

Submitted to:

Hughes Developments Ltd
Christchurch

**ENGEO Limited** 

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### **ENGEO Document Control:**

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### 1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a geotechnical investigation of the property at 708 & 710 Selwyn Road, Rolleston, Christchurch, as outlined in our variation proposal (ref. 12903.000.000\_64).

The purpose of this assessment was to conceptualise 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 fifteen 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 fifteen 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, including 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 is made up of two properties that will be discussed as one. The site covers a total area of 4.8 ha and has the following legal descriptions (Canterbury Maps):

- 708 Selwyn Road Lot 2 DP 479375
- 710 Selwyn Road Lot 1 DP 441634
- 710 Selwyn Road LOT 1 DP 479375

It is located approximately 3 km south of Rolleston town centre. The site is bound to the south by Selwyn Road, the southwest and all other sides by rural properties (Figure 1).



Figure 1: Site Location Plan



Images sourced from Canterbury Maps and "© OpenStreetMap contributors". Not to scale.



## 3 Geological Model

### 3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2018) as being underlain by grey river alluvium.

### 3.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2019) and observed during our site walkover conducted on 19 September 2019, 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 1.2 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).

Figure 2: Historical Aerial Photography

1990 - 1994



Image sourced from Canterbury Maps



### 3.3 Geohazards

#### 3.3.1 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 between 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 northwest / west of the site and trends roughly east-west with a surface rupture length 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 extended to within 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).

### 3.3.2 Liquefaction and Lateral Spreading

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

### 3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 23 September 2019. The investigations comprised fifteen hand auger boreholes and fifteen test pit investigations with associated Scala penetrometer tests.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 1. Hand auger and test pit logs are included in Appendix 2 of this report.

**Table 1: Generalised Summary of Subsurface Conditions** 

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.2 - 0.3	Soft to Stiff	-
SILT / SAND	0.2	0.1 – 1.0	Stiff to Very Stiff / Loose to Dense	Not present at all test locations
Silty GRAVEL / Sandy GRAVEL	0.3 – 1.2	Unknown	Dense to Very Dense	-



### 3.5 ECan Boreholes

A review of three deep ECan borehole logs was conducted. The first (M36/5254), is located on-site, and appears to be a water well servicing the existing dwelling. The other boreholes are located on the northern boundary (M36/7902) and western boundary (M36/4221). A borehole is located south of Selwyn Road (M36/20236) but has no borehole log associated with it on Canterbury Maps.

Well summaries from the three holes of interest are presented in Appendix 3 and summarised in Table 2 below.

Table 2: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water Level (m)	Generalised borelog as logged by driller
M36/4553	33	8.3	Clay to 0.9 m and gravel to 33 m with a layer of clay at 28 m to 29.5 m.
M36/20687	36	Not recorded	Sand to 2.5 m depth and gravel to 36 m depth.
M36/3884	30	7.9	Gravel to 30 m with a layer of peat and clay at 27 m to 28.5 m.
M36/6902	42	12	Gravel to 42 m depth.
M36/7928	37	7.2	Gravel to 37 m depth.





Figure 3: Nearby ECAN Borehole Locations

Aerial photograph sourced from Canterbury Maps. Not to scale.

### 3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 7.2 m and 12 m depth.

### 3.7 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'.

## 4 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.

### 5 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 it considers that:

- There is a significant risk from natural hazards; or
- Sufficient provision has not been made for legal or physical access to each allotment to be created by the subdivision.

An assessment of the risk from natural hazards as required by the RMA includes the following:

- The likelihood of natural hazards occurring (whether individually or in combination);
- The material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and
- Any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

We have assessed the risk of natural hazards at the site in accordance with Section 106 of the Resource Management Act (RMA) and considered the risk to the site from rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. 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 natural hazards such as rockfall, inundation (debris), slope stability, subsidence, flooding and tsunami. As such, the site is considered suitable for subdivision from a geotechnical perspective.

### 6 Geotechnical Recommendations

#### 6.1 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 Earth filling for Residential Development. In particular, any areas to receive fill should be stripped of all 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 2V:1H 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 no steeper than 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.

### 6.2 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.

#### 6.3 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.

#### 6.4 Foundations

Foundations for future proposed residential dwellings within the subdivision may comprise shallow 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 300 kPa may be assumed for foundations bearing on natural silt, sandy gravel or engineered fill, below any topsoil. We anticipate this to be typically below 0.2 m depth based on our subsurface investigations.



### 7 References

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- The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved November 2018, from https://www.nzgd.org.nz.



### 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, 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 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 (03) 328 9012 if you require any further information.

Report prepared by

**Jed Watts** 

**Engineering Geologist** 

Report reviewed by

**Greg Martin, CMEngNZ (PEngGeol)** 

Principal Engineering Geologist

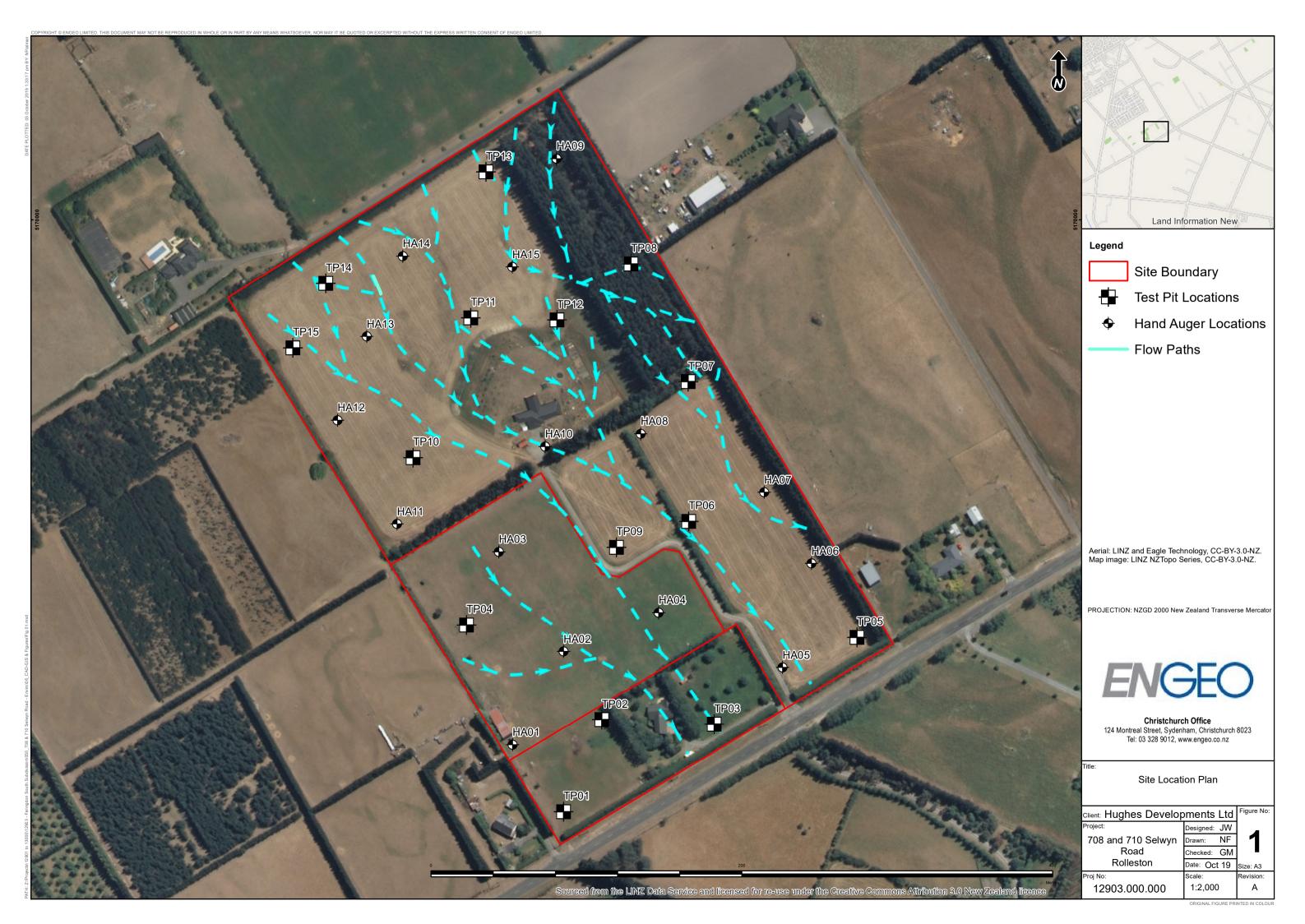




## **APPENDIX 1:**

Site Plan and Inferred Paleo Channels







# **APPENDIX 2:**

Test Pit and Hand Auger Logs





Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Client Ref. : N/A **Date**: 26/09/2019 Hole Depth : 0.4 m

