

Sigma Consultants Ltd

Geotechnical report

66 Mcfetridge Drive

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Document History and Status

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Contents

I OVERVIEW	1
1 Scope of Report	1
2 Building Site	1
3 Soil Type and Geological History	4
4 Liquefaction and lateral spread	5
5 Soft soils and settlement	7
6 Fault Line Proximity	7
7 Geothermal Hazards	7
II FLAT AREA	8
8 Soils Testing	8
9 Soft soils and settlement	11
10 Preliminary proposed foundations	11
III AREA 2 - EAST SLOPE	11
11 Soils Testing	12
12 Soft soils and settlement	14
13 Slope stability	16
14 Preliminary proposed foundations	16
IV AREA 3 - ROLLING LAND	16
15 Soils Testing	19
16 Soft soils and settlement	23
17 Statement of Professional Opinion	27
References	27

List of Figures

1 Site plan and contour	1
2 CPT test points	2
3 Hand auger test points	3
4 Test points and soil profile locations	4
5 SLS Settlement Graph	6
6 ULS Settlement Graph	6
7 Soil profile 1	8
8 Settlement under static load 1	11
9 Soil profile 2	12

10	Settlement under static load 2	15
11	Settlement under static load 3	15
12	Settlement under static load 4	16
13	Soil profile 3	17
14	Soil profile 4	18
15	Soil profile 5	18
16	Settlement under static load 5	24
17	Settlement under static load 6	25
18	Settlement under static load 7	25
19	Settlement under static load 8	26
20	Settlement under static load 9	26
21	Settlement under static load 10	27
22	Initial Site plan	32

List of Tables

1	Summary of Eruptive Sequences	5
2	Summary of predicted settlements	7
3	Summary of static settlements	7
4	Summary of Test 1	9
5	Summary of Test 2	9
6	Summary of Test 3	9
7	Summary of Test 27	10
8	Summary of Test 28	10
9	Summary of Test 29	10
10	Summary of Test 30	10
11	Flat site CPT summary	11
12	Summary of Test 4	12
13	Summary of Test 5	13
14	Summary of Test 6	13
15	Summary of Test 7	13
16	Summary of Test 8	13
17	Summary of Test 9	14
18	Summary of Test 10	14
19	East Sloping site CPT summary	14
20	Summary of Test 11	19
21	Summary of Test 12	19
22	Summary of Test 13	19
23	Summary of Test 14	20
24	Summary of Test 15	20
25	Summary of Test 16	20
26	Summary of Test 17	21
27	Summary of Test 18	21
28	Summary of Test 19	21
29	Summary of Test 20	22
30	Summary of Test 21	22
31	Summary of Test 22	22
32	Summary of Test 23	22
33	Summary of Test 24	23
34	Summary of Test 25	23
35	Summary of Test 26	23
36	Rolling land site CPT summary	24

Part I

OVERVIEW

1 Scope of Report

Sigma Consultants Ltd has been engaged to provide a geotechnical report on soil properties to support a subdivision application for Millbrow Estate. The site is at 66 Mcfetridge Drive, Lot 7 DP 392696, Lot 8 DP 392696 and Lot 1 DP 558193.

2 Building Site

Mcfetridge Drive runs along the north edge of the site and connects into the property in its north. The site is surrounded by rolling land consisting of residential lots, farm land, grazing land and plantation forestry. The site consists of gentle hills in its north side (Area 1 in figure 1). The hills steepen to the south to become rolling land (Area 3 in figure 1) and connects to a bush area at the south end. The eastern portion slopes towards east to a steep downhill leading to Tauranga Direct Road (Area 2 in figure 1). There are three existing properties on the north and northwest corner of the site. The terrain layout and the contour lines (at 5m intervals) are shown in figure 1.

Ten CPT and thirty hand auger tests were completed. These test locations are shown in figures 2 and 3 and a preliminary subdivision plan is shown in appendix 2. Based on the CPT and hand auger test results, five soil profiles were formed as shown in figure 4. These profiles were developed to better display the soil layers. A layout for the profiles is shown in figure 4 and the details are discussed in the soil test sections.

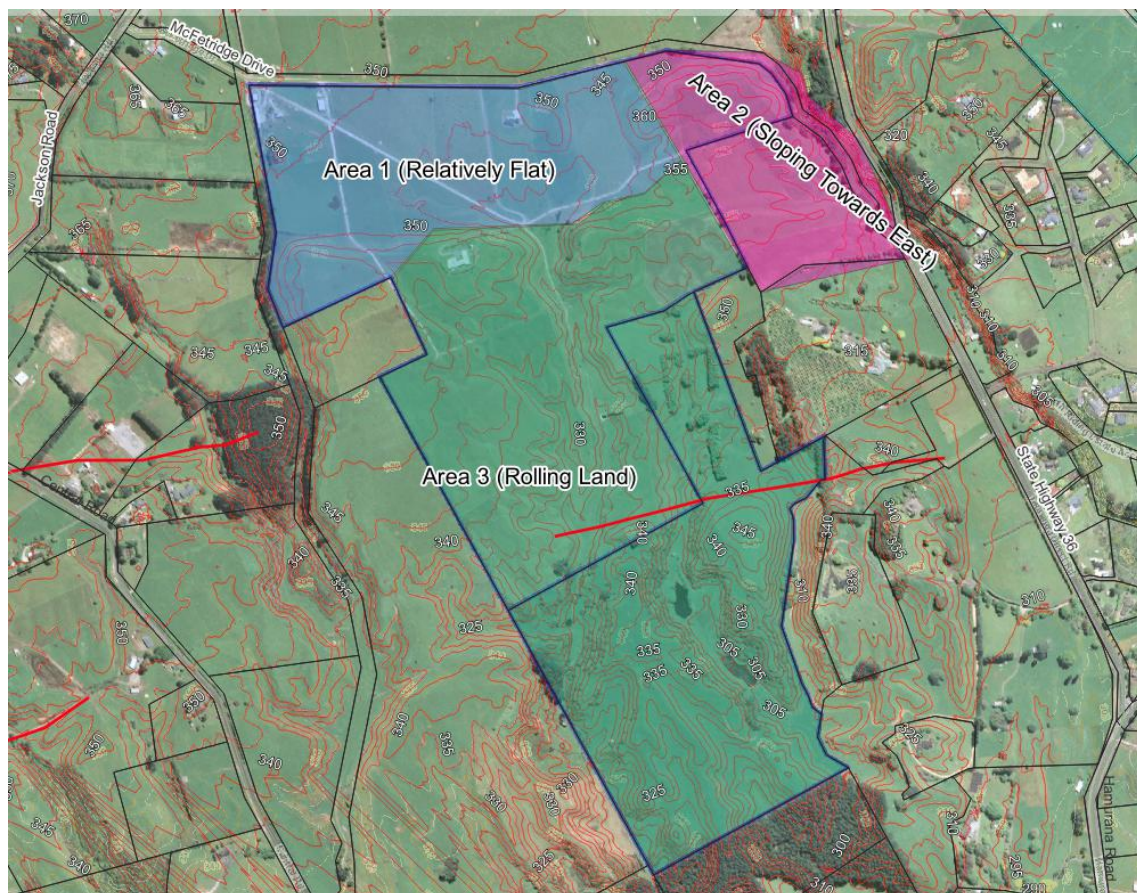


Figure 1: Site plan and contour

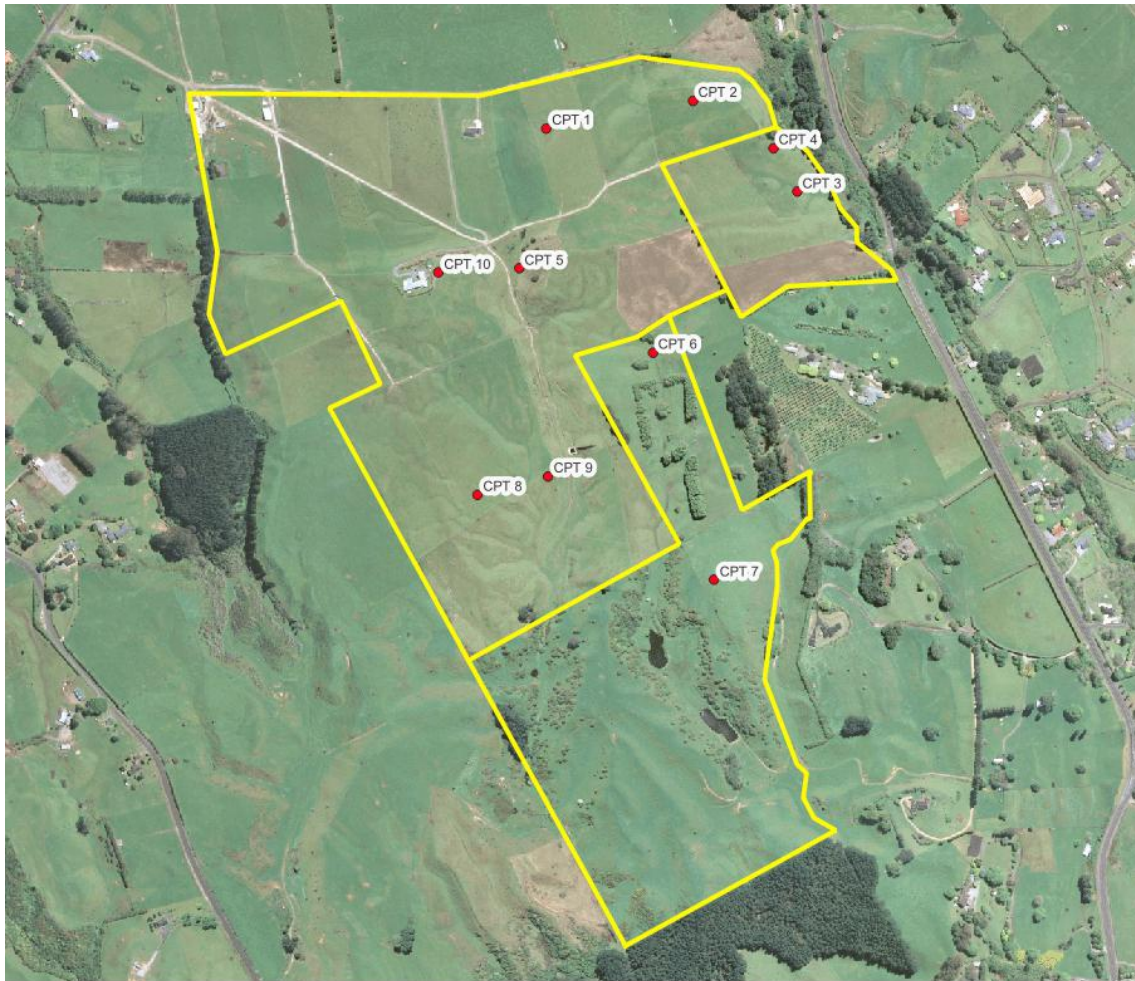


Figure 2: CPT test points

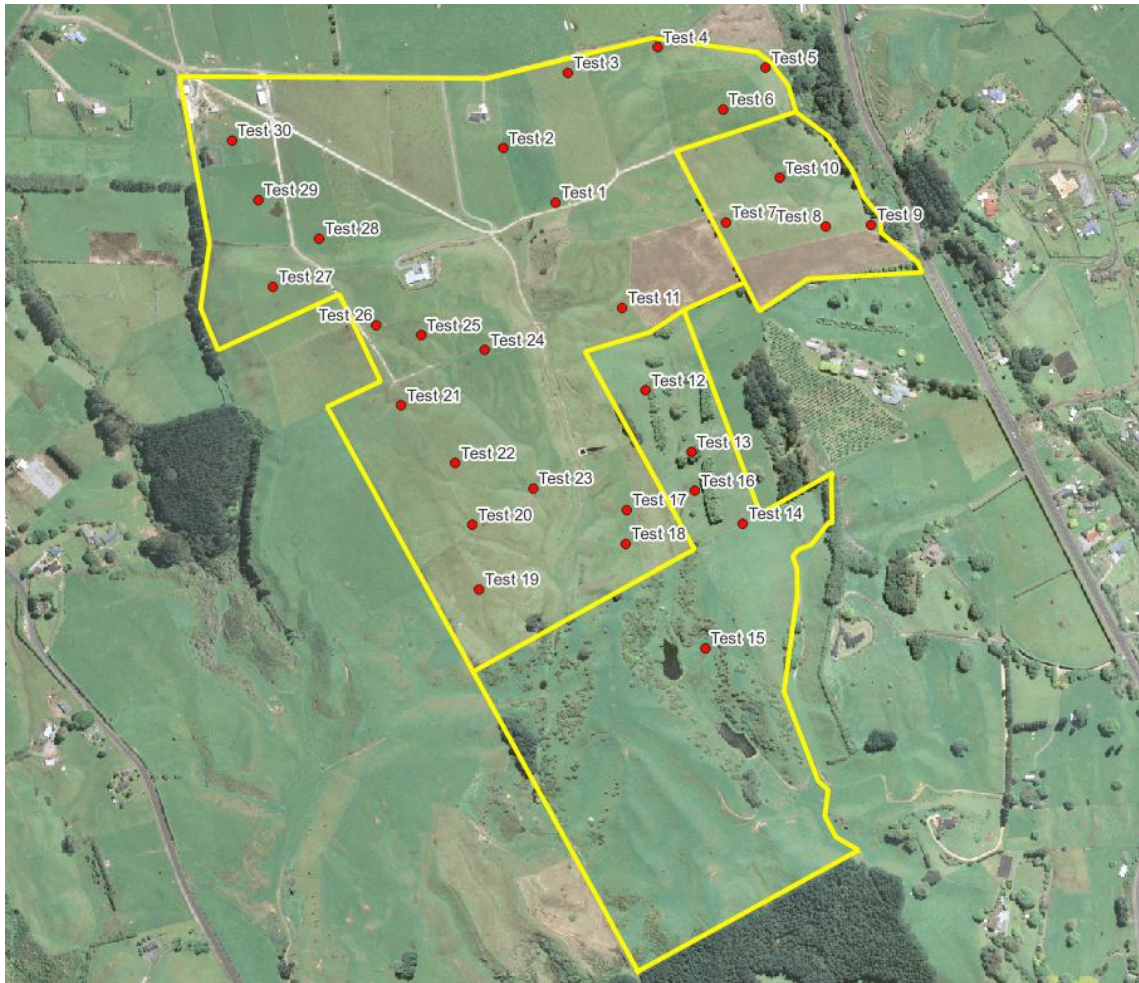


Figure 3: Hand auger test points

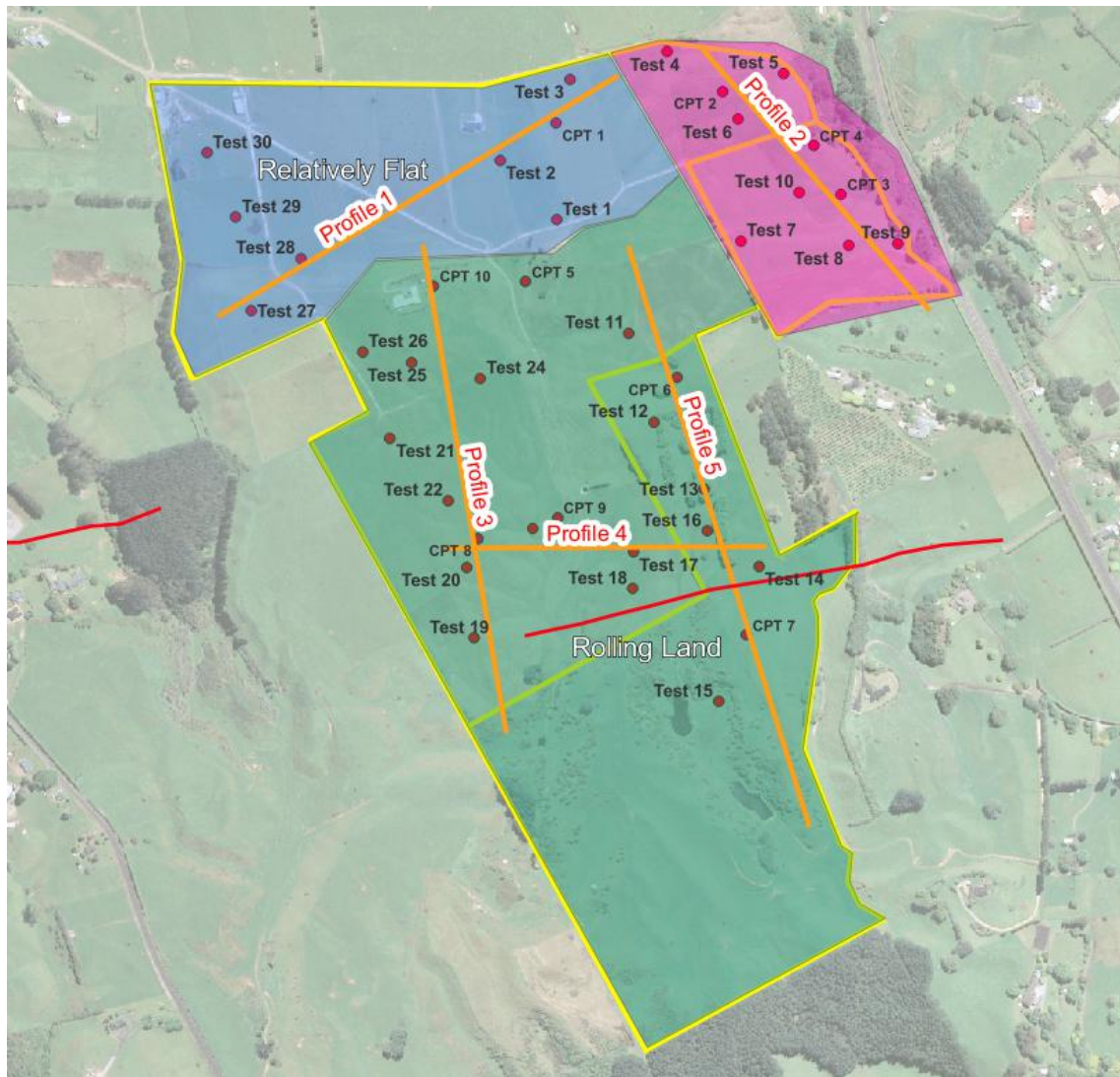


Figure 4: Test points and soil profile locations

3 Soil Type and Geological History

Dellow (2010) shows the soils locally to be Areas of volcanic - derived rocks and soils. Volcanic processes by their very nature are high energy. No soft ground is expected in zone A as the dominant processes preclude the conditions necessary for its development

Leonard, Begg, Wilson et al. (2010) shows the area as Middle Pleistocene igneous rocks and described as Welded, in places columnar jointed, rhyolite ignimbrite; pink to purple-grey vapour phase altered; minor fall deposits.

Landcare, SMAP shows the soils as Oturoa soil series. The soils are mapped west of Lake Rotorua on easy rolling to hilly land. Parent materials are Kaharoa and Taupo Tephra overlying Rotokawau Tephra, Mamaku Tephra, Waiohau Tephra and Rotorua Tephra. Soil profiles consist of very dark greyish brown sand (Kaharoa Tephra) overlying dark brown loamy sand with few Taupo lapilli. They rest on yellowish brown loamy sand and strong brown loamy sand with pockets of greyish brown weathered soft basalt which overly brown greasy sand. The soils are classified as Typic Orthic Pumice Soils.

Pullar and Vucetich show the eruption depths for this site to be approximately as per the table below:

Eruption Sequence	Depth of Deposit	Depth Below Ground	Age before present
Tarawera	0.3	0.3	50
Kaharoa	0.2	0.5	930
Whakatane	0.3	0.8	5,180
Mamaku	0.5	1.3	7,050
Rotoma	0.4	1.7	7,300
Waiohau	0.3	2.0	11,250
Rotorua	1.0	3.0	11,800
Rerewhakaaitu	0.3	3.3	14,700
Oruanui	0.4	3.7	20,000
Okareka	0.5	4.2	21,000
Mangaone	2.0	6.2	30,000
Rotoehu	1.4	7.6	41,000

Table 1: Summary of Eruptive Sequences

4 Liquefaction and lateral spread

CPT testing was undertaken spread out across the site.

CPT's either reached the target depth of 15m or were refused at a depth not less than 9m. Only one test (test 5) showed any ground water table. This test is in the middle of the central flow path, and showed a GWT of 3.85m below ground level.

Liquefaction analysis was undertaken for this test only.

Peak ground accelerations were calculated as per MBIE (2021), from Appendix 1.

This produces peak ground accelerations of 0.09g in the SLS and 0.36g for ULS events.

The serviceability limit state (SLS) is the event at which the building should still be structurally sound and should not need significant structural repair. The ultimate limit state is the event at which the structure should not be a hazard to human life.

NZS 1170 3.2 "Design Requirements" defines the limit states as follows:

- (a) To withstand extreme or frequently repeated actions, or both, occurring during its construction and anticipated use (resistance, deformability and static equilibrium requirements; that is, for safety). Specifically, for earthquake actions for ultimate limit states this shall mean—
- (i) avoidance of collapse of the structural system;
 - (ii) avoidance of collapse or loss of support of parts of the structure representing a hazard to human life inside and outside the structure or parts required for life safety systems; and
 - (iii) avoidance of damage to non-structural systems necessary for the building evacuation procedures that renders them inoperative.
- (b) So that it will not be damaged to an extent disproportionate to the original cause, by events like fire, explosion, impact or consequences of human error (robustness requirement).
- (c) To perform adequately under all expected actions (serviceability requirement).

Liquefaction analysis was undertaken using the method set out in Boulanger and Idriss (2014), and settlements calculated from Zhang, Robertson and Brachman (2002) ¹.

The SLS earthquake produces no expected settlement.

