

Submitted to:

Hughes Development Ltd
Canterbury

ENGEO Limited

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ENGEO Document Control:

Report Title	Geotechnical Investigation - 583 Ea	st Mad	disons Road, I	Rolleston	
Project No.	12903	Doc II)	23a	
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1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a geotechnical investigation of the property at 583 East Maddisons Road, Rolleston, Christchurch, as outlined in our variation proposal (ref. P2016.000.248).

The purpose of the assessment 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 fourteen 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 fourteen 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

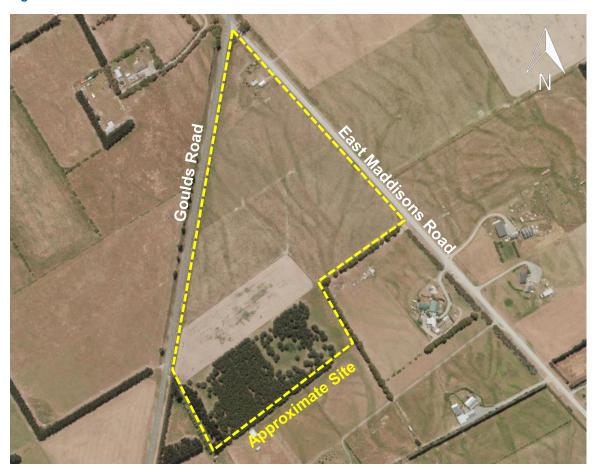
The site covers a total area of 10 ha, and has the following legal description (Selwyn District Council):

583 East Maddisons Road - Lot 1 DP 69688

It is located approximately 3.5 km south of Rolleston town centre, and is bound to the northeast by East Maddisons Road and the west by Goulds Road. Rural properties boarder the site on the remaining sides (Figure 1).



Figure 1: Site Location



Aerial photograph sourced from Canterbury Maps (retrieved December 2017). Not to scale.

3 Geological Model

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) 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, 2016) and observed during our site walkover conducted on 28 and 29 November 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 0.4 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).



3.3 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 5 km northwest / west 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).

3.3.2 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 28 November and 29 November 2017. The investigations comprised 14 hand auger boreholes and 14 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.

Soil Type	Depth to Top of Layer (m)	Layer Thickness	Density/ Consistency
Topsoil	0.0	0.1 to 0.4	Medium-Dense
Sandy GRAVEL and GRAVEL	0.1 to 0.4	Unknown	Very Dense

3.5 ECan Boreholes

A review of two deep ECan borehole logs; one located near the northern end of the site (M36/4891), west of the site (M36/4346) and two to the south (M36/7648) was conducted (Canterbury Maps). The location of these boreholes is presented in Figure 2 and includes the well points on site that have no log data available. The logs from the three holes of interest are presented in Appendix 4 and indicate the site is broadly underlain by a mixture of sandy gravels to depths of at least 28.5 m below ground level. Layers of silt are recorded in the bore well west of the site (M36/4346).



M36/4346

M36/4346

M36/7648

M36/4512

Figure 2: Nearby ECan Borehole Locations

Aerial photograph sourced from Canterbury Maps (retrieved December 2017). Not to scale.

3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 7 m and 8 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 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.

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 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.

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 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 0.3 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 December 2017, 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 Development 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 Engineers 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

Report reviewed by

Jed Watts

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Engineering Geologist

Principal Engineering Geologist

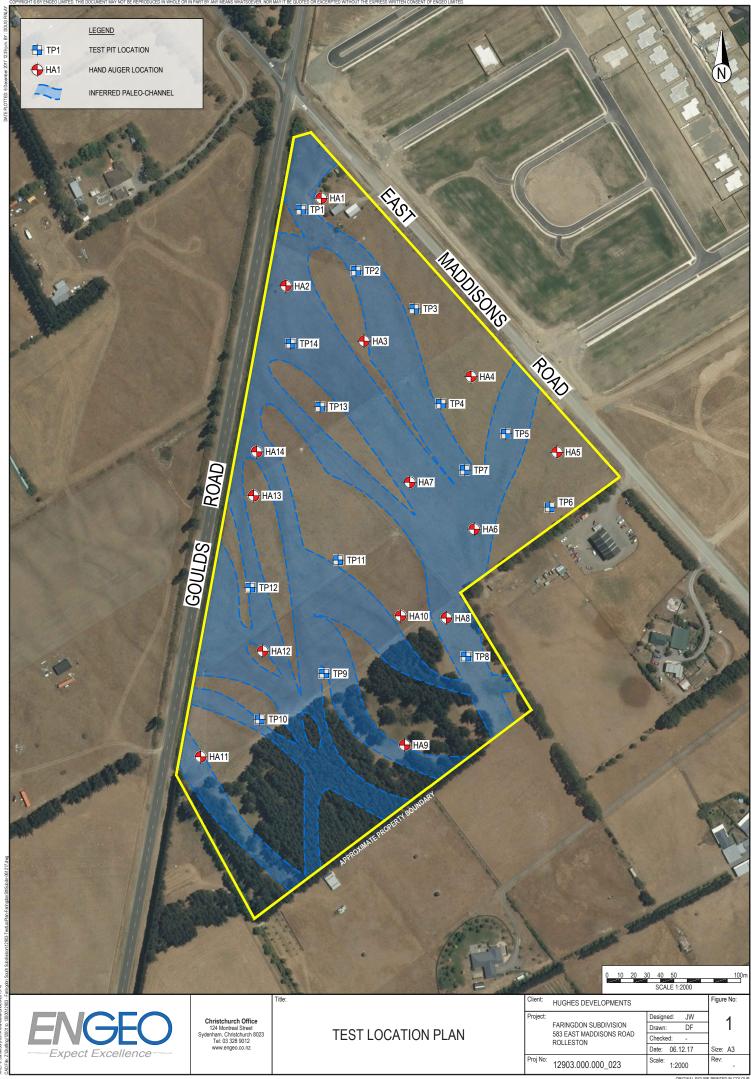




APPENDIX 1:

Site Plan and Test Locations







APPENDIX 2:

Test Pit Logs





Geotechnical Investigation 583 East Maddisons Road Rolleston 12903.000.000 - 023

Excavator met taget depth.