Shear Vane No: 1362 Logged By: KF Reviewed By : JRW

Latitude : -43.624407

ML SIL bro	DESCRIPTION  T with some sand and trace row plasticity. Sand, fine [TOPSO]  T with some sand and trace graden. Low plasticity. Sand, fine.  d of Hole Depth: 0.4 m rmination Condition: Practical results.	otlets; brown. IL].	The state of the s	Elevation (mRL)	Water Level	Moisture Cond.	ري Consistency/ نا Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	В	lows p	per 10	ometer 0mm 10	
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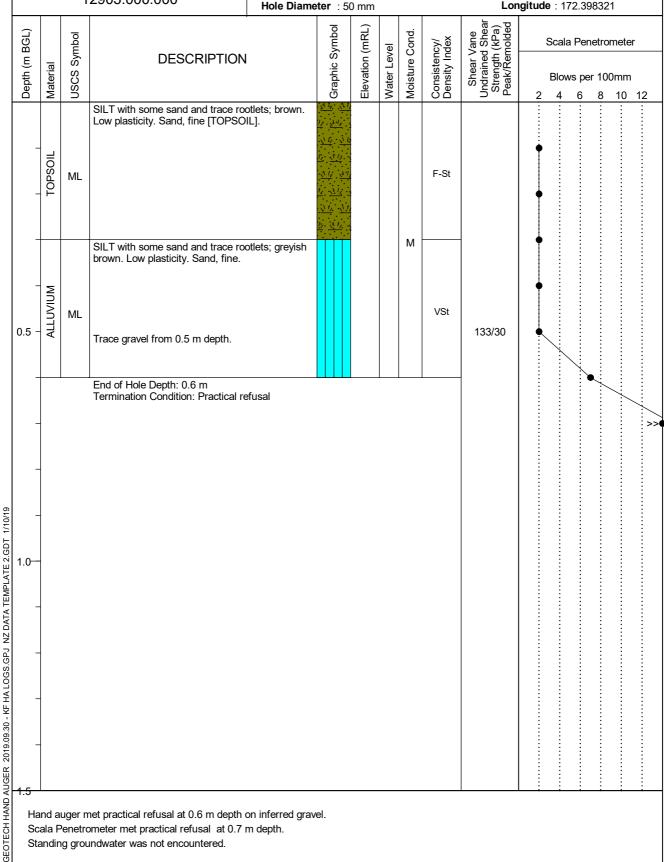


Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client : Hughes Developments Ltd Client Ref. : N/A Date : 26/09/2019 Hole Depth: 0.6 m

Shear Vane No: 1362 Logged By: KF Reviewed By: JRW

Latitude : -43.623809 Longitude: 172.398321



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

Scala Penetrometer met practical refusal at 0.7 m depth.



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Client Ref. : N/A **Date**: 26/09/2019 Hole Depth : 0.4 m

Shear Vane No: 1362 Logged By: KF Reviewed By: JRW Latitude : -43.623238

			2903.000.000	Hole Diame	eter : 5	0 mm					ngitu	<b>de</b> : 1	72.3	978	6	
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_	ALLUVIUM	ML	SILT with some sand and trace robrown. Low plasticity. Sand, fine.  Trace gravel from 0.3 m depth.	ootlets; greyish				M	F-St							
_			End of Hole Depth: 0.4 m Termination Condition: Practical r	refusal			<u> </u>									
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Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Shear Vane No: 1362 Client: Hughes Developments Ltd Client Ref. : N/A Logged By: KF **Date**: 26/09/2019 Reviewed By : JRW Hole Depth : 0.7 m

Latitude : -43.623696

		1	2903.000.000	Hole Diame					ı	Lor		de : 1	72.39		
Depth (m BGL)	_	USCS Symbol	DESCRIPTION		Graphic Symbol	Elevation (mRL)	evel.	Moisture Cond.	ency/ Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Scala	a Pene	etrome	ter
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- 0.5 -	ALLUVIUM	ML	SILT with some sand and trace roots brown. Low plasticity. Sand, fine.	otlets; greyish				101	VSt	107/30					
_		ML	Sandy SILT with trace rootlets and brownish grey with orange mottles plasticity. Sand, fine to medium.	l gravel; . Low				W	St-VSt						
- 1.0			End of Hole Depth: 0.7 m Termination Condition: Practical re												
Sc	ala P	enetro	net practical refusal at 0.7 m depth of the practical refusal at 0.8 modern was not encountered.		vel.						<u> </u>				<u>:</u>



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client : Hughes Developments Ltd Client Ref. : N/A Date : 26/09/2019 Hole Depth: 1.1 m

Shear Vane No: 1362 Logged By: KF Reviewed By: JRW Latitude: -43.624003

Longitude: 172.400091 Hole Diameter: 50 mm Undrained Shear Strength (kPa) Peak/Remolded Graphic Symbol Elevation (mRL) Symbol Depth (m BGL) Moisture Cond. Shear Vane Consistency/ Density Index Scala Penetrometer Water Level **DESCRIPTION** Material USCS 8 Blows per 100mm 6 8 10 12 SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL]. TOPSOIL S-F Μ ML SILT with some sand and trace rootlets; greyish brown. Low plasticity. Sand, fine. Becomes brownish grey with orange mottles from 0.4 m depth. 0.5 207 Н MLSand becomes trace from 0.5 m depth. ALLUVIUM W SILT with some sand and trace rootlets; grey with orange mottles. Low plasticity. Sand, fine to medium. GEOTECH HAND AUGER 2019.09.30 - KF HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 1/10/19 St ML 1.0 89/21 Trace gravel from 1.0 m depth. End of Hole Depth: 1.1 m Termination Condition: Practical refusal

Hand auger met practical refusal at 1.1 m depth on inferred gravel.

Scala Penetrometer met practical refusal at 1.1 m depth.



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston

Shear Vane No: 1362 Client : Hughes Developments Ltd Client Ref. : N/A Logged By: KF Date : 26/09/2019 Reviewed By: JRW

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-		End of Hole Depth: 0.2 m Termination Condition: Practical re	efusal											····
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1.0—														
4														



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston

Client: Hughes Developments Ltd Client Ref. : N/A Date : 26/09/2019 Hole Depth: 0.2 m

Logged By: KF Reviewed By : JRW Latitude: -43.622943

Shear Vane No: 1362

	1	2903.000.000	Hole De Hole Diame	<b>pth</b> : 0. <b>eter</b> : 50	.2 m 0 mm						de:-4 de:17			
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		Blow	s per	100mn	n
TOPSOIL	ML	SILT with some sand, trace rootlet brown. Low plasticity. Sand, fine			ш	>	M	F-St		2	4	6	8 10	12
0.5 -		End of Hole Depth: 0.2 m Termination Condition: Practical re	efusal									·		



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client : Hughes Developments Ltd Client Ref. : N/A Date : 26/09/2019 Hole Depth: 1.2 m

Shear Vane No: 1362 Logged By: KF Reviewed By: JRW Latitude: -43.622644

Longitude: 172.398981 Hole Diameter: 50 mm Undrained Shear Strength (kPa) Peak/Remolded Graphic Symbol Elevation (mRL) Symbol Depth (m BGL) Moisture Cond. Shear Vane Consistency/ Density Index Scala Penetrometer Water Level **DESCRIPTION** Material USCS 8 Blows per 100mm 8 10 12 SILT with some sand, trace rootlets and gravel; brown. Low plasticity. Sand, fine [TOPSOIL]. TOPSOIL S-F ML Μ SILT with some sand; greyish brown. Low plasticity. Sand, fine. 89/21 St ML 0.5 Silty fine to medium SAND; grey with orange mottles. Poorly graded. L-MD SM W GEOTECH HAND AUGER 2019.09.30 - KF HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 1/10/19 Clayey SILT with trace sand; grey with orange mottles. Low plasticity. 1.0 207 Н ML Trace gravel from 1.1 m depth. End of Hole Depth: 1.2 m Termination Condition: Practical refusal

Hand auger met practical refusal at 1.2 m depth on inferred gravel.

