ENGEO Limited
8 Greydene Place, Takapuna, Auckland 0622
PO Box 33-1527, Takapuna, Auckland 0740
T: +64 9 972 2205
www.engeo.co.nz

Project Number #21253.000.001

Geotechnical Investigation

9, 33 & 49 Heights Road, Pukekohe, Auckland

Submitted to:
GBar Properties Limited
33 Coles Crescent
Papakura
Auckland 2110

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Report Title	Geotechnical Investigation - 9, 33 & 49 Heights Road, Pukekohe			
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1 Introduction

ENGEO Ltd was requested by GBar Properties Limited to undertake a geotechnical investigation of the property at 9, 33 & 49 Heights Road, Pukekohe, Auckland (herein referred to as 'the site'). This work has been carried out in accordance with our signed agreement dated 2 December 2022.

The purpose of the assessment is to support a plan change application with respect to a conceptual proposal to redevelop the properties to support a light industrial complex of a nature comparable to that already established at the eastern end of the site.

2 Scope of Work

We have been provided with the Woods Limited Topographic Survey (P18-088-00-0500 to -0501; Appendix 1) and the Indicative Masterplan (P18-188-UD101; Appendix 1) depicting a conceptual development comprising new warehouse buildings, landscaped areas, and two proposed stormwater ponds. Although earthworks concepts are not prepared at this stage, we have assumed that a future development of this nature is to be constructed on terraces involving cuts and fills to be supported by specifically designed retaining walls or formed as engineer designed permanent batters, in line with the existing land use.

This report presents the findings of a preliminary geotechnical investigation undertaken at the site to establish an understanding of the ground conditions, supported by a site walkover to observe the existing landform and land use. It includes an assessment of the geology and geohazards within the site and immediate surrounds. It does not include site-specific hazard assessments that may be required to support a future consent application for a redevelopment of the nature depicted on the plans (e.g., slope stability analysis), or recommendations for design of future retaining walls and building foundations.

3 Site Description

The site is bordered by Heights Road to the north, Paerata Road to the east, Heights Park Cemetery and undeveloped land to the south, and rural farmland to the west. The site has a total elevation change of approximately 10 m from north to south.

The western end of the site characterised by broad gentle slopes (typically 10 degrees or flatter) extending to a broad, shallow overland flow path inside the southern site boundary. A residential dwelling is located at the western end of the site at 49 Heights Road, with the balance of that land undeveloped and in grass with some mature trees.

The central and eastern ends of the site have been earth worked to support a light industrial development, comprising a series of terraces supported by a combination of retaining walls and permanent batters, with a light commercial warehouse and a retail centre at the northern and eastern boundaries. The remaining terraces have been formed with a hard fill surface and are used as storage and laydown areas, with light buildings and canopy structures at some locations.

These features are depicted on the Investigation Location Plan presented in Appendix 2.

4 Desktop Study

4.1 Published Geology

The site is mapped by GNS Science as underlain by undifferentiated Kerikeri Volcanic Group tuff of the South Auckland Volcanic Field. This is described as lithic tuff, comprising comminuted pre-volcanic materials with basaltic fragments, and unconsolidated ash and lapilli deposits.

The south-eastern corner of the site is also mapped as underlain by undifferentiated Kerikeri Volcanic Group basalt lava of South Auckland Volcanic Field. This is described as fine-grained and coarse-grained, porphyritic, olivine basalt, basanite and hawaiite lava flows.

In addition, the land to the north and west of the site is mapped as underlain by the Puketoka Formation which is an alluvial soil of the Tauranga Group typically comprising layers of pumiceous muds, cohesive soils and gravel with interbedded muddy peat and lignite layers. This unit is widespread in the Pukekohe area and is expected to underlie the volcanic deposits, where present.

4.2 Mapped Faults

We have reviewed the GNS Science New Zealand Active Fault Database, which indicates that there are no known active faults on-site. The nearest active fault is the Wairoa South Fault, located approximately 20 km to the east. GNS have not established a vertical slip rate, recurrence interval or date for the last event at the Wairoa South Fault.

4.3 Historical Aerial Photographs

We have reviewed historical aerial photographs of the site sourced from Retrolens and Nearmaps. These photographs were viewed under the context of underlying areas of potential instability and significant changes to landform.

Table 1: Historical Aerial Photograph Summary

Date	Description
1942	First available photograph: The site is undeveloped, being used as a field for agricultural purposes. Most of the surrounding area is used for agriculture. The overland flow path is located central to the site, aligned broadly southwest to northeast. No obvious evidence of scour, erosion or instability is visible on the overland flow path margins in this photograph.
1961-1969	No change.
1978	Minor development in the east of the site, imagery is poor, but it appears that earthworks are in progress and the commercial retail building has been constructed.
1981	The residential buildings have been constructed in the northwest corner of the site at 49 Heights Road and the balance of the land has been established for horticultural purposes.
1988	Slight increase in the amount of vegetation throughout the site. Area to the south of the site has continued development.

Date	Description
2001	There appears to be a further increase in the amount of vegetation throughout the site, particularly in the south of 33 Heights Road and around the boundary of 49 Heights Road.
2003/4	There appears to be earthworks in progress throughout 9 Heights Road.
2006	Multiple new minor structures have been constructed in the north-eastern portion of the site within 9 Heights Road. The eastern portion of 33 Heights Road has been terraced to form a storage / laydown area.
2008	No change.
2010/11	The storage / laydown area has been further developed expanding north to the boundary of 33 Heights Road.
2017	Access tracks have been formed in the western portion of 33 Heights Road.
2021/22	Land development work is ongoing in the northern portion of 33 Heights Road where the new light warehouse building is constructed, and at the western end where the terracing of the landform is ongoing.

