Private Plan Change Request – Hughes Developments Limited Appendix B – Geotechnical Investigations





Geotechnical Investigation

163 Halkett Road

West Melton

Submitted to:
Hughes Developments Ltd
Canterbury

ENGEO Limited

124 Montreal Street, Sydenham, Christchurch 8023 PO Box 373, Christchurch 8140, New Zealand Tel +64 3 328 9012 Fax +64 3 328 9013 www.engeo.co.nz



Contents

1	Introduction	3
2	Site Description	3
3	Geological Model	4
3.1	Regional Geology	4
3.2	ECan Boreholes	5
3.3	Groundwater	5
3.4	Geomorphology	5
3.5	Geohazards	6
3.5.1	Seismicity	6
3.5.2	Liquefaction and Lateral Spreading	6
4	Site Investigation	6
4.1	Subsurface Investigations	6
4.2	Site Seismic Class	7
5	Liquefaction Assessment	7
6	RMA Section 106 Requirements and Suitability to Subdivide	7
7	Geotechnical Recommendations	8
7.1	Earthworks	8
7.2	Subdivision Roading	8
7.3	Stormwater Control	8
7.4	Foundations	8
8	References	9
9	Limitations	10



Tables

Table 1: Generalised Summary of Subsurface Conditions

Figures

Figure 1: Site Location Plan

Figure 2: Nearby ECan Borehole Locations

Appendices (at the rear of this report)

Appendix 1: Site Location Plan

Appendix 2: Hand Auger Borehole Logs

Appendix 3: Test Pit Excavation Logs

ENGEO Document Control:

Report Title	Geotechnical Investigation - 163 Ha	alkett Ro	oad, West Melt	ton	
Project No.	14088.000.000	Doc IE)	02	
Client	Hughes Developments Ltd	Client	Contact	Kelvin Bac	k
Distribution (PDF)	Kelvin Back – kelvin@hughesdevel	opment	s.co.nz		
Date	Revision Details/Status		WP	Author	Reviewer
03/07/17	Final		ВК	LF	GM



1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation for the proposed subdivision at 163 Halkett Road, as outlined in our proposal (ref. P2016.000.248, dated 15 June 2017).

The purpose of this investigation was to determine a geological model of the site; assess the likely future land performance; comment on the suitability of the site for residential subdivision; address the requirements of Section 106 of the Resource Management Act (RMA); and provide recommendations for subdivision works and foundations for typical timber framed residential dwellings.

Our scope of works included the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases.
- Undertake a geotechnical site walkover.
- Undertake 11 hand auger boreholes with associated Scala penetrometer tests to assess the near surface material types and strength characteristics.
- Organise and technically supervise the excavation of 12 test pits, including geotechnical logging of the exposed soils.
- Preparation of this report outlining our findings on the ground conditions and the suitability of
 the site for residential subdivision. This will include geotechnical advice on the likely
 foundation Technical Category, conceptual foundation recommendations for typical timber
 framed residential dwellings, and address likely geohazards as required by Section 106 of the
 RMA.

2 Site Description

The site covers an area of 8.317 ha and has a legal description of Lot 1 DP 34902 BLK XI Rolleston SD (Selwyn District Council). It is located to the north-eastern of West Melton with residential properties immediately to the west and rural lots to the east. The property spans between Halkett Road to the north and West Coast Road to the south (Figure 1).







Image sourced from Google Maps (July 2017), not to scale.

The site is currently used predominantly as pasture, with three utility sheds located near the central portion of the site. It is predominantly flat, with undulations representing old stream channels. Near the northern side of the site the broad undulations measure up to 2 m high, while near the southern side of the site these are typically 0.5 to 1 m high.

The Canterbury Earthquake Recovery Authority (CERA, now disestablished) has categorised the site as 'N/A Rural & Unmapped', meaning future development can proceed following normal consenting processes.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by beach sand or river sand dunes.



3.2 ECan Boreholes

A review of three deep ECan borehole logs located to the north (M35/10753), west (M35/10751) and east (M35/9443 and M35/5159) of the site was conducted. The locations of these boreholes are presented in Figure 2. While borehole M35/1013 is located on site, there is no data for this borehole.

Figure 2: Nearby ECan Borehole Locations

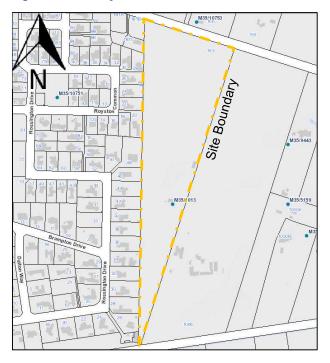


Image sourced from Canterbury Maps (retrieved June 2017).

The borehole logs indicate interbedded sandy gravel and claybound gravel from the surface through to the maximum depth of 78 m.

3.3 Groundwater

Groundwater is recorded within the ECan boreholes discussed above, at depths between 21 m and 24 m below ground level.

3.4 Geomorphology

As evident on aerial imagery (Canterbury Maps, 2016) and observed during our site walkover conducted on 28 June 2017, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast trend. Based on observations, silt and sand deposits with variable thickness (up to 0.8 m) are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).



3.5 Geohazards

3.5.1 Seismicity

There are no known or mapped faults in the immediate area of the site, however the site may be at risk of ground shaking induced by movement of proximal or distal faults.

The site is located north of two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 6 km south of the site and trends roughly east-west with a surface rupture of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have occurred at a depth of 1 km to 2 km below ground surface.

Large regional areas of faulting (GNS, 2015) namely the Ashley Fault, Porters Pass-Amberley Fault Zone, and the Hope and Alpine Faults, are further afield but present a high seismic hazard to the Christchurch area due to the anticipated size of earthquakes generated. The largest of these faults is the Alpine Fault, which has a return period of 250-300 years and is expected to produce a M8 earthquake. The last rupture on the Alpine Fault is believed to have occurred in 1717 (Pettinga et al., 2001).

3.5.2 Liquefaction and Lateral Spreading

The site is located within an area mapped as 'damaging liquefaction unlikely' (NZGD Map CGD5140, 2012).

4 Site Investigation

4.1 Subsurface Investigations

ENGEO undertook site investigations to assess the shallow subsurface material types and strength characteristics on 28 June 2017. The investigations comprised 11 hand auger boreholes with associated Scala Penetrometer tests, and 12 test pit excavations.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1.

Table 1: Generalised Summary of Subsurface Conditions

Soil Type	Depth to Top of Layer (m)	Layer Thickness (m)	Consistency / Density	Comment
Silt [Topsoil]	0	0.2 to 0.5	Soft to Firm	-
Silt and Sand	0.2 to 0.5	0.1 to 0.5	Soft to Very Stiff / Loose to Medium Dense	No present in all layers
Gravel	0.2 to 0.8	>1.8	Medium Dense to Dense	



"Good ground" (as defined in NZS 3604:2010) under static conditions was typically encountered below 0.6 m depth.

Test locations are shown on the site plan presented in Appendix 1. Hand auger borehole and test pit logs are presented in Appendices 2 and 3.