Scala Penetrometer met practical refusal at 1.2 m depth.



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Client Ref. : N/A **Date**: 26/09/2019 Hole Depth : 0.4 m

Logged By: KF Reviewed By : JRW Latitude : -43.621063

Shear Vane No: 1362

		1	2903.000.000	Hole Diame	eter:5	0 mm					gitu	de : 1	172.3	3983	337	
Depth (m BGL)	ial	USCS Symbol	DESCRIPTION		Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded					romet	
epth	Material	SCS			iraph	levat	Vater	loist	consis	She Indra Strer	2				00mr	
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	∢	ML	brown. Low plasticity. Sand, fine to	o medium.					St-H							<u> </u>
			End of Hole Depth: 0.4 m Termination Condition: Practical re	efusal					<u>I</u>							
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Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

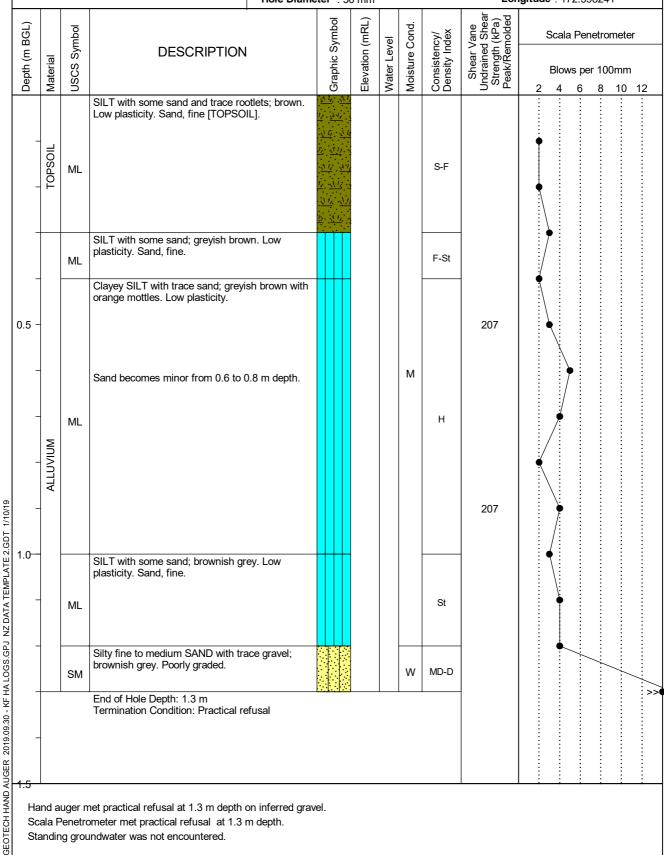
Client : Hughes Developments Ltd Client Ref. : N/A Date : 26/09/2019 Hole Depth: 1.3 m

Logged By: KF Reviewed By: JRW Latitude: -43.622722

Shear Vane No: 1362

Hole Diameter: 50 mm

Longitude: 172.398241



Hand auger met practical refusal at 1.3 m depth on inferred gravel.

Scala Penetrometer met practical refusal at 1.3 m depth.



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903 000 000

Shear Vane No: 1362 Client: Hughes Developments Ltd Client Ref. : N/A Logged By: KF Reviewed By : JRW **Date**: 26/09/2019 Hole Depth : 0.3 m

**Latitude**: -43.623145

		1	2903.000.000	Hole Diame						Lor		de : 17			
n BGL)		ymbol	DESCRIPTION	I	Symbol	ר (mRL)	evel	Cond.	ency/ Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Scala	Pen	etrom	eter
Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	ı	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Undraine Strengt Peak/Re	2		s pei	100n 8 1	nm  0 1
-	TOPSOIL	ML	SILT with some sand and trace ro Low plasticity. Sand, fine [TOPSC	otlets; brown.				М	S-F						
-			End of Hole Depth: 0.3 m Termination Condition: Practical n	efusal	<u> </u>										
_															:
0.5 -															
-															
-															
-															
1.0-															
-															
-															
-															
	1														:
-											Ι :	•			:



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Scala Penetrometer met practical refusal at 0.6 m depth.

Standing groundwater was not encountered.

A = ALLUVIUM

Client : Hughes Developments Ltd Client Ref. : N/A Date : 26/09/2019 Hole Depth: 0.4 m

Shear Vane No: 1362 Logged By: KF Reviewed By: JRW Latitude : -43.62252

Hole Diameter : 50 mm Longitude: 172.396508 Shear Vane Undrained Shear Strength (kPa) Peak/Remolded Graphic Symbol Elevation (mRL) Depth (m BGL) JSCS Symbol Moisture Cond. Consistency/ Density Index Scala Penetrometer Water Level **DESCRIPTION** Material Blows per 100mm 6 8 10 12 SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL]. TOPSOIL S-F ML М SILT with minor sand, trace rootlets and gravel; greyish brown. Low plasticity. Sand, fine. ⋖ S-F ML End of Hole Depth: 0.4 m Termination Condition: Practical refusal 0.5 SEOTECH HAND AUGER 2019.09.30 - KF HA LOGS.GPJ NZ DATA TEMPLATE 2.GDT 1/10/19 1.0-Hand auger met practical refusal at 0.4 m depth on inferred gravel.



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Client Ref. : N/A **Date**: 26/09/2019 Hole Depth: 0.4 m

Shear Vane No: 1362 Logged By: KF Reviewed By : JRW Latitude : -43.62205

		ı	2903.000.000	Hole Diame	eter : 5	60 mm					gitud	de : 1	72.3	3968	378	
3GL)		Symbol			/mbol	mRL)	<u></u>	ond.	dex	'ane Shear (kPa) nolded		Scal	a Pe	eneti	romete	er
Depth (m BGL)	Material	USCS Syr	DESCRIPTION	I	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Blov	ws p	er 1	00mm	ı
<u>ă</u> _	TOPSOIL	ML	SILT with some sand and trace ro Low plasticity. Sand, fine [TOPSC	IL].	5 1/2 3 1/2 1/2 3 1/2 1/2 3 1/2 1/2 3 1/2		M	M	ŏă s	2.00	•	4	6	8	3 10	12
_	ALLUVIUM	ML	SILT with some sand and trace gr brown. Low plasticity. Sand, fine. Becomes wet from 0.3 m depth.	avel; greyish				W	S-F				· · · · · · · · · · · · · · · · · · ·	\ \ \		
_			End of Hole Depth: 0.4 m Termination Condition: Practical r	efusal			ļ									····
0.5 -																
_	-															
-																
_																
_																
1.0-																
-	1										:	:	÷			:
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-	_															
-																



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Client Ref. : N/A **Date**: 26/09/2019 Hole Depth : 0.4 m

