29 July 2020

T2 GROWTH CELL PROPOSED PRIVATE PLAN CHANGE

GEOTECHNICAL DESKTOP REPORT

Sanderson Group Limited

and

Kotare Properties Limited

Ref: HAM2020-0016AD/0043ABRev 0

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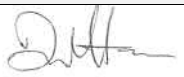
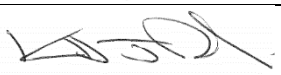
HAM2020-0016AD/0043AB		
Date	**Revision**	**Comments**
10 June 2020	A	Draft for Internal Review
29 July 2020	0	Issue to Client

	Name	**Signature**	**Position**
Prepared by	Jack Whattam		Engineering Geologist
Reviewed by	Kori Lentfer		Associate Engineering Geologist
Authorised by	Ken Read		Principal Geotechnical Engineer

1. INTRODUCTION

CMW Geosciences (CMW) has been engaged by the Sanderson Group Ltd to undertake a geotechnical desk top assessment in relation to the development suitability of the T2 Growth Cell for residential development. The work is to support a submission to the Waipa District Plan seeking rezoning of the land from 'Deferred Residential' to 'Residential'.

Our work has been carried out in accordance with Variation No. 1 (ref. HAM2020-0016AB Rev 0, dated 9 April 2020), to the CMW fee proposal referenced HAM2020-0016AA Rev.0.

The purpose of this report is to present the findings of our review of available geotechnical data, and available local desktop and investigation reports. The object of this work being to identify potential geotechnical hazards affecting the site and comment on the suitability of the land for the proposed plan change.

Since the initial commission of this report Kotare Properties and Sanderson Group have agreed that this report be prepared on their joint behalf.

2. INFORMATION SOURCES

The conceptual layout of the T2 Growth Cell is depicted on the Boffa Miskell T2 Structure Plan Concept presented in ***Appendix F***.

In preparing this report we have reviewed the following existing reports and information which have been prepared as a part of local developments in the vicinity of the T2 Growth Cell:

- Factual and interpretive information for the CMW Geosciences geotechnical investigation report (GIR) for the Te Awamutu Country Club / Kotare Wetlands Development, to be issued
- HD Geotechnical report entitled "T1 Residential Growth Cell, Te Awamutu – Suitability Assessment" ref. HD057, dated 5 October 2015;
- Maunsell Limited, letter report entitled "Rochdale Subdivision Site, Off Frontier Road, Te Awamutu: Stormwater Management, Wastewater Disposal, and Water Supply Assessment, ref. 600 427 95/Rochdale01, dated 29 July 2008; and
- Maunsell Limited, letter report entitled "Rochdale Subdivision Site, Off Frontier Road, Te Awamutu: Geotechnical Assessment, ref. 600 427 95/Rochdale02, dated 24 July 2008.

We have also examined the following

- The published geological map of the area,
- Historic aerial photographs available on the Retrolens website,
- Past and recent satellite imagery from Google Earth Pro,
- Past published maps of the area, and
- Contour maps available on the Waikato Regional Council website

3. THE SITE

3.1. Location

The T2 growth cell is located approximately 2.5km west of Te Awamutu town centre, as shown on Figure 1 below, and has an area of approximately 41ha.

The growth cell is bounded by Frontier Road to the south, Pirongia Road to the north, and by farmland to the west.

Along the eastern site boundary is the T1 Growth Cell, which is currently undergoing earthworks for residential subdivision.

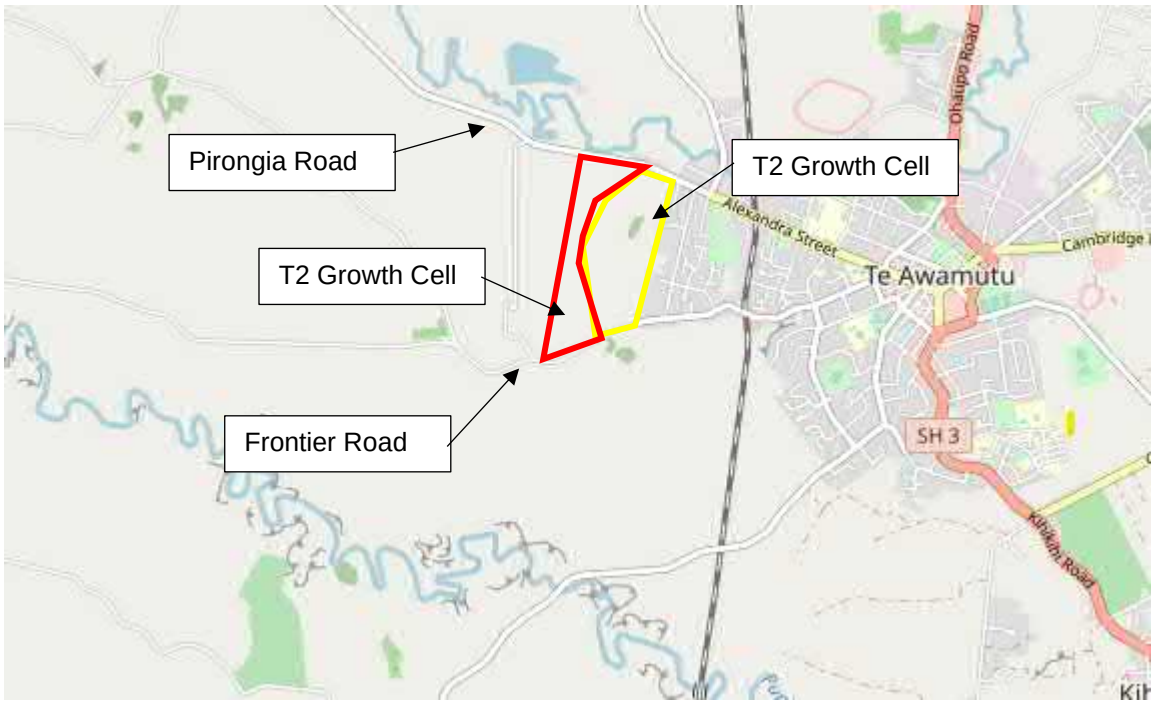


Figure 1: Site location (OpenStreetMap).

3.2. Site Description

The current site land use is pastureland for dairy farming.

Three residential dwellings, a dairy shed, and associated sheds/farm buildings are located near the northern edge of the growth cell off Pirongia Road.

Another dwelling is accessed of Frontier Road in the southern portion.

There is a farm shed adjacent to Frontier Road at the southern boundary of the growth cell.

A large water reservoir tank is located in the south-eastern corner of the growth cell, adjacent to Frontier Road.

The site topography consists of rolling hills with moderate to steep slope angles (up to 1V:2.5H), and incised gullies. The rolling hills are the dominant feature of the site, covering approximately 85% of the area, with elevations from approximately RL 65m to RL 84m.

Two gully areas are present within the site boundaries, one in the north and one in the south-west.

The northern gully drains to the northeast and is steeply incised at its southern end, giving way to moderate to gentle gully sides towards the north and draining out to a relatively flat plain at RL 44m to RL 47m.

The south-western gully is moderately incised, drains to the north west, but only the head of the gully system lies within the site boundary.

Elevations presented are to Moturiki Vertical Datum 1953.

4. SITE GEOLOGY

4.1. Published information

The published geological map[1] of the area (Figure 2) shows the site to be predominantly underlain by primary and reworked, non-welded ignimbrites of the early to middle Pleistocene Walton Subgroup.

There are comparatively minor areas of lacustrine mud, silt gravel and peat of the late Pleistocene Piako Subgroup shown in in the south-west corner of the site.

Cross-bedded pumice sand, silt and gravel with interbedded peat of the late Pleistocene aged Hinuera Formation deposits are mapped just to the north of the growth cell boundary.

4.2. Previous Investigations

Previous investigations conducted by Maunsell Limited and HD Geotechnical in the adjacent T1 growth cell, and by CMW in the southern portion of the T2 growth cell found that the site geology is generally consistent with the published information with the addition of soils of the Hamilton Ash.

Walton Subgroup soils were found to be overlain by of up to 4.7m of stiff to hard silt/clay of the Hamilton Ash Formation.

This was underlain by very stiff to hard sandy silt / clayey silt, sensitive silt, and dense to very dense sand of the Puketoka Formation, part of the Walton Subgroup.

Piako Subgroup soils comprising locally derived alluvial clay, silt, and sand mixtures, were encountered during the CMW site investigation and appear constrained to within the southwestern gully.

Factual investigation records from the reports referred to above are presented in ***Appendix A*** (Maunsell Limited), ***Appendix B*** (HD Geotechnical), and ***Appendix C*** (CMW Geosciences).

[1] GNS Geological Map 1:250,000 scale Geological Map No 4 ‘Waikato’. S.W Edbrooke et al.

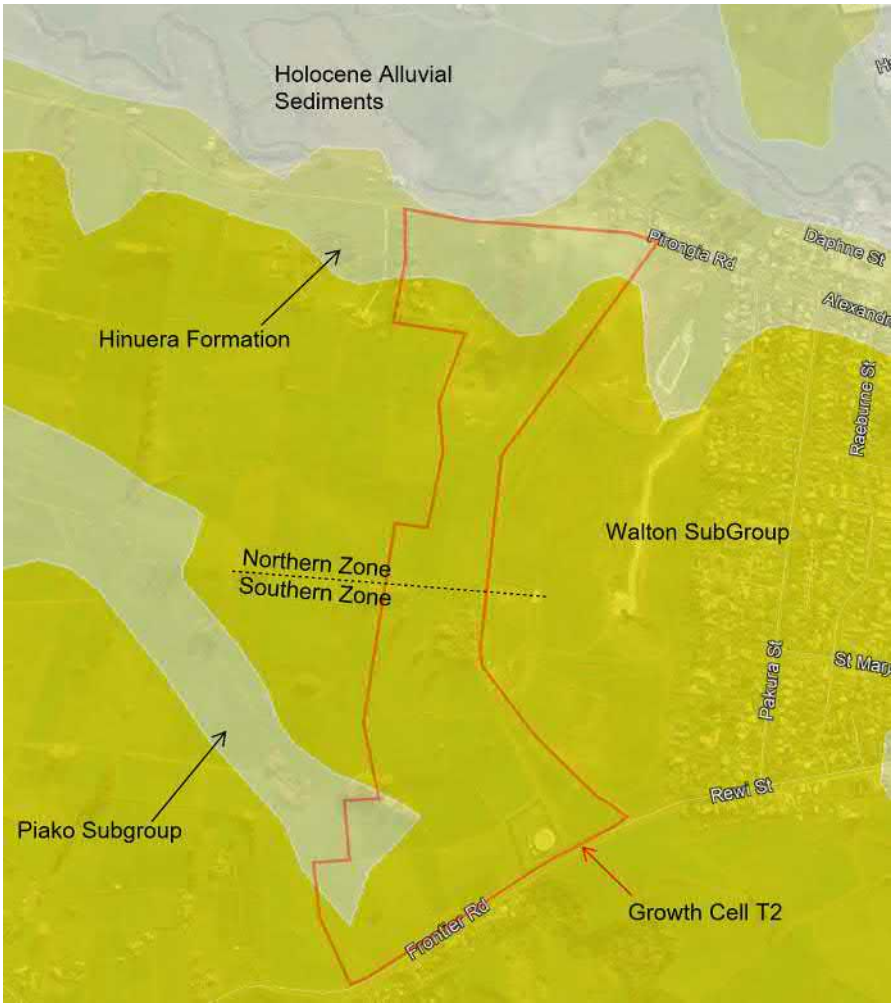


Figure 2: Local Geology (GNS 1:250K geological map).

5. PREVIOUS LAND USE

As part of this work we have examined historic aerial photographs dating back to 1944. Copies of these are provided in ***Appendix D.***

The study area has always been in pasture over the period assessed.

The only area where significant changes can be seen is the north-east trending gully in the northern portion of the site.

Between 1957 and 1961 it appears that two farm dams / access tracks were constructed across the gully approximately 80m and 280m from Pirongia Road.

Between 1966 and 1971, a number of trees were removed from the north-east trending gully in the area adjacent to Pirongia Road. Further tree removal occurred in the head of the north-east trending gully between 1979 and 1995.

Since 1944 there is no particular evidence observed on the aerial photographs of major slips, but it appears that slope sides in the north-east trending gully have receded, while slopes angles have reduced slightly.

Google Earth aerial images show a constructed pond within the upper region of the northeast trending gully in 2006 but this has been filled in by 2008.

Between 2006 and 2019 (the extent of historic Google imagery) the slope sides of the north-east trending gully have undergone some recession. Slumping and small surface movements have been

occurring at least since 2006 as indicated by hummocky areas and terracette's on gully side slope sides. Older aerial imagery does not have the resolution to see these features, although they are likely to have been present.

6. LANDFORM FEATURES

6.1. Surface water

A number of springs and saturated depressions were observed during the site walkovers carried out by HD Geotechnical in the adjacent T1 area. These are understood to have been confined to low lying areas and gully inverts.

Approximate locations of springs and surface water are shown on the appended HD Geotechnical Site Plan (***Appendix B)***.

No springs or surface water were noted within growth cell T2 during CMW's investigation in late summer (March 2020). However, it is considered likely that springs and surface water will be present in low lying regions of the T2 growth cell during winter months.

6.2. Groundwater

Previous site investigations in growth cells T1 and T2 recorded late summer (April) to late-winter (September) groundwater levels ranging from approximately RL 41.5m in the low-lying areas to RL 56.5m in the high elevation areas.

In the low-lying areas around gullies and the drainage plains of growth cell T1, groundwater levels were noted to be 0.3m to 1.6m below ground level, equating to approximately RL 41.5m to RL 45m. The investigations noting these levels were conducted in July and September.

In mid-elevation areas (approximately RL 53m to 55m) of growth cell T1, groundwater levels were noted to be approximately 2.7m below ground level in hand auger boreholes, equating to approximately RL 51m to RL 53m. The investigations noting these levels were conducted in July and September. Groundwater was not encountered in any of the machine boreholes conducted by Maunsell Limited during their investigation.

During the CMW investigation, which was undertaken in March, groundwater was not encountered within the CPT probe holes, test pits, hand augers, or during installation of the piezometers. When the piezometers were dipped on 17 April 2020, CPT07 was dry to the base at 8m below ground level, and CPT01 had groundwater at 7.5m below ground level, (RL 56.5m).

Later test pit and hand auger investigations in the south-western gully encountered groundwater at between RL 52.3m to 53.8m.

The groundwater levels recorded in all the previous site investigations show a hydraulic gradient, trending north to north-east. This is toward the nearby major stream courses shown on **Figure 3** below.

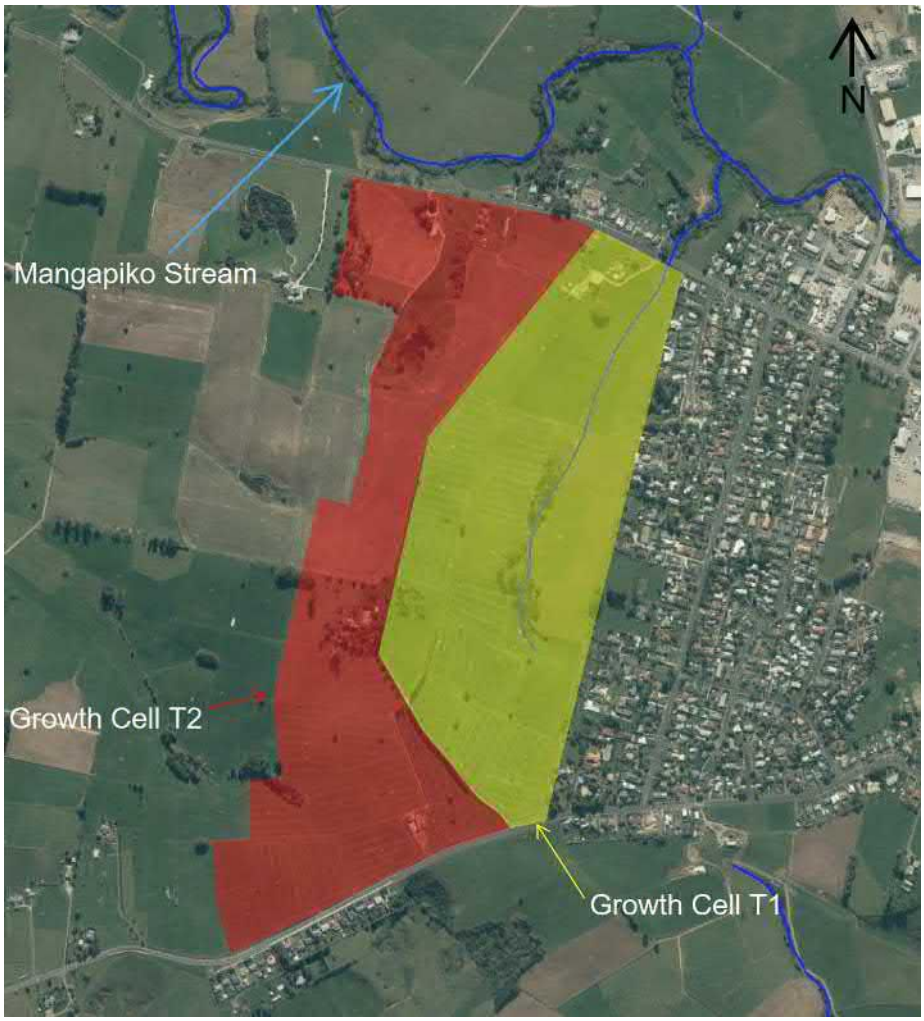


Figure 3: Major stream courses (Waikato Regional Council maps)

We conservatively estimate that ground water levels noted during investigations carried out in summer months may rise by up to 2m in some areas in winter.

6.3. Geomorphology

We have divided the T2 growth cell into a southern and northern zone for the geomorphological assessment below. CMW have undertaken a detailed site investigation and walkover of the southern zone for the Geotechnical Investigation Report, yet to be issued.

