

Geotechnical Investigation Report

1695 Pohuehue Road, Warkworth

For Pohuehue Community Housing Ltd.

Haigh Workman Reference: 25 050-GEO

May 2025



Revision History

Revision N ^o	Issued By	Description	Date
A	Ben Richardson	First Issue	30 th May 2025
B	Ben Richardson	Resource Consent	24 th June 2025

Prepared by



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Reviewed by



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MEngNZ

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Executive Summary

Haigh Workman Limited were engaged to undertake a geotechnical investigation for the site suitability to construct 12 units serviced by a proposed driveway located at 1695 Pohuehue Road, Warkworth. Geotechnical investigations comprised 14 hand augered boreholes across the site and a site walkover to assess the existing ground conditions.

Pakiri Formation Soils were encountered in most boreholes with an area of the lower lying part of the site having soils consisting of river and hill slope deposits overlaying the pakiri formation soils. Groundwater was recorded at a minimum of 2.4 m bgl during the fieldwork period (after a long dry period). It is reasonable to expect that groundwater is subject to rise and fall based on seasonal effects.

Concept plans identifying the location of the and size of the proposed buildings and driveway are provided in Appendix A. Providing the recommendations set out within this report are respected, we consider the sites to be stable and suitable for residential development at the designated building platform areas. Should the client choose to change the designated building platform areas, further investigative work may be required to confirm suitability.

Preliminary foundation recommendations are outlined in Section 5. Foundations are to be designed to accommodate the shrink swell characteristics of the site soils, classified as Class H in accordance with B1/AS1. Alternatively specific design following the recommendations within AS2870:2011, updated to the B1 return periods.

Construction recommendations are outlined in Section **Error! Reference source not found.**

A geotechnical engineer familiar with the findings of this report should be engaged to carry out inspections during earthworks and foundation excavations to confirm soil and foundation conditions are consistent with those summarised within this report. Inspections will be required at the following points:

- We consider shallow foundations found within stiff to very stiff natural soil or engineered fill to be suitable. Providing foundations are designed accordingly within any influence zones of retaining walls.
- Building Foundations to be specifically designed by a professional engineer to cater for Class H1 soils in accordance with AS2870.
- Filling below the driveway is permitted to a maximum thickness of 1.0m. Batters shall be a maximum gradient of 1V:3H and any earthworks shall be constructed in accordance with NZS4431 (2022).
- Based on our stability assessment generally the proposed building sites are considered to be stable.
- There are existing retaining walls that appear to have been designed and constructed as landscape walls. These walls shall not be relied on to support building foundations. Further recommendations may be required upon the final building consent design.
- Site excavations up to 2.0 m may be battered at a maximum gradient of 1V:3H; otherwise, batters will require suitable retaining subject to specific engineering design.

A geotechnical engineer familiar with the findings of this report should be engaged to carry out inspections during earthwork and foundation excavations to confirm soil and foundation conditions are consistent with those summarised within this report. Inspections will be required at the following points:

- Geotechnical drawing review before building consent application.
- Confirm location of the proposed development.

- Observe ground conditions exposed on any prepared building platform and observe foundation excavations to confirm exposed soils are suitable.
- Observe and test any filling to ensure an engineered standard is achieved.