Scala Penetrometer met practical refusal

Standing groundwater was not encountered

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 Logged By : HB

Max Test Pit Depth: 2.1 m Reviewed By : JW Digger Type/Size : Bucket Excavator Latitude :

Longitude : Bucket Type/Size : Excavatability (Relative Scale) Graphic Symbol Scala Penetrometer Moisture Cond. Symbol Shear Vane Consistency/ Density Index Water Level Undrained **DESCRIPTION** Depth (m) Shear Strength Material Blows per 100mm Peak/Remolded Harder nscs (Easier (kPa) 4 6 8 10 12 SILT with trace rootlets; light brown. Low plasticity [TOPSOIL]. വ ML D Sandy fine to coarse GRAVEL with some cobbles; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to 0.5 Μ 1.0-Sand becomes fine to coarse from 1.0 m GW Becomes wet at 1.1 m depth 1.5 W 2.0 583 EAST MADDISONS ROAD TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 5/12/17 Depth of Excavation: 2.1 m Termination Condition: Target depth 2.5 3.0-GEOSCIENCE TEST PIT LOG



Geotechnical Investigation 583 East Maddisons Road Rolleston

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 $\textbf{Logged By}: \mathsf{HB}$ Reviewed By: JW

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Geotechnical Investigation 583 East Maddisons Road Rolleston 12903.000.000 - 023

Excavator met taget depth.

Scala Penetrometer met practical refusal

Standing groundwater was not encountered

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 Logged By : HB

Max Test Pit Depth: 2.1 m Reviewed By : JW Digger Type/Size : Bucket Excavator Latitude :

Longitude : Bucket Type/Size : Excavatability (Relative Scale) Graphic Symbol Scala Penetrometer Moisture Cond. Symbol Shear Vane Consistency/ Density Index Water Level Undrained **DESCRIPTION** Depth (m) Shear Strength Material Blows per 100mm Peak/Remolded Harder nscs (Easier (kPa) 6 8 10 12 SILT with trace rootlets; light brown. Low plasticity [TOPSOIL]. S ML D Sandy fine to coarse GRAVEL with some cobbles; brownish grey. Well graded, sub-rounded to rounded. Sand, fine to 0.5 medium. М Becomes wet at 0.7 m depth 1.0-GW W 1.5 2.0 583 EAST MADDISONS ROAD TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 5/12/17 Depth of Excavation: 2.1 m Termination Condition: Target depth 2.5 3.0-GEOSCIENCE TEST PIT LOG



Geotechnical Investigation 583 East Maddisons Road Rolleston 12903 000 000 - 023

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 $\textbf{Logged By}: \mathsf{HB}$

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Geotechnical Investigation 583 East Maddisons Road Rolleston 12903.000.000 - 023 Client: Hughes Development Ltd Shear Vane No:
Date: 28/11/17 Logged By: HB

Max Test Pit Depth : 3 m Reviewed By : JW
Digger Type/Size : Bucket Excavator Latitude :

		129			.000	- 023	Digger Type/Size Bucket Type/Size	: Bucket :	Exca	vator		Latitud Longitud					
Depth (m)	Material	Easier Sox Blad	avatal tive S	oility Scale) Harder	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	ВІ	ala Po	oer 1	00mr	m
	TS	" :	:	:		SILT with trace ro	potlets; light brown. Lov		<u> </u>		00		2	4 (0	10	
0.5 -	-				ML	plasticity [TOPSC] Sandy fine to coa cobbles; brownish sub-rounded to romedium.	ore. In grey. Well graded, Dounded. Sand, fine to	e		D M							
- 1.0 - -						Becomes wet at 1	I.0 m depth ne cobbles from 1.2 m										
- 1.5 - - -	ALLUVIUM				GW	depth.											
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2.5 - - - - -																	
- 3.0 - -	-					Depth of Excavati Termination Cond	ion: 3 m dition: Target depth		\			_					
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Geotechnical Investigation 583 East Maddisons Road Rolleston 12903.000.000 - 023 Client : Hughes Development Ltd Shear Vane No :
Date : 28/11/17 Logged By : HB

Max Test Pit Depth : 2.2 m Reviewed By : JW
Digger Type/Size : Bucket Excavator Latitude :

A Harder ML	SILT with trace roplasticity [TOPSO] Fine to coarse GR coarse sand and cowell graded, sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-sub-to-	RAVEL with some fine to cobbles; brownish grey. rounded to rounded.	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear V Undrair Shear Str Peak/Rem (kPa	ned ength nolded	Blo		enetror	
ML	plasticity [TOPSO] Fine to coarse GR coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sa	IL]. RAVEL with some fine to cobbles; brownish grey. rounded to rounded. .0 m depth	1/. · *y. · /·	3M	M	<u> </u>			2	4 6 6	8	10
	plasticity [TOPSO] Fine to coarse GR coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sand and coarse sa	IL]. RAVEL with some fine to cobbles; brownish grey. rounded to rounded. .0 m depth			M							
GW	Depth of Excavation	on: 2.2 m			W							
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	Depth of Excavation Termination Cond	on: 2.2 m lition: Target depth										
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Geotechnical Investigation 583 East Maddisons Road Rolleston

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 Logged By : HB

Max Test Pit Depth : 3 m Reviewed By: JW Digger Type/Size : Bucket Excavator Latitude :

		129	03.0	000	.000	- 023	Bucket Type/Siz			avalui		Longitud		
Depth (m)	Material	Exca (Relat Easier	vatab ive S	cale) Harder	USCS Symbol	DES	CRIPTION	6	Grapriic Symbol	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Blows	enetromete per 100mm
<u>ă</u> -		Ш	:			SILT with trace ro	potlets; light brown. L		5 ≥	ŠŽ	ŏŏ		2 4	6 8 10 ²
_	TS				ML_		RAVEL with some fir	ue to		D				
- 0.5 - - -						coarse sand and	cobbles; brownish gr -rounded to rounded	ey.	X					
- - 1.0 -						Becomes wet at a	1.0 m depth		Š	М				
- - 1.5 - -	ALLUVIUM				GW									
- 2.0— - -	AI									w				
- 2.5 - - -														
- 3.0 - - - -			<u>;</u>			Depth of Excavat Termination Cond	ion: 3 m dition: Target depth		S					
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Geotechnical Investigation 583 East Maddisons Road Rolleston

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 Logged By : HB

Max Test Pit Depth : 2.4 m Reviewed By: JW Digger Type/Size : Bucket Excavator Latitude :