5 Site Investigation

ENGEO attended the site on 8 December 2022 to undertake a site walkover and hand auger borehole investigation to characterise the site. The investigation findings are summarised in the following sections.

5.1 Surface Conditions and Geomorphology

5.1.1 9 & 33 Heights Road

The landform across 9 and 33 Heights Road is highly variable, comprising a series of terraces supported primarily by cut or fill batters, with retaining walls in the northern and eastern parts of the sites where buildings have been constructed.

Existing timber pole retaining walls were observed to be up to approximately 4 m height, and where observed were assessed to be in typically good condition. Batter slopes were formed up to approximately 3.5 m height, in some places these were protected by coconut matting and geotextiles (e.g. along the northern site boundary at the north-western end of 33 Heights Road). Elsewhere the batters were formed in cut or fill soils and in some places evidence for scour associated with surface water overtopping the batter slopes was observed (e.g. near the centre of the site between terraces). Localised evidence for active instability of the batter slopes was also observed in some areas (e.g. tension cracks, head scarps and debris lobes), however these were limited in extent (approximately 3 m wide where measured) and located away from existing structures and retaining walls.

There are multiple stockpiles of clay, topsoil, and unsuitables (topsoil and building refuse) across the area, as well as areas of swampy ground in the vicinity of the overland flow path. Hard fill has been placed across the terraces used for storage to facilitate vehicle trafficking.

5.1.2 49 Heights Road

The landform across 49 Heights Road is largely undeveloped beyond the dwelling and immediate surrounds, including driveway and parking areas and low height landscaping retaining walls. However, at the time of our site walkover we observed stockpiles of clay, topsoil, and unsuitables (trees and vegetation, building refuse and plastic) in the southern portion of the site.

No obvious evidence of active instability (e.g. head scarps) or surface erosion (e.g. scour or channelised water flows) were observed in this part of the site.

5.2 Subsurface Conditions

Ten hand auger boreholes (HA01 to HA10) were drilled across the site to depths of up to 5.0 m below ground level (bgl) with associated *in situ* strength testing.

All hand auger boreholes were logged in accordance with the New Zealand Geotechnical Society Field Classification Guidelines (NZGS, 2005). Full logs are presented in Appendix 3, and test locations are shown on the Investigation Location Plan in Appendix 2.

5.2.1 Ground Conditions

Ground conditions encountered through the site were broadly consistent with the published geology. Most boreholes encountered native ground comprising a combination of stiff to very stiff clays and silts with variable sand and gravel content consistent with completely weathered tuff of the South Auckland Volcanic Field.

Fill was encountered in boreholes HA04 through HA07 and HA09. The fill typically comprised site-won native material, but was intermixed with topsoil and occasional refuse (e.g. plastic fragments). Where encountered, the fill was in locations away from the established commercial and warehouse buildings, and is inferred to be uncontrolled fill associated with the historical terracing of the site.

Borehole HA06 encountered Tauranga Group alluvium underlying the fill, which was described as firm to stiff clayey silt and silty clay with variable sand content. This borehole was drilled in the base of the overland flow path.

5.2.2 Groundwater

Groundwater was encountered in five of the hand auger boreholes (HA01, HA03, HA05, HA07 and HA09) at depths between 1.8 and 4.5 m bgl. The remaining hand auger boreholes did not encounter standing groundwater, however saturated ground conditions were encountered in borehole HA06 below 2.5 m bgl.

5.3 Ground Model

The investigation data confirms that the site is underlain primarily by completely weathered tuff soils that are cohesive in nature with a variable sand and gravel component. Undrained shear strength tests indicate that the soils are typically stiff to very stiff.

Young alluvial soils were encountered near the base of the overland flow path, and while no obvious organic soils were encountered, there is insufficient evidence at this stage to confirm or deny their presence within the site boundary.

Undocumented fill is present across the site, comprising a combination of site-won soils mixed with topsoil and imported fill (e.g. hardfill) and occasional building refuse debris. The fill material has been stockpiled across all three properties, as well as used to form the terraces currently in use as storage / laydown areas.

Due to site operations, we did not investigate the land immediately surrounding the buildings on the northern and eastern boundaries, however it is assumed that fill areas in the vicinity of those buildings would have been formed under engineering guidance at the same time as the buildings were constructed. That assumption will need to be confirmed to support any future work in close proximity to those buildings.

6 Geohazard Assessment

We have assessed the site for the geohazards normally applicable to land within the wider Auckland area. These hazards include:

- Slope instability
- Consolidation settlement
- Ground rupture by faulting
- Liquefaction and lateral spreading
- Soil erosion

6.1 Slope Instability

Based on our site observations and review of historical aerial photographs, the site does not appear to be subject to global slope instability. The naturally occurring slopes are typically flatter than 10 degrees, and where locally steeper these are not displaying obvious evidence of instability.

Evidence for shallow-seated, local instability was observed on some of the man-made batter slopes and is attributed to the oversteepened slope angles together with uncontrolled surface water flows. Future land development work would need to address the potential for instability in the existing uncontrolled batters, as well as for future cuts and fills that may be proposed.

6.2 Consolidation Settlement

The native ground identified at the site typically comprises stiff to very stiff cohesive soils that are unlikely to be susceptible to consolidation settlements under lightweight industrial building loads. However, these soils may be susceptible to settlement where they are subjected to fill loads in conjunction with building loads, and / or where heavily loaded buildings are proposed.

Where young alluvium and non-engineered is present beneath future fills and / or buildings, there is a greater likelihood of consolidation settlement under loads.

