

**GEOTECHNICAL SUBDIVISION COMPLETION REPORT  
(INSPECTING ENGINEERS REPORT)  
FRONTIER DEVELOPMENTS SUBDIVISION – Stage 4  
HIGHLAND CRESCENT & SIERRA PLACE, TE AWAMUTU**

for

**Frontier Developments Ltd**  
PO Box 5254  
Hamilton 3242

by

**Mark T Mitchell Ltd**  
Consulting Geotechnical Engineers  
1150 Victoria Street – PO Box 9123  
Hamilton 3240

9 November, 2021

# Mark T Mitchell Ltd

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Consulting Geotechnical Engineers

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Ref: W – 16639.7  
9 November, 2021

Frontier Developments Ltd  
PO Box 5254  
Hamilton 3242

Dear Sir,

**Re: Geotechnical Completion Report - Soils and Earth Fill Report,  
Frontier Developments Residential Subdivision  
Stage 4 - Lots 65 to 100  
Highland Crescent & Sierra Place, Te Awamutu**

Please find enclosed copies of our Soils Investigation and Geotechnical Completion Report for the above-referenced project.

The results of our studies indicate that the site is suitable for use as a residential subdivision. A test hole has been drilled within each of the lots to provide a guide to the soil conditions present. The results of these tests indicate that standard foundations are to be used on all lots, as detailed in the attached report.

At the time of building site preparation work, where site soils are found to be different from those shown on the attached Bore Hole Logs, which could arise following wet weather conditions, we should inspect the site excavations to advise on the extent of remedial work required.

Yours faithfully

**Mark T Mitchell Ltd**  
*Consulting Geotechnical Engineers*



Mark T Mitchell  
Director

**GEOTECHNICAL SUBDIVISION COMPLETION REPORT  
(INSPECTING ENGINEERS REPORT)  
FRONTIER DEVELOPMENTS SUBDIVISION – STAGE 4  
HIGHLAND CRESCENT & SIERRA PLACE, TE AWAMUTU**

## **1. INTRODUCTION**

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This report combines the Soils Investigation Report and the Subdivision Completion Report (or the Inspecting Engineer's Report) for Frontier Developments Residential Subdivision Stage 3, which is located off Highland Crescent & Sierra Place, Te Awamutu. This stage of the development comprises Lots 65 to 100, the locations of which are shown on the attached Site Plan, Drawing No. 16639-10. The development is being undertaken by Frontier Developments Ltd, with the land surveying and engineering design carried out by S & L Consultants Ltd (S&L).

The topography of Stage 4 of the subdivision consists of an elevated low hill that slopes upwards from Pioneer Drive that has been terraced to create level building areas on each lot.

The purpose of the Soils Investigation was to determine the subsurface conditions within the specified lots and to evaluate what special conditions, if any, would be required for the foundation support of residential dwellings to be constructed on the site. This Geotechnical Completion Report also details the extent of filling and other activities that have taken place during the site development and outlines limitations of earth filling that has been placed during the subdivision development.

## **2. FIELD INVESTIGATION AND SITE TESTING**

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### **2.1 Soil Testing**

The soil conditions within the Stage 4 subdivision areas were investigated following completion of the site earthworks, which consisted of cut and fill land re-contouring. These earthworks were generally carried out between the 2018-2019 and the 2020-2021 construction seasons. This included excavations of up to 2.0 metres in depth within elevated regions and filling of up to about 6.0 metres in lower areas. The Filling was placed and compacted within localised areas to produce near-level building sections as shown on the attached Cut/Fill Isopach Plan, Drawing No. 16639-11.

The earthworks included Pioneer Drive, with compacted filling placed up to about 2 metres in depth in parts to obtain the required road gradient.



The Filling that has been placed within this Stage 4 Development has been inspected and tested under the direction of Geocon Geotechnical Ltd and Mark T Mitchell Ltd geotechnical staff. On-site testing included nuclear density (NDM) testing, in-situ shear vane and Scala Penetrometer probe testing. Laboratory testing including soil compaction, water content and shear vane testing. The testing criteria adopted were in general accordance with NZS 4431:1989 "Code of Practice for Earthfill for Residential Development".

The soil conditions within the Stage 4 project site were investigated by drilling, thirty-six each, 2.0-metre hand auger test borings, together with Scala Penetrometer probe and in-situ shear vane tests at the centre point of each lot, as shown on the Site Plan. The designated bore hole number corresponds to the relevant Lot number, with Bore Hole Logs and associated test results presented on Figs. A-1 to A-18.

The purpose of the bore holes and associated testing was to provide guidance as to the general consistency, relative density and shear strength of soils located within the building site areas. This testing was also to determine general requirements for foundation construction for residential dwellings.

It should be noted that the Topsoil depths encountered within each of the bore holes are likely to vary across the general lot areas.

## 2.2 Soil Descriptions

The near-surface soil conditions consist of 100 to 350mm of Topsoil over natural soils or Engineer-certified Fill to variable depths. The Fill composition is a mixture of various coloured brown, compacted Clays and Silts. The naturally occurring soils below the Filling consist of firm to very stiff, Silts and Clays which continue to at least the base of the 2 metre deep bore holes.

The original soils have developed by the progressive weathering of volcanic ash (tephra) erupted about 60,000 to 350,000 years Before Present (1950's) and described generally as the Hamilton Ash Formation. The ash layers are a few metres thick and are representative of a sequence of volcanic ash deposits weathered to Clay and Silt soils. Some of these ash soils were excavated during earthworks and provided the bulk material for the filling operations.

The Hamilton Ash sequence overlies the Walton Subgroup which consists of two geological units referred to as the Karapiro and Puketoka Formations. These soils are older and are distinguished from the Hamilton Ash soils as pumiceous in nature. The Walton Subgroup soils are believed to have been deposited as primary or re-worked alluvial deposits or as non-welded distal ignimbrites (volcanic deposit). These soils typically consist of pumiceous silts, clays and consolidated fine-grained sands with weathered pumice inclusions.

Due to the non-uniform manner in which the alluvial soils were deposited and the continually changing river channel alignments, variations in soil grain size, density and shear strength may occur within relatively short distances.



### 3. ENGINEER-CERTIFIED FILL – ALL LOTS

#### 3.1 Fill Areas and Depths

Earth filling has been placed within all, or part of the following lots to form near-level building site areas. Note that the filling will typically cover only a portion of the lots concerned.

Fill Depth Range	Lot Numbers
0.0 to 1.0 metres	66, 67, 68, 83, 96 and 97
0.0 to 1.5 metres	65, 69, 70, 73, 74, 75, 79, 80, 81, 93, 98 and 99
0.0 to 2.0 metres	72, 76, 77, 78 and 95
0.0 to 2.5 metres	71, 82 and 100
0.0 to 3.5 metres	90 and 94
0.0 to 4.5 metres	91
0.5 to 2.5 metres	84
0.5 to 4.5 metres	85 and 92
0.5 to 5.5 metres	86
3.0 to 6.5 metres	87
4.5 to 5.5 metres	89
4.5 to 6.0 metres	88

#### 3.2 Fill Description

The Engineer-certified Fill was placed and compacted between May 2019 and November 2020 by C & R Developments Ltd, with periodic field and laboratory testing carried out by Geocon Geotechnical Ltd and Mark T Mitchell Ltd, to ensure that the filling was constructed to the requirements of New Zealand Standard NZS 4404:2010, Land Development and Subdivision Infrastructure.

Compaction of these soils was carried out using a combination of 12 and 24 tonne sheep-foot/wedge-foot and flat-drum rollers and loaded HM300 and HM400 articulated dump trucks.

The Contract Specification required the level of compaction effort applied to achieve a density which is acceptable for building construction to the NZ Standard for Light Timber Framed Buildings, NZS 3604:2011. Engineer-verification consisting of site inspections and testing was carried out during regular inspections during the backfilling process.

The Engineer-certified Filling is generally capable of supporting residential foundation designed in accordance with NZS 3604:2011. However, because building sites may contain areas of well-compacted filling that are alongside naturally occurring soils of a lower density, it is recommended for lots within this category further compaction of soils takes place.