4.2 Site Seismic Class

In accordance with NZS 1170.5:2004, Class D applies to this particular site, defining it as a 'deep soft soil site'.

5 Liquefaction Assessment

Based on our site investigation and observations, and owing to the nature of the subsurface materials and depth to groundwater at the site, we consider the potential for liquefaction and lateral spreading on the site to be very low.

We therefore consider the site of the proposed subdivision to have Technical Category 1 (TC1) future land performance whereby future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances.

6 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant a subdivision consent, or may grant a consent subject to specific consent conditions if the land is likely to be subject to the following:

- Erosion, including surface and subsurface erosion, associated with water and wind.
- Falling debris, including rockfall that could impact the site from upslope sources.
- Subsidence, which involves the removal of underlying support by natural or artificial means.
- Slippage, which is defined as the downslope transfer of materials by sliding and / or flowage.
- Inundation, which may be sourced from streams, coastal processes or excess precipitation.

Based on our observations and the nature of the site, its performance during the CES, and the site's distance from the nearest significant watercourse, we consider it is unlikely for the site to be subject to any of the above hazards and, as such, the site is considered suitable for subdivision from a geotechnical perspective.



7 Geotechnical Recommendations

7.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earthfilling for Residential Development. In particular, any areas to receive fill should be stripped of any vegetation, topsoil, non-engineered fill, soft or organic soils prior to fill placement.

Fill may comprise clean natural sandy gravel or silty soils, or clean imported soils and / or granular fill, compacted to achieve no less than 95% of maximum dry density. Fill faces steeper than 2:1 and higher than 600 mm should be retained and referred back to ENGEO. Although unlikely, where any springs or groundwater seeps are encountered they should be intercepted with suitable drainage and discharged to a Council approved outlet.

All unretained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination of 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

A comprehensive earthworks specification should be provided to the earthworks contractor prior to starting excavations and an inspection / testing regime agreed, along with a robust erosion and sediment control plan.

7.2 Subdivision Roading

Vegetation, any organic or deleterious material, topsoil and non-engineered fill should be removed from the site under pavement areas prior to aggregate placement. Based on our observations during testing, we consider the natural ground below the topsoil at the site should provide an adequate subgrade for the proposed pavement areas.

7.3 Stormwater Control

Concentrated stormwater flows from all impermeable areas must be collected and carried in sealed pipes to the Council system or an alternative disposal point subject to approval from Council. Uncontrolled stormwater must not be allowed to saturate the ground as this will potentially affect future foundation performance both statically and during future seismic activity.

7.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise pad, strip or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 200 kPa may be assumed for foundations bearing on natural soils or engineered fill, below any topsoil. We anticipate this to be typically below 0.2 m depth based on our subsurface investigations. Greater capacity may be available across many Lots and will be confirmed during building consent testing. Alternatively, a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for bearing on the underlying gravels, typically encountered below 0.6 m depth.



8 References

- Canterbury Earthquake Recovery Authority. My Property. Retrieved June 2017, from http://cera.govt.nz/my-property.
- Canterbury Maps, Groundwater. Retrieved January 2017, from http://canterburymaps.govt.nz/Viewer.
- Canterbury Maps, Historic Aerial Imagery. Retrieved June 2017, from https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery.
- Forsyth, P., Barrell, D. J., & Jongens, R. (2008). Sheet 16 Geology of the Christchurch Area 1:250,000. Lower Hutt: Institute of Geological and Nuclear Sciences.
- GNS Science (2015). New Zealand Active Faults Database. Retrieved January 2017, from http://data.gns.cri.nz /af.
- Pettinga J.R., Yetton M.D., Van Dissen R.J., & Downes G. (2001). Earthquake Source Identification and Characterisation for the Canterbury Region, South Island, New Zealand. Bulletin of the New Zealand Society for Earthquake Engineering, Vol 34, No. 4, pp 282-317.
- Selwyn District Council, Property Search, retrieved June 2017 from https://www.selwyn.govt.nz/my-property/rates/search-properties.
- Standards Association of New Zealand (1989). NZS 4431:1989. Code of Practice for Earthfilling for Residential Development.
- Standards Association of New Zealand (2004). NZS 1170.5:2004. Structural Design Actions Part 5: Earthquake Actions New Zealand.
- Standards Association of New Zealand (2010). NZS 3604:2010. Timber Framed Buildings.
- Standards Association of New Zealand (2010). NZS 4404:2010. Land Development and Subdivision Infrastructure.
- The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved June 2017, from https://www.nzgd.org.nz.



9 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, Hughes Developments Ltd, 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 IPENZ/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 (03) 328 9012 if you require any further information.

Report prepared by

Lauren Foote

Engineering Geologist

Report reviewed by

Greg Martin, PEngGeol

Principal Engineering Geologist





APPENDIX 1:

Site Location Plan







APPENDIX 2:

Hand Auger Borehole Logs





Geotechnical Investigation 163 Halkett Road West Melton 14088 Client: Hughes Developments Ltd Shear Vane No:

Client Ref. :

Date: 28/06/17 **Hole Depth**: 0.4 m Logged By : EG/RP

Reviewed By : LF

Latitude :

Longitude :

			14088	Hole Diame						ngitud			
(m)	a	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded			a Pene	
Depth (m)	Materia	uscs			Graph	Water	Moistu	Consis Densit	Peak/Remolded	2	Blov 4	ws per 6	1 12
	TOPSOIL	ML	SILT with trace sand and rootlets; plasticity [TOPSOIL].	brown. Low			W	S		•			:
-	4	ML	SILT with trace sand; greyish brow plasticity.	n. Low				F			·	-	
- 0.5 - - -			End of Hole Depth: 0.4 m Termination Condition: Practical re	fusal									× × × × × × × × × × × × × × × × × × ×
- 1.0 - -													
- 1.5 - - -													
- 2.0— -													

Hand auger met practical refusal at 0.4 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.4 m depth.

Standing groundwater was not encountered

A = ALLUV**I**UM



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

Client Ref. :

Date: 28/06/17 Hole Depth: 0.3 m

Shear Vane No:

Logged By : EG/RP Reviewed By: LF Latitude :

		14088	Hole Diame	ter : 5	0 mr	n		Lor	gitu	de :				
Depth (m) Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Blo	ws p	er 10	omete	l
OIL	ML	SILT with trace sand and rootlets; plasticity [TOPSOIL].	brown. Low		M	W	<u>ŏă</u> s		•	! 4	6	8	10	12
4 9	SP	Fine to medium SAND; grey. Poorl	y graded.				MD			\				
- 0.5 - - - - 1.0-		End of Hole Depth: 0.3 m Termination Condition: Practical re	fusal											/^
1.5 - 2.0— Hand aug Scala Per Standing A = ALLU														
Hand aug Scala Per Standing A = ALLU	netro grou	net practical refusal at 0.3 m depth of the practical refusal at 0.3 meter met practical refusal at 0.3 meter was not encountered M		el.										



