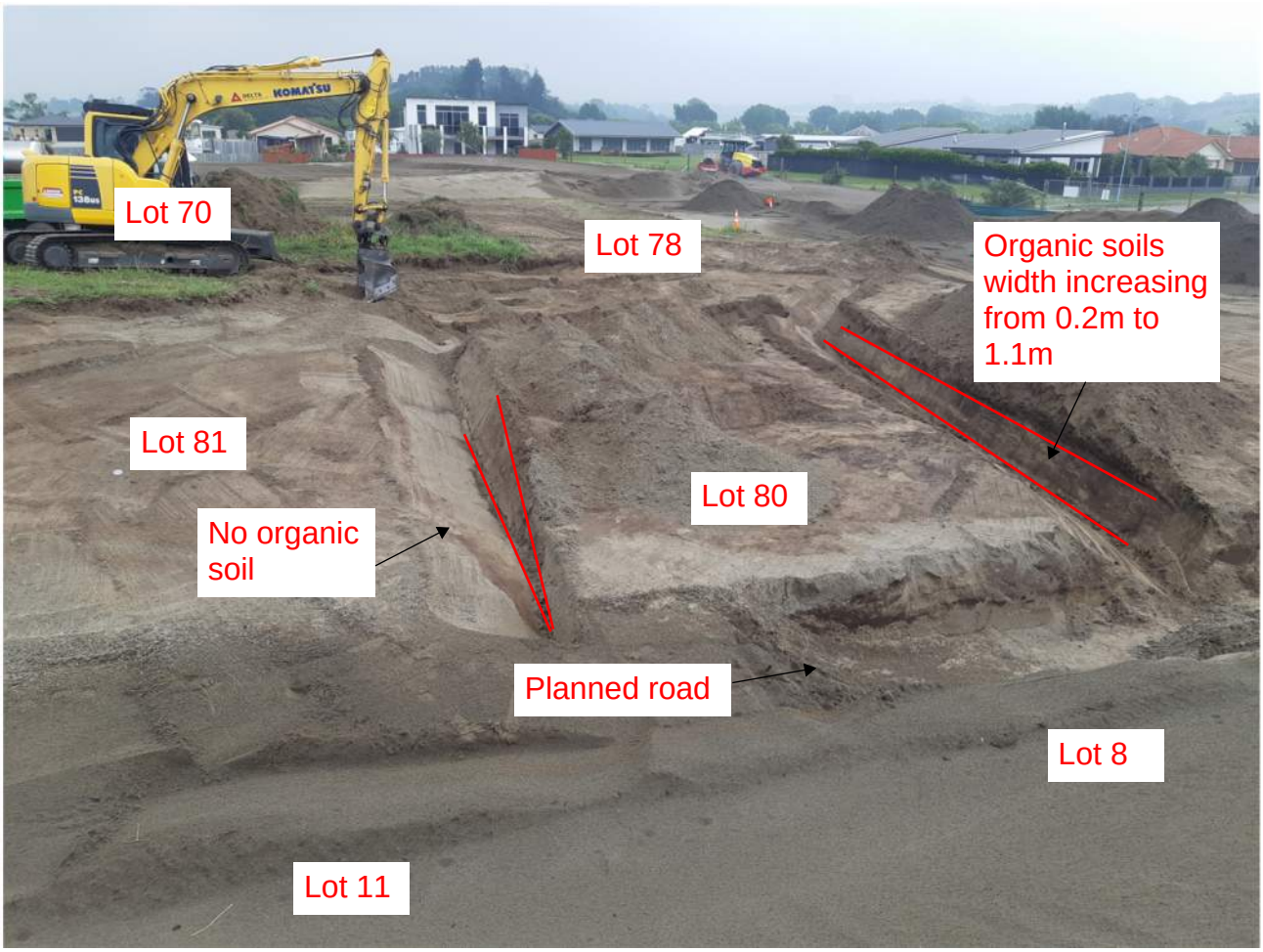

Lot 70
Lot 78
Organic soils width increasing from 0.2m to 1.1m
Lot 81
Lot 80
No organic soil
Planned road
Lot 8
Lot 11

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 11/11/2021	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 10:15	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

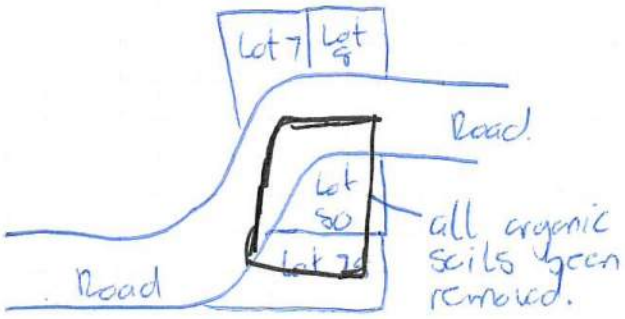
Site Address: Waiotahe Dunes

Findings

- All the organic soils for Lot 80, Lot 78 and the planned road have been excavated.
- Lots 105, 104, 75 have been grassed

Recommendation

- Lot 80, Lot 78 and the planned road can be backfilled in Layers of 200mm and compacted.
- Lots 73 & 74 can be grassed
- EDC must do compaction tests on Lots 7, 8, 11, 10, 9 and 6 once the upper 390mm has been scrapped off and recompacted.



11/11/2021

H & S Comments:

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Photos:

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ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 18/11/2021	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 14:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB4ww	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahe Dunes

Findings

- EDC went back to the site to do compaction tests on the lots that previously failed (Lots 1-4, 7, 8 and 11) by not achieving NZS 3604, 5 blows per 100mm
- Scala Penetrometer tests were conducted on the above mentioned lots.
- All the lots passed 5 blows per 100mm from 400mm begL, except for Lots 3 and 7 which only achieved 5 blows per 100mm from 0.7m begL.

Recommendation

- The upper 600mm of Lots 3 and 7 must be scrapped off, the base must be proof rolled and recompacted in 200mm layers
- The rest of the lots that passed, can be topsoiled and planted.

18/11/2021

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

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Email: team@edc.co.nz Web: www.edc.co.nz

EXPLORATORY HOLE LOG

ADDRESS:		BOREHOLE / HA No:
		P/N:
DRILLED BY:	DEPTH OF WATER STRIKE:	DATE: 18/11/2021

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @

lot 1 lot 2 lot 6 lot 11 lot 8 lot 7 lot 4 lot 3 lot 10

SCALA START DEPTH.....

			4		3		X		X		X		\
X	X	0.1	4	1.1	2	2.1	0.5	3.1	.5	4.1	.5	5.1	1
1	.5		1		3		.5		.5		.5		1
1	.5	0.2	1	1.2	2	2.2	1	3.2	1	4.2	1	5.2	1
1	1		1		3		1		1		2		1
1	1	0.3	2	1.3	2	2.3	2	3.3	2	4.3	2	5.3	1
2	2		1		2		2		1		2		2
1	2	0.4	2	1.4	3	2.4	3	3.4	2	4.4	2	5.4	2
2	2		2		2		3		2		3		2
5	3	0.5	3	1.5	3	2.5	2	3.5	2	4.5	2	5.5	2
6	3		3		4		3		2		3		2
7	3	0.6	3	1.6	4	2.6	4	3.6	2	4.6	2	5.6	2
bouncy	3		3		3		3		2		3		2
	2	0.7	3	1.7	3	2.7	2	3.7	2	4.7	3	5.7	2
	3		4		3		3		2		3		2
	2	0.8	3	1.8	3	2.8	3	3.8	2	4.8	3	5.8	3
	3		3		3		3		2		2		3
	5	0.9	3	1.9	4	2.9	3	3.9	3	4.9	2	5.9	2
			4										
		1.0	3	2.0		3.0		4.0		5.0		6.0	

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 22/11/2021	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 12:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahe Dunes

Findings

- EDC went back to lots 3 and 7 after these lots failed to achieve 5 blows per 100mm. The sites were recompacted and achieved the 5 blows per 100mm from 0.4m begL.
- EDC also did a formation inspection for Lot 77 and all the organic materials were removed.

Recommendation

- Lots 7 and 3 can be topsoiled and planted.
- The base of Lot 77 must be proof rolled and compacted in 200mm layers.
- Continue to focus on moisture control and compaction to be done with the roller.

JB
22/11/2021

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

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8. By checking any work, Engineering Design Consultants Ltd does not verify that the work does not require a variation from Council. We recommend that this is confirmed in writing from Council Inspector/Engineer.

9. If in doubt, ASK the Engineer.

5 x 5 CHECK

1. STOP - engage brain before you act.
2. LOOK - identify any hazards.
3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.

ENGINEERING DESIGN CONSULTANTS LIMITED
CIVIL · STRUCTURAL · GEOTECHNICAL · ENVIRONMENTAL · FIRE

Email: team@edc.co.nz Web: www.edc.co.nz

EXPLORATORY HOLE LOG

ADDRESS:	BOREHOLE / HA No:
	P/N:
DRILLED BY: / DEPTH OF WATER STRIKE:	DATE: 22/11/2021

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @

SCALA START DEPTH.....

	1		X											
0.1	1	1.1	X	2.1		3.1		4.1		5.1				
	3		X											
0.2	3	1.2	5	2.2		3.2		4.2		5.2				
	3		5											
0.3	1	1.3	1	2.3		3.3		4.3		5.3				
	1		2											
0.4	2	1.4	2	2.4		3.4		4.4		5.4				
	3		3											
0.5	4	1.5	2	2.5		3.5		4.5		5.5				
	3		3											
0.6	4	1.6	4	2.6		3.6		4.6		5.6				
	4		3											
0.7	4	1.7	4	2.7		3.7		4.7		5.7				
	4		3											
0.8	5	1.8	4	2.8		3.8		4.8		5.8				
	5		3											
0.9	4	1.9	4	2.9		3.9		4.9		5.9				
1.0		2.0		3.0		4.0		5.0		6.0				

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 18/1/2022	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 09.15	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahi Drifts

Findings for drains

EDC was commisioned by Paul to come and do compaction tests on the drains that was completed. Compaction tests were carried out on Lot 74, the area between Lot 1 & Lot 77 in front of Lot 80, Lot 2, Lot 8, the drain between Lot 8 & 11 and the drain between Lot 4 & 7.

ALL the ~~be~~ areas achieved 5 blows per 100mm from below 0.4m, except for Lot 74 and the 2 drains between between Lot 8 & Lot 11 and the drain between Lot 4 & Lot 7.

Findings for Lots

Lot 77 Lots 78 and Lot ~~79~~ 80 was also investigated. The Scala results indicated that Lots 77 & 80 achieved 5 blows per 100mm from 0.3m below existing ground. Lot 78 only achieved 5 blows per 100mm from 0.6m below existing ground.

Recommendation for drains

Lot 74: Remove upper 0.3m of soils and recompact
Lot 8 & 11: Remove upper 0.3m of soils and recompact.
Lot 4 & 7: Remove the upper 0.8m of soils and recompact in 200mm Layers

Recommendation for Lots

Lot 78: The upper 0.5m of the soils needs to be removed, the base compacted and compact in layers of 200mm.

Ensure that the new layers are moist controlled.

18/1/2022

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

ENGINEERING DESIGN CONSULTANTS LIMITED
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Auckland Office: 1st Floor, Unit 1, 100 Bush Road, Albany 0632. Ph: 09 451 9044 Fax: 09 415 1280
Christchurch Office: 3/22 Ranfurly Street, St Albans, Christchurch 8014. Ph: 03 355 5559
Postal: PO Box 118, Albany Village 0755, Auckland. Email: team@edc.co.nz Web: www.edc.co.nz

EXPLORATORY HOLE LOG

ADDRESS: Wanaka ~~Dairy~~ Drifts

BOREHOLE / HA No:

P/N:

DRILLED BY:

DEPTH OF WATER STRIKE:

DATE: 18/1/22

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
	Drains & services	/ @
		/ @

1 = Lot 74
2 = Road between Lot 4 77
3 = Lot 80 Services
4 = Lot 2
5 = Lot 8
6 = between Lot 8 & 11
7 = between Lot 4 & 7

SCALA START DEPTH.....	1	2	3	4	5	6	7
	4	5	X	X	X	6	X
0.1	X	5	X	X	X	X	X
	5	1	1	5	3	5	3
0.2	5	2	1	5	3	5	3
	1	3	1	1	3	5	3
0.3	1	3	2	1	1	5	1
	1	2	3	2	2	2	1
0.4	2	4	3	2	2	1	1
	2	4	4	3	2	2	1
0.5	2	4	4	4	3	1	2
	3	5	5	3	3	3	2
0.6	2	4	5	4	3	3	2
	3	4	5	4	3	4	2
0.7	3	4	7	4	3	3	2
	4	6	6	4	4	4	2
0.8	4	5	7	4	4	4	2
	4	4	7	4	4	3	2
0.9	5	3	7	5	4	4	3
1.0		2.0	3.0	4.0	5.0	6.0	

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Postal: PO Box 118, Albany Village 0755, Auckland. Email: team@edc.co.nz Web: www.edc.co.nz

EXPLORATORY HOLE LOG

ADDRESS: Waiotahe Drifts

BOREHOLE / HA No:

P/N:

DRILLED BY:

DEPTH OF WATER STRIKE:

DATE: 18/1/2022

DEPTH	STRATA DESCRIPTION	SHEAR VANES
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @
		/ @

Lots

78 80 77

SCALA START DEPTH

	X		X		X				
0.1	X	1.1	X	2.1	5	3.1	4.1	5.1	
	5		X		5				
0.2	5	1.2	3	2.2	1	3.2	4.2	5.2	
	1		5		2				
0.3	1	1.3	2	2.3	2	3.3	4.3	5.3	
	1		3		3				
0.4	2	1.4	2	2.4	3	3.4	4.4	5.4	
	2		3		2				
0.5	2	1.5	4	2.5	3	3.5	4.5	5.5	
	2		4		3				
0.6	2	1.6	4	2.6	2	3.6	4.6	5.6	
	4		5		3				
0.7	4	1.7	5	2.7	2	3.7	4.7	5.7	
	4		5		2				
0.8	5	1.8	4	2.8	3	3.8	4.8	5.8	
	6		4		5				
0.9	6	1.9	5	2.9	6	3.9	4.9	5.9	
1.0		2.0		3.0		4.0	5.0	6.0	

X ✓ ✓

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 24/1/2022	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 10:00	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahe Drifts

~~Findings~~

The formation for Lot 77 was investigated on 24/1/2022. ALL the organic material was removed and the base of the lot consisted of fine dune sand.

Recommendation

- Lot 77 can be compacted in 200mm Layers (Maximum).
- Focus on moisture control as the new Layers of sand will be dry

24/1/22.

H & S Comments: See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

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9. If in doubt, ASK the Engineer.

5 x 5 CHECK

1. STOP - engage brain before you act.
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3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.