¹Python scripts, developed by Sigma Consultants Ltd, were used to produce the predicted settlements. The libraries have been posted on a public forum, and can be found at <https://github.com/atokelove/liquefactionLibraries>.

Liquefaction and settlement plots for 0.09g

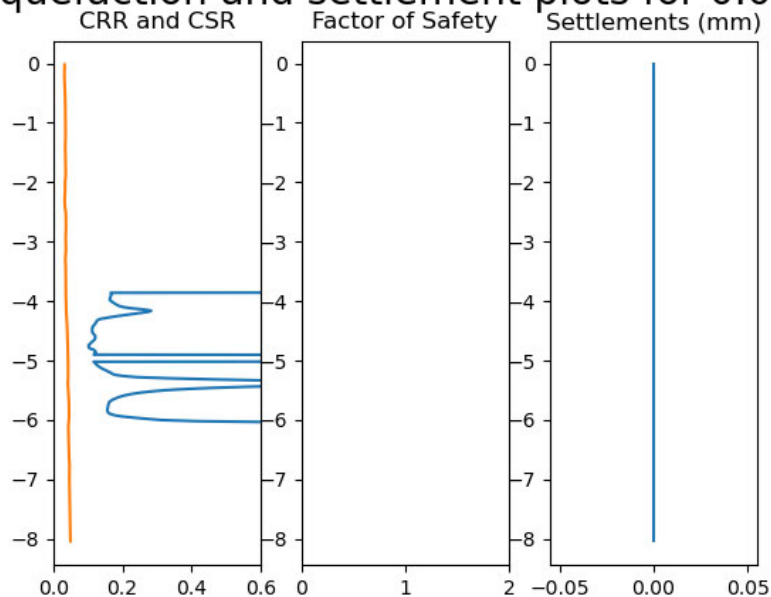


Figure 5: SLS Settlement Graph

The ULS earthquake produces a settlement of approximately 25mm.

Liquefaction and settlement plots for 0.36g

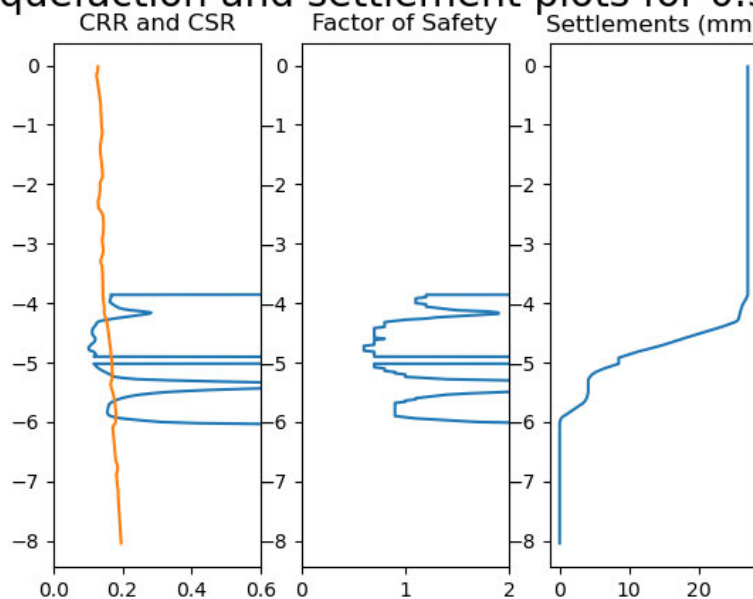


Figure 6: ULS Settlement Graph

As outlined above, this test is in a location where no lots are proposed, and was the only test with a recorded water table. Reviewing the requirements of Table 2 from Brunsdon et al. (2012) the development can be safely viewed as complying with TC 1.

Foundation Technical Category	Future land performance expectation from liquefaction	Nominal SLS land settlement	Nominal ULS land settlement	Nominal Lateral Stretch
TC1 (where confirmed)	Liquefaction damage is unlikely in a future large earthquake	0–15 mm	0–25 mm	Generally not expected
TC2 (where confirmed)	Liquefaction damage is possible in a future large earthquake	0–50 mm	0–100 mm	<50 mm
TC3 (where confirmed)	Liquefaction damage is possible in a future large earthquake	>50 mm	>100 mm	>50 mm
Un-categorised	Land in the uncategorised area will contain properties that experience future land performance as per one of the above categories. It also includes urban non-residential land, unmapped rural land, the Port Hills and Banks Peninsula. Normal consenting conditions apply. This may include the need for engaging a geotechnical engineer to determine the appropriate solution for the property, based on a site-specific assessment.	N/A	N/A	

Table 2: Summary of predicted settlements

5 Soft soils and settlement

Static settlement due to imposed loads were calculated using Robertson 2008, with a 20m x 15m foundation, as expected with a raft style footing, and a 10kPa load, as expected with a conventionally constructed modern house. Predicted settlements are as below.

CPT	Elastic settlement (mm)	50 year settlement (mm)
1	1.9	2.1
2	3.2	4
3	3.7	4
4	4.6	5.1
5	2	2.2
6	5.2	6
7	4	5
8	5.4	7
9	4.8	5.1
10	3	3.8

Table 3: Summary of static settlements

6 Fault Line Proximity

The GNS active faults database shows an active fault running through the southern portion of the property. A study commissioned by the owner undertaken by GNS indicates that this fault is of low concern.

7 Geothermal Hazards

The site is outside the Geothermal fields documented in the Rotorua District Plan. Therefore:

- Geothermal gas
- Geothermal eruptions
- Abandoned geothermal bores .
- Subsidence due to geothermal activity
- Hydrothermal eruption

Are all unlikely to affect the property

Part II

FLAT AREA

The flat area is denoted as the blue area in figure 1. The terrain in this region is plain land with gentle sloping. Auger and scala tests 1-3, 27 - 30 and CPT test 1 were done in this area. The soil profile for this region is profile 1 and is shown as figure 5, the y axis has been exaggerated by 20 for a better display.

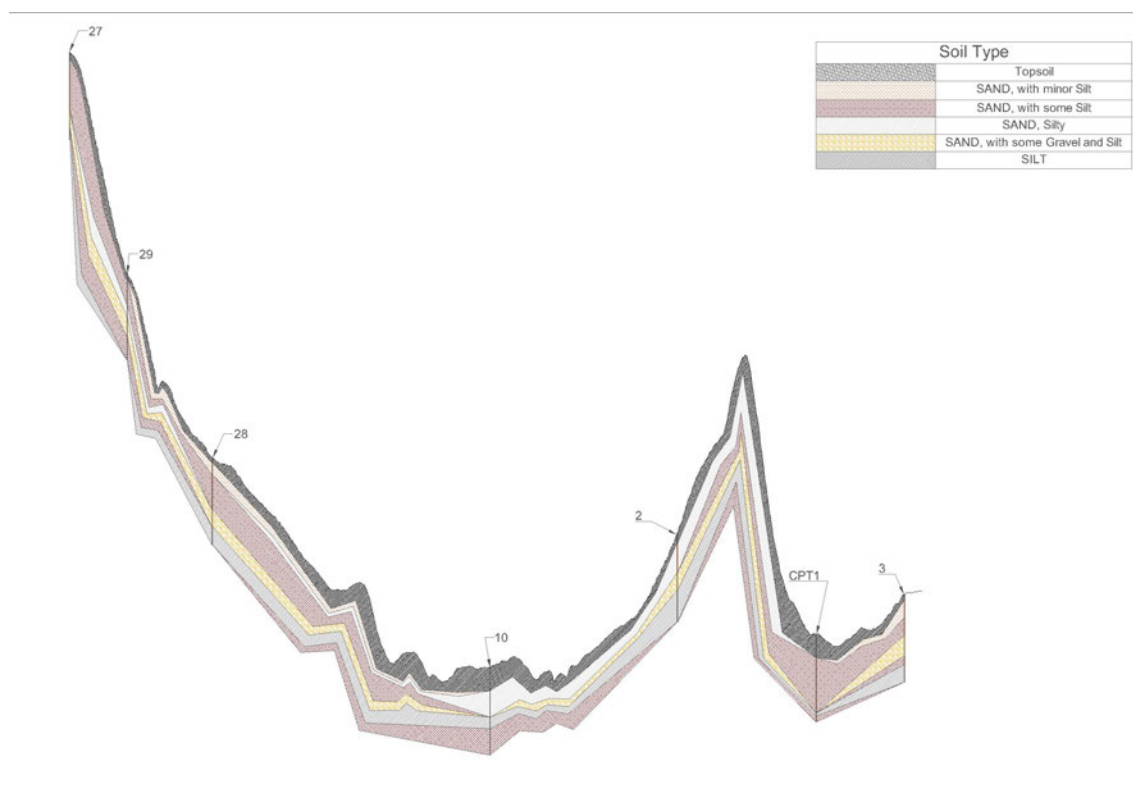


Figure 7: Soil profile 1

8 Soils Testing

Tables summarising the found soils are below:

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.6	1.00
SAND, with some Silt, Dark brown, Fine - Medium Sand, Moist	0.6 - 0.9	1.50
SAND, with minor Silt, Light brown, Fine, Moist - Dry	0.9 - 1.3	2.25
SAND, Silty, Dark brown, Fine, Moist	1.3 - 1.8	1.25
SAND, with some Silt, Brown, Fine - Medium Sand, Moist - Wet	1.8 - 2.2	1.50
SAND, Silty, with some Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet	2.2 - 2.7	1.00
SILT, with some Sand and minor Gravel, Grey with yellow spots, Medium - Coarse Sand, Moist - Wet	2.7 - 3	9.25

Table 4: Summary of Test 1

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.50
SAND, Silty, Orangish brown, Fine, Moist - Wet	0.3 - 1.3	2.75
SAND, Silty, with some Gravel, Orangish brown, Fine - Coarse Sand, Fine Gravel, Wet	1.3 - 1.9	6.00
SILT, with minor Sand and Gravel, Grey, Medium - Coarse Sand, Fine Gravel, Wet	1.9 - 2.7	6.25
SILT, with some Sand, Grey, Fine, Moist	2.7 - 3	4.25

Table 5: Summary of Test 2

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL,	0 - 0.2	1.50
SAND, with minor Silt, Black and brown, Fine, Moist	0.2 - 0.8	1.75
SAND, with some Silt, Dark brown, Fine, Moist	0.8 - 1.4	2.25
SAND, with some Silt and Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	1.4 - 2.1	5.25
SAND, with some Silt, Brown, Fine - Medium Sand, Moist	2.1 - 2.4	5.00
SILT, Sandy, Grey, Fine, Moist - Dry, Powdery	2.4 - 3	4.50

Table 6: Summary of Test 3

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.50
SAND, with some Silt, Yellow, Fine, Moist	0.3 - 2	3.25
SAND, with some Silt and minor Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	2 - 2.6	3.75
SILT, Brownish grey, Fine, Moist	2.6 - 3	2.25

Table 7: Summary of Test 27

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.2	1.50
SAND, with minor Silt, Greyish brown and black, Fine, Moist	0.2 - 0.6	1.00
SAND, with some Silt, Brown, Fine, Moist	0.6 - 1.8	1.75
SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	1.8 - 2.4	5.00
SILT, Grey, Fine, Moist	2.4 - 3	3.50

Table 8: Summary of Test 28

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.2	2.00
SAND, with some Silt, Brown, Fine, Moist - Dry	0.2 - 1.1	1.50
SAND, Silty, Yellow, Fine, Moist - Dry	1.1 - 1.5	2.75
SAND, Silty, with minor Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	1.5 - 2.2	3.50
SAND, with some Silt, Grey, Fine, Moist	2.2 - 3	4.25

Table 9: Summary of Test 29

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.6	1.50
SAND, Silty, Greyish brown, Fine - Medium Sand, Moist	0.6 - 2.1	2.00
SAND, Silty, with minor Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	2.1 - 2.5	3.50
SAND, with minor Silt and a trace of Gravel, Grey, Fine - Medium Sand, Medium Gravel, Moist - Dry	2.5 - 3	2.75

Table 10: Summary of Test 30

In general, a relatively thick layer of topsoil overlies silty sand and sand layers, becoming silty with depth. CPT test 1 shows generally sandy layers to refusal at 9.2m. The soils do not comply with the requirements of NZS 3604:2011.

9 Soft soils and settlement

Static settlement due to imposed loads were calculated using Robertson 2008, with a 20m x 15m foundation, as expected with a raft style footing, and a 10kPa load, as expected with a conventionally constructed modern house. This resulted in a 1.9 mm settlement, and a 2.1 mm long term settlement over 50 years. Damage due to load induced settlement is therefore highly unlikely. The settlements at 0 and 10m depth are summarized as below with graphs.

CPT	Settlement (mm)	50 year settlement (mm)
1	1.9	2.1

Table 11: Flat site CPT summary

Settlements Calculation according to theory of elasticity

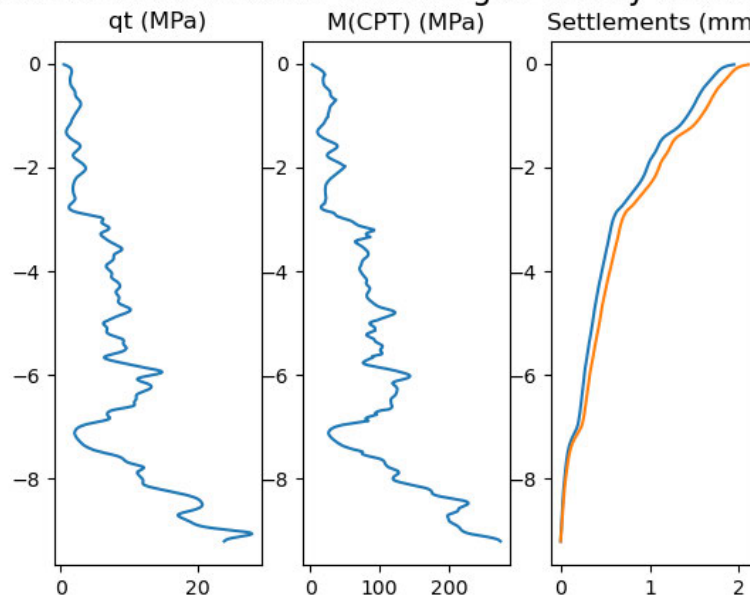


Figure 8: Settlement under static load 1

10 Preliminary proposed foundations

Further testing on each new lot should be undertaken before design of new structures on site is undertaken.

Before construction of new dwellings, the topsoil should be removed from the platforms, and replaced with competent fill material.

Based on the preliminary testing outlined above, raft slabs, in compliance with the Firth Ribraft manual, or other similar specification should be suitable for these sites.

Part III

AREA 2 - EAST SLOPE

The East slope area is shown in pink area in Figure 1. The area slopes gently from the eastern portion of area 1 to the approximate boundary of the lots with the proposed walkway / reserve area. The site then slopes at an approximate grade of 1(v) : 1.4(h). Auger and scala tests 2-10 and CPT tests 2-4 were done in this area. The soil profile for this region is profile 2 and is show as figure 7, the y axis has been exaggerated by 20 for a better display.

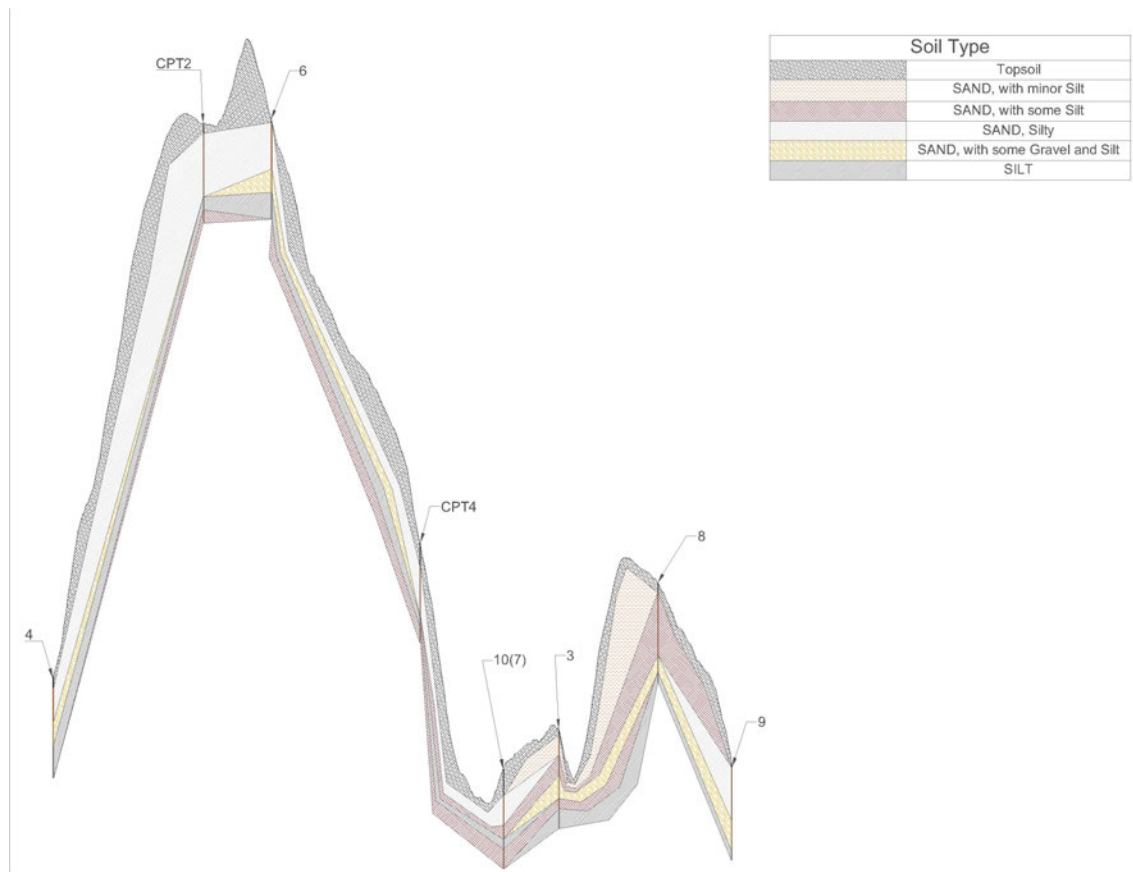


Figure 9: Soil profile 2

11 Soils Testing

Tables summarising the found soils are below:

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.75
SAND, Silty, Black and brown, Fine, Moist	0.3 - 1.3	1.75
SAND, with some Silt and Gravel, Yellow, Fine - Coarse	1.3 - 2	3.75
Sand, Fine Gravel, Moist		
SILT, Grey, Fine, Moist - Dry	2 - 3	4.00

Table 12: Summary of Test 4

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.2	2.50
SAND, with some Silt, Yellowish Brown and Dark Brown, Fine, Moist, becomes Silty with depth	0.2 - 1.5	2.00
SAND, Silty, with some Gravel, Yellow, with traces of Black, Fine - Coarse Sand, Fine Gravel, Moist - Wet	1.5 - 2.4	5.00
SILT, Grey, Fine, Moist, High Plasticity	2.4 - 3	2.50

Table 13: Summary of Test 5

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.1	1.00
SAND, Silty, Brownish orange, Fine, Moist	0.1 - 1.5	2.25
SAND, with some Silt and Gravel, Yellow with traces of black, Fine - Coarse Sand, Fine - Medium Gravel, Wet	1.5 - 2.2	4.50
SILT, Grey, Fine, Moist	2.2 - 3	4.50

Table 14: Summary of Test 6

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.75
SAND, Silty, Brown, Fine - Medium Sand, Moist	0.3 - 1.6	2.50
SAND, with some Silt and Gravel, Yellowish brown, Fine - Coarse Sand, Fine Gravel, Moist	1.6 - 2.2	3.25
SILT, Grey, Fine, Moist - Wet	2.2 - 3	6.00

Table 15: Summary of Test 7

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.50
SAND, Silty, Yellow and dark brown, Fine, Moist	0.3 - 2.2	3.00
SAND, with some Silt and a trace of Gravel, Yellowish and black, Fine - Coarse Sand, Fine Gravel, Moist	2.2 - 2.7	2.25
SILT, with some Sand, Grey, Fine - Medium Sand, Moist	2.7 - 3	2.75

Table 16: Summary of Test 8

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.2	1.00
SAND, Silty, Yellow and brown, Fine, Moist, More Silt with depth	0.2 - 1.8	2.00
SAND, Silty, with some Gravel, Yellow and brown, Fine - Coarse Sand, Fine Gravel, Wet	1.8 - 2.7	3.50
SILT, Grey, Fine, Moist - Wet	2.7 - 3	2.50

Table 17: Summary of Test 9

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.8	1.25
SAND, Silty, Brown and black, Fine, High Plasticity, Moist,	0.8 - 1.7	2.50
SAND, with some Silt, Brownish grey, Fine, Low Plasticity, Moist,	1.7 - 2.1	2.00
SAND, Silty, Brown, Fine, High Plasticity, Moist,	2.1 - 2.4	3.50
SAND, with some Silt, Brown, Fine - Medium Sand, Moist,	2.4 - 3	3.75

Table 18: Summary of Test 10

In general, a relatively thick layer of topsoil overlies silty sand and sand layers, becoming silty with depth.

CPT tests 2 and 4 show generally sandy layers to 4m, with a silt layer from 4 to roughly 9m. Sand and sand mixtures from 9 - 12m and silty layers below that.

CPT test 3 shows more generally sand layers, without the silts shown in the other nearby tests.

The soils do not comply with the requirements of NZS 3604:2011.

12 Soft soils and settlement

Static settlement due to imposed loads were calculated using Robertson 2008, with a 20m x 15m foundation, as expected with a raft style footing, and a 10kPa load, as expected with a conventionally constructed modern house. Predicted settlements are shown in the table below.