1 Introduction

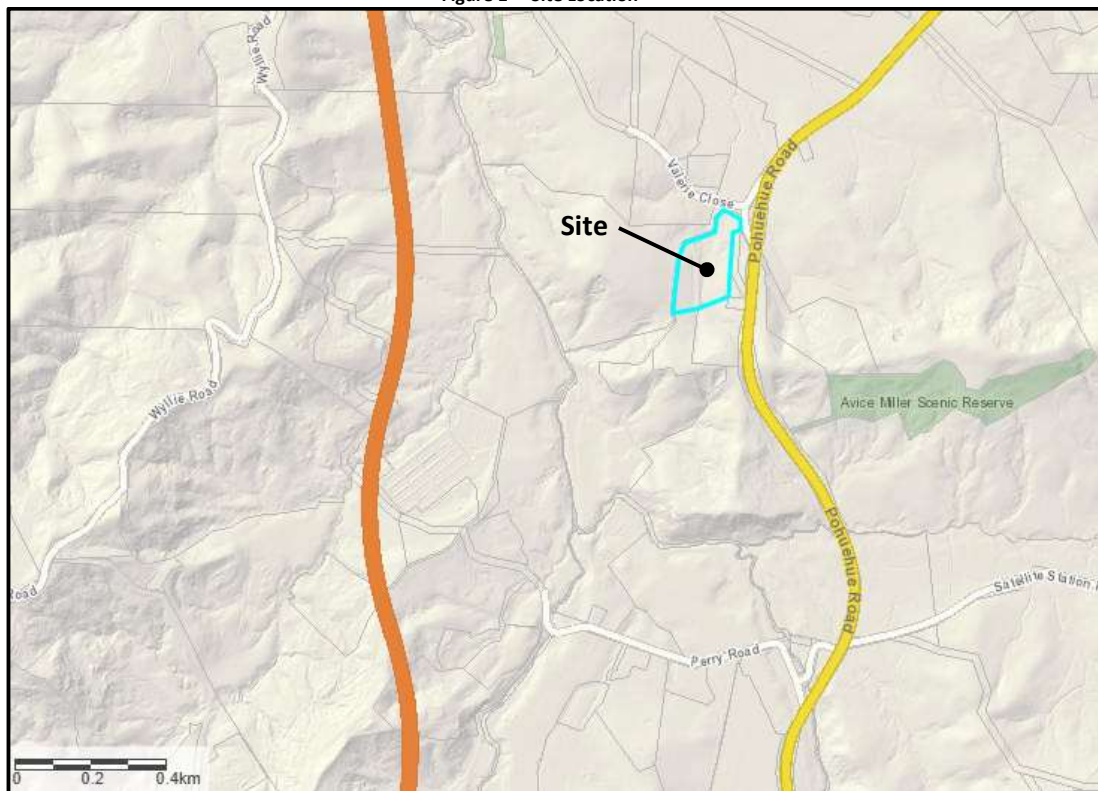
1.1 Project Brief and Scope

Haigh Workman Ltd (Haigh Workman) was engaged by Pohuehue Community Housing Ltd. (the Client) to undertake a geotechnical investigation at 1695 Pohuehue Road, Warkworth (Lot 1, DP 100471) (the site) to establish ground conditions to check suitability to construct twelve new relocatable buildings for the use of emergency housing at the above address. This report presents the information gathered during the site investigation, interpretation of data obtained and site-specific geotechnical recommendations relevant to the site.

The purpose of this report is to assess the available data and interpret ground and groundwater conditions for site suitability, and geotechnical constraints identified for future development. This report provides the following:

- A summary of the published geology with reference to the geotechnical investigations undertaken;
- Analysis of the data obtained from site investigations;
- Assessment of preliminary design parameters, providing recommendations for design, and;
- Identification of any additional geotechnical risks and/or hazards

Figure 1 – Site Location



1.2 Site Description

The site is legally described as Lot 1, DP 100471 with an area of 28,714 m² (2.8 ha) and is within the rural production zone to the south of Warkworth. The site has one existing dwelling and 2 farm sheds. The site is currently accessed from Valerie Close via a gravel driveway that approaches the site through the northern boundary and leads to the farm sheds and existing dwelling within the north-eastern portion of the site.

There is an overland flow path (OLFP) leading to a man-made pond that bisects the site in a south to north orientation. Approximately half of the site is covered in established pine nut trees with half being towards the southeast of the OLFP and half to the southwest.

To the west of the pond, the site has undergone historic earthworks with minor cutting into the area where pine nut trees have been planted and substantial non-engineered filling to construct a large flat area. The fill batter slopes down towards the pond area.

1.3 Proposed Development

The site plans within Appendix A show the extents and locations of the proposed development. A gravel driveway is proposed to access the existing dwelling, the 12 new emergency housing buildings, and the manager's office. It is proposed to carry out minor earthworks consisting of cut and fill to create the driveway and parking areas. The proposed buildings are to be constructed on timber piles. Proposed building platform areas are on gentle slopes of less 14°. Should the development locations be subject to change, further investigation will be required. Refer to Appendix A for the site plans which assign the proposed buildings numbers 1 to 12.