Our assessment of geomorphology in the northern zone has relied on available aerial and satellite imagery, and contour plans.

The geomorphic features identified in both zones are shown on the appended Geomorphological Plans (***Drawing 01 and 02***).

6.3.1. **Southern Zone.**

The dominant regional landform comprises rolling hills. The site is a local high point with hillsides sloping away from the site in all directions.

A main ridge runs in a north-northwest to south-southeast orientation along the eastern boundary of the site, at elevations of RL 81m to 84m. A secondary ridge branches off the main ridge and runs

along the southern site boundary in a northeast to southwest direction, at elevations of RL 81m to 70m.

The low point of the site is located centrally on the western site boundary at RL 58m. Two incised gullies have been eroded into the hills and converge at the central western boundary. The northern gully runs in a north-east to south-west direction, the other, (more steeply incised) central gully, runs in a generally east to west direction. Another gully is present beyond the south-western site boundary and runs in a south to north direction. All three gullies merge and continue towards the north-west.

An ephemeral pond is located at the base of the central gully, at RL 60m. The pond was dry at the time of our site investigation; however, a review of historic aerial photographs shows that it fills during winter months. A drainage channel for an intermittent stream begins at the pond and continues west, off site, running along the base of the gully.

The northern and western gullies have no drainage channels, but it is expected that springs may develop here during winter months.

A major scarp associated with a historic landslide is present at the head of the central gully, with eroded material deposited in the base of the gully as colluvium.

A generally even graded area, between elevations of between RL 59m to 65m, is located near the central western site boundary at the base of a steepened slope. This feature has been flagged as a possible debris lobe associated with a relic, deep seated rotational landslide.

A recent shallow translational slip is located on the eastern bank of the western gully.

Evidence of soil creep in the form of terracette's is visible along a steep bank surrounding the pond.

6.3.2. **Northern Zone**

The dominant regional landforms in the northern zone are rolling hills and a steeply incised, north-east trending gully. This zone is also a local high point with hillsides sloping away from the site in all directions.

The eastern boundary of the site bisects a south-west / north-east orientated ridgeline, with the high point of RL 83m located on this ridgeline, approximately at the mid-point of the southern and northern zones.

The low point of RL 44m is located roughly halfway along the northern site boundary on a relatively flat drainage plain. This drainage plain is part of the Mangapiko Stream course that drains the surrounding hills and joins the Waipa River to the west.

A steep sided gully, with maximum slope gradients of approximately 1V:2.5H, has been incised into the rolling hills north of the high point. The gully slope falls from RL 70m, to RL 53m at the base of the gully. The gully is orientated south-west to north-east and drains onto the low-lying drainage plain noted above.

Slope crest recession over the last 75 years, as indicated by changes in the slope crest observed in historic aerial images, hummocky ground, and small terrecettes around this gully indicate that small to medium slopes failures (i.e. soil creep and/or minor slumping) are or have been active here.

7. GEOTECHNICAL HAZARDS

An assessment of hazards and associated risk ratings for the T2 development site is provided in ***Appendix E***.

The flooding hazard in the low-lying area adjacent to Pirongia Road is considered to be low based on the available Waipa District Council flood hazard mapping.

Natural hazards of tsunami, wind, drought, and fire are not covered by the assessment.

In the sections below we cover only those geotechnical hazards that were assessed as medium to very high risk under current conditions (i.e. with no geotechnical mitigation).

7.1. Liquefaction and Lateral Spread

Soil liquefaction is a process where typically saturated, granular soils develop excess pore water pressures during cyclic (earthquake) loading that exceed the effective stress of the soil. In loose soils, some dilation can occur during this process, which can lead to individual soil grains moving into suspension. Following the onset of liquefaction, the shear strength and stiffness of the liquefied soil is effectively lost causing excessive differential settlement of the ground surface, bearing capacity failure and collapse of structures and low-angle lateral spreading of slopes in liquefiable soils.

In accordance with NZGS guidance[2] the liquefaction susceptibility of the soils at this site has been considered with respect to geological age and soil fabric.

7.1.1. Geological Age Considerations

The vast majority of case history data compiled in empirical charts for liquefaction evaluation come from Holocene deposits or man-made fills (Seed and Idriss, 1971). Table 1 of Idriss and Boulanger (extracted from Youd and Perkins (1978)), presents the susceptibility of soil deposits to liquefaction based on geological age, which states that Pleistocene aged alluvium (>12,000 years) has a very low to low risk of liquefaction.

Within the study area the soils below groundwater levels are generally understood to be clays, silts, and sands of the early to mid-Pleistocene aged Walton Subgroup, (ca. 1.26Ma to 2.18Ma), with a comparatively minor presence of late Pleistocene aged Piako Subgroup soils (, ca. 22ka to 17ka). Piako Subgroup soils are typically high plasticity clays.

The geological age of Walton Subgroup soils is older than what the case history data would suggest as being susceptible to liquefaction.

The soils of the Piako Subgroup, and Hinuera Formation are of late Pleistocene age and may be considered as of low risk of liquefaction based on age.

7.1.2. Soil fabric and Consistency/density considerations

Recent case histories suggest that soils comprised of sands, non-plastic silts, gravels, and their mixtures are susceptible to liquefaction.

The clay soils of the Walton and Piako Subgroup are therefore not considered to be at risk of liquefaction.

Furthermore, although silts and sands are present across the site, previous investigations generally show these to be firm to hard (silt) and dense to very dense (sands) and are therefore considered unlikely to liquefy.

Beneath the southern part of the site potentially liquefiable soils are generally at depths greater than 5m. We consider that the depth to liquefiable soils is likely to be similar in the northern portion of the site, with the exception of potential Hinuera Formation soils discussed below.

With the above conclusions regarding geological age, soil fabric, and depth to liquefiable soils, we consider the risk of surface manifestation of liquefaction to be low, and the risk of potentially damaging liquefaction induced ground deformation or liquefaction induced lateral spread to be low across the majority of the site.

[2] Earthquake Geotechnical Engineering Practice, Module 3: Identification, assessment and mitigation of liquefaction hazards", (May 2016)

If Hinuera Formation soils extend into the northern low-lying part of the site, we considered the risk of surface manifestation and potentially damaging liquefaction induced ground deformation to be moderate to high in this area of the site.

7.1.3. Cyclic Softening

Although not considered liquefiable, the high plasticity silt and clay soil such as those of the Hamilton Ash formation encountered across the elevated hills of the site may still be susceptible to some strength loss, referred to as cyclic softening, during the ULS seismic event. However, these soils were very stiff to hard, and are considered to have a low risk of cyclic softening due to their strength.

7.1.4. Lateral Spread

Following the onset of liquefaction, the liquefied soils behave as a very weak undrained material, which can give rise to lateral spreading where a free face is present within the vicinity of the site or where cut and fill batters are proposed over or within liquefiable soils.

In its current state, the site is considered to have a low risk of surface manifestation of lateral spread as potentially liquefiable soils within the elevated portions of the site were found to be overlain by at least 5m of non-liquefiable soils. However, careful consideration should be given to the design and placement of cut batters to ensure that the deeper liquefiable soils are not left exposed in a free face.

7.2. Slope Stability

Previous site investigations and site walkovers in growth cells T1 and T2 indicated currently active small-scale, and ancient medium-scale slope instability.

No large-scale slope failures were noted in any previous geotechnical study of either cell.

Similarly, we observed no large-scale on-going slope instability during our examination of the available aerial and satellite imagery.

Surficial soil creep, accelerated by farming practices and the removal of vegetation, appears to be occurring on many of the rolling hill slopes and gully side slopes across the site.

The primary area of concern for medium-scale slope instability is the steeply incised portion of the north-east trending gully, where historic aerial imagery indicates moderate recession of the slope crest.

Generally, slope instability and its effects can be mitigated by removing any colluvium, reducing slopes angles, constructing shear keys, buttressing slopes by backfilling gullies, retaining walls, and/or defining building setback restrictions from slope crests.

7.3. Uncontrolled Fill

Our examination of available aerial and satellite imagery indicates the presence of at least two areas of uncontrolled fill in the northern gully of the study area.

It is important to quantify the depth and extent of this uncontrolled fill, and to either remove/improve it during earthworks, or define the areas where it is present as “no build” or “specific design” zones.

7.4. Soft Soils / Settlement

In general the risk of significant settlement in the higher elevation portions of the study area under the expected building loads (i.e. lightweight timber residential buildings) is considered to be low. Some building-load induced settlement could occur, but we expect this would be within NZ building Code limits.

In the gullies and other low-lying areas of the site, lower strength soils are considered likely to be present. Significant settlement under earth-fill and/or building loads is considered a moderate to high risk in these areas.

Typical mitigation measures for areas likely to undergo significant settlement are undercutting and removal of these soils or preloading with appropriate survey monitoring of settlement magnitudes.

Preloading does not require excavation and disposal of soft and compressible soils from the site but can be time consuming and expensive process.

If soft / compressible soils are shallow, then undercutting and disposing off-site can be time and cost effective.

7.5. Expansive Soils

Seasonal shrinking and swelling of expansive soils can result in ground movements that are large enough to damage structures. Case histories of damage include significant cracking of concrete floors and foundations poured in summer months on desiccated subgrades comprising expansive soils, which have subsequently heaved (moved upwards) as rainfall has increased the moisture content of the soil. In some cases extensive repairs or re-building were required. Damage can also result if settlement occurs because of expansive soils drying out.

This hazard is addressed by a combination of suitable foundation design and site preparation.

NZS 3604:20113 excludes from the definition of 'good ground', soils with a liquid limit of more than 50% and a linear shrinkage of more than 15% due to their potential to shrink and swell as a result of seasonal fluctuations in water content. For soils exceeding these limits, NZS 3604 has historically referenced AS 2870. for foundation design advice. However, the November 2019 update of Acceptable Solution B1/AS14 provides amendments to NZS 3604 that define a method for testing and classifying the soils and provides foundation designs for specific, simple house configurations across the range of expansive soil conditions.

Nevertheless, there is evidence in the NZ geotechnical community indicating that the use of the B1/AS1 method of assessment of expansiveness and therefore its design recommendations are likely to be erroneous. Accordingly, our assessments herein have been made in line with our experience and the AS2870 references.

The AS2870 site classification system was established for assessment of expansive soil class primarily for Australian soils. This standard has been adopted in New Zealand and has been further assessed to encompass the Auckland/Northland soils (BRANZ Report, 2008). These documents are relevant where swelling clays are present with mineralogy being predominantly of Smectite / Montmorillonite clays.

With reference to published literature (Lowe & Percival, 1993, Lowe et al.,2014) the Waikato region clay soils of the Hamilton and Kauroa Ashes (the dominant surficial soil type at this locality) are dominated by Halloysite, Kaolinite and some Allophane clay mineralogy's. Upon exposure to air during periods of dry weather, these clay minerals can undergo non-recoverable shrinkage i.e. the volume of the soil is permanently decreased. In this case significant surface cracking can occur. This behaviour is unique to Halloysite dominant clays and therefore differs from Smectite / Montmorillonite (swelling/shrinking) dominated clays, on which AS2870 and the BRANZ report are based.

Whilst strict application of current standards typically classes these soils as expansive soil class M to E, based on published research and visual - tactile identification of soils in accordance with AS2870, adopting stiffened raft foundation systems or NZ3604 type foundations to comply with expansive soil

[3] Standards New Zealand (2011) Timber-framed buildings, NZS 3604:2011, NZ Standard

[4] Ministry of Business, Innovation and Employment (2019) *Acceptable Solutions and Verification Methods for NZ Building Code Clause B1 Structure,* B1/AS1, Amendment 19

class M is often recommended. These recommendations should be confirmed as a part of Resource Consent application and post earthworks geotechnical reporting.

7.6. Sensitive Soils

The near surface clays of the Hamilton Ash are not considered sensitive however, the silty soils of the Piako Subgroup, Hinuera Formation and Puketoka Formation are often highly sensitive, losing shear strength on remoulding.

The sensitive nature of these soils may make them difficult to deal with during site earthworks, and care must be taken to limit disturbance and carefully control moisture levels. Alternatively, where these soils are encountered, they can be blended with less sensitive soils.

Undercutting and replacement with engineered fill such as imported clay / well graded sand, or site won clay from the Hamilton Ash Formation and some soils of the Walton Subgroup may also be considered.

Although their use as fill is not generally recommended, if excavated sensitive silts are to be placed as engineered fill we recommended that field compaction trials are undertaken to test the soil sensitivity under normal compaction conditions and to verify treatment requirements.

8. FURTHER WORK

This desktop report has been carried out to support a zoning change from deferred residential to residential, and has been conducted without civil engineering design drawings, cut/fill earthworks plans, or confirmed building layout plans.

If the site is to be developed, further geotechnical investigation and assessment should be undertaken to provide a full understanding of the geotechnical hazards and risks across the northern portion of the site.

We recommend that the following is considered as a minimum:

- Sampling and testing of near surface soils that may be used as engineered fill to confirm compaction properties.
- Routine investigation of near surface soils for foundation bearing capacity assessment.
- If Hinuera Formation soils are found in the above investigations of near surface soils, then given their moderate to high liquefaction hazard, additional CPT investigation and assessment are required in conjunction with geotechnical design to appropriately mitigate or manage the liquefaction risk.
- Steeper slopes across the site (i.e. around gully heads) require detailed geotechnical investigation and assessment to clarify the presence and scale of any slope instability. Specific slope stability analyses should be conducted for all slopes where currently active or historic instabilities are noted.
- The areas of uncontrolled fill require investigation to confirm their nature, depth, and extent.
- Where soft and compressible soils may be present, further geotechnical investigation including test pits or boreholes and Cone Penetration Tests (CPT's) would be expected as part of a detailed site investigation to enable assessment of expected settlement magnitudes.

9. CONCLUSION

It is our opinion that the study area of growth cell T2 is suitable for the proposed re-zoning for residential use.

As noted above, further geotechnical work including ground investigation and geotechnical analyses will be required to confirm the observations made to date and to aid in the development of a workable and economic development plan.

10. LIMITATION

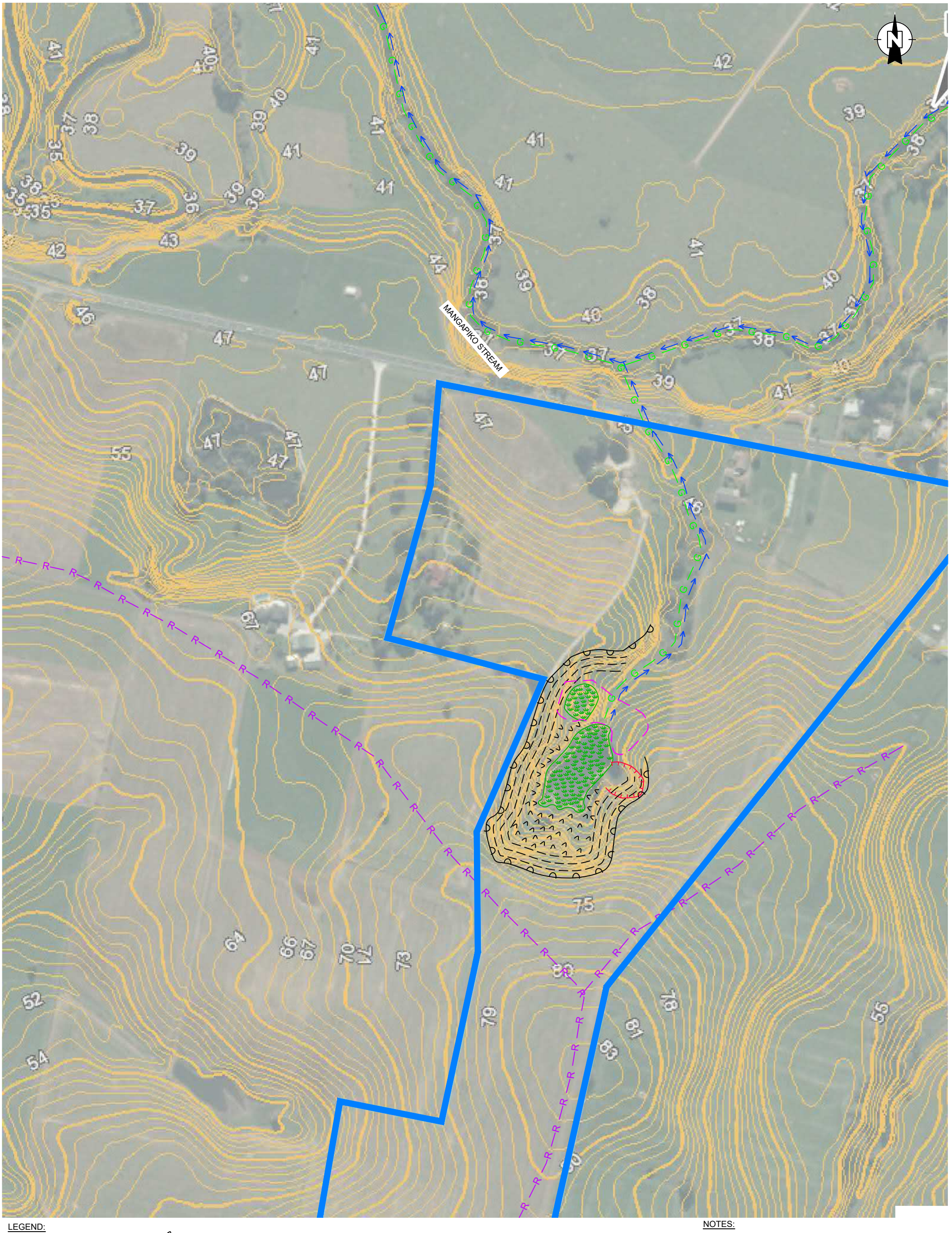
This report has been prepared for the use by our client Sanderson Group Limited, their consultants and the Waipa District Council. Liability for its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes. No other warranty, expressed or implied, is made as to the professional advice included in this report.