ENGINEERING DESIGN CONSULTANTS

SITE REPORT		HEALTH & SAFETY
EDC File No: 48749	Date: 28/1/2022	Are you entering site alone? Yes/No (If 'yes' call/text the office to advise when entering and leaving, ensure that you speak to someone or receive a response to your text.)
BC/EPA No:		Induction completed? Yes/No (If 'no' please give reason.....)
Time: 12:45	Weather: Fine	Signed in? Yes/No Signed out? Yes/No
Inspected by: JGB	Site Manager: Paul	Carry out 5 x 5 check? Yes/No (Please refer overleaf for instructions. Identify potential hazards and note below.)

Site Address: Waiotahe Dunes

Findings

- A compaction test was carried out on Lot 77 and the Scala Penetrometer results are as follow:

5
5
5
5
1
1
2
3
3
3
4
4
4
6
5
6
5
5

Recommendation

- The Scala results indicates that the upper 0.3m of the soil is loose and its expected from the nature of the soils.
- From below 0.3, 5 blows per 100mm has been achieved up to the end of the hole.

28/1/2022

H & S Comments:

See Over For Limitations and 5 x 5 Instructions

Photos:

LIMITATIONS

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5 x 5 CHECK

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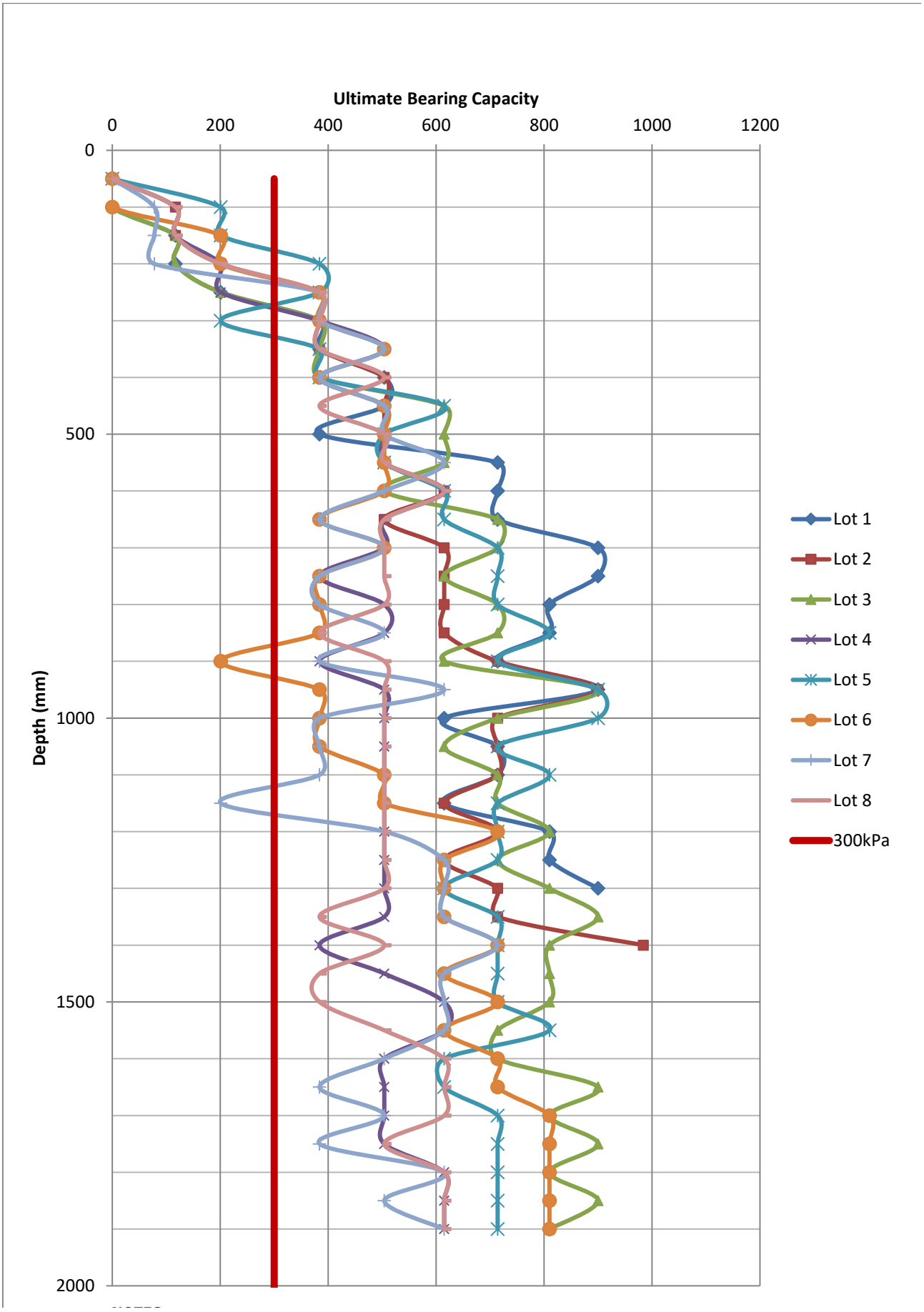
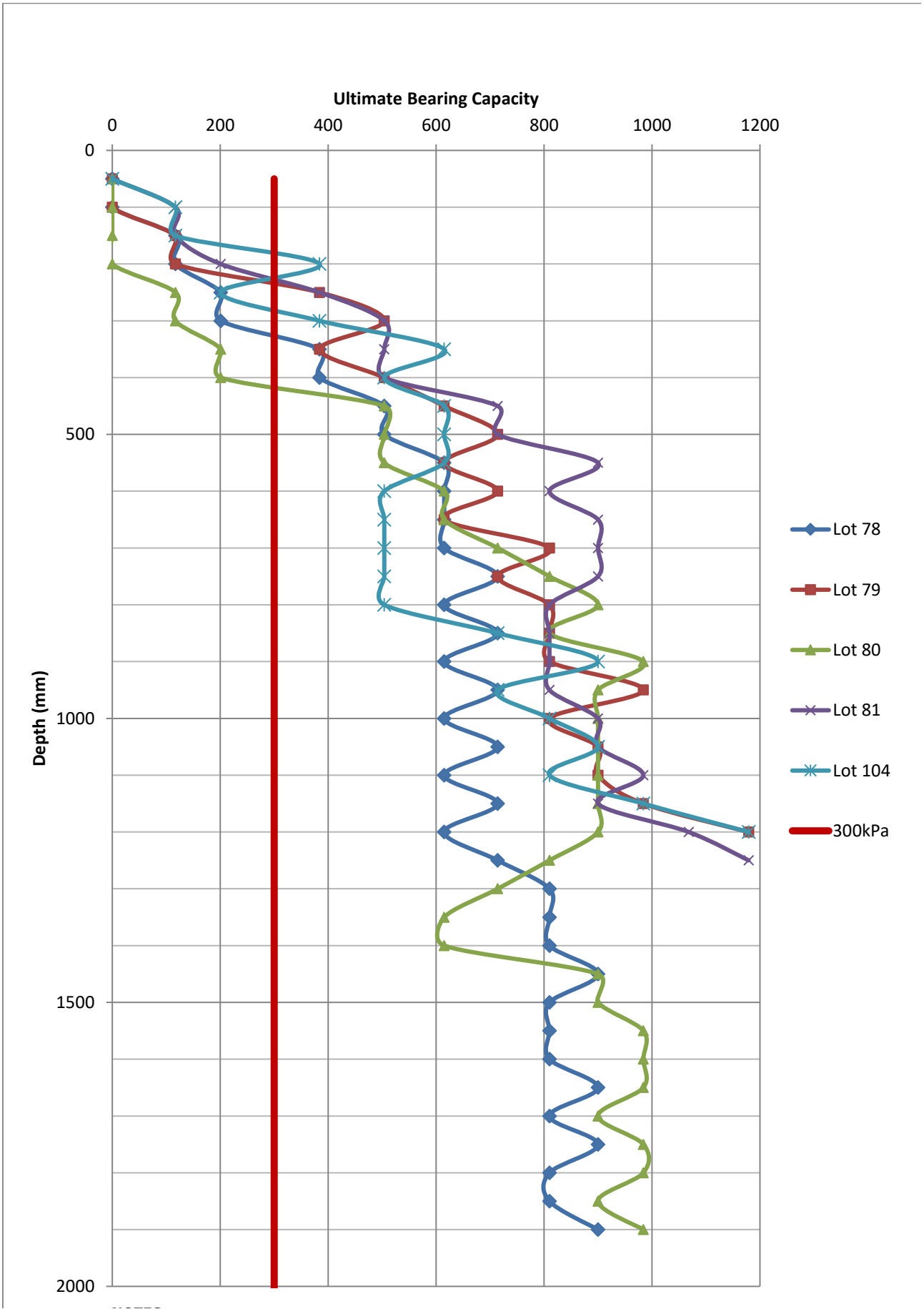
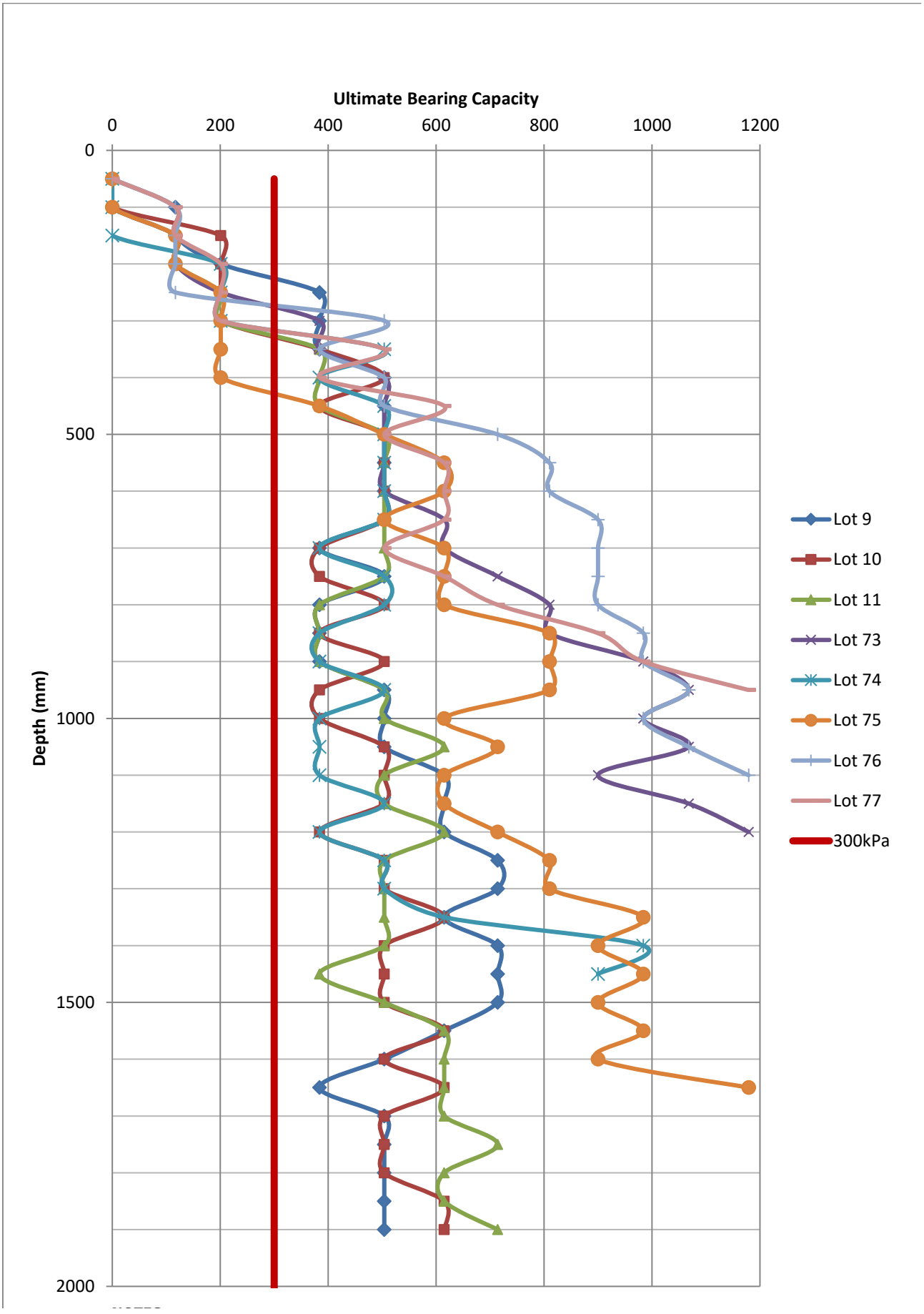
2. LOOK - identify any hazards.
3. ASSESS - what damage could those hazards cause.
4. MANAGE - implement controls, tell others.
5. SAFELY - complete the task.


Ultimate Bearing Capacity
0
200
400
600
800
1000
1200
Depth (mm)
0
500
1000
1500
2000
Lot 1
Lot 2
Lot 3
Lot 4
Lot 5
Lot 6
Lot 7
Lot 8
300kPa


Ultimate Bearing Capacity
0
200
400
600
800
1000
1200
0
500
1000
1500
2000
Depth (mm)
Lot 78
Lot 79
Lot 80
Lot 81
Lot 104
300kPa


Ultimate Bearing Capacity
0
200
400
600
800
1000
1200
Depth (mm)
0
500
1000
1500
2000
Lot 9
Lot 10
Lot 11
Lot 73
Lot 74
Lot 75
Lot 76
Lot 77
300kPa

APPENDIX D

GEOLAB BENKELMAN BEAM RESULTS

Tauranga Laboratory

Geolab Limited

25/38 Ashley Place,
Papamoa NZ 3118

Phone:027 475 4011

Benkelman Beam Deflection

Report No: BB:TAUR22S-01113
Issue No: 1

Client: Delta Contracting Limited
109 Gow Road PO Box 311
Opotiki

Principal: Paul Blennerhassett
Project No.: 773-TAUR00101
Project Name: Opotiki (EDC48749)
Lot No.:
TRN:

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation.
{This document may not be altered or reproduced except in full. This report relates only to the positions tested.}

Approved Signatory: Eric Paton
(Director-Testing)
IANZ Accredited Laboratory Number:1352
Date of Issue: 13/04/2022

Site Details

Sample ID: TAUR22S-01113
Source: -
Material: M4
Project Location: Waiotahe, Opotiki
Test Location: Waiotahe Drifts Boulevard
Layer: Base

Date Tested: 11/04/2022
Time Tested: 09:40
Tested By: Kim Vitali

Offset From: Centreline

Benkelman Beam Deflection Test Results

Disp. (m)	Offset (m)	Lane	Deflection (mm)
CH 5	1	Right hand side	0.48
CH 10	3	Right hand side	1.04
CH 30	1	Right hand side	0.94
CH 50	3	Right hand side	1.10
CH 70	1	Right hand side	0.80
CH 90	3	Right hand side	0.70
CH 110	1	Right hand side	0.60
CH 115	1	Left hand side	0.82
CH 100	1	Left hand side	0.50
CH 80	3	Left hand side	0.34
CH 60	1	Left hand side	0.60
CH 40	3	Left hand side	0.50
CH 20	1	Left hand side	0.50