2 Geology

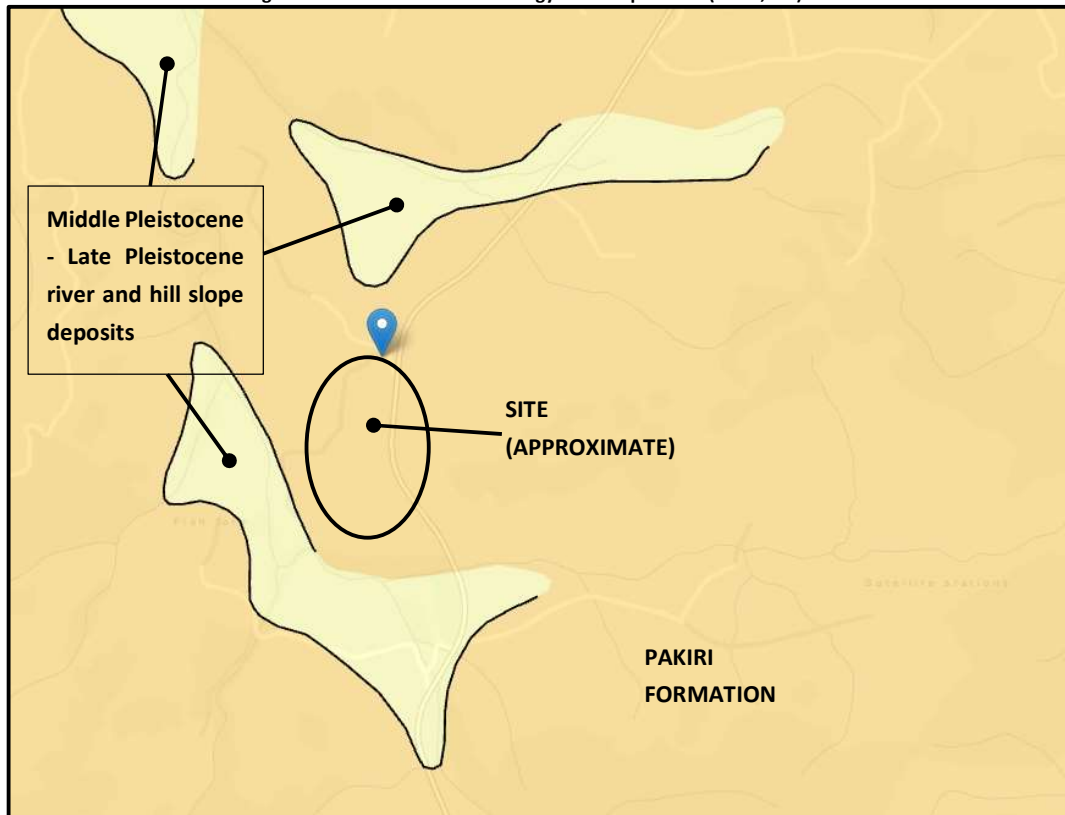
2.1 Published Geology

The GNS New Zealand Geology Web Map indicates geology at the proposed building areas as 'Pakiri Formation of Warkworth Subgroup (Waitemata Group)' and is described as 'Alternating thick-bedded, volcanic-rich, graded sandstone and siltstone.'

The GNS mapping indicates the geology in areas to the north and south of the site to consist of 'Middle Pleistocene - Late Pleistocene River and hill slope deposits' which is described as 'Predominantly pumiceous sand, silt, mud and clay, with interbedded gravel and peat'.

Based on our geotechnical investigations, we consider that a thin veneer of the river and hill slope deposits also bisect through the site near the base of the gully. These deposits are underlain by Pakiri Formation soils.

Figure 2 – GNS New Zealand Geology Web Map Extract (1:250,000)



3 Geotechnical Investigations

3.1 Subsurface Investigations

Haigh Workman undertook a ground investigation during March and April 2025 comprising 14 hand auger boreholes designated BH1 to BH12, and BH WW1 to BH WW2. Hand auger boreholes were completed to depths of up to 3.0 m below ground level (bgl). The purpose of the hand auger boreholes was to visually log the soil conditions extracted from the ground within the proposed building footprints and to provide a geotechnical ground model. Two hand augers were also carried out within the proposed wastewater disposal area for the purposes of determining ground water depth and soil permeability rate for wastewater dispersion calculations. Exploratory hole locations are depicted on the Investigation Plan in Appendix A.

Handheld shear vanes were carried out in 0.5 m increments within the hand augers. All materials retrieved from boreholes were logged in accordance with the NZGS publication, 2005¹. Hand auger logs are presented in Appendix B.

¹ NZGS, 2005: 'Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes'.

3.2 Subsoil Conditions

Stratigraphy observed during the ground investigation has been divided into different geotechnical units. Table 3-1 provides a summary of the materials encountered, with depth to base of unit provided where encountered.

Table 3-1: Summary of Investigation Results

Hole ID	Topsoil (m bgl)	Fill (m bgl)	River and hill slope deposits (m bgl)	Pakiri formation residual soils (m bgl)	Groundwater Level (m bgl)
BH1	0.1	0.1 – 0.7	NE	0.7 – 3.0+	NE
BH2	0.1	NE	NE	0.1 – 3.0+	NE
BH3	0.35	NE	0.35 – 3.0+	NE	NE
BH4	0.8	0.8 – 1.1	1.1 – 3.0+	NE	NE
BH5	0.05	0.05 – 1.1	1.1 – 3.0+	NE	NE
BH6	0.05	0.05 – 0.7	0.7 – 3.0+	NE	NE
BH7	0.25	NE	NE	0.25 – 3.0+	NE
BH8	0.35	NE	NE	0.35 – 3.0+	NE
BH9	0.3	NE	0.3 – 2.8	2.8 – 3.0+	2.4
BH10	0.2	NE	0.2 – 2.7	2.7 – 3.0+	NE
BH11	0.4	NE	0.4 – 3.0+	NE	NE
BH12	0.25	NE	NE	0.25 – 3.0+	NE
BH WW1	0.2	NE	NE	0.2 – 1.5+	NE
BH WW2	0.25	NE	NE	0.25 – 2.0+	NE

NE – Not Encountered

3.2.1 Topsoil

Organic SILT was encountered in all boreholes to a depth of 0.05 - 0.8m bgl. Topsoil thickness may vary outside of the specific test locations.

3.2.2 Fill

Non engineered fill was encountered within areas downslope of the existing dwelling and driveway within 4 of the boreholes. The depth of fill ranged from 0.7 – 1.1 m. The fill thickness is expected to vary within the building platform numbers 1 to 7. The fill material encountered is not considered suitable as a founding material for the proposed dwellings and piled footings should be embedded below this layer.