It should be noted that data for this report has been obtained from discrete test locations and desktop study. No invasive investigations were completed in the southern zone of the site and as such this report should be seen as a working overview of the site that is to be added to and updated to include additional testing to form an understanding of the geotechnical nature of the entire site.

11. CLOSURE

Should you require any further information or clarification regarding the information provided in this report, please do not hesitate to contact the undersigned.

Drawings



LEGEND:

- SOIL CREEP
- HUMMOCKY GROUND
- RIDGE
- GULLY
- T2 GROWTH CELL BOUNDARY
- POSSIBLE UNCONTROLLED FILL
- POND/SWAMP
- MINOR SCARP: SIDE/FLOW (TEETH POINTING DOWNSLOPE)
- CONVEX SLOPE BREAK
- OPEN DRAIN/STREAM (ARROW IN DIRECTION OF FLOW)

NOTES:

1. BASE PLAN ADAPTED FROM WAIKATO COUNCIL GIS.

1:3000 0 30 60 90 120 150 m

CMW Geosciences

CLIENT: SANDERSON GROUP		DRAWN: WPJ	PROJECT No: HAM2020-0016
PROJECT: TE AWAMUTU COUNTRY CLUB, FRONTIER ROAD, TE AWAMUTU		CHECKED: JW	DRAWING: 01
		REVISION: 0	SCALE: 1:3000
TITLE: GEOMORPHOLOGICAL PLAN NORTHERN ZONE		DATE: 22/05/2020	SHEET: A3

LEGEND:

- SOIL CREEP
- RIDGE
- GULLY
- SITE BOUNDARY
- POSSIBLE DEBRIS LOBE
- BUILDING
- MINOR SCARP: SIDE/FLOW (TEETH POINTING DOWNSLOPE)
- MAJOR SCARP: SIDE/FLOW (TEETH POINTING DOWNSLOPE)
- SHOW DIRECTION OF MOVEMENT BEYOND SCARP
- CONVEX SLOPE BREAK
- OPEN DRAIN/STREAM (ARROW IN DIRECTION OF FLOW)
- T2 GROWTH CELL BOUNDARY
- POSSIBLE MAJOR SCARP: SIDE/FLOW (TEETH POINTING DOWNSLOPE)
- POND/SWAMP

NOTES:

1. BASE PLAN ADAPTED FROM WAIKATO COUNCIL GIS.

1:3000 — 0 30 60 90 120 150 m

CMW Geosciences

CLIENT: SANDERSON GROUP		DRAWN: WPJ	PROJECT No: HAM2020-0016
PROJECT: TE AWAMUTU COUNTRY CLUB, FRONTIER ROAD, TE AWAMUTU		CHECKED: JW	DRAWING: 02
		REVISION: 0	SCALE: 1:3000
TITLE: GEOMORPHOLOGICAL PLAN SOUTHERN ZONE		DATE: 22/05/2020	SHEET: A3

Appendix A – Maunsell Limited Site Investigation Records

CONCEPT PLAN

F2212 C2

APPLICANT Rochdale Holdings Ltd

COMPRISED IN CT: SA1479/81 & 309635

LOCAL BODY Waipa District

LAND DISTRICT South Auckland

SCALE: 1:4000 DATE: March 2008

(A3 ORIGINAL)

TOTAL AREA: 35.3643ha

- Proposed Residential Zone
- Proposed Commercial Zone
- Ponds & Stream
- Roading
- REC Proposed Recreational Reserve

Geotech Testing Key

- ⊙ Machine Auger (generally to 5m bgl)
- ⊙ Hand Auger (1.8m to 3m bgl)
- ⊙ Perc Test (generally to 2m bgl)

DRAWN: W.H. Bouter

NOTE: Areas and dimensions on this application plan are subject to change on field survey.

This plan has been prepared only for the purpose of illustrating an application for a resourse consent. It should not be used for any other purpose.

PROPOSED ZONING OF Part Allotment 242 & Lot 2 DP 17703

Frontier Road

CKL Surveying and Planning
Setting New Boundaries
Land & Engineering Surveyors
Resource Management Planners
Land Development Consultants
Members of the Consulting Surveyors of N.Z.
105 Market Street PO Box 126 Te Awamutu Ph 07 871 6114 Fax 07 871 6181 Email office@ckl.co.nz
TE AWAMUTU HAMILTON AUCKLAND WANAKA

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 1

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, friable, moist, firm. (TOPSOIL)			
0.20m	Brownish Orange SIT with minor CLAY, moist, firm.		-	
			-	
			-	
	- Light Brown at 0.90m.		-	
1.0			-	
1.3m	Brown CLAYEY SILT, moist, firm.		-	
			-	
2.0	Light Brownish Orange SILTY CLAY, moist, firm.		-	
			-	
			-	
3.0			-	
			-	
			-	
4.0			-	
			-	
			-	
5.0	End of log at 5.0m.		-	
			-	
			-	
6.0			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 1870
Correction factor: Reading x 1.85 -1.99
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Rowan Buckley

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 2

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, friable, moist, firm. (TOPSOIL)			
0.20m	Brownish Orange CLAYEY SILT, moist, firm.		-	
		0.5m 153 kPa	-	
			-	
	- Light Brownish Orange at 0.80m.	1.0m		
1.0		146 kPa	-	
		1.5m	-	
1.6m	Brown SILTY CLAY,moist, firm.	UTP	-	
		2.0m	-	
2.0		UTP	-	
		2.5m	-	
2.6m	Light Brown SILTY CLAY, moist to wet.	UTP	-	
		3.0m	-	
3.0		UTP	-	
		3.5m	-	
		220 kPa	-	
4.0			-	
			-	
			-	
5.0	End of log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 1870
Correction factor: Reading x 1.85 -1.99
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Rowan Buckley

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 3

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, friable, moist, firm. (TOPSOIL)		-	
0.30m	Brownish Orange SILTY CLAY, moist, firm.	0.5m 135 kPa	-	
	- Brown at 0.60m.		-	
1.0		1.0m 135 kPa	-	
	- Light Brown at 1.4m.	1.5m UTP	-	
		2.0m UTP	-	
2.0			-	
		2.5m UTP	-	
		3.0m UTP	-	
3.0			-	
		3.5m 202 kPa	-	
3.7m	Mottled Orange SILTY CLAY, moist to wet.		-	
4.0			-	
			-	
			-	
			-	
5.0	End of log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 1870
Correction factor: Reading x 1.85 -1.99
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Rowan Buckley

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 4

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, friable, moist, firm. (TOPSOIL)		-	
0.30m	Brownish Orange SILTY CLAY, moist, firm.	0.5m UTP	-	
	- Light Brown at 0.80m.		-	
1.0		1.0m 209 kPa	-	
		1.5m 220 kPa	-	
2.0		2.0m UTP	-	
		2.5m UTP	-	
		3.0m UTP	-	
3.0	Light Brownish Orange SILTy CLAY, moist to wet.		-	
		3.5m UTP	-	
4.0			-	
			-	
			-	
5.0	End of log at 5.0m.		-	
			-	
			-	
6.0			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 1870
Correction factor: Reading x 1.85 -1.99
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Rowan Buckley

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 5

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, friable, moist, firm. (TOPSOIL)			
0.25m	Brownish Orange CLAYEY SILT, moist, firm.	0.5m 146 kPa		
0.80m	Dark Brownish Orange SILTY CLAY, moist, firm to stiff.	1.0m 165 kPa		
1.0				
1.4m	Brown SILTY CLAY, moist, stiff.	1.5m UTP		
2.0		2.0m UTP		
		2.5m UTP		
3.0	- Brownish Yellow from 3.0m.	3.0m UTP		
		3.5m UTP	-	
4.0			-	
			-	
			-	
5.0	End of log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 1870
Correction factor: Reading x 1.85 -1.99
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Rowan Buckley

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 6

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Light Brownish Orange SILTY CLAY, slightly friable, moist, firm.	0.5m 144 kPa	-	
			-	
1.0	- Brownish Yellow from 1.0m.	1.0m 141 kPa	-	
		1.5m 157 kPa	-	
2.0		2.0m 181 kPa	-	
		2.5m 132+kPa	-	
3.0		3.0m UTP*	-	
		3.5m UTP	-	
4.0	- Light Greyish Brown from 4.0m.		-	
	- mottled Brownish Yellow from 4.5m.		-	
5.0	End of Log at 5.0m.		-	
6.0			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.60 - 3.34
These values are corrected
UTP represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 7

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brownish Orange SILTY CLAY, slightly friable, moist, firm.	0.5m 146 kPa	-	
	- Light Brown from 0.8m.	1.0m 146 kPa	-	
1.0		1.5m UTP	-	
	- Brown from 1.5m.	2.0m UTP	-	
2.0		2.5m UTP	-	
		3.0m kPa	-	
3.0		3.5m UTP	-	
	- Brownish Yellow, moderately plastic from 3.6m.		-	
4.0			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.60 - 3.34
These values are corrected
UTP represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 8

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brownish Orange SILTY CLAY, slightly friable, moist, firm.	0.5m 136 kPa	-	
	- Brown from 0.8m.		-	
1.0		1.0m 179 kPa	-	
		1.5m UTP*	-	
2.0		2.0m UTP*	-	
		2.5m 136 kPa	-	
3.0	- Light Brownish Orange from 3.0m.	3.0m 131 kPa	-	
		3.5m UTP	-	
4.0			-	
5.0	End of Log at 5.0m.		-	
6.0			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 9

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Light Brownish Orange SILTY CLAY, moist, firm.	0.5m 142 kPa	-	
			-	
1.0		1.0m UTP	-	
			-	
		1.5m 142 kPa	-	
	- Brownish Yellow from 1.8m.		-	
2.0		2.0m 157 kPa	-	
			-	
		2.5m 148 kPa	-	
			-	
3.0		3.0m 151 kPa	-	
		3.5m 162 kPa	-	
			-	
4.0			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 10

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brownish Yellow SILTY CLAY, slightly friable, moist, firm.	0.5m 167 kPa	-	
			-	
1.0		1.0m 151 kPa	-	
			-	
	- Brown from 1.5m.	1.5m UTP*	-	
2.0		2.0m 201+kPa	-	
	- Light Brown from 2.2m.		-	
		2.5m UTP	-	
			-	
3.0		3.0m 176 kPa	-	
			-	
	- Light Brownish Orange from 3.5m.	3.5m 173 kPa	-	
			-	
4.0			-	
	- moderately plastic from 4.5m.		-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 11

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brown SILTY CLAY, slightly friable, moist, firm.	0.5m 120 kPa	-	
			-	
		1.0m 136 kPa	-	
1.0			-	
		1.5m UTP*	-	
		2.0m 201+kPa	-	
2.0	- Light Brownish Yellow from 2.0m.		-	
		2.5m 182 kPa	-	
			-	
		3.0m 201+kPa	-	
3.0			-	
		3.5m 201+kPa	-	
			-	
4.0	- Light Brown from 4.0m.		-	
			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 12

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brown SILTY CLAY, moderately friable, moist, firm.	0.5m 176 kPa	-	
	- Brownish Yellow from 0.7m.		-	
1.0		1.0m 151 kPa	-	
		1.5m 182 kPa	-	
	- Brown and moderately plastic from 1.7m.		-	
2.0		2.0m UTP*	-	
		2.5m UTP*	-	
			-	
3.0		3.0m 164 kPa	-	
		3.5m 198 kPa	-	
4.0			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
6.0			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 13

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brownish Orange SILTY CLAY, moderately friable, moist, firm.	0.5m 164 kPa	-	
			-	
		1.0m 182 kPa	-	
1.0	- Brown and moderately plastic from 1.0m.		-	
		1.5m UTP*	-	
		2.0m 201+kPa	-	
2.0			-	
		2.5m 182 kPa	-	
		3.0m 182 kPa	-	
3.0			-	
		3.5m 201+kPa	-	
	- Brownish Yellow from 3.5m.		-	
4.0			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 14

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		6	
0.3m	Brownish Orange SILTY CLAY, highly friable, moist, soft to firm.	0.5m 61 kPa	4	
	- soft from 0.6m.		3	
0.8m	Light Grey CLAYEY SILT, moderately plastic, moist, soft.	1.0m 120 kPa	3	
1.0	- firm from 1.2m.		8	
		1.5m 114 kPa	5	
			8	
2.0	Light Grey mottled Light Yellow SILTY fine SAND, moist, medium dense.		14	
2.5m	Light Grey pumiceous fine SAND, moist, medium dense.		9	
			11	
3.0	- moist to wet with trace SILT from 3.0m.		14	
	- wet from 3.2m.		14	
			-	
4.0			-	
			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 15

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brownish Orange SILTY CLAY, moderately friable, moist, firm.	0.5m 136 kPa	-	
			-	
1.0	- Brown and slightly plastic from 1.0m.	1.0m 167 kPa	-	
		1.5m UTP*	-	
2.0		2.0m UTP*	-	
			-	
	- Light Brownish Orange from 2.5m.	2.5m UTP*	-	
			-	
3.0	- Brownish Yellow and moderately plastic from 3.0m.	3.0m UTP*	-	
		3.5m UTP*	-	
			-	
4.0			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Machine Auger 16

PROJECT No. : 600 427 95
DATE : 5 June 2008

MAUNSELL | AECOM

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		-	
0.3m	Brownish Orange SILTY CLAY, moderately plastic, moist, firm.	0.5m 201+kPa	-	
			-	
1.0		1.0m 201+kPa	-	
	- Brown from 1.2m.		-	
		1.5m UTP	-	
2.0		2.0m 136 kPa	-	
			-	
		2.5m 160 kPa	-	
			-	
3.0	- Brownish Yellow from 3.0m.	3.0m 136 kPa	-	
		3.5m 160 kPa	-	
	- Reddish Orange mottled Light Grey & Brownish Yellow from 3.5m.		-	
4.0	- mottled Pinkish Orange from 4.0m.		-	
			-	
			-	
			-	
5.0	End of Log at 5.0m.		-	
			-	
			-	
			-	
6.0			-	
			-	
			-	
7.0			-	

COMMENTS: Shear Vane: DR 2257
Correction factor: Reading x 1.55 - 3.82
These values are corrected
UTP* represents Unable to Penetrate.

LOGGED BY: Geoff Painter

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Rochdale Subdivision, Frontier Rd, Te Awamutu
Auger No. : Auger 17

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	6	
0.3m.	Light Brown CLAYEY SILT, moist, firm.	3	
		3	
	- moderately plastic from 0.8m.		
1.0		13	
		11	
	- streaked Dark Brown from 1.6m.	18	
	End of log at 1.8m.	15	
2.0		-	
		-	
		-	
3.0		-	

COMMENTS: DCP NUMBERS represent number of blows per 300mm.

LOGGED BY: Nicky Ries

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Roachdale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 18

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	5	
0.2m	Light Brownish Grey streaked Light Orange SILT, moist, firm.	8	
	-intermixed Dark Brown organic SILT with trace rootlets from 0.55m.	5	
0.9m	Dark Brown organic SILT, trace rootlets, slight organic odour, moist to wet, firm.	11	
1.0	Light Brownish Grey fine to medium SILTY SAND, moist to wet, medium dense.		
1.2m	Brownish Grey organic SILT, organic odour, trace rootlets, moist to wet, firm.	6	
	-wet from 1.6m. (Water Table)	6	
2.0	-hard to obtain sample from 2.0m.	6	
2.1m	Light Grey streaked Light Orange SILT, wet, soft.	8	
		11	
2.6m	Brownish Orange SILT with trace fine SAND, wet, firm.	9	
3.0	End of Log at 3.0m.	-	

COMMENTS: DCP numbers represent the number of blows per 300mm

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Roachdale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 19

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	3	
0.3m	Light Brownish Grey SILT with minor fine SAND, moist to wet, firm.	8	
		11	
0.75m	Light Greyish Brown Organic SILT, moist, firm to stiff.		
	-slight organic odour and wet from 0.9m.		
1.0	-Water Table.	10	
		5	
	-Dark Brown, organic odour, trace rootlets and moist from 1.4m.		
	-hard to obtain sample from 1.5m.	4	
1.8m	Light Bluish Grey fine SANDY SILT, wet, medium dense.	5	
2.0	End of Log at 2.0m. Unable to obtain sample.	6	
		8	
		8	
3.0		-	

COMMENTS: DCP NUMBERS represent number of blows per 300mm.