CPT	Settlement (mm)	50 year settlement (mm)
2	3.2	4
3	3.7	4
4	4.6	5.1

Table 19: East Sloping site CPT summary

Settlements Calculation according to theory of elasticity

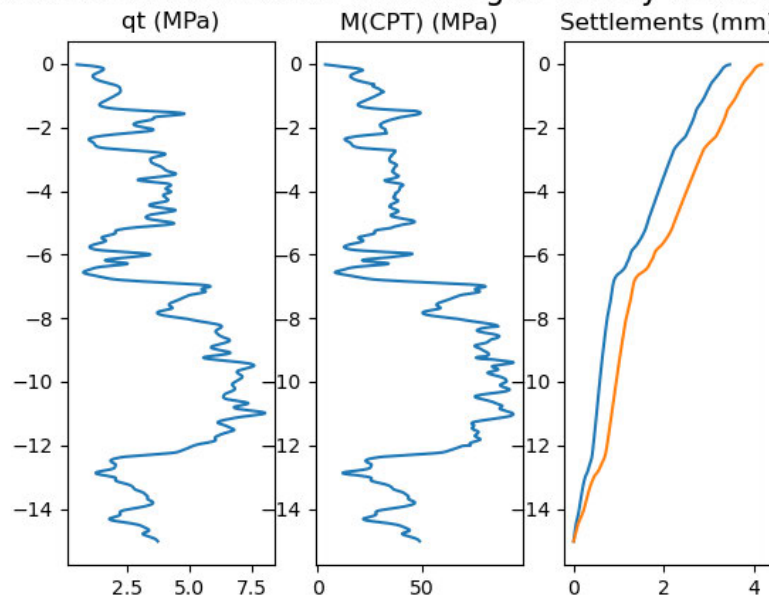


Figure 10: Settlement under static load 2

Settlements Calculation according to theory of elasticity

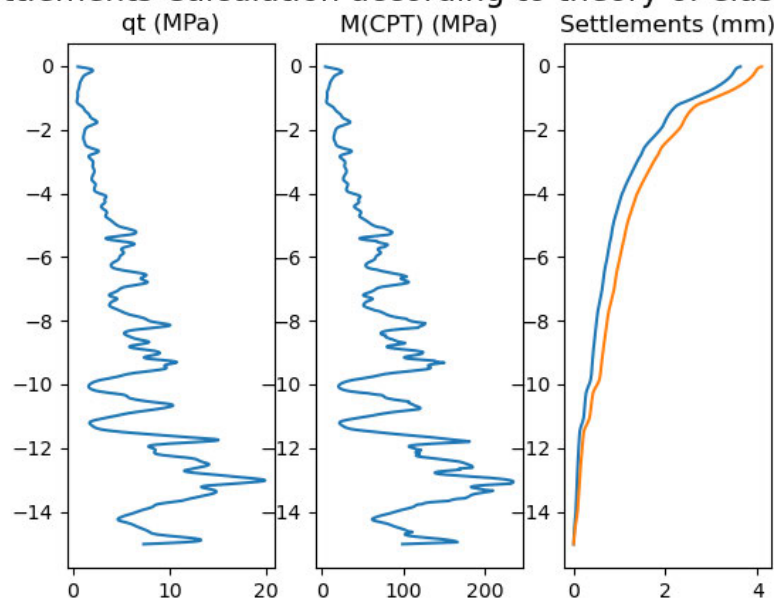


Figure 11: Settlement under static load 3

Settlements Calculation according to theory of elasticity

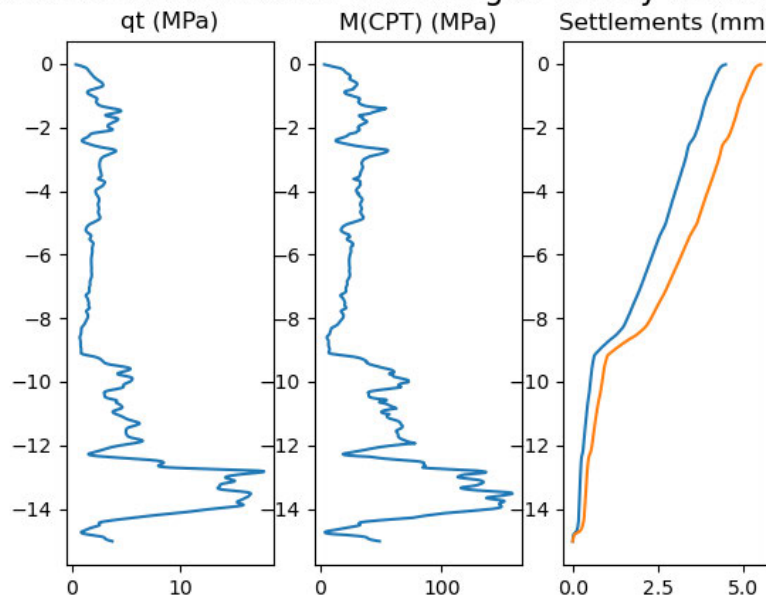


Figure 12: Settlement under static load 4

13 Slope stability

The current lot layout, including reserve / walkway areas and proposed building platforms were arranged to allow a 1:3 plane of regression from the base of the slope to the building platform. In the event that a structure is proposed outside of the platforms of lots 22 - 25 to the east of the proposed platforms, then specific engineering design should be undertaken, including slope stability analysis.

14 Preliminary proposed foundations

Further testing on each new lot should be undertaken before design of new structures on site is undertaken.

Before construction of new dwellings, the topsoil should be removed from the platforms, and replaced with competent fill material.

Based on the preliminary testing outlined above, raft slabs, in compliance with the Firth Ribraft manual, or other similar specification should be suitable for these sites.

Part IV

AREA 3 - ROLLING LAND

The rolling land area is shown as the green area in figure 1. The terrain in this region is rolling land with moderate slopes. Auger and scala tests 11-26 and CPT tests 5-10 were done in this area. The soil profile for this region is profile 3 - 5 (shown as figures 8-10), the y axis has been exaggerated by 20 for a better display. A fault line crosses the southern portion of this site running east - west, as shown in figures 1 and 4 above, and indicated in figure 13 below.

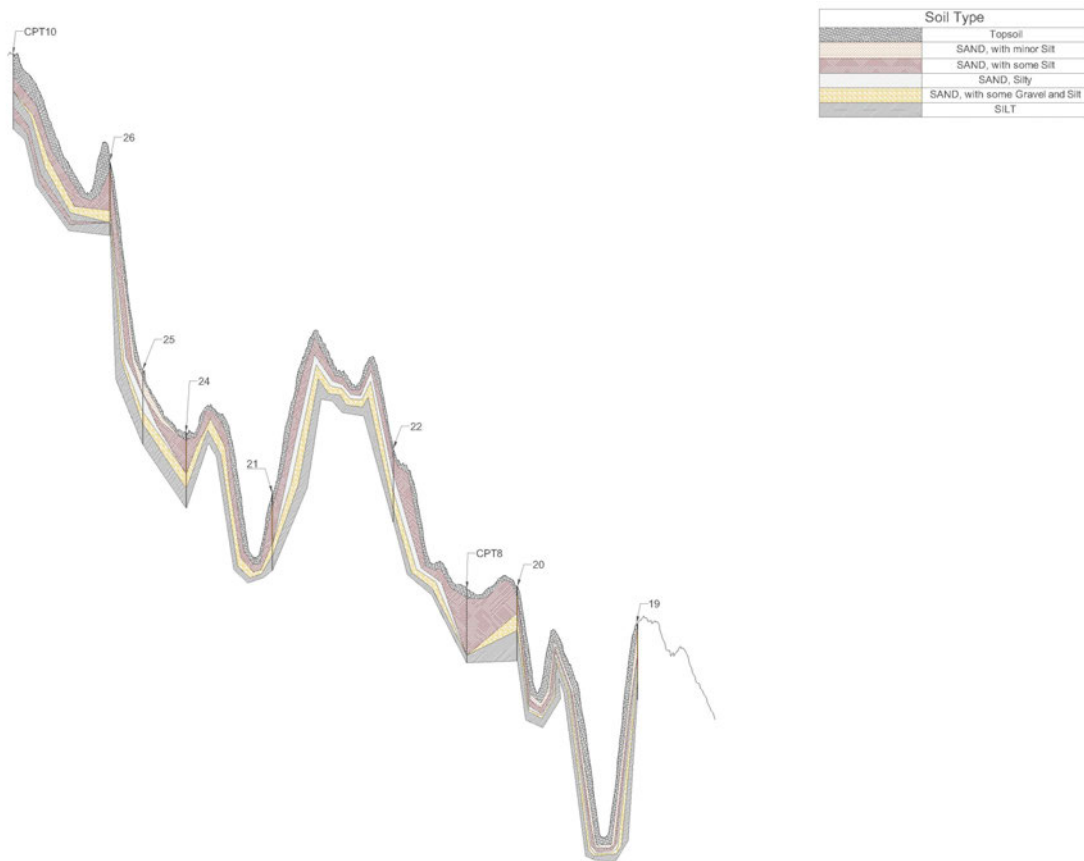


Figure 13: Soil profile 3

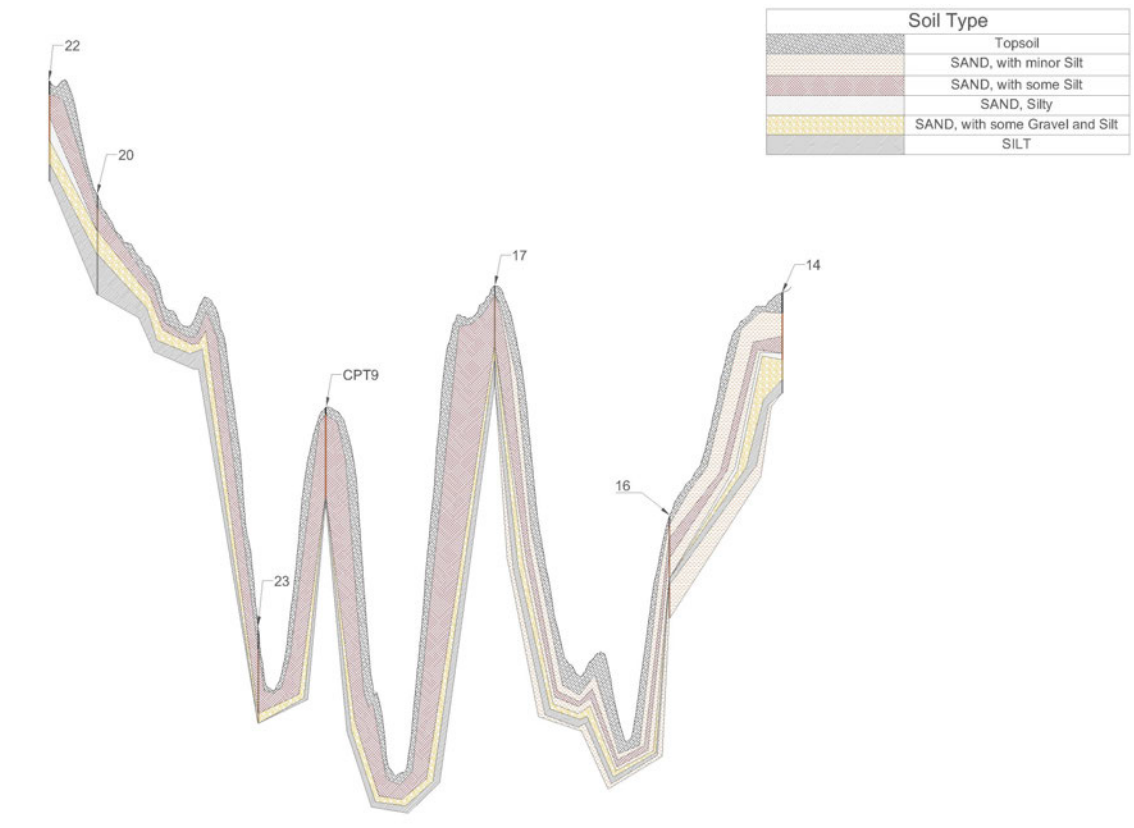


Figure 14: Soil profile 4

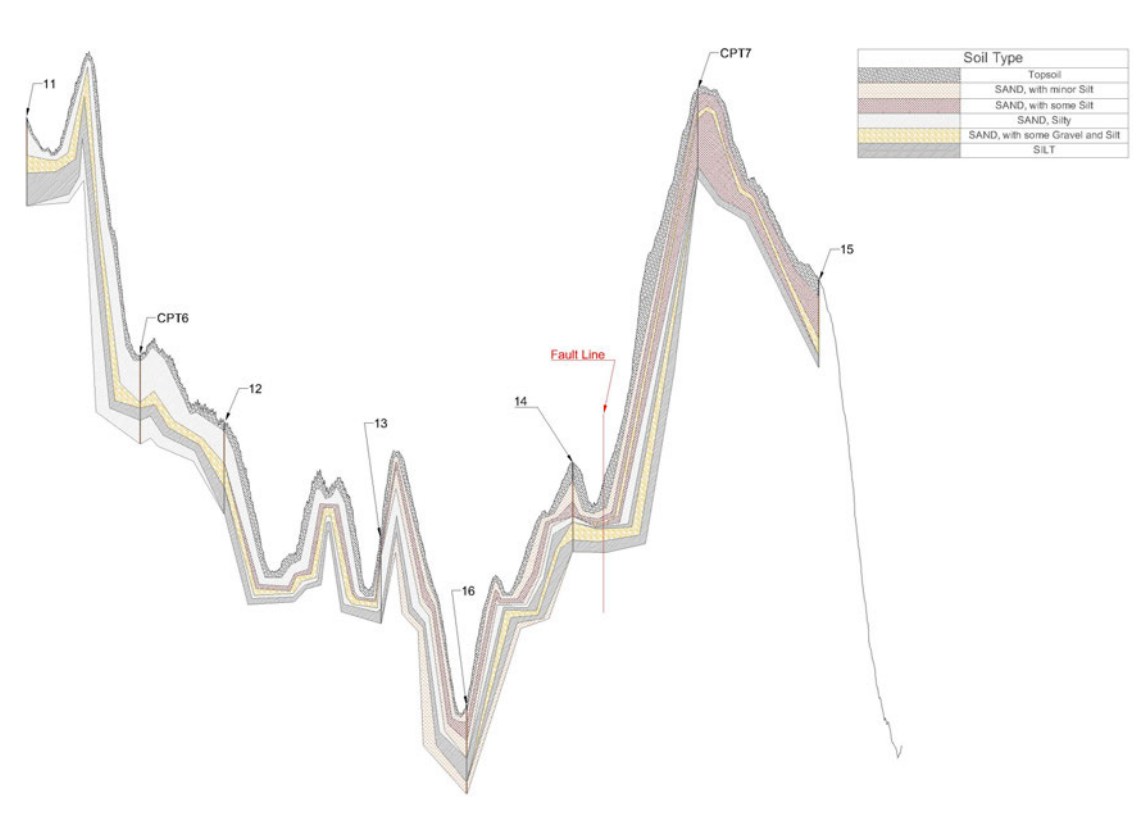


Figure 15: Soil profile 5

15 Soils Testing

Tables summarising the found soils are below:

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.75
SAND, Silty, Orangish brown, Fine, Moist - Wet	0.3 - 1.3	2.00
SAND, Silty, with some Gravel, Orangish yellow, Fine - Coarse Sand, Fine Gravel, Wet	1.3 - 1.9	4.00
SILT, with minor Sand and Gravel, Grey, Coarse Sand, Fine Gravel, Wet	1.9 - 2.7	3.25
SILT, with some Sand, Grey, Fine, Moist	2.7 - 3	4.25

Table 20: Summary of Test 11

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.2	1.50
SAND, Silty, Black and orange, Fine, Moist	0.2 - 1.3	2.25
SAND, with a trace of Silt and some Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet	1.3 - 2.1	4.50
SILT, Grey, Fine, Wet	2.1 - 3	2.75

Table 21: Summary of Test 12

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.4	1.25
SAND, with some Silt and a trace of Gravel, Black and brown, Fine - Coarse Sand, Fine Gravel, Moist	0.4 - 0.7	1.00
SAND, Silty, Dark brown, Fine - Coarse Sand, Moist	0.7 - 2.5	2.25
SILT, Sandy, Yellow and black, Fine, Wet	2.5 - 3	9.50

Table 22: Summary of Test 13

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.6	1.00
SAND, with minor Silt and a trace of Gravel, Yellow, Fine, Moist - Dry	0.6 - 1.3	2.00
SAND, with some Silt, Orange, Fine, Moist	1.3 - 1.8	3.50
SAND, Silty, Yellow and black, Fine - Medium Sand, Moist	1.8 - 2	4.00
SAND, Silty, with some Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet	2 - 2.6	4.25
SILT, with minor Sand and Gravel, Yellow and black, Medium - Coarse Sand, Fine Gravel, Wet	2.6 - 3	2.00

Table 23: Summary of Test 14

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.6	1.25
SAND, with some Silt, Brown and dark brown, Fine, Moist	0.6 - 2	2.25
SILT, with some Silt and Gravel, Fine - Coarse Sand, Fine Gravel, Fine, Moist	2 - 2.6	2.75
SILT, Sandy, Grey, Fine, Moist - Wet, Dense	2.6 - 3	2.75

Table 24: Summary of Test 15

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.6	1.25
SAND, with minor Silt, Brown and dark brown, Fine - Medium Sand, Moist - Dry	0.6 - 1.3	1.50
SAND, with some Silt, Brown, Fine, Moist - Dry	1.3 - 1.8	1.75
SAND, with minor Silt, Brownish grey, Fine, Moist	1.8 - 2	1.00
SAND, Silty, Brown and black, Fine - Medium Sand, Moist - Wet	2 - 2.6	2.50
SAND, with minor Silt, Grey, Fine - Medium Sand, Wet	2.6 - 3	3.25

Table 25: Summary of Test 16

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	2.00
SAND, Silty, Yellowish brown and Black, Fine - Medium Sand, Moist	0.3 - 0.9	2.25
SAND, with some Silt, Yellowish brown and Black, Fine, Moist	0.9 - 1.2	2.50
SAND, Silty, Yellowish brown and Black, Fine - Medium Sand, Moist	1.2 - 1.8	3.50
SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	1.8 - 2.2	4.75
SILT, Grey, Fine, Wet	2.2 - 3	3.00

Table 26: Summary of Test 17

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.5	1.25
SAND, with some Silt, Yellowish brown and black, Fine, Moist	0.5 - 1.3	2.00
SAND, Silty, Brown, Fine, Moist	1.3 - 2.1	2.25
SAND, with some Silt and Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet	2.1 - 2.7	5.00
SILT, with minor Sand, Grey and black, Fine, Moist - Wet	2.7 - 3	4.75

Table 27: Summary of Test 18

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.2	1.50
SAND, with minor Silt, Black and brown, Fine, Moist	0.2 - 1.3	2.75
SAND, Silty, Dark brown, Fine, Moist	1.3 - 1.8	2.75
SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist - Wet	1.8 - 2.3	4.50
SILT, Grey with black spots, Fine, Moist - Wet	2.3 - 3	2.75

Table 28: Summary of Test 19

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.4	1.25
SAND, with some Silt, Brown and dark brown, Fine, Moist	0.4 - 1.1	1.50
SAND, with some Silt and Gravel, Yellowish brown, Fine - Coarse Sand, Fine Gravel, Moist	1.1 - 1.8	3.25
SILT, with minor Sand, Grey with white dots Medium - Coarse Sand, Moist - Wet	1.8 - 2	5.50
SILT, Sandy, Grey, Fine, Moist	2 - 3	4.25

Table 29: Summary of Test 20

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.4	1.50
SAND, with some Silt, Yellow and dark brown, Fine, Moist	0.4 - 1.9	2.25
SAND, Silty, with some Gravel, Yellow and dark brown, Fine - Coarse Sand, Fine Gravel, Moist - Wet	1.9 - 2.4	4.75
SILT, Grey, Fine, Moist	2.4 - 3	3.00

Table 30: Summary of Test 21

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.4	1.50
SAND, with some Silt, Yellowish brown and black, Fine, Moist	0.4 - 1.1	1.50
SAND, Silty, Yellowish brown and black, Fine - Medium Sand, Moist	1.1 - 1.5	2.00
SAND, with minor Silt, Yellowish brown and black, Fine - Medium Sand, Moist	1.5 - 1.8	5.00
SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	1.8 - 2.5	5.00
SILT, Grey, Fine, Wet	2.5 - 3	3.00

Table 31: Summary of Test 22

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.8	1.25
SAND, with some Silt, Brown and black, Fine, Moist	0.8 - 2.7	4.00
SAND, with some Silt and Gravel, Brown, Fine - Coarse Sand, Fine Gravel, Moist	2.7 - 3	4.75

Table 32: Summary of Test 23

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	1.50
SAND, with some Silt and Gravel, Dark brown. Fine - Coarse Sand, Fine Gravel, Moist	0.3 - 0.8	1.50
SAND, with some Silt, Yellow, Fine, Moist	0.8 - 1.6	2.75
SAND, with minor Silt and some Gravel, Yellow and traces of black, Fine - Coarse Sand, Fine Gravel, Moist	1.6 - 2.2	5.25
SILT, Grey, Fine, Moist	2.2 - 3	3.25

Table 33: Summary of Test 24

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.3	2.00
SAND, with minor Silt, Yellowish brown, Fine, Moist - Dry,	0.3 - 1	1.25
SAND, Silty, Yellowish brown, Fine, Moist	1 - 1.7	2.75
SAND, with some Silt and Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	1.7 - 2.2	4.25
SILT, Grey, Fine, Moist	2.2 - 3	5.25

Table 34: Summary of Test 25

Soil Description	Depth	Average Scala Blows/ 100 mm
TOPSOIL	0 - 0.4	1.25
SAND, with some Silt, Yellowish brown, Fine, Moist	0.4 - 2	3.50
SAND, with minor Silt and some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist	2 - 2.5	5.00
SILT, with minor Sand, Brownish grey, Fine, Moist - Wet	2.5 - 3	3.25

Table 35: Summary of Test 26

16 Soft soils and settlement

Static settlement due to imposed loads were calculated using Robertson 2008, with a 20m x 15m foundation, as expected with a raft style footing, and a 10kPa load, as expected with a conventionally constructed modern house. This resulted in a average of 4.1mm settlement, and a 4.9mm long term settlement over 50 years. Damage due to load induced settlement is therefore highly unlikely. The settlements at 0 and 10m depth are summarized as below with graphs.