		129	903.	000	.000	- 023	Digger Type/Size Bucket Type/Size		LXCa	valui		Latitud Longitud			
Depth (m)	Material	Easier (Sasa	avatal itive S	cale) Harder	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Blo		netrome r 100m 8 10
-	TS				ML	SILT with trace ro plasticity [TOPSC	ootlets; light brown. Lov DIL].	1/ 2/1/		D				•	
0.5 -					GW	coarse sand and	RAVEL with some fine cobbles; brownish grey-rounded to rounded.	do .		М					7
- - 1.5 - - -	ALLUVIUM				GW	Becomes wet at Sandy GRAVEL brownish grey. W to rounded. Sand	with some cobbles; /ell graded, sub-rounde	d		W					
2.0— - - - - 2.5 –						Depth of Excavat	ion: 2.4 m								
2.5 - - -						Termination Cond	dition: Target depth								
3.0															
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Geotechnical Investigation 583 East Maddisons Road Rolleston

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 Logged By : HB

Max Test Pit Depth : 3 m Reviewed By: JW Digger Type/Size : Bucket Excavator Latitude :

					.000	- 023	Bucket Type/Size	Bucket E				Longitude		
Depth (m)	Material	Easier Blast	avatak tive S	y (ale) Harder Harder	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Blows	Penetromet s per 100mm 6 8 10
<u> </u>	TS			<u> </u>	ML	SILT with trace ro	ootlets; light brown. Low	: 74 1× · · · 7/7	>		00		2 4	6 8 10
 0.5 	-				IVIL	Fine to coarse GF coarse sand; brow rounded.	RAVEL with some fine to RAVEL with some fine to vnish grey. Well graded, e cobbles from 0.4 m			D M				
- 1.0 								X						
- - 1.5 - - -	ALLUVIUM				GW	Becomes wet at 1	.2 m depth							
- 2.0 - -										W				
- 2.5 - - - -														
- 3.0 - - -				;		Depth of Excavati Termination Cond	on: 3 m lition: Target depth	X						
- 3.5 	<u> </u>											 		
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Geotechnical Investigation 583 East Maddisons Road Rolleston

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 Logged By : HB

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

		129	03.	000	.000	- 023	Bucket Type/Size			vator		Longitud		
Depth (m)	Material	Easier (Rela	avatal tive S	y (elso:	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)		Penetrome s per 100mi 6 8 10
	TS	<u> </u>		:	ML	SILT with trace ro	ootlets; light brown. Low		_		00		2 4	• • •
0.5 -						Sandy fine to coa cobbles: brownish	rse GRAVEL with some n grey. Well graded, nunded. Sand, fine to			D M				
1.0-	ALLUVIUM				GW	Becomes wet at 1	.2 m depth							
1.5 -										W				
2.0		;_		;		Depth of Excavati	on: 2 m lition: Target depth							
2.5 -														
3.0-														
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Geotechnical Investigation 583 East Maddisons Road

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 $\textbf{Logged By}: \mathsf{HB}$

			Rolle	eston	ns Road - 023	Max Test Pit Depth : 2 Digger Type/Size : 1 Bucket Type/Size :	2.2 m		/ator		Rev	ewed Latitu ongitu	By : ide :	JW			
Depth (m)	Material	Excav (Relativ	atability /e Scale Jau Harder Harder Jau Jau Jau Jau Jau Jau Jau Jau Jau Jau	Symbo	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Undr Shear S Peak/R	· Vane ained Strengt emolde Pa)	th ed	Scala Blow 2 4	s per	100n 8 10	nm
0.5 -	Z			ML	plasticity [TOPSO	otlets; light brown. Low olL]. rse GRAVEL with some of grey. Well graded, bunded. Sand, fine to			D M						•		\hat{\sigma}
1.0	ALLUVIUM			GW	Becomes wet at 1	.0 m depth			W								
2.0—					Depth of Excavati	on: 2 2 m											
2.5 -					Termination Cond	lition: Target depth											
3.0																	
3.5	- 							 	 						- - - -	-	-
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Exca	avato	or met t	aget dep	oth.	cal refusal		=TOPS		<u> </u>				- - - -		 - 	- - - -	



Geotechnical Investigation 583 East Maddisons Road Rolleston 12903 000 000 - 023

Client: Hughes Development Ltd Shear Vane No: Date : 28/11/17 $\textbf{Logged By}: \mathsf{HB}$

Max Test Pit Depth : 2.1 m Reviewed By: JW Digger Type/Size : Bucket Excavator Latitude :

		129	903.	000	.000	- 023						e/Siz	e :		_					ı		gitud					
Depth (m)	Material	Easier (Rela	avatal itive S	bility Scale) Harder	USCS Symbol		C	DES	CRII	PTIC	ON			Graphic Symbol	.	Water Level	Moisture Cond.	Consistency/ Density Index	vapur fucus	Shea Und Shear Peak/F	raine Stre	ed nath				netro er 10	
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Geotechnical Investigation 583 East Maddisons Road Rolleston 12903.000.000 - 023 Client : Hughes Development Ltd Shear Vane No :
Date : 28/11/17 Logged By : HB

Max Test Pit Depth : 3 m Reviewed By : JW Digger Type/Size : Bucket Excavator Latitude :

		129	03.0)OO.	.000	- 023	Bucket Type/Size					L	ongitud) :		
Depth (m)	Material	Easier (Relat	vatab ive S	tale) Harder	USCS Symbol	DES	CRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear S Peak/Re	Vane ained Strength emolded Pa)	Blo	a Pene ws per	
	TS				ML	SILT with trace ro	potlets; light brown. Lo		· <u>;</u> ,						•	
- - 0.5 - - -	-					Sandy fine to coa cobbles; brownish sub-rounded to ro medium.	rse GRAVEL with som n grey. Well graded, ounded. Sand, fine to	ne		M						•
- 1.0 -										141						
- - 1.5 - - -	ALLUVIUM				GW	Becomes wet at 1 Sand becomes fir depth.	1.2 m depth ne to coarse from 1.3 r	m								
- 2.0 										w						
- 2.5 - - - -	-															
- 3.0 							on: 3 m	3								
- - -						Termination Cond	ion: 3 m dition: Target depth									
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APPENDIX 3:

Hand Auger Borehole Logs



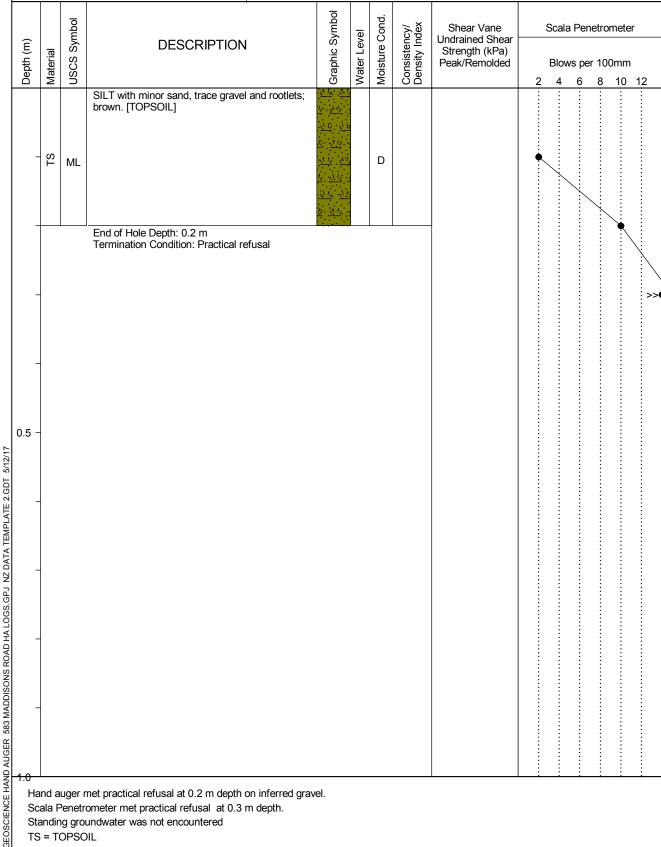


Shear Vane No: Client: Hughes Developments Ltd

 $\textbf{Logged By} : \mathsf{EG}/\mathsf{JDW}$ Client Ref. :

Date : 28/11/17 Reviewed By: JW

Hole Depth: 0.2 m Latitude : 12903.000.000 - 023 Longitude : Hole Diameter: 50 mm



Hand auger met practical refusal at 0.2 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.3 m depth. Standing groundwater was not encountered TS = TOPSOIL



Geotechnical Investigation 583 East Maddisons Road Farringdon

Shear Vane No : Client: Hughes Developments Ltd

Client Ref. : Date : 28/11/17

Logged By : EG/JDW Reviewed By: JW

		129	Farringdon 03.000.000 - 023	Hole De Hole Diame		.4 m			L	atitude: ngitude:			
Depth (m)	rial	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		Penetro		
Dept	Material	nsc			Grap	Wate	Mois	Cons	reak/Remolded	2 4	per 10 6 8	10	
-	SI	ML	SILT with trace gravel, sand and re Low plasticity [TOPSOIL]	potlets; brown.	7 24 24 24 24 24 24 24 24 24 24 24 24 24		D						
					17. 17. 17.	<u>.</u>							
			End of Hole Depth: 0.4 m Termination Condition: Practical re	efusal									
ALCE HAND AUGER 583 MADDISONS ROAD HA LOGS, GP3 NZ DATA TEMPLATE Z.GDT 5/12/17	_												

Scala Penetrometer met practical refusal at 0.4 m depth. Standing groundwater was not encountered



Geotechnical Investigation 583 East Maddisons Road Farringdon 12903 000 000 - 023

Standing groundwater was not encountered

TS = TOPSOIL

Client : Hughes Developments Ltd Shear Vane No : 1150

Client Ref. :

Logged By : EG/JDW Reviewed By: JW

Date : 28/11/17 Hole Depth : 0.5 m

Latitude :

DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION DESCRIPTION		129	03.000.000 - 023	Hole Diame				ı		gitude :				
SILT with trace sand and rootlets; brown. Low plasticity [TOPSOIL] SILT; yellowish brown. Low plasticity.	epth (m)	SCS Symbol	DESCRIPTION	I	aphic Symbol	ater Level	oisture Cond.	onsistency/ ensity Index	Undrained Shear					
- < ML	-		SILT with trace sand and rootlets; plasticity [TOPSOIL]	brown. Low	10 24 34 34 34 34 34 34 34 34 34 34 34 34 34	M		ŏă.		2 4	6	8 10	0 12	2
		ML							- 201					



Geotechnical Investigation 583 East Maddisons Road Farringdon

Shear Vane No : Client: Hughes Developments Ltd Logged By : EG/JDW

Client Ref. :

Date : 28/11/17 Reviewed By: JW Hole Depth : 0.3 m Latitude :

SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] End of Hole Depth: 0.3 m Termination Condition: Practical refusal	SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] ML ML D A A A A A A A A A A A A	SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] ML End of Hole Depth: 0.3 m Termination Condition: Practical refusal		129	03.000.000 - 023	Hole Depth Hole Diameter			ı		titud gitud				
SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] End of Hole Depth: 0.3 m Termination Condition: Practical refusal	SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] ML End of Hole Depth: 0.3 m Termination Condition: Practical refusal	SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] ML End of Hole Depth: 0.3 m Termination Condition: Practical refusal	epth (m) aterial	SCS Symbol	DESCRIPTION		raphic Symbol ater Level	oisture Cond.	onsistency/ ensity Index	Undrained Shear Strength (kPa)			s per	r 100n	nm
			-		SILT with trace gravel, sand and ro Low plasticity [TOPSOIL]						2	4	6	8 1	
	0.5 -	0.5 -	_		End of Hole Depth: 0.3 m Termination Condition: Practical re	fusal	· · · · · · · · · · · · · · · · · · ·								



Geotechnical Investigation 583 East Maddisons Road Farringdon

Shear Vane No: Client: Hughes Developments Ltd

Client Ref. :

Logged By : EG/JDW Reviewed By: JW

Date: 28/11/17 **Hole Depth**: 0.2 m

Latitude :

	129	903.000.000 - 023	Hole Dep Hole Diame						atituc gituc				
Depth (m)	USCS Symbol	DESCRIPTION	I	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2		s per	100m	
- <u>v</u>		SILT with trace gravel and rootlets plasticity [TOPSOIL]			1	D					•		
		End of Hole Depth: 0.2 m Termination Condition: Practical re	efusal										
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Client: Hughes Developments Ltd