Shear Vane No: 1362 Logged By: KF Reviewed By : JRW

Latitude : -43.621533

Depth (m BGL)	USCS Symbol	DESCRIPTION	I	Graphic Symbol	Elevation (mRL)	_	ond.	-, X	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Scala	a Pene	tromet	er
	USCS			.2	ion (	Leve	Moisture Cond.	Consistency/ Density Index	sar Va lined a ligth (					
				Graph	Eleva	Water Level	Moist	Consi Densi	Sh Undra Stre	2			100mr 8 10	m ) 12
	ML	SILT with some sand and trace ro Low plasticity. Sand, fine [TOPSO	otlets; brown. IIL].	17 - 30 19 - 3				S-F		•				
ALLUVIUM	ML	SILT with some sand, trace rootle greyish brown. Low plasticity. San	ts and gravel; d, fine.				M	F-St						
		End of Hole Depth: 0.4 m Termination Condition: Practical re	efusal									•		
0.5 -												:		
-														
											:			
-														:
-														
1.0-														
1.0												:		
-														
-														
											:			:
														:
-												:		:
														:
1.5										<u> </u>	<u>:</u>	<u>:</u>	<u>: :</u>	<u> </u>



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Client Ref. : N/A **Date**: 26/09/2019 Hole Depth : 0.6 m

Shear Vane No: 1362 Logged By: KF Reviewed By : JRW Latitude: -43.621591

		1	2903.000.000	Hole Diame					ı	Lor		de : -43. de : 172.			
Depth (m BGL)		USCS Symbol	DESCRIPTION	I	Graphic Symbol	Elevation (mRL)	evel	Moisture Cond.	tency/ Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Scala P	Peneti	rome	ter
Depth (	Material	nscs			Graphic	Elevatic	Water Level	Moistur	Consistency/ Density Index	Shea Undrair Streng Peak/F	2	Blows	per 1		m ) 1:
-	TOPSOIL	ML	SILT with some sand and trace ro Low plasticity. Sand, fine [TOPSO	otlets; brown. JL].	7			М	F-St		•	•			
- 0.5 -	ALLUVIUM	ML	Sandy SILT with minor gravel and greyish brown. Low plasticity. San medium. Gravel, fine, subangular subrounded.	d. fine to					St-VSt						
_	-		End of Hole Depth: 0.6 m Termination Condition: Practical re	efusal					L			•		•	
_	_												$ \sqrt{} $	/	
=	_												\		
1.0 <del></del> -															
_	_												<		
_	_														
	I														



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF Reviewed By : JRW

Max Test Pit Depth : 2 m Digger Type/Size : Bucket Excavator Latitude : -43.624847 Bucket Type/Size : 24 Tonne Longitude: 172.398351

						Bucket Type/Size . 2	4 1011110	7					F. 172.390	JJ 1	
Depth (m BGL)	Material	Easier (Relati	vatab ve S	Harder (all chilis	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Pe	er 100r	
-	TOPSOIL				ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	17 · 34 · 14 · 31 · 31 · 31 · 31 · 31 · 31				S-F		ļ		
0.5 -					GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.					MD-D				^>
1.0-	ALLUVIUM					Sandy fine to coarse GRAVEL with trace silt; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M					
1.5 -					GW						MD-D				
2.0						Depth of Excavation: 2 m	X					_			
- -						Termination Condition: Target depth									
2.5															
Z.5  Test Scal Stan															
	"			1											
Scal Star	la Po	met tar enetror g grour	neter	met	pract	ical refusal. t encountered.									



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF Max Test Pit Depth: 2.2 m Reviewed By: JRW

Digger Type/Size : Bucket Excavator Latitude : -43.624318 **Longitude**: 172.398695 Bucket Type/Size : 24 Tonne

			120	,00.0	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Bucket Type/Size	24 Tonn	Э				Longitude	: 17	2.39	3695	
Depth (m BGL)	Material			ability Scale Harder Harder	ymbc	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)		ows	per 1	ometer 00mm 10 12
-	TOPSOIL			<del>_</del>	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	1/ · 2/ · 1/  1/ · 2/ · 1/  · 2/ · 1/  · 2/ · 1/  · 2/ · 2/  · 2/			_	S-F		•			10 12
- 0.5 - -					ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.	N / 2			M	St					
1.0	ALLUVIUM				GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.					MD-D					
1.5 -	ALLU				GW	Sandy fine to coarse GRAVEL with trace cobbles and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				w	MD-D					
- - - <del>2.5</del>	-					Depth of Excavation: 2.2 m Termination Condition: Target depth										
Sca	ala P	eneti	romet	t deptler me	t pract	ical refusal. t encountered.										



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF

Max Test Pit Depth : 2 m Reviewed By : JRW Digger Type/Size : Bucket Excavator Latitude : -43.624326 Bucket Type/Size : 24 Tonne **Longitude**: 172.399585

(T)		Exc	cavata	ability	0	Bucket Typeroize 1.2				.pc	- X		Scala Penetror	neter
Depth (m BGL)	Material	Easier ()	ative	(Scale) Harder	) y	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Blows per 100	)mm 10 12
-	TOPSOIL				ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	7 · 3 · 3 · 3 · 3 · 3 · 3 · 3 · 3 · 3 ·				S		<b>!</b>	
0.5 -					ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.				M	F-St			
- - 1.0—	Σ				GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brow. Well graded, subangular to subrounded. Sand, fine to medium.					MD-D			
1.5 -	ALLUVIUM					Sandy fine to coarse GRAVEL; grey. Well graded, subangular to subrounded. Sand, fine to coarse.  Trace cobbles from 1.3 m depth.	XXX			w				
- - -					GW	Trace silt from 1.7 m depth.					MD-D			
2.0					<u> </u>	Depth of Excavation: 2 m Termination Condition: Target depth								
- 2.5														
Sca	la P	enetr	omet	t depth er me vater w	t pract	ical refusal. t encountered.								



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF Reviewed By : JRW Max Test Pit Depth : 2 m

Digger Type/Size : Bucket Excavator Latitude : -43.62379 **Longitude**: 172.397622 Bucket Type/Size : 24 Tonne

					••••		Bucket Type/Size :	24 Tor	ne					Longitud	e: 1/2.	39/62	<u> </u>	
Depth (m BGL)	Material	Easier Syx3	avatal tive S	Harder Harder	USCS Symbol	DESC	CRIPTION	Graphic Symbol		Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)		a Penovs per		mm
_	TOPSOIL				ML	SILT with some sa brown. Low plastic [TOPSOIL].	and and trace rootlets; city. Sand, fine	17.34.	<u>,, , , , , , , , , , , , , , , , , , ,</u>				S-F					
0.5			:: -:-		ML	rootlets; greyish bi Sand, fine.	and, trace gravel and rown. Low plasticity.					М	St		•	•		
-					GW	Sandy fine to med some silt and trace brown. Well grade subrounded. Sand	ed, subangular to						MD-D					>
1.0-	ALLUVIUM		•			cobbles and rootle	se GRAVEL with trace ets; grey. Well graded, rounded. Sand, fine to				•							
1.5 -	∢				GW	Sand becomes so depth.	me from 1.6 to 1.8 m					W	MD-D					
2.0						Depth of Excavation	on: 2 m											
						Termination Cond	ition: Target depth											
2.5																		
Z.5  Test Scale Stan																		
Scal	la Pe	met ta enetro	mete	r met	pract	ical refusal. t encountered.												