3.2.3 River and hill slope deposits

River and hill slope deposits were encountered within 7 of the boreholes. The boreholes were located within the lower lying areas of the site. Based on our geotechnical investigations, we consider that wedged veneer of the river and hill slopes exist overlaying the Pakiri Formations soils. These deposits were located at a depth of 2.7 - 3.0+ m bgl.

The vane shear strengths in this material were highly variable, ranging from 53 kPa to 198+ kPa.

3.2.4 Pakiri Formation Residual soils

Pakiri Formation Residual soils were encountered within 9 of the boreholes.

The vane shear strengths in this material were variable, ranging from 99 kPa to 198+ kPa.

3.2.5 Groundwater

Groundwater was recorded during drilling the investigation at a minimum of 2.4 m in BH9. It is reasonable to expect that groundwater is subject to rise and fall based on seasonal effects.

4 Geotechnical Assessment

4.1 Stability Assessment

A qualitative stability assessment has been carried out for the proposed development site, focusing on the natural and modified slopes within the area. The site is underlain primarily by Pakiri Formation soils and localized alluvial deposits. Site observations and review of available geological information indicate that existing slope angles are gentle to very gentle, with inclinations less than 14 degrees throughout the area of interest.

Given the low slope angles and the nature of the underlying materials, the risk of slope instability is considered to be very low. The Pakiri Formation typically comprises silty CLAYs and Clayey SILTS that have a long-standing record of stable performance under natural conditions on gentle slopes. Similarly, the alluvial deposits observed on site are composed primarily of cohesive silts and clays with moderate to high plasticity, which tend to exhibit favourable residual strength characteristics when undisturbed.

There is no evidence of historical slope failure or active ground movement within the site or the immediate surrounding area. Vegetative cover is well established, further contributing to slope stability by reducing surface erosion and promoting shallow root reinforcement. On this basis, and considering the benign slope geometry, it is concluded that the existing slopes are stable and do not pose a geotechnical hazard under current or proposed land use.

4.2 Liquefaction Assessment

Pakiri formation soils are generally not considered to be liquefiable due to the particle size distribution as the clay content is too high. Residual soils encountered on this site predominantly comprise moderately to highly plastic clays and silt. Where sandy CLAY was encountered, the clay content and plasticity are considered too high to be liquefiable. Due to the nature of these soils, we consider the liquefaction and lateral spread potential to be negligible.

5 Preliminary Design Recommendations

5.1 General

NZS 3604:2011 defines 'good ground' as any soil or rock capable of permanently withstanding an ultimate bearing capacity of 300 kPa. This equates to an allowable bearing pressure of 100 kPa when applying a safety factor of 3.0. It's important to note that 'good ground' excludes certain soil types, such as potentially compressible soils like topsoil, soft clays, uncompacted loose gravel, expansive soils with a liquid limit over 50% and a linear shrinkage over 15%, and ground susceptible to liquefaction or lateral spreading.

We consider that 'good ground' as defined in NZS 3604 is not met on this site due to:

- Slightly reduced bearing capacity
- Existing fill

- Expansive soils

However, the stiff to hard natural material encountered within the hand augered boreholes is considered suitable to support foundations. During building development, site specific testing and design parameters will be required.

For preliminary advise we recommend all timber pole foundations are embedded below the existing fill and a minimum of 1.0 m on ground with slopes of less than 10° and 1.5 m on ground with slopes of over 10°.

Bearing capacities etc are to be confirmed during building consent stage. Based on the limited testing undertaken for this resource consent, we anticipate a slightly reduced ultimate bearing capacity may be required on sites 8 – 11.

5.2 Seismic Hazard

From a review of the investigation data, it is recommended that the site be designed using Site Class C (Shallow soil site). This is based on satisfaction of the criteria outlined in Section 3.1.3.4 of NZS1170.5:2004².

5.3 Expansive Soil Class (Shrink-Swell Characteristics)

The sub-soils encountered during the site investigation indicated generally fine-grained clay or silt natural soils. The fine-grained soils are susceptible to shrinking in the summer and swelling in the winter due to seasonal variations of water content.

Based on experience of the geology, it is recommended the site be designated as 'Class H' in accordance with B1/AS1, alternatively specific design following the recommendations within AS2870:2011, updated to the B1 return periods.

6 Construction

6.1 Earthworks

6.1.1 Building Platforms

We recommend no filling within the building footprints should be carried out, without specific settlement design at the building consent stage. We consider earthworks batters shall be limited to a maximum (1V:3H) gradient for building platforms. Cut batter height shall be limited to 1.0 m unless it is retained with specific engineering design.

6.1.2 Driveway

Cuts and fills for the driveway will be required for construction. Refer to the Civil report reference 25 050-CIV for further details. Earthworks fill batters shall be limited to a maximum grade of 1V:3H. Cut batters shall be limited to a maximum grade of 1V:2H and 2.0m in height.