Comments

TAUR22W00259

APPENDIX E

IMPORTED HARDFILL GRADING CERTIFICATES

GAP65
TEST REPORT

Project :	**Production Testing**
Location :	**Motu River**
Client :	**Gaddum Construction Limited**
Contractor :	**N/a**
Sampled by :	**Guy Gaddum**
Date sampled :	**7/12/21**
Sampling method :	**Not Stated**
Sample description :	**GAP 65**
Sample condition :	**Moist**
Source :	**Motu River**

Project No :	**2-89820.00**
Lab Ref No :	**RT3668**
Client Ref No :	**Motu River**

Particle Size Distribution

Sieve Size (mm)	Percentage Passing		
	Sample	Lower Limit - Coarse	Upper Limit - Fine
63.0	**100**	100	100
37.5	**86**	-	-
19.0	**60**	40	65
9.5	**45**	-	-
4.75	**32**	-	-
2.36	**21**	-	-
1.18	**13**	-	-
0.600	**8**	-	-
0.300	**5**	0	10
0.150	**4**	-	-
0.075	**3**	-	-

% passing the finest sieve is obtained by difference

Crushing Resistance

% Fines @ Spec. Load	**Not Tested**	%
Specification	-	%
Crushing Resistance	-	kN
Nom Aggregate Size	-	mm
Specified Load	-	kN

Broken Faces Content of Aggregate

Fraction (mm)	Percentage by Weight	
	Sample	Lower Limit
65.0 - 37.5	**99**	-
37.5 - 19.0	**85**	-
19.0 - 9.5	**89**	-
9.5 - 4.75	**98**	-

Plasticity Index

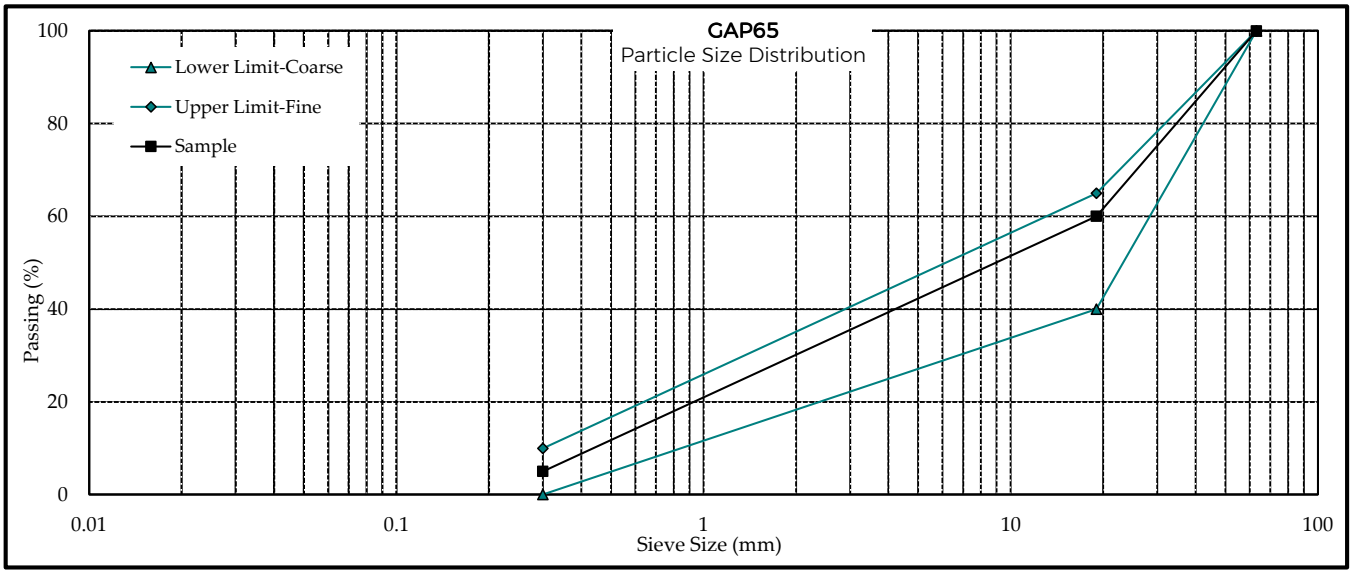
Sample CPL	**Not Tested**
Sample PI	-

Clay Index

Sample CI	**Not Tested**
Specification	-

Sand Equivalent (Washed, Mechanical Shaking)

Sample SE	**Not Tested**
Specified	>= 25



Test Methods

Plasticity Index	NZS 4407 : 2015 : Test 3.4	Crushing Resistance	NZS 4407 : 2015 : Test 3.10
Sand Equivalent	NZS 4407 : 2015 : Test 3.6	Broken Faces Content of Aggregate	NZS 4407 : 2015 : Test 3.14
Particle Size Distribution	NZS 4407 : 2015 : Test 3.8.1	Clay Index	NZS 4407 : 2015 : Test 3.5
		Testing specificatons from Waikato Local Authority RITS (2018)	

Date tested : 9/12/21
Date reported : 9/12/21

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.
This report may only be reproduced in full
All information supplied by Client

IANZ Approved Signatory

Designation : *Laboratory Manager*
Date : 9/12/21

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

WSP
Rotorua (Vaughan Road)
Quality Management Systems Certified to ISO 9001

35 Vaughan Road
35 Vaughan Road, 3010, Rotorua, New Zealand

Telephone +64 7 343 1440
Website www.wsp.com/nz

TNZ M/4 : 2006 AP40
TEST REPORT

Project :	**Production Testing**
Location :	**Motu River**
Client :	**Gaddum Construction Limited**
Contractor :	**N/a**
Sampled by :	**Guy Gaddum**
Date sampled :	**14/12/21**
Sampling method :	**N/a**
Sample description :	**AP40**
Sample condition :	**Moist**

Project No :	**2-89820.00**
Lab Ref No :	**RT3689**
Client Ref No :	

Particle Size Distribution

Sieve Size (mm)	Percentage Passing Sample	Limits
63.0	-	100 - 100
37.5	100	100 - 100
19.0	81	66 - 81
9.5	51	43 - 57
4.75	33	28 - 43
2.36	25	19 - 33
1.18	18	12 - 25
0.600	13	7 - 19
0.300	9	3 - 14
0.150	6	0 - 10
0.075	4	0 - 7

% passing the finest sieve is obtained by difference

Grading Shape Control

Fraction (mm)	% Within Fraction Sample	Limits
19.0 - 4.75	48	28 - 48
9.5 - 2.36	26	14 - 34
4.75 - 1.18	15	7 - 27
2.36 - 0.600	12	6 - 22
1.18 - 0.300	9	5 - 19
0.600 - 0.150	7	2 - 14

Crushing Resistance

% Fines @ Spec. Load	**Not Stated**	%
Specification	-	%
Crushing Resistance	-	kN
Nom Aggregate Size	-	mm
Specified Load	-	kN

Broken Faces Content of Aggregate

Fraction (mm)	Percentage by Weight Sample	Lower Limit
37.5 - 19.0	87	70
19.0 - 9.5	73	70
9.5 - 4.75	72	70

Plasticity Index

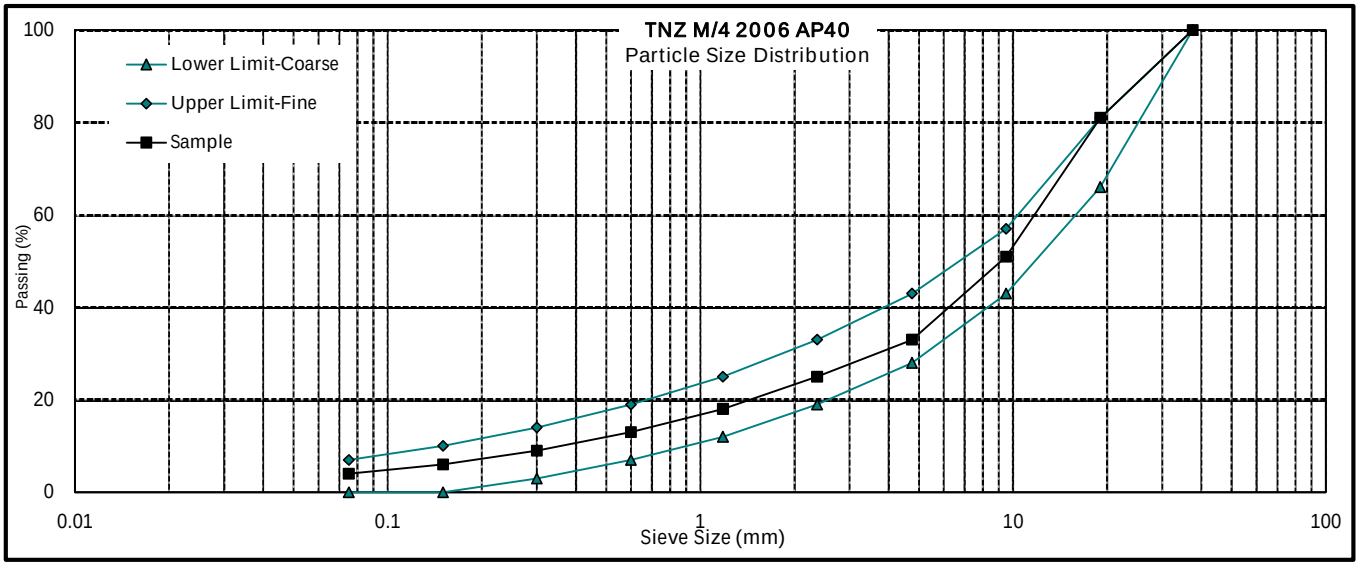
Sample PI	**Not Tested**
Specification	<= 5

Clay Index

Sample CI	**Not Tested**
Specification	<= 3

Sand Equivalent (Washed, Mechanical Shaking)

Sample SE	-
Specified	>= 40



Test Methods

Particle Size Distribution	NZS 4407 : 2015 : Test 3.8.1
Broken Faces Content of Aggregate	NZS 4407 : 2015 : Test 3.14

Date tested : 16/12/21

Date reported : 17/12/21

Sampling is not covered by IANZ Accreditation. Results apply only to sample tested.

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All information supplied by Client

IANZ Approved Signatory

Designation : *Laboratory Manager*

Date : 21/12/21

ACCREDITED IANZ TESTING LABORATORY

Test results indicated as not accredited are outside the scope of the laboratory's accreditation

WSP
Rotorua (Vaughan Road)
Quality Management Systems Certified to ISO 9001

35 Vaughan Road
35 Vaughan Road, 3010, Rotorua, New Zealand

Telephone +64 7 343 1440
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APPENDIX F

CONE PENETRATION TEST RESULTS & LIQUEFACTION ANALYSIS

Egneering Design Consultants Ltd
202 The Strand,Whakatane
www.EDC.co.nz

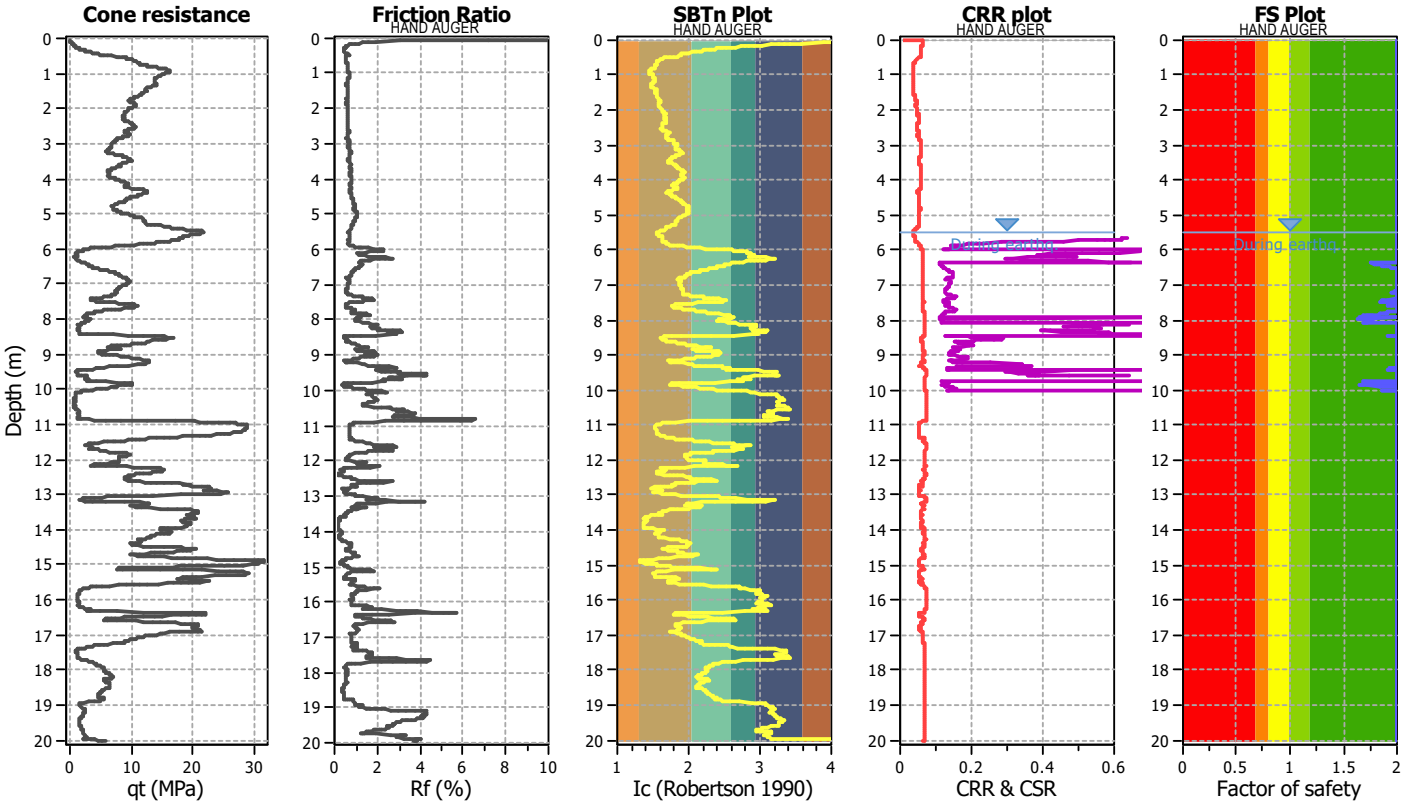
LIQUEFACTION ANALYSIS REPORT

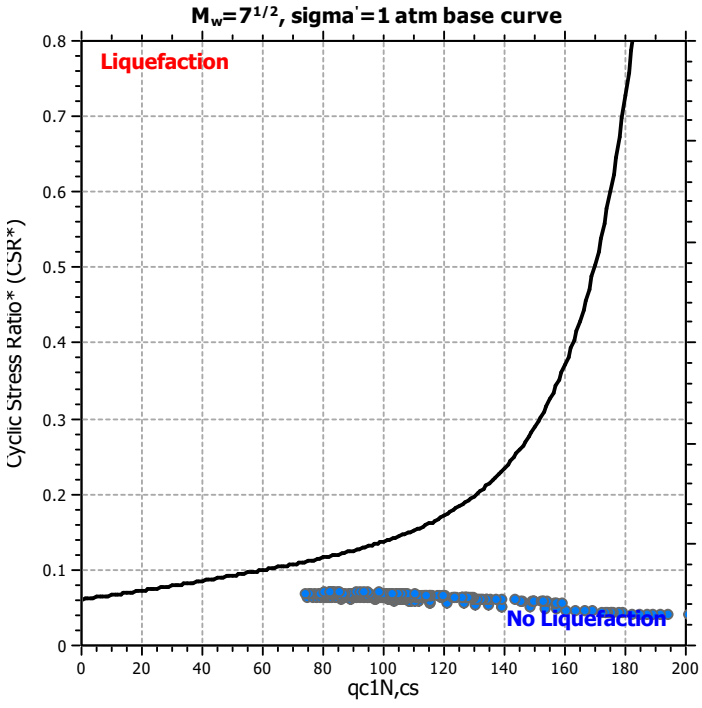
Project title : Geotechnical Completion Report **Location : Waiotahe Drifts, Opotiki**