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Roachdale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 20

PROJECT No: 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Light Brown SILT, moist, firm. (Topsoil)	5	
0.4m	Light Brown mottled Orange SILT, moist, firm. -Light Grey mottled Orange from 0.45m.	3	
	-trace fine SAND from 0.6m.	3	
1.0		2	
	-Greyish White and minor fine SAND from 1.35m.	4	
1.5m.	SILTY fine SAND, wet (Water Table)	4	
		6	
2.0	-hole collapsing to 2.0m.	8	
		8	
		7	
3.0	End of Log at 3.0m.	7	

COMMENTS: DCP numbers represent number of blows per 300mm

LOGGED BY: Nicky Ries

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 21

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		7	
0.3m	Light Brown SILT with trace fine SAND, moist, firm.	0.3m 112 kPa	5	
		0.6m 138 kPa	6	
		0.9m 135 kPa	10	
1.0	- minor CLAY from 1.2m.	1.2m 118 kPa	14	
	- slightly plastic from 1.5m.	1.5m 140 kPa	17	
1.8m	End of log at 1.8m.		16	
2.0			-	
			-	
			-	
3.0			-	

COMMENTS: Shear Vane: DR 2944
Correction factor: Reading x 1.86 - 17.99
These values are corrected
UTP represents Unable to Penetrate

LOGGED BY: Nicky Ries

MAUNSELL | AECOM

PROJECT : Soils Investigations
CLIENT : Rochadale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 22

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	Water Level
0.0	Dark Brown SILT, moist, firm.		
0.25m	Light Brown CLAYEY SILT, moist, firm.	0.3m 131 kPa	
1.6m	Light Brown mottled Dark Brown SILTY CLAY, moist, firm.	0.6m 105 kPa	
1.0		0.9m 105 kPa	
		1.2m 103 kPa	
		1.5m 94 kPa	
1.8m	End of lot at 1.8m.	1.8m 233 kPa	
2.0			
3.0			

COMMENTS: Shear Vane: DR 2944
Correction factor: Reading x 1.86 - 17.99
These values are corrected
UTP represents Unable to Penetrate

LOGGED BY: Nicky Ries

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Roachdale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 23

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)		
		0.3m 94 kPa	
0.35m	Brownish Yellow SILT with some CLAY, moist, firm.		
		0.6m 108 kPa	
0.8m	Brownish Yellow SILTY CLAY, moist, firm.		
		0.9m 56 kPa	
1.0			
		1.2m 127 kPa	
	-trace fine SAND from 1.25m.		
		1.5m 157 kPa	
		1.8m UTP	
	-minor fine GRAVEL from 1.9m.		
2.0			
		2.1m 172 kPa	
	-minor fine SILTSTONE SAND from 2.35m.	2.4m 131 kPa	
	-water table from 2.7m.	2.7m 127 kPa	
3.0	End of Log at 3.0m.	3.0m 131 kPa	

COMMENTS: Shear Vane: DR 2944
Correction factor: Reading x 1.86 - 17.99
These values are corrected
UTP represents Unable to Penetrate

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Roachdale Holdings Ltd
LOCATION : Frontier Road, Te Awamutu
AUGER No. : Auger 24

PROJECT No. : 600 427 95
DATE : 7 July 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	0.3m	6	
0.3m	Light Brownish Orange SILTY fine SAND, moist, medium dense.	224 kPa	5	
		0.6m		
	-Light Grey from 0.6m.	164 kPa	6	
0.8m	Dark Brownish Orange SILTY CLAY, moist to wet, firm.	0.9m		
		149 kPa	7	
1.0		1.2m		
		112 kPa	5	
		1.5m		
		257+ kPa	7	
	-Light Brownish Grey from 1.65m.	1.8m		
		164 kPa	10	
2.0	-Whitish Grey streaked Light Orange from 2.05m.	2.1m		
		90 kPa	10	
		2.4m		
		79 kPa	11	
		2.7m		
	-wet from 2.7m. (Water Table)	131 kPa	8	
		3.0m		
3.0	End of Log at 3.0m.	133 kPa	9	

COMMENTS: Shear Vane: DR 2944
Correction factor: Reading x 1.86 - 17.99
These values are corrected
UTP represents Unable to Penetrate

LOGGED BY: Kurt Silver

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 1

PROJECT No. : 600 427 95
DATE : 12 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.3m	Brownish Orange CLAYEY SILT, moist, firm.	-	
		-	
1.0		-	
		-	
		-	
		-	
2.0	End of Log at 2.0m.	-	
		-	
		-	
		-	
3.0		-	

COMMENTS:

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 2

PROJECT No. : 600 427 95
DATE : 12 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.3m	Brownish Yellow CLAYEY SILT, moist, firm.	-	
		-	
	-Dark Brownish Orange from 0.8m.	-	
1.0		-	
		-	
		-	
		-	
2.0	End of Log at 2.0m.	-	
		-	
		-	
		-	
3.0		-	

COMMENTS:

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 3

PROJECT No. : 600 427 95
DATE : 12 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.3m	Brownish Yellow CLAYEY SILT, moist, firm.	-	
		-	
1.0		-	
		-	
	-Light Greyish Yellow and some fine pumiceous fine SAND from 1.55m	-	
1.8m	Dark Brown SILTY CLAY, moist to wet, firm.	-	
2.0	End of Log at 2.0m.	-	
		-	
		-	
3.0		-	

COMMENTS:

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 4

PROJECT No. 600 427 95
DATE : 22 April 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)			
0.3m	Brownish Orange SILT, moderately friable, moist, firm.			
0.7m	Brownish Yellow CLAYEY SILT, with trace fine SAND, moist, firm.			
1.0				
1.4m	Brown SILTY CLAY, slightly friable, moist, firm.			
2.0	End of log at 2m.			
3.0				
4.0				
5.0				
6.0				
7.0				

COMMENTS:

LOGGED BY: Geoff Painter

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 5

PROJECT No. 600 427 95
DATE : 22 April 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)			
0.3m	Brownish Yellow CLAYEY SILT, slightly friable, moist, firm.			
1.0				
1.2m	Brown SILTY CLAY, moist, firm to stiff.			
	End of log at 1.3m. (UTP)			
2.0				
3.0				
4.0				
5.0				
6.0				
7.0				

COMMENTS:

LOGGED BY: Geoff Painter

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 6

PROJECT No. 600 427 95
DATE : 22 April 2008

DEPTH	MATERIAL DESCRIPTION	Shear Strength	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)			
0.25m	Brownish Orange SILT with trace CLAY, moist, firm.			
	- minor CLAY from 0.5m.			
0.85m	Brownish Orange CLAYEY SILT, moist to firm.			
1.0				
	- Brownish Yellow from 1.8m			
2.0	End of log at 2m.			
3.0				
4.0				
5.0				
6.0				
7.0				

COMMENTS:

LOGGED BY: Geoff Painter

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 7

PROJECT No. : 600 427 95
DATE : 12 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.3m	Dark Brownish Yellow CLAYEY SILT, moist, firm.	-	
		-	
0.95m	Dark Brown SILTY CLAY, moist, firm.	-	
1.0		-	
		-	
		-	
2.0	End of Log at 2.0m.	-	
		-	
		-	
3.0		-	

COMMENTS:

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 8

PROJECT No. : 60042795
DATE : 29 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.2m	Brownish Orange CLAYEY SILT, moist, firm.	-	
0.6m	Light Brownish Yellow SILTY CLAY, moist, firm.	-	
1.0		-	
		-	
	-Yellowish Brown and stiff from 1.6m.	-	
	-Brown from 1.7m.	-	
2.0	End of Log at 2.0m.	-	
		-	
		-	
		-	
3.0		-	

COMMENTS: DCP NUMBERS represent number of blows per 300mm.

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 9

PROJECT No. : 60042795
DATE : 29 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.4m	Light Brownish Grey SILT, moist, firm.	-	
	-100mm thick layer of Light Whitish Grey SILTY fine SAND, moist, medium dense.	-	
1.0	-wet from 1.4m (Water Table)	-	
1.5m	Dark Brown Organic SILT with minor fragments of decomposing wood, wet, soft to firm.	-	
1.6m	End of Log at 1.6m.	-	
2.0		-	
		-	
		-	
3.0		-	

COMMENTS: DCP NUMBERS represent number of blows per 300mm.

LOGGED BY: Gareth Brownlie

MAUNSELL | AECOM

PROJECT : Soils Investigation
CLIENT : Rochdale Holdings Ltd
LOCATION : Frontier & Pirongia Roads, Te Awamutu
Auger No. : Perc 10

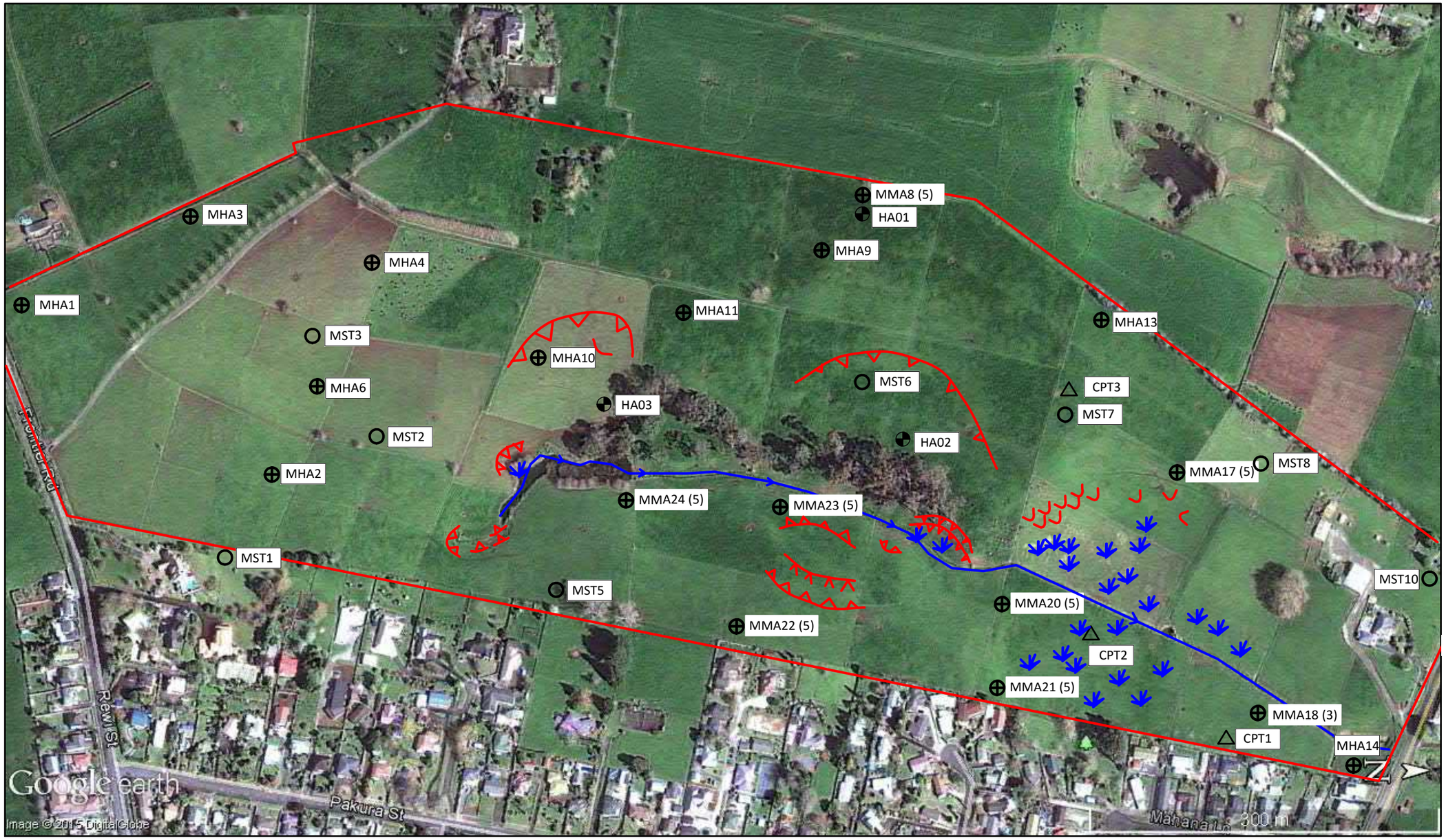
PROJECT No. : 60042795
DATE : 29 April 2008

DEPTH	MATERIAL DESCRIPTION	DCP (Scala) Penetrometer	Water Level
0.0	Dark Brown SILT, moist, firm. (Topsoil)	-	
0.25m	Brownish Yellow CLAYEY SILT, moist, firm.	-	
		-	
		-	
1.0		-	
		-	
1.5m	Dark Brown SILTY CLAY, moist, firm.	-	
		-	
2.0	End of Log at 2.0m.	-	
		-	
		-	
		-	
3.0		-	

COMMENTS: DCP NUMBERS represent number of blows per 300mm.

LOGGED BY: Geoff Painter

Appendix B – HD Geotechnical Site Investigation Records



N

HD geotechnical

LEGEND

- HD Geotechnical Hand auger location (HA1)
- Maunsell hand auger location (MHA1)
- Maunsell machine auger location (MMA15) and depth (5)
- Maunsell soakage test location (MST7)
- CPT location
- Surface creep
- Springs and surface water
- Convex slope break
- Stream / open drain
- Concave slope break

PROJECT:
T1 Growth Cell
Te Awamutu

CLIENT:
Rochdale Holdings Ltd

TITLE:
Site Plan

Drawing No:
HD057/1

Drawing by:
EC

Revision No:

0	Issued to client.	5.10.15	AH

Test record

Date: 09.09.15
Project: HD057
Test Number: HA01
Location: Western margin of site at the top of hill

Test type: Hand Auger

Depth	Geology	Test Results: DCP (blows/100mm)	Test Results: Shear Vane (kPa)	Material Description	Detailed Description
0	Topsoil			Topsoil	SILT, dark brown. Moist.
0.1					
0.2	Hamilton Ash			Undifferentiated airfall tephra	0.2m: Clayey SILT, with trace fine sand, brown. Stiff becoming very stiff, dry to moist, moderately to highly plastic.
0.3			55/20		
0.4					
0.5					
0.6			121/29		
0.7					0.7m: light brown.
0.8					
0.9					
1			101/32		
1.1					1.1m: brown.
1.2					
1.3			173/26		
1.4					
1.5			202/43		
1.6					
1.7					1.7m: brownish orange.
1.8			202+		
1.9					
2					2m: increased clay.
2.1					
2.2			202+		
2.3					2.3m: End of borehole - target depth.
2.4					
2.5					
2.6					
2.7					
2.8					
2.9					
3					
3.1					

Comments:	**Groundwater observations:**
Shear Vane: SV 1746	No groundwater at time of testing.

Test record

Date: 09.09.15
Project: HD057
Test Number: HA02
Location: Lobe of large bowl

Test type: Hand Auger

Test Results

Depth	Geology	DCP (blows/ 100mm)	Shear Vane (kPa)	Material Description	Detailed Description
0	Topsoil			Topsoil	SILT, dark brown. Moist.
0.1	Colluvium			Reworked ash material	0.1m: SILT, with some clay, brownish orange. Stiff, dry to moist.
0.2					
0.3			72/17		
0.4					
0.5					
0.6			43/9		
0.7					
0.8					
0.9	Hamilton Ash		159/25	Undifferentiated airfall tephra	0.9m: Clayey SILT, brown. Very stiff, moist, highly plastic.
1					
1.1					
1.2			127/26		1.2m: trace fine sand.
1.3					
1.4					1.4m: SILT, with minor fine sand, some clay, light brown. Very stiff, moist, highlly plastic.
1.5			176/32		
1.6					1.5m: Clayey SILT, with some sand and trace gravel, brown. Very stiff, moist, highly plastic.
1.7					
1.8			202+		
1.9					
2					2m: increasing clay.
2.1			195/46		
2.2					
2.3					
2.4					
2.5			202+		2.5m: End of borehole - target depth.
2.6					
2.7					
2.8					
2.9					
3					
3.1					

Comments:

Shear Vane:
SV 1746

Groundwater observations:
No groundwater at time of testing.

Test record

Date: 09.09.15
Project: HD057
Test Number: HA03
Location: Western side of pond

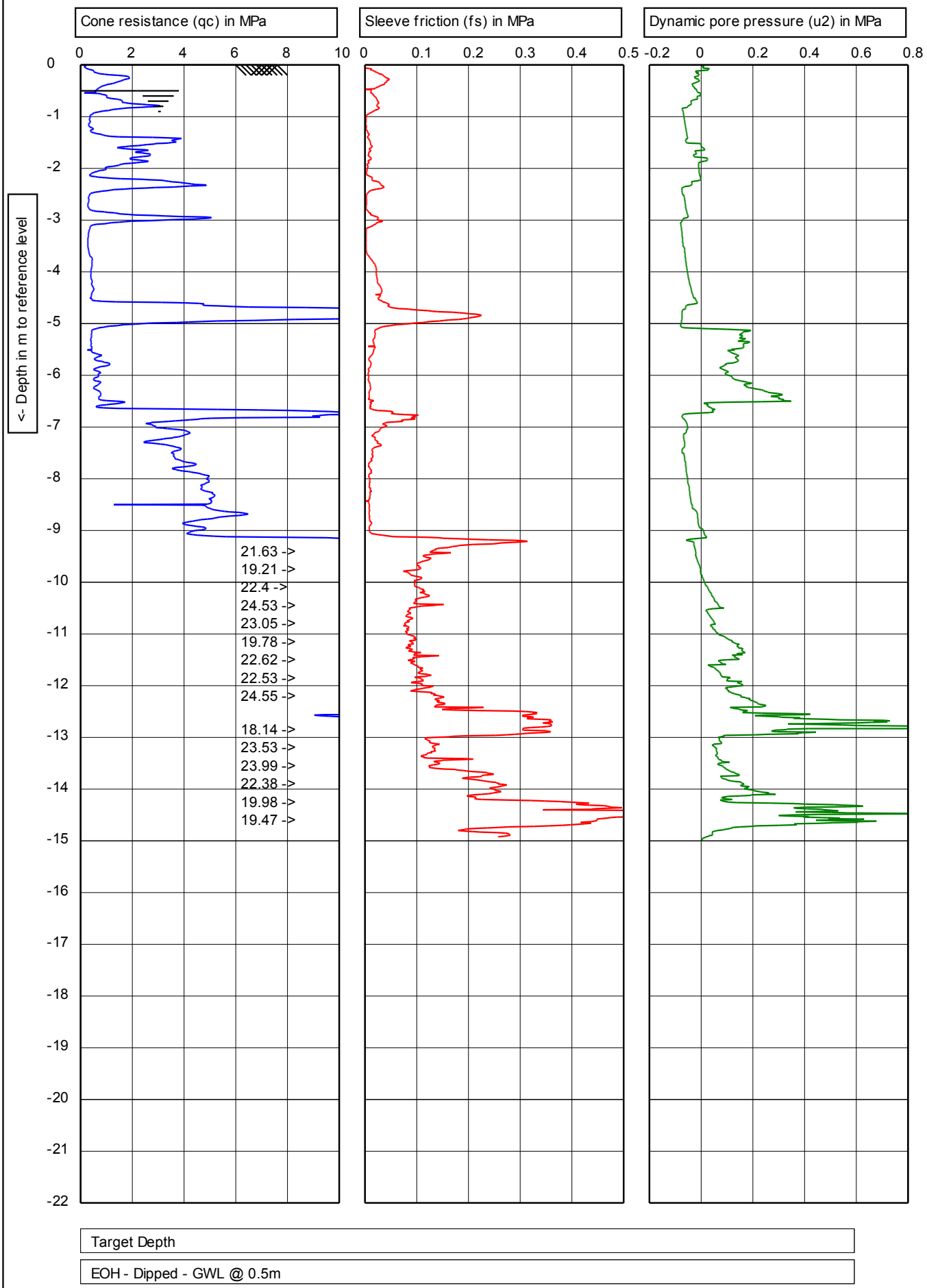
Test type: Hand Auger

Depth	Geology	Test Results: DCP (blows/ 100mm)	Test Results: Shear Vane (kPa)	Material Description	Detailed Description
0	Topsoil			Topsoil	SILT, dark brown. Moist; trace rootlets and charcoal at base.
0.1					
0.2					
0.3	Hamilton Ash			Undifferentiated airfall tephra	0.3m: SILT, with some clay, brown. Stiff to very stiff, dry to moist, moderately plastic.
0.4					
0.5			156/30		
0.6					
0.7					
0.8					0.8m: Clayey SILT, brown. Stiff to very stiff, moist, highly plastic; trace fine sand.
0.9			95/33		
1					
1.1					
1.2			118/33		
1.3					
1.4					1.4m: trace manganese nodules.
1.5			76/32		1.5m: Moist to wet.
1.6					
1.7					1.7m: minor manganese staining.
1.8			108/32		1.8m: Sandy clayey SILT, brown. Very stiff, moist, moderately plastic; sand, fine to coarse, quarts, pumice, lithics.
1.9					
2					2m: brownish orange.
2.1					
2.2					2.2m: brown.
2.3			113/29		2.3-2.35m: heavily manganese stained.
2.4					
2.5					2.5m: End of borehole - target depth.
2.6					
2.7					
2.8					
2.9					
3					
3.1					

Comments:

Shear Vane:
SV 1746

Groundwater observations:
No groundwater at time of testing.