² NZS 1170.5: 2004, New Zealand Standard, Structural Design Actions – Part 5: Earthquake Actions.

We recommend that any earthworks be carried out in accordance with NZS4404³ and NZS4431⁴. It may not be practical to carry out earthworks in winter months or periods of prolonged rainfall, therefore we recommend site formation works are undertaken in weather conditions favourable for earthworks activities.

We recommend that inferred CBR testing of the subgrade is carried out during engineering plan approval to determine suitable hardfill thickness (Subbase and/or Basecourse) for the driveway. It is anticipated that the CBR value will be between 3 and 7% for the subgrade.

6.2 Sensitive Soils

Due to the nature of the underlying geology, the soils may exacerbate rapidly upon site excavations and drilling potentially leading to soil cracking and degradation to which care is therefore required during construction to ensure soil protection and moisture conditioning for subgrade performance.

6.3 Ground Stabilisation

For general land upkeep and erosion protection, it is recommended that, temporary cleared land due to construction processes are either revegetated or stabilised with the final surface covering or wearing course as soon as practicable.

6.4 Geotechnical Investigation

It is recommended that during initial building consent preparation, further site-specific investigation and confirmation of design parameters shall be carried out once resource consent is granted and the exact locations of proposed buildings are known.

6.5 Services

It is recommended that stormwater and wastewater is disposed of in a manner as to not exacerbate erosion of the surrounding land. It is important that all stormwater runoff from the proposed development including, roof, driveway and other sealed areas, is collected by means of sealed pipes and discharged in a controlled manner away from the development.

7 Limitations

This report has been prepared for the use of Pohuehue Community Housing Ltd. with respect to the brief outlined to us. This report is to be used by our Client and their Consultants and may be relied upon when considering geotechnical advice. Furthermore, this report may be utilised in the preparation of resource consent applications with local authorities. The information and opinions contained within this report shall not be used in other context for any other purpose without prior review and agreement by Haigh Workman Ltd.

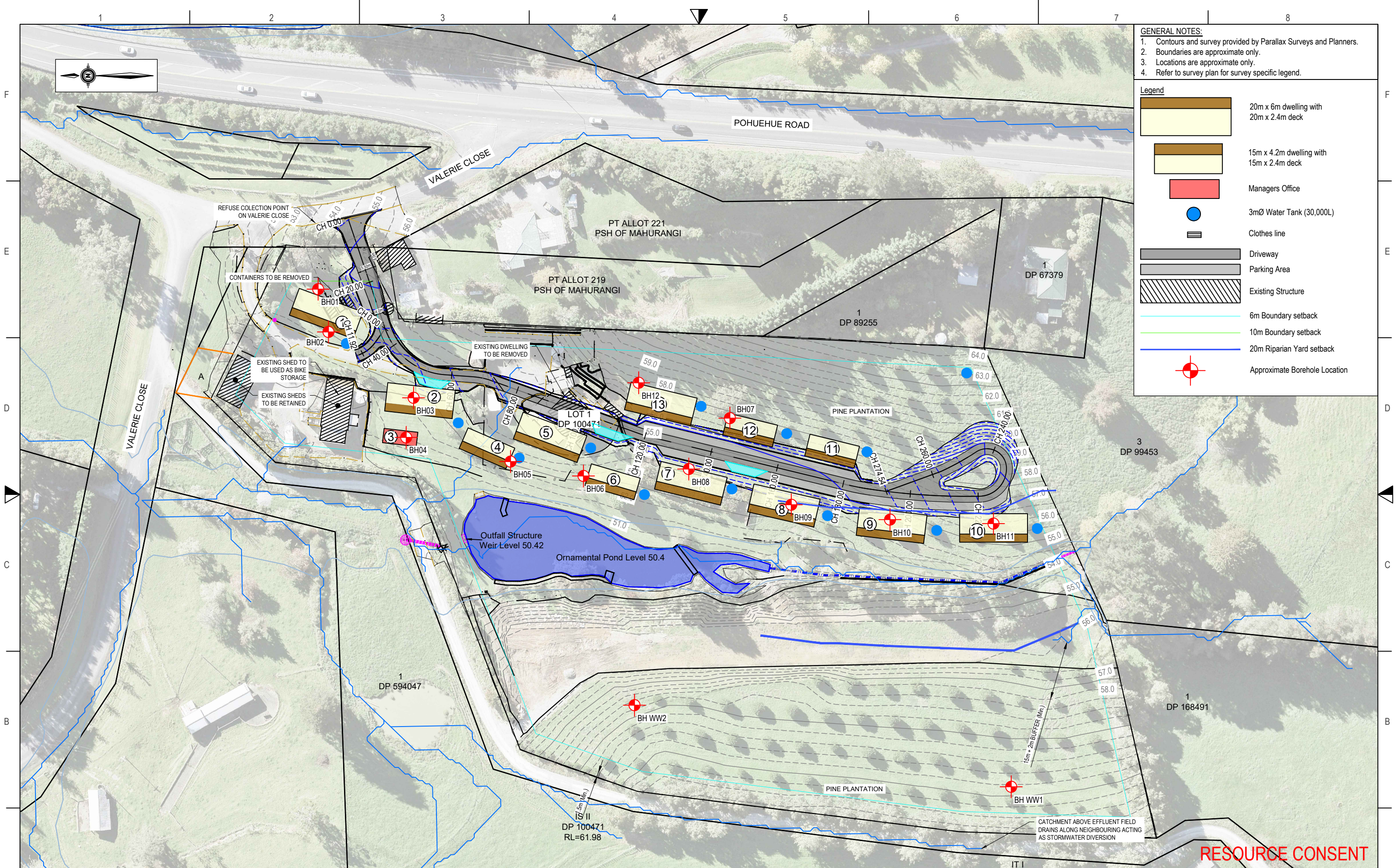
The recommendations given in this report are based on site data from discrete locations and prepared specifically for the dwelling and other structures shown on the attached drawings. If any changes are made, we must be allowed to review the new development proposal to ensure that the recommendations of this report remain valid. Inferences about the subsoil conditions away from the test locations have been made but cannot