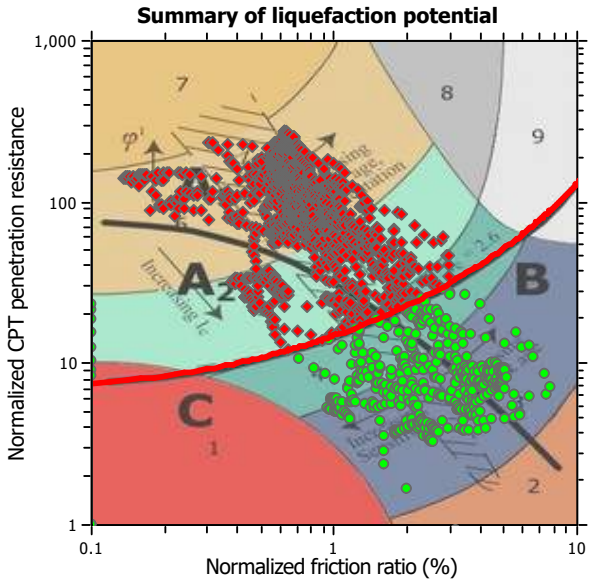
CPT file : CPT01

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	6.00 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.50 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

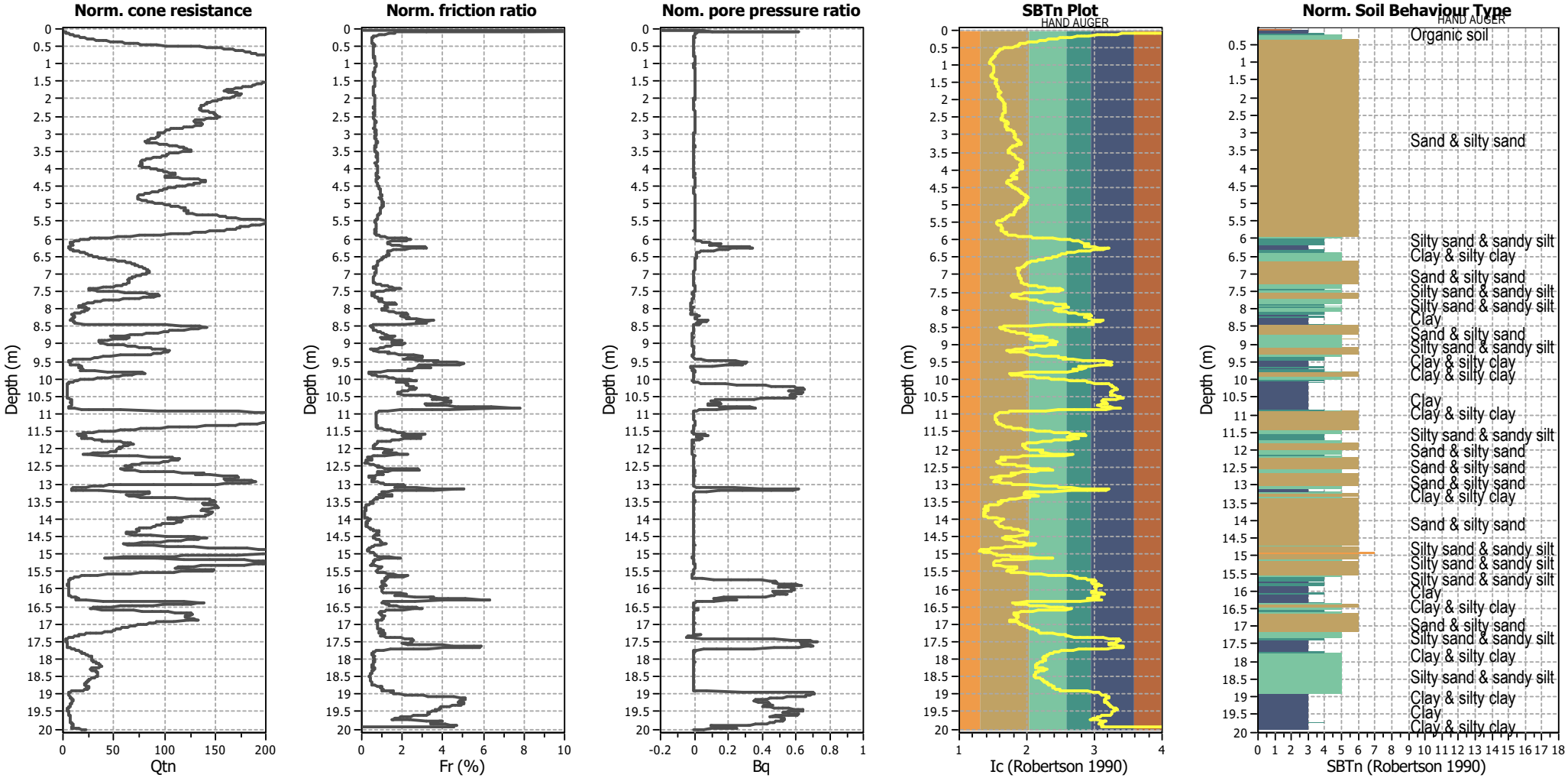






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots (normalized)



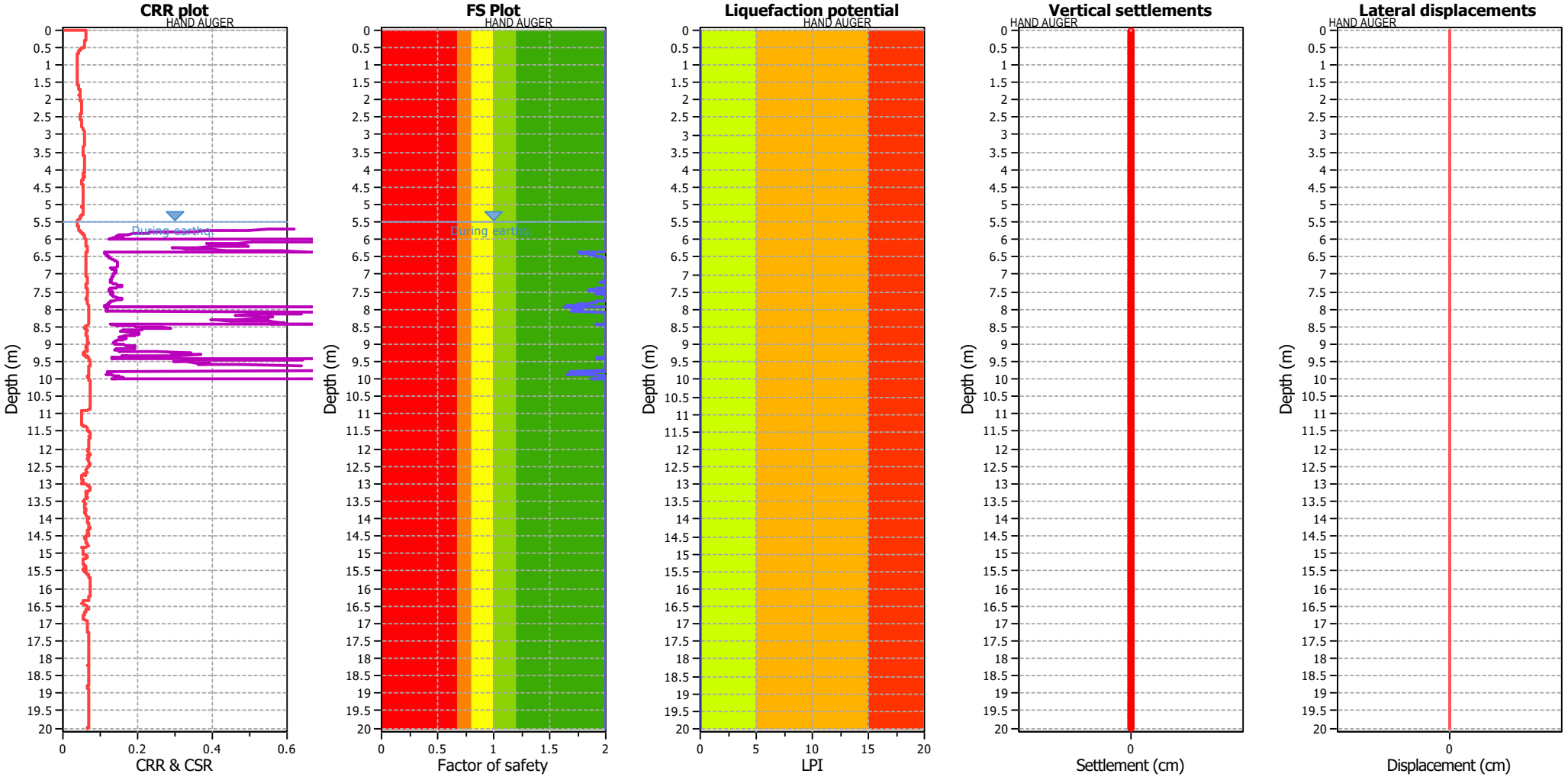
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 m	Fill height:	N/A	Limit depth:	10.00 m

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	6.00 m	Fill height:	N/A	Limit depth:	10.00 m

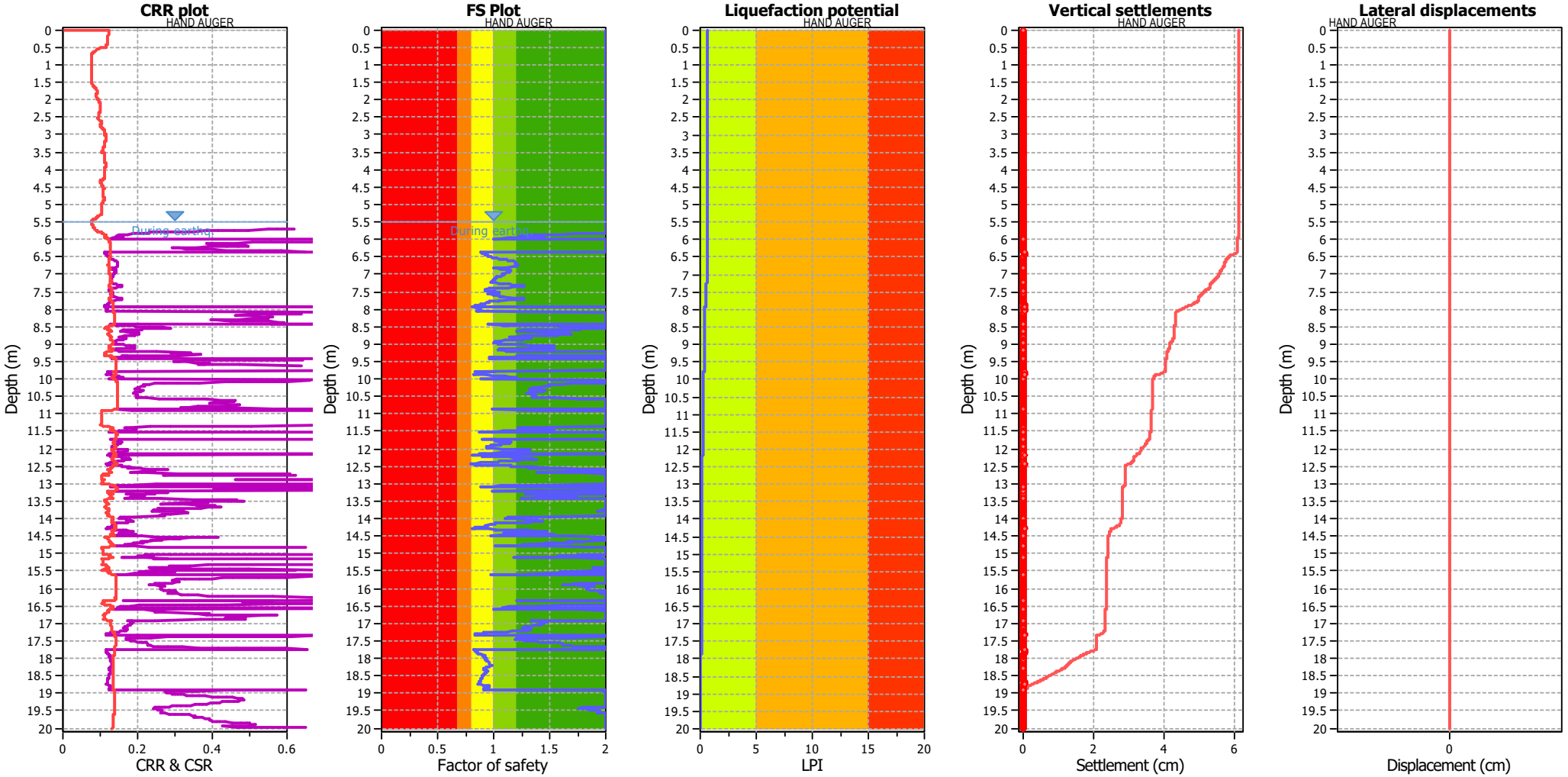
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.22	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	6.00 m	Fill height:	N/A	Limit depth:	N/A