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000 Client : Hughes Developments Ltd Shear Vane No : N/A
Date : 23.09.19 Logged By : KF
Max Test Pit Depth : 2 m Reviewed By : JRW

Digger Type/Size: Bucket ExcavatorLatitude: -43.623868Bucket Type/Size: 24 TonneLongitude: 172.40069

					Buoket Type/OIZe : 2							
Depth (m BGL)	Material	cavatabili lative Sca		USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer  Blows per 100mm  2 4 6 8 10 12
_	TS			ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	11 · 37·14 · 37 · 37				S		•
-				ML	Sandy SILT with some gravel and trace rootlets; greyish brown. Low plasticity. Sand, fine. Gravel, fine to medium, subangular to subrounded.					St		
0.5 -					Sandy fine to coarse GRAVEL with trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.	なな			М			
1.0	ALLUVIUM		-	GW	Sand becomes fine to coarse from 1.0 m depth.  Trace cobbles from 1.1 m depth.	C C C C C C C C C C C C C C C C C C C				MD-D		
1.5 - - - -					No rootlets from 1.4 m depth.  Sand becomes some from 1.5 to 1.6 m depth.				w			
2.0-	-				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5	-											·

Test pit met target depth. Scala Penetrometer met practical refusal. Standing groundwater was not encountered

GEOTECH TEST PIT LOG 2019.09.24 - KF TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 1/10/19



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF

Reviewed By : JRW Max Test Pit Depth: 2.2 m Digger Type/Size : Bucket Excavator Latitude : -43.623107 Longitude: 172.399274 Bucket Type/Size : 24 Tonne

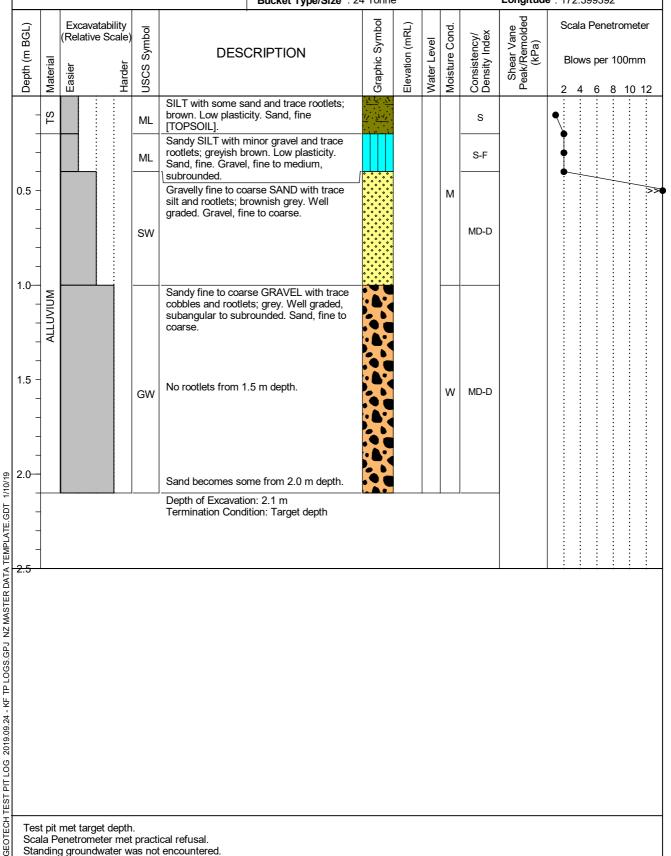
J. (		Exc	cavata	ability	<u></u>		Bucket Type/Size				nd.	~ ×	e pep	Scala I		ter
Depth (m BGL)	Material	Easier (	auve	(elass Harder	USCS Symbol	DESC	CRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Blows 2 4	100m 3 10	
_	TOPSOIL				ML	SILT with some sa brown. Low plastic [TOPSOIL].	and and trace rootlets; ity. Sand, fine	17 - 77 - 71 17 - 77 - 71				S		•		
0.5 -					ML	SILT with some sa greyish brown with plasticity. Sand, fir	and and trace gravel; a orange mottles. Low ne.				M	St				
- - 1.0- - -	ALLUVIUM					rootlets; brownish subangular to subr medium. No silt from 1.0 m Sand becomes fine	rounded. Sand, fine to								(	
- - 1.5 - - -	ALLU				GW	depth.  Trace cobbles from  Trace rootlets from	n 1.4 m depth. n 1.5 to 1.6 m depth.				w	MD-D				
- 2.0 <del></del> -																
-	-					Depth of Excavation Termination Condi	on: 2.2 m tion: Target depth									
2.3																



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Shear Vane No: N/A Logged By: KF Date: 23.09.19

Max Test Pit Depth: 2.1 m Reviewed By: JRW Digger Type/Size : Bucket Excavator Latitude: -43.622307 Bucket Type/Size : 24 Tonne Longitude: 172.399392



Test pit met target depth. Scala Penetrometer met practical refusal. Standing groundwater was not encountered



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Shear Vane No: N/A **Date**: 23.09.19 Logged By: KF Max Test Pit Depth : 2 m Reviewed By: JRW

Digger Type/Size : Bucket Excavator Latitude : -43.621693 **Longitude**: 172.398888 Bucket Type/Size : 24 Tonne

						Bucket Type/Size .	24 101111						£ . 172.390000	
Depth (m BGL)	Material	Exc (Rela )	avatal ative S	cale)	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetr Blows per 1	00mm
-	TS				ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	17 - 77 - 74				F		•	
_					ML	Sandy SILT with trace gravel and rootlets; brownish grey. Low plasticity. Sand, fine.					F-St		Í	
0.5 -						Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.	XX							•
1.0-	Σ					No silt or rootlets from 0.9 m depth.	X			м				
_	ALLUVIUM					Becomes grey from 1.0 m depth.				IVI	MDD			
1.5 -	AL				GW	Trace cobbles from 1.2 m depth.					MD-D			
-						Trace rootlets from 1.6 m depth.								
2.0						Sand becomes some from 1.9 m depth.  Depth of Excavation: 2 m	X							
MPLA1E.GD1 1/10/19						Termination Condition: Target depth								
2.5														
GEOTECH IEST PILLOG ZOTBUBY, 24 - KF IPLOGS, GPU NZ MAS IEK DATA IEMPLATE, GDI 75 C S 20 C S S S S S S S S S S S S S S S S S S														
Tes Sca Star	la P	enetro	arget onete	r met	practi	ical refusal. Ex	cavation	comp SOIL	letec	l in fo	orested a	area.		



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF

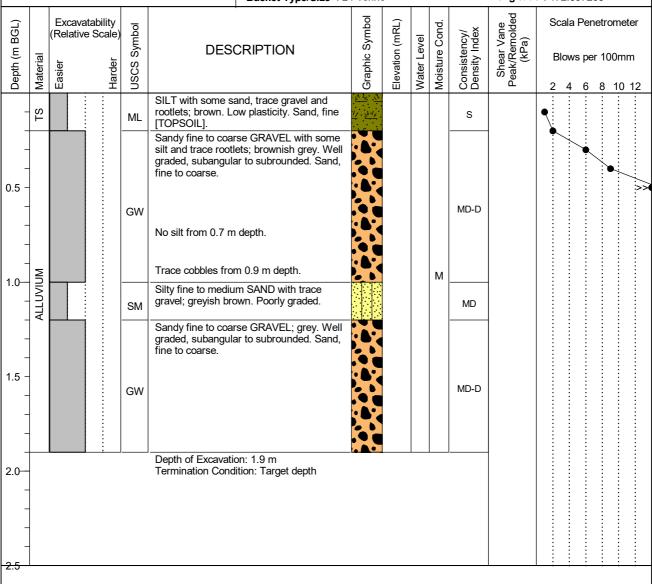
Max Test Pit Depth : 2 m Reviewed By : JRW Digger Type/Size : Bucket Excavator Latitude : -43.623285 Bucket Type/Size : 24 Tonne Longitude: 172.398781

						Bucket Type/Size . 2	4 1011110	7				Longitud	9.17	2.000	77 0 1		
Depth (m BGL)	Material	Easier )	cavatal ative S	y (elso Harder Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)		ows	eneti per 1	00m	ım
-	TOPSOIL		:		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	1/ · 2/ /2 · 2/ ·				S		•				
0.5 -					ML	Sandy SILT with trace gravel; greyish brown. Low plasticity. Sand, fine.					F-St						
1.0-	ALLUVIUM					Gravel becomes minor from 0.8 m depth.  Sandy fine to coarse GRAVEL with some silt and trace cobbles; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.  No silt from 1.2 m depth.				M						<del>\</del>	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\
1.5 -					GW	Sand becomes some from 1.6 to 1.6 m depth.					MD-D						
2.0				<u>:</u>		Depth of Excavation: 2 m Termination Condition: Target depth											
2.5	-													:		<u>:</u>	<u>:</u>
2.0   5   E																	
Tes Sca Sta	la P	enetr	target of	r met	practi	ical refusal. : encountered.											