Client Ref. :

Date : 28/11/17

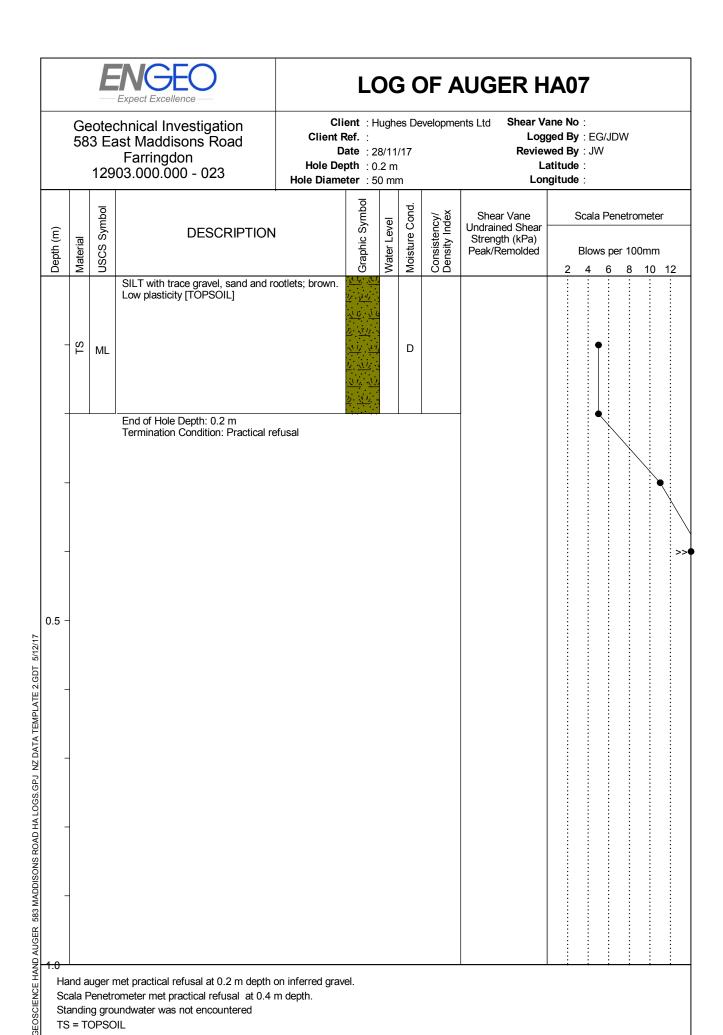
Hole Depth : 0.2 m

Shear Vane No :

Logged By : EG/JDW

Reviewed By: JW Latitude :

		129	03.000.000 - 023	Hole Depth Hole Diameter			T		gitud				
Depth (m)	rial	USCS Symbol	DESCRIPTION		Graphic Symbol Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded		la Per			
Dept	Material	nsc			Grap Wate	Mois	Cons	Peak/Remoided	2		91 TC 8	10	
-	TS	ML	SILT with trace gravel, sand and re Low plasticity [TOPSOIL] End of Hole Depth: 0.2 m			D							
			End of Hole Depth: 0.2 m Termination Condition: Practical re	fusal									
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Hand auger met practical refusal at 0.2 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.4 m depth. Standing groundwater was not encountered TS = TOPSOIL



Shear Vane No : Client: Hughes Developments Ltd

Client Ref. :

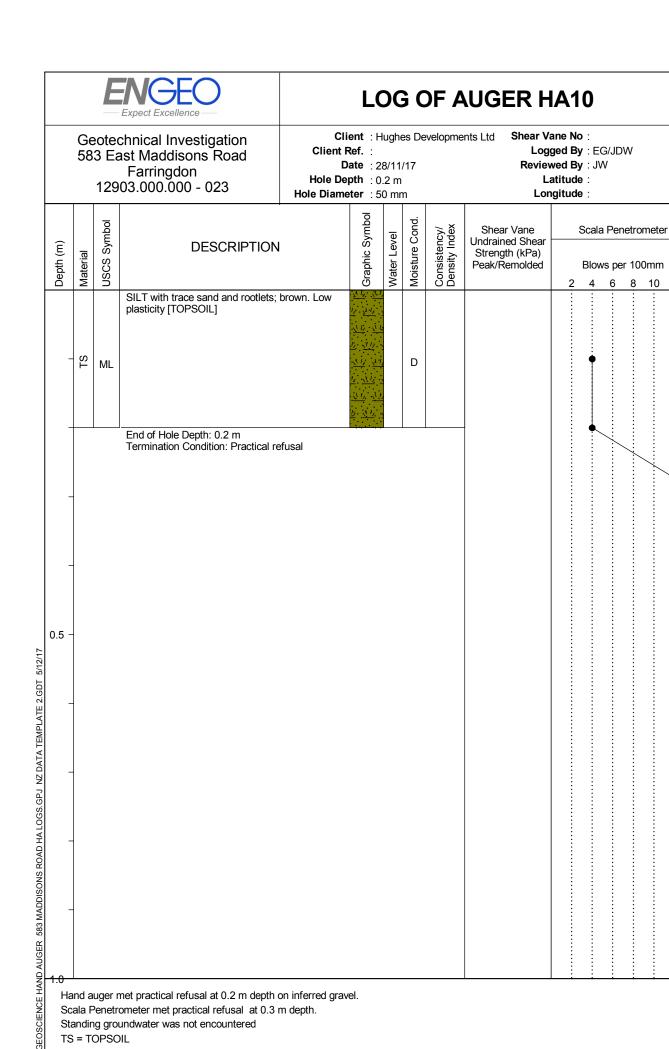
Date : 28/11/17

Reviewed By: JW

Logged By : EG/JDW

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Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2	Blov			omete 00mm 10	
	TS	ML	SILT with trace gravel, sand and re Low plasticity [TOPSOIL]	<u>/</u> / /		1	D						•		
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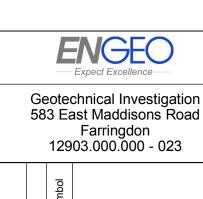
	Ge 58	3 Ea	chnical Investigation ast Maddisons Road Farringdon 03.000.000 - 023	Client F D Hole De	Client: Hughes Developments Ltd Client Ref.: Date: 28/11/17 Hole Depth: 0.2 m Hole Diameter: 50 mm Shear Vane No: Logged By: EG/JDW Reviewed By: JW Latitude: Longitude:							
Depth (m)	Material	USCS Symbol	DESCRIPTION	ı	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Blows	Penetrome per 100m 6 8 1	
_	TS	ML	SILT with trace gravel, sand and a Low plasticity [TOPSOIL]	ootlets; brown.	\$\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2}\frac{1}{2		D				•	
_			End of Hole Depth: 0.2 m Termination Condition: Practical r	efusal								
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Hand auger met practical refusal at 0.2 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.3 m depth. Standing groundwater was not encountered TS = TOPSOIL