OPUS

Graphs on this page are not IANZ accredited

u2
150 cm²
10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012

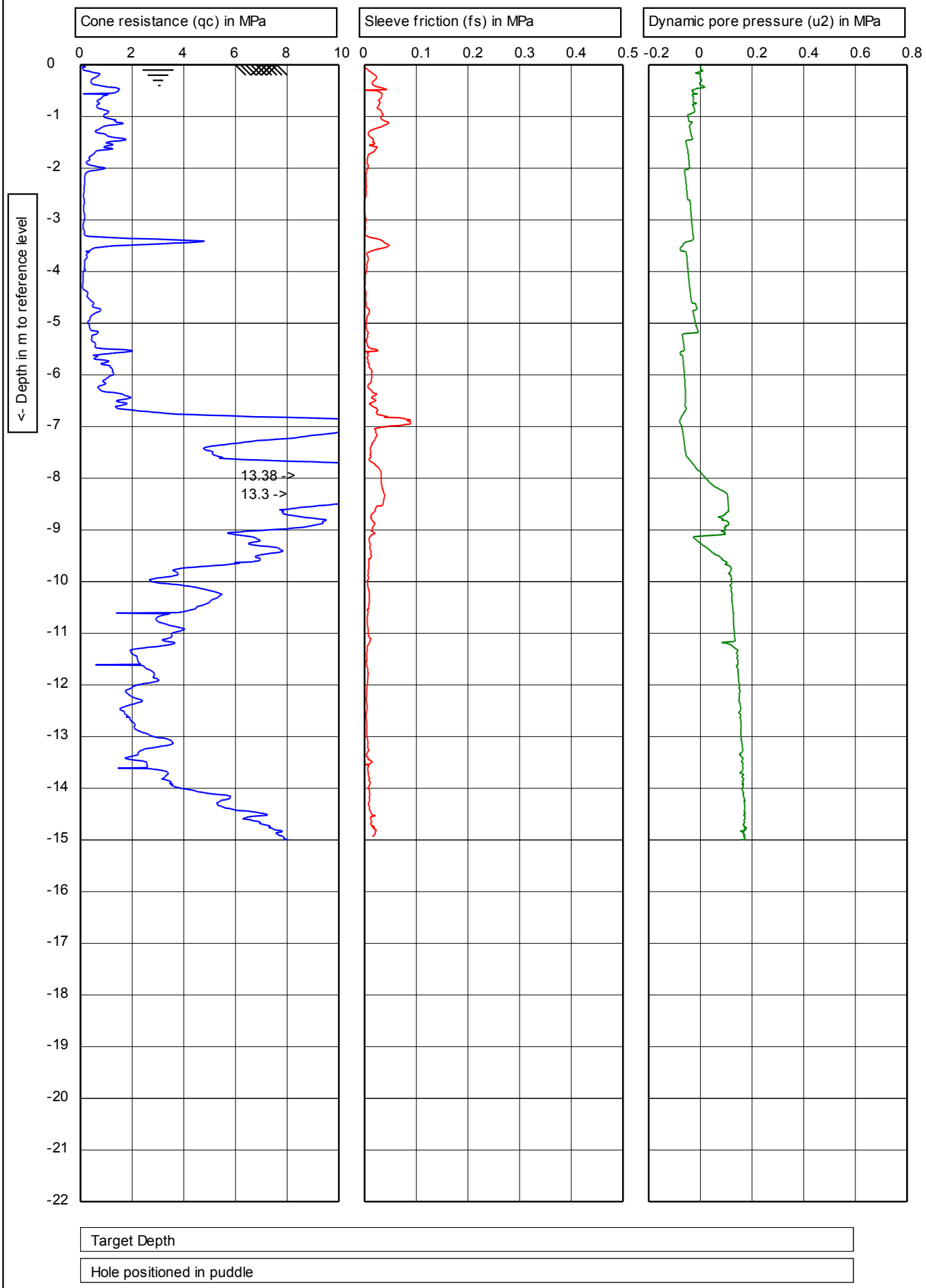
G.L.: **0.00 m MSL** | W.L.: **-0.50 m**

Project: **Te Awamutu T1**

Location: **5 Pirongia Rd - Te Awamutu**

Position: **1802153, 5791310 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**25/08/2015**
Cone no.:	**C10CFIIP.C14122**
Project no.:	**268242.15_015**
CPT no.:	**01**

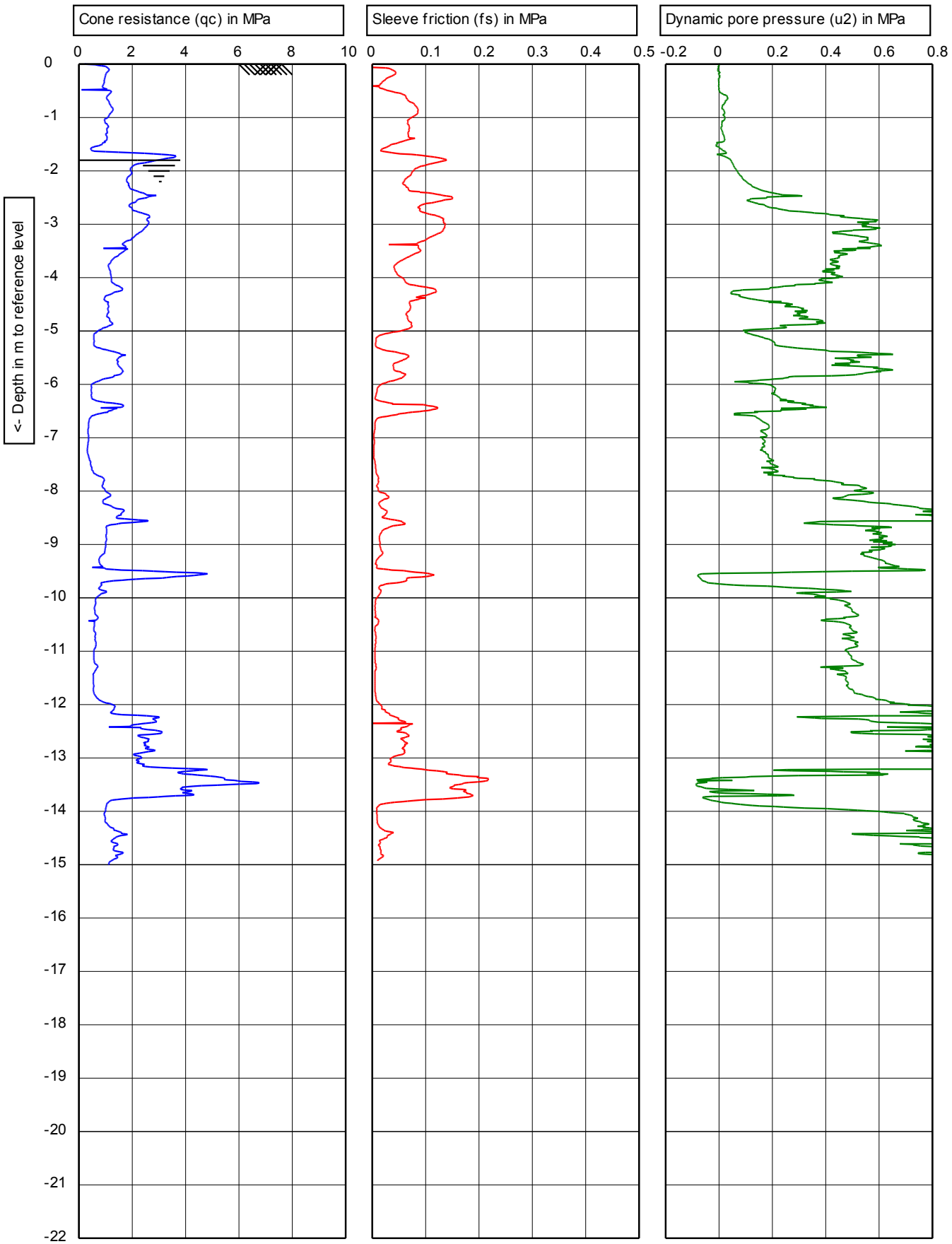


OPUS

Graphs on this page are not IANZ accredited

Test according ASTM D5778-12 & ISO 22476-1:2012		Predrill:	**0.00 m Predrilled**
G.L.: **0.00 m MSL**	W.L.: **0.00 m**	Date:	**25/08/2015**
Project: **Te Awamutu T1**		Cone no.:	**C10CFIIP.C14122**
Location: **5 Pirongia Rd - Te Awamutu**		Project no.:	**268242.15_015**
Position: **1802071, 5791213 NZTM**		CPT no.:	**02** **1/6**

1.44



Target Depth

EOH - Dipped - GWL @ 1.8m

OPUS

Graphs on this page are not IANZ accredited

u2 150 cm² 10 cm²

Test according ASTM D5778-12 & ISO 22476-1:2012

G.L.: **0.00 m MSL** W.L.: **-1.80 m**

Project: **Te Awamutu T1**

Location: **5 Pirongia Rd - Te Awamutu**

Position: **1801858, 5791159 NZTM**

Predrill:	**0.00 m Predrilled**
Date:	**25/08/2015**
Cone no.:	**C10CFIIP.C14122**
Project no.:	**268242.15_015**
CPT no.:	**03**

1.44

Appendix C – CMW Site Investigation Records

NOTES:

1. BASE PLAN ADAPTED FROM WAIKATO COUNCIL GIS.

LEGEND:

SITE BOUNDARY

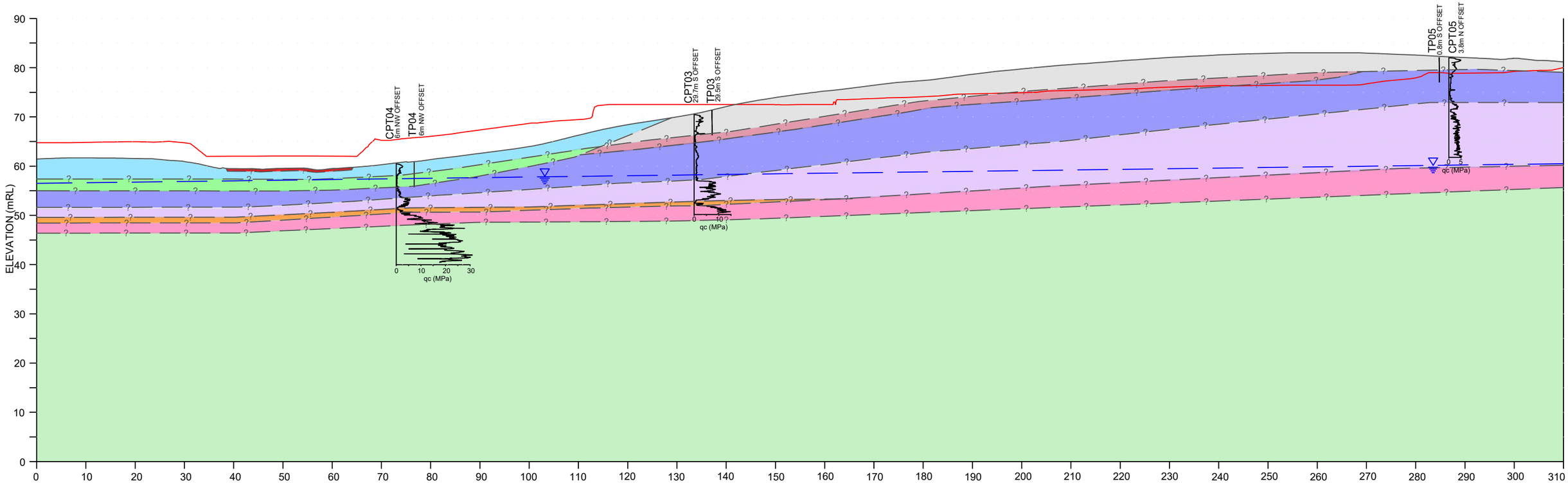
1:2500 0 25 50 75 100 125 m

CMW Geosciences

CLIENT: SANDERSON GROUP		DRAWN: WPJ	PROJECT No: HAM2020-0016
PROJECT: FRONTIER ROAD DEVELOPMENT FRONTIER ROAD, TE AWAMUTU		CHECKED: AS	DRAWING: 01
		REVISION: B	SCALE: 1:2500
TITLE: GEOTECHNICAL INVESTIGATION PLAN		DATE: 07/04/2020	SHEET: A3

SOUTH-WEST

NORTH-EAST



SECTION A

LEGEND:

- ASSUMED WINTER WATER TABLE
- EXISTING GROUND PROFILE
- EXISTING GROUND PROFILE
- PRELIMINARY EARTHWORKS PROFILE
- STIFF SILTY CLAY/CLAYEY SILT (COLLUVIUM COMPRISING DISPLACED VOLCANIC ASHES)
- SOFT TO FIRM SILTY CLAY/CLAYEY SILT (COLLUVIUM COMPRISING DISPLACED PUKETOKA FORMATION)
- FIRM SENSITIVE SILT (PUKETOKA FORMATION)
- ORGANIC SILT (ALLUVIUM)
- STIFF TO HARD SILT/CLAY (VOLCANIC ASH)
- FIRM TO STIFF SILT (WALTON SUBGROUP)
- VERY STIFF TO HARD SANDY SILT/CLAYEY SILT (PUKETOKA FORMATION)
- SENSITIVE SILT (PUKETOKA FORMATION)
- VERY STIFF TO HARD SANDY SILT/SILTY SAND (PUKETOKA FORMATION)
- DENSE TO VERY DENSE SAND (PUKETOKA FORMATION)

1:800 0 8 16 24 32 40 m

CMW Geosciences

CLIENT: SANDERSON GROUP		DRAWN: WPJ	PROJECT No: HAM2020-0016
PROJECT: TE AWAMUTU COUNTRY CLUB, FRONTIER ROAD, TE AWAMUTU		CHECKED: AS	DRAWING: 02
		REVISION: D	SCALE: 1:800
TITLE: SECTION A		DATE: 22/04/2020	SHEET: A3

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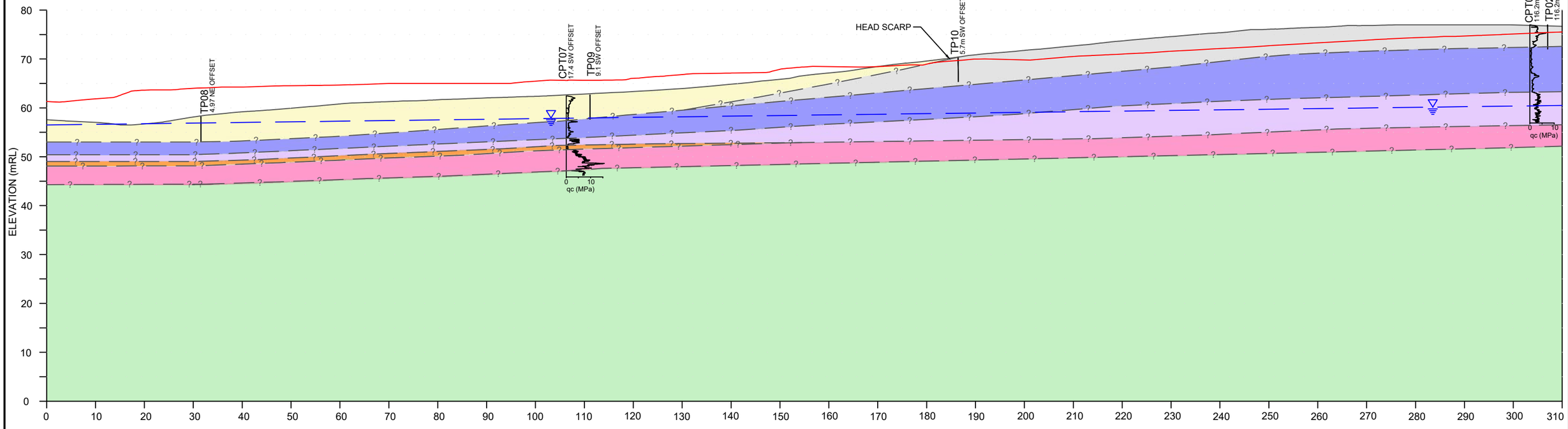
NORTH-WEST

