

HUNUA PROPERTY DEVELOPMENT LIMITED

WHITE ROAD, HUNUA, AUCKLAND



GEOTECHNICAL ASSESSMENT FOR PROPOSED HOUSE SITES: LOTS 1 - 5

REF: R6120-1A
DATE: 30 APRIL 2020

REPORT QUALITY CONTROL

REPORT PREPARED BY: GROUND CONSULTING LIMITED (GCL)



PUKEKOHE OFFICE

UNIT 2, 4 MANUKAU ROAD, PUKEKOHE
POST: PO BOX 1019, PUKEKOHE, 2120
EMAIL: pukekohe@gcltech.co.nz
TEL: 09 239 2229


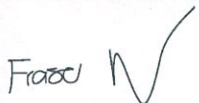
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A	30 APRIL 2020	ISSUED TO CLIENT	LUKE KENNEDY	FRASER WALSH
APPROVAL				
AUTHOR SIGNATURE			REVIEWER SIGNATURE	
NAME		LUKE KENNEDY	NAME	FRASER WALSH CMEngNZ (PEngGeol)
TITLE		ENGINEERING GEOLOGIST	TITLE	DIRECTOR

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1 INTRODUCTION

1.1 PROJECT BACKGROUND

A geotechnical assessment has been undertaken by GCL for a proposed house site within each of the Lots 1 - 5 at White Road, Hunua at the request of the client Hunua Property Development Limited. The site location is presented in Drawing 001.

This geotechnical assessment has been prepared for the purpose of obtaining a subdivision consent with Auckland Council.

This report includes a summary of the investigations undertaken and provides an assessment of:

- Ground conditions.
- Groundwater conditions.
- Building platform stability.
- Foundation conditions.
- Surface water management.
- Other pertinent constraints and issues identified with the site.

1.2 PREVIOUS INVESTIGATIONS

GCL has previously undertaken a series of geotechnical assessments for a proposed 27 Lot subdivision, of which a portion encompasses the newly proposed development of this current report.

The previous geotechnical reports are referenced under R0359-1A to R0359-3A; dated 30 September 2009, 27 June 2011 and 15 April 2015. These assessments comprised the completion of 22 hand auger bore investigations for geotechnical considerations, in addition to 27 shallow hand auger bores for purposes of general effluent disposal assessment.

Pertinent information from the previous reports has been reviewed and utilised where suitable for the purposes of this report.

1.3 CURRENT GEOTECHNICAL INVESTIGATIONS

The investigations undertaken as part of this assessment have consisted of:

- Desktop study of the site including:
 - Published Geology.
 - Historic Aerial Photographs.
 - Google Earth Imagery.
 - Auckland Council GIS Viewer.
- Site mapping and reconnaissance by an Engineering Geologist.
- Completion of five hand auger bores with down-hole shear strength testing with a Pilcon vane, referenced HA101 to HA501. The hand auger bores have been constructed in the vicinity of the proposed house sites.

The investigations have been carried out in accordance with NZS3604:2011 and the Building Code. The investigation locations are shown on Drawing 002.

1.4 PROPOSED SITE DEVELOPMENT

The proposed site development is not known at this stage but is likely to comprise the formation of a level building platform for a dwelling located within each proposed Lot as shown on Drawing 002. The proposed house sites will be accessed via. a right of way off White Road.

An effluent disposal field will likely be developed to the west of the proposed house sites.

Stormwater disposal is proposed to be located within the eastern portions of each Lot, as shown on Drawing 002. The details of stormwater control and management is provided within Section 7 of this report.

2 SITE CONDITIONS

2.1 SITE LOCATION

The site is situated within the Hunua area of the Auckland Region. The site is accessible off White Road. The site is currently surrounded by farmland and rural lifestyle development.

A site location map is presented on Drawing 001.

2.2 SITE SERVICES

GCL has not undertaken any specific searches of the site utilities and services for the purpose of this report. However, at the time of our site investigation, there was no evidence of any buried services in the immediate vicinity of the proposed house site.

2.3 SITE TOPOGRAPHY

The proposed house sites of each Lot are located upon gently sloping topography with measured slope angles of less than 15° to the horizontal. The proposed house sites are remote from steeper slopes.

Each Lot is presently grassed.

2.4 SITE SURFACE WATER FEATURES

The Lots are drained via. a northwest trending watercourse which outlets to a main ditch drain located along the northern boundary of the subdivision. The watercourse dissects the eastern portion of Lots 2 – 5 and within the central western portion of Lot 1.