This would take place after the building site area has been excavated to design level, with the entire building site area then to be compacted with a roller of minimum 2 tonne weight.



### 3.3 Fill Placement Procedures

Prior to placement of Engineer-certified Filling within the lots, the Topsoil and some of the underlying soils were removed and stockpiled for later re-spreading. Also, benching was carried out prior to any filling being placed in areas where natural slopes of greater than 1 vertical to 5 horizontal were present.

Within many lots, house foundations are likely to straddle areas of both filled ground and natural ground. The fill soils are generally stiffer and have a lower void ratio than those of natural ground, with a potential for minor differences in their performance over time as the near-surface soils dry out.

The recommendations provided in the following section of this report will alleviate potential problems associated with soil shrinkage with time and also with other variations in soil properties along the perimeter house foundations.

## 4. BUILDING SITE PREPARATION – ALL LOTS

### 4.1 Ground Conditions

The near-surface soils within Stage 4 typically consist of 100 to 350mm of Topsoil, overlying either naturally occurring, firm to very stiff, clayey Silt and silty Clay soils or alternatively, similar soil types that have been obtained from elsewhere and compacted in place. These Silt and Clay soils are expected to provide satisfactory support for residential foundations that are designed in accordance with NZS 3604:2011, providing site preparation works are carried out as recommended below.

### 4.2 Site Preparation

It is expected that building site areas will initially be excavated to about 0.5 metres beyond the building lines to remove the topsoil layer, with the depth of that excavation being about 200 to 350mm. Where low-strength soils are exposed within the proposed building site areas, those soils should initially be compacted in place and then tested to determine whether they are of adequate strength, or alternatively removed and replaced with compacted pit sand.

Otherwise, the exposed surface should be well compacted using a minimum 2 tonne vibrating roller over both natural ground and filled area to provide a uniform support to the concrete floor slab.

In addition, where house foundations straddle areas of both filled and natural ground, undercutting of the soils supporting the exterior footings should be carried out to accommodate the variations in soil properties, such as soil shrinkage over time. The recommended undercut details are as follows:

- Minimum 400mm below underside of concrete footing
- Extend to minimum 400mm beyond exterior foundation line
- Excavation width of minimum 1200mm wide at its base.

It is recommended that the undercut areas are to be backfilled with pit sand and compacted with a 2 tonne vibratory compactor in 2 layers up to the underside of the concrete slab.



## 5. TIMBER FLOOR CONSTRUCTION

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The near surface, stiff to very stiff, Silt and Clay soils that are present within the project site are generally capable of supporting foundations for timber floor structures which are designed to the requirements of NZS 3604:2011 the NZ Standard for Timber Framed dwellings. However, where soil strengths are in doubt, the foundation soils should be tested to verify that shear strengths exceed 80kPa or Scala values exceed 5 blows per 100mm for sand or rockfill.

## 6. GROUNDWATER

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Groundwater was not encountered in any of the Bore Holes during the autumn investigation due to the elevated nature of the site.

## 7. VARIATIONS OF SOIL TYPE, DENSITY AND SHEAR STRENGTH

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Prospective purchasers and owners of lots within this development are advised that variations in soil type, density and shear strength will occur across the overall site and within individual sections. This fact applies to both unfilled and filled ground and in some circumstances, supplementary foundation preparation and construction work may be required where soft soil conditions are encountered.

## 8. ASSESSMENT OF NATURAL HAZARDS

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For this particular residential site development, natural hazards consist of:

- ground subsidence
- surface flooding
- slope instability

### 8.1 Ground Subsidence – Building Sites

Sections 3 to 5 of the above report state that the results of the recent testing indicate that the soils underlying the subdivision are suitable for foundation support and ground subsidence is unlikely to develop to the extent that would affect building foundation support, subject to our recommendations being followed.

### 8.2 Surface Flooding

The land topography of the sections within Stage 4 development currently consists of gently sloping ground surfaces and therefore surface water flooding of the respective lots in their as-developed state is not expected to occur.



### 8.3 Slope Instability

The completed land topography is such that all as-constructed ground slopes, within both cuts and fills possess a Factor of Safety of at least 1.5 and 'safe' building platforms have been provided, as required by Section 106 of the Resource Management Act (1991).

### 8.4 Certification

A Statement of Professional Opinion as to suitability of Land for Subdivision is presented at the end of this report, which includes a statement that providing the recommendations presented in this report are adhered to, the environmental risks associated with the proposed subdivision development are acceptable.

## 9. LIMITATIONS

The Geotechnical opinions and recommendations that are contained in this report are based on site conditions as they presently exist and further assume that the exploratory holes and soundings are representative of subsurface conditions throughout the site, i.e. inferences about the nature and continuity of ground conditions away from the bore holes have been made in the preparation of this report. It is assumed that subsurface conditions elsewhere are not significantly different from those disclosed by the investigation.

We should be notified of any subsurface conditions that appear to be different from those as disclosed by this investigation so that the conditions may be reviewed and our recommendations reconsidered where necessary.

This report and certification does not preclude routine foundation inspections by the Builder or the Waipa District Council Building Inspectors. Where such inspections reveal the presence of localised soft areas, further soils investigations may need to be carried out to assess the extent of the problem soils and to determine what treatment, if any, of the foundation soils is required.

## 10. CONCLUSIONS AND RECOMMENDATIONS

The results of this study indicate that, based upon all available information, there is a stable building site available on each of the proposed lots. A test hole has been drilled centrally within each of the lots to provide a guide to the soil conditions present. Some lots may require engineer-design of foundations on account of the soil conditions present.

A Statement of Suitability of Earth Fill for Residential Development (NZS 4431 Appendix A), a Statement of Suitability of Land for Building Development (Schedule 2A: NZS 4404:2010) and Table 1 (Summary of House Foundation Requirements) are included with this report.

### ***Mark T Mitchell Ltd***

Consulting Geotechnical Engineers



Mark T Mitchell  
Director





**Attached:**

Site Plan, Drawing No. 16639-10  
Cut/Fill Isopach Plan, Drawing No. 16639-11  
Geocon Geotechnical Ltd Bore Holes : Figs. A-1 to A-18  
Schedule 2A : Ref: NZS 4404:2010  
Appendix A : Ref: NZS4431:1989  
Table 1 : Summary of House Foundation Requirements



# Mark T Mitchell Ltd

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Consulting Geotechnical Engineers

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**SCHEDULE 2A** (Ref: NZS 4404:2010)

To: The Director of Works/Development Engineer  
Waipa District Council  
Private Bag 2402  
Te Awamutu 3840

Ref: W – 16639

## STATEMENT OF PROFESSIONAL OPINION AS TO SUITABILITY OF LAND FOR RESIDENTIAL BUILDING DEVELOPMENT

Subdivision : Frontier Developments – Stage 4  
Owner/Developer : Frontier Developments Ltd  
Location : Lots 65 to 100  
Highland Crescent & Sierra Place, Te Awamutu

I, Mark Thomson Mitchell, a Director of Mark T Mitchell Ltd, Consulting Geotechnical Engineers of 1150 Victoria Street, Hamilton, hereby confirm that:

1. I am a geo-professional as defined in Section 1.2.2 of NZS 4404:2010 and was retained by the Developer, as the geo-professional on the above development.
2. The extent of our inspections during construction and the results of all tests carried out are as described in our Soils and Earthfill report dated 9 November, 2021.
3. In my professional opinion, not to be construed as a guarantee, I consider that:
  - a. The Engineer-Certified Earth Fill has been placed in compliance with the requirements of the Waipa District Council.
  - b. The completed works take into account land slope and foundation stability considerations, subject to the foundation recommendations contained in our report dated 9 November, 2021
  - c. Subject to 3(a) and 3(b) of this Schedule, the original ground not affected by Filling is suitable for the erection thereon of buildings designed according to NZS 3604:2011, although the presence of groundwater within both naturally occurring and fill soils may result in a decrease in soil strength, thereby resulting in additional building site preparation work.
  - d. The original ground not affected by Filling and the Filled ground are not subject to erosion, subsidence, or slippage in accordance with the provisions of Section 106 of the Resource Management Act 1991 provided the recommendations contained in our report dated 9 November, 2021 are followed.