Geotechnical Investigation 163 Halkett Road West Melton 14088 Client: Hughes Developments Ltd Sho

Client Ref. : 28/06/17

Hole Depth : 0.2 m

Shear Vane No:

Logged By: EG/RP Reviewed By: LF

Latitude :

			14088	Hole Diame						ngitud					
Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded			a Pene			
De	TOPSOIL Ma	SN ML	SILT with trace sand and rootlets; plasticity [TOPSOIL].	brown. Low	7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	M.	W _C	S S		2	4	6	8 1	0 1	2
-	-		End of Hole Depth: 0.2 m Termination Condition: Practical re	efusal	<u> </u>						· · · · · · · · · · · · · · · · · · ·	•			
0.5 -															>>
-	-														
-	-														
1.0-	_														
-	_														
1.5	_														
-	_														
1.5 -	_														
2.0-															
<u> </u>										L					<u>: </u>

Hand auger met practical refusal at 0.2 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.4 m depth.



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

Client Ref. :

Date : 28/06/17 Hole Depth: 0.5 m

Shear Vane No:

Logged By: RP/EG Reviewed By: LF Latitude :

Hole Diameter: 50 mm Longitude: Graphic Symbol Moisture Cond. JSCS Symbol Consistency/ Density Index Shear Vane Undrained Shear Scala Penetrometer Water Level Depth (m) **DESCRIPTION** Materia Strength (kPa) Peak/Řemolded Blows per 100mm 6 8 10 12 SILT with trace sand and rootlets; brown. Low plasticity [TOPSOIL]. S-F ML Μ SILT with trace sand and gravel; greyish brown. F-St ⋖ ML Low plasticity. 0.5 End of Hole Depth: 0.5 m Termination Condition: Practical refusal 1.0-SEOSCIENCE HAND AUGER HAND AUGERS.GPJ NZ DATA TEMPLATE 2.GDT 29/6/17 1.5 2.0-

Hand auger met practical refusal at 0.5 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.5 m depth.

Standing groundwater was not encountered

A = ALLUVIUM



Geotechnical Investigation 163 Halkett Road West Melton

Client: Hughes Developments Ltd

Client Ref. :

Date : 28/06/17

Hole Depth : 0.3 m

Shear Vane No:

 $\textbf{Logged By}: \mathsf{RP/EG}$

Reviewed By: LF Latitude:

			14088	Hole De Hole Diame						atitud			
Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2	Blow	etrome - 100n - 8 1	
	TOPSOIL	ML	SILT with trace sand and rootlets; plasticity [TOPSOIL].				M	S-F					
- 0.5 - - -			End of Hole Depth: 0.3 m Termination Condition: Practical re	efusal									
- 1.0—													
- - 1.5 -													
- - 2.0													



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

Client Ref. :

Date: 28/06/17

Hole Depth: 0.3 m Hole Diameter: 50 mm Shear Vane No: Logged By : EG/RP

Reviewed By: LF Latitude:

			14088	Hole De Hole Diame						atitud				
Depth (m)	Material	USCS Symbol	DESCRIPTION	I	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2	Blow	s per	etromet	m
_	TS	אר	SILT with trace sand and rootlets; [TOPSOIL].		1/2 · 2/4 · 1/2 ·	> <u></u>	W	s		2	4	6	8 10	0 12
	∢	ML	SILT with trace sand; brownish griplasticity.					S		•				:
- 0.5 - - -			End of Hole Depth: 0.3 m Termination Condition: Practical re	efusa l										
- 1.0 - -														
- 1.5 - - -														
- 2.0-														



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

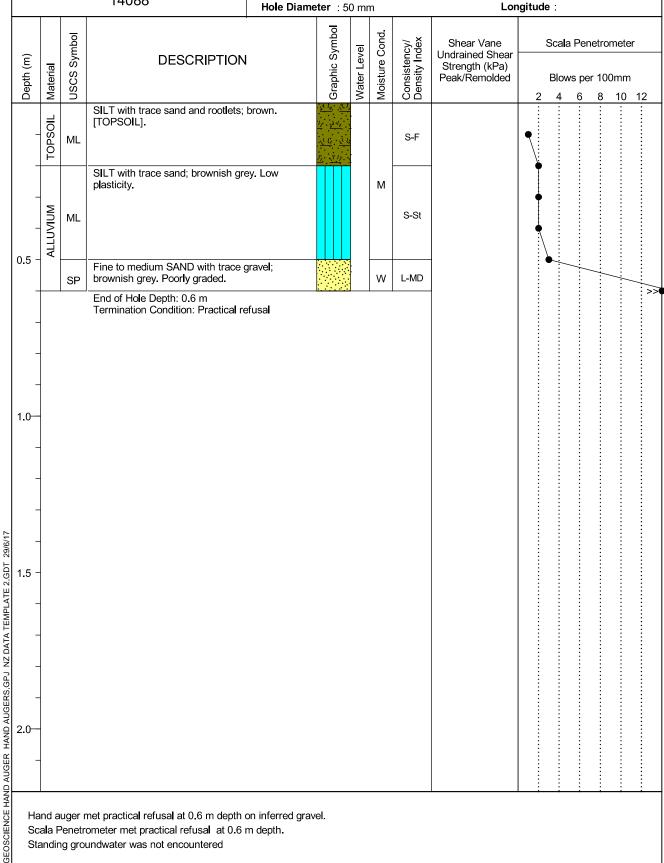
Client Ref. :

Date : 28/06/17 Hole Depth: 0.6 m

Shear Vane No:

Logged By: RP/EG Reviewed By: LF Latitude :

Longitude:



Hand auger met practical refusal at 0.6 m depth on inferred gravel.

Scala Penetrometer met practical refusal at 0.6 m depth.



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

Shear Vane No:

Client Ref. :

 $\textbf{Logged By}: \mathsf{RP/EG}$ Reviewed By: LF

Date : 28/06/17 Hole Depth : 0.4 m

Latitude :

			14088	Hole Diame	ter:5	0 mr	n		Lor	gitud	de :				
Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2	Blo	ows	per 1	romete 00mn 3 10	
	TOPSOIL	ML	SILT with trace sand and rootlets; [TOPSOIL].	brown.	1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2 1/2			S-F		•					
_	ALLUVIUM	ML	SILT with trace sand; brownish graphasticity.				Μ	S-F							
0.5 -			End of Hole Depth: 0.4 m Termination Condition: Practical re	efusal											····
_															
1.0-															
-															
-															
1.5 -															
-	_														
-															
2.0—															



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

Client Ref. :

Date : 28/06/17

Hole Depth: 0.5 m Hole Diameter: 50 mm Shear Vane No:

 $\textbf{Logged By}: \mathsf{RP/EG}$

Reviewed By: LF Latitude:

			14088	Hole Diame				Г		gituc				
Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2		per 1	100mm	
	TOPSOIL	ML	SILT with trace sand and rootlets; [TOPSOIL].	brown	1/ 2/1/ 1/ 2/1/ 2/1/ 2/1/			S-F		•				
_	ALLUVIUM	ML	SILT with trace sand; brownish greplasticity.				М	S-St		:\ 	•			
0.5 -	AL	SP	Fine to medium SAND with trace of brownish grey. Poorly graded. End of Hole Depth: 0.5 m Termination Condition: Practical re					L-MD		, T				
- 1.0— - - 1.5 — - -														\(\frac{1}{2}\)
2.0-														