This is in agreement with the Auckland Council GIS viewer and Google Earth.

The watercourse is relatively dry as a result of sub-surface piping along the watercourse base by 350mm ID concrete pipes and 150mm/110mm ID nova-coil pipes.

Surface water from the site is considered to be via. sheet flow from each slope aspect within the Lots.

2.5 SLOPE INSTABILITY FEATURES

The gently sloping topography in the vicinity of the proposed house sites does not contain any slope instability features.

2.6 AERIAL PHOTOGRAPHS

Aerial photographs available from the Auckland Council GIS Viewer and Google Earth dating from 2001 to 2017 were studied to observe the site over time and assess the geomorphological setting. The review of historic aerial photography indicates that there has been no significant modification of the proposed site; however, in 2019 an adjacent subdivision to the north-east has been under development.

3 GROUND CONDITIONS

3.1 PUBLISHED GEOLOGY

The Geological Map of New Zealand, Sheet 3, at a scale of 1:250,000 maps the site as being underlain by the Puketoka Formation. The Puketoka Formation consists of pumiceous mud, sand and gravel with muddy peat and lignite: rhyolite pumice, including non-welded ignimbrite, tephra and alluvia.

3.2 SUB-SURFACE INVESTIGATIONS

Sub-surface investigations have been undertaken in the vicinity of each proposed house site. The sub-surface investigations have comprised a single hand auger bore within each house site, constructed to a depth of 3.0m.

Core recovered from the hand auger bores has been logged and is presented in Appendix A. Logging of the core has been undertaken in accordance with NZ Geotechnical Society Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes.

Down-hole strength testing with a Pilcon shear vane has been undertaken within the hand auger bores. The corrected readings are presented in Appendix A.

3.3 SUB-SURFACE CONDITIONS

A summary of the sub-surface conditions identified in the investigations undertaken is presented below. The sub-surface conditions have been extrapolated between the investigations undertaken. Whilst care has been taken to provide sufficient sub-surface information following best practice for the purposes of subdivision consent, no guarantee can be given on the validity of the inference made.

3.3.1 Topsoil

Topsoil mantles the site to a measured depth of between 0.15m to 0.25m

3.3.2 Puketoka Formation

The Puketoka Formation underlies the entire site to a depth of at least 3.0m. Residual soils derived from the formation typically consists of very stiff to hard clayey SILT.

Additionally, very dense SILT which is too hard to penetrate was identified at depth within investigations conducted in Lots 1 and 2.

Down-hole shear strength testing undertaken provided an undrained shear strength of between 119kPa and >211kPa.

4 GROUNDWATER CONDITIONS

Groundwater was not encountered within any of the hand auger bores undertaken, indicating a coherent and perched groundwater depth of at least 3.0m from existing ground level in the vicinity of the proposed house sites. This is consistent with the elevated nature of the sites relative to local surface water and groundwater features.

Groundwater is susceptible to seasonal variations. The current measured groundwater during this investigation is indicative of autumn conditions. As such, it is feasible that groundwater levels may rise following a period of prolonged rainfall and during the winter months. Given the nature and topography of the site, it is unlikely, however, that a coherent groundwater table would rise significantly to the extent that it would interfere with shallow foundations.

5 BUILDING PLATFORM STABILITY

5.1 GENERAL

The assessed house sites are shown on Drawing 002. The proposed house sites are located on broad gently sloping topography which is underlain by competent ground conditions and is remote from steeper slopes and/or slopes prone to the development of slope instability features.

The low overall slope angles and underlying competent ground conditions in the vicinity of the proposed house sites should provide safe and stable building platforms.

5.2 SLOPE STABILITY

The gently sloping topography located in the vicinity of each proposed house site is considered to provide favourable slope stability conditions. All building platform development works should be in accordance with recommendations and constraints provided in Section 6 and 7 of this report in order to maintain existing safe and stable conditions.

6 FOUNDATION CONDITIONS

6.1 GENERAL

The proposed site development is not known at this stage but is likely to comprise a light weight single story timber framed dwelling with weatherboard and/or brick cladding. It is anticipated that the structure will be founded on shallow foundations.

As discussed in Section 5.1 of this report, the site is underlain by competent ground conditions. The competent ground conditions are considered to provide the following in regards to NZS 3604:2011:

- "Good ground" according to NZS 3604:2011 is achieved in terms of soil bearing capacity.
- "Good ground" according to NZS 3604:2011 is achieved in terms of overall slope stability conditions.
- "Good ground" according to NZS 3604:2011 **is not** achieved in terms of seasonal soil shrink/swell.