SOUTH-EAST



SECTION B

LEGEND:

- ASSUMED WINTER WATER TABLE
- EXISTING GROUND PROFILE
- EXISTING GROUND PROFILE
- PRELIMINARY EARTHWORKS PROFILE
- STIFF TO HARD SILT/CLAY (VOLCANIC ASH)
- FIRM TO HARD SILTY CLAY/CLAYEY SILT (COLLUVIUM)
- FIRM TO STIFF SILT (WALTON SUBGROUP)
- VERY STIFF TO HARD SANDY SILT/CLAYEY SILT (PUKETOKA FORMATION)
- SENSITIVE SILT (PUKETOKA FORMATION)
- VERY STIFF TO HARD SANDY SILT/SILTY SAND (PUKETOKA FORMATION)
- DENSE TO VERY DENSE SAND (PUKETOKA FORMATION)

1:800 0 8 16 24 32 40 m

CMW Geosciences

CLIENT: SANDERSON GROUP		DRAWN: WPJ	PROJECT No: HAM2020-0016
PROJECT: TE AWAMUTU COUNTRY CLUB, FRONTIER ROAD, TE AWAMUTU		CHECKED: AS	DRAWING: 03
		REVISION: D	SCALE: 1:800
TITLE: SECTION B		DATE: 22/04/2020	SHEET: A3

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HAND AUGER BOREHOLE LOG - HA01

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 19/03/2020
Borehole Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446706.1mE; 674071.9mN Projection: Mount Eden
Elevation: 75.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
			75.0			OL: Organic SILT: dark brown. Non plastic. (Topsoil)			
	0.3	Peak = 159kPa Residual = 14kPa	74.7			ML: SILT with minor sand: yellowish brown. Low plasticity, sensitive; sand, fine. (Walton Subgroup)			
	0.6	Peak = UTP							
	0.9	Peak = UTP		1			D	VSt to H	
	1.2	Peak = UTP							
	1.5	Peak = 147kPa Residual = 37kPa							
	1.8	Peak = UTP	73.2			CH: Silty CLAY: brown. Low plasticity, moderately sensitive. (Walton Subgroup)			
	2.1	Peak = UTP		2					
	2.4	Peak = UTP					M	H	
	2.8	Peak = UTP							
	3.0	Peak = UTP		3		Borehole terminated at 3.0 m			
				4					
				5					

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

HAND AUGER BOREHOLE LOG - HA02

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 19/03/2020
Borehole Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446757.8mE; 674323.5mN Projection: Mount Eden
Elevation: 65.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description (Soil: Soil symbol; soil type; colour; structure; bedding; plasticity; sensitivity; additional comments. (origin/geological unit) Rock: Colour; fabric; rock name; additional comments. (origin/geological unit))	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)
			65.0			OL: Organic SILT: dark brown. Non plastic. (Topsoil)			
	0.3	Peak = 58kPa Residual = 14kPa	64.7			ML: SILT: yellowish brown. Low plasticity, sensitive to extra sensitive. (Walton Subgroup)	D	St	
	0.6	Peak = 144kPa Residual = 17kPa							
	0.9	Peak = UTP		1					
	1.2	Peak = >200kPa Residual = 35kPa							
	1.5	Peak = UTP							
	1.8	Peak = UTP					M	VSt to H	
	2.1	Peak = UTP	62.9	2		CH: Silty CLAY: brown. High plasticity, sensitive. (Walton Subgroup)			
	2.5	Peak = 173kPa Residual = 29kPa							
	2.8	Peak = UTP							
	3.0	Peak = UTP		3		Borehole terminated at 3.0 m			
				4					
				5					

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:
Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP01

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446435.7mE; 673978.7mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 64.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm) 5 10 15 20	Structure & Other Observations
			64.0			OL: Organic SILT: dark brown. Non plastic. (Topsoil)				
			63.7			ML: SILT: yellowish brown. Low plasticity, extra sensitive. (Walton Subgroup)				
						... at 0.90m, becoming brown.				
	1.0	Peak = 176kPa Residual = 17kPa		1			D	H		
	2.0	Peak = UTP		2						
			61.4			CH: Silty CLAY: yellowish brown. High plasticity, sensitive. (Walton Subgroup)				
	3.0	Peak = 155kPa Residual = 26kPa		3			M	VSt		
			60.2			ML: SILT: light yellowish brown. Low plasticity, moderately sensitive. (Walton Subgroup)				
	4.0	Peak = 55kPa Residual = 26kPa		4			M to W	F		
			59.5			ML: SILT with trace sand: yellowish brown. Low plasticity, moderately sensitive; sand, fine to medium. (Walton Subgroup)	M			
	5.0	Peak = 86kPa Residual = 26kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP02

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446706.1mE; 674071.9mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 75.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			75.0			OL: SILT: dark brown. Non plastic. (Topsoil)			5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
			74.7			ML: SILT: yellowish brown. Low plasticity. (Walton Subgroup)				
	0.5	Peak = UTP								
	1.0	Peak = UTP		1			D to M			
	1.5	Peak = UTP								
	2.0	Peak = UTP	73.0	2		MH: Silty CLAY: brown. High plasticity. (Walton Subgroup)		H		
						... at 2.60m, becoming light brown.				
	3.0	Peak = UTP		3						
	3.5	Peak = UTP					M			
	4.0	Peak = UTP		4						
	5.0	Peak = UTP		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP03

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446630.9mE; 674242.7mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 72.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			72.0			OL: Organic SILT: dark brown. Non plastic. (Topsoil)				
			71.7			ML: SILT: yellowish brown. Low plasticity. (Walton Subgroup)				
	0.5	Peak = UTP					D	H		
	1.0	Peak = 130kPa Residual = 26kPa	71.0	1		ML: Clayey SILT: brown. Low plasticity, sensitive to moderately sensitive. (Walton Subgroup)				
	2.0	Peak = 133kPa Residual = 29kPa		2			D to M	VSt		
	3.0	Peak = 107kPa Residual = 40kPa		3						
			68.8			CH: Silty CLAY with trace sand: light greyish brown. High plasticity, moderately sensitive; sand, fine. (Walton Subgroup)		St		
	3.5	Peak = 89kPa Residual = 35kPa								
			68.4			CH: Silty CLAY: light brown. High plasticity, moderately sensitive. (Walton Subgroup)				
	4.0	Peak = 49kPa Residual = 20kPa		4			M to W	F		
	4.5	Peak = 40kPa Residual = 17kPa								
	5.0	Peak = 35kPa Residual = 20kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP04

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446561.6mE; 674253.6mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 62.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			62.0			OL: Organic SILT: dark brown. Non plastic. (Topsoil)	D			
			61.7			ML: Clayey SILT: yellowish brown. Low plasticity, moderately sensitive. (Colluvium)				
	1.0	Peak = 72kPa Residual = 26kPa		1			M	St		
	1.5	Peak = 89kPa Residual = 29kPa								
	2.0	Peak = 20kPa Residual = 12kPa	60.0	2		ML: SILT: grey, mottled orange. Low plasticity. (Colluvium)	M to W	S		
			59.7			OL: Organic SILT with minor wood fragments: dark brown to black. Non plastic. (Colluvium)				
			59.5			ML: SILT: grey, mottled orange. Low plasticity, moderately sensitive. (Colluvium)				
	3.0	Peak = 20kPa Residual = 12kPa		3			W	S to F		
	4.0	Peak = 29kPa Residual = 12kPa		4						
	4.5	Peak = 32kPa Residual = 14kPa								
	5.0	Peak = 23kPa Residual = 12kPa		5		Test pit terminated at 5.00 m				

Dynamic Cone Penetrometer (Blows/100mm): 5 10 15 20

Structure & Other Observations: Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP05

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446757.8mE; 674323.5mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 82.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			82.0			OL: SILT: dark brown. Non plastic. (Topsoil)			5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
			81.7			ML: SILT: light yellowish brown. Low plasticity, extra sensitive. (Walton Subgroup)		VSt		
	1.0	Peak = 101kPa Residual = 6kPa		1						
			80.7			CH: Silty CLAY: brown. High plasticity. (Walton Subgroup)	D to M			
	1.5	Peak = UTP								
	2.0	Peak = UTP		2				H		
	2.8	Peak = 86kPa Residual = 14kPa	79.2			CH: Silty CLAY: light yellowish brown. High plasticity, moderately sensitive to sensitive. (Walton Subgroup)				
	3.0	Peak = 104kPa Residual = 17kPa		3						
	3.5	Peak = 86kPa Residual = 29kPa					M	St to VSt		
	4.0	Peak = 89kPa Residual = 40kPa		4						
	4.5	Peak = 69kPa Residual = 32kPa								
	5.0	Peak = 84kPa Residual = 26kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP06

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446534.0mE; 674368.0mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 65.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			65.0			OL: SILT: dark brown. Non plastic. (Topsoil)			5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
			64.7			ML: SILT: light yellowish brown. Low plasticity, sensitive. (Walton Subgroup)				
	1.0	Peak = 130kPa Residual = 12kPa		1			D to M	VSt		
	2.0	Peak = UTP		2						
			62.9			CH: Silty CLAY: light brown. High plasticity, sensitive. (Walton Subgroup)				
	2.5	Peak = UTP								
	3.0	Peak = 187kPa Residual = 26kPa		3			M	VSt to H		
	4.0	Peak = 141kPa Residual = 23kPa		4						
			60.3			ML: SILT: grey. Low plasticity, moderately sensitive. (Walton Subgroup)				
	4.8	Peak = 69kPa Residual = 23kPa					M to W	St		
	5.0	Peak = 58kPa Residual = 23kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP07

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446651.0mE; 674636.6mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 80.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm) 5 10 15 20	Structure & Other Observations
			80.0			OL: SILT: dark brown. Non plastic. (Topsoil)	D			
			79.7			ML: SILT: light yellowish brown. Low plasticity. (Walton Subgroup)				
	0.5	Peak = UTP						H		
	1.0	Peak = 173kPa Residual = 26kPa	79.0	1		ML: SILT with some clay: brown. Low plasticity, sensitive. (Walton Subgroup)	D to M			
	2.0	Peak = UTP		2				VSt to H		
	3.0	Peak = UTP	77.0	3		CH: Silty CLAY: yellowish brown. High plasticity, sensitive to moderately sensitive. (Walton Subgroup)				
	4.0	Peak = 104kPa Residual = 23kPa		4			M	VSt		
	5.0	Peak = 144kPa Residual = 55kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP08

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446469.6mE; 674249.3mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 58.50m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			58.5			OL: SILT: dark brown. Non plastic. (Topsoil)			5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
			58.2			ML: SILT: yellowish brown. Low plasticity, sensitive. (Colluvium)				
	0.5	Peak = UTP								
						... at 0.90m, becoming light yellowish brown.	D			
	1.0	Peak = 187kPa Residual = 32kPa		1				H		
			56.7			ML: SILT: grey. Low plasticity. (Colluvium)				
	2.0	Peak = 75kPa Residual = 12kPa	56.5	2		CH: Silty CLAY: white, mottled brown and orange. High plasticity, blocky, sensitive. (Colluvium)		St		
			56.1			ML: SILT: grey. Low plasticity, extra sensitive. (Colluvium)	M			
	2.5	Peak = 147kPa Residual = 14kPa						VSt		
	3.0	Peak = 144kPa Residual = 20kPa	55.5	3		CH: CLAY: yellow. High plasticity, insensitive to sensitive. (Colluvium)				
	4.0	Peak = 32kPa Residual = 26kPa		4			M to W	F to St		
	4.5	Peak = 112kPa Residual = 43kPa								
			53.7			ML: Clayey SILT with minor sand: light blue. Low plasticity, moderately sensitive; sand, medium to coarse. (Walton Subgroup)	W	St		
	5.0	Peak = 75kPa Residual = 29kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP09

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

CMW Geosciences

Position: Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 63.00m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			63.0			OL: SILT: dark brown. Non plastic. (Topsoil)				
			62.7			ML: SILT: yellowish brown. Low plasticity, sensitive. (Colluvium)				
	0.5	Peak = UTP					D	H		
	1.0	Peak = 147kPa Residual = 16kPa		1						
			61.6			ML: SILT with some clay: brown. Low plasticity, sensitive. (Colluvium)				
	1.5	Peak = 130kPa Residual = 26kPa								
	2.0	Peak = 118kPa Residual = 17kPa		2						
			60.6			ML: SILT with some clay and trace sand: grey, mottled orange. Low plasticity, moderately sensitive. (Colluvium)		VSt		
	2.5	Peak = 147kPa Residual = 49kPa					M			
	3.0	Peak = 112kPa Residual = 40kPa		3						
	4.0	Peak = 135kPa Residual = 26kPa	59.0	4		ML: SILT: light yellow. Low plasticity, sensitive. (Colluvium)	M to W			
			58.2			CH: Silty CLAY: reddish brown. High plasticity, moderately sensitive. (Walton Subgroup)				
	5.0	Peak = 110kPa Residual = 29kPa		5		Test pit terminated at 5.00 m				

Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

TEST PIT LOG - TP10

Client: Sanderson Group
Project: Frontier Road Development
Site Location: Frontier Road, Te Awamutu
Project No.: HAM2020-0016
Date: 22/03/2020
Test Pit Location: Logged by: AS Checked by: EE Scale: 1:25 Sheet 1 of 1

Position: 446539.3mE; 674110.5mN Projection: Mount Eden Pit Dimensions: m by m
Elevation:Elevation: 70.50m Datum: Survey Source: Site Plan

Groundwater	Samples & Insitu Tests: Depth	Samples & Insitu Tests: Type & Results	RL (m)	Depth (m)	Graphic Log	Material Description	Moisture Condition	Consistency/ Relative Density	Dynamic Cone Penetrometer (Blows/100mm)	Structure & Other Observations
			70.5			OL: Organic SILT: dark brown. Non plastic. (Topsoil)			5 10 15 20	Discontinuities: Depth; Defect Number; Defect Type; Dip; Defect Shape; Roughness; Aperture; Infill; Seepage; Spacing; Block Size; Block Shape; Remarks
			70.2			ML: SILT: yellowish brown. Low plasticity. Extra sensitive. (Walton Subgroup)				
	0.5	Peak = UTP								
	1.0	Peak = 176kPa Residual = 20kPa		1		... at 1.00m, becoming brown.	D	VSt to H		
	1.5	Peak = UTP								
	2.0	Peak = UTP		2						
			68.3			CH: Silty CLAY: yellowish brown. High plasticity, insensitive to moderately sensitive. (Walton Subgroup)		H		
	3.0	Peak = UTP		3			M	VSt		
	4.0	Peak = 104kPa Residual = 35kPa		4						
	4.8	Peak = 46kPa Residual = 26kPa						F		
	5.0	Peak = 43kPa Residual = 23kPa		5		Test pit terminated at 5.00 m				

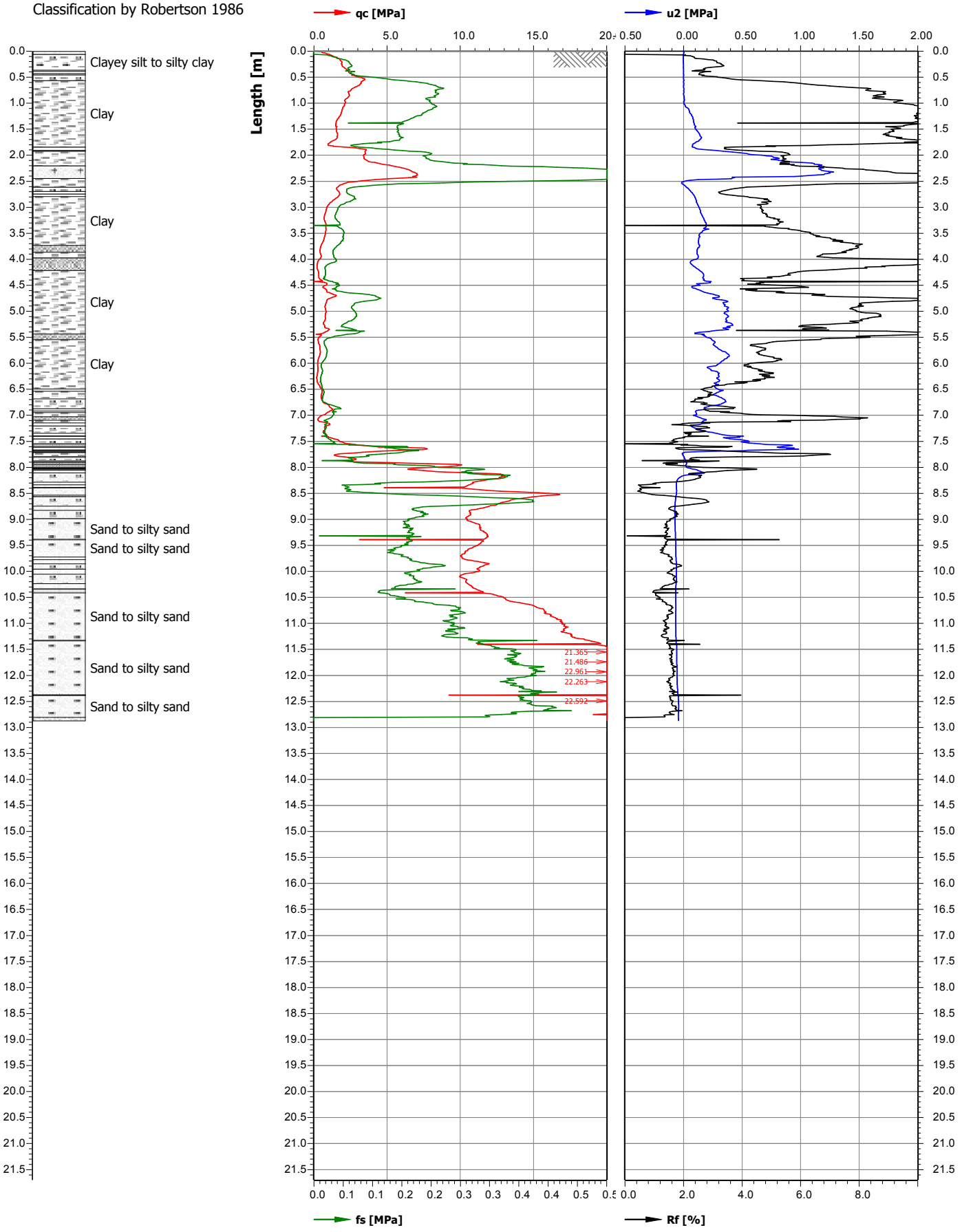
Termination Reason: Target Depth Reached
Shear Vane No: 1785 DCP No:

Remarks: Groundwater not encountered.