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

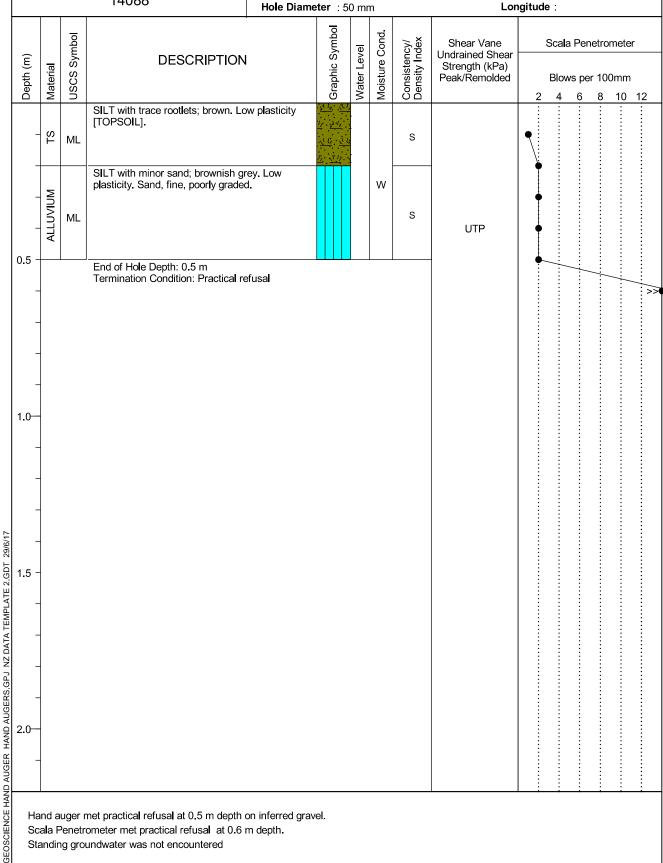
Client Ref. :

Date : 28/06/17

Hole Depth: 0.5 m Hole Diameter: 50 mm Shear Vane No:

Logged By: RP/EG

Reviewed By: LF Latitude :



Hand auger met practical refusal at 0.5 m depth on inferred gravel.

Scala Penetrometer met practical refusal at 0.6 m depth.



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd

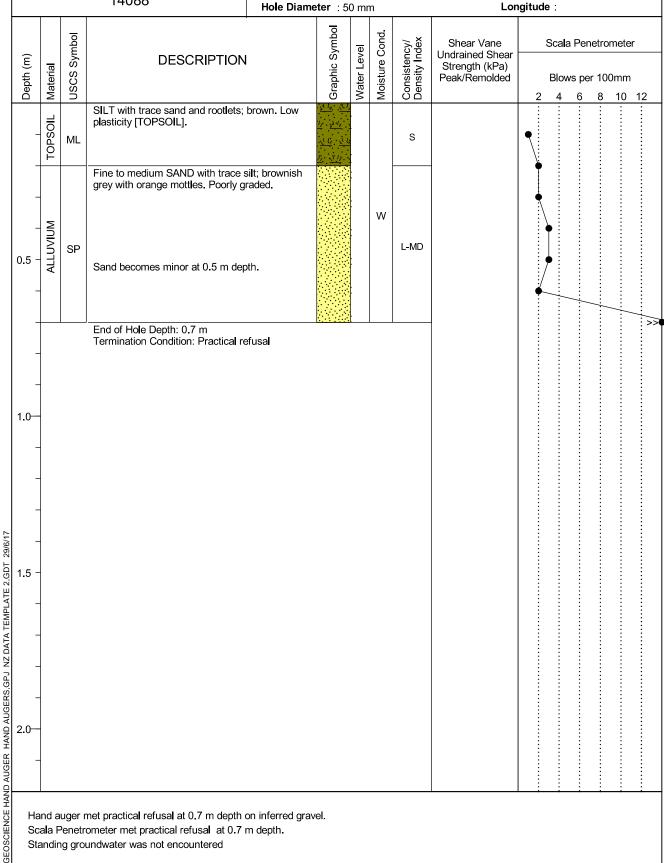
Client Ref. :

Date : 28/06/17

Hole Depth: 0.7 m Hole Diameter: 50 mm Shear Vane No:

Logged By: EG/RP

Reviewed By: LF Latitude :



Hand auger met practical refusal at 0.7 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.7 m depth.



APPENDIX 3:

Test Pit Excavation Logs





Geotechnical Investigation 163 Halkett Road West Melton 14088

 $\textbf{Client} \ : \textbf{Hughes Developments Ltd} \ \ \textbf{Shear Vane No} \ :$ Date : 28/06/17 Logged By: RP

Max Test Pit Depth : 1.2 m Reviewed By: LF Digger Type/Size : Bucket Excavator Latitude:

		Exca	avata	bi l ity	_				+						-	<u> </u>		d.			Qh.	ear V	/ano	5	 3cala	a Per	netro	met	t€
Depth (m)	Material	Easier (Re l a	tive S	e) Harder Harder	USCS Symbol			DI	ESC	RIF	PTIC	ON				Grapnic Symbol	Water Level	Moisture Cond.	Consistency/	ensity Index	Ur Shea Peak	ndrair ar Str	ned ength nolde	ו		vs pe	er 10	0mr	n
<u> </u>		Ш		<u> </u>	<u> </u>	SIL [*] brov	T with	n trac ow p l	e sar lastic	nd, gi ity [T	avel OPS	and OIL].	rootle	ets;	3 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1.		Μ	Σ							2 4	6	8	10	
- - 0.5 -	TOPSOIL				ML										1/2 : 1/2 :			М	S-	F					_	<u></u>	···	÷	_
- - -	ALLUVIUM				CW	cob	e to co bles a ded, s grad	and s	e GR/ and; unde	AVEL brow d. Sa	_ witl nish and, 1	n son grey. fine t	ne Wel o coa	l rse,		さらら		w	MD	<u>ں</u>									
- - - -	ALLU				GW											No.		VV	IVID	ע									
-						Dep Teri	oth of minat	Exca ion C	vatio Condit	n: 1,: ion:	2 m Prac	tica l ı	efus	al															
.5 - - -	-																												
- 2.0— -	_																												
 	- + - + - +	- - - -	 	 	— — -	- -	 - 		- -	- + ·	 - - -	 	<u> </u>			 -	 -	 	 		 -	- - - -	— -	- -	 	- - - - -	 	_	1 + 1 +
 	- - +	- - - -	<u> </u>	_ 	- -	- -	<u> </u>		- -	- -	- <u> </u> -	 - -	<u> </u>	 	_ 	<u> </u>	 	<u> </u>		_ _	- - -	- - -	- - - + -	- -	 	<u> </u>	_	_	 - -
- - 	- † _	- - - -	 - -	 <u> </u>	- - 	- - - <u>L</u> _	 	 	- - -	- † : - ‡ :	- - - -	 - -	 - -	 		 -	 	 - -		_ 		· - - _	- - - <u> </u> _	 -	 — - 	 -	 	_	1
- -	- 	- -	 	 	- -	 - 		 	 - 	 - + - 	 - -	 	 +-	 		 	 — - 	 	 - - 	— - 	 	 - -	 - -	 -	 	 -	 	_	+
	_	_ _	→ —		_ + -	_			-	- † ·	_ _ 	<u> </u>	T —			Г — L _ I	 	<u> </u>		_			- -] — -] — .			_	I
	-+	- -	+- - - -	+ - 	-+- 	- -	- 		 	- + · -	- - - -	 	+ - -	 	— —	⊢ — —		+-		— - 			- + - - -	- -		+ - -	 	_	†
 	- 		-																										