As such in accordance with NZS3604:2011, specific engineered foundation design is required. Sections 6.2 and 6.3 of this report provide recommendations for specific engineered foundation design.

6.2 SHALLOW FOUNDATION DESIGN PARAMETERS

6.2.1 General

To be compliant with ultimate limit state design methods outlined in AS/NZS 1170, this report provides ultimate bearing capacity values and a strength reduction factor in order to allow calculation of design foundation bearing capacity.

We have adopted a strength reduction factor of 0.5 (ie. a factor of safety of 2) which is in general accordance with the requirements of AS/NZS 1170.

We have also adopted a design c_u value of 80kPa which is based on the site specific testing undertaken.

6.2.2 Shallow Pad/Strip Footings

Table 1 outlines design bearing capacities for a shallow pad/strip footing solution. The design capacities are based on a minimum foundation embedment depth of 450mm from cleared ground level. The embedment depth requirement for this foundation will be subject to formal engineering design and in general accordance to AS 2870 which is outlined in Section 6.3 of this report.

TABLE 1: Shallow Pad/Strip Footing Design Parameters

LOAD CASE	DESIGN c_u	ULTIMATE BEARING CAPACITY	STRENGTH REDUCTION FACTOR	DEPENDABLE BEARING CAPACITY
ULTIMATE LIMIT STATE DESIGN	80kPa	480kPa	0.5	240kPa

6.2.3 Shallow Pile Foundations

Table 2 outlines design bearing capacities for a shallow pile foundation solution for light weight timber structures and appurtenant structures. The design capacities are based on a minimum foundation embedment depth of 450mm from cleared ground level. The embedment depth requirement for this foundation will be subject to formal engineering design and in general accordance to AS 2870 which is outlined in Section 6.3 of this report.

TABLE 2: Shallow Pile Foundation Design Parameters

END BEARING CASE				
LOAD CASE	DESIGN CU	ULTIMATE BEARING CAPACITY	STRENGTH REDUCTION FACTOR	END DEPENDABLE BEARING CAPACITY
ULTIMATE LIMIT STATE DESIGN	80kPa	480kPa	0.5	240kPa
AUGURED PILE SKIN FRICTION				
LOAD CASE	DESIGN CU	-	STRENGTH REDUCTION FACTOR	DEPENDABLE SKIN FRICTION
ULTIMATE LIMIT STATE DESIGN	30kPa	-	0.5	15kPa

6.3 SOIL EXPANSIVENESS

The site soil is considered to be moderately expansive (Class M) according to AS 2870 based on the logging of recovered hand auger bore core samples.

Engineered foundation design should resist shrink/swell associated with Class M soil according to AS 2870 or other equivalent solution. This includes controls on foundation embedment depth, foundation reinforcing, slab thickening and slab mesh as determined from the building cladding.

6.4 FOUNDATION CONSTRUCTION

We recommend that all foundation excavations are inspected by a suitably qualified person.

Care should be taken to ensure that all unsuitable material such as the topsoil layer, weak ground, areas of non-engineered fill and or hard spots are removed from the building platform prior to building construction. Where such material is excavated, this shall be replaced with suitably compacted granular material or 10MPa site concrete.

6.5 FOUNDATION SERVICE BRIDGING

We recommend that where a service line and associated backfilled trench are located within a 45° loading line taken from the base of a load bearing structure foundation bridging is required.

Service line trenching and backfilling should be in accordance with recommendations provided in Section 7 of the report.

6.6 RETAINING WALLS

Engineered retaining walls will be required on site under the following circumstances:

- where the retention height is greater than 1.5m;
- where retaining wall supports any surcharged loads such as sloping ground and structure/traffic loads; and
- where retaining wall failure will affect the stability and integrity of adjacent structures and neighbouring properties.

We recommend the following geotechnical parameters for the engineered retaining wall design as required:

- Cohesion (c') = 2kPa
- Friction angle (ϕ') = 28°
- Undrained shear strength (c_u) = 80kPa
- Unit weight (γ) = 18kN/m³

All retaining walls should be constructed with appropriate toe drainage and backfilled to their full height with lightly compacted free draining granular material or other appropriate drainage solution. Toe drainage should be discharged at a point that will not impact or influence the construction works on site or alternatively be connected to the reticulated stormwater system.