CPT	Settlement (mm)	50 year settlement (mm)
5	2	2.2
6	5.2	6
7	4	5
8	5.4	7
9	4.8	5.1
10	3	3.8

Table 36: Rolling land site CPT summary

Settlements Calculation according to theory of elasticity

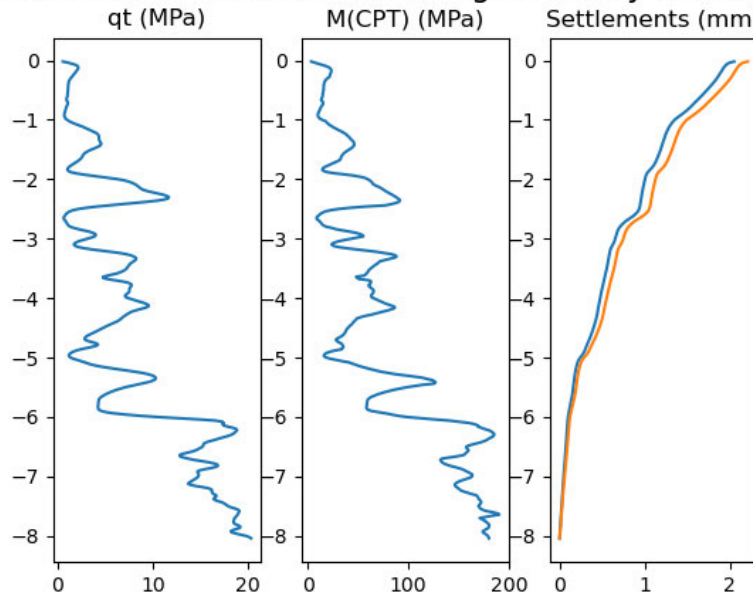


Figure 16: Settlement under static load 5

Settlements Calculation according to theory of elasticity

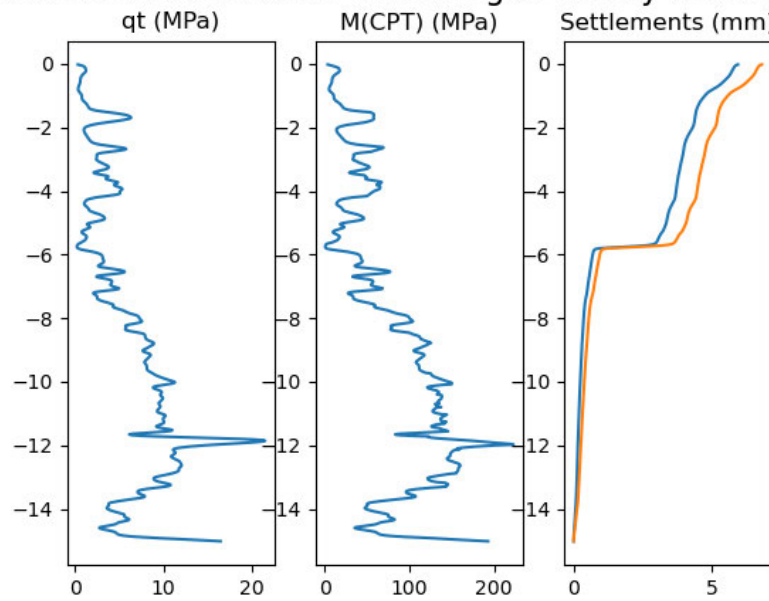


Figure 17: Settlement under static load 6

Settlements Calculation according to theory of elasticity

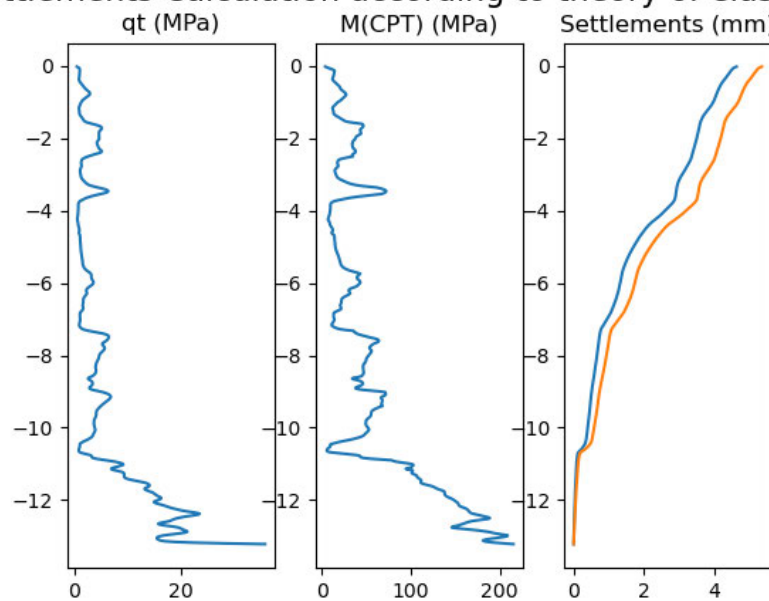


Figure 18: Settlement under static load 7

Settlements Calculation according to theory of elasticity

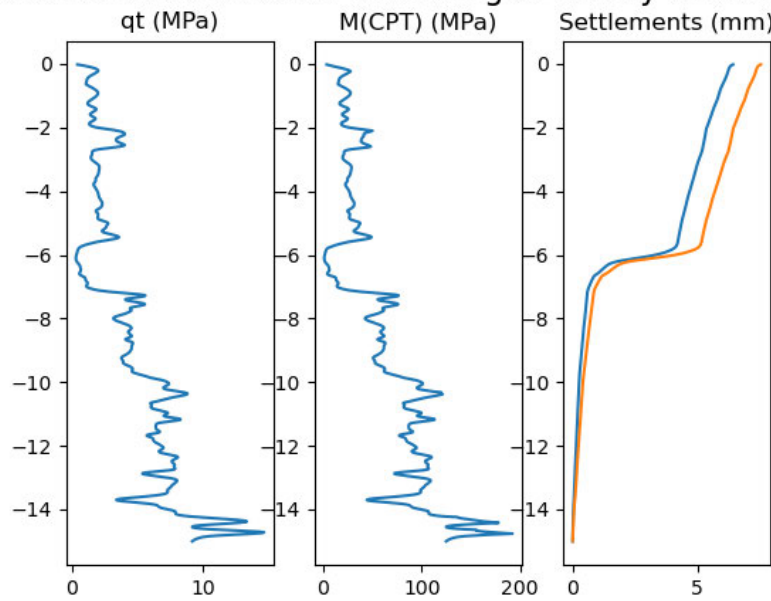


Figure 19: Settlement under static load 8

Settlements Calculation according to theory of elasticity

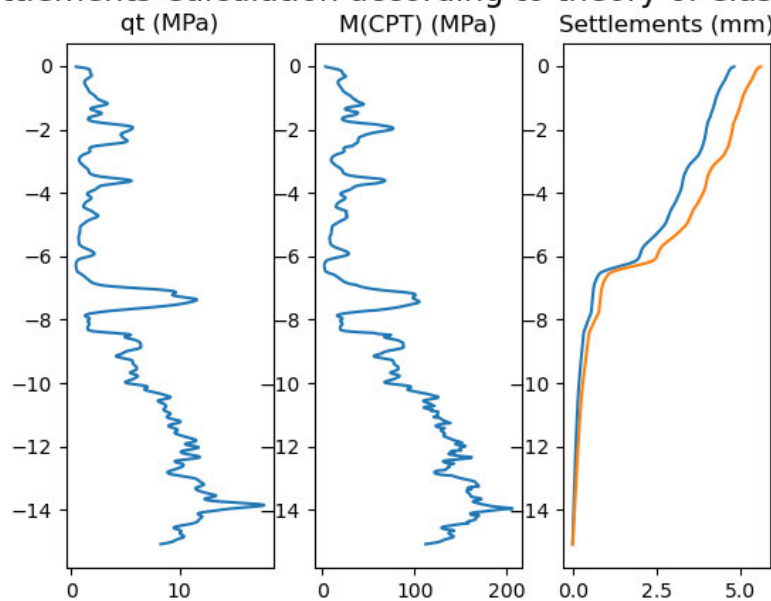


Figure 20: Settlement under static load 9

Settlements Calculation according to theory of elasticity

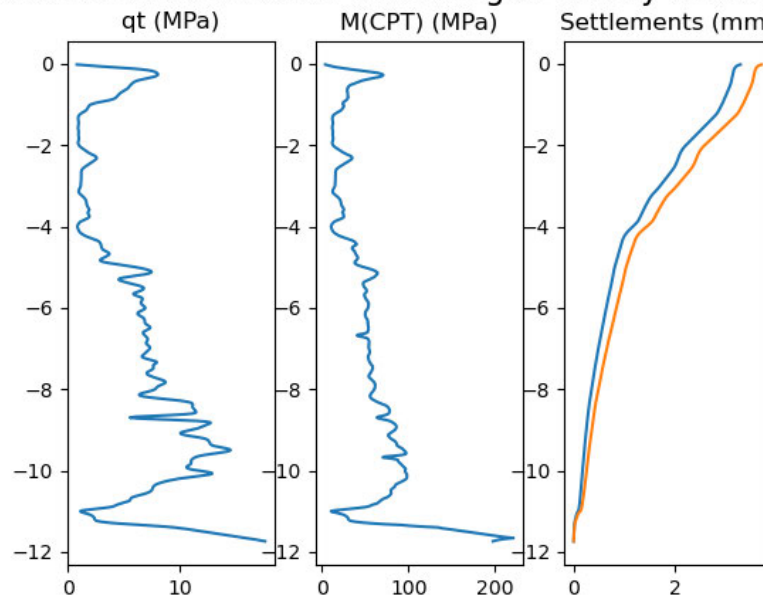


Figure 21: Settlement under static load 10

17 Statement of Professional Opinion

I Adam Paul Tokelove of Sigma Consultants Ltd hereby confirm that:

- I am a Chartered Professional Engineer experienced in the field of geotechnical engineering and was retained by the owner / developer as the Geotechnical Expert on the development outlined in this report.
- The extent of my inspections during construction, and the results of all tests carried out are described in this report.
- I confirm that I have given consideration to the level of complexity as identified in the Rotorua Civil Engineering Industry Standard Chapter 3.

This professional opinion is furnished to the Council and the owner / developer for their purposes alone on the express condition that it will not be relied on by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of the building.

Sigma Consultants Ltd

05 August 2022

Reviewed by

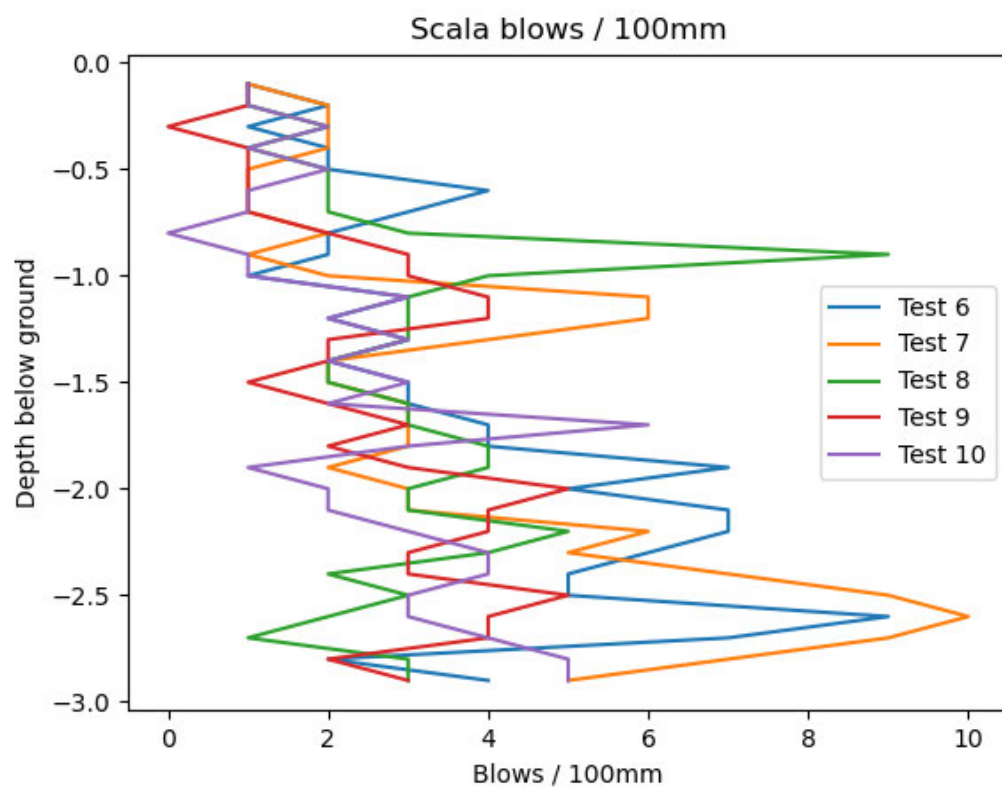
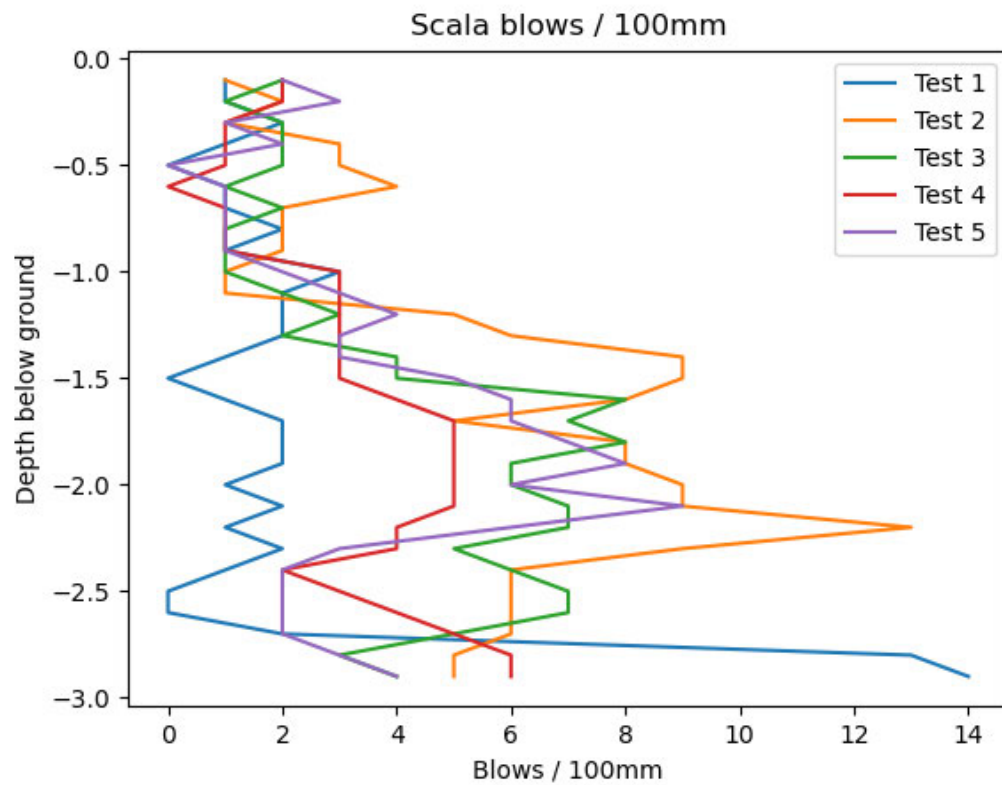
Adam Tokelove CMEngNZ, CPEng, IntPE(NZ)
Principal Civil Engineer, Sigma Consultants Ltd
05 August 2022

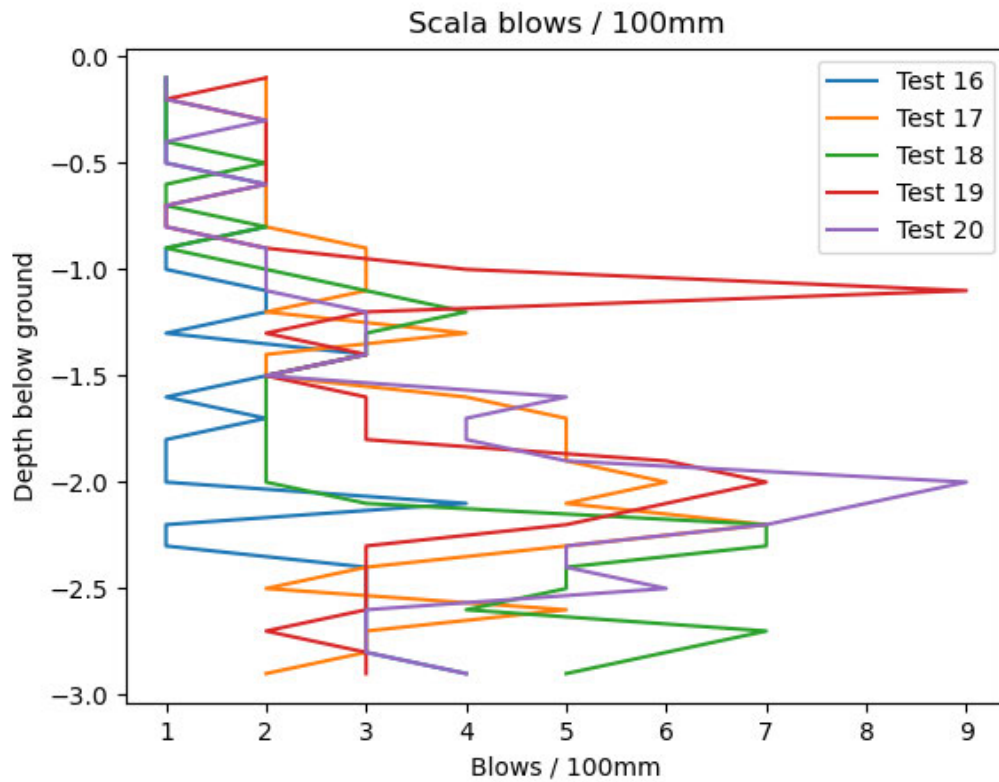
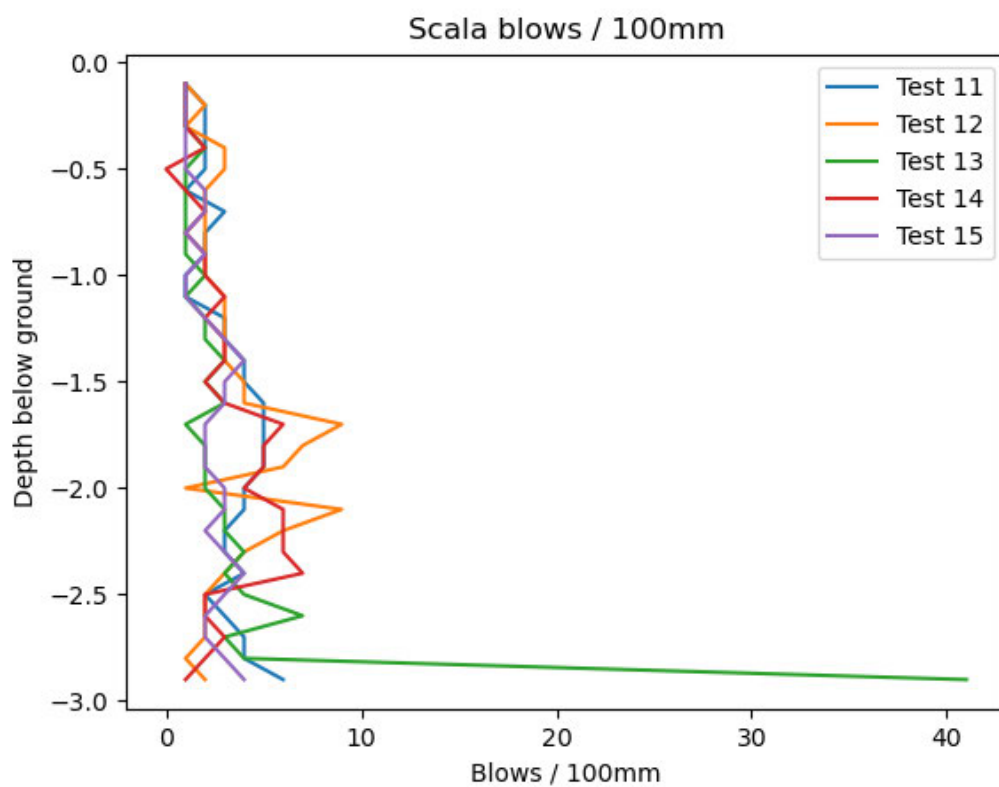
References