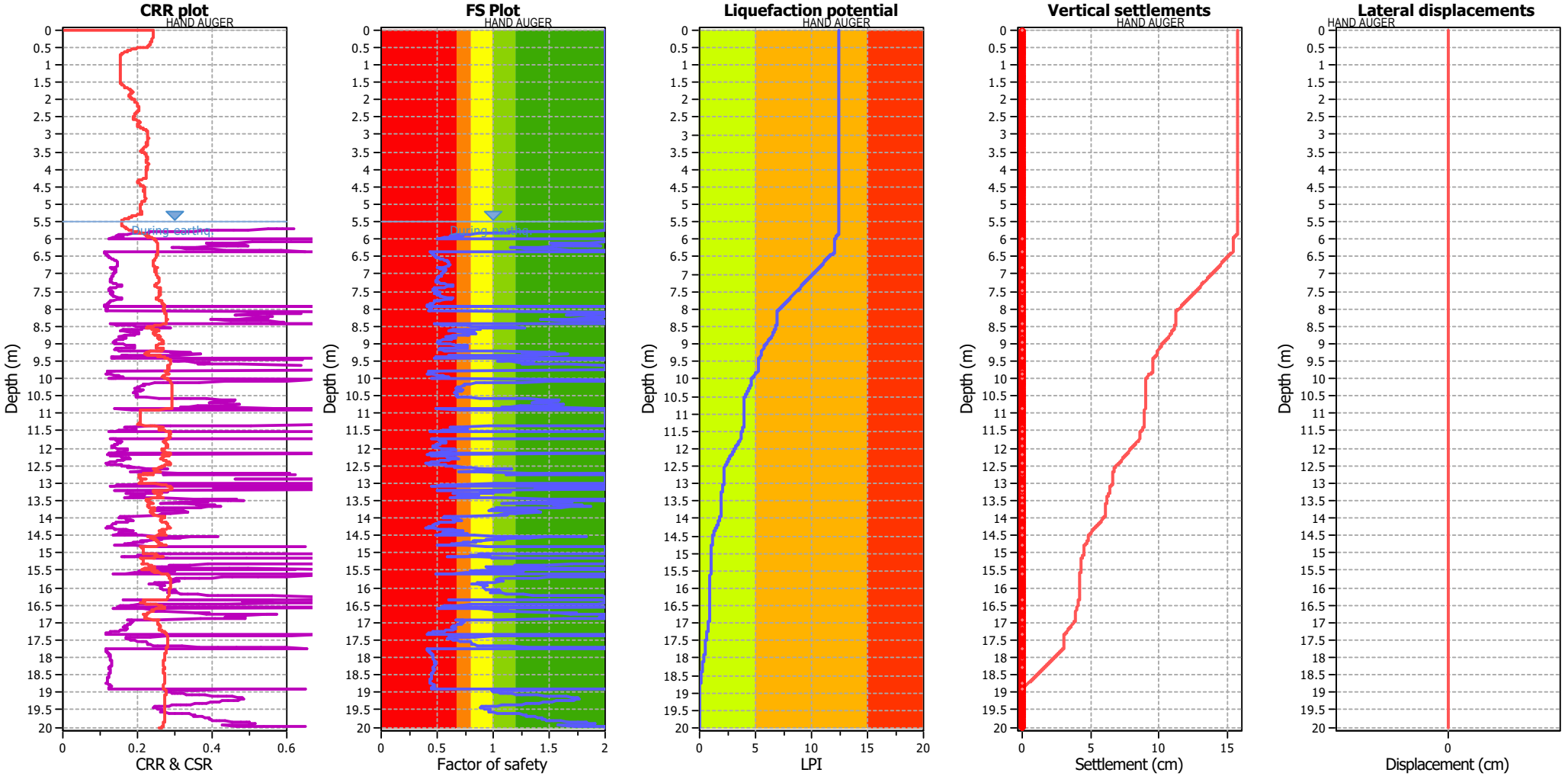
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.50 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	6.00 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
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LPI color scheme

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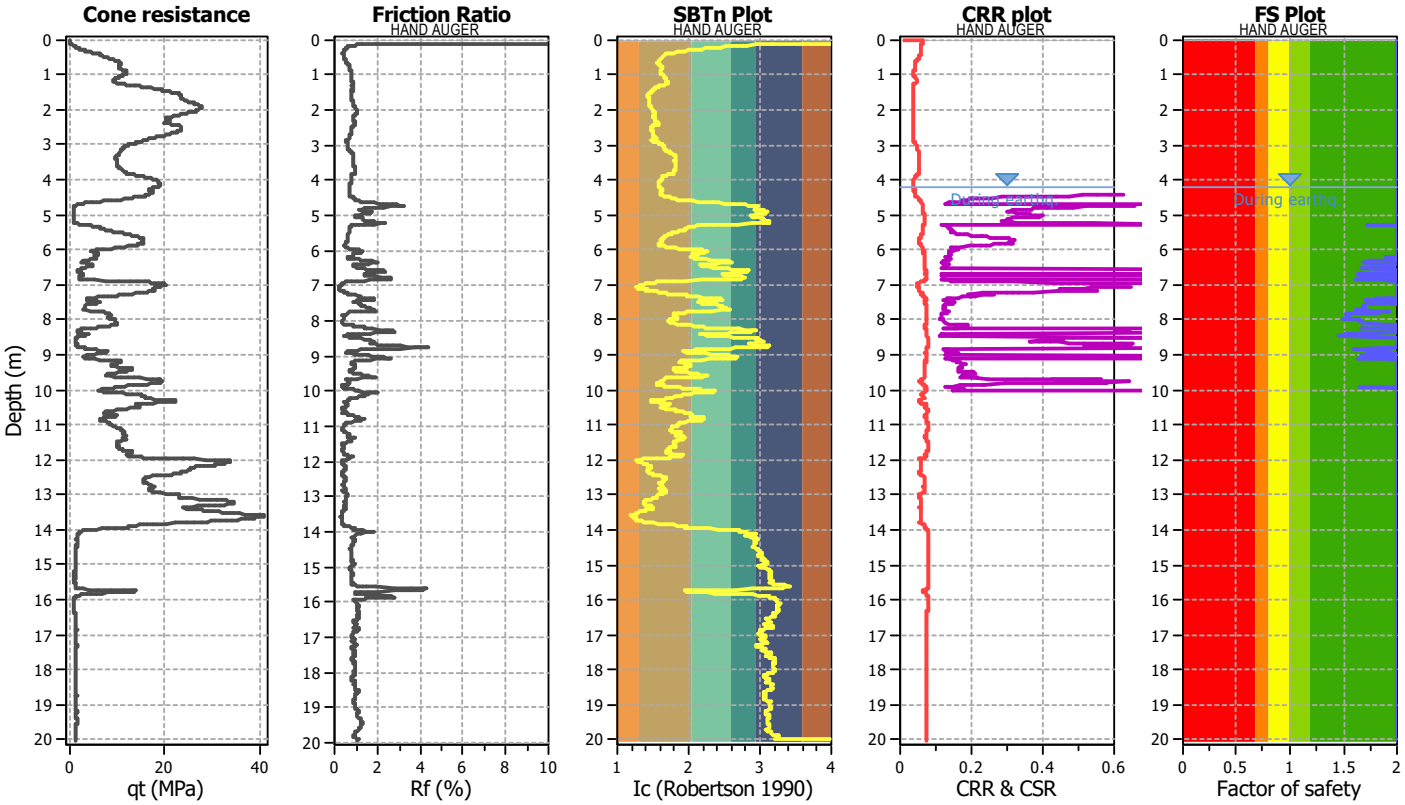
LIQUEFACTION ANALYSIS REPORT

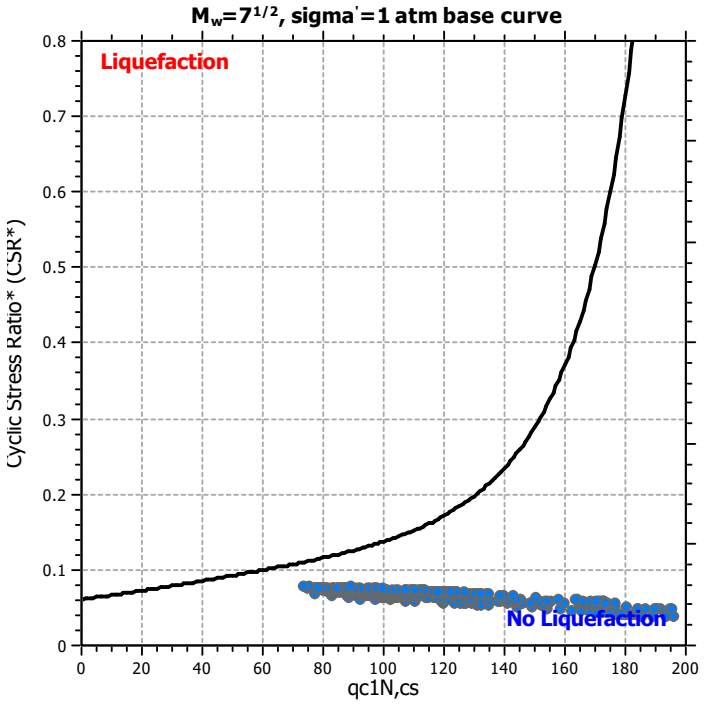
Project title : Geotechnical Completion Report **Location : Waiotahe Drifts, Opotiki**

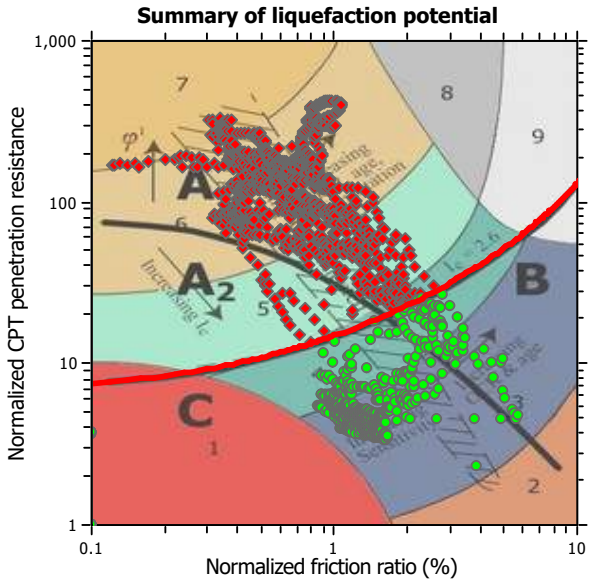
CPT file : CPT02

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	4.70 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	4.20 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

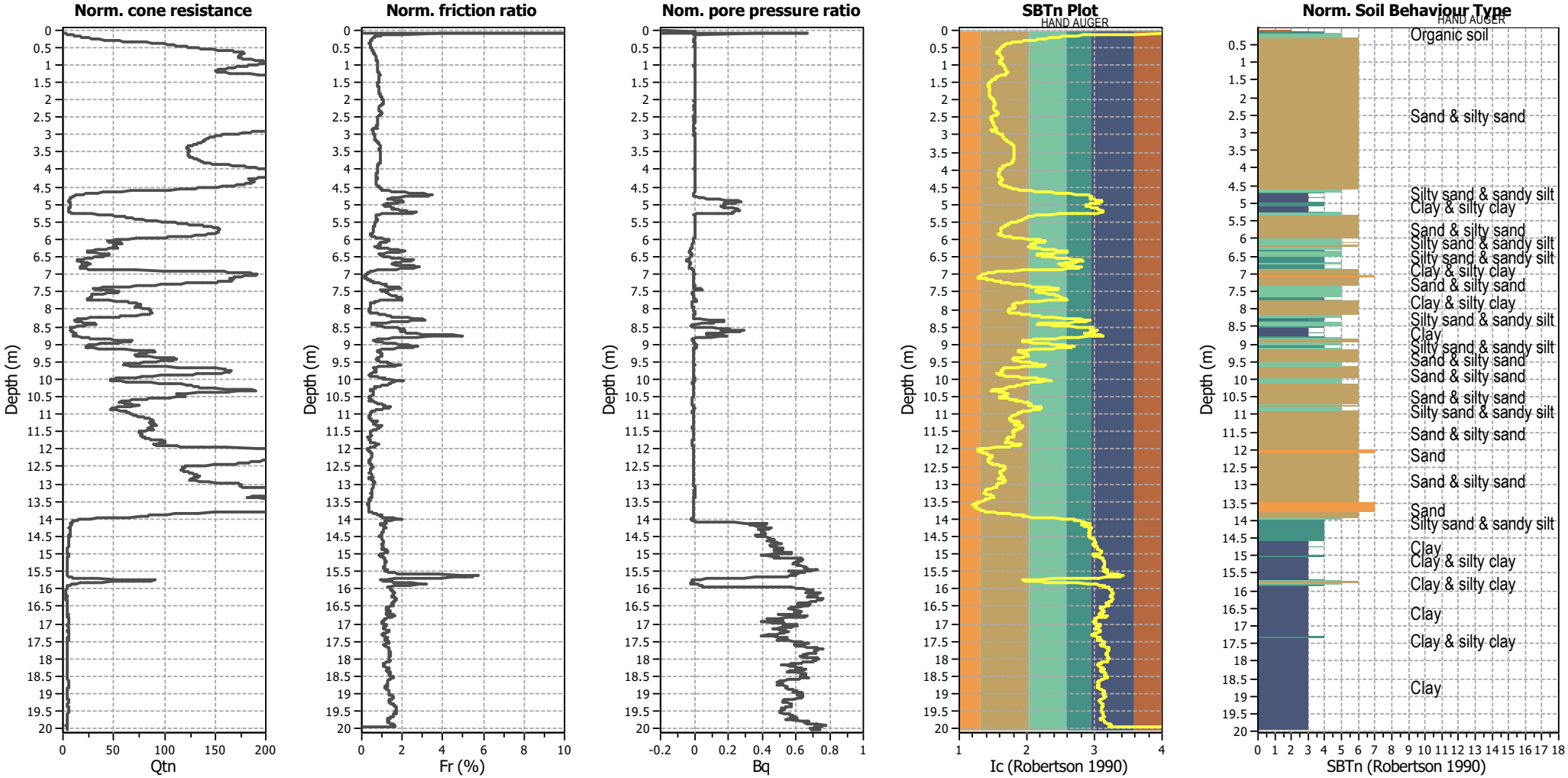






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots (normalized)