³ New Zealand Standard NZS 4404, *Land Development and Subdivision Infrastructure*, 2010.

⁴ New Zealand Standard NZS 4431, *Code of Practice of Earthfilling for Residential Development*, 1989.

be guaranteed. We have inferred an appropriate geotechnical model that can be applied for our analyses. However, variations in ground conditions from those described in this report could exist across the site. Should conditions encountered differ to those outlined in this report we ask that we be given the opportunity to review the continued applicability of our recommendations.

Appendix A – Site Investigation Plan



- GENERAL NOTES:**
- Contours and survey provided by Parallax Surveys and Planners.
 - Boundaries are approximate only.
 - Locations are approximate only.
 - Refer to survey plan for survey specific legend.
- Legend**
- 20m x 6m dwelling with 20m x 2.4m deck
 - 15m x 4.2m dwelling with 15m x 2.4m deck
 - Managers Office
 - 3mØ Water Tank (30,000L)
 - Clothes line
 - Driveway
 - Parking Area
 - Existing Structure
 - 6m Boundary setback
 - 10m Boundary setback
 - 20m Riparian Yard setback
 - Approximate Borehole Location

Rev	Date	Description	By	Checked
A	27/05/2025	1st ISSUE	AS	JB
B	13/06/2025	RESOURCE CONSENT	AS	BR

DWG SITE INVESTIGATION PLAN

A3 SCALE 1:1000

0 20m 50m

Date 27/05/2025

Drawn AS Checked BR Approved JB

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Project	1695 Pohuehue Road Lot 1 DP 100471	Stage	
Client	Pohuehue Community Housing Ltd	Dwg No.	GEO-02
Project No.	25 050	Sheet No.	2 of 11
RC no.			

Appendix B – Exploratory Hole Records

3 Elizabeth Street
Warkworth, 0910
New Zealand

Phone 09 425 9422

www.haighworkman.co.nz
info@haighworkman.co.nz

Borehole Log - BH#01

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 26/03/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.1m - Clayey SILT with some gravel; Brown. Dry, hard, non plastic. [FILL]	0.1	FILL						
0.7m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.7							
0.9m - Clayey SILT; Pink, grey, and orange. Moist, hard, low plasticity.	0.9							
1.8m - Clayey SILT; Pink, grey, and orange. Wet, Stiff, low plasticity.	1.8	PAKIRI FORMATION						
3.0m - End of Bore (Target depth reached)	3.0							

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

3 Elizabeth Street
Warkworth, 0910
New Zealand

Phone 09 425 9422

www.haighworkman.co.nz
info@haighworkman.co.nz

Borehole Log - BH#02

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 26/03/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description Based on NZGS Logging Guidelines 2005	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.1m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.								
0.5m - Clayey SILT; Pink, grey, and orange. Moist, hard, low plasticity.	0.5					198+	198+	
	1.0					198+	198+	
1.5m - Clayey SILT; Pink, grey, and orange. Wet, Stiff, low plasticity.	1.5	PAKIRI FORMATION		Groundwater not encountered		198+	198+	
	2.0				4	76/20	76/20	
	2.5				4	73/20	73/20	
3.0m - End of Bore (Target depth reached)	3.0				5	96/20	96/20	
	3.5							
	4.0							
	4.5							

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

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3 Elizabeth Street
Warkworth, 0910
New Zealand

Phone 09 425 9422

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Borehole Log - BH#03

Hole Location: Refer to Site Plan

JOB No. 25 050

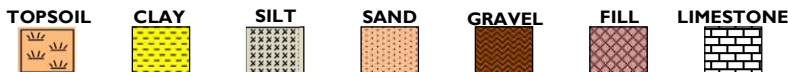
CLIENT: Bill Endean
DATE DRILLED: 07/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm): 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Moist, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.35m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	River and hill slope deposits		Groundwater not encountered		5	198/43	
	1.0					2	198/89	
	1.5					2	198/99	
2.0m - Light grey streaks present. Becomes wet.	2.0					2	145/66	
	2.5					2	112/76	
3.0m - End of Bore (Target depth reached)	3.0				2	106/50		