Client: Hughes Developments Ltd Shear Vane No:

Client Ref. :

Date: 28/11/17 **Hole Depth**: 0.2 m Logged By : EG/JDW

Reviewed By : JW
Latitude :
Longitude :

12903.000.000 - 023			Hole Depth : 0.2 m Hole Diameter : 50 mm				Latitude : Longitude :							
Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2		a Penet vs per 1		n
1	TS	ML	SILT with trace gravel, sand and re Low plasticity [TOPSOIL].	potlets; brown.		1	D						•	
_			End of Hole Depth: 0.2 m Termination Condition: Practical re	efusal										•
_														
).5 –														

Hand auger met practical refusal at 0.2 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.4 m depth. Standing groundwater was not encountered

TS = TOPSOIL



Geotechnical Investigation 583 East Maddisons Road Farringdon 12903.000.000 - 023

Shear Vane No: Client: Hughes Developments Ltd

Client Ref. :

Logged By : EG/JDW Date : 28/11/17 Reviewed By: JW Hole Depth: 0.3 m Latitude : Longitude :

Hole Diameter: 50 mm

Graphic Symbol **JSCS Symbol** Moisture Cond. Consistency/ Density Index Shear Vane Undrained Shear Scala Penetrometer Water Level Depth (m) **DESCRIPTION** Material Strength (kPa) Peak/Remolded Blows per 100mm 6 8 10 12 SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] Z ML D SILT with trace sand; brownish grey. Low plasticity. ML End of Hole Depth: 0.3 m Termination Condition: Practical refusal 0.5 GEOSCIENCE HAND AUGER 583 MADDISONS ROAD HA LOGS. GPJ NZ DATA TEMPLATE 2.GDT 5/12/17 Hand auger met practical refusal at 0.3 m depth on inferred gravel.

Scala Penetrometer met practical refusal at 0.5 m depth. Standing groundwater was not encountered

TS = TOPSOIL



Geotechnical Investigation 583 East Maddisons Road Farringdon 12903.000.000 - 023

Shear Vane No: Client: Hughes Developments Ltd $\textbf{Logged By}: \mathsf{EG/JDW}$

Client Ref. :

Date : 28/11/17 Reviewed By: JW Hole Depth: 0.4 m Latitude :

Longitude : Hole Diameter: 50 mm Graphic Symbol **JSCS Symbol** Moisture Cond. Consistency/ Density Index Shear Vane Undrained Shear Scala Penetrometer Water Level Depth (m) **DESCRIPTION** Strength (kPa) Material Peak/Remolded Blows per 100mm 6 8 10 12 SILT with trace gravel, sand and rootlets; brown. Low plasticity [TOPSOIL] Z ML SILT with trace sand; yellowish brown. Low plasticity. ⋖ ML End of Hole Depth: 0.4 m Termination Condition: Practical refusal 0.5 GEOSCIENCE HAND AUGER 583 MADDISONS ROAD HA LOGS. GPJ NZ DATA TEMPLATE 2.GDT 5/12/17

Hand auger met practical refusal at 0.4 m depth on inferred gravel. Scala Penetrometer met practical refusal at 0.6 m depth. Standing groundwater was not encountered TS = TOPSOIL

A = ALLUVIUM

EXPECT Excellence
otechnical Investig B East Maddisons Farringdon

Geo gation 583 Road +arringdon

Client : Hughes Developments Ltd Shear Vane No :

Client Ref. :

 $\textbf{Logged By} : \mathsf{EG/JDW}$ Reviewed By: JW

Date : 28/11/17 Hole Depth: 0.4 m

Latitude :

	12903.000.000 - 023			Hole Depth : 0.4 m Hole Diameter : 50 mm				Latitude : Longitude :							
Depth (m)	Material	USCS Symbol	DESCRIPTION		Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	2	Scala Blow 4			00mr	
-	TS	ML	SILT with trace gravel, sand and re Low plasticity [TOPSOIL]	potlets; brown.	\$\frac{30}{0}\cdot \frac{30}{0}\cdot \frac{30}{0		N				•	\			
-	A	ML	SILT with trace sand; yellowish broplasticity.				D						•		*
0.5 -	_		End of Hole Depth: 0.4 m Termination Condition: Practical re	efusal											
-	-														
-	-														
-1.0 Ha	and a	uger r	net practical refusal at 0.4 m depth	on inferred aray	el.		Α :	= ALLUV	 					:	

Scala Penetrometer met practical refusal at 0.4 m depth. Standing groundwater was not encountered TS = TOPSOIL



APPENDIX 4:

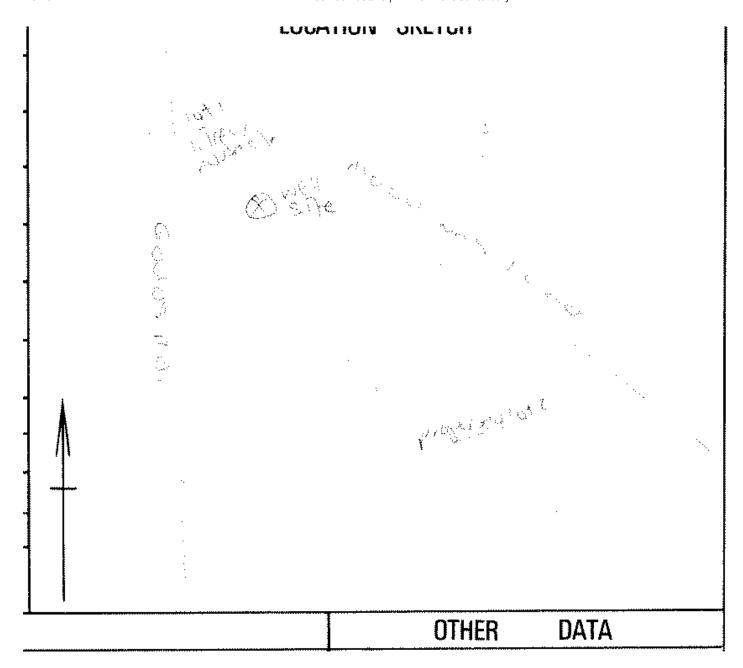
ECan Well Logs



Bore or Well No	M36/4891
Well Name	CNR MADDISONS & GOULDS ROAD
Owner	Mr & Ms B N & J A Stevens & Gray