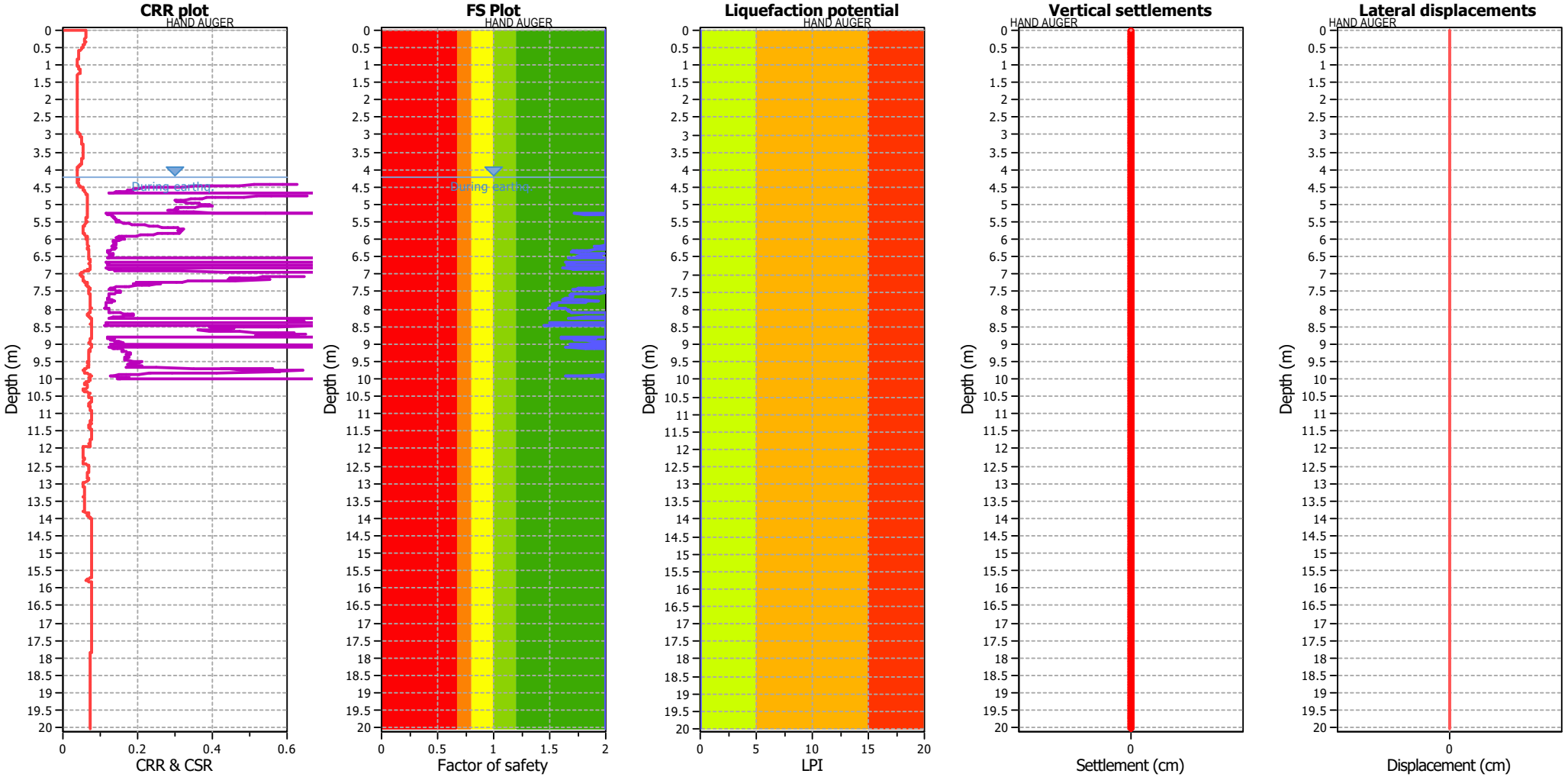
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	4.70 m	Fill height:	N/A	Limit depth:	10.00 m

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	4.70 m	Fill height:	N/A	Limit depth:	10.00 m

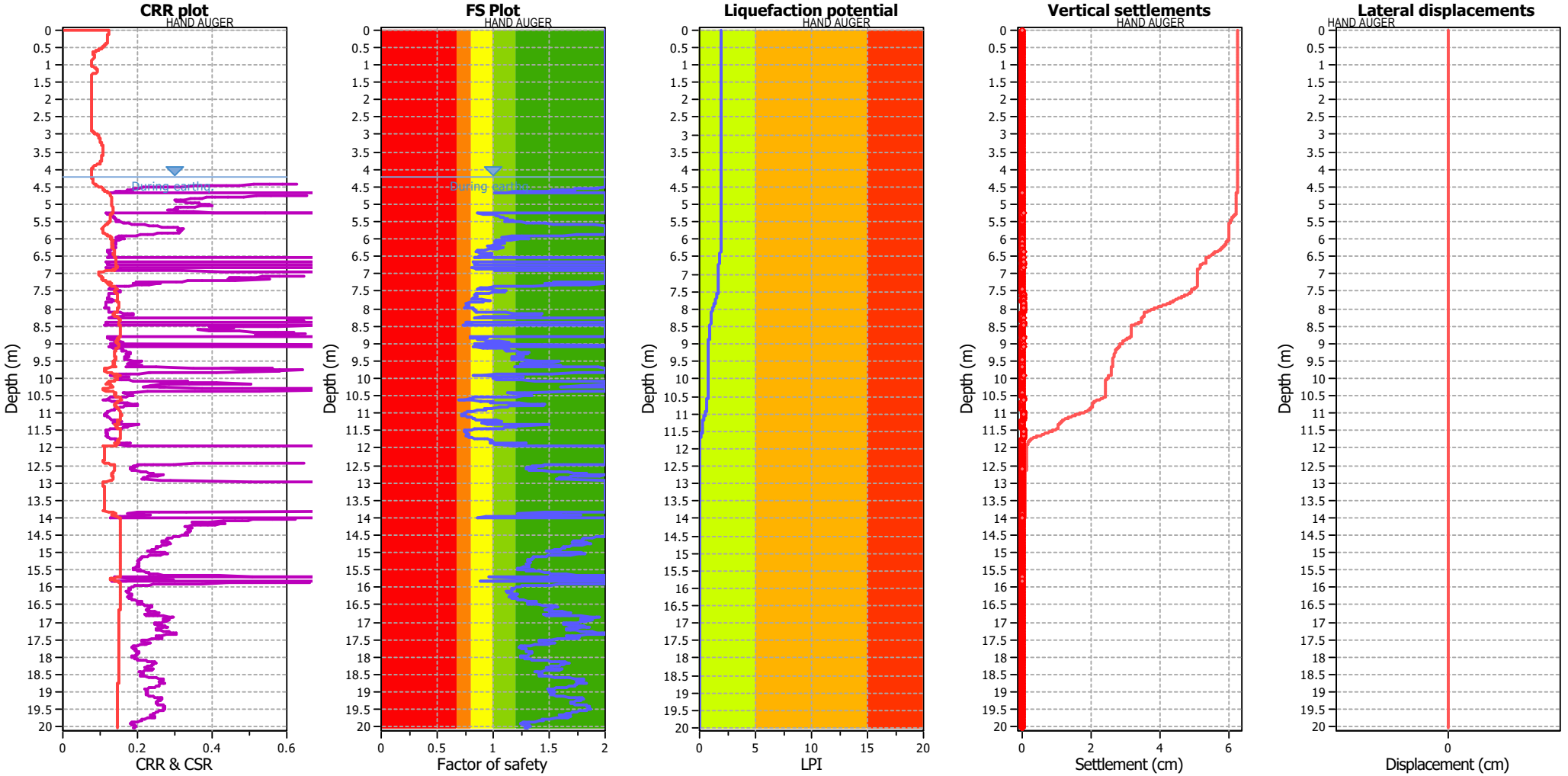
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.22	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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- Liquefaction and no liq. are equally likely
- Unlike to liquefy
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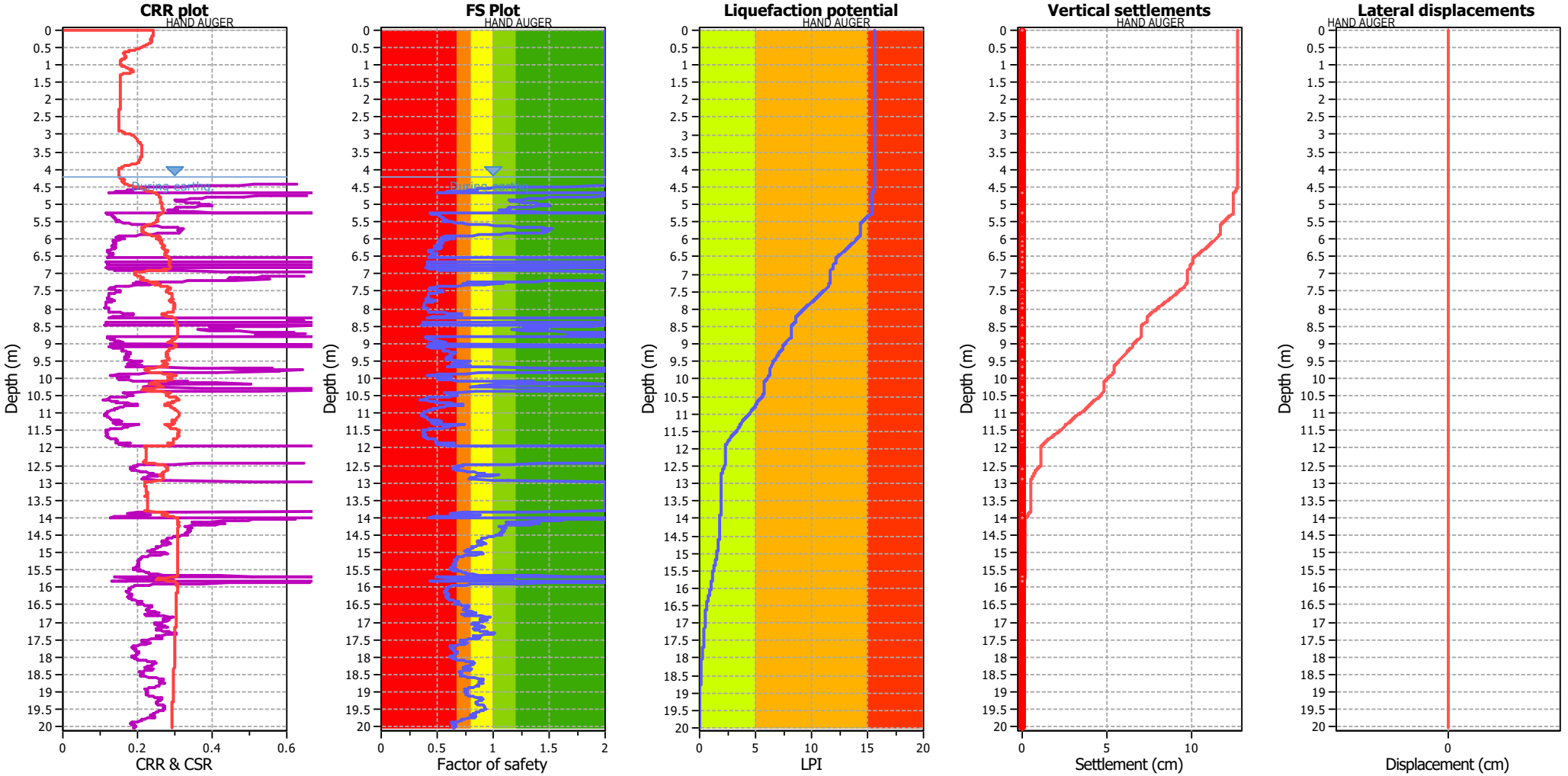
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	4.20 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	4.70 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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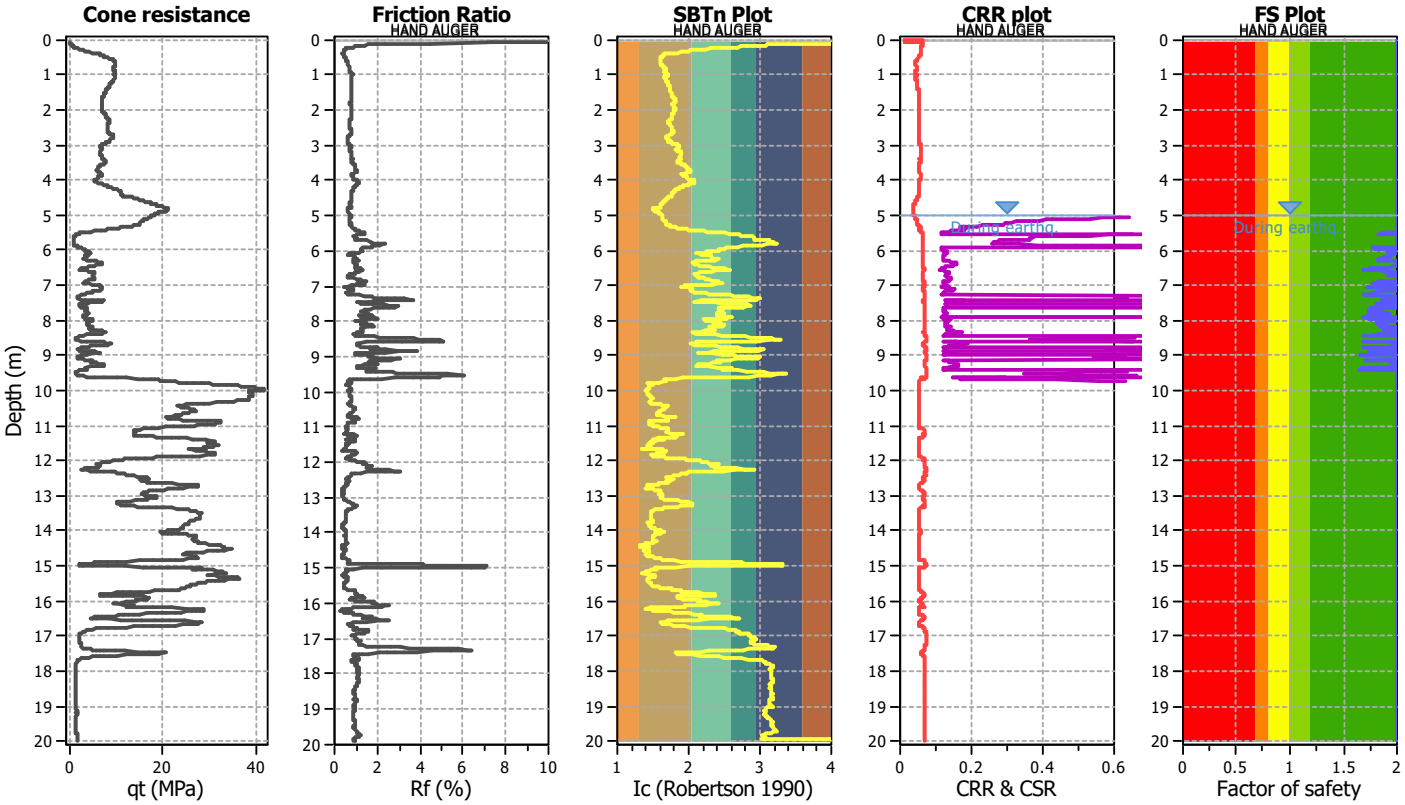
LIQUEFACTION ANALYSIS REPORT