4. This professional opinion is furnished to Waipa District Council and the Developer for their purposes alone on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building.
5. This certificate shall be read in conjunction with our geotechnical report referred to in clause 2 and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.



Signed by

Mark T Mitchell, BE (Civil), MS, CPEng  
(Member ACENZ, IPENZ, ASCE)

Date: 9 November, 2021

On behalf of **Mark T Mitchell Ltd**, Consulting Geotechnical Engineers



# Mark T Mitchell Ltd

Consulting Geotechnical Engineers

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## APPENDIX A (Ref: NZS 4431:1989)

To: The Director of Works  
Waipa District Council  
Private Bag 2402  
Te Awamutu 3840

Ref: W – 16639

### STATEMENT OF SUITABILITY OF EARTH FILL FOR RESIDENTIAL BUILDING DEVELOPMENT

Subdivision : Frontier Developments – Stage 4  
Owner/Developer : Frontier Developments Ltd  
Location : Lots 42 to 64  
Highland Crescent & Sierra Place, Te Awamutu

I, Mark Thomson Mitchell, Consulting Geotechnical Engineer of 1150 Victoria Street, Hamilton and a Director of Mark T Mitchell Ltd, hereby confirm that:

1. The Engineer-Certified Earth Fill has been placed to a standard equal to or better than the requirements of NZS 4431:1989, the NZ Standard Code of Practice for Earth Fill for Residential Development.
2. While work was in progress, I carried out the function of Inspecting Geotechnical Engineer.
3. During the work, my staff and I, made periodic visits of inspection to the site, as detailed in my report dated 9 November 2021, a copy of which is attached.
4. Fill is present in the following lots:  
Engineer-Certified Fill: Lots 65 to 100
5. In the opinion of the Inspecting Engineer, the limitations as set out in our 9 November, 2021 report should be observed when constructing dwellings over, or in the vicinity of Filled ground.
6. This Certification, that the Controlled Earth Fills have been placed equal to or to a better standard than the requirements of NZS 4431, does not remove the necessity for the normal inspection and design of foundations as would be made in natural ground.

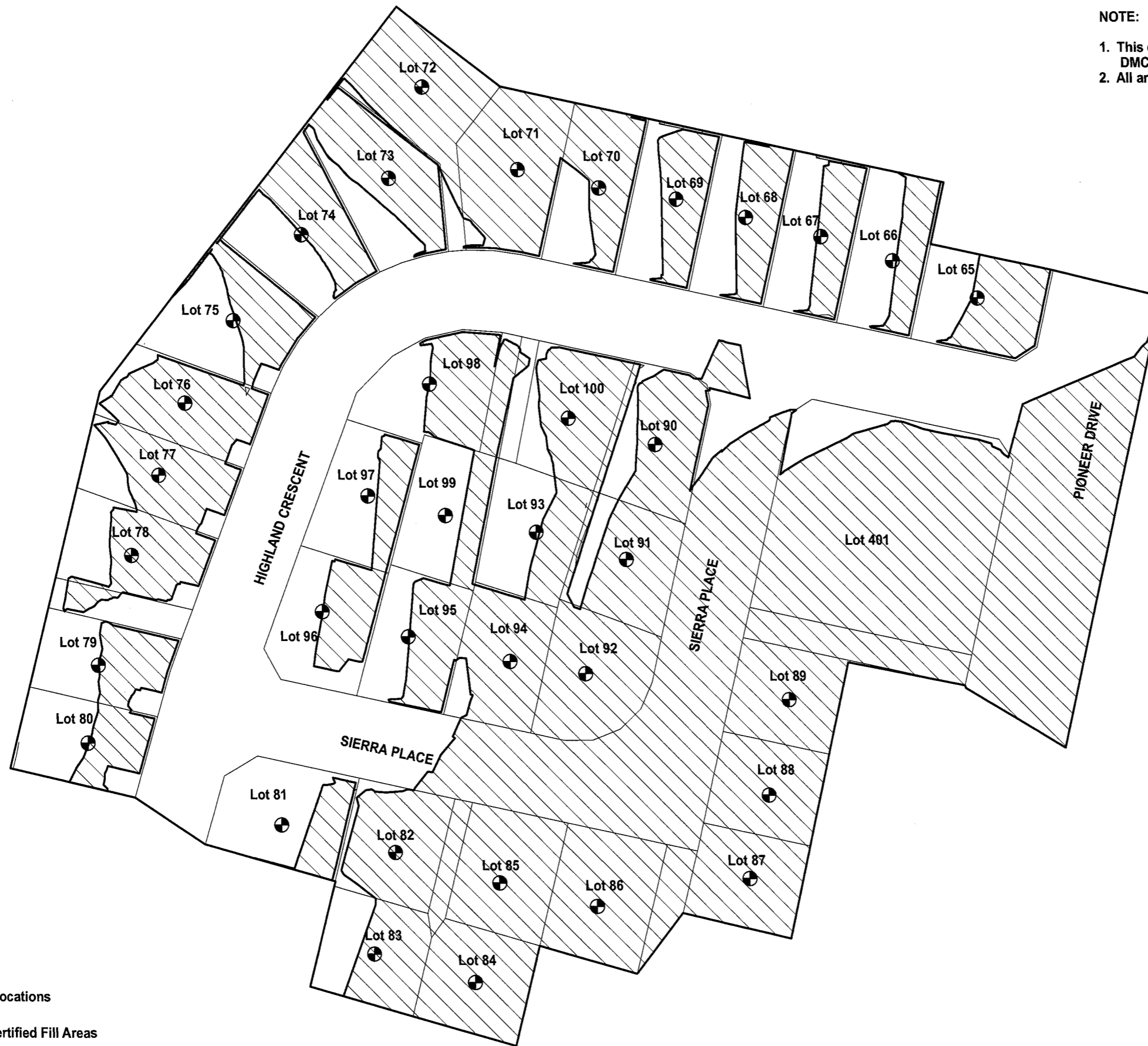
**Mark T Mitchell Ltd**

Signed   
Mark T Mitchell, BE(Civil), MS, MIPENZ  
(Member ACENZ, IPENZ, ASCE)

Date: 9 November, 2021

NOTE:

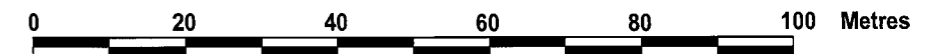
1. This drawing is reproduced from the Cut / Fill Plan prepared by DMC Ltd based on data supplied by Shrimpton and Lipinski.
2. All areas and distances where shown are subject to survey.