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

3 Elizabeth Street
Warkworth, 0910
New Zealand

Phone 09 425 9422

www.haighworkman.co.nz
info@haighworkman.co.nz

Borehole Log - BH#04

Hole Location: Refer to Site Plan

JOB No. 25 050

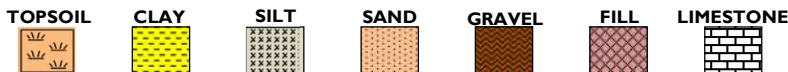
CLIENT: Bill Endean
DATE DRILLED: 07/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Moist, stiff, non plastic. [TOPSOIL/FILL]	0.0	T/S					50/17	Scala Penetrometer not undertaken (Not required)
	0.5							
0.8m - Silty CLAY; Pinkish brown, moist, very stiff, high plasticity. [FILL]	1.0	FILL		Groundwater not encountered			178/40	
1.1m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	1.5	River and hill slope deposits						
1.9m - Dark grey streaks present. Becomes wet.	2.0							
2.0m - Silty CLAY; Dark grey with brown streaks. Moist, stiff, high plasticity.	2.5							
3.0m - End of Bore (Target depth reached)	3.0							

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#05

Hole Location: Refer to Site Plan

JOB No. 25 050

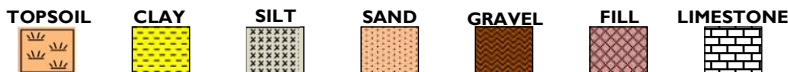
CLIENT: Bill Endean
DATE DRILLED: 07/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Moist, stiff, non plastic.	0.0	FILL		Groundwater not encountered			132/23	Scala Penetrometer not undertaken (Not required)
0.05m - Silty CLAY; Pinkish brown, moist, very stiff, high plasticity. [FILL]	0.5							
1.1m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	1.0	River and hill slope deposits		Groundwater not encountered			99/33	
	1.5							
1.9m - Light grey streaks present. Becomes wet.	2.0							
	2.5							
3.0m - End of Bore (Target depth reached)	3.0						185/92	
	3.5						185/83	
	4.0						182/83	
	4.5						162/83	

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:

UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:

Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#06

Hole Location: Refer to Site Plan

JOB No. 25 050

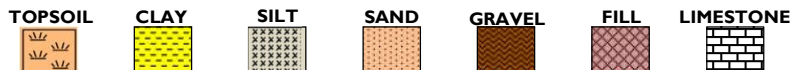
CLIENT: Bill Endean
DATE DRILLED: 07/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm): 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Moist, stiff, non plastic.	0.0	TS						Scala Penetrometer not undertaken (Not required)
0.05m - Silty CLAY; Pinkish brown, moist, very stiff, high plasticity. [FILL]								
	0.5					3	99/40	
0.7m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.						3	165/59	
	1.0							
1.5m - Light grey streaks present. Becomes wet.						2	165/73	
	1.5							
	2.0					2	139/76	
	2.5					2	125/76	
3.0m - End of Bore (Target depth reached)	3.0					2	99/63	
	3.5							
	4.0							
	4.5							

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:

UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:

Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#07

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)	
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)	
0.25m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.25	PAKIRI FORMATION		Groundwater not encountered		3	198+		
	0.5								
	1.0								
1.5m - Clayey SILT; Pink, grey, and orange. Moist, very stiff, low plasticity.	1.5								
1.9m - Clayey SILT; Pink, grey, and orange. Wet, Stiff, low plasticity.	2.0								
	2.5								
3.0m - End of Bore (Target depth reached)	3.0					3	99/36		
	3.5								
	4.0								
	4.5								

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:

UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:

Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#08

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm): 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.35m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	River and hill slope deposits		Groundwater not encountered		198+	198+	
	1.0					198+		
1.5m - Silty CLAY; Orangish brown with light grey. Wet, stiff, high plasticity.	1.5				3	125/50		
	2.0				2	76/43		
	2.5				2	69/33		
3.0m - End of Bore (Target depth reached)	3.0				2	79/33		
	3.5							
	4.0							
	4.5							

LEGEND:



Corrected shear vane reading	
Remoulded shear vane reading	
Scala Penetrometer	

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#09

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.3m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	River and hill slope deposits		Groundwater encountered @ 2.4m		198+		
1.0m - Clayey SILT with minor fine sand; Grey and yellowish brown. Moist to wet, stiff, low plasticity.	1.0				3	135/46		
1.8m - Clayey SILT with minor fine sand; Light grey. Wet, firm to stiff, low plasticity.	2.0				2	59/26		
2.8m - Clayey SILT; Orangish brown. Wet, stiff to very stiff, low plasticity.	2.5				3	53/20		
3.0m - End of Bore (Target depth reached)	3.0				4	116/30		
	3.5	Pakiri Formation						
	4.0							
	4.5							