Due to the sloping nature of the site, future developments are likely to span a combination of cut and filled ground where terraces are formed, which can give rise to differential settlements of structures where the risk is not accommodated in the building design.

6.3 Ground Rupture by Faulting

There are no active faults mapped within the site or immediate surrounds, so the risk of ground rupture associated with faulting is assessed to be negligible.

6.4 Liquefaction and Lateral Spreading

The cohesive volcanic soils identified at the site are not normally susceptible to liquefaction and lateral spreading under seismic loads. However, geologically young alluvial deposits, such as the type normally found in the Puketoka Formation which underlies the volcanic deposits in this area, can contain sand and gravel layers which may liquefy under seismic loads.

A low to moderate risk of soil liquefaction may be expected in this geological setting, and a future development should be supported by a site-specific liquefaction analysis to confirm the level of risk and inform the land development proposals. Our experience in the area suggests that conventional mitigation measures (e.g. limiting foundation embedment depths) can be adopted to manage this risk.

6.5 Soil Erosion

The site is bisected by an overland flow path, although no obvious evidence of scour or significant soil erosion was observed in its base during our time on-site. Evidence for surface water scour was observed away from the overland flow path, where uncontrolled surface water appears to have overtopped batter slopes.

Control of surface water is outside the scope of this assessment and falls under the civil design scope. However, it is important that the civil design takes into account the potential for concentrated surface water flows in high rainfall events and limits the potential for scour and soil erosion which may then go on to induce larger instability events due to soil saturation or loss of toe support.

7 Conclusion

Based on the desktop review and site investigation described herein, we consider the site generally suitable for a future light industrial development of a nature broadly comparable to that already completed at the site. The current landform would require specific engineering design of earthworks and retaining measures to facilitate building development, however no specific measures beyond conventional bulk earthworks, drainage operations and standard retaining walls are likely to be required. Where analyses demonstrate that consolidation settlement, liquefaction and/or slope instability risks require mitigation, these should be able to be addressed through conventional remediation measures (e.g., settlement monitoring, specifically designed buildings and foundations, retaining walls, and / or fill rafts).

This assessment does not preclude the requirement for specific geotechnical investigations that may be necessary to support an application for resource consent, and to inform design of earthworks, retaining structures and building foundations. As a minimum we expect that a future consent application should be supported by a geotechnical report that includes deep machine borehole and CPT testing to confirm the deep soil profile below the 5 m investigated for this assessment, and allow for site-specific liquefaction and consolidation settlement risk assessments.

At this stage, the investigation findings suggest that the stockpiled materials and terraces used as storage / laydown areas are formed in uncontrolled fill comprising a combination of site won soils mixed with unsuitables including topsoil and building refuse. It should be expected that this material will need to be undercut, unsuitables stripped out (where possible), and the clean approved soil replaced under engineering control, prior to construction of buildings and retaining structures. All necessary benching and drainage measures as described in NZS 4431 would also be required and included in the bulk earthworks design process.

It is recommended that a Geotechnical Engineer is engaged to support the conceptual design process and address the geohazards described herein early in the programme, allowing for a developed design that includes appropriate mitigation measures.

8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, GBar Properties Limited, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the Engineering NZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

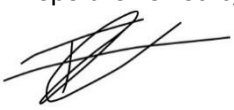
We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (09) 972 2205 if you require any further information.

Report prepared by

Heather Lyons, CMEngNZ (PEngGeol)