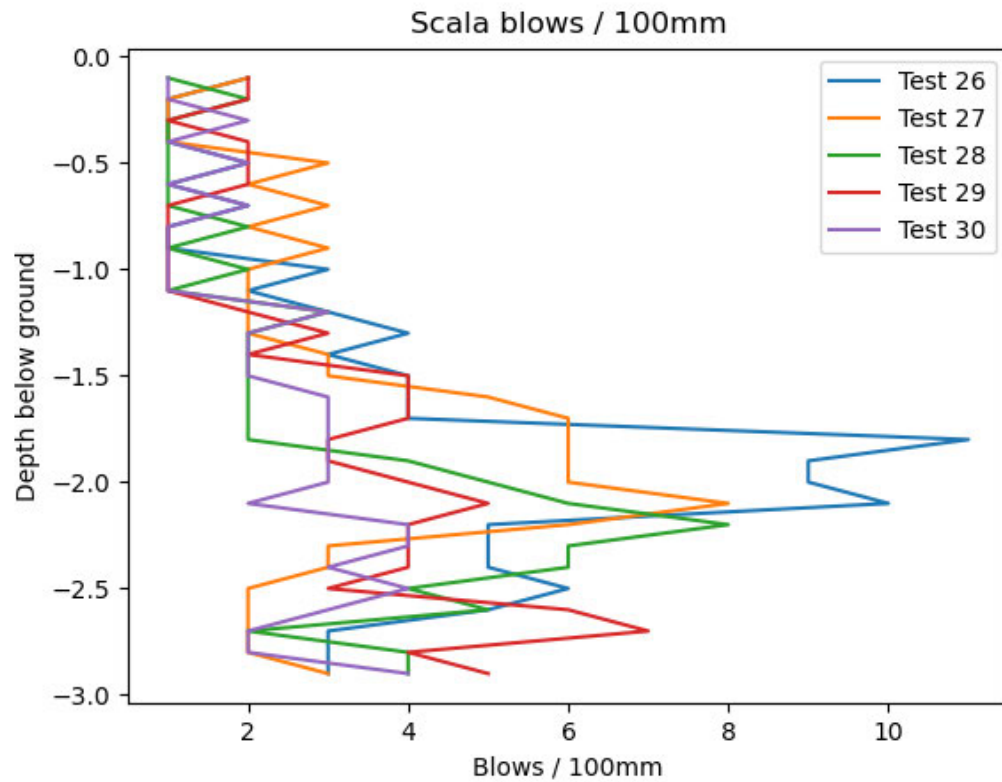
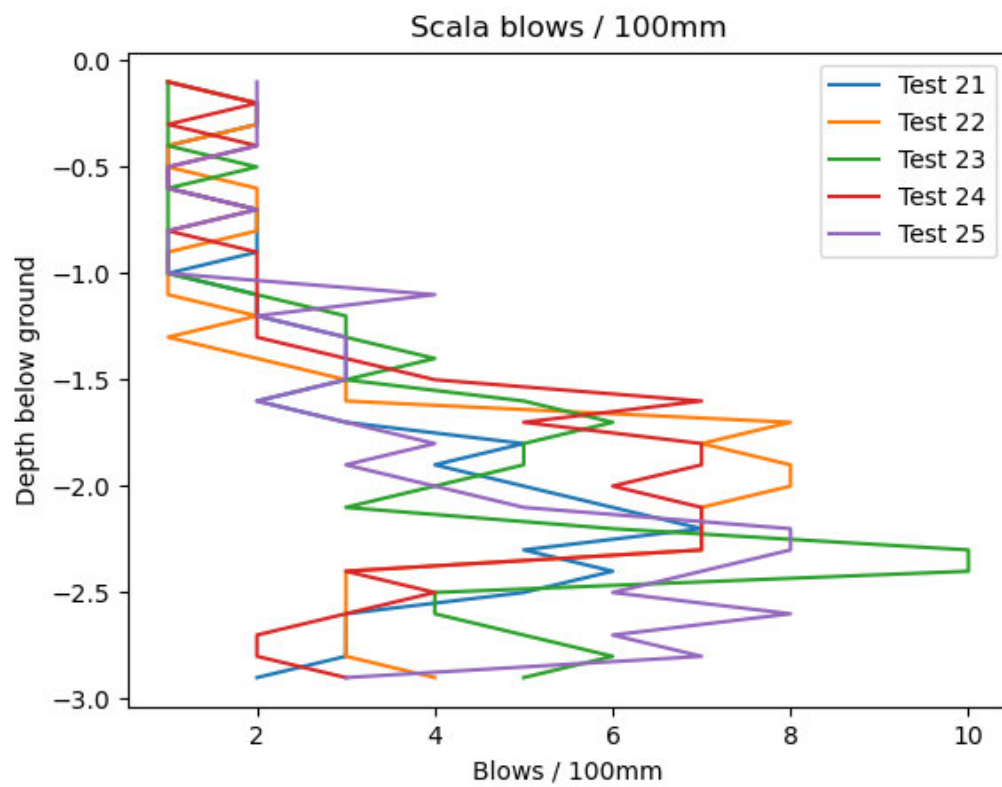
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Appendix 1 - Scala Graphs







Appendix 2 - Preliminary site plan



Figure 22: Initial Site plan

Appendix 3 - Borelogs



Engineering Log

Client Stuart Milsom
Principal Stuart Milsom
Project Geotechnical Report
Borehole Location Test 1

Borehole No. Test 1
Sheet: 1
Project No. 9047
Date Started 15/07/2022
Date Completed 15/07/2022
Logged by Drillcore
Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (remoulded or peak) kPa	Penetration resistance test																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
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Engineering Log

Client	Stuart Milsom
Principal	Stuart Milsom
Project	Geotechnical Report
Borehole Location	Test 2

Borehole No.	Test 2
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Sheet: 1
Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		Hole Diameter		Drilling Information		Material Substance		Material		Moisture condition		Consistency or density index		Penetration resistance test	
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Moisture condition	Consistency or density index	Penetration resistance test	blows / 100mm	blows / 100mm	blows / 100mm
				1.0			TOPSOIL								
				2.0			SAND, Silty, Orangish brown, Fine, Moist - Wet								
				2.5			SAND, Silty, with some Gravel, Orangish brown, Fine - Coarse Sand, Fine Gravel, Wet								
				3.0			SILT, with minor Sand and Gravel, Gery, Medium - Coarse Sand, Fine Gravel, Wet								
				3.5			SILT, with some Sand, Gery, Fine, Moist								
				3.8			End of hole								

Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005

Vane shear (kPa)

- Remoulded
- × Peak
- >>> Peak greater than 200kPa
- UTP Unable to penetrate

Water

01/01/2015 Water level on date shown

Water inflow

Water outflow

Moisture

D Dry

M Moist

W Wet

S Saturated

Consistency / Density Index

VS Very Soft

S Soft

F Firm

St Stiff

VSt Very Stiff

H Hard

VL Very Loose

L Loose

MD Medium Dense

D Dense

VD Very Dense

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 3

Borehole No. Test 3
 Sheet: 1
 Project No. 9047
 Date Started 15/07/2022
 Date Completed 15/07/2022
 Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
							SAND, with minor Silt, Black and brown, Fine, Moist				
				1.0			SAND, with some Silt, Dark brown, Fine, Moist				
				2.0			SAND, with some Silt and Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
							SAND, with some Silt, Brown, Fine - Medium Sand, Moist				
				3.0			SILT, Sandy, Grey, Fine, Moist - Dry, Powdery				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 4

Borehole No. Test 4

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear 100 (remoulded 150 or peak) kPa	Penetration resistance test blows / 100mm
				0.0			TOPSOIL				
				1.0			SAND, Silty, Black and brown, Fine, Moist				
				2.0			SAND, with some Silt and Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
				3.0			SILT, Grey, Fine, Moist - Dry				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ► Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 5

Borehole No. Test 5
 Sheet: 1
 Project No. 9047
 Date Started 15/07/2022
 Date Completed 15/07/2022
 Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material	Moisture condition	Consistency or density index	vane shear (remoulded or peak) kPa	Penetration resistance test
							Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.				blows / 100mm
							TOPSOIL				
				1.0			SAND, with some Silt, Yellowish Brown and Dark Brown, Fine, Moist, becomes Silty with depth				
				2.0			SAND, Silty, with some Gravel, Yellow, with traces of Black, Fine - Coarse Sand, Fine Gravel, Moist - Wet				
				3.0			SILT, Grey, Fine, Moist, High Plasticity				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ◄ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 6

Borehole No. Test 6

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore

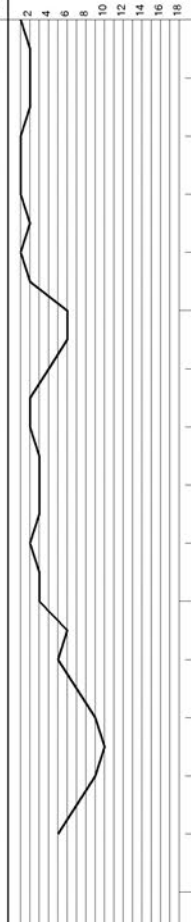
Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear kPa (remoulded 100 or peak) 150 or peak) 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0			SAND, Silty, Brownish orange, Fine, Moist				
				2.0			SAND, with some Silt and Gravel, Yellow with traces of black, Fine - Coarse Sand, Fine - Medium Gravel, Wet				
				3.0			SILT, Grey, Fine, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ► Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 7

Borehole No. Test 7
 Sheet: 1
 Project No. 9047
 Date Started 15/07/2022
 Date Completed 15/07/2022
 Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number											
Hole Diameter		50		Northing		Bearing		Datum													
Drilling Information				Material Substance																	
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear (remoulded 100 (remoulded 125 or peak) kPa 150 175	Penetration resistance test										
											blows / 100mm										
							TOPSOIL														
				1.0			SAND, Silty, Brown, Fine - Medium Sand, Moist														
				2.0			SAND, with some Silt and Gravel, Yellowish brown, Fine - Coarse Sand, Fine Gravel, Moist														
				3.0			SILT, Grey, Fine, Moist - Wet														
							End of hole														
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense											

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 8

Borehole No. Test 8

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (remoulded 100 (remoulded 150 or peak) kPa)	Penetration resistance test									
											blows / 100mm									
							TOPSOIL													
				1.0																
				2.0			SAND, Silty, Yellow and dark brown, Fine, Moist													
							SAND, with some Silt and a trace of Gravel, Yellowish and black, Fine - Coarse Sand, Fine Gravel, Moist													
				3.0			SILT, with some Sand, Grey, Fine - Medium Sand, Moist													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard		VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense								

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 9

Borehole No. Test 9
 Sheet: 1
 Project No. 9047
 Date Started 15/07/2022
 Date Completed 15/07/2022
 Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number																
Hole Diameter		50		Northing		Bearing		Datum																		
Drilling Information				Material Substance																						
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear (remoulded 100 (remoulded 125 or peak) kPa 150 175	Penetration resistance test															
											blows / 100mm															
							TOPSOIL																			
				1.0			SAND, Silty, Yellow and brown, Fine, Moist, More Silt with depth																			
				2.0			SAND, Silty, with some Gravel, Yellow and brown, Fine - Coarse Sand, Fine Gravel, Wet																			
				3.0			SILT, Grey, Fine, Moist - Wet																			
							End of hole																			
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard																

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 10

Borehole No. Test 10

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear log (remoulded 100 or peak) kPa	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
				0.0			TOPSOIL													
				1.0			SAND, Silty, Brown and black, Fine, High Plasticity, Moist,													
				2.0			SAND, with some Silt, Brownish grey, Fine, Low Plasticity, Moist,													
							SAND, Silty, Brown, Fine, High Plasticity, Moist,													
				3.0			SAND, with some Silt, Brown, Fine - Medium Sand, Moist,													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ◄ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 11

Borehole No. Test 11

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0			SAND, Silty, Orangish brown, Fine, Moist - Wet				
				2.0			SAND, Silty, with some Gravel, Orangish yellow, Fine - Coarse Sand, Fine Gravel, Wet				
				3.0			SILT, with minor Sand and Gravel, Grey, Coarse Sand, Fine Gravel, Wet				
							SILT, with some Sand, Grey, Fine, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 12

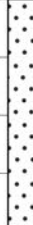
Borehole No. Test 12

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (remoulded 100 (remoulded 150 or peak) kPa)	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
				0.0			TOPSOIL													
				1.0			SAND, Silty, Black and orange, Fine, Moist													
				2.0			SAND, with a trace of Silt and some Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet													
				3.0			SILT, Grey, Fine, Wet													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 13

Borehole No. Test 13

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
							SAND, with some Silt and a trace of Gravel, Black and brown, Fine - Coarse Sand, Fine Gravel, Moist				
				1.0							
				2.0							
							SAND, Silty, Dark brown, Fine - Coarse Sand, Moist				
				3.0							
							SILT, Sandy, Yellow and black, Fine, Wet				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 14

Borehole No. Test 14

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (remoulded) (kPa)	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
							TOPSOIL													
				1.0			SAND, with minor Silt and a trace of Gravel, Yellow, Fine, Moist - Dry													
							SAND, with some Silt, Orange, Fine, Moist													
				2.0			SAND, Silty, Yellow and black, Fine - Medium Sand, Moist													
							SAND, Silty, with some Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet													
				3.0			SILT, with minor Sand and Gravel, Yellow and black, Medium - Coarse Sand, Fine Gravel, Wet													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 15

Borehole No. Test 15

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0							
				2.0			SAND, with some Silt. Brown and dark brown, Fine, Moist				
							SILT, with some Silt and Gravel, Fine - Coarse Sand, Fine Gravel, Fine, Moist				
				3.0			SILT, Sandy, Grey, Fine, Moist - Wet, Dense				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSst Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 16

Borehole No. Test 16

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (remoulded) (kPa)	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
							TOPSOIL													
				1.0			SAND, with minor Silt, Brown and dark brown, Fine - Medium Sand, Moist - Dry													
							SAND, with some Silt, Brown, Fine, Moist - Dry													
				2.0			SAND, with minor Silt, Brownish grey, Fine, Moist													
							SAND, Silty, Brown and black, Fine - Medium Sand, Moist - Wet													
				3.0			SAND, with minor Silt, Grey, Fine - Medium Sand, Wet													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) • Remoulded x Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ◄ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 17

Borehole No. Test 17

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number																
Hole Diameter		50		Northing		Bearing		Datum																		
Drilling Information				Material Substance																						
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test															
											blows / 100mm															
							TOPSOIL																			
				1.0			SAND, Silty, Yellowish brown and Black, Fine - Medium Sand, Moist																			
							SAND, with some Silt, Yellowish brown and Black, Fine, Moist																			
							SAND, Silty, Yellowish brown and Black, Fine - Medium Sand, Moist																			
				2.0			SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist																			
							SILT, Grey, Fine, Wet																			
				3.0			End of hole																			
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ◆ Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate				Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow				Moisture D Dry M Moist W Wet S Saturated				Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 18

Borehole No. Test 18

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type	NZ	Easting	Slope	R. L. Surface	Vane Number
Hole Diameter	50	Northing	Bearing	Datum	
Drilling Information		Material Substance			
Stratigraphy	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol
					Material
					Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.
					Moisture condition
					Consistency or density index
					Vane shear log (remoulded 150 or peak) kPa
					Penetration resistance test
					blows / 100mm
			1.0		TOPSOIL
			2.0		SAND, with some Silt, Yellowish brown and black, Fine, Moist
			2.5		SAND, Silty, Brown, Fine, Moist
			3.0		SAND, with some Silt and Gravel, Yellow and black, Fine - Coarse Sand, Fine Gravel, Moist - Wet
			3.5		SILT, with minor Sand, Grey and black, Fine, Moist - Wet
			3.8		End of hole
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005		Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow	
		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard	
				VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 19

Borehole No. Test 19

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Hole Diameter		50		Northing		Bearing		Datum																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																		
Drilling Information				Material Substance																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak)	Penetration resistance test																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
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Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 20

Borehole No. Test 20

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear log (remoulded 100 or peak) kPa	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
							TOPSOIL													
				1.0			SAND, with some Silt, Brown and dark brown, Fine, Moist													
							SAND, with some Silt and Gravel, Yellowish brown, Fine - Coarse Sand, Fine Gravel, Moist													
				2.0			SILT, with minor Sand, Grey with white dots Medium - Coarse Sand, Moist - Wet													
				3.0			SILT, Sandy, Grey, Fine, Moist													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ▶ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 21

Borehole No. Test 21

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0							
				2.0			SAND, with some Silt, Yellow and dark brown, Fine, Moist				
							SAND, Silty, with some Gravel, Yellow and dark brown, Fine - Coarse Sand, Fine Gravel, Moist - Wet				
				3.0			SILT, Grey, Fine, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 22

Borehole No. Test 22

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear kPa (remoulded 100 or peak) 150 or peak) 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0			SAND, with some Silt, Yellowish brown and black, Fine, Moist				
							SAND, Silty, Yellowish brown and black, Fine - Medium Sand, Moist				
				2.0			SAND, with minor Silt, Yellowish brown and black, Fine - Medium Sand, Moist				
							SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
				3.0			SILT, Grey, Fine, Wet				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ▲ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 23

Borehole No. Test 23

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0							
				2.0			SAND, with some Silt, Brown and black, Fine, Moist				
				3.0			SAND, with some Silt and Gravel, Brown, Fine - Coarse Sand, Fine Gravel, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSst Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 24

Borehole No. Test 24

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (kPa) (remoulded or peak)	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
							TOPSOIL													
							SAND, with some Silt and Gravel, Dark brown. Fine - Coarse Sand, Fine Gravel, Moist													
				1.0			SAND, with some Silt, Yellow, Fine, Moist													
				2.0			SAND, with minor Silt and some Gravel, Yellow and traces of black, Fine - Coarse Sand, Fine Gravel, Moist													
				3.0			SILT, Grey, Fine, Moist													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard VL Very Loose L Loose MD Medium Dense D Dense VD Very Dense										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 25

Borehole No. Test 25

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0			SAND, with minor Silt, Yellowish brown, Fine, Moist - Dry,				
							SAND, Silty, Yellowish brown, Fine, Moist				
				2.0			SAND, with some Silt and Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
				3.0			SILT, Grey, Fine, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ◆ Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 26

Borehole No. Test 26

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear 100 (remoulded 150 or peak) kPa	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
							TOPSOIL													
				1.0																
				2.0			SAND, with some Silt, Yellowish brown, Fine, Moist													
							SAND, with minor Silt and some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist													
				3.0			SILT, with minor Sand, Brownish grey, Fine, Moist - Wet													
							End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard										

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 27

Borehole No. Test 27

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore
 Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0							
				2.0			SAND, with some Silt, Yellow, Fine, Moist				
							SAND, with some Silt and minor Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
				3.0			SILT, Brownish grey, Fine, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 28

Borehole No. Test 28

Sheet: 1
 Project No. 9047

Date Started 15/07/2022
 Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure. Grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear kPa (remoulded 100 or peak) 150 or peak) 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0			SAND, with minor Silt, Greyish brown and black, Fine, Moist				
				2.0			SAND, with some Silt, Brown, Fine, Moist				
				3.0			SAND, Silty, with some Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
							SILT, Grey, Fine, Moist				
							End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak >>> Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ► Water inflow ▲ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 29

Borehole No. Test 29

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

Date Completed 15/07/2022

Logged by Drillcore

Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number	
Hole Diameter		50		Northing		Bearing		Datum			
Drilling Information				Material Substance							
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, Grading, bedding, plasticity, sensitivity, Secondary and minor components, additional information.	Moisture condition	Consistency or density index	vane shear kPa (remoulded or peak) 25 50 75 100 125 150 175	Penetration resistance test
											blows / 100mm
							TOPSOIL				
				1.0			SAND, with some Silt, Brown, Fine, Moist - Dry				
							SAND, Silty, Yellow, Fine, Moist - Dry				
				2.0			SAND, Silty, with minor Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist				
							SAND, with some Silt, Grey, Fine, Moist				
				3.0			End of hole				
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak ××× Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown ▶ Water inflow ◀ Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard	

Engineering Log

Client Stuart Milsom
 Principal Stuart Milsom
 Project Geotechnical Report
 Borehole Location Test 30