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000 Client : Hughes Developments Ltd Shear Vane No : N/A
Date : 23.09.19 Logged By : KF
Max Test Pit Depth : 1.9 m Reviewed By : JRW

Digger Type/Size : Bucket Excavator Latitude : -43.622695
Bucket Type/Size : 24 Tonne Longitude : 172.397203



Test pit met target depth. Scala Penetrometer met practical refusal. Standing groundwater was not encountered

GEOTECH TEST PIT LOG 2019.09.24 - KF TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 1/10/19

TS = TOPSOIL



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF

Reviewed By : JRW Max Test Pit Depth : 2 m Digger Type/Size : Bucket Excavator Latitude: -43.622004 Bucket Type/Size : 24 Tonne **Longitude**: 172.397686

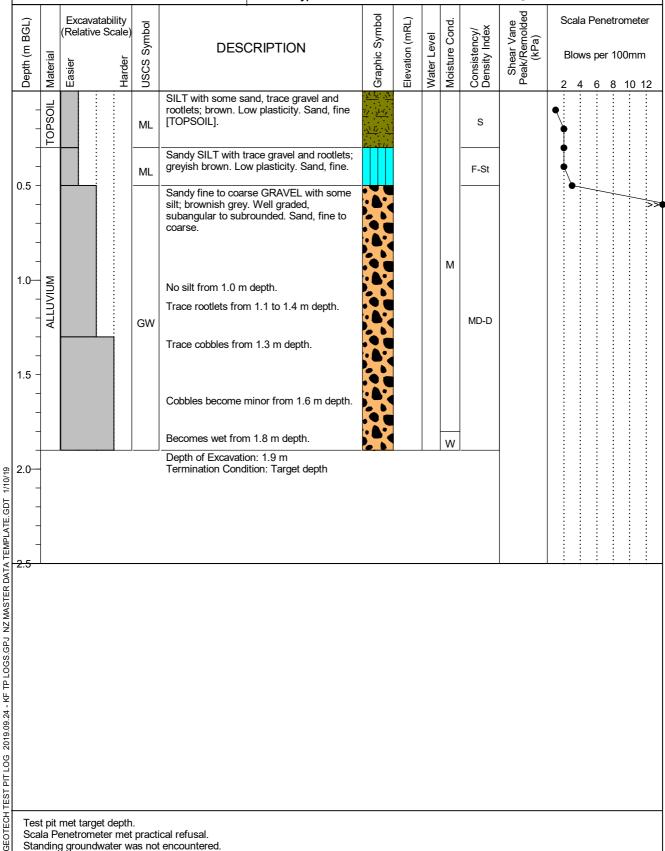
BGL)		Exc (Rela	avatal	oility Scale)	Symbol	Bucket Type/Size . 2			le/	Cond.	ncy/ idex	Vane molded gal		cala			mete	er
Depth (m BGL)	Material	Easier		Harder	USCS Sy	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	2 2	Blows	s pe		0mm	
_	TOPSOIL				ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	17.34.7 17.34.7 18.31				S		•					
0.5 -					ML	Sandy SILT with trace gravel and rootlets; greyish brown with orange mottles. Low plasticity. Sand, fine.					F-St			•				
1.0	ALLUVIUM					Sandy fine to coarse GRAVEL with some silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.  No silt from 1.1 m depth.				M						+		/Ā
1.5 -	A				GW	Trace cobbles from 1.3 m depth.  Becomes wet from 1.6 m depth.					MD-D							
2.0-						Depth of Excavation: 2 m Termination Condition: Target depth				W								
- -																		
2.5	•																·	-
Z.5  Tess Sca Star																		
Sca	la P	enetr	arget omete	r met	practi	ical refusal. encountered.												



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Shear Vane No: N/A Logged By: KF Date: 23.09.19 Reviewed By: JRW

Max Test Pit Depth : 1.9 m Digger Type/Size : Bucket Excavator Latitude: -43.622004 Bucket Type/Size : 24 Tonne Longitude: 172.398351



Test pit met target depth. Scala Penetrometer met practical refusal.

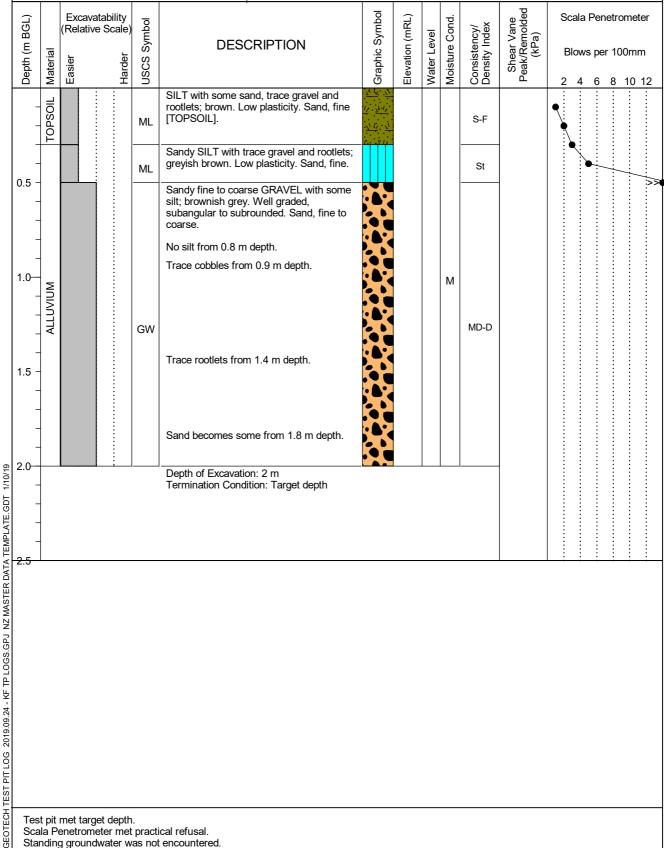


Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

Client: Hughes Developments Ltd Shear Vane No: N/A Logged By: KF Date: 23.09.19

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

Latitude: -43.621142 Bucket Type/Size : 24 Tonne Longitude: 172.39774



Test pit met target depth. Scala Penetrometer met practical refusal.



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF Reviewed By : JRW Max Test Pit Depth : 2 m

Digger Type/Size : Bucket Excavator Latitude : -43.621724 Bucket Type/Size : 24 Tonne **Longitude**: 172.396442

					Bucket Type/Size . 2	+ 1011110	•				Longitud	6 . 17	2.090	)442		
Depth (m BGL)	Material	Excavatabil (Relative Sc io io io io io io io	Harder (ella	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)		ows	enetr per 10	00mn	n
-	TOPSOIL			ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].	1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1				S		•				
	Ė			ML ,	Sandy SILT with trace gravel and rootlets; greyish brown. Low plasticity. Sand, fine.					St			·			
0.5	_				Sandy fine to coarse GRAVEL with some silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to coarse.											/ <u>X</u>
-					No silt from 0.8 m depth.	75										
1.0-	ALLUVIUM			GW	Trace cobbles from 1.0 m depth.				М	MD-D						
1.5 -					Sand becomes some from 1.4 m depth.											
-	-					8										
6,0					Depth of Excavation: 2 m Termination Condition: Target depth											
GDT 1/					remination Condition. Target depth											
PLATE.													:			
₩ 2.5																
GEOTECH TEST PIT LOG 2019.09.24 - KF TP LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 1/10/19 S S S S S S S S S S S S S S S S S S S																
09.24 - KF TP																
G 2019.0																
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CH TES	.4 : 14	mot townst 1														
Sta	ala P	met target de enetrometer g groundwate	met p	oracti s not	ical refusal. : encountered.											