Associate Engineering Geologist

Report reviewed by

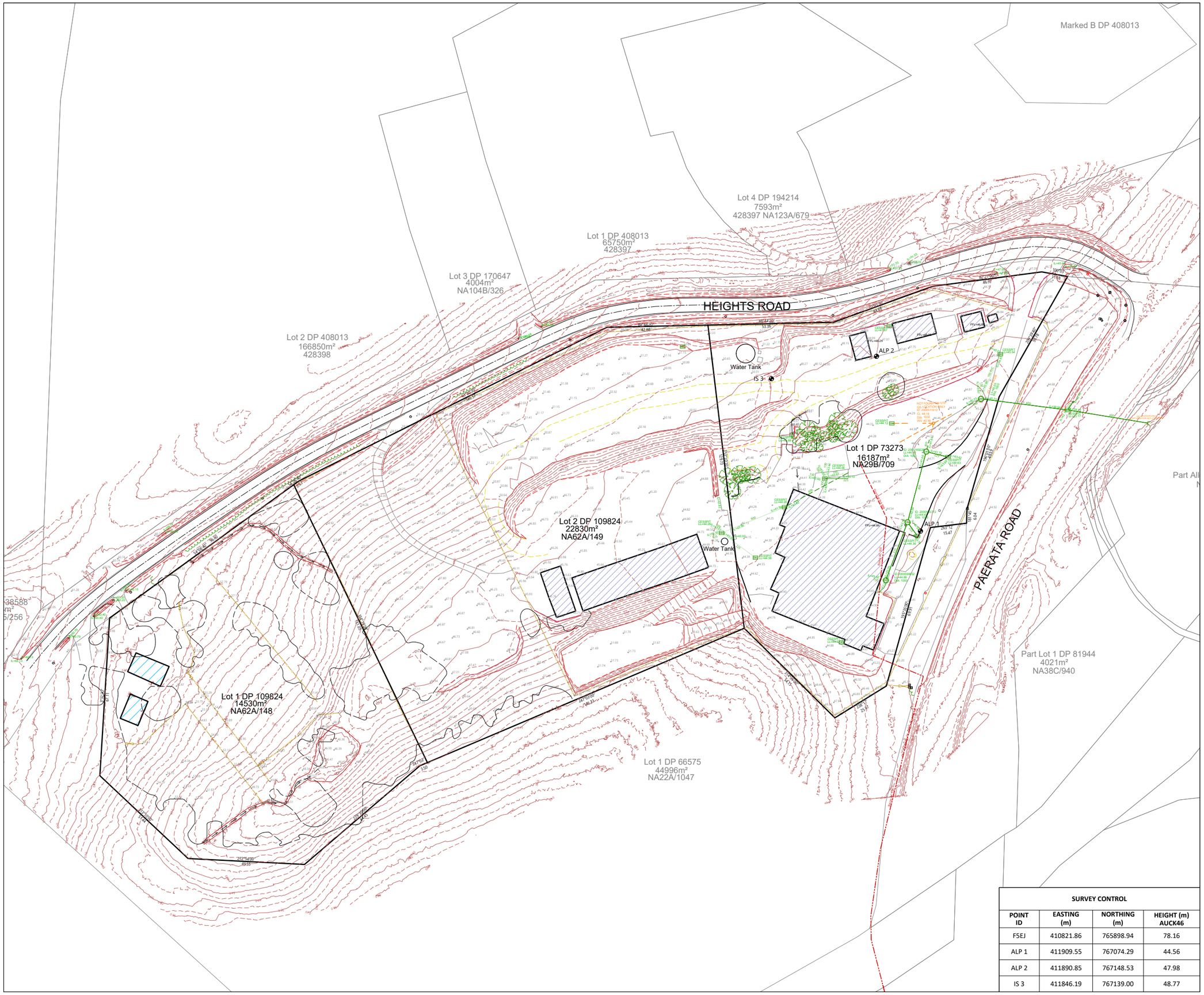


Dustin Tookey, CMEngNZ (CPEng)

Associate Geotechnical Engineer

APPENDIX 1:

Woods Limited Plans



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ALP 1	411909.55	767074.29	44.56
ALP 2	411890.85	767148.53	47.98
IS 3	411846.19	767139.00	48.77

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NOTES

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KEY

- 40.0 MAJOR CONTOURS
- MINOR CONTOURS
- SS PIPE
- SW PIPE
- W WATER METER
- CESSPIT
- LIGHT POLE
- SW SW MANHOLE
- TREE
- S STREET SIGN
- P POWER BOX
- H FIRE HYDRANT
- 23.4 SPOT HEIGHT

SCALEBAR (m) 0 15 30 75 — SCALE | 1:1500 @A3 | 1:750 @A1|

REVISION DETAILS		BY	DATE
1	ISSUED FOR INFORMATION		07/10/20

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DESIGNED	/	
DRAWN	DN	
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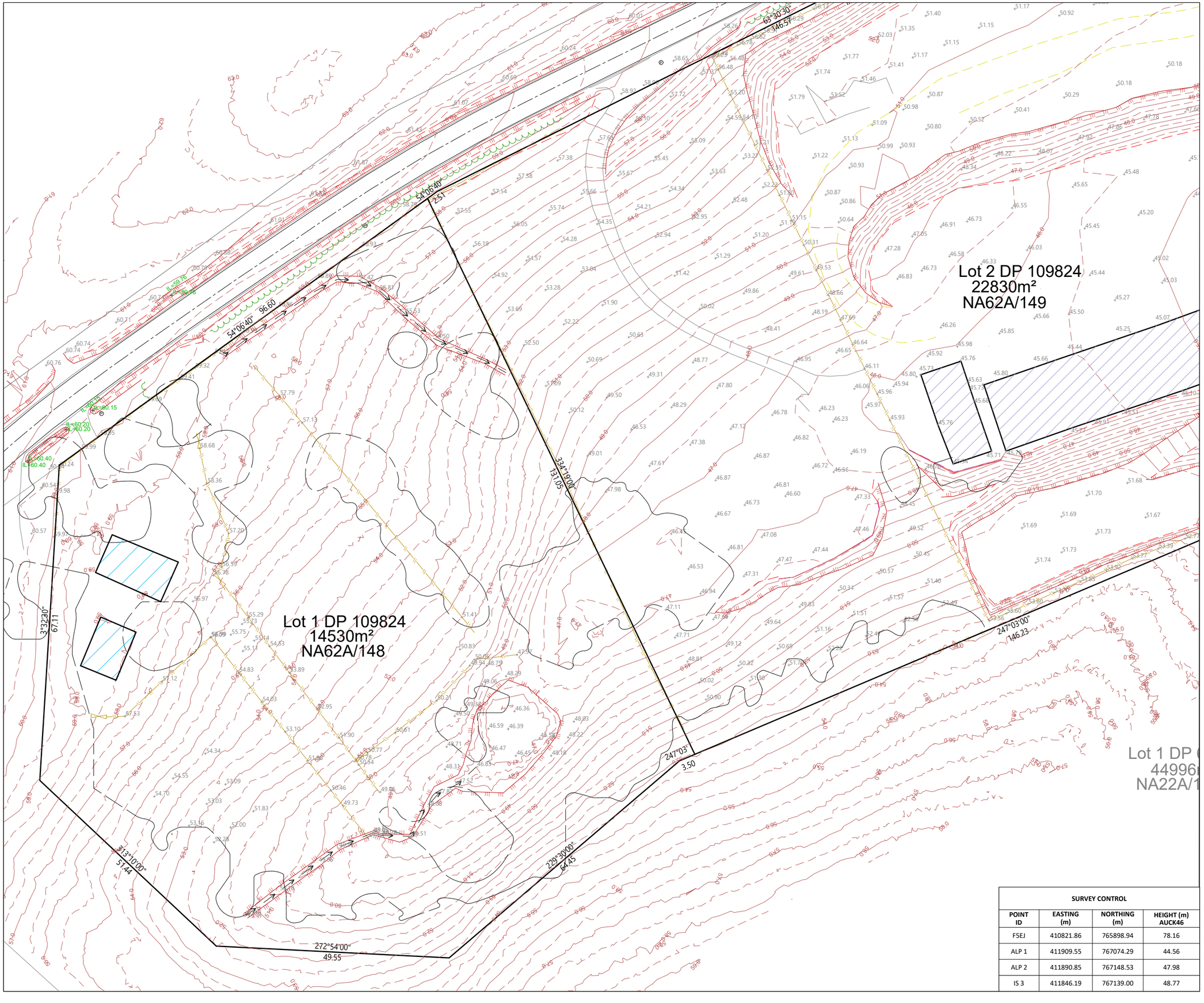