6.7 SEISMIC CONSIDERATIONS

Site investigations have identified stiff to hard soils associated with the Puketoka Formation. A volcanoclastic tuff unit is outcropped within the northern streambed of the proposed subdivision. As such, we consider the site sub soil class C is appropriate according to NZS1170.5.

7 SITE DEVELOPMENT CONSTRAINTS

7.1 TEMPORARY EARTHWORKS

Site development works may require excavation and or temporary batters prior to the construction of formal retaining structures. As such, there is the risk of batter collapse during construction especially if left unsupported for an extended period of time and or left exposed during prolonged period of rainfall. Therefore, we recommend the following:

- Cut faces should not be left unsupported for a period in excess of three days and may require additional protection with polythene sheeting during inclement weather.
- Where excavations are immediately adjacent to or situated on a property boundary, then further precautions may be required to ensure stability through the construction of temporary buttressing. These works should be assessed and approved by a suitably qualified person.
- The contractor is expected to employ the appropriate plant and machinery to undertake the excavation and retaining wall construction.
- The contractor is responsible at all times to ensure that all necessary precautions are undertaken to protect exposed temporary batters.
- Appropriate silt and stormwater control measures should be employed.

7.2 PERMANENT EARTHWORKS

We recommend the following constraints for the construction of permanent and long term site earthworks carried out the vicinity of the proposed house site:

- All unretained cut batters should be graded at no steeper than 1(v) on 2(h) and be no higher than 1.5m (ie. a maximum cut depth of 1.5m from existing ground level).
- Cut batters should be located at least the cut batter height from a dwelling and a property boundary.
- All unretained fill batters should be graded at no steeper than 1(v) on 2(h) and be no higher than 1.5m (ie. a maximum fill depth of 1.5m from existing ground level).
- Where fill is placed upon sloping topography, suitable keying of the slope prior to fill placement should be adhered to in line with standard practices and as certified by a qualified person.
- Fill batters should be located at least the fill batter height from a dwelling and a property boundary.
- Fill providing structural support to the dwelling should be placed in an engineered manner as inspected and certified by a suitably qualified person.
- All cut and fill batters should be topsoiled & grassed and/or weed matted & planted on completion.
- Earthworks which does not comply with the above recommendations should be assessed by a suitably qualified person and may require retention and/or stabilization with an engineered structure.

7.3 SERVICES

We recommend that all underground services are backfilled with adequately compacted clay backfill to minimise the risk of significant trench consolidation and settlement.

Trench excavations should be shored or battered appropriately in accordance with the OSH/DOL Approved Code of Practice for Safety in Excavations and Shafts for Foundations (April 2000).

The contractor is expected to employ the appropriate plant and machinery to undertake the excavation and retaining wall construction.

8 STORMWATER MANAGEMENT

Stormwater disposal should be in compliance with the operative District & Regional Plans and the Building Code. In summary this requires the following:

- Hydrogeological neutrality should be provided on the lot boundary and within receiving environments (such as overland flowpaths) with the addition of impervious surfaces. In addition, the disposal of stormwater should not provide a nuisance to neighbouring properties and public infrastructure.
- Stormwater should be managed in such a way as to avoid slope erosion, earthworks batters, retaining walls, building structures and effluent disposal areas.

- Stormwater should be managed in such a way as to have no significant effect on overall slope stability conditions.
- Stormwater should be directed to a public reticulated stormwater system where possible.
- Site development should be mindful of existing surface water features including overland flowpaths and appropriate remedial measures should be provided where required.

9 NATURAL HAZARDS RISK ASSESSMENT

In accordance with Section 106 of the Resource Management Act, we have undertaken a qualitative natural hazards risk assessment for the proposed house site. The natural hazard consequence and likelihood of occurrence has been assessed by means of the overall risk matrix as shown in Table 3, with the risk classifications defined in Table 4.