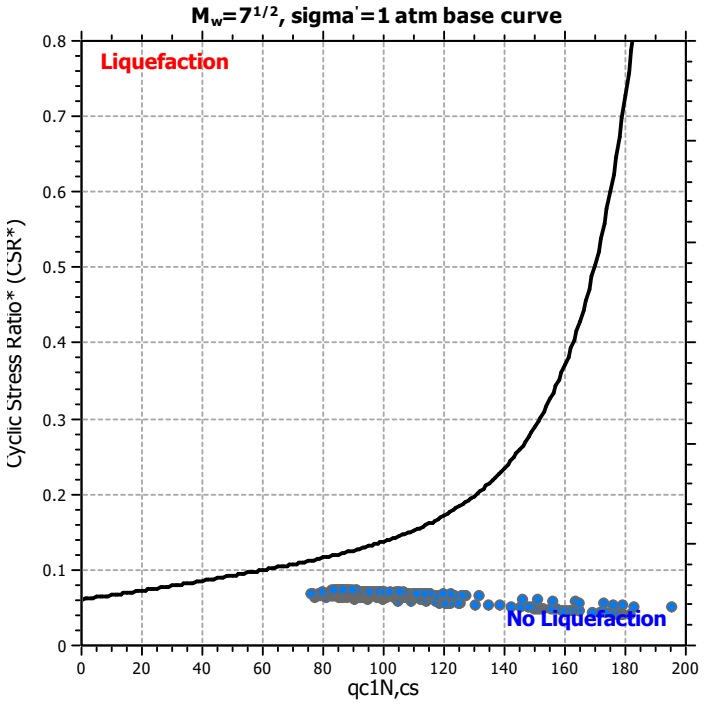
Project title : Geotechnical Completion Report **Location : Waiotahe Drifts, Opotiki**

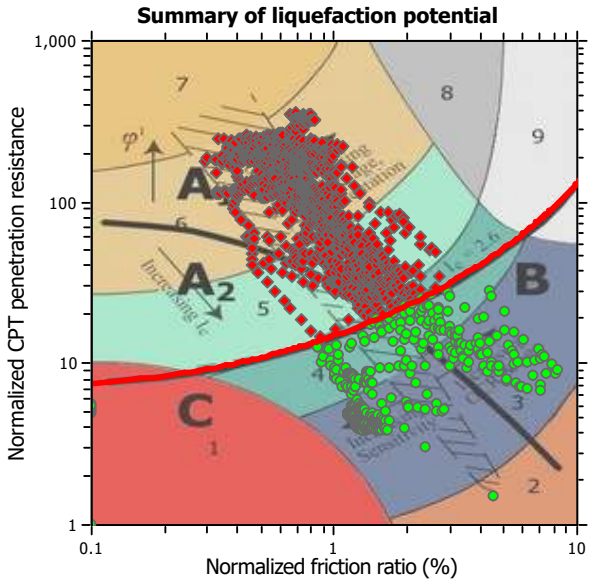
CPT file : CPT03

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	5.50 m	Use fill:	No	Clay like behavior applied:	Sand & Clay
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	5.00 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	10.00 m
Earthquake magnitude M_w:	6.10	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method based
Peak ground acceleration:	0.11	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

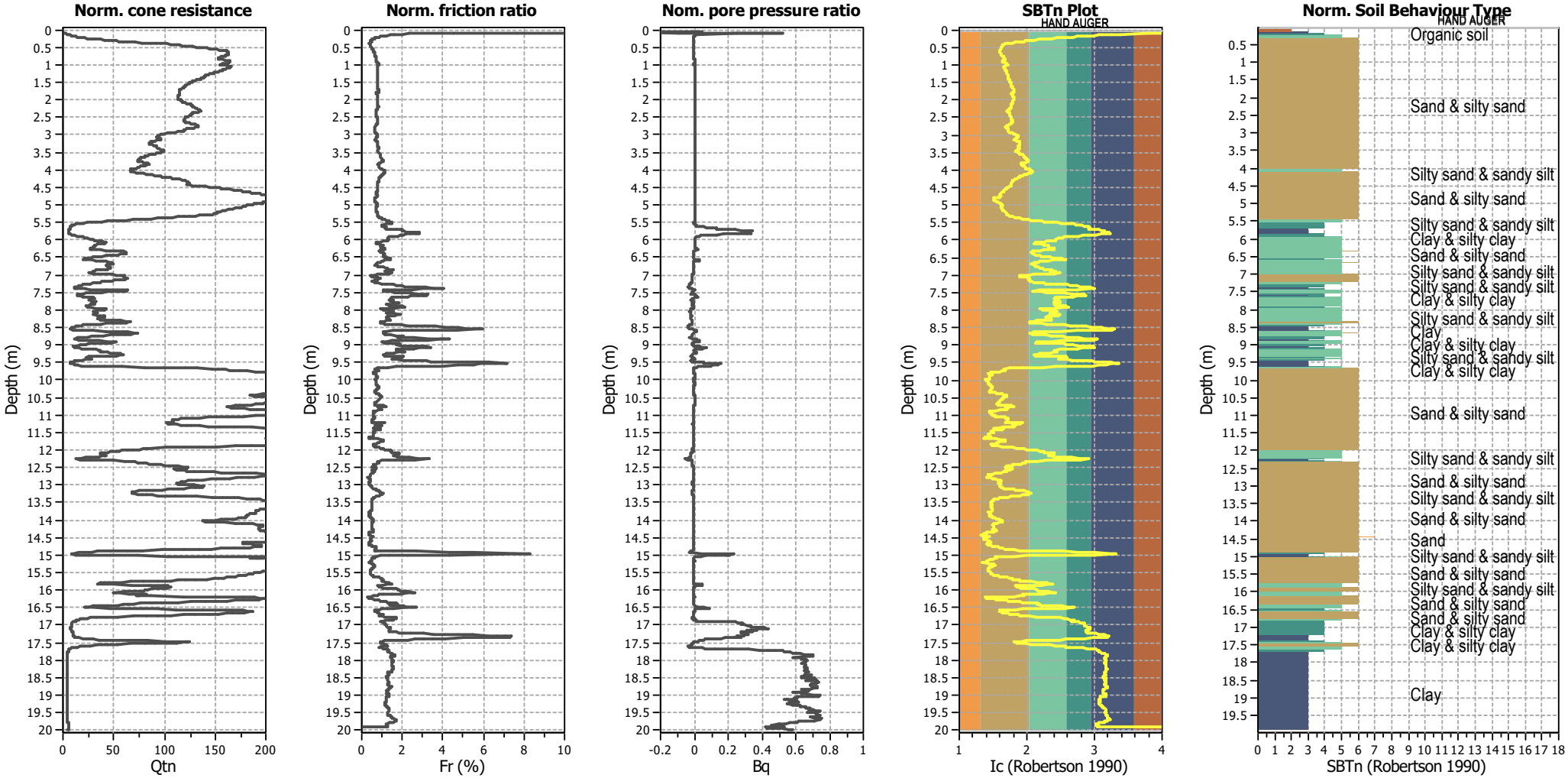






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots (normalized)



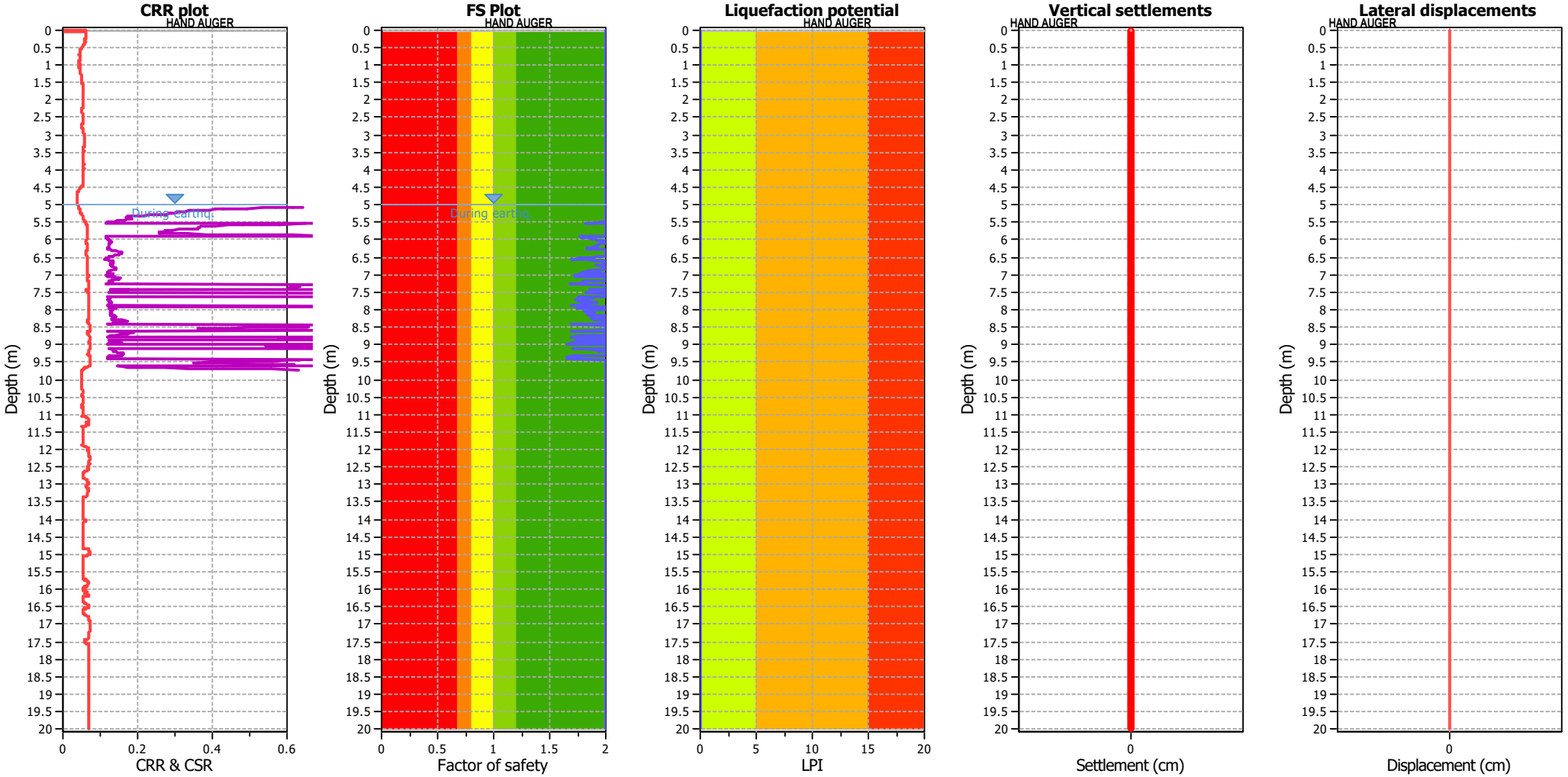
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	5.50 m	Fill height:	N/A	Limit depth:	10.00 m

SBTn legend

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

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.11	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	5.50 m	Fill height:	N/A	Limit depth:	10.00 m

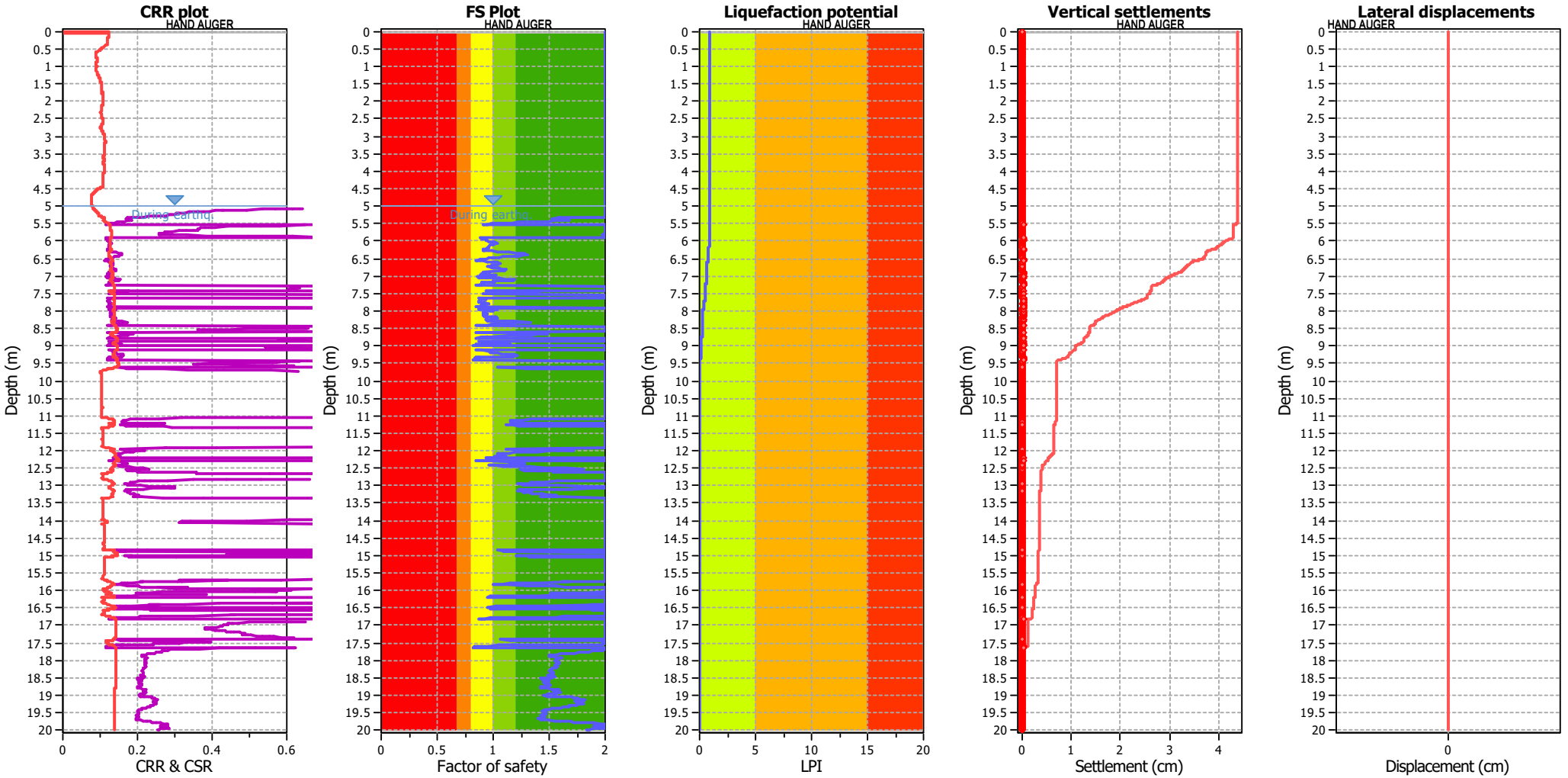
F.S. color scheme

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

LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.22	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.50 m	Fill height:	N/A	Limit depth:	N/A