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SCALEBAR (m) 0 7.5 15 37.5

SCALE | 1:750 @A3 | 1:375 @A1|

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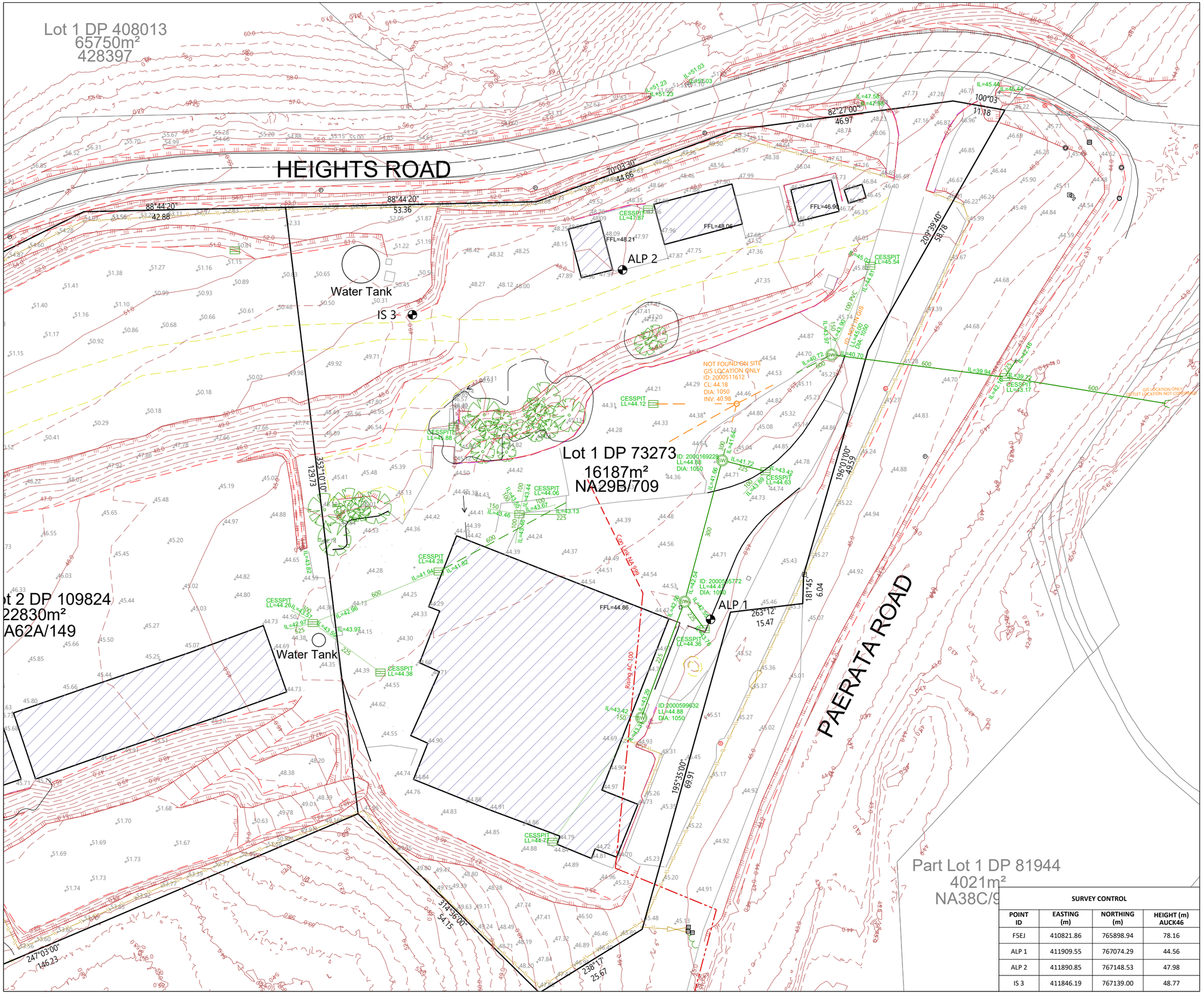

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DWG NO	P18-088-00-0502-SU	

SURVEY CONTROL

POINT ID	EASTING (m)	NORTHING (m)	HEIGHT (m) AUCK46
F5EJ	410821.86	765898.94	78.16
ALP 1	411909.55	767074.29	44.56
ALP 2	411890.85	767148.53	47.98
IS 3	411846.19	767139.00	48.77

C:\USERS\ROWANH\APPDATA\LOCAL\TEMP\BRICSCAD\BP_1\P18-088-00-0500-SU.DWG, 2020-Nov-04 12:05, DWG TO PDF - FLAT PC3, RowanH