Table 3: Risk Matrix

POTENTIAL CONSEQUENCES	LIKELIHOOD				
	VERY UNLIKELY (0 – 5%)	UNLIKELY (5 – 45%)	POSSIBLE (45 – 55%)	LIKELY (55 – 95%)	ALMOST CERTAIN (95 – 100%)
SEVERE	Low	Low	Moderate	High	Very high
MODERATE	Negligible	Low	Moderate	Moderate	High
MINOR	Negligible	Low	Low	Moderate	Moderate
NEGLIGIBLE	Negligible	Negligible	Negligible	Low	Low

Table 4: Summary of Risk Classification

RATING SCALE	SECTION 106 COMPLIANCE	DISCUSSION
VERY HIGH	Non-compliant	There is a high probability that severe damage to the proposed house site could arise from an identified source without appropriate remedial action
HIGH	Non-compliant	The proposed house site is likely to experience significant damage from an identified source without remedial action
MODERATE	Non-compliant	It is possible that damage could arise to the proposed house site, but it is unlikely that such damage would be significant
LOW	Compliant	It is possible that damage could arise to the proposed house site from an identified source though this is likely to be mild or unlikely
NEGLIGIBLE	Compliant	The presence of the identified source does not give rise to the potential to cause significant damage to the proposed house site

Table 5 shows a risk register for the proposed house site and appropriate mitigation measures if applicable based on Tables 3 & 4.

Table 5: Risk Register

RISK	POTENTIAL CONSEQUENCES	LIKELIHOOD	RISK CLASSIFICATION	COMMENT	MITIGATION MEASURES
SLOPE INSTABILITY	Severe	Very unlikely	Low	See Section 5.2	n/a
GROUND SUBSIDENCE	Severe	Very unlikely	Low	See Section 6	n/a
SOIL SHRINK/SWELL	Moderate	Likely	Moderate	See Section 6.4	Engineered foundations designed for Class M soil expansivity
EARTHQUAKE	Severe	Unlikely	Low	Remote from active fault	n/a
FLOODING	Minor	Very unlikely	Negligible	Elevated site remote from surface water features	n/a
TSUNAMI	Minor	Very unlikely	Negligible	Elevated site remote from ocean	n/a
VOLCANIC ERUPTION/ASH FALL	Moderate	Unlikely	Low	Remote from active volcanic centre	n/a

Table 5 indicates the risk classification for the identified natural hazards is low to negligible for all risks apart from "soil shrink/swell" where appropriate mitigation measures can be reasonably provided. As such, we consider the proposed house site fulfills Section 106 of the Resource Management Act.

10 LIMITATIONS

10.1 GENERAL

Ground Consulting Ltd has undertaken this assessment in accordance with the brief as provided, based on the site, Lot layout and house site locations as shown on Drawing 002. This report has been provided for the benefit of our client, and for the authoritative council to rely on for the purpose of processing the consent for the specific project described herein. No liability is accepted by this firm or any of its directors, servants or agents, in respect of its use

by any other person, and any other person who relies upon information contained herein does so entirely at their own risk.

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The sub-surface conditions have been extrapolated between the investigations undertaken. Whilst care has been taken to provide sufficient sub-surface information following best practice, no guarantee can be given on the validity of the inference made and it must be appreciated that actual conditions could vary from the assumed model.

10.2 FURTHER INVESTIGATIONS REQUIRED

This assessment has been undertaken for the proposed site development to date for the purposes of obtaining a subdivision consent. Any structural changes, alterations and additions made to the proposed development should be checked by a suitably qualified person and may require further investigations and analysis for the purposes of obtaining a building consent should subdivision consent be granted. This includes but not limited to:

- Building outside of the approved house site.
- Construction of a building platform which does not comply with the recommended site constraints.
- Provision of a development specific on-site stormwater disposal design.

In addition, geotechnical inspections will be required during construction to assess site slopes, foundation excavations, retaining walls and other geotechnical aspects of the development. This is to ensure ground conditions encountered are in accordance with the findings of this assessment. If ground conditions differ from those presented in this report, advice on design and construction modifications should be sought from a suitably qualified person.

DRAWINGS

The drawings are an integral part of the contract and shall be read in conjunction with the specifications and the conditions of contract.

The drawings are to be read in conjunction with the specifications and the conditions of contract. The drawings are to be read in conjunction with the specifications and the conditions of contract.

10.2. DRAWING REVISIONS

The drawings are to be read in conjunction with the specifications and the conditions of contract. The drawings are to be read in conjunction with the specifications and the conditions of contract.