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd Shear Vane No: Date : 28/06/17 Logged By: RP

Max Test Pit Depth: 2 m Reviewed By: LF Digger Type/Size : Bucket Excavator Latitude :

)88 			Buck	et Typ	e/Size :	_				Longitud	le :			
Depth (m)	Material	Excava (Relative	tability e Scale) Harder Harder	Syn		DES	CRIPT	ON		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	BI	cala Pe	oer 10)0mn
<u> </u>	OPSOIL	ш : : :	<u>+</u>	ML	SILT with rootlets; to mediu	brown. L	ow plast	icity. Sa	and, fine	1/. · ×1. · /.	>	M	S-F		2	4 6) 0	10
- - 0.5 - -	01				Fine to c	coarse Gl e cobbles subround	RAVEL v s; browni	with sor	ne sand									
- - 1.0- - -	ALLUVIUM			GW								w	MD-D					
- 1.5 - - - -					Some co	obbles en	ncountere	ed from	1.8 m									
2.0-		::		<u></u>	Depth of	Excavat	ion: 2 m	arget de	epth			<u> </u>						
-					Termina	tion Con	G.1											i
	- - - +		—		Termina		 +-		T -			 		 			 - 	; ; — ;
- - - - -	— — — — — — — —		— — — — — —		ermina						-	 		 		— 	-	
	- -				Termina									 		-+- -+- -+-	-	
					Termina						-					-+- -+- -+- -+-	-	
	- + - + + - + - + - +				Termina											- + - - + - - + - - + - - + - - + -		
					Termina											- + - - + - - + - - + - - + - - + - - + -		
- - - - - - - - - - - - - - - - - - -	-+ -+ -+ -+ -+ -+ -+ -+				Termina											- + - - + - - + - - + - - + - - + - - + -		
					Termina													
					Termina													



Geotechnical Investigation 163 Halkett Road West Melton Client: Hughes Developments Ltd: Shear Vane No:
Date: 28/06/17 Logged By: RP

Max Test Pit Depth : 2 m Reviewed By : LF
Digger Type/Size : Bucket Excavator Latitude :

		Exca	/atabi l it	,			Bucket Type/Size			7:		Longitud		a Pei	netror	met
Depth (m)	Material	(Relati	ve Scal	Harder (a)	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)		ws pe	er 100	
-	TOPSOIL				ML	SILT with trace sa brown. Low plasti	and, gravel and rootlet city [TOPSOIL].	s, <u>x / / x</u> . <u>/ / x / x</u> . <u>/ / x / x / x / x / x / x / x / x / x </u>	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		S-F		•			
- - 0.5 -					SP		AND with trace silt ar own. Poorly graded.	id			MD-D					
- - 1.0 - - -	ALLUVIUM				€W	and trace cobbles graded, subround well graded.	RAVEL with some sar ; brownish grey. Well ed. Sand, fine to coar countered from 1.4 m	se,		М	MD-D					
1.5 - - - - - 2.0	-					Depth of Excavati	on: 2 m lition: Target depth									
												 		_ :	-	<u>:</u>
	- ‡	_	 	_ -	<u> </u>		_ + _ _ _ _		- -	<u> </u>	<u> </u>	+		<u> </u>	-	
	- †	-j	† — - -	-j-	+-		-+		-j-	+-	+ −i− · 	+	⊢ - i −	- -	- 	
	_ T	_		- - -	- -	-	-+	_ 	_ _ _ _	-			 -	 - -	-	
- 1	- +	-		- -	+-				- -	+-	<u> </u>	 		<u> </u>		
	- 1	-	ļ — <u>†</u> -	_ _	1-	- - - -			- -	1-				<u> </u>		-
	-+	1	+ — + -	- -	+-		-+	- + - + - +	_ _	+ - -	·	+ 		+ - + -		_
- - - - 	- † - † - ‡	-	i	_ _	+-		-+			1	1 1	1 1 1 1	1 I	1		
- - - - 	- - - - 	- -	i i † — † - ! — ‡ -	 - - -	+- +-	- - - - - - - - - - - - -	- + - - - - 		- -	<u>i</u> –	<u>-</u>	+		<u> </u>	-	
	+ + +		i i i — i - i — i - i — i -	 - - -	- - - - - -	- - - - - - - - - - - - - - 		 	_ _	<u> </u>				_ - -		_
				 - - - - - -					_ _ - - - -	- - - - - - -		<u> </u>		 + - - - -		_ ·



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd Shear Vane No: Date : 28/06/17 Logged By: RP

Max Test Pit Depth : 2 m Reviewed By: LF Digger Type/Size : Bucket Excavator Latitude :