AREA SCHEDULE SUMMARY

	EXISTING BUILDING 1	EXISTING BUILDING 2	NEW BUILDING 1	NEW BUILDING 2	NEW BUILDING 3	NEW BUILDING 4	NEW BUILDING 5	NEW BUILDING 6	NEW BUILDING 7	NEW BUILDING 8	NEW BUILDING 9
GFA	2,414m²	2,666m²	1,819m²	1,962m²	950m²	1,000m²	900m²	1,550m²	1,500m²	1,500m²	1,382m²
PARKING PROVIDED	15	45	20	51	16	30	35	44	35	30	20

TOTAL STORMWATER POND AREA	2,000m²
TOTAL GFA (EXISTING + NEW)	17,643m²
TOTAL PARKING PROVIDED	341

WOODS
EST.1970

SITE PLAN LEGEND

- PROPERTY BOUNDARY
- 0.5m CONTOURS
- EXISTING RETAINING WALL
- PROPOSED RETAINING WALL
- EXISTING WAREHOUSE
- PROPOSED WAREHOUSE
- PROPOSED CANOPY & LOADING
- PROPOSED STORMWATER POND
- LANDSCAPE AREA
- SERVICE AREA

REVISION DETAILS		BY	DATE
A	PLAN CHANGE	SW	22/06/2023

DESIGNED	SW	9, 33, and 49 HEIGHTS ROAD, PUKEKOHE
DRAWN	SW	
CHECKED	EW	
APPROVED	EW	WOODS.CO.NZ

N

GBAR PROPERTIES

9-49 HEIGHTS ROAD PROPOSED PLAN CHANGE

INDICATIVE MASTERPLAN

STATUS	PLAN CHANGE	REV
SCALE	1:1500 @A3	A
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P18-188-UD101	

APPENDIX 2:

Investigation Location Plan

Legend

Hydrology

Rivers and Permanent Streams

- Open Watercourse
- Overland Flow Paths - 3ha to 100ha (25,000)
- Overland Flow Paths - 1ha to 3ha (25,000)
- Overland Flow Paths - 1ha to 3ha (15,000)
- Overland Flow Paths - 4000m2 to 1ha (8,000)
- Overland Flow Paths - 2000m2 to 4000m2 (5,000)
- Site Boundary
- Hand Auger Borehole

Contours

- Contours 50m

0 25 m 50 m

ENGEO

Produced by **Datanest.earth**

Title: Investigation Location Plan		
Client: GBar Properties Limited		Figure No.: 1 Size: A3
Project: 9, 33, 49 Heights Road, Pukekohe	Drawn: HL	
Date: 19-01-2023	Checked: DT	
Proj No.: 21253.000.001	Scale: 1:1500	Version: Final

APPENDIX 3:

Hand Auger Borehole Logs

LOG OF AUGER HA01

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 1858
Logged By : JCh
Reviewed By : HP
Latitude : -37.1768345
Longitude : 174.894892

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer (Blows per 100mm)
0.0	TS	OL	[TOPSOIL].				N/A		
	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT; orange brown. Low plasticity.				F	35/17	
0.5				56				111/48	
1.0			1.0 m - Becomes orange brown with occasional red streaks			M		100/32	
								182/60	
1.5				55	▼			130/63	
								222+	
2.0			1.9 m - Becomes brownish red.					222+	
2.5				54			VSt - H	222+	
3.0									
						W		159/95	
3.5				53				222+	
								190/95	
4.0			4.0 m - Becomes orange brown.					184/54	
4.5				52				159/63	
								155/60	
5.0			End of Hole Depth: 5 m Termination Condition: Target depth						

Hand auger met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Dip test showed standing water at 1.8 m. (08/12/22).
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

GEOTECH HAND AUGER HEIGHTS ROAD HAS.GPJ NZ DATA TEMPLATE 2.GDT 23/12/22

LOG OF AUGER HA02

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 3 m
Hole Diameter : 50 mm

Shear Vane No : 2093
Logged By : ZS
Reviewed By : HP
Latitude : -37.177122488377
Longitude : 174.89501863718

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TS	OL	[TOPSOIL].				D	N/A		
	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT with minor fine sand; light brown with dark grey, black and orange streaks and mottles. Low plasticity.		53				107/48	
0.5			0.6 m - Becomes mottled light grey.					F-H	35/6	
			0.8 m - Becomes mottled orange.						197+	
1.0			Clayey SILT with minor fine sand and trace fine gravel; orange brown. Low plasticity.		52				96/11	
1.5		ML	1.6 m - Becomes reddish brown.				M	St-H	197+	
									169/107	
2.0									122/25	
		ML	Clayey SILT with trace fine sand and gravel; orange red with brown and grey mottles. Low plasticity.		51				111/48	
2.5			2.6 m - Brown mottling ceases.					St-VSt	91/32	
			2.9 m - Becomes with light brown streaks.						111/27	
3.0			End of Hole Depth: 3 m Termination Condition: Target depth							
3.5										
4.0										
4.5										
5.0										

Hand auger met target depth at 3 m.
TS = Topsoil; N/A = Not Applicable.
Standing groundwater was not encountered.
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

GEOTECH HAND AUGER HEIGHTS ROAD HAS.GPJ NZ DATA TEMPLATE 2.GDT 23/12/22

LOG OF AUGER HA03

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 3049
Logged By : RD
Reviewed By : HP
Latitude : -37.1774401
Longitude : 174.8951962

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Elevation (mRL)	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0	TS	OL	[TOPSOIL].		M	N/A	
0.5	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT; light brown. Low plasticity.			VSt	159/50
							175/97
1.0		CH	CLAY with minor silt; light brown. High plasticity.	48		VSt	154/97
1.5							147/92
							120/67
2.0		CH	CLAY; light grey with orange streaks. High plasticity.	47		St	72/32
							70/33
2.5		CH	Silty CLAY; intermixed white, orange and red. High plasticity.		W	St	52/37
							82/35
3.0				46			62/30
3.5							99/25
							70/32
4.0				45			68/32
							67/27
4.5		ML	SILT with minor fine to medium sand; orange brown with with pinkish yellow staining. Low plasticity.		S	H	234+
							234+
5.0			End of Hole Depth: 5 m Termination Condition: Target depth	44			