LEGEND

- denotes Bore Hole locations
- ▨ Engineer Certified Fill Areas

SCALE 1:1000

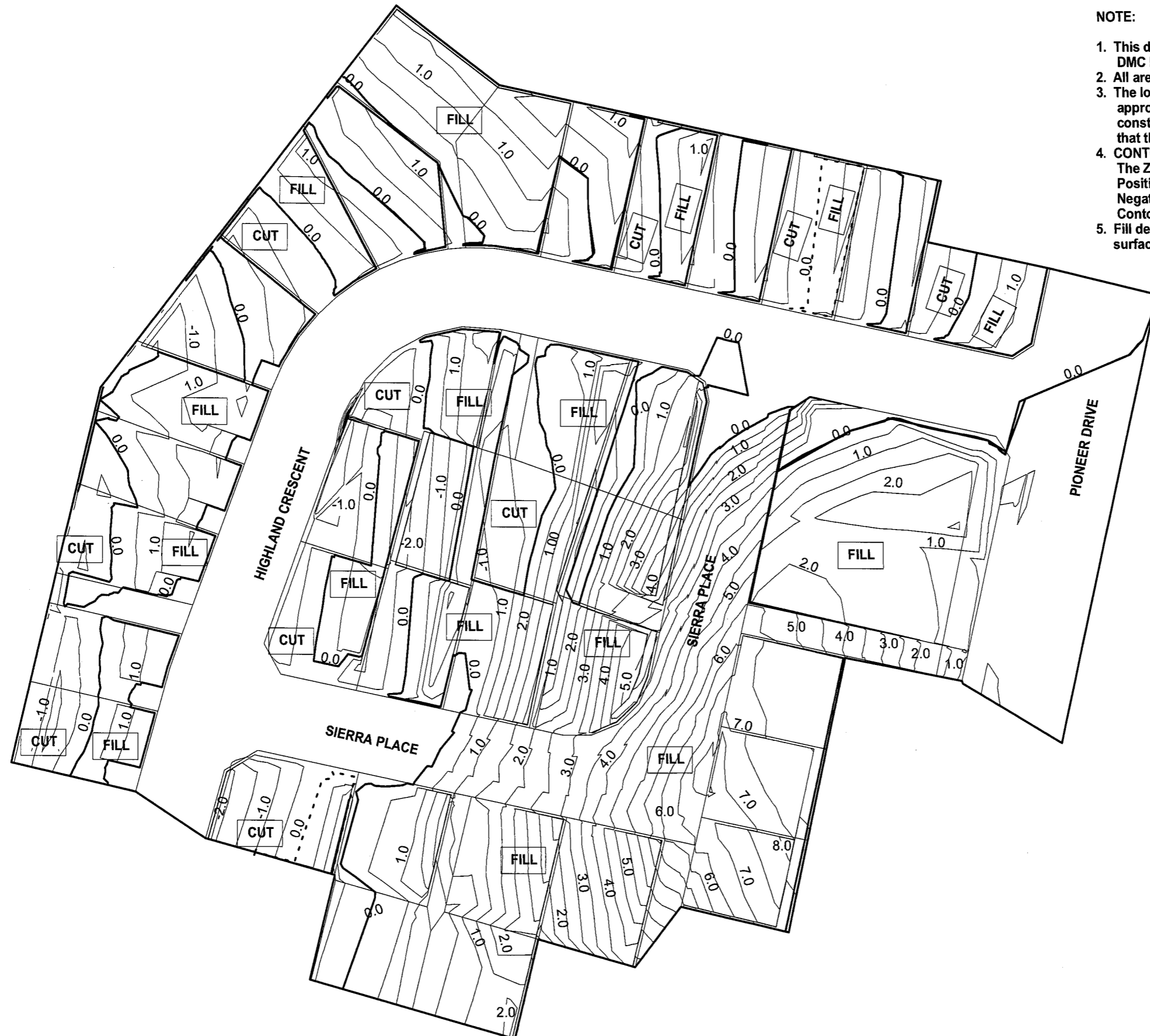


**Mark T Mitchell Ltd**  
Consulting Geotechnical Engineers  
1150 Victoria Street, P.O. Box 9123, Hamilton

FRONTIER DEVELOPMENTS LTD  
Site Investigation for Proposed Residential Subdivision  
Stage 4, Highland Crescent & Sierra Place, Te Awamutu

**SITE PLAN**

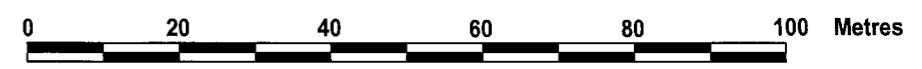
DRAWING No. 16639-10  
INITIAL DATE November 2021  
ISSUE DATE 09.11.2021



**NOTE:**

1. This drawing is reproduced from the Cut / Fill Plan prepared by DMC Ltd based on data supplied by Shrimpton and Lipinski.
2. All areas and distances where shown are subject to survey.
3. The locations of the Fill/No Fill boundaries are approximate only. Care should be taken when constructing foundations near these boundaries that the actual Fill/No Fill Boundary be located.
4. **CONTOURS**  
The Zero contour line is a thick black line labeled 0.0  
Positive depth of Fill contours are shown as 1.0  
Negative height of Cut contours are shown as -1.0  
Contour intervals are 0.5m.
5. Fill depths are the difference between the original topsoil surface and asbuilt topsoil surface.

SCALE 1:1000



GRAPHIC LOG	BORE HOLE LOG Lot No. 65		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL						
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10							
	TOPSOIL.			TS																		
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.			Filling	140+/44																	
	clayey SILT. Very stiff, moist, moderately plastic, yellowish brown. Becoming light yellowish brown @ 1.5 metres.		1	Hamilton Ash	140+/26																	
					140+/32																	
					140+/26																	
					140+/42																	
			2		140/30																	
	Bottom of Bore Hole completed 09/08/21																					
			3																			

BORE HOLE LOG Lot No. 66		NOTES	
SOIL DESCRIPTION		- The stratification lines represent the approximate boundary between soil types and the transition may be gradual. - Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 should be applied to the top metre to attain Undrained Shear Strength (kPa). - Scala test was carried out in 1.0 metre depth increments.	
	TOPSOIL.		
	clayey SILT. Stiff to very stiff, moist, moderately plastic, yellowish brown. Becoming slightly plastic @ 0.6 metres.		1
	SILT with some clay and trace fine to medium sand. Very stiff, slightly plastic, orangey brown. Containing no sand and becoming yellowish brown @ 1.2 metres.		
	clayey SILT with minor fine to medium sand. Stiff, moist, manganese nodules, yellowish brown. Becoming non plastic and no sand @ 1.7 metres.		2
	Bottom of Bore Hole completed 09/08/21		
			3

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4	DRILL METHOD: Hand Auger	LOGGED: NS	PLOTTED: NS
JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu	RIG: VANE No. 1432	DATE LOGGED: 09/08/21	
JOB NUMBER: W-16639	DRILLER: NS	CHECKED: <i>KH</i>	

GRAPHIC LOG	BORE HOLE LOG Lot No. 67	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
					1	2	3	4	5	6	7	8	9	10				
	SOIL DESCRIPTION																	
	TOPSOIL.		TS															
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.		FILL	140+/12														
	clayey SILT. Stiff to very stiff, slightly plastic, brown.	1	Hamilton Ash	132/28														
	SILT with some clay and trace fine sand. Stiff to very stiff, moist-wet, orangey brown. Becoming moist and yellowish brown @ 1.6 metres. " yellowish brown mottled dark brown @ 1.7 metres. " yellowish brown @ 1.8 metres.	2		104/18														
				100/12														
				74/14														
				140+/23														
				136/24														
	Bottom of Bore Hole completed 09/08/21	3																

### BORE HOLE LOG Lot No. 68

#### NOTES

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 should be applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

#### SOIL DESCRIPTION

GRAPHIC LOG	BORE HOLE LOG Lot No. 68	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
					1	2	3	4	5	6	7	8	9	10				
	SOIL DESCRIPTION																	
	TOPSOIL.		Topsoil															
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.		Filling	140+/45														
	clayey SILT. Very stiff, moist, slightly plastic, yellowish brown. Becoming stiff @ 2.0 metres.	1	Hamilton Ash	140+/38														
				140+/26														
				140+/36														
				124/24														
				86/12														
	Bottom of Bore Hole completed 09/08/21	2																
		3																

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4  
 JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu  
 JOB NUMBER: W-16639

DRILL METHOD: Hand Auger  
 RIG: \_\_\_\_\_ VANE No. 1432  
 DRILLER: NS

LOGGED: NS PLOTTED: NS  
 DATE LOGGED: 09/08/21  
 CHECKED: KH



GRAPHIC LOG	BORE HOLE LOG Lot No. 69		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			TS															
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.			Filling	118/22 140+ 106/23 140+/30														
	clayey SILT. Very stiff, moist, slightly plastic, yellowish brown.		1	Hamilton Ash	140+/34 140/31														
			2		138/34														
		Bottom of Bore Hole completed 10/08/21																	
			3																


No Groundwater

BORE HOLE LOG Lot No. 70		NOTES																	
SOIL DESCRIPTION		- The stratification lines represent the approximate boundary between soil types and the transition may be gradual. - Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 and 446 of 1.43 should be applied to the top metre to attain Undrained Shear Strength (kPa). - Scala test was carried out in 1.0 metre depth increments.																	
GRAPHIC LOG	BORE HOLE LOG Lot No. 70		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			TS															
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.			Filling	140+/74 140+/82 140+/52														
	clayey SILT. Very stiff, moist, moderately plastic, yellowish brown. Becoming dark yellowish brown @ 0.9 metres. " yellowish brown @ 1.2 metres.		1	Hamilton Ash	114/38 116/30 140+/34 140+/36														
			2		140+/38														
		Bottom of Bore Hole completed 03/09/2021																	
			3																