				140	88					В	uck	et T	ype	/Size	е:							Lo	ongi	tude	e :					
Depth (m)	Material	Easier (Relati	vatab ive S	tale) Harder	USCS Symbol			D)ES	CR	IPT	101	N			0	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	(hear Jndra ear S ak/Re (kF	aine tren mol	d		Blow	vs pe	enetro er 10		nr
<u>-</u> -	TOPSOIL				ML	SIL	T wit wn. L	h tra	ce sa dasti	and, city	gra\ [TOI	vel a PSO	nd r	ootle	ets;	1/2 · 1/2 ·	7, 7, 7, 7, 7, 7,		М	S-F					•				10	
_					ML	SIL bro	T wit wn. L	h tra	ce gi olasti	ravel	and	d sar	nd; g	reyis	sh					F									·	_
0.5 - - - -						and grad	e to d trac ded, s I grad	e cot subro	obles	; bro	owni	sh g	rey.	Wel	l		さくく													
- - - - -	ALLUVIUM				GW														W	MD-D										
- 1.5 - - -																	No.													
- 2 . 0-						Dep Ter	oth of mina	Exc.	avati Cond	ion: 2 dition	2 m n: Ta	nrget	dep	oth			8													
	Ţ		T			Ī													<u> </u>		 		_			<u>:</u> _	- :		Ţ	-
	- + - +		 		- + - - + -	- - 	-i — - -i — -	I		_ <u> </u>		 		 	 		 	i	† – i	 	+ - + -		_ †	 		, — - — -	 	-	† — —	
	_	_				_	ļ	<u> </u> _	<u> </u>	_		_		<u>.</u> _		_	<u> </u> 	<u> </u>	<u> </u> _	<u> </u>	<u> </u>	<u> </u>	_ ‡				<u> </u> _	<u> </u>	<u> </u>	
	- +	-	 	 -	- ‡-	-	-	-	 	-		<u> </u> 		-	 		<u> </u>	<u> </u>	<u> </u>	 -	<u> </u>	<u>.</u> ⊢ –	- ‡	ļ	 		<u> </u>	-	<u> </u>	-
	-+		-	 	- ‡-	-		-		-		_		-			-		+-		+-								 -	
	<u> </u>	-	<u> </u>	!. 	- +-	- <u> </u> -	- 	<u> </u> _				L	! — - !	<u> </u>	 	_	<u>L</u> _	!— - !	1 -	_	<u> </u> -		- 1				<u> </u>	·!	1 —	
	-+ 	-	— 	-	-+-	- +	- 	+ - 	⊢	— 		 	— - 	⊢ — 	— — 		⊢ — 	— - 	+-	⊢	+-	⊢	— 	- — I	⊢	; — - 	⊢ — 	· — –	+ — 	
	$ \top$		T — T	 			- -						l	Г — L _			Г — L _	 	T —		T =		_ 1			— - 	Г — L _	 	1 —	
			Ī				 -												Ī _		Ī-		_ [Ī —	
	Τ"						ļ												<u> </u>		<u> </u>							<u> </u>	<u> </u>	
	_		1		1			1	1 1									1	1				. !				1	1	1	
	- - 	_	ļ_	L _ .	_ i -		_	1_1	$\sqcup \sqcup$			$\vdash \vdash$	l — -	<u> </u>	I— —		<u> </u>	·I— -	+ $-$	\vdash \dashv \vdash	+ $-$	\vdash	_ 1		ᆫᅴ	l — -	⊢ –	.	↓_	- 4



Geotechnical Investigation 163 Halkett Road West Melton

 $\textbf{Client} \ : \textbf{Hughes Developments Ltd} \ \ \textbf{Shear Vane No} \ :$ $\textbf{Date}\ : 28/06/17$ Logged By: RP Max Test Pit Depth : 2 m Reviewed By : LF

			14	408	88						Buck				e : E e :										tude tude					
Depth (m)	Material	Excav (Relati	vatabi l i ive Sca	Harder alk	USCS Symbol			С	ES	CR	IPT	'IOI	N			0	Graphic Symbol	Water Level	Moisture Cond.	Consistency/	ensity Index	She	near Indra ear S k/Re (kF	aineo tren mol	d ath	E	3lows	s pei	r 100	0mm
<u> </u>	TOPSOIL				ח ML	S I L bro	T wit	h tra ₋ow p	ce sa	and, icity	gra\ [TOI	∕el a PSC	nd r	ootle	ets;	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	×	^	M	S-						2	4	6	8	10 1
- -					ML	SIL	.T wit	h tra ₋ow p	ce g	rave icity.	l and	d sar	nd; g	greyi	sh	Î				F	:						····			
0.5 - - - - 1.0-	ALLUVIUM					and gra	e to d trac ded, Il gra	e col subr	obles	s; bro	owni	sh g	rey.	We	II		なるなるな													
- - 1.5 - - -	ALLU				GW												とくくくく		W	MD	-D									
- 2 . 0-						De _l Ter	pth o	f Exc tion	avat Cond	ion: ditior	2 m n: Ta	ırget	dep	oth			2													
	 _ + _ +	_		_ _ - -	- - - - - -	- -	 -	 + +	<u> </u>		 		— —	 			 - 		 	<u> </u>		 	 	— +	 	— —	_ _ +	- — - - — - - — -	_ _ _ _	-
 	- - 	_ 	- -	- - - -	- - - + -	- -	_ _	<u> </u>	<u> </u>	 	<u> </u>	 	 	 - - -	 		<u> </u>	 	<u> </u>	 	_ 	 	 	- -	 	 	- - +	 	- - 	- -
- - .	- - 	-	 	- - - -	- - - <u> </u> -	- - - <u> </u> -	-	 - -	 	 — - 	 -	 	 —	├ ├ - └ -	 	-	 	 	 	 		 	 	- - 	 	 	- - 	- -	- - 	- - -
 	- - 	-	 	- - - -	- - - -		_ _ _ _ _ :	∔ — —		i — - i — -	 	 	— —	<u> </u>			 	i— - i— -	 -	 		 	 	- - 	- — - —	 	- - 	- — - - — -	- - 	-
 	_ <u> </u> _ + _	_L_ -		_ _ - -	-	- - - -	_ - :	⊥ — + — 	∟ _ 		L _ 	∟ _ 	: : 	⊥ _ + -	 		L _ 	 	⊥ _ · + _ ·	⊥ _ 		 	 	_ - -	 -	 - -	_ <u> </u> _ +	- — - - — - 	_ <u> </u> - 	- -
	- † - 1		i — i	—i- —i-	- † - - ‡ -	- - -	-j: -j:	† – ‡ –		i — - ! — -	 		i — :	† − † −	i— —		_ ⊢_	i— - !— -	† — 1	;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;;	_ j	i	- j	— † — ‡	¦ !	- i	_ †	- -	- † - ↓	_



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd Shear Vane No: Date : 28/06/17 Logged By: RP Max Test Pit Depth : 2 m Reviewed By: LF

Digger Type/Size : Bucket Excavator

Latitude:

			140)88		Bucket Type/Size					Longitud	e :	
Depth (m)	Material	Excava (Relative e.se Excava	tability e Scale) Harder Harder	Şyu	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)		netromete er 100mm 8 10 1
-	TOPSOIL			ML	SILT with trace sa Low plasticity [TC	and and rootlets; brown. PSOIL].	17 - 71 12 - 71 17 - 71 12 - 71 17 - 71 12 - 71			S-F		•	
- - 0.5 - -				SM	Silty fine to mediu brown. Poorly gra	m SAND; greyish ded.			М	MD			
- - 1.0— -	ALLUVIUM				trace cobbles and	RAVEL with some sand, silt; brownish grey. Well ed. Sand, fine to coarse,							
- - 1.5 - - - -				GW	Some cobbles en depth.	countered from 1.5 m			W	MD-D			
2 . 0—					Depth of Excavati Termination Cond	on: 2 m lition: Target depth							
	-+ -+ -+							-	 				
	- - - - 		- - - - - - - -	- + - -		-+	· - † - · - † - · - † -	-	- - - - - - - - - -				
	_ <u> </u>		-		-		-	- - 	 		+ +		



Geotechnical Investigation 163 Halkett Road West Melton

Client: Hughes Developments Ltd Shear Vane No: Date : 28/06/17 Logged By: RP Max Test Pit Depth : 1.5 m Reviewed By: LF