Scala Penetrometer
Blows per 100mm
2 4 6 8 10 12

Hand auger met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Dip test showed standing water at 2.2 m. (08/12/22).
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

GEOTECH HAND AUGER HEIGHTS ROAD HAS.GPJ NZ DATA TEMPLATE 2.GDT 23/12/22

LOG OF AUGER HA04

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 2524
Logged By : JM
Reviewed By : HP
Latitude : -37.1760935
Longitude : 174.8957066

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	FILL	ML	[FILL] SILT with minor fine sand and trace fine gravel; reddish brown with black mottles. Low plasticity.		57			VSt	141/62	
0.5	FILL	OL	[FILL] Organic clayey SILT with trace fine sand; dark brown with black mottles. Low plasticity.					VSt	121/32 129/35	
1.0	SOUTH AUCKLAND VOLCANIC FIELD	ML	SILT with minor clay and trace fine sand; light orange brown. Low plasticity.		56			VSt - H	120/26 175/40 188+	
2.0	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT with trace fine to medium sand; brown. Low plasticity.		55		M	VSt - H	188+ 175/94 188+ 188+	
3.0	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT with minor fine to medium sand; orange brown with pink and red streaks. Low plasticity.		54			VSt		
3.5	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT; brownish red with white and pink streaks. Low plasticity.					VSt - H	188+ 175/102 188+	
4.5	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT with trace fine to medium sand ash nodules; pinkish white with light grey streaks. Low plasticity.		53			H	188+	
5.0	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT; brownish red with white and pink streaks. Low plasticity.					VSt	148/90	
			End of Hole Depth: 5 m Termination Condition: Target depth							

Hand auger met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Standing groundwater was not encountered.
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

LOG OF AUGER HA05

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 3.2 m
Hole Diameter : 50 mm

Shear Vane No : 2093
Logged By : ZS
Reviewed By : HP
Latitude : -37.1765583
Longitude : 174.8959215

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TS		[TOPSOIL].					N/A		
	FILL	OL	[FILL] Organic SILT with minor clay and some rootlets; blackish brown with occasional white mottles. Low plasticity.		48		M	VSt	141/22	
0.5	FILL	ML	[FILL] Clayey SILT with some fine to medium sand and gravel; brown with light to dark grey, black, red streaks and yellow mottles. Gravel is basalt, sub angular. Low plasticity.				D	VSt	157/24	
1.0	BTS	OL	[BURIED TOPSOIL].					N/A	127/22	
	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT with trace fine to medium gravel; dark brown with grey mottles. Gravel is basalt, sub angular. Low plasticity. 1.3 m - Becomes brown, streaks become dark brown. 1.7 m - Becomes orange brown.		47			VSt	124/32 101/25 141/35	
2.0							M		191/15	
		ML	Clayey SILT with minor fine sand; whitish brown with dark brown streaks and orange mottles. Low plasticity. 2.6 m - Becomes browish white with red streaks. 2.75 m - Becomes light red with white streaks.		46			St - VSt	66/17 118/51	
3.0		CH	Silty CLAY; bluish grey with red streaks. High plasticity. 3.05 m - Becomes streaked and mottled yellow			▼	W	VSt	125/59	
			End of Hole Depth: 3.2 m Termination Condition: Target depth							

Hand auger met target depth at 3.2 m.
TS = Topsoil; N/A = Not Applicable; BTS = Buried Topsoil.
Dip test showed standing water at 3.1 m. (08/12/22).
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

LOG OF AUGER HA06

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 4 m
Hole Diameter : 50 mm

Shear Vane No : 3049
Logged By : RD
Reviewed By : HP
Latitude : -37.1767288
Longitude : 174.8961112

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TS	OL	[TOPSOIL].					N/A		
0.5	FILL		[FILL] SILT with minor clay and fine sand; orange with black streaks. Low plasticity. 0.5 m - Encountered minor fine basalt gravel. 0.9 m - Encountered plastic refuse inclusion.		46		M	St - H	234+ 147/59 100/33 234+ 84/47	
2.0	FILL	ML	[FILL] Clayey SILT; light brown with dark brown inclusions. Low plasticity.		45		W	St-VSt	135/67	
2.5	TAURANGA GROUP	CH	Silty CLAY with minor fine to medium sand; brown with black staining. High plasticity.					St	69/38 84/37	
3.0	TAURANGA GROUP	ML	Clayey SILT with minor fine to medium sand; light grey. Low plastiity.		44		S	F-St	35/13 67/27	
3.5	TAURANGA GROUP	CH	CLAY with minor silt; light grey. High plasticity					F-St	67/33 25/10 30/10	
4.0			End of Hole Depth: 4 m Termination Condition: Target depth		43				25/10	
4.5										
5.0										

Hand auger met target depth at 4 m.
Scala Penetrometer met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Standing groundwater was not encountered.

Elevation data estimated from Auckland GeoMaps.
Coordinate data estimated from Google Earth.