This report is based on the attached field description for soil and rock, CMW Geosciences - Field Logging Guide, Revision 3 - April 2018.

PRO-DRILL	Project name: CMW52FrontierRoad	Date investigation: 19/03/2020	
	Test name: CPT01	Cone name: S10CFIIP.1734	
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



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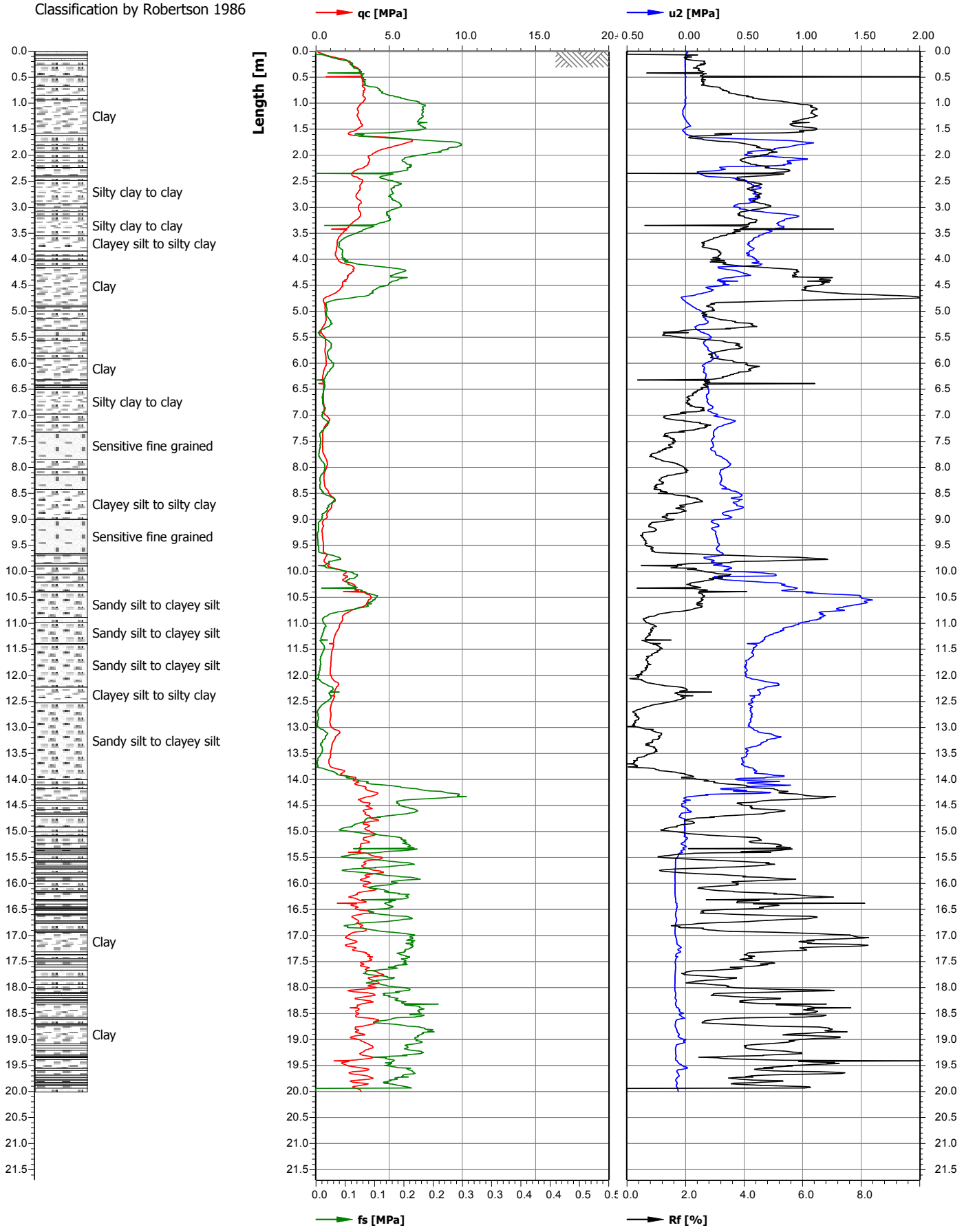
	Test name: CPT02	Cone name: S10CFIIP.1734	
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



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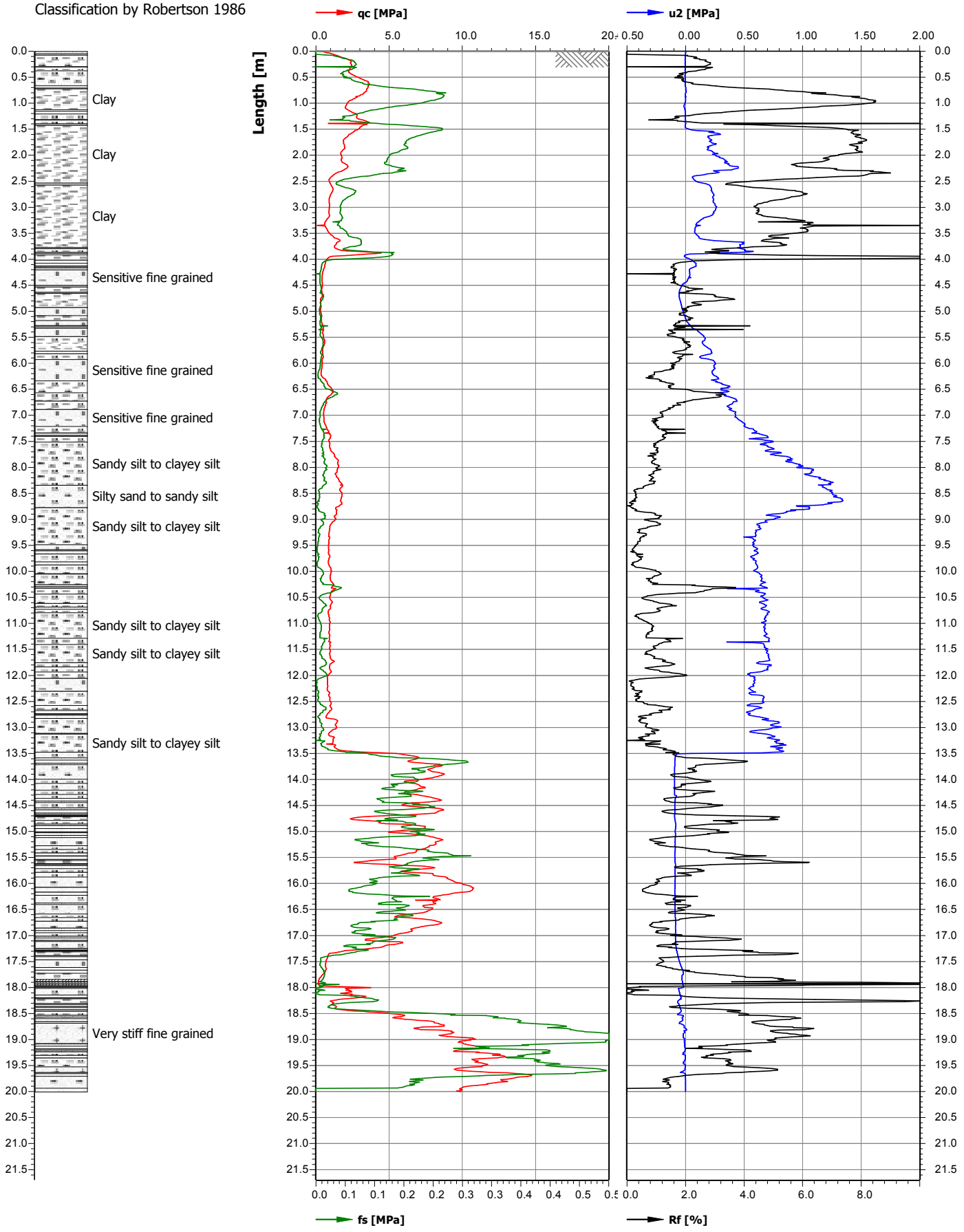
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



PRO-DRILL	Project name: CMW52FrontierRoad	Date investigation: 19/03/2020	
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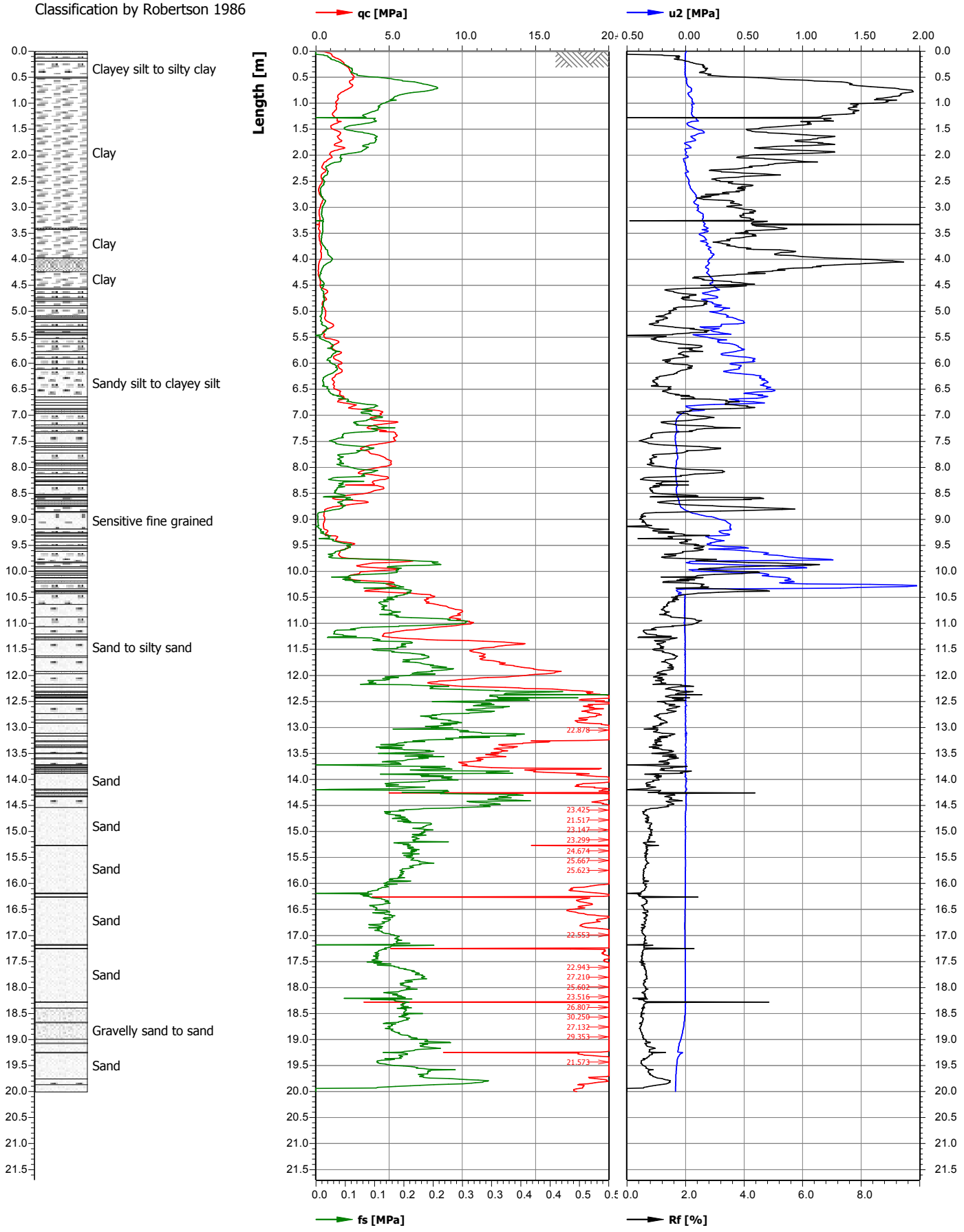
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



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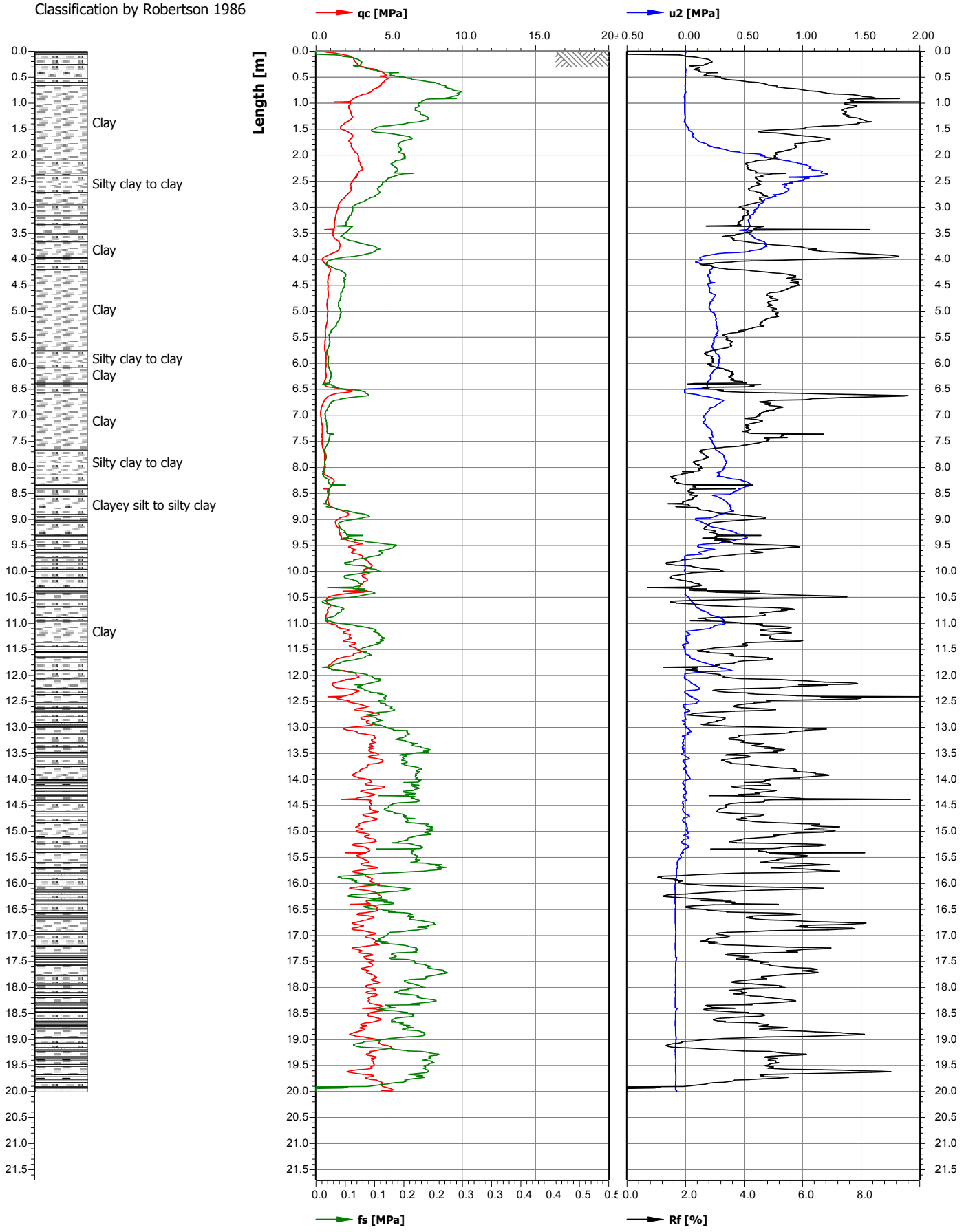
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