No Groundwater

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4	DRILL METHOD: Hand Auger	LOGGED: NS	PLOTTED: NS
JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu	RIG: VANE No. 1432 & 446	DATE LOGGED: 10/08/21 & 03/09/2021	CHECKED: <i>KU</i>
JOB NUMBER: W-16639	DRILLER: NS		

<b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton	<b>BORE HOLE LOG</b>	<b>BORE HOLE LOG Lots 69 &amp; 70</b>	
		LOCATION: refer Site Plan	RL (m):
		SHEET: 1 OF 1	Fig. No. A-3

GRAPHIC LOG	BORE HOLE LOG Lot No. 71	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL	
					1	2	3	4	5	6	7	8	9	10		
	TOPSOIL.		TS													
	FILLING: Mixture of Silt, Clay & Sand. Engineer certified, high strength, wet, various coloured browns.	1	Filling	140+/20 140+/16 140+ 140+/28 140+												
	clayey SILT. Stiff to very stiff, wet, moderately plastic, yellowish brown.	2	Hamilton Ash	132/18 84/10												
	Bottom of Bore Hole completed 10/08/21	3														


End of the Day

**BORE HOLE LOG Lot No. 72**

**SOIL DESCRIPTION**

**NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 should be applied to the top metre to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	BORE HOLE LOG Lot No. 72	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL	
					1	2	3	4	5	6	7	8	9	10		
	TOPSOIL.		TS													
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.	1	Filling	140+/40 140+/50 140+/70 134/42 138/32												
	silty CLAY with trace fine sand. Very stiff, moist, moderately plastic, yellowish brown. Becoming light yellowish brown @ 1.7 metres.	2	Hamilton Ash	140+/42 110/26												
	Bottom of Bore Hole completed 03/09/21	3														

No Groundwater

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4 DRILL METHOD: Hand Auger LOGGED: NS PLOTTED: NS

JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu RIG:            VANE No. 1432 DATE LOGGED: 10/08/21 & 03/09/21

JOB NUMBER: W-16639 DRILLER: NS CHECKED: NA

GRAPHIC LOG	BORE HOLE LOG Lot No. 73		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL		
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10			
	TOPSOIL.			Topsoil														
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, moist, various coloured browns.			Filling	140+/48 140+/36 UTP 140+/78													
	clayey SILT. Stiff to very stiff, moist, moderately plastic, yellowish brown.		1	Hamilton Ash	128/24 96/20 118/26													
	Bottom of Bore Hole completed 10/08/21		2															
			3															




No Groundwater




BORE HOLE LOG Lot No. 74		NOTES																
GRAPHIC LOG	SOIL DESCRIPTION		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL		
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10			
	TOPSOIL.			Topsoil														
	silty CLAY. Very stiff, highly plastic, yellowish brown.				140+/44 140+/52													
	clayey SILT. Stiff, moist, moderately plastic, yellowish brown. Becoming very stiff and dark yellowish brown @ 1.0 metres. " yellowish brown @ 1.4 metres.		1	Hamilton Ash	92/20 76/18 118/22 140+/44													
	Bottom of Bore Hole completed 10/08/21		2		140+/32													
			3															

No Groundwater

JOB NAME: <u>FRONTIER DEVELOPMENTS LTD - Stage 4</u>	DRILL METHOD: <u>Hand Auger</u>	LOGGED: <u>NS</u>	PLOTTED: <u>NS</u>
JOB LOCATION: <u>Highland Crescent &amp; Sierra Place, Te Awamutu</u>	RIG: <u>VANE No. 1432</u>	DATE LOGGED: <u>10/08/21</u>	
JOB NUMBER: <u>W-16639</u>	DRILLER: <u>NS</u>	CHECKED: <u>KH</u>	

 <b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton	<b>BORE HOLE LOG</b>	<b>BORE HOLE LOG Lots 73 &amp; 74</b> LOCATION: refer Site Plan      RL (m): SHEET: 1 OF 1      Fig. No. A-5
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GRAPHIC LOG	BORE HOLE LOG Lot No. 75		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			Topsoil															
		clayey SILT. Very stiff, moist, moderately plastic, dark yellowish brown. Becoming light yellowish brown @ 0.5 metres.	1	Hamilton Ash	140+/40														
		clayey SILT. stiff to very stiff, slightly plastic, yellowish brown.	2	Hamilton Ash	140+/30														
	Bottom of Bore Hole completed 10/08/21 		3		136/28														

BORE HOLE LOG Lot No. 76		NOTES																	
GRAPHIC LOG	SOIL DESCRIPTION		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			Topsoil															
		FILLING: Mixture of Silt & Clay. Engineer certified, high strength, dry-moist, various coloured browns. Becoming moist @ 0.6 metres.	1	Filling	140+/46														
		clayey SILT. Very stiff, moist, slightly plastic, yellowish brown.	2	Hamilton Ash	140+/56														
	Bottom of Bore Hole completed 10/08/21 		3		140+/80														

JOB NAME: <u>FRONTIER DEVELOPMENTS LTD - Stage 4</u>	DRILL METHOD: <u>Hand Auger</u>	LOGGED: <u>NS</u>	PLOTTED: <u>NS</u>
JOB LOCATION: <u>Highland Crescent &amp; Sierra Place, Te Awamutu</u>	RIG: <u>VANE No. 1432</u>	DATE LOGGED: <u>10/08/21</u>	
JOB NUMBER: <u>W-16639</u>	DRILLER: <u>NS</u>	CHECKED: <u>KH</u>	

GRAPHIC LOG	BORE HOLE LOG Lot No. 77		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
		TOPSOIL.		Topsoil															
		FILLING: Mixture of Silt & Clay. Engineer certified, high strength, dry-moist, various coloured browns.		Filling	140+/27 110/36 140+/42 140+/62														
		clayey SILT. Stiff, moist, moderately plastic, yellowish brown. Becoming slightly plastic @ 1.4 metres. " light yellowish brown @ 1.6 metres.	1	Hamilton Ash	85/18 90/36														
		Bottom of Bore Hole completed 10/08/21	2																
			3																

**BORE HOLE LOG Lot No. 78**

**SOIL DESCRIPTION**

**NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 should be applied to the top metre to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	BORE HOLE LOG Lot No. 78		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
		TOPSOIL.		Topsoil															
		FILLING: Mixture of Silt & Clay. Engineer certified, high strength, dry-moist, various coloured browns.		Filling	140+/34 140+/94 140+/74 140+/34														
		clayey SILT with trace fine to medium sand. Stiff to very stiff, moist, slightly plastic, yellowish brown. Becoming moderately plastic and light yellowish brown @ 1.8 metres	1	Hamilton Ash	124/18 110/14 90/22														
		Bottom of Bore Hole completed 12/08/21	2																
			3																

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4

JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu

JOB NUMBER: WV-16639

DRILL METHOD: Hand Auger

RIG: VANE No. 1432

DRILLER: NS

LOGGED: NS

PLOTTED: NS

DATE LOGGED: 12/08/21

CHECKED: KA

 <b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton	<b>BORE HOLE LOG</b>		<b>BORE HOLE LOG Lots 77 &amp; 78</b>	
	LOCATION: refer Site Plan		RL (m):	
SHEET: 1 OF 1		Fig. No. A-7		

GRAPHIC LOG	BORE HOLE LOG Lot No. 79		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			Topsoil															
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, dry-moist, various coloured browns.			Filling	140+/40														
					140+/64														
			1		106/16														
					92/12														
	clayey SILT. Stiff, moist, slightly plastic, light yellowish brown. Becoming moderately plastic @ 1.4 metres.		2	Hamilton Ash	72/22														
					62/20														
					74/32														
	Bottom of Bore Hole completed 12/08/21		3																