		VV	est N 140	vielto 188	on	Digger Type/Size Bucket Type/Size	: Bucket	Exca	vator		Latitud Longitud	e :	
Depth (m)	Materia	Excavata (Relative	tarder Harder Harder	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)		enetrometer per 100mm
-	TOPSOIL			ML	SILT with trace s Low plasticity [TO	and and rootlets; browr PSOIL].		i				•	
0.5 -				ML	brown. Low plast				М				Á
- - 1.0— - -	ALLUVIUM			GW	cobbles and trace	RAVEL with some sand silt; brownish grey. Wilded. Sand, fine to coars	ell 😲 🍆		w				
- 1.5 - - -					Depth of Excavat Termination Cond	ion: 1.5 m dition: Practical refusal							
- 2.0—													



Geotechnical Investigation 163 Halkett Road West Melton Client : Hughes Developments Ltd Shear Vane No :
Date : 28/06/17 Logged By : RP

Max Test Pit Depth : 2 m Reviewed By : LF
Digger Type/Size : Bucket Excavator Latitude :

		Exca	avatabi	lity	-										3	<u> </u>		او	, y		Shea	r Va	ne	So	ca l a P	enet	ome	ete
Depth (m)	Materia	Easier <u>a</u>	tive Sc	Harder (a	USCS Symbol			DE	SCF	RIPT	101	N			Graphic Symbol	Glapliic Sylli	Water Level	Moisture Cond.	Consistency/ Density Index	SI Pe	Undi near eak/R	raine Strei	ed nath	B 2	lows	per 1 6 8		
-	TOPSOIL				ML	S I L [*] Low	T with plast	trace icity [7	sand FOPS	and OIL].	root	lets;	brov	vn.	7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.7.			М	S-F					•				
-					ML	SIL	T with ticity.	trace	sand	; gre	yish	brov	vn. L	.ow				•	S-F					•<				>
).5 - - - -				-		and grad	mino	parse (r cobb ubrou ed.	les; b	rown	ish (grey.	. We	ll .													···	_
- - - - -	ALLUVIUM				GW											200		w	MD-D									
- 1.5 - - -																のという												
- 2.0- -						Dep Teri	oth of I	Excav on Co	ation: nditio	2 m on: Ta	arget	dep	th															
	_ _ +	_ _	<u> </u>	- - -	_ 					 	 	— - — - 	 		_ _ _			ļ			 - 	 	 		_ 		 	-
	- - 	_ _	 - 	-	- -	- -			- - - -	<u> </u>	_ _ _ 	 	_ _ _ - -		-	-	 	<u> </u>		<u> </u> -	-	 	<u> </u>		- -	- -	 - -	 - - -
-	- - 	- -		-	- + -		 		i-	;	i 	i 	 	 	- 	-	i 	i † — ·		† -	i -	i 	i		- -	- -	i	 -
 	- - -	- -		- -	- - - -	- -			 	 +	 	— - — - 	i i i		- † - +			— : 	 - -		- -	 	 	— — — —	- - - -	- - 		- † - †
	_ T			-		-				T —		I — -	Г — I L I		_	-		T — :		T -] — :] — : 	T —			_ _	 	1
- T	- - 	- -		- -	- -					 - -	 	 			- - - 		 	ļ — :		<u>+</u> -	-	 	 - -		- † ·	- - - -	- - - - -	T - T -
		- 1	1 1			- 1	1	- 1		1	I	I			- 1		I	I	1 1	- 1	1	1	1		- 1	1		- 1



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd Shear Vane No: Date : 28/06/17 Logged By: RP Max Test Pit Depth : 2 m Reviewed By: LF

Latitude :

Digger Type/Size : Bucket Excavator Bucket Type/Size :

			140	88		Bucket Type/Size	oucket E	xca	valor		Longitud	
Depth (m)	Material	Excavata (Relative seige Excavata		Syn	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrome Blows per 100m 2 4 6 8 10
-	OPSOIL			ML	SILT with trace sa Low plasticity [TO	and and rootlets; brown. PSOIL].	$\overline{\lambda} \cdot \overline{\lambda}_{I \cdot I \cdot I}$			S-F		•
-	1			GW	minor cobbles, tra	RAVEL with some sand, ice silt and organics; ell graded, subrounded. se, well graded.	X			MD		
).5 - - -					Fine to coarse GF and minor cobble	RAVEL with some sand s; brownish grey. Well ed. Sand, fine to coarse,						
- 1.0— -	ALLUVIUM			GW					W	MD-D		
- - 1.5 - - -					Some cobbles endepth.	countered from 1.3 m						
- -0.2 -					Depth of Excavati Termination Cond	on: 2 m ition: Target depth						
			T -	- -			 	 - 	 	 	 	
	- 	 - - 	 - - 	- -	- 	-+	 	 	 	 		
i	- † - +		- -	- -	- - - - - - - - - 	- - - - - - - - - - 	i — i — i — i —	 	† — † —	 	† - + - - + -	
-	$-\frac{1}{1}$	- -	- -	- +-	- 	-+		 	 		 	
	- † - +	- 	- - - 	- † - - + -	- - - - - - - - - - -	- + - -	;	·	† — † —	- -' 	†- 	<u> </u>
-	-+		- -	- + -			- -	<u> </u> -	<u> </u>	<u> </u>		
		_ -	-	_ -	- - - - - - - - -		l _	. .	 -	L		
	_		. <u>i. </u>		- +			1 -	1			, , <u>+-</u>
	_	-i- i- -i- i-	- - - -	-+- -¦-	-		i	<u>i</u> -	<u> </u>	<u> </u>	 	<u> </u>



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd: Shear Vane No:
Date: 28/06/17 Logged By: RP