LEGEND:



Corrected shear vane reading	
Remoulded shear vane reading	
Scala Penetrometer	

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#10

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.2m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.2	River and hill slope deposits		Groundwater encountered @ 2.7m				
	0.5							198+
	1.0							152/50
	1.5							109/50
	2.0							92/33
1.8m - Clayey SILT with minor fine sand; Grey and yellowish brown. Moist to wet, stiff, low plasticity.	2.0	Pakiri Formation						116/36
	2.5							125/43
	3.0							
2.7m - Clayey SILT; Orangish brown with pink . Wet, stiff to very stiff, low plasticity.	2.7							
3.0m - End of Bore (Target depth reached)	3.0							

LEGEND:



Corrected shear vane reading
Remoulded shear vane reading
Scala Penetrometer

Notes:

UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:

Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#11

Hole Location: Refer to Site Plan

JOB No. 25 050

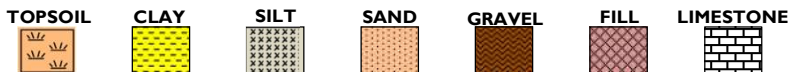
CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.4m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	River and hill slope deposits		Groundwater encountered @ 2.8m		198+	198+	
1.3m - 50mm Decayed vegetation.	1.0				3	99/33		
1.6m - Light grey bands become present.	1.5				2	86/43		
2.2m - Clayey SILT with minor fine sand; Grey and yellowish brown. Moist to wet, stiff, low plasticity.	2.0				3	91/36		
	2.5				3	125/40		
3.0m - End of Bore (Target depth reached)	3.0				2	59/26		

LEGEND:



Corrected shear vane reading █
Remoulded shear vane reading █
Scala Penetrometer ●

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#12

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm): 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.25m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	Pakiri Formation		Groundwater not encountered		■	UTP	
0.8m - Clayey SILT; Orangish brown with grey. Moist, very stiff, moderate plasticity.	1.0					■	UTP	
1.3m - Clayey SILT; Dark pink with grey. Dry, very stiff, moderate plasticity, friable.	1.5					■	198+	
	2.0					■	198+	
	2.5					■	198+	
3.0m - End of Bore (Target depth reached)	3.0				4	■	162/40	

LEGEND:



Corrected shear vane reading	■
Remoulded shear vane reading	■
Scala Penetrometer	●

Notes:
UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:
Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#WW1



Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

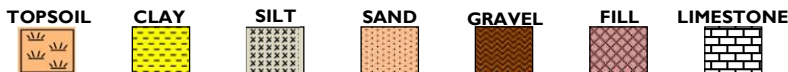
SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.2m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	Pakiri Formation		Groundwater not encountered		—	UTP	
	1.0					—	UTP	
1.5m - End of Bore (Target depth reached)	1.5					—	198+	
	2.0							
	2.5							



LEGEND:



Corrected shear vane reading	
Remoulded shear vane reading	
Scala Penetrometer	•

Notes:

UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:

Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP

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Borehole Log - BH#WW2

Hole Location: Refer to Site Plan

JOB No. 25 050

CLIENT: Bill Endean
DATE DRILLED: 01/04/2025

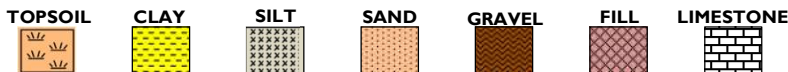
SITE: 1695 Pohuehue Road
DRILLING METHOD: Hand Auger
HOLE DIAMETER (mm) 50

LOGGED BY: BR
CHECKED BY: JB

Soil Description <small>Based on NZGS Logging Guidelines 2005</small>	Depth (m)	Geology	Graphic Log	Water Level	Sensitivity	Vane Shear and Remoulded Vane Shear Strengths (kPa)	Shear Values (kPa)	Scala Penetrometer (blows/100mm)
0.0m - Clayey SILT with organic matter; Dark brown. Dry, stiff, non plastic. [TOPSOIL]	0.0	T/S						Scala Penetrometer not undertaken (Not required)
0.25m - Silty CLAY; Orangish brown. Moist, very stiff, high plasticity.	0.5	Pakiri Formation		Groundwater not encountered			UTP	
1.0m - Clayey SILT; Pink, cream, and brown. Moist, very stiff, moderate plasticity.	1.0						UTP	
	1.5				3		135/46	
2.0m - End of Bore (Target depth reached)	2.0	3			125/43			
	2.5							



LEGEND:



Corrected shear vane reading

Remoulded shear vane reading

Scala Penetrometer

Notes:

UTP = Unable to penetrate. mbgl = metres below ground level.
Hand Held Shear Vane S/N: 326

Test Methods:

Shear Strength using a Hand Held Shear Vane, NZ Geotechnical Soc Inc 8/2001
Scala Penetrometer: NZS4402: 1986: 6.5.2 Hand method using a DCP