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HUNUA PROPERTY DEVELOPMENT LTD
WHITE ROAD, HUNUA, AUCKLAND
SITE LOCATION PLAN

Rev	Date	Status	Drafted	Reviewer
A	15/04/2020	Issued	LK	FW

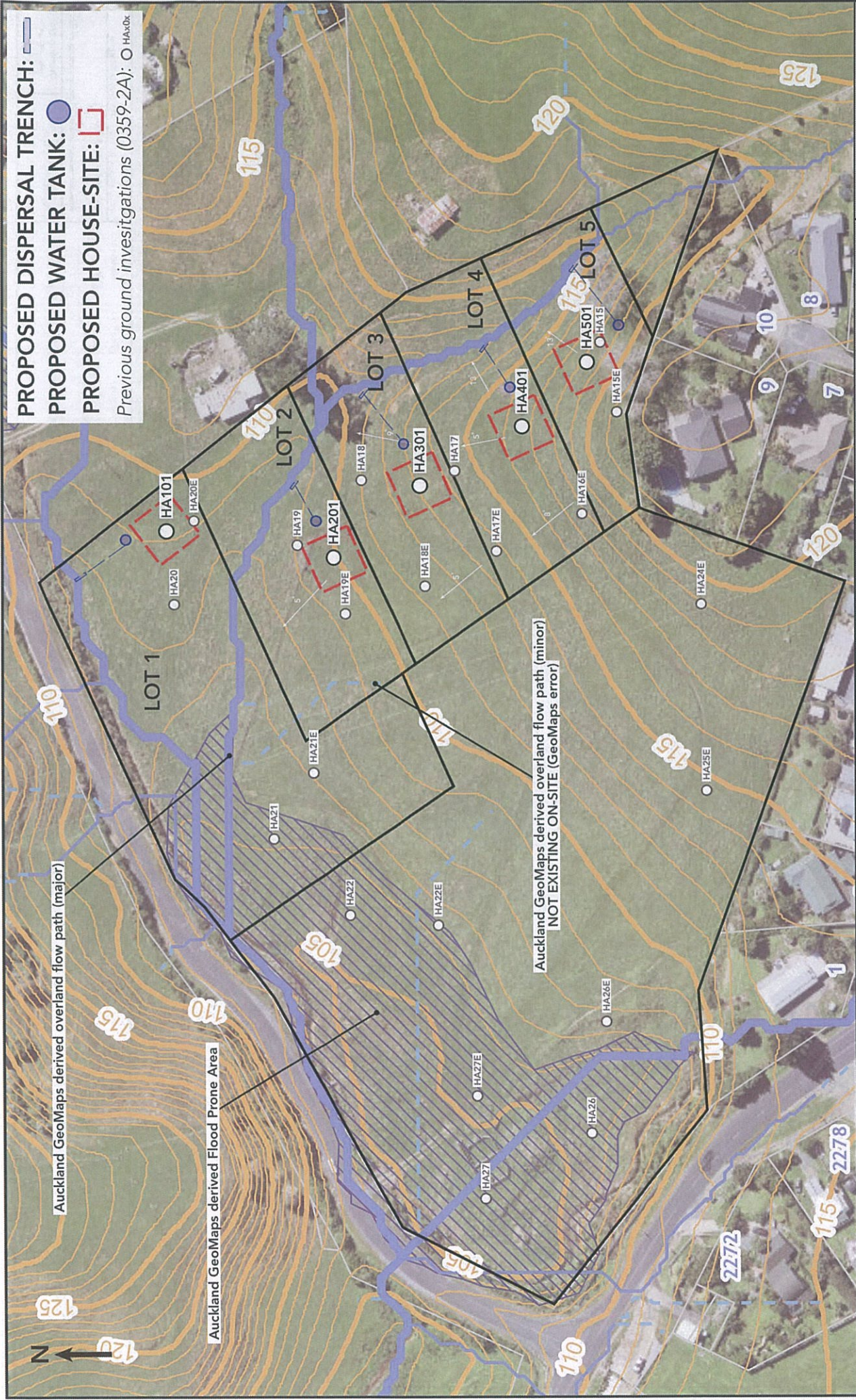
File Ref:
MAC/Projects/6000/120/R6/120-1A/R6/120-1A-DIW001.ai

Scale (A4) 1:18,000

0 72 360 720m

Project No. 6120
Report Ref. R6/120-1A

Drawing No.
001





HUNUA PROPERTY DEVELOPMENT LTD
WHITE ROAD, HUNUA, AUCKLAND
INVESTIGATION LOCATION PLAN

Rev	Date	Status	Drafted	Reviewer
A	15/04/2020	Issued	LK	FW

File Ref.
HAC/Project/4000/120/0/120-1A/0120-1A-01002-04

Scale (A4) 1:1,500

0 6 30 60m

Project No. 6120
Report Ref. R6120-1A

Drawing No.
002

APPENDIX A: INVESTIGATION LOGS



INVESTIGATION LOG

HA101

Report Ref

R6120-1A

Location Method (±2m)