PRO-DRILL	Project name: CMW52FrontierRoad	Date investigation: 19/03/2020	
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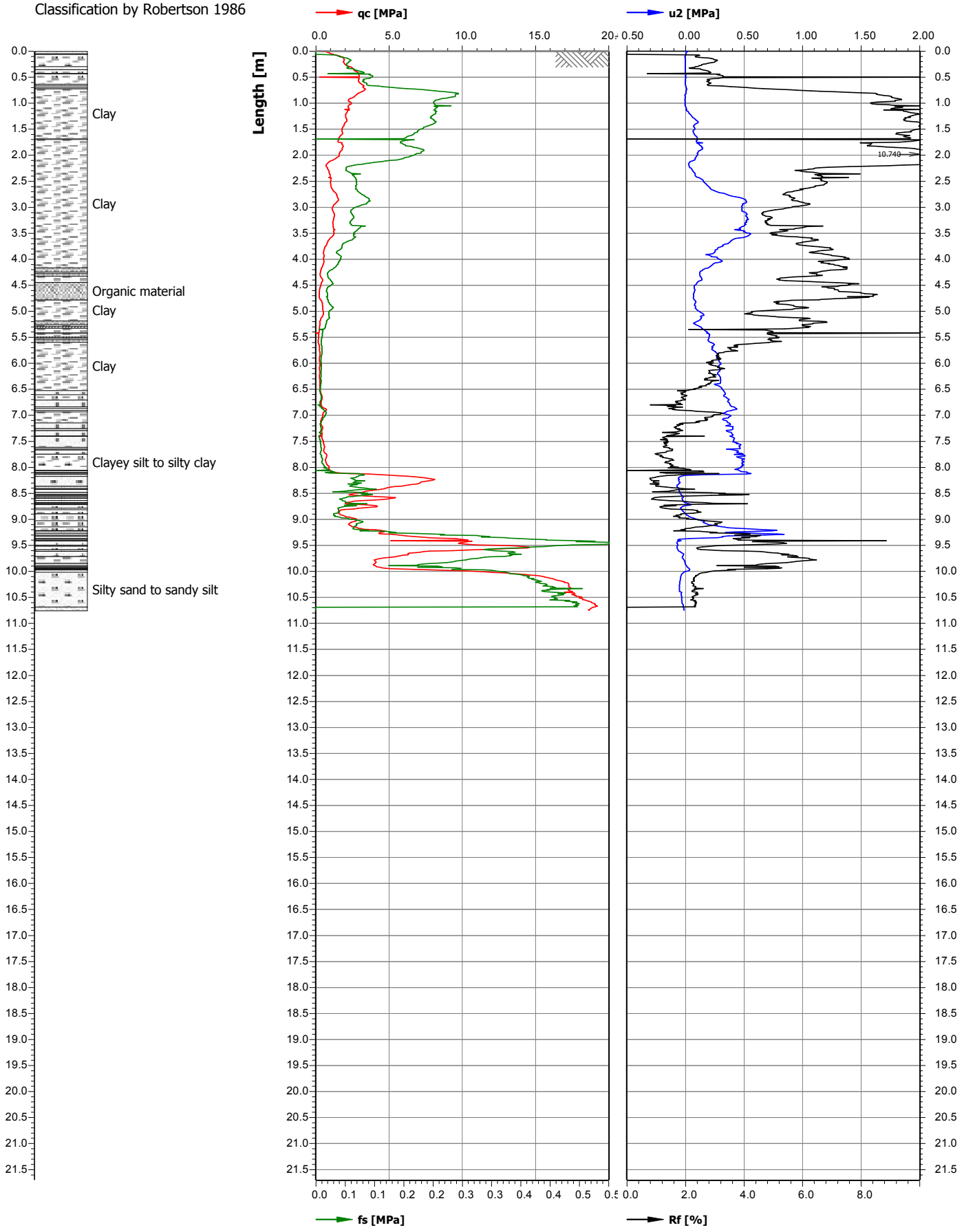
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



PRO-DRILL	Project name: CMW52FrontierRoad	Date investigation: 19/03/2020	
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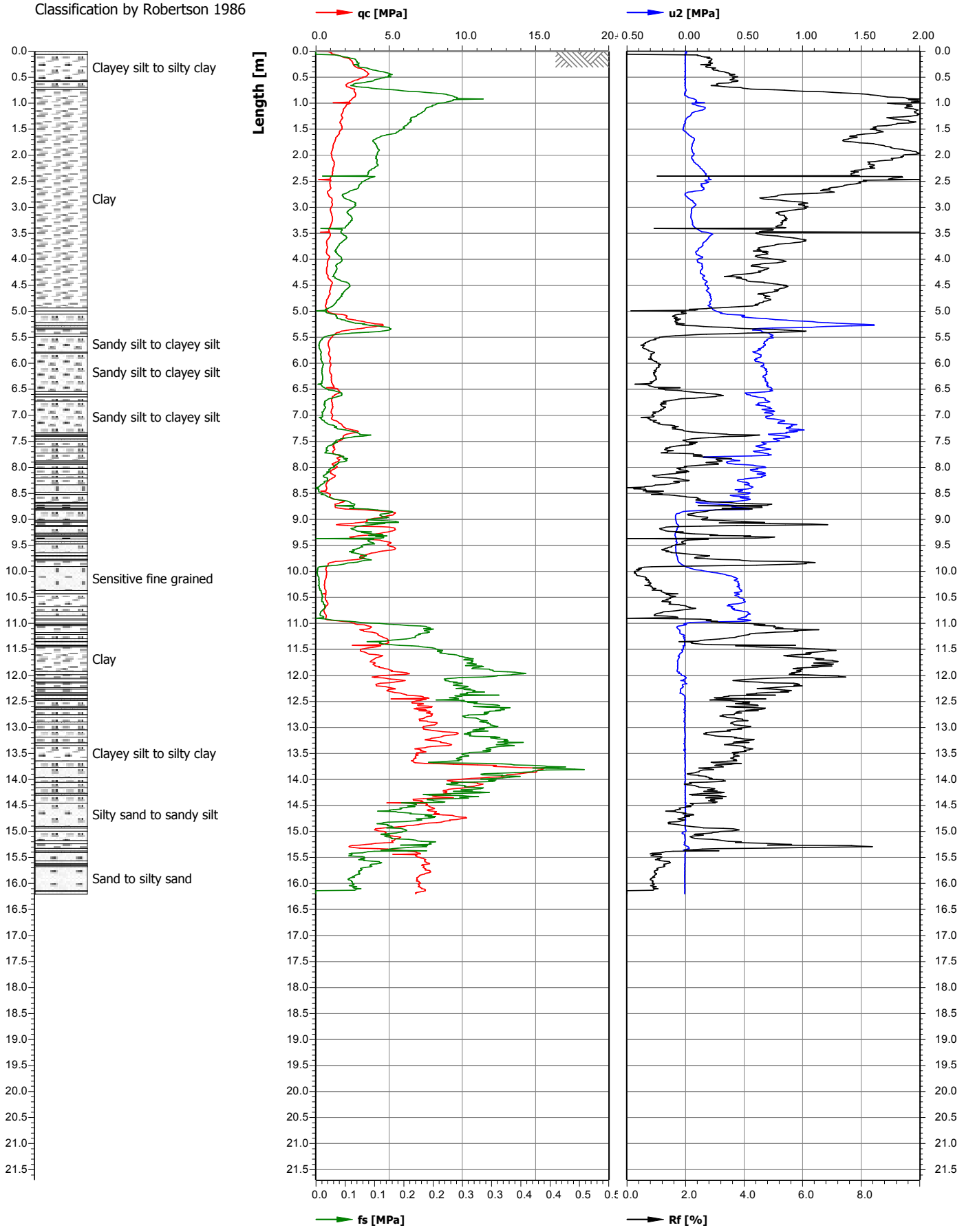
Test location name	Client: CMW	Net surface area quotient of ...: 0.850/0.000	Nominal surface area of cone...: 10.0/150.0
X coordinate [m]/Y coordinat...: 0.00/0.00	Project contractors	Fig. no.:	
Z value [m]: 0.00	Project engineer	Scale: 1:100	Page: 1/1
Remarks1			

Classification by Robertson 1986



Appendix D – Historic Aerial Images

Appendix E – CMW Natural Hazards Risk Assessment

NATURAL HAZARDS RISK ASSESSMENT FOR LAND SUBDIVISION
52 FRONTIER ROAD, TE AWAMUTU, WAIKATO

A. CONTEXT

Section 106 of the Resource Management Act (RMA) requires an assessment of the risk from natural hazards to be carried out when considering the granting of a subdivision consent. S106 RMA specifically states that the assessment must consider the combined effect of the natural hazard likelihood and material damage to land, other land or structures (consequence).

Section 2 of the RMA defines natural hazards as any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment.

This appendix to CMW report reference HAM2020-0016AB Rev0 sets out the criteria for and presents the results of an assessment of the geotechnical-related natural hazards associated with this proposed subdivision development. The remaining hazards, i.e. tsunami, wind, drought, fire and flooding hazards are not covered by this assessment.

B. BASIS OF ASSESSMENT

B1. Risk Classification

The occurrence of natural hazards and their potential impacts on the proposed subdivision development is assessed in terms of risk significance, which is based on likelihood and consequence factors. A risk table is used to help assess the likelihood and consequence factors, the form of which used by CMW for this project is presented in Table B1.

Table B1: Natural Hazard Risk Classification

		Consequence				
		Insignificant 1	Minor 2	Moderate 3	Major 4	Catastrophic 5
Likelihood	Almost Certain 5	Medium 5	High 10	Very high 15	Extreme 20	Extreme 25
	Likely 4	Low 4	Medium 8	High 12	Very high 16	Extreme 20
	Moderate 3	Low 3	Medium 6	Medium 9	High 12	Very high 15
	Unlikely 2	Very low 2	Low 4	Medium 6	Medium 8	High 10
	Rare 1	Very low 1	Very low 2	Low 3	Low 4	Medium 5

B2. Likelihood

With respect to assessing the likelihood or chance of the risk occurring, the qualitative definitions used by CMW for this project are provided in Table B2 for each likelihood classification.

Table B2: Qualitative Natural Hazard Likelihood Definitions		
1	Rare	The natural hazard is not expected to occur during the design life of the project
2	Unlikely	The natural hazard is unlikely, but may occur during the design life
3	Moderate	The natural hazard will probably occur at some time during the life of the project
4	Likely	The natural hazard is expected to occur during the design life of the project
5	Almost Certain	The natural hazard will almost definitely occur during the design life of the project

B3. Consequence

In terms of determining the consequence or severity of the natural hazard occurring, the qualitative definitions used by CMW for this project are provided in Table B3 for each consequence classification.

Table B3: Qualitative Natural Hazard Consequence Definitions		
1	Insignificant	Very minor to no damage, not requiring any repair, no people at risk, no economic effect to landowners.
2	Minor	Minor damage to land only, any repairs can be considered normal property maintenance no people at risk, very minor economic effect.
3	Moderate	Some damage to land requiring repair to reinstate within few months, minor cosmetic damage to buildings being within relevant code tolerances, does not require immediate repair, no people at risk, minor economic effect.
4	Major	Significant damage to land requiring immediate repair, damage to buildings beyond serviceable limits requiring repair, no collapse of structures, perceptible effect to people, no risk to life, considerable economic effect.
5	Catastrophic	Major damage to land and buildings, possible structure collapse requiring replacement, risk to life, major economic effect or possible site abandonment.

B4. Risk Acceptance

It is recognised that the natural hazard risk assessment provided herein is qualitative and, due to the wide range of possible geohazards that could occur, is somewhat subjective. Other methods are available to quantitatively assess an acceptable level of geotechnical related natural hazard risk, such as defining an acceptable factor of safety with respect to slope stability or acceptable differential ground settlements with respect to recommended building code limits.

Therefore, to give this qualitative natural hazard risk assessment some relevance to more commonly adopted numerical or quantitative geotechnical assessment techniques, a residual risk rating of very low to medium (risk value = 1 to 9 inclusive) is considered an acceptable result for the proposed subdivision development.

A risk rating of high to extreme (risk value ≥ 10) is considered an unacceptable result for the proposed subdivision development.

C. RISK ASSESSMENT

The natural hazards relevant to this proposed subdivision development and adjacent, potentially affected land have been assessed with respect to the criteria outlined above.

Assessment is based on proposed post development ground conditions with and without any geotechnical controls. The latent risk was first assessed with the site in its proposed developed state to consider the risks to the development and surrounding land, including assessment of land modifications from the pre-existing natural state, without any implemented geotechnical controls. The specific geotechnical mitigation measures and engineering design solutions outlined in the table below and CMW report, where relevant, were then considered to determine the natural hazard residual risk remaining after the proposed controls have been implemented.

Results of this assessment are presented in Table C1 below.

Table C1: Natural Hazard Risk Assessment Results

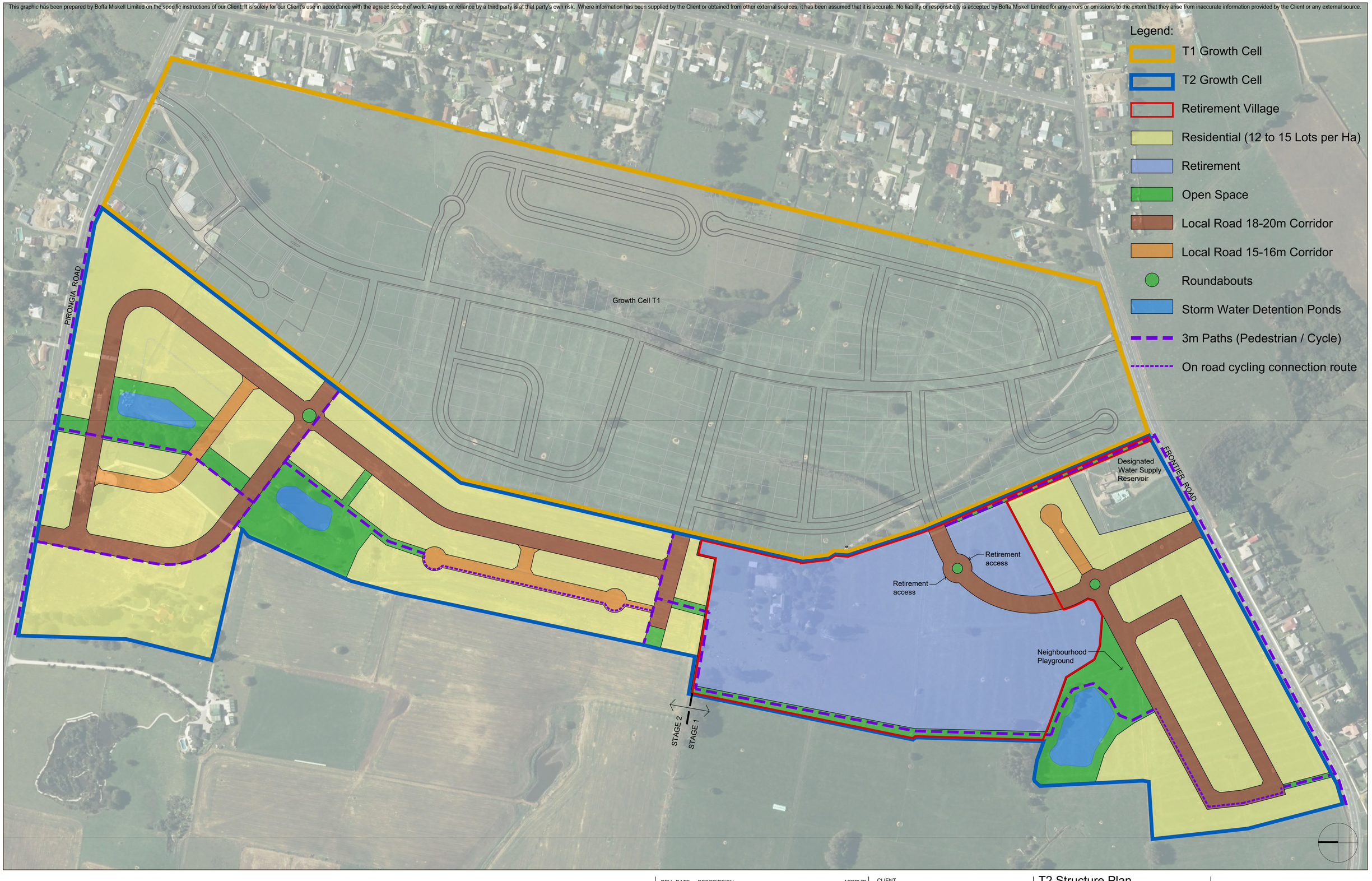
RMA S2 Hazard	Description	Proposed Site Latent Risk of Damage to Land / Structures			Comments and Geotechnical Control	Proposed Site Residual Risk of Damage to Land / Structures OR Acceleration/ Worsening of Hazard with Geotechnical Controls Implemented		
		Likelihood	Consequence	Risk Rating		Likelihood	Consequence	Risk Rating
Earthquake	Fault Rupture	1	4	Low 4	Proximity to active faults	1	4	Low 4
	Liquefaction	2	4	Medium 8	Predominately clay soils based on investigation data	1	4	Low 4
	Lateral Spread	2	4	Medium 8	Predominately clay soils based on investigation data	1	4	Low 4

Landslip	Global Slope Instability	3	4	High 12	Overall decrease in slope gradients after earthworks	1	4	Low 4
	Soil Creep	4	3	High 12	Overall decrease in slope gradients across site after completed earthworks	1	4	Low 4
	Bearing Capacity Failure	2	4	Medium 8	Undercut and replace, not expected to encounter soft soils at surface	1	4	Low 4
Subsidence	Expansive Soils	1	4	Low 4	Laboratory testing and appropriate foundation design	1	4	Low 4
	Soft Soils	4	4	Very High 16	Undercut and remove / preload/ foundation design	2	4	Medium 8
	Sensitive Soils	3	2	Medium 6	Compaction control, contractor awareness, removal if necessary	2	2	Low 4
Sedimentation	Rockfall, Debris Inundation	1	3	Low 4	All structures located above slopes and streams flood levels	1	3	Low 4

Notes:

- Assessments include the impact of the proposed subdivision works on adjacent properties.
- The following reference(s) contain information on the hazards contained in this assessment and the non-geotechnical hazards that have not been included:
    - **Waikato** https://waikatoregion.maps.arcgis.com/apps/MapSeries/index.html?appid=f2b48398f93146e8a5cf0aa3fddce92c

Appendix F – Boffa Miskell T2 Structure Plan Concept



Boffa Miskell

Te Awamutu Country Club

KOTARE PROPERTIES

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REV	DATE	DESCRIPTION	APPRV'D
J	23.07.20	Preliminary	MPe
K	27.07.20	Preliminary Concept	MPe
L	06.08.20	Final Concept	MPe
M	28.08.20	Updated Concept	MPe
N	18.09.20	Update Northern T2 Growth Cell	MPe
O	12.10.20	Clarifications	MPe

CLIENT
Sanderson Group

CONSULTANTS
BBO
STANTEC
Nicklin CE Ltd Wainui Environmental

FOR PLAN CHANGE

T2 Structure Plan

T2 Structure Plan

Design	MHu	Scale	Date
Drawn	MHu/MPe	1:2000 @ A1	06/08/2020
Check	JSo	1:4000 @ A3	

DRAWING NO. BM200127_001

REVISION O

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