BORE HOLE LOG Lot No. 80		NOTES																	
SOIL DESCRIPTION		- The stratification lines represent the approximate boundary between soil types and the transition may be gradual. - Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 should be applied to attain Undrained Shear Strength (kPa). - Scala test was carried out in 1.0 metre depth increments.																	
GRAPHIC LOG	SOIL DESCRIPTION		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	1	2				3	4	5	6	7	8	9	10						
	TOPSOIL.			Topsoil															
	FILLING: Mixture of Silt & Clay. Engineer certified, high strength, dry-moist, various coloured browns.			FILL	140+														
	silty CLAY. Stiff, moist, moderately plastic, light yellowish brown.				140+/76														
					106/33														
			1		72/12														
	clayey SILT. Stiff, moist, slightly plastic, yellowish brown. Becoming moderately plastic @ 1.2 metres. " slightly plastic @ 1.6 metres.		2	Hamilton Ash	72/12														
					68/18														
					74/12														
	Bottom of Bore Hole completed 12/08/21		3																

JOB NAME: <u>FRONTIER DEVELOPMENTS LTD - Stage 4</u>	DRILL METHOD: <u>Hand Auger</u>	LOGGED: <u>NS</u>	PLOTTED: <u>NS</u>
JOB LOCATION: <u>Highland Crescent &amp; Sierra Place, Te Awamutu</u>	RIG: <u>VANE No. 1432</u>	DATE LOGGED: <u>12/08/21 &amp; 03/09/2021</u>	
JOB NUMBER: <u>WV-16639</u>	DRILLER: <u>NS</u>	CHECKED: <u>KH.</u>	

 <b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton	<b>BORE HOLE LOG</b>	<b>BORE HOLE LOG Lots 79 &amp; 80</b>	
		LOCATION: refer Site Plan	RL (m):
		SHEET: 1 OF 1	Fig. No. A-8

GRAPHIC LOG	BORE HOLE LOG Lot No. 81	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Re moulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL				
					1	2	3	4	5	6	7	8	9	10					
	TOPSOIL.		Topsoil																
	clayey SILT. Firm, moist, slightly plastic, yellowish brown. Containing manganese nodules and becoming brown @ 0.7 metres. Becoming yellowish brown mottled brown @ 0.9 metres. Becoming yellowish brown @ 1.0 metres.	1	Hamilton Ash	48/10 32/8 48/14 44/10 36/8 28/12															
	Bottom of Bore Hole completed 03/09/21	2		42/12															
		3																	

GRAPHIC LOG	BORE HOLE LOG Lot No. 82	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Re moulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.		TS															
	FILLING: Mixture of Silt, Clay, Topsoil & Sand. Engineer certified, high strength, dry-moist, various coloured browns.		Filling	136/30 140+/46 140+/68 140+/51														
	silty CLAY. Stiff, moist, moderately plastic, brown.	1	Hamilton Ash	86/32 140+/18														
	SILT with some clay. Very stiff, dry to moist, dark yellowish brown.			140+														
	silty CLAY. Very stiff, moist, moderately plastic, dark yellowish brown. Becoming highly plastic @ 1.8 metres.	2		136/60														
	Bottom of Bore Hole completed 03/09/21	3																

**NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 1432 of 1.64 should be applied to the top metre to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4	DRILL METHOD: Hand Auger	LOGGED: NS	PLOTTED: NS
JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu	RIG: VANE No. 1432	DATE LOGGED: 03/09/21	
JOB NUMBER: W-16639	DRILLER: NS	CHECKED: <i>KM</i>	

 <b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton	<b>BORE HOLE LOG</b>	<b>BORE HOLE LOG Lots 81 &amp; 82</b>	
		LOCATION: refer Site Plan	RL (m):
		SHEET: 1 OF 1	Fig. No. A-9

GRAPHIC LOG	BORE HOLE LOG Lot No. 83	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL		
					1	2	3	4	5	6	7	8	9	10			
	SOIL DESCRIPTION																
	TOPSOIL.		Filling	140+/42													
	FILLING: Mixture of Silt, Clay and Sand. Engineer certified, high strength, dry to moist, various coloured browns.		UTP														
	silty CLAY. Stiff to very stiff, moist, moderately to highly plastic, dark yellowish brown.		80/28														
	clayey SILT. Stiff, moist, slightly plastic, light yellowish brown. Containing minor fine to medium sand @ 1.1 metres. " no sand @ 1.2 metres. Becoming moderately plastic @ 1.9 metres.	1	Hamilton Ash	68/18													
			70/18														
			100/12														
		2	80/24														
	Bottom of Bore Hole completed 03/09/21																
		3															

No Groundwater

BORE HOLE LOG Lot No. 84		NOTES																
SOIL DESCRIPTION		- The stratification lines represent the approximate boundary between soil types and the transition may be gradual. - Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 446 of 1.43 to 1.2 metres and 559 of 1.39 for greater than 1.2 metres for Bore Hole No. 84 and Vane 1432 of 1.64 for Bore Hole No. 83 should be applied to attain Undrained Shear Strength (kPa). - Scala test was carried out in 1.0 metre depth increments.																
GRAPHIC LOG	SOIL DESCRIPTION	DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.		Topsoil															
			Filling	140+/30														
	FILLING: Mixture of Silt and Clay. Engineer certified, variable strength, moist, various coloured browns. Containing trace fine gravel @ 1.0 metre.		56/20															
	clayey SILT. Very stiff, moist, moderately plastic, yellowish brown.	1	Hamilton Ash	140+/62														
			140+/50															
			116/26															
		2	110/24															
	Bottom of Bore Hole completed 06/10/2021																	
		3																

No Groundwater

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4	DRILL METHOD: Hand Auger	LOGGED: NS/CFK	PLOTTED: NS/JB
JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu	RIG: VANE No. 1432/446/559	DATE LOGGED: 03/09/21 to 06/10/21	
JOB NUMBER: W-16639	DRILLER: NS/JB	CHECKED: KA.	





GRAPHIC LOG	<b>BORE HOLE LOG Lot No. 87</b>		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10	
	TOPSOIL.		1	TS	110/12											No Groundwater
	FILLING: Mixture of Silt, Clay & Sand. Engineer certified, moderate to high strength moist to wet, slightly plastic, various coloured browns.															
		140+	Filling	140+											No Groundwater	
		140+			Filling	140+										
		140+/50	Filling	140+/50												
		140+/50			Filling	140+/50										
		Bottom of Bore Hole completed 03/09/21	2	Filling			140+/50									
					3	Filling		140+/50								

**BORE HOLE LOG Lot No. 88**

**SOIL DESCRIPTION**

**NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 446 of 1.43 should be applied to the top metre to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	<b>BORE HOLE LOG Lot No. 88</b>		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10	
	TOPSOIL.		1	TS	140+/30											No Groundwater
	FILLING: Mixture of Clay & Silt. Engineer certified, moderate to high strength, moist, moderately to highly plastic, various coloured browns.															
		140+/8	Filling	122/4											No Groundwater	
		140+/26			Filling	138/28										
		140+	Filling	140+												
		Bottom of Bore Hole completed 03/09/21			2	Filling	140+									
			3	Filling				140+								

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4

JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu

JOB NUMBER: WV-16639

DRILL METHOD: Hand Auger

RIG: VANE No. 446

DRILLER: NS

LOGGED: NS

PLOTTED: NS

DATE LOGGED: 03/09/21

CHECKED: NS

<p><b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton</p>	<h2>BORE HOLE LOG</h2>	<b>BORE HOLE LOG Lots 87 &amp; 88</b>	
		LOCATION: refer Site Plan	RL (m):
SHEET: 1 OF 1		Fig. No. A-12	

GRAPHIC LOG	BORE HOLE LOG Lot No. 89		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			TS															
	FILLING: Mixture of Silt, Clay & Sand. Engineer certified, variable strength, moist, various coloured browns.		1	Filling	140+/6 130/48 60/8 120/2 140+														
	Bottom of Bore Hole completed 03/09/21		2		140+														
			3																