Borehole No. Test 30

Sheet: 1
 Project No. 9047

Date Started 15/07/2022

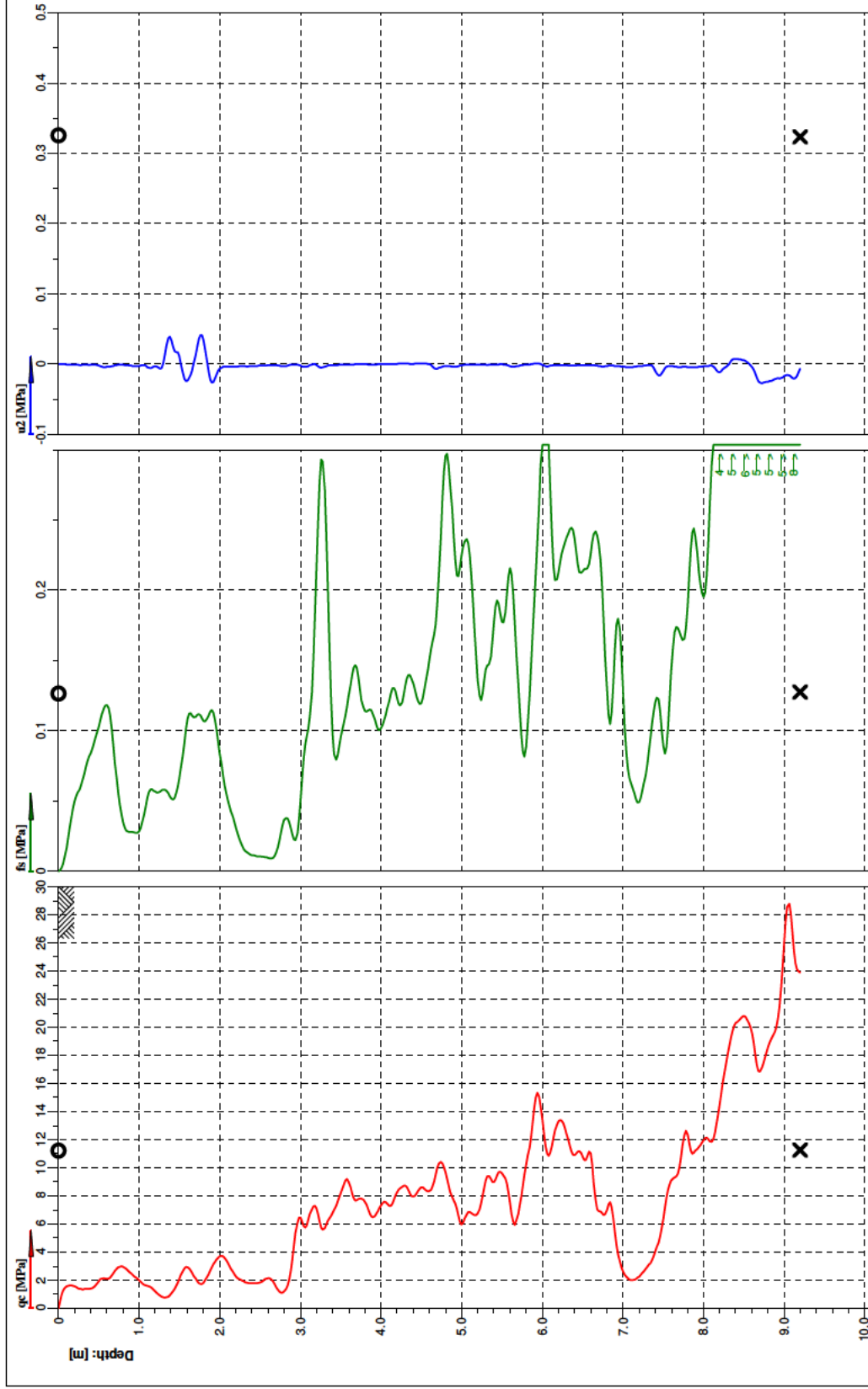
Date Completed 15/07/2022

Logged by Drillcore

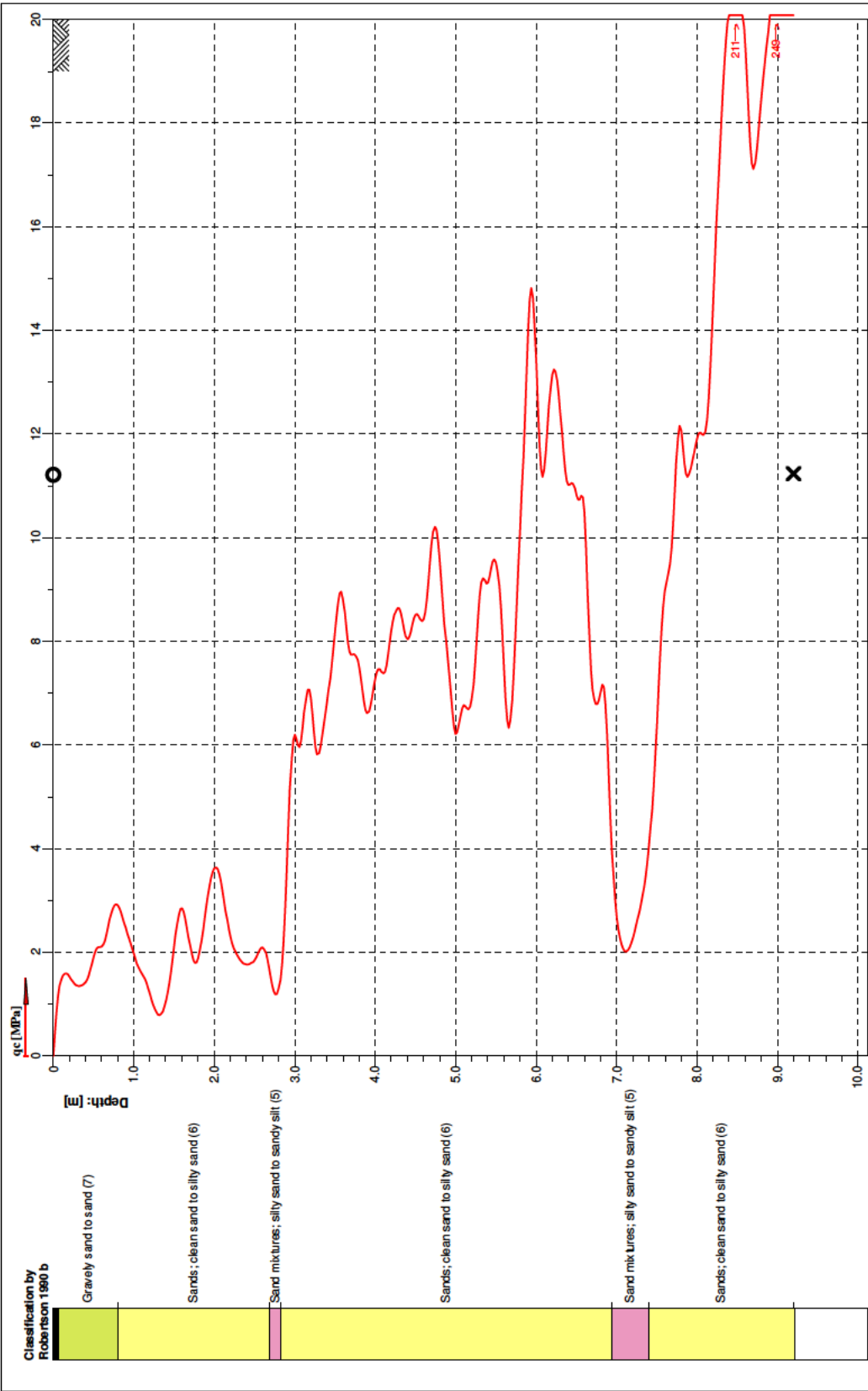
Checked by APT

Penetrometer type		NZ		Easting		Slope		R. L. Surface		Vane Number										
Hole Diameter		50		Northing		Bearing		Datum												
Drilling Information				Material Substance																
Stratigraphy	Water	Notes samples, tests, etc	RL	Depth metres	Graphic log	Classification symbol	Material Soil type, colour, structure, grading, bedding, plasticity, sensitivity. Secondary and minor components, additional information.	Moisture condition	Consistency or density index	Vane shear (remoulded 100 (remoulded 125 or peak) kPa 150 175)	Penetration resistance test									
											blows / 100mm									
											2	4	6	8	10	12	14	16	18	
				0.0			TOPSOIL													
				1.0																
				2.0			SAND, Silty, Greyish brown, Fine - Medium Sand, Moist													
				2.5			SAND, Silty, with minor Gravel, Yellow, Fine - Coarse Sand, Fine Gravel, Moist													
				3.0			SAND, with minor Silt and a trace of Gravel, Grey, Fine - Medium Sand, Medium Gravel, Moist - Dry													
				3.5			End of hole													
Classification symbols and soil description based on Field Description of Soil and Rock, New Zealand Geotechnical Society Inc 2005				Vane shear (kPa) ● Remoulded × Peak → Peak greater than 200kPa UTP Unable to penetrate		Water ▼ 01/01/2015 Water level on date shown → Water inflow → Water outflow		Moisture D Dry M Moist W Wet S Saturated		Consistency / Density Index VS Very Soft VL Very Loose S Soft L Loose F Firm MD Medium Dense St Stiff D Dense VSt Very Stiff VD Very Dense H Hard										

Appendix 4 - CPT tests



Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m		Ground level:	0.00	Test No.:	CPT01
Project ID:	S38.03119 E176.21184	Client:	Sigma Consultants Ltd		Date:	6/07/2022	Scale:	1 : 64
Project:	66 MCFETRIDGE DRIVE				Page:	1/2	Fig.:	
Target depth 15m. Refused at 9.20m. No water detected.								
						File:	CPT01.cpt	





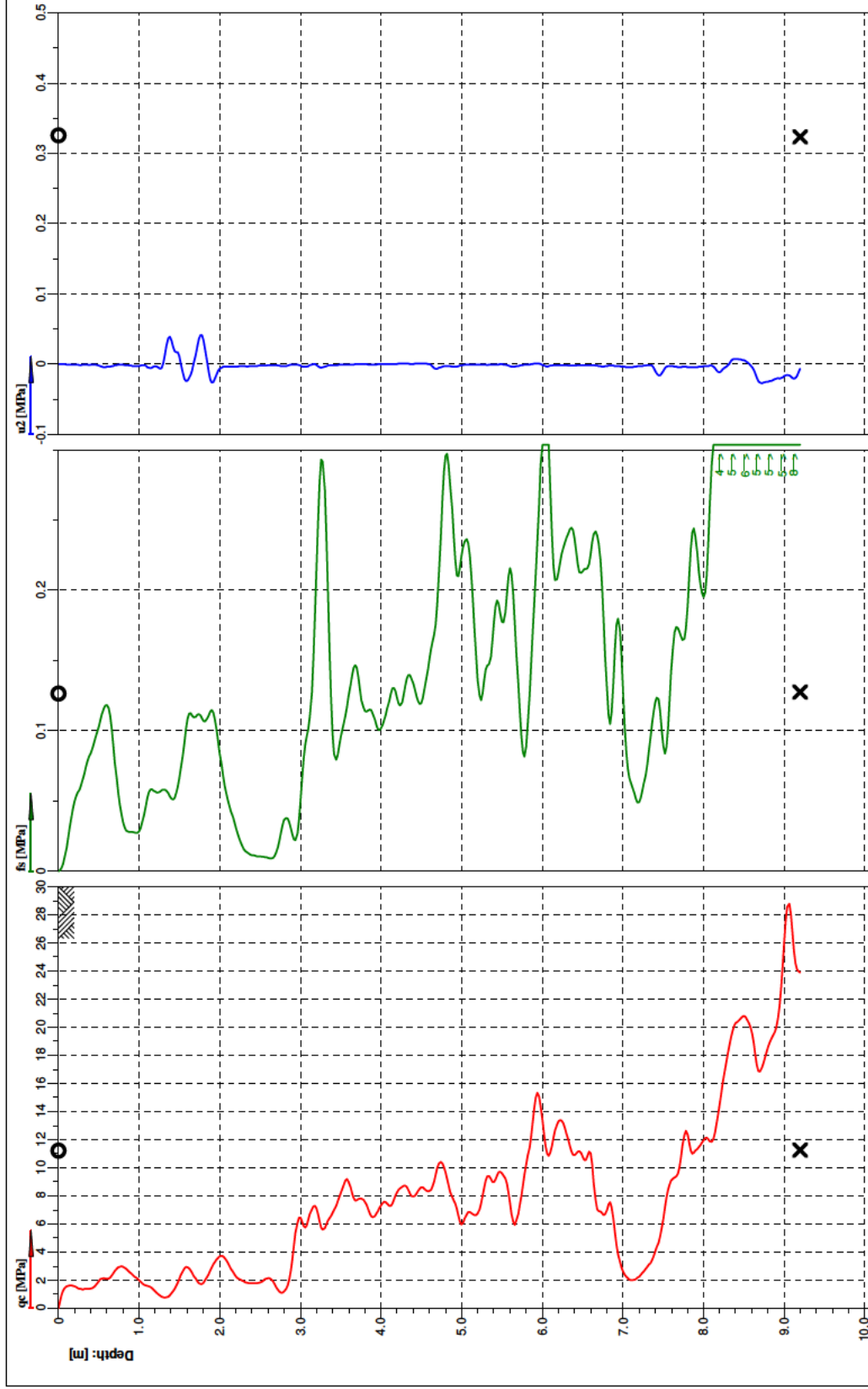
Cone No. : 4670	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT01
Tip area [cm²]: 10	Client:	Sigma Consultants Ltd	Date:	6/07/2022	Scale:	1 : 64
Sleeve area [cm²]: 150	Project:	S38.03119 E176.21184	Page:	2/2	Fig.:	
66 MCFETRIDGE DRIVE			File:	CPT01.cpt		
Target depth 15m. Refused at 9.20m. No water detected.						



Core No: 4670

Tip area [cm²]: 10

Sleeve area [cm²]: 160

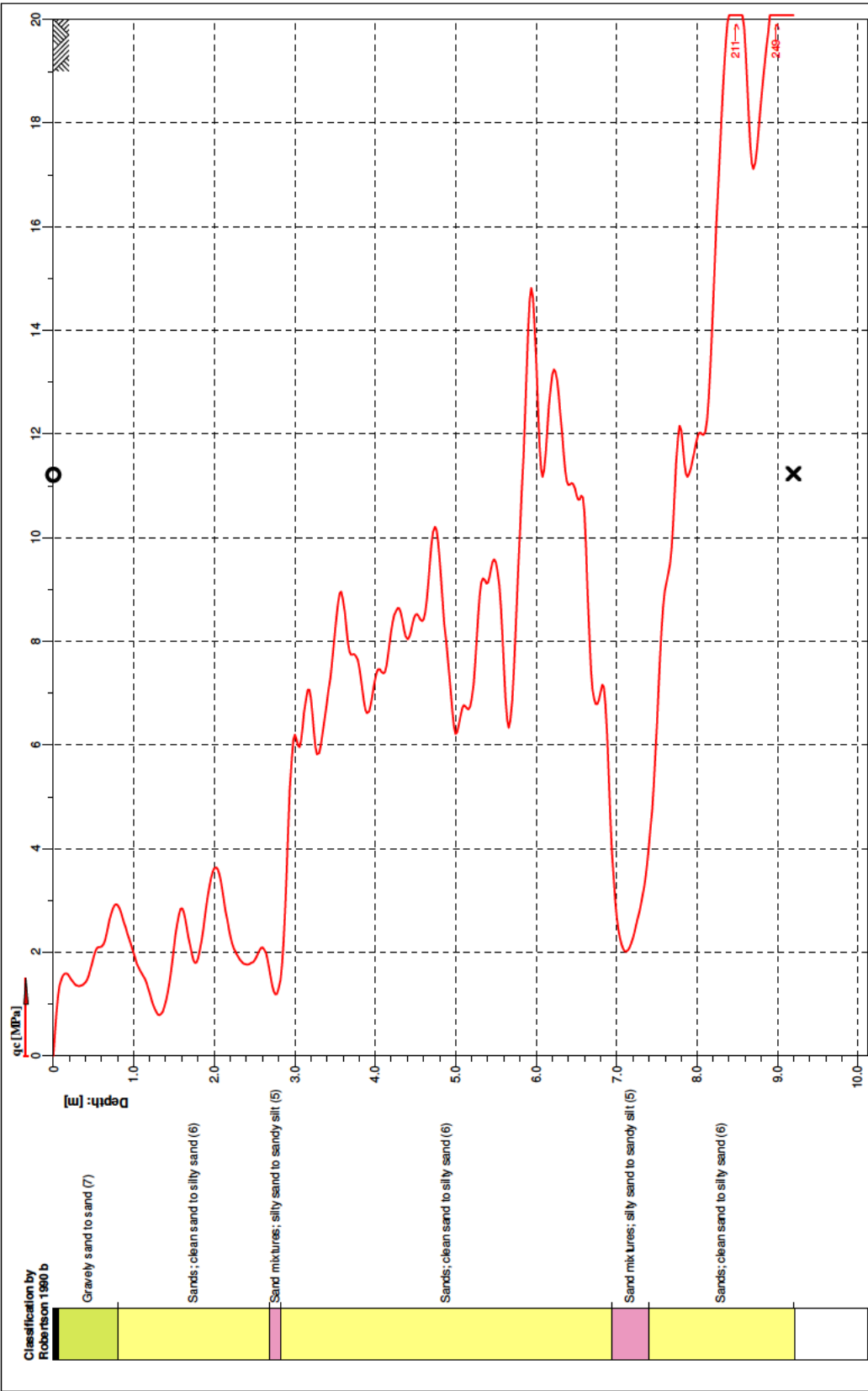


Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT01
Project ID:	S38.03119 E176.21184	Client:	Sigma Consultants Ltd	Date:	6/07/2022	Scale:	1 : 64
Project:	66 MCFETRIDGE DRIVE			Page:	1/2	Fig.:	
Target depth 15m. Refused at 9.20m. No water detected.				File:	CPT01.cpt		



Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 160







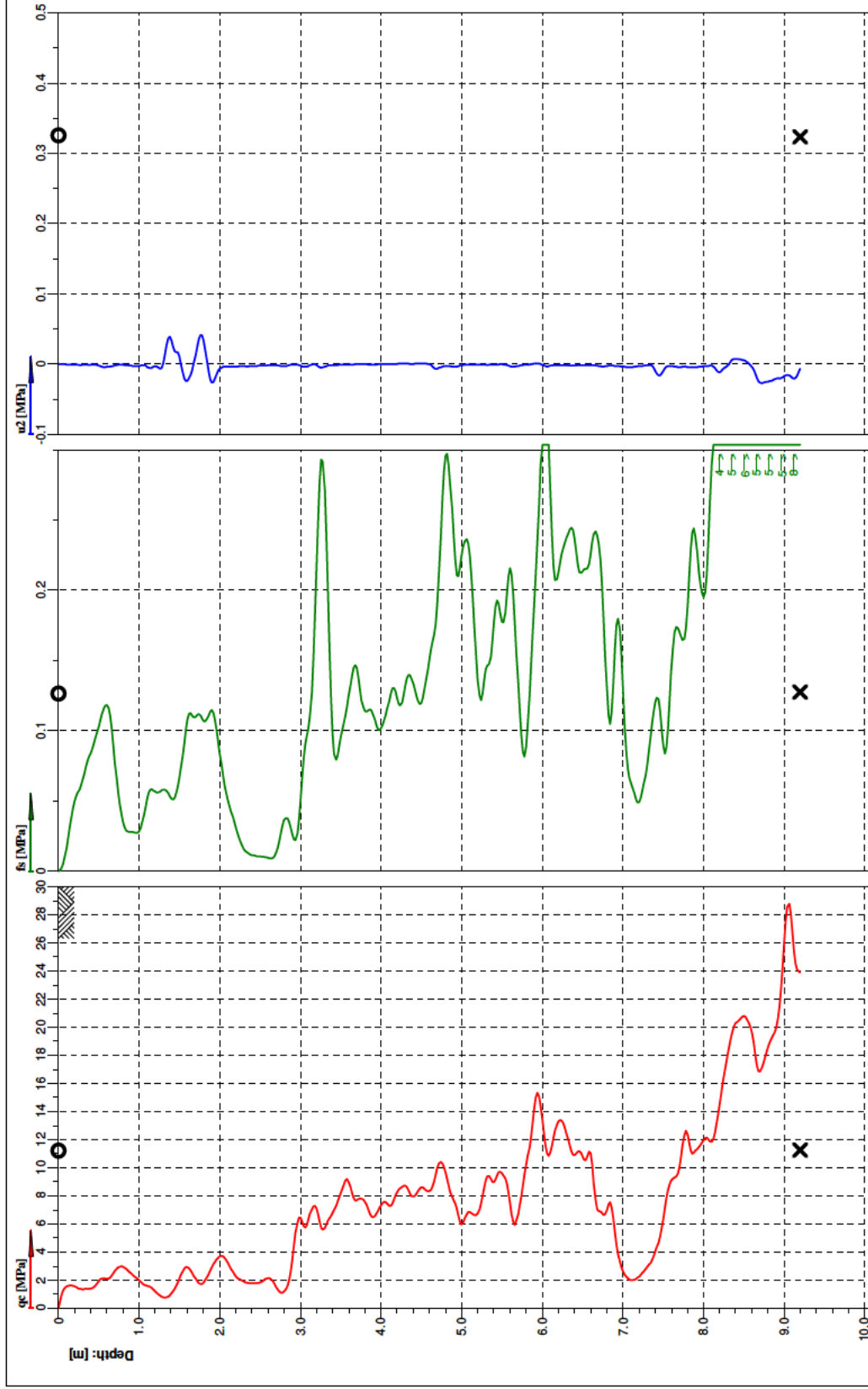
Cone No. : 4670	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT01
Tip area [cm²]: 10	Client:	Sigma Consultants Ltd	Date:	6/07/2022	Scale:	1 : 64
Sleeve area [cm²]: 150	Project:	S38.03119 E176.21184	Page:	2/2	Fig.:	
66 MCFETRIDGE DRIVE			File:	CPT01.cpt		
Target depth 15m. Refused at 9.20m. No water detected.						