Well Number	M36/4891	File Number	CO6C/06015
Owner	Mr & Ms B N & J A Stevens & Gray	Well Status	Active (exist, present)
Street/Road	CNR MADDISONS & GOULDS ROAD	NZTM Grid Reference	BX23:50117-70000
Locality	ROLLESTON	NZTM X and Y	1550117 - 5170000
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	25.25m	Water Level Count	0
Diameter	150mm	Initial Water Level	7.38m below MP
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	39.15m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 2.5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	6	Calc Min 95%	8.70m below MP
Aquifer Name	Riccarton Gravel	Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	05 May 1995	Max Tested Yield	8 l/s
Driller	Clemence Drilling Contractors	Drawdown at Max Tested Yield	4 m
Drilling Method	Unknown	Specific Capacity	2.25 l/s/m
Casing Material	UNKNOWN	Last Updated	08 Nov 2013
Pump Type	Unknown	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	23.25	25.25				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
05 May 1995	1	8	105.585472	3.56	4

Comments

Comment Date	Comment
	Wood and grey pug below 26.7 m to unkown depthincomplete log.

Bore Log

Borelog for well M36/4891

Grid Reference (NZTM): 1550118 mE, 5170001 mN

Location Accuracy: 50 - 300m

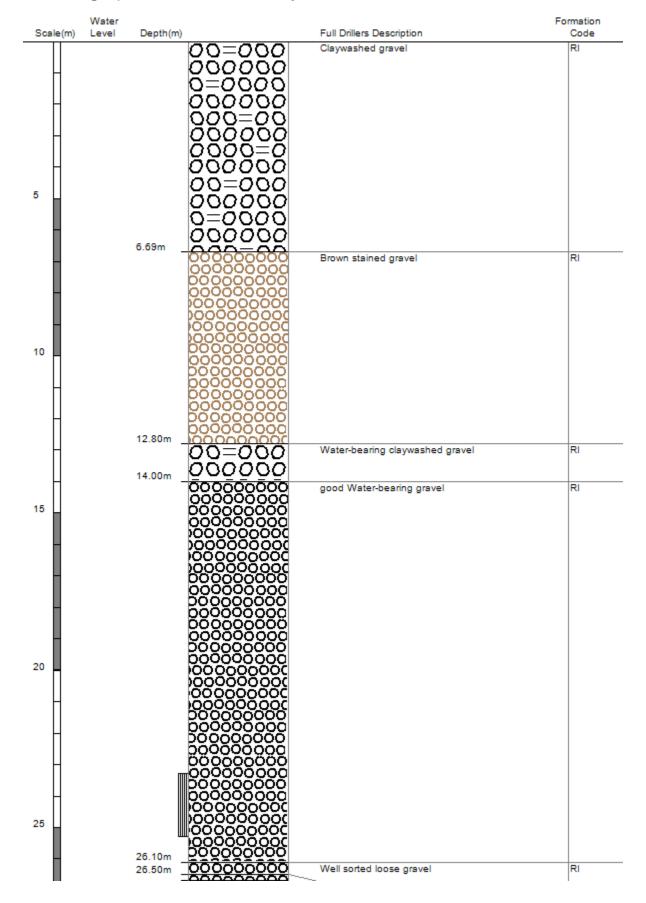
Ground Level Altitude: 39.2 m +MSD Accuracy: < 2.5 m

Driller: Clemence Drilling Contractors

Drill Method: Unknown

Borelog Depth: 26.7 m Drill Date: 05-May-1995

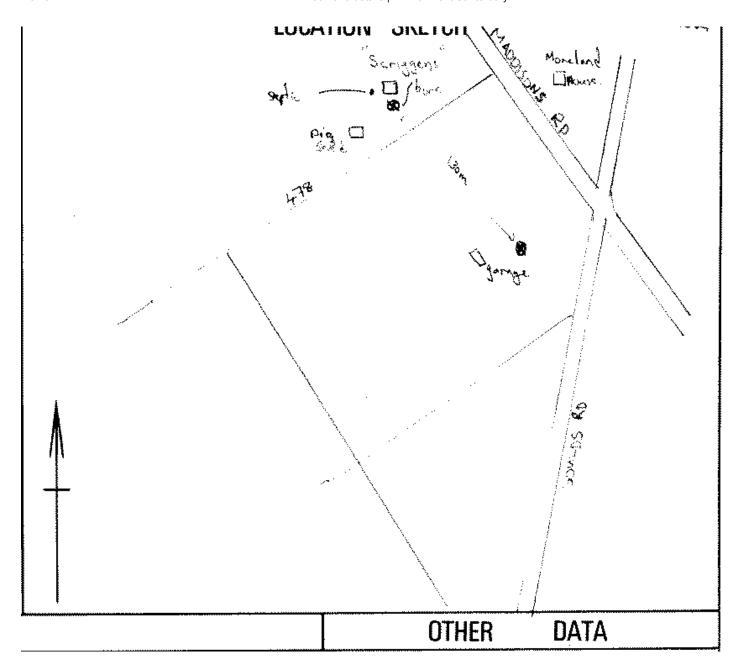




Bore or Well No	M36/4346
Well Name	CNR MADDISONS & GOULDS RDS
Owner	MAIN M.R.