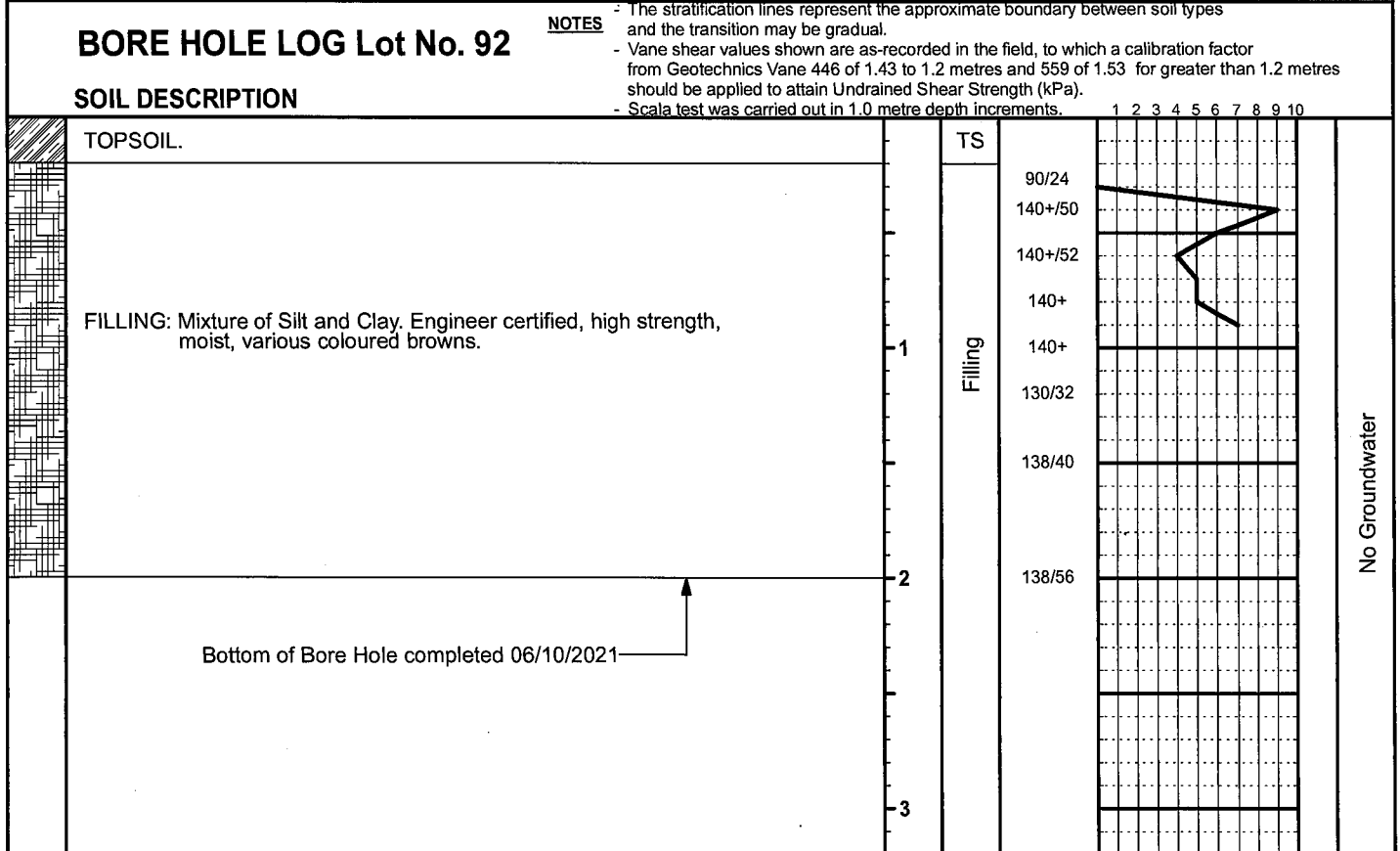
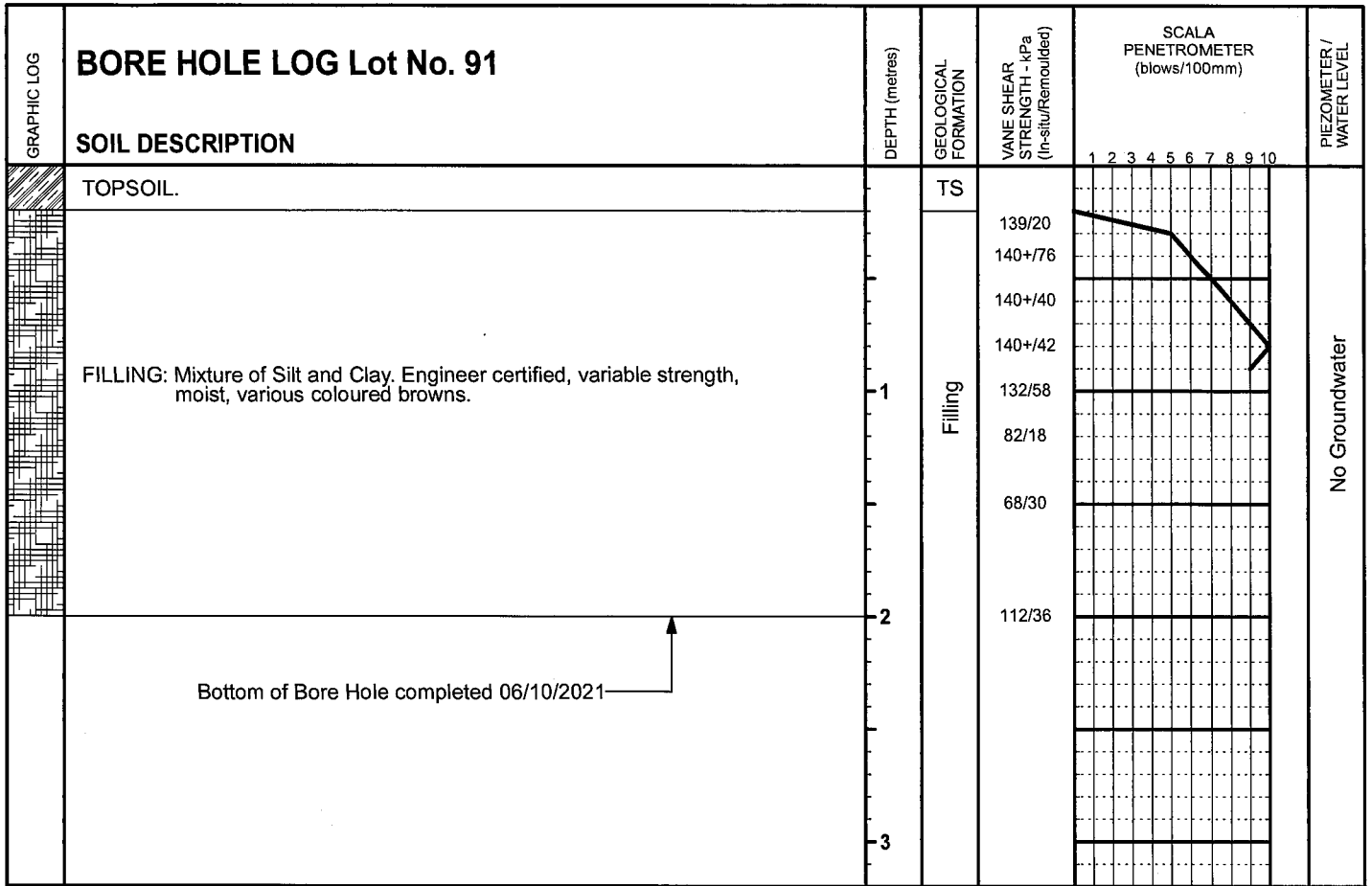
**BORE HOLE LOG Lot No. 90** **NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 446 of 1.43 to 1.2 metres and 559 of 1.39 for greater than 1.2 metres for Bore Hole No. 90 and Vane 446 of 1.43 for Bore Hole No. 89 should be applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	BORE HOLE LOG Lot No. 90		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL			
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10				
	TOPSOIL.			Topsoil															
	FILLING: Mixture of Silt and Clay. Engineer certified, variable strength, moist, various coloured browns.		1	Filling	140+ 140+ 80/20 140+ 140+														
	clayey SILT. Stiff, moist, moderately plastic, orangey brown.		2	Hamilton Ash	62/22														
	Bottom of Bore Hole completed 06/10/2021		3																

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4 DRILL METHOD: Hand Auger LOGGED: NS/CFK PLOTTED: NS/ JB  
 JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu RIG: VANE No. 446/559 DATE LOGGED: 03/09/21 to 06/10/21  
 JOB NUMBER: W-16639 DRILLER: NS/JB CHECKED: NS