Core No: 4670

Tip area [cm²]: 10

Sleeve area [cm²]: 160

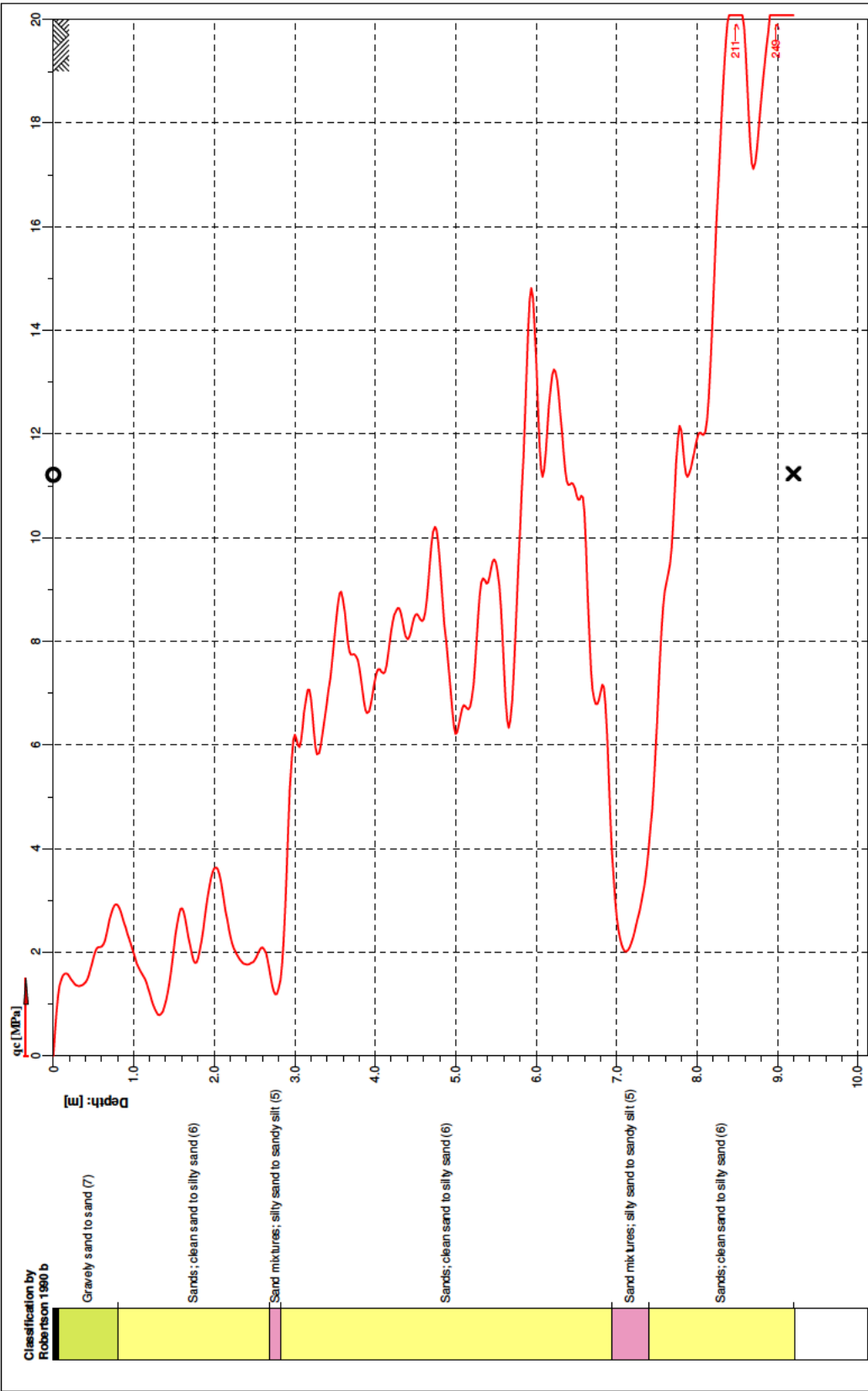


Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT01
Project ID:	S38.03119 E176.21184	Client:	Sigma Consultants Ltd	Date:	6/07/2022	Scale:	1 : 64
Project:	66 MCFETRIDGE DRIVE			Page:	1/2	Fig.:	
Target depth 15m. Refused at 9.20m. No water detected.				File:	CPT01.cpt		



Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 160







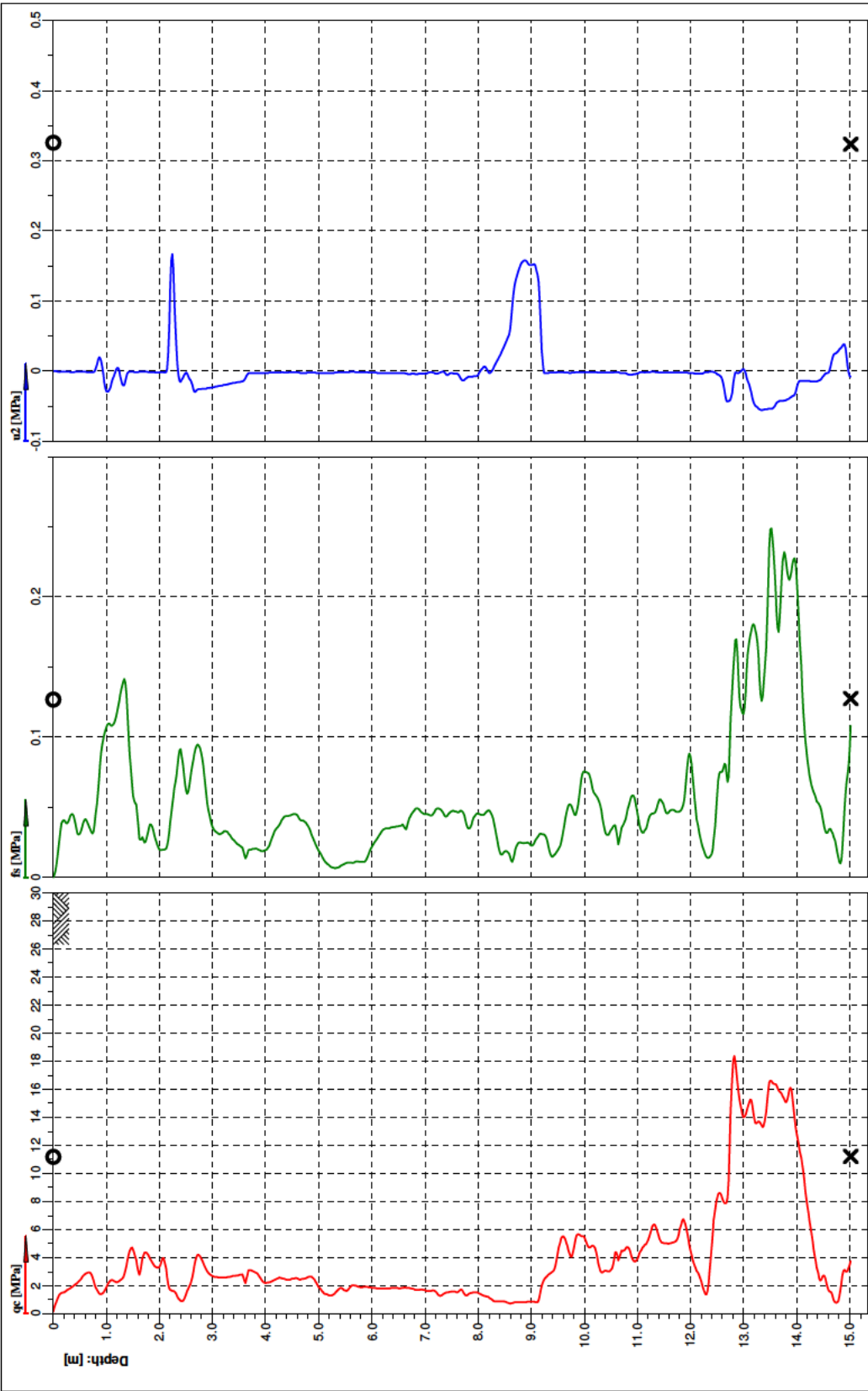
Cone No. : 4670	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT01
Tip area [cm²]: 10	Client:	Sigma Consultants Ltd	Date:	6/07/2022	Scale:	1 : 64
Sleeve area [cm²]: 150	Project:	S38.03119 E176.21184	Page:	2/2	Fig.:	
66 MCFETRIDGE DRIVE			File:	CPT01.cpt		
Target depth 15m. Refused at 9.20m. No water detected.						



Core No: 4670

Tip area [cm²]: 10

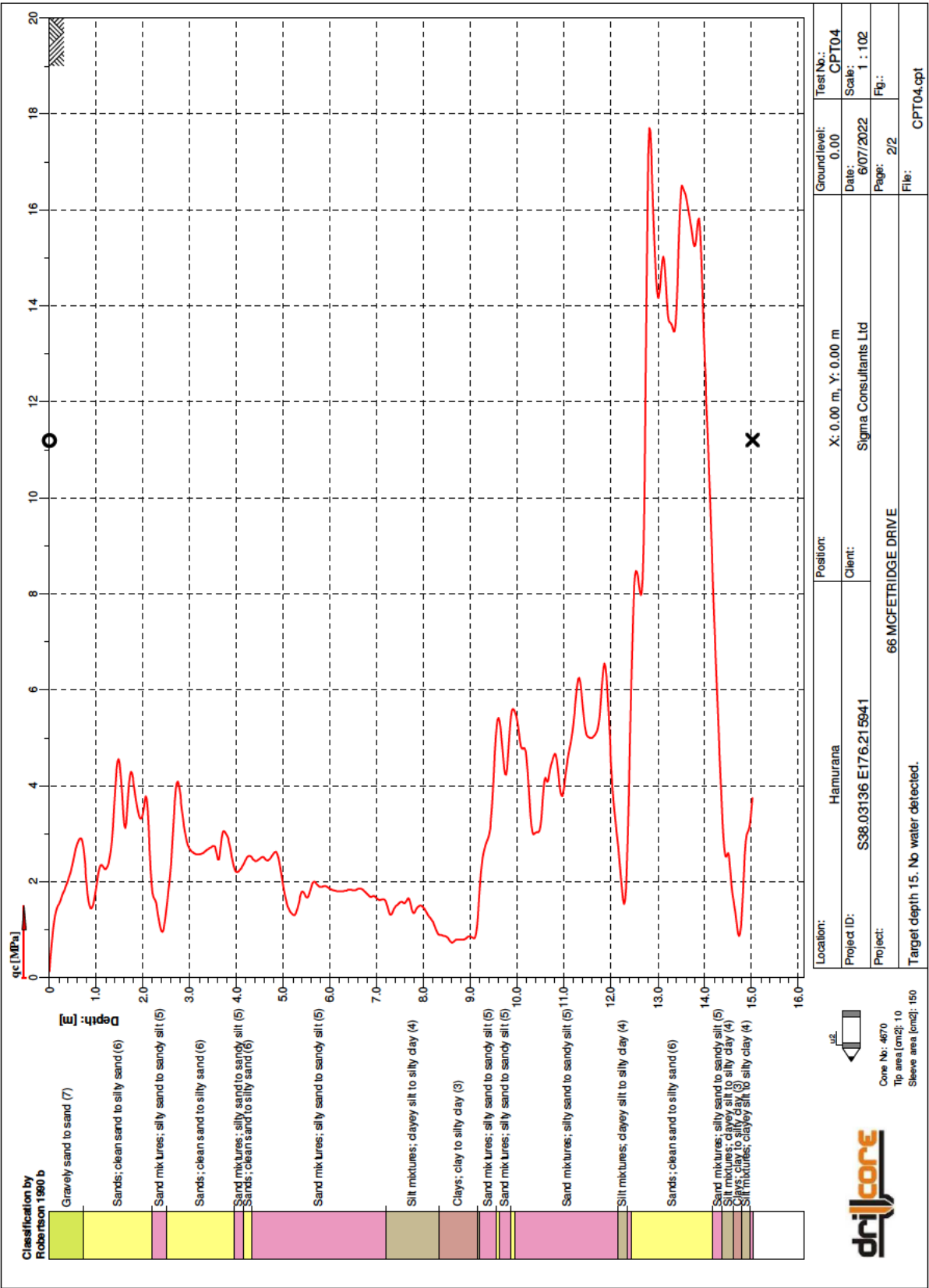
Sleeve area [cm²]: 150

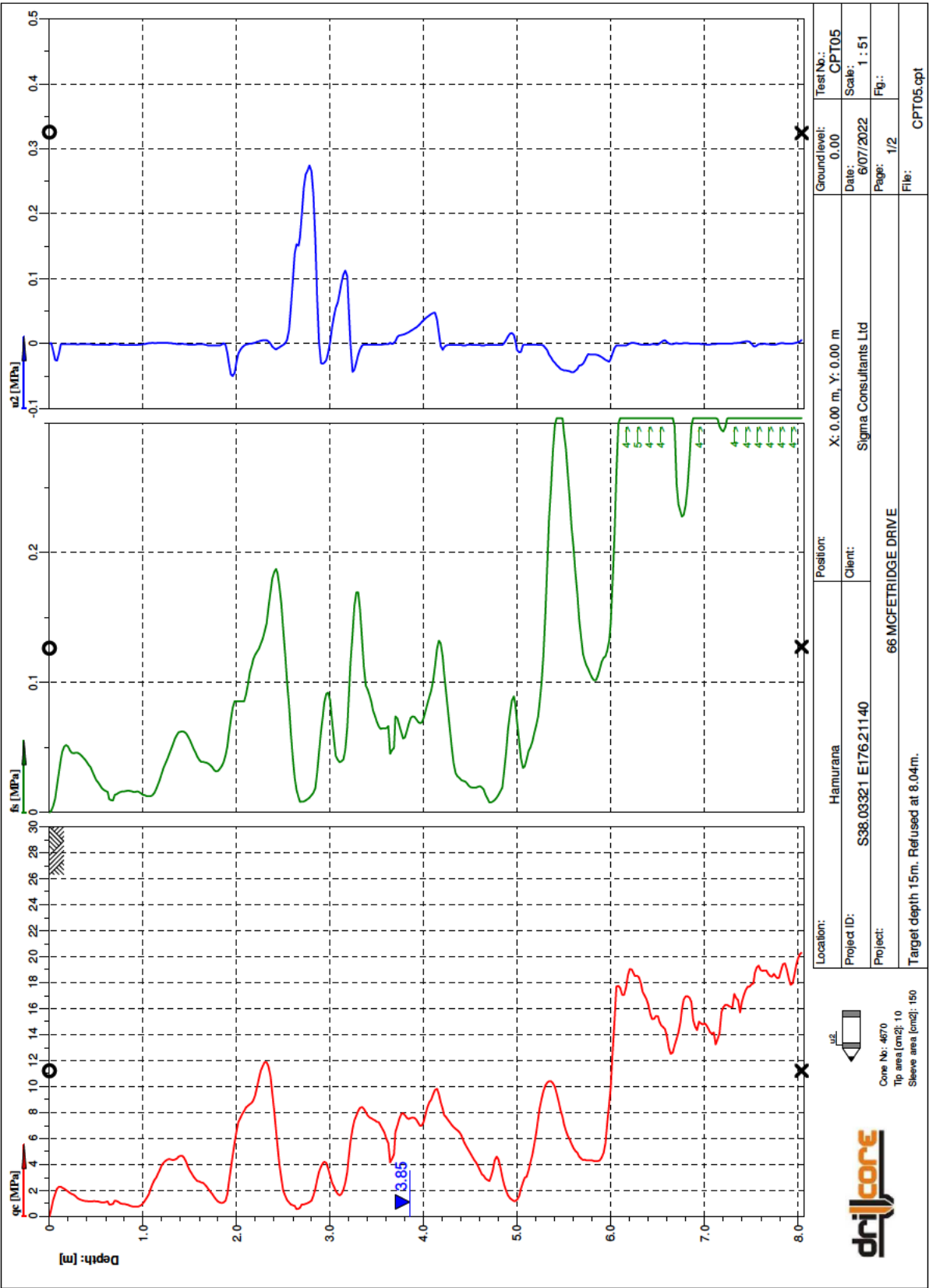


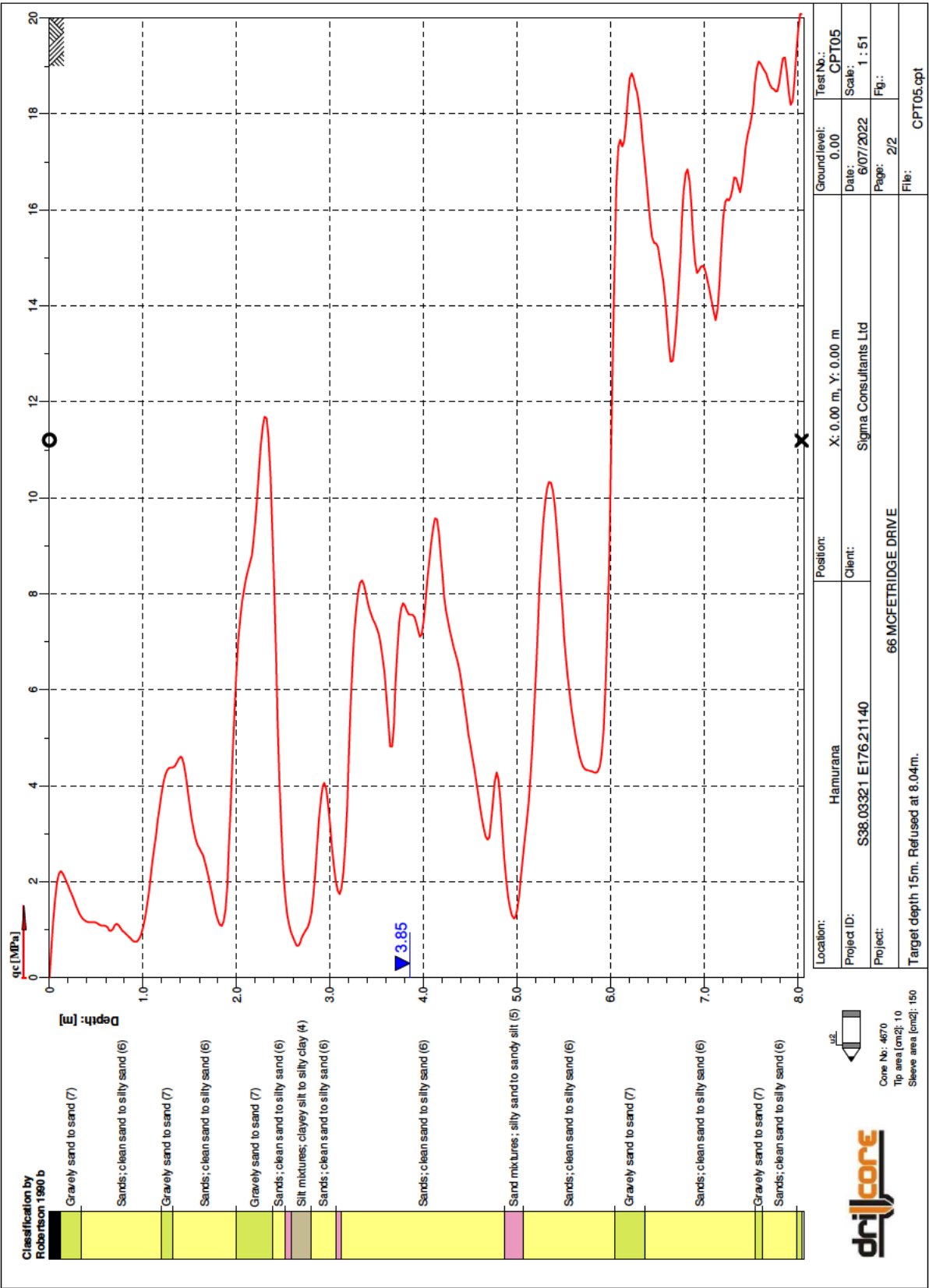
Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m	Ground level:	0.00	Test No.:	CPT04
Project ID:	S38.03136 E176.215941	Client:	Sigma Consultants Ltd	Date:	6/07/2022	Scale:	1 : 97
Project:	66 MCFETRIDGE DRIVE			Page:	1/2	Fig.:	
Target depth 15. No water detected.				File:	CPT04.cpt		