GEOTECH HAND AUGER HEIGHTS ROAD HAS.GPJ NZ DATA TEMPLATE 2.GDT 23/12/22

LOG OF AUGER HA07

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 1858
Logged By : JCh
Reviewed By : HP
Latitude : -37.1769837
Longitude : 174.8963025

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	TS	OL	[TOPSOIL].					N/A		
	FILL	OL	[FILL] Organic SILT with minor clay and trace fine to coarse sand; dark brown with orange streaks and mottles. Low plasticity.					VSt	159/38	
0.5	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT with trace fine sand; brownish orange. Low plasticity.		51			VSt-H	222+	
1.0									141/38	
		ML	Clayey SILT; light brown with some brownish orange streaks. Low plasticity.						152/36	
1.5					50				209/111	
									184/121	
2.0			2.0 m - Becomes brownish red with occasional light orange streaks and mottles.						222+	
		ML					M	VSt - H	198/114	
2.5					49				184/121	
3.0			3.0 m - Becomes intermixed light to dark orange, red and white.						222+	
									106/67	
3.5		CH	Silty CLAY; intermixed red, white and light orange. High plasticity.		48			St	95/51	
									97/48	
4.0									94/48	
4.5		ML	Clayey SILT; intermixed white, brownish red, light orange with occasional black mottles. Low plasticity.		47	▼	W	St	82/48	
									78/48	
5.0			End of Hole Depth: 5 m Termination Condition: Target depth							

Hand auger met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Dip test showed standing water at 4.5 m. (08/12/22).
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

LOG OF AUGER HA08

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 3049
Logged By : RD
Reviewed By : HP
Latitude : -37.1767193
Longitude : 174.897186

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT; orange. Low plasticity.		50			VSt	176/130	
0.5									150/100	
1.0		CH	Silty CLAY; red. High plasticity.				M	VSt	159/114	
1.5					49				150/97	
2.0									164/100	
2.5					48				154/100	
3.0									147/100	
3.5			3.6 m - Becomes light brown.		47				147/92	
4.0		ML	Clayey SILT; light grey with red mottles. Low plasticity.					St-VSt	127/69	
4.5					46		W		120/69	
5.0			End of Hole Depth: 5 m Termination Condition: Target depth						120/72	
									109/50	
									117/47	
									99/32	
									80/33	
									94/43	

Hand auger met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Standing groundwater was not encountered.
Elevation data estimated from Auckland GeoMaps.

Coordinate data estimated from Google Earth.

LOG OF AUGER HA09

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 1858
Logged By : JCh
Reviewed By : HP
Latitude : -37.175989
Longitude : 174.897062

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Elevation (mRL)	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded
0.0	FILL	ML	[FILL] Clayey SILT with some fine to coarse gravel; dark brown with light orange, red and black streaks and mottles. Low plasticity.		M	St-H	67/25
0.5		OL	[FILL] Organic clayey SILT with trace fine to medium sand; intermixed brownish black and light to dark orange with occasional red streaks and mottles. Low plasticity.	49		VSt-H	222+
1.0		OL	[FILL] Organic clayey SILT; Brownish black with some orange streaks. Low plasticity.			VSt	193/76
1.5			1.5 m - Becomes intermixed brown and black with some red and orange mottles.			VSt	143/40
2.0	SOUTH AUCKLAND VOLCANIC FIELD	ML	Clayey SILT; intermixed light grey and light to dark orange. Low plasticity.	48		VSt	113/48
2.5		CH	Silty CLAY; intermixed light grey and light to dark orange. High plasticity.	47	W	VSt	154/67
3.0		ML	Clayey SILT; intermixed light grey and light orange. Low plasticity.			St-VSt	141/48
3.5			No recovery between 3.6 - 3.9 m.	46			154/56
4.0		ML	Clayey SILT; light grey. Low plasticity.			St	159/48
4.5				45			140/36
5.0			End of Hole Depth: 5 m Termination Condition: Target depth				140/32
							67/35
							82/38
							76/54
							82/56
							78/60

Scala Penetrometer
Blows per 100mm
2 4 6 8 10 12

Hand auger met target depth at 5 m.
TS = Topsoil; N/A = Not Applicable.
Dip test showed standing water at 2.6 m. (08/12/22).

Coordinate data estimated from Google Earth.

GEOTECH HAND AUGER HEIGHTS ROAD HAS.GPJ NZ DATA TEMPLATE 2.GDT 23/12/22

LOG OF AUGER HA10

9, 33, 49
Heights Road
Pukekohe, New Zealand
21253.000.001

Client : GBar Properties Limited
Client Ref. : 21253.000.001
Date : 08/12/2022
Hole Depth : 5 m
Hole Diameter : 50 mm

Shear Vane No : 2524
Logged By : JM
Reviewed By : HP
Latitude : -37.1769088
Longitude : 174.8977945

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0.0	T	OL	[TOPSOIL].		48		D	N/A		
	SOUTH AUCKLAND VOLCANIC FIELD	ML	SILT with minor clay, trace fine gravel and rootlets; orange brown. Low plasticity.					VSt	172/35 181/24	
1.0					47				175/34	
		ML	SILT with minor clay, minor fine sand; light orange brown. Low plasticity.					VSt	156/47 163/69	
2.0					46				188+	
		ML	SILT with minor clay; orange brown with red mottles. Low plasticity.				M	H	188+ 188+	
3.0					45				148/86	
		ML	Clayey SILT; brownish red with orange mottles. Low plasticity.					VSt	129/65 121/56 101/54	
4.0					44					
5.0			End of Hole Depth: 5 m Termination Condition: Target depth							

Hand auger met target depth at 5 m.
T = Topsoil; N/A = Not Applicable.
Standing groundwater was not encountered.
Consistency density between 4 and 5 m determined from tactile assessment.

Elevation data estimated from Auckland GeoMaps.
Coordinate data estimated from Google Earth.

GEOTECH HAND AUGER HEIGHTS ROAD HAS.GPJ NZ DATA TEMPLATE 2.GDT 23/12/22