 <b>Geocon Geotechnical Ltd</b> Geotechnical Engineers 1150 Victoria Street, P.O. Box 9123, Hamilton	<b>BORE HOLE LOG</b>	<b>BORE HOLE LOG Lots 89 &amp; 90</b>	
		LOCATION: refer Site Plan	RL (m):
SHEET: 1 OF 1		Fig. No. A-13	



**NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 446 of 1.43 to 1.2 metres and 559 of 1.53 for greater than 1.2 metres should be applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

JOB NAME: <u>FRONTIER DEVELOPMENTS LTD - Stage 4</u>	DRILL METHOD: <u>Hand Auger</u>	LOGGED: <u>CFK/JB</u> PLOTTED: <u>JB</u>
JOB LOCATION: <u>Highland Crescent &amp; Sierra Place, Te Awamutu</u>	RIG: <u>VANE No. 446/559</u>	DATE LOGGED: <u>06/10/2021</u>
JOB NUMBER: <u>W-16639</u>	DRILLER: <u>JB/CFK</u>	CHECKED: <u>[Signature]</u>

GRAPHIC LOG	BORE HOLE LOG Lot No. 93		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL				
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10					
		TOPSOIL.		TS																
		clayey SILT. Stiff, moist, slightly plastic, orangey brown.		Hamilton Ash	132/36															
		silty CLAY. Stiff, moist, moderately plastic, orangey brown.			90/36															
					64/20															
	1				90/40															
		clayey SILT. Very stiff, moist, slightly plastic, orangey brown. Becoming yellowish brown @ 1.8 metres.			140+/34															
					140+/24															
					140+/24															
	2				138/32															
		Bottom of Bore Hole completed 06/10/2021																		
	3																			

**BORE HOLE LOG Lot No. 94**

**SOIL DESCRIPTION**

**NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 446 of 1.43 to 1.2 metres and 559 of 1.53 for greater than 1.2 metres should be applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	BORE HOLE LOG Lot No. 94		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL				
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10					
		TOPSOIL.		Topsoil																
		FILLING: Mixture of Silt and Clay. Engineer certified, high strength, moist, various coloured browns.		Filling	140+/32															
					140+/56															
					140+/60															
	1				140+/52															
					140+															
		clayey SILT. Very stiff, moist, slightly plastic, yellowish brown.		Hamilton Ash	116/36															
					140+															
	2																			
		Bottom of Bore Hole completed 06/10/2021																		
	3																			

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4

JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu

JOB NUMBER: W-16639

DRILL METHOD: Hand Auger




RIG:                      VANE No. 446/559




DRILLER: JB/CFK

LOGGED: CFK/JB PLOTTED: JB

DATE LOGGED: 06/10/2021

CHECKED: Kth

GRAPHIC LOG	BORE HOLE LOG Lot No. 95		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL				
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10					
 x	TOPSOIL.			TS																
	clayey SILT. Very stiff, moist, slightly plastic, orangey brown. Becoming yellowish brown @ 0.6 metres.			Hamilton Ash	140+/40															
					138/40															
 x	silty CLAY. Very stiff, moist, moderately plastic, yellowish brown. containing manganese nodules @ 1.0 metre.		1		140+/36															
					108/30															
					140+/40															
 x	CLAY with some silt. Very stiff, moist, moderately to highly plastic, yellowish brown.		2		140+/50															
					106/66															
			3		140+															
		Bottom of Bore Hole completed 05/10/2021																		

BORE HOLE LOG Lot No. 96		NOTES																		
GRAPHIC LOG	BORE HOLE LOG Lot No. 96		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL				
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10					
 x	TOPSOIL.			TS																
	clayey SILT. Stiff to very stiff, moist, slightly plastic, orangey brown. Becoming yellowish brown @ 0.6 metres.			Hamilton Ash	140+/70															
						140+/40														
 x	silty CLAY. Stiff to very stiff, moist, moderately plastic, manganese nodules, yellowish brown.		1		140+/30															
					126/26															
					68/12															
 x			2		114/32															
					82/30															
			3		106/60															
		Bottom of Bore Hole completed 05/10/2021																		

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4	DRILL METHOD: Hand Auger	LOGGED: JB	PLOTTED: JB
JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu	RIG: VANE No. 559	DATE LOGGED: 06/10/2021	
JOB NUMBER: W-16639	DRILLER: JB	CHECKED: <i>KH</i>	

GRAPHIC LOG	BORE HOLE LOG Lot No. 97		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL				
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10					
		TOPSOIL.		TS																
		clayey SILT. Stiff to very stiff, moist, slightly plastic, orangey brown.		Hamilton Ash	140+/40															
					140+/46															
		silty CLAY. Stiff to very stiff, moist, moderately plastic, yellowish brown. Becoming mottled orangey brown from 1.8 to 1.9 metres.	1		122/44															
						90/24														
					70/22															
					100/54															
			2		106/70															
		Bottom of Bore Hole completed 05/10/2021																		
			3																	

**BORE HOLE LOG Lot No. 98**

**SOIL DESCRIPTION**

**NOTES** - The stratification lines represent the approximate boundary between soil types and the transition may be gradual.  
 - Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 559 of 1.53 should be applied to attain Undrained Shear Strength (kPa).  
 - Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	BORE HOLE LOG Lot No. 98		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL					
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10						
		TOPSOIL.		TS																	
		clayey SILT. Stiff to very stiff, moist, slightly to moderately plastic, orangey brown.		Hamilton Ash	110/28																
					120/40																
			1		140+/49																
					138/40																
		silty CLAY. Very stiff, moist, moderately plastic, yellowish brown.			100/36																
					138/44																
		clayey SILT. Stiff to very stiff, moist, slightly to moderately, yellowish brown.			74/46																
		Bottom of Bore Hole completed 05/10/2021																			
			2																		
			3																		

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4

JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu

JOB NUMBER: W-16639

DRILL METHOD: Hand Auger



RIG:            VANE No. 559

DRILLER: JB

LOGGED: JB PLOTTED: JB



DATE LOGGED: 06/10/2021

CHECKED:

GRAPHIC LOG	BORE HOLE LOG Lot No. 99		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL					
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10						
	TOPSOIL.			TS																	
		clayey SILT. Stiff to very stiff, moist, slightly plastic, yellowish brown. Becoming firm to stiff and lightly to moderately plastic @ 1.2 metres.		1	Hamilton Ash	80/12 140+															
				140+/60 140+																	
				140+																	
				42/12 56/24																	
			2		62/38																
		Bottom of Bore Hole completed 06/10/2021																			
			3																		

**BORE HOLE LOG Lot No. 100** **NOTES**

- The stratification lines represent the approximate boundary between soil types and the transition may be gradual.
- Vane shear values shown are as-recorded in the field, to which a calibration factor from Geotechnics Vane 446 of 1.43 to 1.2 metres and 559 of 1.53 for greater than 1.2 metres should be applied to attain Undrained Shear Strength (kPa).
- Scala test was carried out in 1.0 metre depth increments.

GRAPHIC LOG	BORE HOLE LOG Lot No. 100		DEPTH (metres)	GEOLOGICAL FORMATION	VANE SHEAR STRENGTH - kPa (In-situ/Remoulded)	SCALA PENETROMETER (blows/100mm)										PIEZOMETER / WATER LEVEL					
	SOIL DESCRIPTION					1	2	3	4	5	6	7	8	9	10						
	TOPSOIL.			TS																	
		FILLING: Mixture of Silt and Clay. Engineer certified, high strength, moist, various coloured browns.		1	Hamilton Ash	140+ 140+															
				140+ 140+																	
				120/40 132/42																	
				80/30																	
			2		102/34																
		Bottom of Bore Hole completed 06/10/2021																			
			3																		

JOB NAME: FRONTIER DEVELOPMENTS LTD - Stage 4 DRILL METHOD: Hand Auger LOGGED: CFK/JB PLOTTED: JB  
 JOB LOCATION: Highland Crescent & Sierra Place, Te Awamutu RIG:            VANE No. 446/559 DATE LOGGED: 06/10/2021  
 JOB NUMBER: W-16639 DRILLER: JB/CFK CHECKED: KH