Well Number	M36/4346	File Number	
Owner	MAIN M.R.	Well Status	Active (exist, present)
Street/Road	CNR MADDISONS & GOULDS RDS	NZTM Grid Reference	BX23:49967-69900
Locality	ROLLESTON	NZTM X and Y	1549967 - 5169900
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	26.80m	Water Level Count	0
Diameter	150mm	Initial Water Level	
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	39.12m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 2.5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	15	Calc Min 95%	8.50m below MP
Aquifer Name	Riccarton Gravel	Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	01 Apr 1991	Max Tested Yield	6 l/s
Driller	Dynes Road Drilling	Drawdown at Max Tested Yield	5 m
Drilling Method	Cable Tool	Specific Capacity	1.33 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type	Unknown	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	24.8	26.8				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Apr 1991	1	6.1	80.50892	4.57	4

No comments for this well

Bore Log

Borelog for well M36/4346

Grid Reference (NZTM): 1549968 mE, 5169901 mN

Location Accuracy: 50 - 300m

Ground Level Altitude: 39.1 m +MSD Accuracy: < 2.5 m

Driller: Dynes Road Drilling Drill Method: Cable Tool

Borelog Depth: 28.5 m Drill Date: 01-Apr-1991



Scale(m)	Water Level	Depth(m)		Full Drillers Description	Formation Code
\Box			No Log No Log No	Not logged	RI
Н			og No Log No Log I I No Log No Log No		
			No Log No Log No		
Н			g No Log No Log P		
			No Log No Log No No Log No Log No		
Н			og No Log No Log I		
			No Log No Log No		
Н		4.00m _	No Log No Log No	Lancata modica con al contrata	RI
			O==O== q	Large to medium gravel, small amount of silt	KI
'			F= 0 == 0 =1		
- 11		E 00	0==0==0		
н		6.00m		Silt	RI
- 11			777777		1.0
- H					
- 11		8.00m			
н		0.00111	0==0==0==	Gravel and silt	RI
- 11			000		
- 11			50=50=0		
。 I			0==0==0		
ĭП			==0==0		
			0==0==0==		
П		11.50m	F= 0 == 0		
Ш			-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0	Very tight clay, small shingle	RI
П			0=0=0=0		
Ш			D=0=0=0=0 E0=0=0=0=0		
П			O = O = O = O = O = O		
Ц		14.00m	0=0=0=0=0		
			000000	Tight clay and shingle	RI
5			200,000		
- 11			000000		
- 14		16.00m	0.32,000	-	
- 11			- 0=0=0=0	Tight clay, small gravel	RI
- 14			0=0=0=0=0		
- 11					
- 8		18.00m _	E0=0=0=0=	Clay and gravel, not as tight	RI
- 11		18.50m _	000000000	Gravel, some water	RI
H		19.00m		Tight clay gravel	RI
.			000000	ngin day giavei	
0			000000		
		21.00m			
Н		21.00111	22222	Tight clay and small to medium gravel,	RI
		22.00m	00000	some amount of water	
Н			<u> </u>	Open medium gravel	RI
			000000000		
П			000000000		
Ш		24.00m	000000000		
П			000000000	Small to medium gravel	RI
5		ш	000000000		
			000000000		
		26.00m	000000000		
			000000000000000000000000000000000000000	Small gravel	RI
		Ш	0000000000000		
			00000000000		
		28.00m	000000000000000000000000000000000000000	-	
		28.50m	ED=0=9	Grey silt with wood	BR

Bore or Well No	M36/7648		
Well Name	East Maddisons Road		
Owner	Mr & Ms PM & KI Tilling & Thompson		



Well Number	M36/7648	File Number	CO6C/21547
Owner	Mr & Ms PM & KI Tilling & Thompson	Well Status	Active (exist, present)
Street/Road	East Maddisons Road	NZTM Grid Reference	BX23:50377-69690
Locality	Rolleston	NZTM X and Y	1550377 - 5169690
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	
Depth	26.00m	Water Level Count	0
Diameter	150mm	Initial Water Level	8.10m below MP
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	35.66m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	7	Calc Min 95%	7.90m below MP
Aquifer Name		Aquifer Tests	0
Aquifer Type		Yield Drawdown Tests	2
Drill Date	15 May 2004	Max Tested Yield	8 l/s
Driller	Dynes Road Drilling	Drawdown at Max Tested Yield	4 m
Drilling Method	Cable Tool	Specific Capacity	2.24 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	24	26				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
15 May 2004	1	3.4	44.8738251	1.52	3
15 May 2004	2	8.33	109.940872	3.96	4

No comments for this well

Bore Log

Borelog for well M36/7648

Grid Reference (NZTM): 1550378 mE, 5169691 mN

Location Accuracy: 50 - 300m

Ground Level Altitude: 35.7 m +MSD Accuracy: < 0.5 m

Driller: Dynes Road Drilling Drill Method: Cable Tool

Borelog Depth: 26.0 m Drill Date: 15-May-2004



Scale(m)	Water Level	Depth(m)		Full Drillers Description	Formation Code
			000000000	small-medium gravel	
Н		1.00m _ 1.00m		small-medium gravel	
		1.00m	0==0==0==	small-medium gravel - silt bound	
Ц			==0==0		
- 11			0==0==0==		
Ш			==0==0		
			0=0=0=		
П		4.20m _ 4.20m	000000000	small-medium gravel - silt bound	
5		4.20111	00000000	small-medium gravel - stained	
ĭ			00000000	-	
			000000000		
н			1000000000		
			1000000000		
Н .					
			000000000		
Н			000000000		
			000000000		
Щ			000000000		
			D00000000		
10			000000000		
П			000000000		
- 11			000000000		
П		11.50m	000000000		
		11.50m	0==0==0==	small-medium gravel - stained	
П			=0=0=0	small-medium gravel - silt bound	
			0=0=0=		
Н					
			# 0 # 0 # 0		
Н		14.50m	0==0==0==		
		14.50m _	<u> </u>	small-medium gravel - silt bound	
15			00000000	small-medium gravel - stained - water	
			000000000		
Н			0000000000		
			1000000000		
Н			1000000000		
			000000000		
Щ		18.00m _	000000000		
		18.00m	777773	small-medium gravel - stained - water silt bound, tight driving, no water	
				San Sound, Light Girang, No Water	
		19.50m			
20		19.50m	0::0::0::	silt bound, tight driving, no water	
П			$[\cdot \circ \cdot \circ \cdot \circ \cdot]$	small-medium gravel, sandy - water keeping up	
			h	rechild ob	
П					
			0.0.0.		
Н			D:::O:::O:::a		
			10:.0::0::		
Н			1.0.000 d		
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25			D::0::0::d		
		26.00m	[·o··o·.o·]		