MAP

Client

Hunua Property Development Limited

Coordinates (NZTM2000)

Elevation

Location

White Road, Hunua

White Road, Hunua

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Samples	Depth (m)	Legend	Vane Shear Strength Vane No:1938 Vane Size: 19mm				Values (kPa)	Scala Penetrometer (Blows / 100mm)									Groundwater
					50	100	150	200		2	4	6	8	10	12	14	16	18	
Topsoil	TOPSOIL.			TS															
Puketoka Formation	SILT, with minor clay. Hard; low plasticity; moist; orange.			TS															
				TS															
	SILT & SAND, with minor clay. Hard; low plasticity; moist to dry; orange.			TS															
	SILT, with some sand. Hard; low plasticity; moist to dry; light brownish orange mottled light brown and black speckles.			TS															
	End of Investigation: 1.5m Target depth		1	TS															
				TS															

Investigation Information

Depth 1.5m

Logged By V.L.

Start Date 29/04/20

Termination Target depth

Checked By F.W.

End Date 29/04/20

Machine Used

Test Pit Dimensions

Logged Date 29/04/20

Investigation Type

- ☒ Hand Auger (50mm)
☐ Test Pit
☐ Scala Penetrometer

Water Legend

- ▼ Standing Water Level
↔ Out flow
↗ In flow

Log ref: R6120-1A HA101



INVESTIGATION LOG

HA201

Report Ref

R6120-1A

Client

Hunua Property Development Limited

Coordinates (NZTM2000)

Elevation

Location Method (±2m)

MAP

Location

White Road, Hunua

White Road, Hunua

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Samples	Depth (m)	Legend	Vane Shear Strength Vane No: 1938 Vane Size: 19mm 50 100 150 200	Values (kPa)	Scala Penetrometer (Blows / 100mm) 2 4 6 8 10 12 14 16 18	Groundwater
Topsoil	TOPSOIL.			TS				
Puketoka Formation	Clayey SILT. Hard; moist; light orange; moderate plasticity.					>203		
	SILT, with some clay. Hard; low plasticity; dry; mottled dark orange and reddish orange.					UTP		
	End of Investigation: 0.9m Target depth		1					

Investigation Information

Depth 0.9m Logged By V.L Start Date 29/04/20
Termination Target depth Checked By F.W End Date 29/04/20
Machine Used Test Pit Dimensions Logged Date 29/04/20

Investigation Type

- ☒ Hand Auger (50mm)
- ☐ Test Pit
- ☐ Scala Penetrometer

Water Legend

- Standing Water Level
- Out flow
- In flow

Log ref: R6120-1A HA201



INVESTIGATION LOG

HA301

Report Ref

R6120-1A

Client

Hunua Property Development Limited

Coordinates (NZTM2000)

Elevation

Location Method (±2m)

MAP

Location

White Road, Hunua

White Road, Hunua

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Samples	Depth (m)	Legend	Vane Shear Strength Vane No: 2089-new Vane Size: 19mm 50 100 150 200	Values (kPa) 2 4 6 8 10 12 14 16 18	Scala Penetrometer (Blows / 100mm)	Groundwater
Topsoil	TOPSOIL.							
Puketoka Formation	Clayey SILT. Very stiff to hard; moist; light brownish orange; moderate plasticity; moderate sensitive to insensitive. 0.5m: Becomes Light brownish orange mottled light grey. 0.9m: Becomes moderate to high plasticity.		1			180 46		
	Silty CLAY. Very stiff to hard; high plasticity; moist; light brownish orange mottled light grey; insensitive. 2.0m: Becomes light grey. 2.2m: Becomes light grey mottled light purple. 2.4m: Becomes brown.		2			127 79		
	Clayey SILT. Hard; moist; brownish orange mottled brown; moderate plasticity.					>211		
						113 82		
						>211		
	End of Investigation: 3m Target depth		3			>211		

Investigation Information

Depth 3m Logged By V.L Start Date 29/04/20
Termination Target depth Checked By F.W End Date 29/04/20
Machine Used Test Pit Dimensions Logged Date 29/04/20

Investigation Type

- ☒ Hand Auger (50mm)
- ☐ Test Pit
- ☐ Scala Penetrometer

Water Legend

- ▼ Standing Water Level
- ↔ Out flow
- ↗ In flow

Log ref: R6120-1A HA301



INVESTIGATION LOG

HA401

Report Ref

R6120-1A

Client

Hunua Property Development Limited

Coordinates (NZTM2000)