Geotechnical Investigation 708 & 710 Selwyn Road Rolleston 12903.000.000

**Date**: 23.09.19 Logged By: KF Reviewed By : JRW Max Test Pit Depth : 2 m

Digger Type/Size : Bucket Excavator Latitude: -43.622035 **Longitude**: 172.396163 Bucket Type/Size : 24 Tonne

		•			00.0	,,,,	Bucket Type/Size :	24 Tonne	Э				Longitude	: 17	72.39	9616	3		
Depth (m BGL)	Material	Excar (Relati			USCS Symbol	DESC	CRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Е	cala l	s per	100	)mn	n
	TOPSOIL M	ŭ.		Ĩ	МL	SILT with some sa rootlets; brown. Lo [TOPSOIL].	and, trace gravel and ow plasticity. Sand, fine			M	M	S-F	а.	2	<u>4</u> •	6	8	10	12
0.5 -					GW	Sandy fine to med some silt and trace brown. Well grade subrounded. Sand	d, subangular to					MD-D		•	<del>\</del>	÷	÷	<u></u>	 >>>
- 1.0—			_			rootlets; grey. Wel subrounded. Sand No rootlets from 0					M								
-	ALLUVIUM				GW	Trace cobbles from	n 1.0 m depth.				101	MD-D							
1.5 -						Sand becomes so depth.	me from 1.5 to 1.6 m												
2.0		·				Depth of Excavation	on: 2 m	R											
2.0 — — — — — — — — — — — — — — — — — — —						Termination Cond	on. 2 m ition: Target depth												
2.5														- :	<u>:</u>			<u>:</u>	<u>:</u>
ACCITICAL TOO SUBJUST OF THE COORDINATION OF T																			
Tasi	t nit	mot to:	raot :	donth															
Sca Star	la P	met tar enetror g grour	nete	r met	pract	ical refusal. t encountered.													_



# **APPENDIX 3:**

ECan Borelogs



Bore or Well No	M36/4553
Well Name	SELWYN RD
Owner	MILLS .J



Well Number	M36/4553	File Number	CO6C/02405
Owner	MILLS .J	Well Status	Not Used
Street/Road	SELWYN RD	NZTM Grid Reference	BX23:51477-69781
Locality	ROLLESTON	NZTM X and Y	1551477 - 5169781
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	33.00m	Water Level Count	0
Diameter	150mm	Initial Water Level	5.79m below MP
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	35.21m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 2.5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	10	Calc Min 95%	8.30m below MP
Aquifer Name	Linwood Gravel	Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	01 Nov 1992	Max Tested Yield	6 l/s
Driller	Smiths Welldrilling	Drawdown at Max Tested Yield	8 m
Drilling Method	Unknown	Specific Capacity	0.71 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type	Unknown	Last Field Check	
Water Use Data	No		

#### Borelog for well M36/4553

Grid Reference (NZTM): 1551477 mE, 5169781 mN

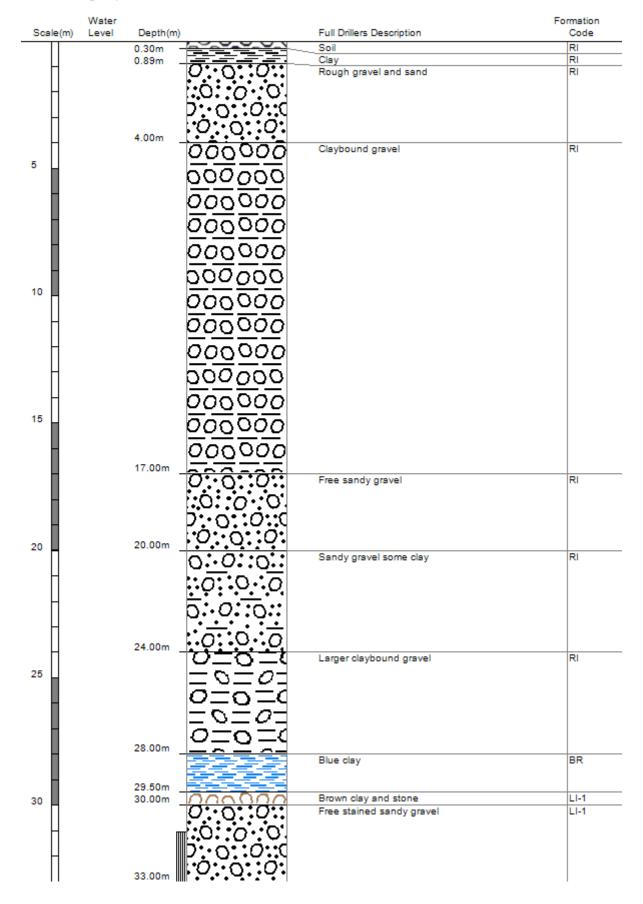
Location Accuracy: 50 - 300m

Ground Level Altitude: 35.2 m +MSD Accuracy: < 2.5 m

Driller: Smiths Welldrilling Drill Method: Unknown

Borelog Depth: 33.0 m Drill Date: 01-Nov-1992





Bore or Well No	M36/20687
Well Name	SELWYN ROAD
Owner	MR G M SOLE



Well Number	M36/20687	File Number	CO6C/32644
Owner	MR G M SOLE	Well Status	Active (exist, present)
Street/Road	SELWYN ROAD	NZTM Grid Reference	BX23:51357-69910
Locality	ROLLESTON	NZTM X and Y	1551357 - 5169910
Location Description		Location Accuracy	2 - 15m
CWMS Zone	Selwyn - Waihora	Use	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	36.00m	Water Level Count	0
Diameter	150mm	Initial Water Level	
Measuring Point Description	ToC	Highest Water Level	
Measuring Point Elevation		Lowest Water Level	
Elevation Accuracy		First reading	
Ground Level	0.30m below MP	Last reading	
Strata Layers	6	Calc Min 95%	
Aquifer Name		Aquifer Tests	0
Aquifer Type		Yield Drawdown Tests	1
Drill Date	12 Oct 2011	Max Tested Yield	4 l/s
Driller	East Coast Drilling	Drawdown at Max Tested Yield	2 m
Drilling Method	Rotary Rig	Specific Capacity	1.59 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type		Last Field Check	
Water Use Data	No		

# **Screens**

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Slotted PVC	34.5	36			100	500

# **Step Tests**

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
12 Oct 2011	1	3.5	46.19364	2.2	0

#### Borelog for well M36/20687

Grid Reference (NZTM): 1551357 mE, 5169911 mN

Location Accuracy: 2 - 15m

Ground Level Altitude: m +MSD Accuracy:

Driller: East Coast Drilling Drill Method: Rotary Rig

Borelog Depth: 36.0 m Drill Date: 12-Oct-2011



Scale(m)	Water Level	Depth(m)		Full Drillers Description	Formation Code
		0.60m _		soils	
Н				sand	
Н		0.50			
		2.50m _	000	sandy gravel	
П			0.00		
Н			h. 0. 0. d		
5					
			20.00		
- 1			0.00.00		
Н					
Ш			0::0::0::		
10		10.00m _	[:O::0::0]		
		_	0:0:0::	sandy gravel, some water	
Н			:0::0::0:		
Н			D::0::d		
Ш			0:0:0:0:		
П			b. 0. 0. d		
Н			0.0.0		
15			i o a		
			0.00		
П			0.00.000		
н					
- 4			100.0		
20					
Н			.00.0.		
Н					
Ц					
П			0.0.0.		
25			1.0.0		
H			0::0::0::		
Ш		27.00m	[: 0::0::0]		
			000000	claybound gravel	
- 1			00000		
- 1					
30		30.00m _	000000		
			000000000	well-rounded water-bearing gravel	
П			00000000		
Н			1000000000		
Н			000000000000000000000000000000000000000		
Ц			1000000000		
35		m	00000000		
33			555555555 5000000000 50000000000000000		
		36.00m			I