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LPI color scheme

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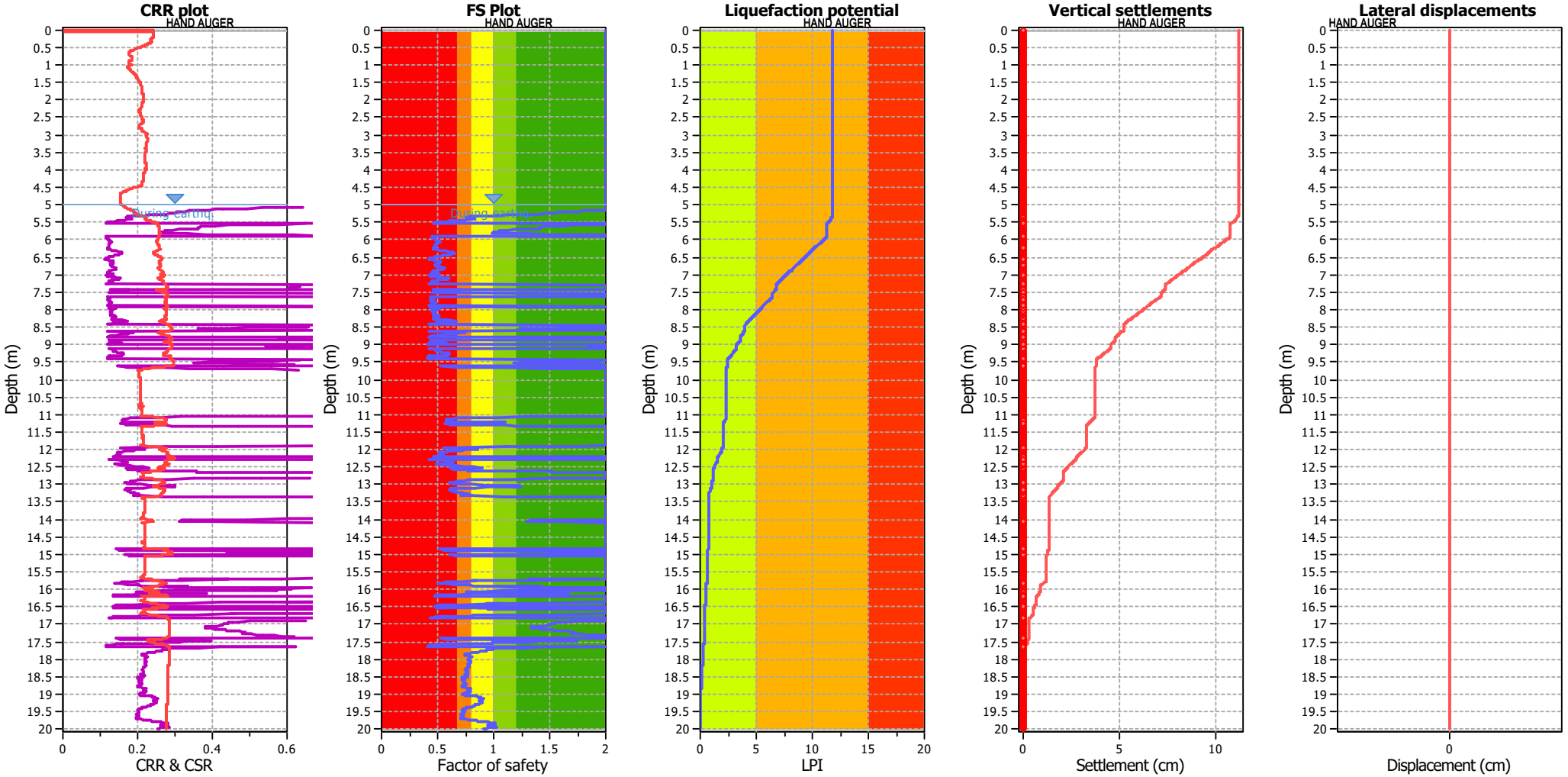
Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	5.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.10	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sand & Clay
Peak ground acceleration:	0.44	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	5.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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- High risk
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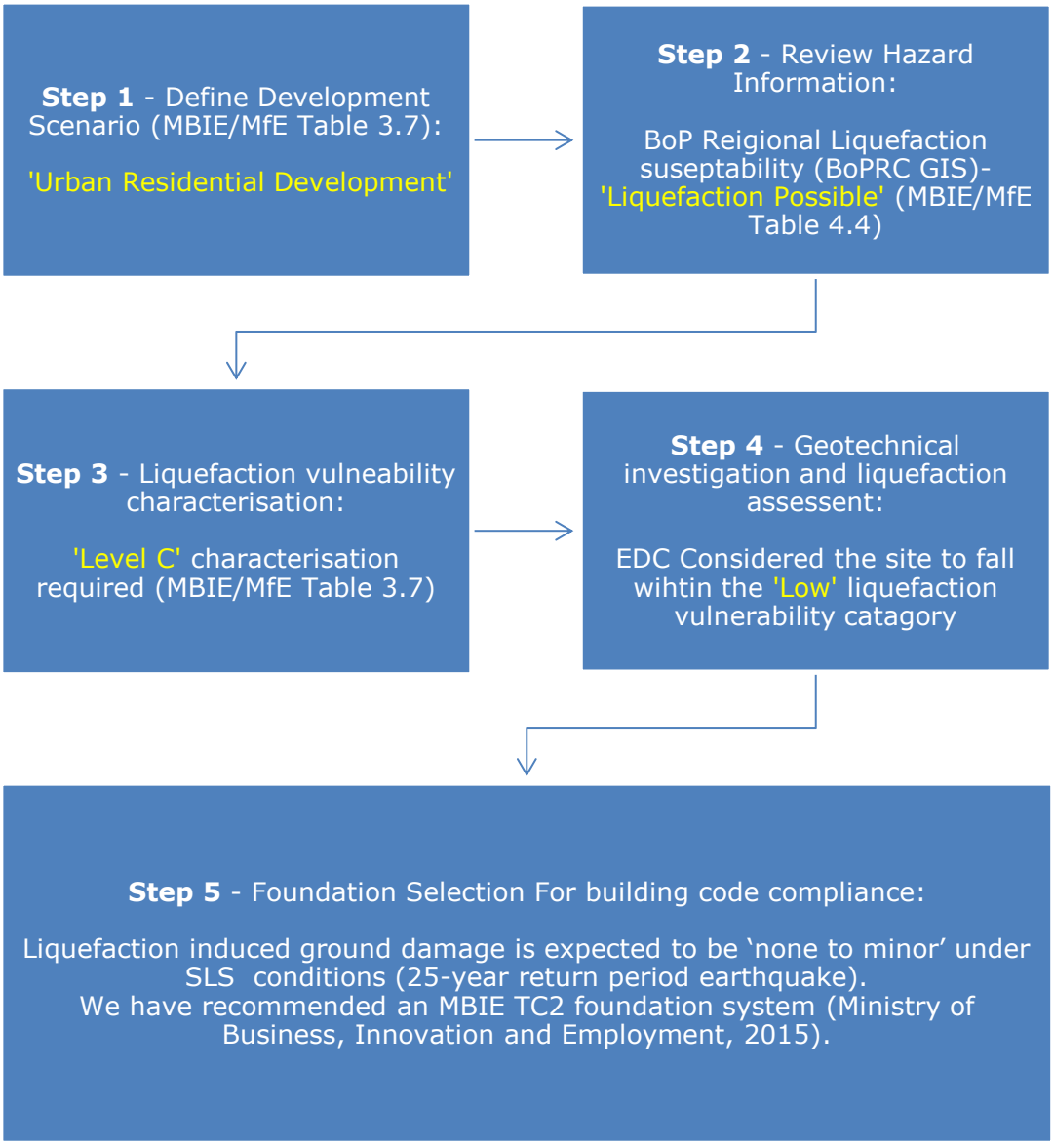
APPENDIX G

MBIE/MFE SITE SPECIFIC LIQUEFACTION ASSESSMENT FLOW CHART, ASSESSMENT MATRIX & DEFINITIONS



STEP 1 – Define development scenario (refer to Table 3.7 of MBIE/MfE Guidence (2017)

Increasing likelihood and severity of ground damage

Increasing new capital investment and total exposure to a single event

DEVELOPMENT SCENARIO[2]	LIQUEFACTION VULNERABILITY CATEGORY			
	LIQUEFACTION CATEGORY IS UNDETERMINED			
	LIQUEFACTION DAMAGE IS UNLIKELY		LIQUEFACTION DAMAGE IS POSSIBLE	
	Very Low	Low	Medium	High
Sparsely populated rural area (lot size more than 4 Ha) eg A new farm building	Level A	Level A	Level A	Level A
Rural-residential setting (lot size of 1 to 4 Ha) eg A 'lifestyle' property	Level A	Level B	Level B	Level B
Small-scale urban infill (original lot size less than 2500 m2) eg Demolish old house and replace with four townhouses	Level B	Level B	Level B	Level D
Commercial or industrial development[7] eg A warehouse building in an industrial park	Level B	Level B	Level C	Level D
Urban residential development (lot size less than 1 Ha; typically <1000 m2) eg Home in a new subdivision	Level B	Level C	Level C	Level D

Table 4.4: Performance criteria for determining the liquefaction vulnerability category

LIQUEFACTION CATEGORY IS UNDETERMINED

A liquefaction vulnerability category has not been assigned at this stage, either because a liquefaction assessment has not been undertaken for this area, or there is not enough information to determine the appropriate category with the required level of confidence.

LIQUEFACTION DAMAGE IS UNLIKELY		LIQUEFACTION DAMAGE IS POSSIBLE	
There is a probability of more than 85 percent that liquefaction-induced ground damage will be ***None to Minor*** for 500-year shaking. At this stage there is not enough information to distinguish between ***Very Low*** and ***Low***. More detailed assessment would be required to assign a more specific liquefaction category.		There is a probability of more than 15 percent that liquefaction-induced ground damage will be ***Minor to Moderate*** (or more) for 500-year shaking. At this stage there is not enough information to distinguish between ***Medium*** and ***High***. More detailed assessment would be required to assign a more specific liquefaction category.	
Very Low Liquefaction Vulnerability There is a probability of more than 99 percent that liquefaction-induced ground damage will be ***None to Minor*** for 500-year shaking.	**Low Liquefaction Vulnerability** There is a probability of more than 85 percent that liquefaction-induced ground damage will be ***None to Minor*** for 500-year shaking.	**Medium Liquefaction Vulnerability** There is a probability of more than 50 percent that liquefaction-induced ground damage will be: ***Minor to Moderate*** (or less) for 500-year shaking; and ***None to Minor*** for 100-year shaking.	**High Liquefaction Vulnerability** There is a probability of more than 50 percent that liquefaction-induced ground damage will be: ***Moderate to Severe*** for 500-year shaking; and/or ***Minor to Moderate*** (or more) for 100-year shaking.

Table 3.1: Levels of detail for liquefaction assessment studies, and the key defining features

LEVEL OF DETAIL	KEY FEATURES
Level A Basic desktop assessment	Considers only the most basic information about geology, groundwater and seismic hazard to assess the potential for liquefaction to occur. This can typically be completed as a simple 'desktop study', based on existing information (eg geological and topographic maps) and local knowledge. **Residual uncertainty:** The primary focus is identifying land where there is a ***High*** degree of certainty that ***Liquefaction Damage is Unlikely*** (so it can be 'taken off the table' without further assessment). For other areas, substantial uncertainty will likely remain regarding the level of risk.
Level B Calibrated desktop assessment	Includes high-level 'calibration' of geological/geomorphic maps. Qualitative (or possibly quantitative) assessment of a small number of subsurface investigations provides a better understanding of liquefaction susceptibility and triggering for the mapped deposits and underlying ground profile. For example, the calibration might indicate the ground performance within a broad area is likely to fall within a particular range. It may be possible to extrapolate the calibration results to other nearby areas of similar geology and geomorphology, however care should be taken not to over-extrapolate (particularly in highly variable ground such as alluvial deposits), and the associated uncertainties (and potential consequences) should be clearly communicated. Targeted collection of new information may be very useful in areas where existing information is sparse and reducing the uncertainty could have a significant impact on objectives and decision-making. **Residual uncertainty:** Because of the limited amount of subsurface ground information, significant uncertainty is likely to remain regarding the level of liquefaction-related risk, how it varies across each mapped area, and the delineation of boundaries between different areas.
Level C Detailed area-wide assessment	Includes quantitative assessment based on a moderate density of subsurface investigations, with other information (eg geomorphology and groundwater) also assessed in finer detail. May require significant investment in additional ground investigations and more complex engineering analysis. **Residual uncertainty:** The information analysed is sufficient to determine with a moderate degree of confidence the typical range of liquefaction-related risk within an area and delineation of boundaries between areas, but is insufficient to confidently determine the risk more precisely at a specific location.
Level D Site-specific assessment	Draws on a high density of subsurface investigations (eg on or very close to the site being assessed), and takes into account the specific details of the proposed site development (eg location, size and foundation type of building). **Residual uncertainty:** The information and analysis is sufficient to determine with a ***High*** degree of confidence the level of liquefaction-related risk at a specific location. However, the scientific understanding of liquefaction and seismic hazard is imperfect, so there remains a risk that actual land performance could differ from expectations even with a high level of site-specific detail in the assessment.

Increasing level of detail and decreasing degree of uncertainty

APPENDIX H

INDIVIDUAL LOT SUMMARY

Subdivision Geotechnical Summary Table

Stage 5a Waiotahe Drifts Subdivision

EDC: 48749

24/05/2022

LOT	AREA	CUT		FILL		SLOPE TYPE	SPECIFIC CONSIDERATIONS				FOUNDATION REQUIREMENTS & COMMENTS AS APPLICABLE
		SOIL TYPE	MAX DEPTH	FILL TYPE	MAX DEPTH		Public Services	Retaining Walls	Expansive Soil	Building Set-Back	
1	525m^2	-	-	Sand	1.0m	Up to north	No	No	No	No	Recommended foundations include MBIE TC2 Enhanced Slab and shallow piles designed in accordance with building consent stage bearing capacity assessment.
2	539m^2	-	-	Sand	1.0m	Up to north	No	No	No	Yes	
3	503m^2	-	-	Sand	2.0m	Up to north	No	TBC	No	Yes	
4	460m^2	-	-	Sand	2.0m	Up to north	No	TBC	No	Yes	
5	572m^2	Sand	0.5m	-	-	Level	No	No	No	No	
6	724m^2	Sand	0.5m	-	-	Level	No	No	No	No	
7	677m^2	Sand	0.5m	-	-	Up to north	No	No	No	No	
8	636m^2	Sand	1.5m	-	-	Up to north	No	No	No	No	
9	719m^2	Sand	1.5m	-	-	Level	No	No	No	No	
10	719m^2	Sand	1.0m	-	-	Level	No	No	No	No	
11	543m^2	Sand	2.5m	-	-	Up to north	No	No	No	No	
73	437m^2	-	-	Sand	1.5m	Level	No	TBC	No	Yes	
74	424m^2	-	-	Sand	1.5m	Level	No	TBC	No	Yes	
75	459m^2	-	-	Sand	1.5m	Level	No	TBC	No	Yes	
76	480m^2	-	-	Sand	1.5m	Level	No	No	No	No	
77	455m^2	-	-	Sand	2.0m	Level	No	No	No	No	
78	456m^2	-	-	Sand	2.0m	Level	No	No	No	No	
79	476m^2	Sand	1.5m	Sand	1.0m	Level	No	No	No	No	
80	419m^2	Sand	1.0m	Sand	2.0m	Level	No	No	No	No	
81	429m^2	-	-	Sand	2.0m	Level	No	No	No	No	