Elevation

Location Method (±2m)

MAP

Location

White Road, Hunua

White Road, Hunua

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Samples	Depth (m)	Legend	Vane Shear Strength Vane No: 2089-new Vane Size: 19mm 50 100 150 200	Values (kPa) 2 4 6 8 10 12 14 16 18	Scala Penetrometer (Blows / 100mm)	Groundwater
Topsoil	TOPSOIL.			TS				
Puketoka Formation	Clayey SILT. Very stiff to hard; moist; light brownish orange mottled light grey; moderate plasticity; moderate sensitive.					199		
						52		
			1			198		
						121		
						207		
						84		
	1.8m: Becomes light brownish orange.							
	2.0m: With trace Tuff.		2			144		
						103		
	Clayey SILT. Very stiff; moist; light brownish orange mottled light grey; moderate plasticity; insensitive.					119		
						91		
	2.7m: Becomes light grey mottled light brownish orange.							
	End of Investigation: 3m Target depth		3			156		
						99		

Investigation Information

Depth 3m Logged By V.L Start Date 29/04/20
Termination Target depth Checked By F.W End Date 29/04/20
Machine Used Test Pit Dimensions Logged Date 29/04/20

Investigation Type

- ☒ Hand Auger (50mm)
- ☐ Test Pit
- ☐ Scala Penetrometer

Water Legend

- ▼ Standing Water Level
- ↔ Out flow
- ▶ In flow



INVESTIGATION LOG

HA501

Report Ref

R6120-1A

Client

Hunua Property Development Limited

Coordinates (NZTM2000)

Elevation

Location Method (±2m)

Location

White Road, Hunua

White Road, Hunua

Geology	Geological Interpretation (refer to separate Geotechnical and Geological Information sheet for further information)	Samples	Depth (m)	Legend	Vane Shear Strength Vane No: 1938 Vane Size: 19mm Values (kPa)	Scala Penetrometer (Blows / 100mm)	Groundwater
Tops of	TOPSOIL.						
Puketoka Formation	Clayey SILT. Hard; moist; Light orange; moderate plasticity. 0.6m: Becomes light orange streaked light grey.					>203	
	Clayey SILT & SAND. Very stiff; low plasticity; moist; sand, fine to medium; light orange mottled light grey; insensitive.		1			162 114	
	Silty CLAY. Very stiff; high plasticity; moist to wet; light grey streaked light orange; insensitive.					142 73	
	Pumiceous Silt some Sand, fine to coarse, Clay; light grey mottled orange, streaked red; wet; low plasticity; very stiff; insensitive.		2			130 85	
	Clayey SILT. Very stiff; moist; light orange streaked light grey; moderate plasticity; insensitive to moderate sensitive.					128 62	
	Clayey SILT, with some sand. Very stiff; moist to wet; sand, fine to medium; low to moderate plasticity; insensitive to moderate sensitive.					130 59	
	End of Investigation: 3m Target depth		3				

Investigation Information

Depth 3m Logged By V.L Start Date 29/04/20
Termination Target depth Checked By F.W End Date 29/04/20
Machine Used Test Pit Dimensions Logged Date 29/04/20

Investigation Type

- ☒ Hand Auger (50mm)
☐ Test Pit
☐ Scala Penetrometer

Water Legend

- ▼ Standing Water Level
↔ Out flow
↗ In flow

Log ref: R6120-1A HA501

PUKEKOHE OFFICE

UNIT 2, 4 MANUKAU ROAD, PUKEKOHE
POST: PO BOX 1019, PUKEKOHE, 2120
EMAIL: pukekohe@gcltech.co.nz
TEL: 09 239 2229

QUEENSTOWN OFFICE

157 GLENDA DRIVE, FRANKTON
POST: PO BOX 2963, QUEENSTOWN 9349
EMAIL: queenstown@gcltech.co.nz
TEL: 03 442 5700

AUCKLAND CENTRAL OFFICE

LEVEL 1, KAURI TIMBER BUILDING
104 FANSHAWE STREET, AUCKLAND, 1010
EMAIL: auckland@gcltech.co.nz
TEL: 09 379 0777

GREAT BARRIER IS. OFFICE

6 MOANA VIEW ROAD, OKUPU
POST: PO BOX 1019, PUKEKOHE, 2120
EMAIL: office@gcltech.co.nz
TEL: 09 239 2229

**GCL**

Ground Consulting Ltd