Bore or Well No	M36/3884	
Well Name	SELWYN RD	
Owner	PALMER AG & ER	



Well Number	M36/3884	File Number	CO6C/02405
Owner	PALMER AG & ER	Well Status	Active (exist, present)
Street/Road	SELWYN RD	NZTM Grid Reference	BX23:51397-69641
Locality	ROLLESTON	NZTM X and Y	1551397 - 5169641
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	24.00m	Water Level Count	2
Diameter	127mm	Initial Water Level	5.84m below MP
Measuring Point Description	ToC	Highest Water Level	5.81m below MP
Measuring Point Elevation	34.61m above MSL (Lyttelton 1937)	Lowest Water Level	6.77m below MP
Elevation Accuracy	< 2.5 m	First reading	19 Jan 1989
Ground Level	0.40m below MP	Last reading	07 Jun 1989
Strata Layers	10	Calc Min 95%	8.30m below MP
Aquifer Name	Riccarton Gravel	Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	18 Apr 1988	Max Tested Yield	1 l/s
Driller	McMillan Drilling Ltd	Drawdown at Max Tested Yield	1 m
Drilling Method	Rotary/Percussion	Specific Capacity	0.73 l/s/m
Casing Material	STEEL	Last Updated	06 Apr 2017
Pump Type	Unknown	Last Field Check	07 Jun 1989
Water Use Data	No		

#### Borelog for well M36/3884

Grid Reference (NZTM): 1551397 mE, 5169641 mN

Location Accuracy: 50 - 300m

Ground Level Altitude: 34.2 m +MSD Accuracy: < 2.5 m

Driller: McMillan Drilling Ltd Drill Method: Rotary/Percussion

Borelog Depth: 30.0 m Drill Date: 18-Apr-1988



Scale(m)	Water Level	Depth(m)		Full Drillers Description	Formation Code
		0.30m -		Earth	RI
H		1.50m	000000000	Grey gravels	RI
	5.41 <b>\$</b> 5.37	-		Sandy gravels	RI
15		10.00m _	000000 000000 000000 000000	Claybound gravels	RI
20		17.50m _	0:0:0:0 0:0:0:0 0:0:0:0 0:0:0:0	Sandy claybound gravels	RI
25		25.00m	600000000 00000000 00000000 00000000 0000	Free gravels	RI
-~ H		25.29m -		Blue clay	BR
		27.00m _	00000000	Blue gravels  Peat and clay	BR BR
		28.50m _	000000000	Free gravels, Brown water	LI-1

Bore or Well No	M36/6902
Well Name	Springston Rolleston Road
Owner	Mr A J Cartwright



Well Number	M36/6902	File Number	CO6C/17606
Owner	Mr A J Cartwright	Well Status	Active (exist, present)
Street/Road	Springston Rolleston Road	NZTM Grid Reference	BX23:51267-70000
Locality	Rolleston	NZTM X and Y	1551267 - 5170000
Location Description		Location Accuracy	10 - 50m
CWMS Zone	Selwyn - Waihora	Use	Irrigation, Domestic Supply
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	42.00m	Water Level Count	0
Diameter	150mm	Initial Water Level	6.40m below MP
Measuring Point Description	toc	Highest Water Level	
Measuring Point Elevation	34.65m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.30m below MP	Last reading	
Strata Layers	9	Calc Min 95%	12.00m below MP
Aquifer Name	Linwood Gravel	Aquifer Tests	0
Aquifer Type		Yield Drawdown Tests	1
Drill Date	29 Aug 2001	Max Tested Yield	23 l/s
Driller	Smiths Welldrilling	Drawdown at Max Tested Yield	12 m
Drilling Method	Rotary Rig	Specific Capacity	1.88 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type		Last Field Check	
Water Use Data	No		

## **Screens**

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	25.5	27				
2	Stainless steel	39	42				

# **Step Tests**

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
29 Aug 2001	1	22.6	298.278961	12	1

#### No comments for this well

Borelog for well M36/6902 page 1 of 2

Grid Reference (NZTM): 1551267 mE, 5170001 mN

Location Accuracy: 10 - 50m

Ground Level Altitude: 34.4 m +MSD Accuracy: < 0.5 m

Driller: Smiths Welldrilling Drill Method: Rotary Rig

Borelog Depth: 42.0 m Drill Date: 29-Aug-2001



Scale(m)	Water Level	Depth(m)		Full Drillers Description	Formation Code
- Julian Care (III)	Level	0.30m	6000000	Soil	RI
		0.30m	000000	_ Soil	RI
5		0.30m	000000 000000 000000 000000 000000	Soil Claybound gravels	RI Ri
		10.00m	000000		
10		10.00m	000	Claybound gravels	RI
15				Claybound sandy gravels	RI

Bore or Well No	M36/7928	
Well Name	SELWYN ROAD	
Owner	RP & EM YATES	



Well Number	M36/7928	File Number	CO6C/02264
Owner	RP & EM YATES	Well Status	Active (exist, present)
Street/Road	SELWYN ROAD	NZTM Grid Reference	BX23:51567-70040
Locality	ROLLESTON	NZTM X and Y	1551567 - 5170040
Location Description		Location Accuracy	10 - 50m
CWMS Zone	Selwyn - Waihora	Use	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	37.00m	Water Level Count	0
Diameter	150mm	Initial Water Level	7.60m below MP
Measuring Point Description	ToC	Highest Water Level	
Measuring Point Elevation	34.47m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.40m below MP	Last reading	
Strata Layers	9	Calc Min 95%	
Aquifer Name		Aquifer Tests	0
Aquifer Type		Yield Drawdown Tests	1
Drill Date	01 Jun 2005	Max Tested Yield	7 l/s
Driller	Dynes Road Drilling	Drawdown at Max Tested Yield	10 m
Drilling Method	Cable Tool	Specific Capacity	0.71 l/s/m
Casing Material	Steel	Last Updated	08 Nov 2013
Pump Type		Last Field Check	
Water Use Data	No		

# **Screens**

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	35	37				

# **Step Tests**

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Jun 2005	1	7.12	93.97107	10	4

Borelog for well M36/7928 page 1 of 2

Grid Reference (NZTM): 1551567 mE, 5170041 mN

Location Accuracy: 10 - 50m

Ground Level Altitude: 34.1 m +MSD Accuracy: < 0.5 m

Driller: Dynes Road Drilling Drill Method: Cable Tool

Borelog Depth: 37.0 m Drill Date: 01-Jun-2005



Scale(m)	Water Level	Depth(m)		Full Drillers Description	Formation Code
132.2(11)		0.30m	6969	topsoil	3335
- 11		0.30m _ 0.30m	AAAAA	topsoil	
- 11	,	2.50111		medium-large gravels	
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- 11			000000		
- 11			NO COO		
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- 11			booool		
- 11			000001		
Н			200000		
- 11			$\overline{D}$		
- 11			000000		
Ц		4.00m _	$\overline{D}$		
- 11	4	4.00m	0==0==0==	medium-large gravels	
- 11			==0==0	small-medium gravels, silt bound	
5					
" H			0==0==0==		
			==0==0==0		
			<i>0</i> ≕0≕0≕		
		5.00m _		small-madium grouple silt beyond	
		5.00m	O==O==O==	small-medium gravels, silt bound small-medium gravels, firm silt	
			== 0 == 0 == 0	and meaning graves, little and	
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			E0==0==0		
	8	3.00m	0==0==0==		
	8	3.00m	0==0==0==	small-medium gravels, firm silt	
			- 🛥	medium gravels, wet silt	
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