x Test Pit Depth: 2 m Reviewed By: LF

			Wes	40		ווכ				0)igg	er T	ype		h : 2 e : E e :		et E	xca	vator						itud itud						_
Depth (m)	Material	Easier (Relat	vatabil ive Sc	Harder (ale)	USCS Symbol			[DES	CR	IPT	101	N				Graphic Symbol	Water Level	Moisture Cond.	Consistency/	Density Index	She	hear Jndr ear S k/Re (kF	aine Strer	d		3low:	Pens per		Omr	m
-	TOPSOIL				ML	SI Lo	LT w ow pla	ith tra	ace sa y [TC	and a	and i	rootl	lets;	brov	vn.	1/2 · 1	7			S-						•					
- - 0.5 -					ML	pla	LT w asticit aded.	ith mi	inor s ind, fi	sand; ine to	gre o me	yish ediur	bro m, p	wn. I	Low /					F-V	/St					•			····	·····/	
	ALLUVIUM				GW	an gr:	id tra	coars	bbles	s; bro	wnis	sh g	rey.	Wel	l				М	MD	i-D										
- 2 . 0						De Te	epth o	of Exc ation	cavati Cond	ion: 2 dition	2 m n: Ta	rget	dep	oth		<u>}</u>	X														
_ 	_ _ 	 -	 	 -	_ -	 - 	- -	+-	 		ا ا — ا		 	 - -	 	_	 -	 	<u> </u> _	 		 -	 	 	 -	 	_ 	 - — -	_ _ 		1
<u>i</u> -	- †	-j-	 	- —j-	- -	- -	- <u>i</u> -	+-		i — i I — I	- – i		i — -	- 	— — 		- - 	i— - i	 	- -i	_	i	 	i — - I	i	 -	- †	- — j-	- +	-	t
	– T – +	_ _	 →	 -	_	- T	_ _	T-	\vdash		- — i		i — - I — -	⊢ — ⊢ —			 ⊢ _	 	T —	 ⊢				i — - I — -			_ T	- — -	- T - +	_	Ī
	$-\frac{1}{+}$	-	1 - 1		- +-	-	- -	+-	-	 			 — -	<u> </u>	 		 		+-			-	 	 	 -		-+		- +	-	1
	- 		<u> </u>			- <u> </u>	- -	<u>+</u> -			¦		<u> </u>	<u> </u>	<u> </u>		<u>L</u> _	<u> </u>	1 _			L _		<u> </u>	<u> </u>		-	¦-		_	I
: !	-+ 	_ _	+ - + 	- — - !	- + - - <u> </u> -	- - 	_ _	+-	H -	—	 !		— - — -	+ - -	 		⊢	 	+ -	+ - 		-	-	— - — -	-	⊢	-+	- — - !	- + - !	_	1
_	_ ‡		ļ _ ļ	 .	_ ‡-	- <u> </u>	_	<u> </u>		 			 	<u> </u>	<u> </u>		<u> </u> 	<u> </u>	<u> </u>	<u> </u>		L _	<u> </u>	 	L _		- †	- — ļ-	_ ‡	_	ļ
_ _ -	- 	-	 	 -	- +-	- +	- -	+-	<u> </u>	 	 		 	 	 —		 	 	+-	<u> </u>		 -	 	 	 -	ı 	-+	- — - -	- 		1+
i	-+		 			-	- -	+-		-	¦		¦ — -	<u> </u>			<u> </u>	<u> </u>	 			-		¦ — -	-		- ‡		†	-	
	- 1								1				· — -		I— —		\vdash $-$	· I — -	+ $-$	\leftarrow						\vdash	$ \downarrow$				1



Geotechnical Investigation 163 Halkett Road West Melton 14088

Client: Hughes Developments Ltd Shear Vane No: Date : 28/06/17 Logged By: RP

Max Test Pit Depth: 1.6 m Reviewed By: LF Digger Type/Size : Bucket Excavator Latitude:

				88		Bucket Type/Size :	T_				Longitud				
Depth (m)	Material	Excavata (Relative : .e. .e. .e. .e. .e. .e. .e.	ability Scale) Harder	USCS Symbol	DES	SCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Blo		netroner 100	
	OPSOIL		:	ML	SILT with trace s Low plasticity [To	and and rootlets; brown. DPSOIL].	1			S-F		•			:
-	- -			ML	SILT with trace g brown. Low plast	ravel and sand; greyish iicity.			M	S-F				····	
- 0.5 - - -					and cobbles; bro	RAVEL with some sand wnish grey. Well graded, ad, fine to coarse.									
- - 1.0 -	ALLUVIUM			GW					w	MD-D					
- - 1.5 - -					Depth of Excavat Termination Con	tion: 1.6 m dition: Practical refusal									
_															
- 2.0- -			·												<u>.</u>
2.0	 		- - - - - - - - - -	 -			 	-	 	 	 		T		
2.0	- - - - - - - - - -			— — — — — — — — — — — — — — — — — — —			 	-	 				— +- +-		
- - - - - - - - - - - - - - - - - - -				— — — — — — — — — — — — — — — — — — —				-							
				— — — — — — — — — — — — — — — — — — —				-							
									 				T + - + - + - + - + - + - + - + - + - +		
													T + + + + + + + + + + +		



Geotechnical Investigation 163 Halkett Road West Melton

Scala Penetrometer met practical refusal

Date: 28/06/17 Logged By: RP Max Test Pit Depth : 1.4 m Reviewed By: LF

		٧١	/est N 140	71811C	n			Digg	er Type/Size et Type/Size	: Bucke		cava	ator				itude itude	∍ :				
Depth (m)	Material	Excavat (Relative	tability Scale) Harder	USCS Symbol		[DESC	CRIPT	TION	Grophic Cymbol	Graphic Cyrindol	Water Level	Moisture Cond.	Consistency/ Density Index	Un Shea Peak/	ar Var draine Strer Remo kPa)	ed ngth				r 10(mete Omm
	TOPSOIL			ML	SILT Low p	with tra lasticit	ace sa y [TOI	nd and PSO I L].	rootlets; brown		<u></u>		_	S-F				•	-7	<u> </u>	:	10 1
-	Ť			ML	SILT	with tra	ace gra plastic	avel and ity.	d sand; greyish				M	S-F					•		···	
- - 5.0 -					and c	obbles	; brow	nish gre	vith some sand ey. Well graded o coarse.	d d,												
-	ALLUVIUM			GW									w	MD-D								
.0 <u> </u>				O							Š											
_																						
_			:		Donth	of Ev	oovotic	n: 1 / ı		•								:			:	: :
.5 - -		i	;		Depth Termi	of Exc nation	cavatic Condi	n: 1.4 i tion: Pr	n actical refusal	•												
5 - - - -			;		Depth Termi	of Exended	cavatic Condi	n: 1.4 ı tion: Pr	m actical refusal		~											
-			·		Depth Termi	of Exo	cavatic Condi	n: 1.4 ı tion: Pr	m actical refusal													
-			;		Depth Termi	of Exnation	Cavatic Condi	n: 1.4 ition: Pr	m actical refusal						 	 -						
-	— — — — — — —				Depth Termi	of Exmander	Cavatic	n: 1.4 i	m actical refusal		 				 	——————————————————————————————————————	- - + - -			 		
-	——————————————————————————————————————		; - - - - - - - - - -		Depth Termi	of Extraction	cavatic Condi	n: 1.4 i	m actical refusal		 		— — — —							 	— — — — — — — — — — — — — — — — — — —	
-			- - - - - - - - - - - -		Depth Termi	of Extended in the control of the co	cavatic Condi	n: 1.4 i	m actical refusal		 								——————————————————————————————————————			
-			- - 		Depth Termi	of Extended in the control of Extended in the co	cavatic Condi	n: 1.4 ition: Pr	m actical refusal			— 				——————————————————————————————————————			——————————————————————————————————————			
-					Depth Termi	of Extended in the control of Extended in the co	Cavatic Condi		m actical refusal							——————————————————————————————————————			——————————————————————————————————————			
-			- ; - - - - - - - - - - - - - - - -		Depth Termi	of Extended in the control of Extended in the co	Condi	n: 1.4 ition: Pr	m actical refusal		- - - - - - -								——————————————————————————————————————			
-	——————————————————————————————————————				Depth Termi	of Example	Cavatic Condi		m actical refusal		 	——————————————————————————————————————							——————————————————————————————————————			
-					Depth Termi	of Extended in the control of Extended in the co	Cavatic Condi		m actical refusal		- - - - -					——————————————————————————————————————						
.5 -					Depth Termi	of Example	Cavatic Condi		m actical refusal		 											