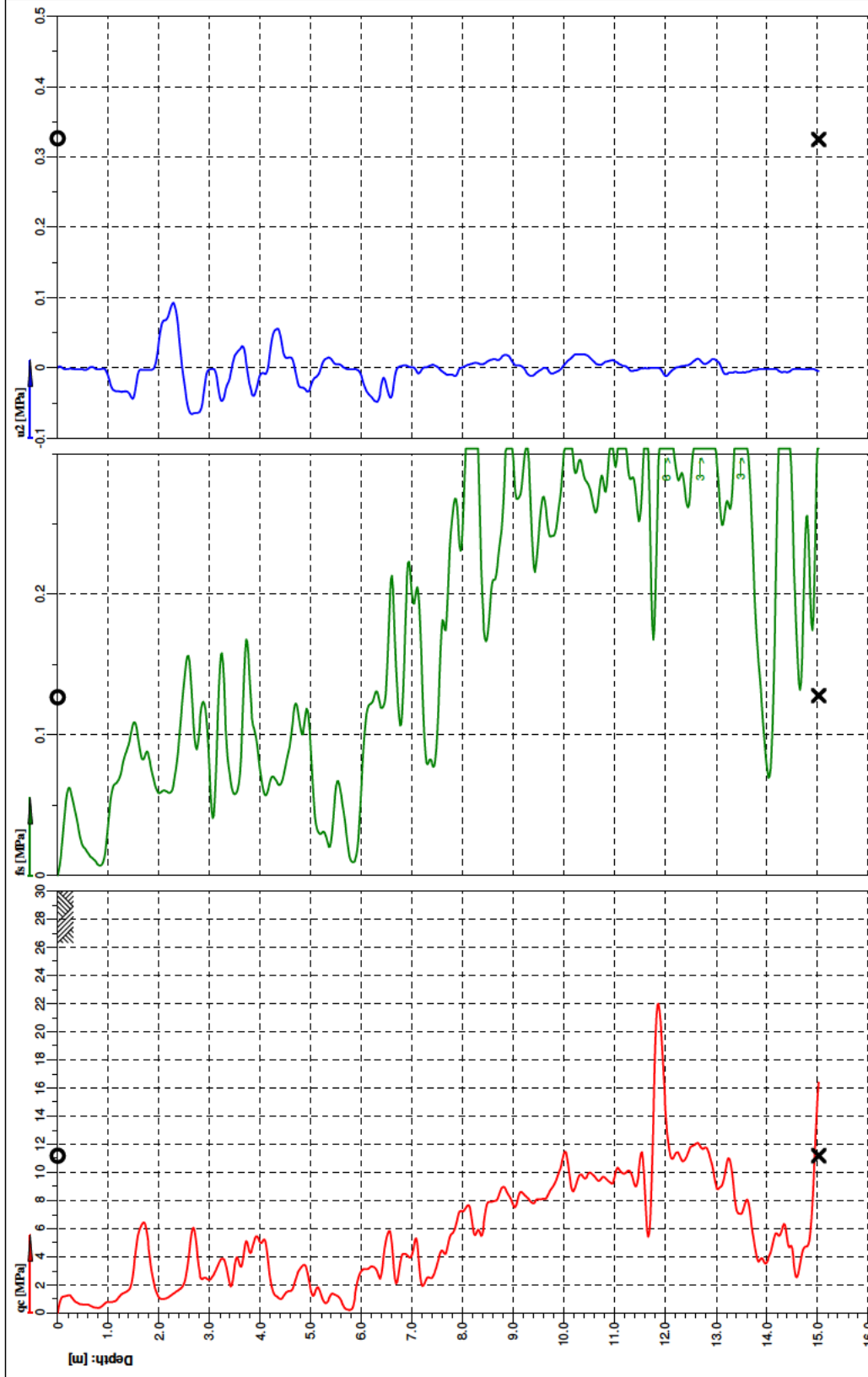


Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 150







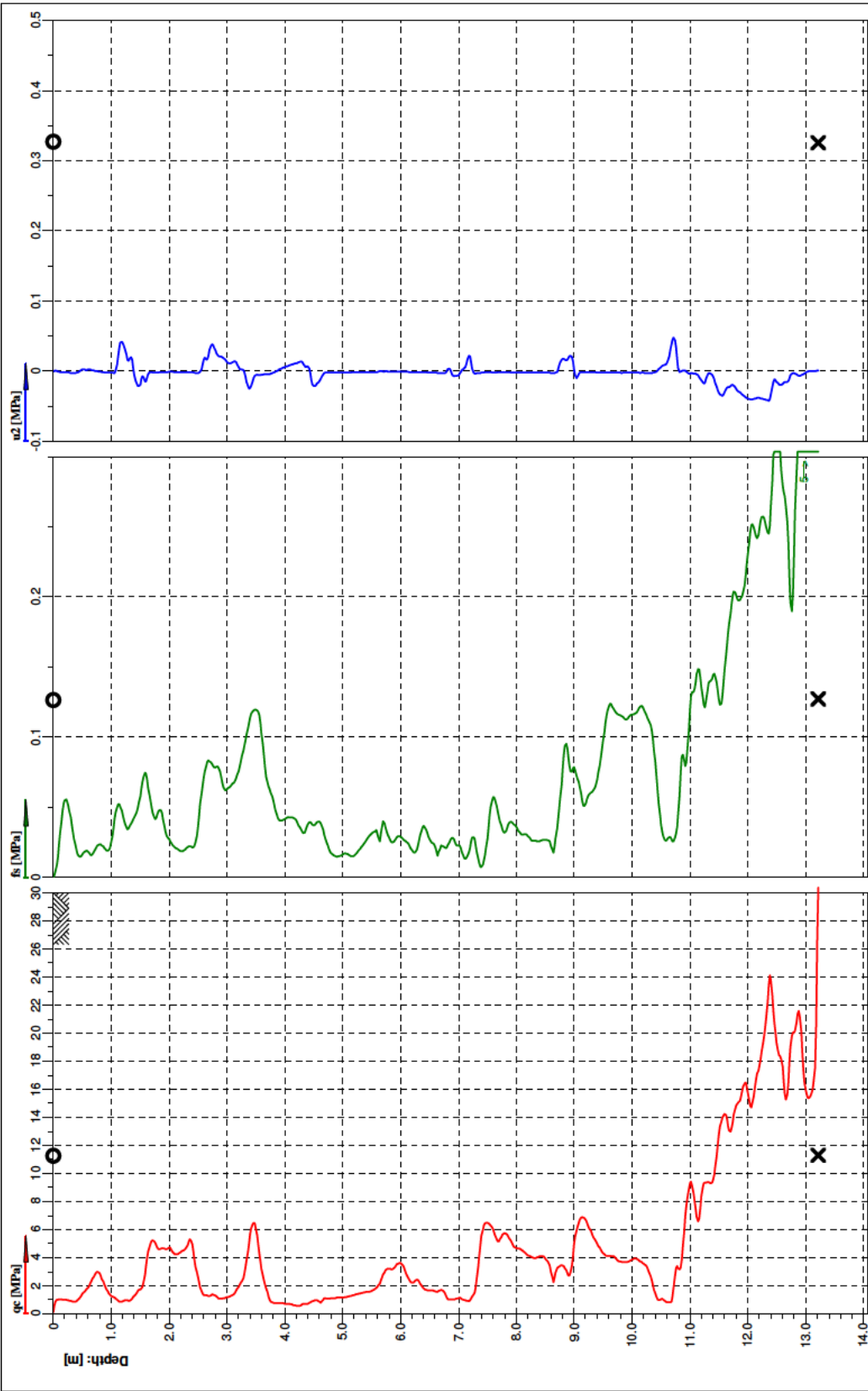


Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m		Ground level:	0.00	Test No.:	CPT06
Project ID:	S38.03436 E176.21388	Client:	Sigma Consultants Ltd		Date:	6/07/2022	Scale:	1 : 102
Project:	66 MCFETRIDGE DRIVE				Page:	1/2	Fig.:	
Target depth 15m. No water detected.					File:	CPT06.cpt		



Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 150

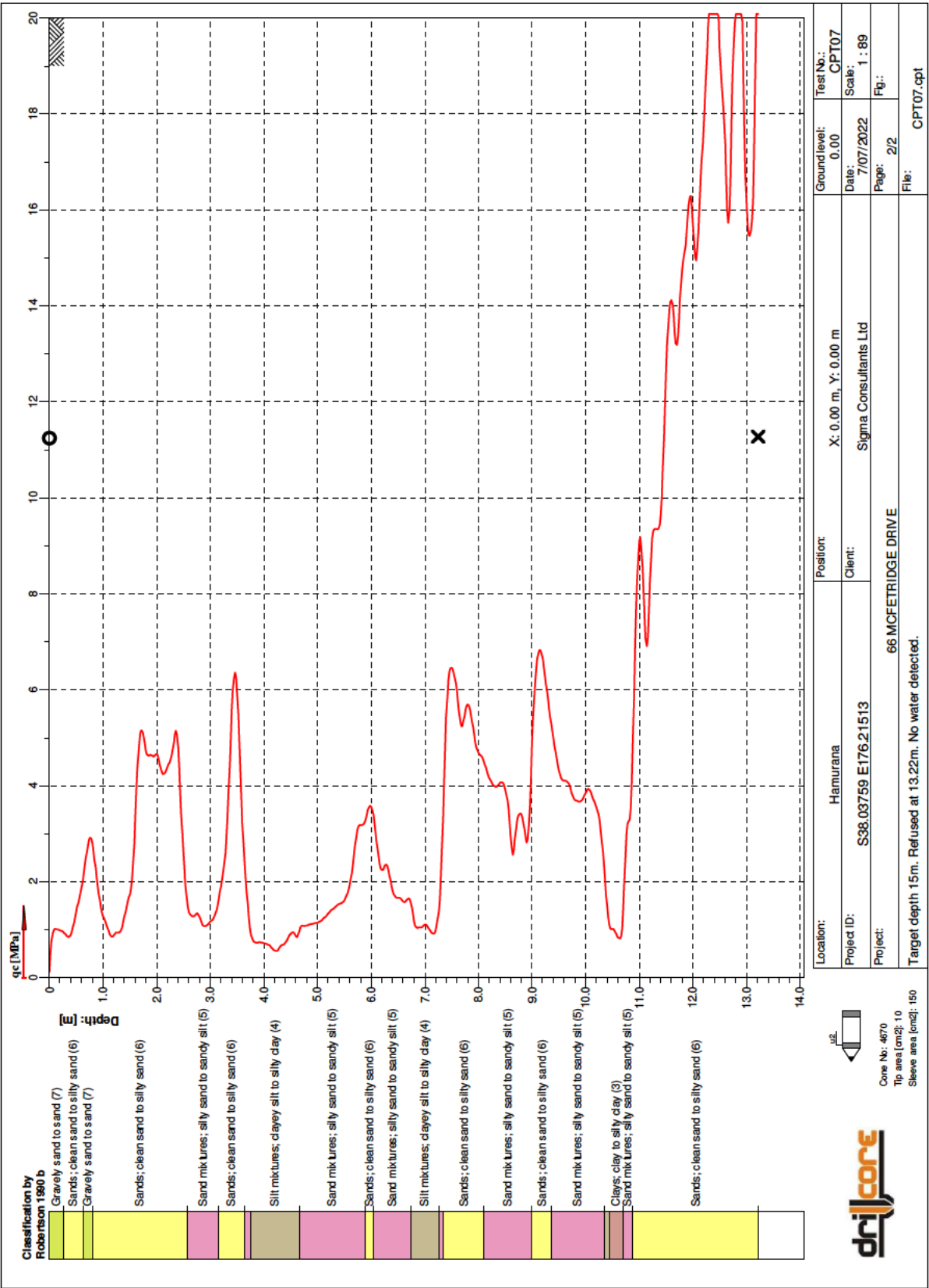


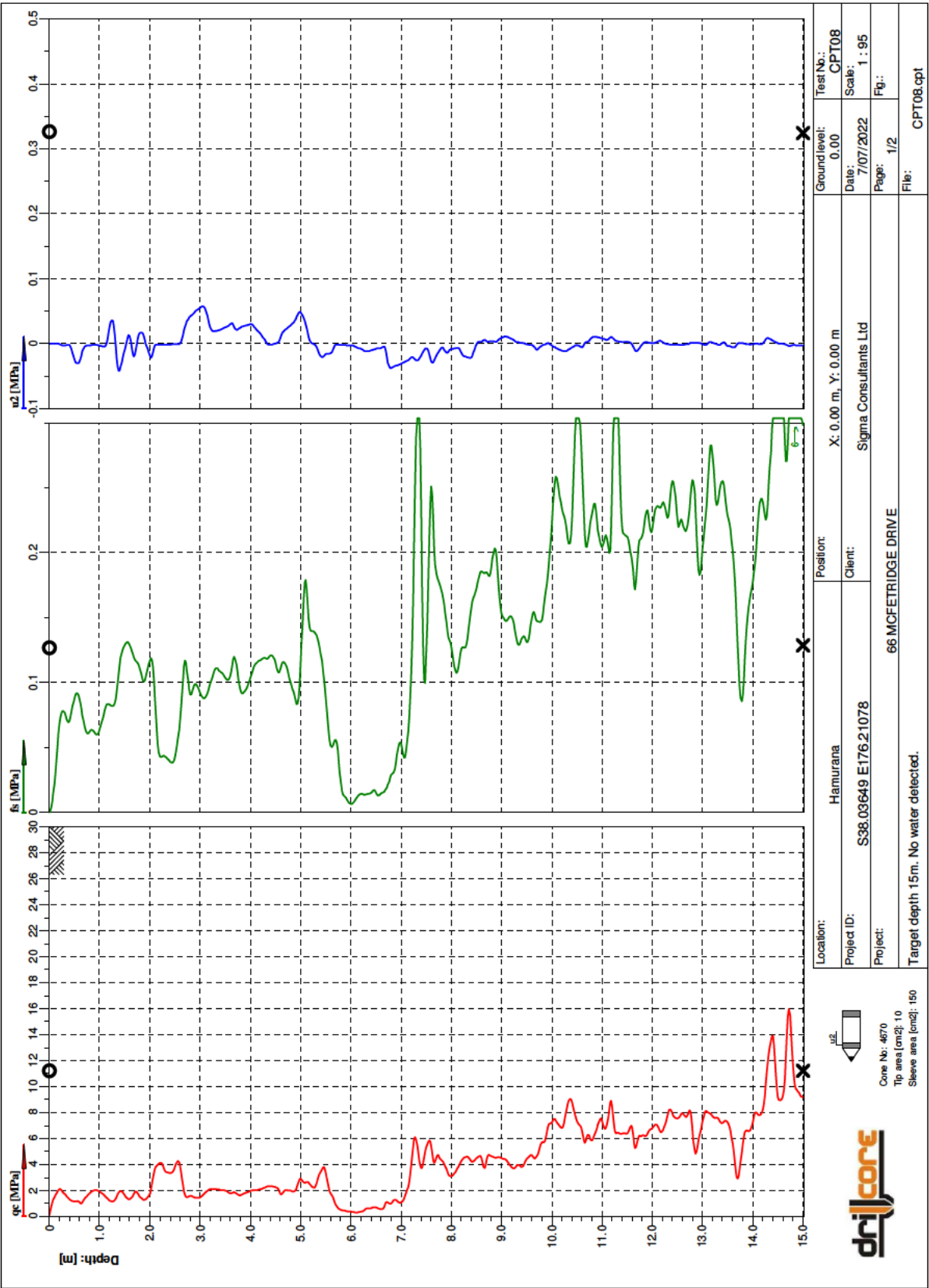


Location: Hamurana		Position: X: 0.00 m, Y: 0.00 m	Test No.: CPT07
Project ID: S38.03759 E176.21513	Client: Sigma Consultants Ltd	Date: 7/07/2022	Scale: 1 : 89
Project: 66 MCFETRIDGE DRIVE		Page: 1/2	Fig.: 1/2
Target depth 15m. Refused at 13.22m. No water detected.		File: CPT07.cpt	



Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 160

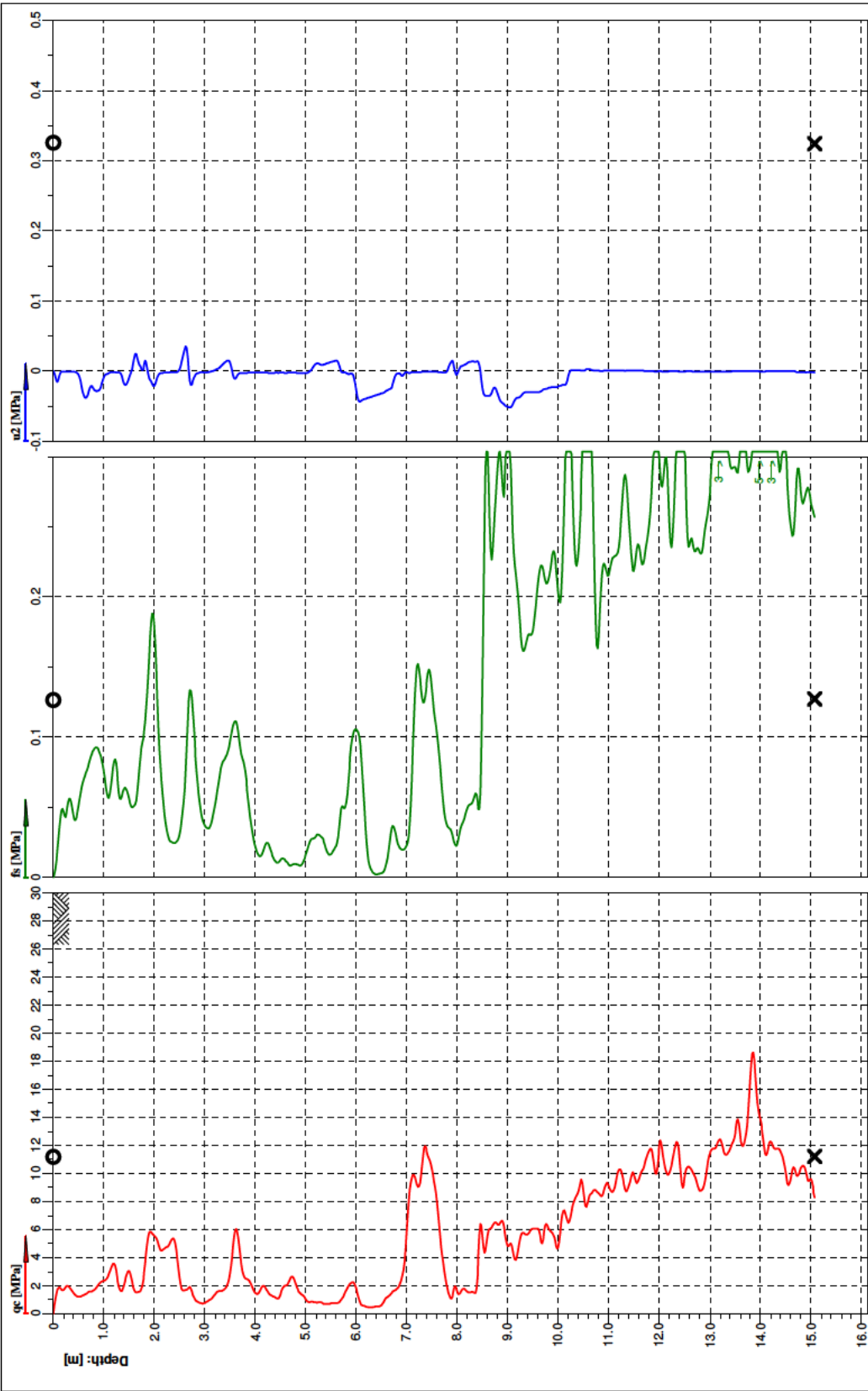




Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m	Test No.:	CPT08
Project ID:	S38.03649 E176.21078	Client:	Sigma Consultants Ltd	Date:	7/07/2022
Project:	66 MCFETRIDGE DRIVE	Page:	1/2	Scale:	1 : 95
Target depth 15m. No water detected.				Fig.:	
				File:	CPT08.cpt



Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 150



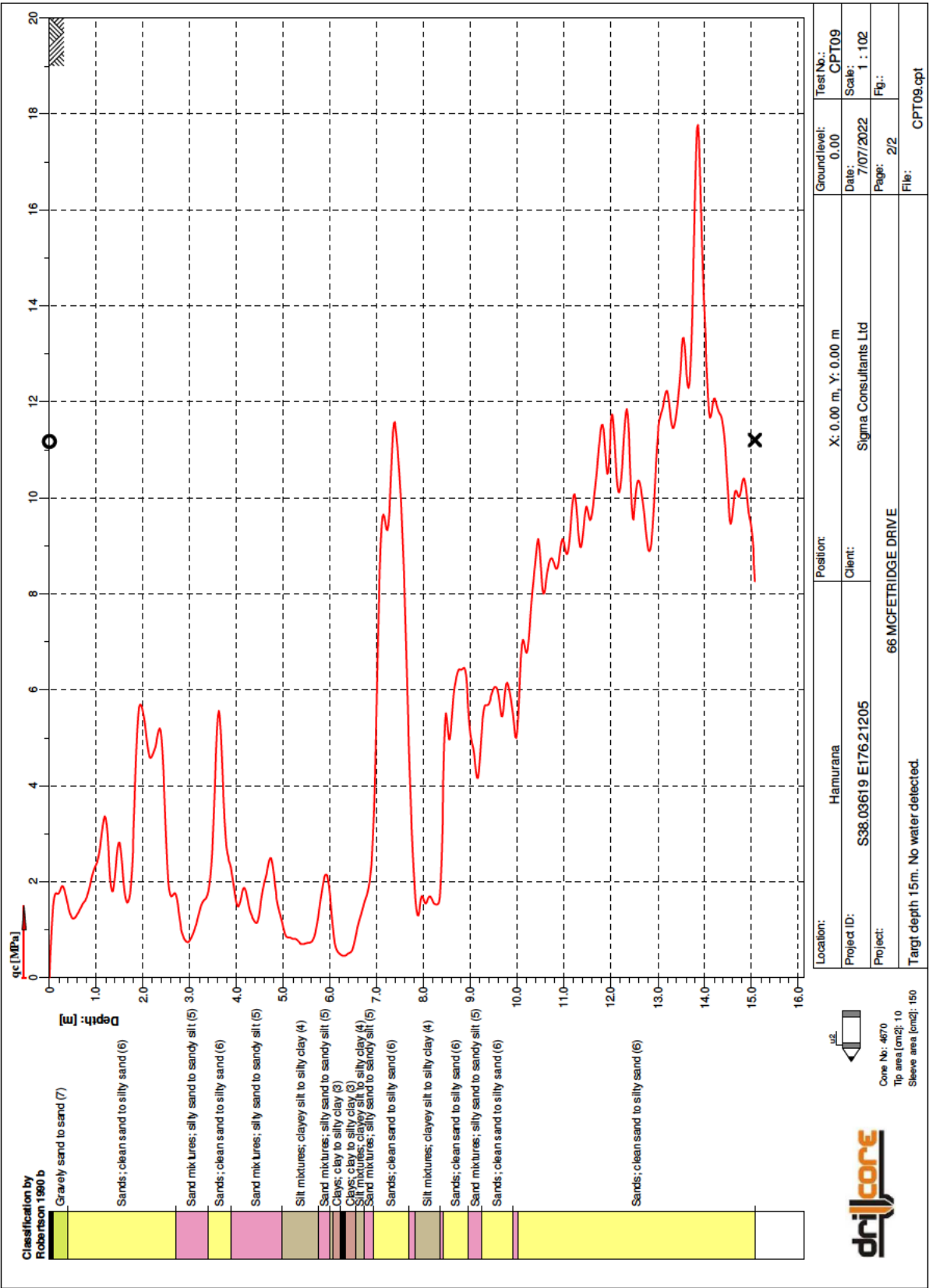
Location:	Hamurana	Position:	X: 0.00 m, Y: 0.00 m		Ground level:	0.00	Test No.:	CPT09
Project ID:	S38.03619 E176.21205	Client:	Sigma Consultants Ltd		Date:	7/07/2022	Scale:	1 : 102
Project:	66 MCFETRIDGE DRIVE				Page:	1/2	Fig.:	
Target depth 15m. No water detected.					File:	CPT09.cpt		



Core No: 4670

Tip area [cm²]: 10

Sleeve area [cm²]: 160





Location: Hamurana		Position: X: 0.00 m, Y: 0.00 m	Test No.: CPT10
Project ID: S38.03331 E176.20993	Client: Sigma Consultants Ltd	Date: 7/07/2022	Scale: 1 : 89
Project: 66 MCFETRIDGE DRIVE		Page: 1/2	Fig.: 1/2
Target depth 15m. Refused at 11.74m.		File: CPT10.cpt	



Core No: 4670
Tip area [cm²]: 10
Sleeve area [cm²]: 150

