ENGEO

Expect Excellence

Geotechnical Investigation

108 Dunns Crossing Road

Rolleston

Christchurch

Submitted to:

Hughes Developments Ltd

Christchurch

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08.11.2019
12903.000.000_70

ACENZ

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ENGEO Document Control:

Report Title	Geotechnical Investigation - 108 Dunns Crossing Road, Rolleston			
Project No.	12903.000.000	Doc ID	70	
Client	Hughes Developments Ltd	Client Contact	Kelvin Black	
Distribution (PDF)	Kelvin Black			
Date	Revision Details/Status	WP	Author	Reviewer
08/11/2019	Issued to Client	JB	KF	GM

1 Introduction

ENGEO Ltd was requested by Hughes Developments Ltd to undertake a geotechnical investigation of the property at 108 Dunns Crossing Road, Rolleston, Christchurch, as outlined in our variation proposal (ref: P2019.002.259_01).

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 sixteen 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; and
- 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 covers a total area of 10.1 ha and has the following legal description (Canterbury Maps):

- 108 Dunns Crossing Road - Lot 2 DP 61278.

It is located approximately 3 km southwest of Rolleston town centre. The site is bound to the southwest by Dunns Crossing Road, 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., 2008) as being underlain by brownish grey river alluvium (Q2a).

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 4 November 2019, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast trend (Figure 2). Based on observations, silty sand deposits with variable thickness (up to 0.8 m) are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

Figure 2: Historical Aerial Imagery – 1990 to 1994

Image sourced from Canterbury Maps. Not to scale.

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 5.6 km north / northwest 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 in an area mapped where “damaging liquefaction is unlikely” (NZGD Map CGD5140, 2012), and a “zone of very low liquefaction potential” (GNS, 2006).

3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 4 November 2019. The investigations comprised sixteen hand auger boreholes and fourteen 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: Summary of Subsurface Conditions

Soil Type	Depth to Top of Layer (m)	General Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.1 – 0.3	Soft to Firm	-
Silty SAND	0.2	0.7 – 0.8	Loose to Dense	Present in TP09 and TP11
Sandy Gravel	0.1 – 1.0	Unknown	Medium Dense to Very Dense	Consistent across the site

3.5 ECan Boreholes

A review of four deep ECan borehole logs was conducted. The first (M36/4450), is located on-site, and appears to be a water well servicing the properties irrigation. The other boreholes are located to the north (M36/5038), north east (M36/5041) and south (M36/4449) of the site. A borehole is located west of Dunns Crossing Road (M36/8130) but has no borehole data for the first 54 m of the soil profile on Canterbury Maps (Figure 3)

Well logs from the four holes of interest are presented in Appendix 3 and summarised in Table 2.

Table 2: Generalised Summary of ECan Boreholes

ECan Borehole	Total Depth (m)	Water level (m)	Generalised borelog as logged by driller
M36/4449	24	7.7	Gravel to 24 m with a layer of clay from 12 to 14 m and sandy gravel from 14 to 18 m.
M36/4450	26	8.1	Gravel to 26 m with a layer of clay from 12 to 18 m, 22 to 24 m and 26 o 26.5 m.
M36/5038	32	8.5	Silt bound gravel to 4 m and gravel to 32 m with a layer of silty gravel 12 to 14.4 m.
M36/5041	34	8.6	Gravel to 34 m with layers of silt bound gravel from 2 to 5.4 m and 8.2 to 12.8 m.

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 7.7 m and 8.6 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

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 future land performance to be in line with Technical Category 1 (TC1), 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 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

Canterbury Maps, Groundwater. Retrieved November 2019, from http://canterburymaps.govt.nz/Viewer.

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Forsyth, P., Barrell, D. J., & Jongens, R. (2008). Sheet 16 - Geology of the Christchurch Area 1:250,000. Lower Hutt: Institute of Geological and Nuclear Sciences.

GNS Science (2015). New Zealand Active Faults Database. Retrieved November 2018, from http://data.gns.cri.nz /af.

Pettinga J.R., Yetton M.D., Van Dissen R.J., & Downes G. (2001). Earthquake Source Identification and Characterisation for the Canterbury Region, South Island, New Zealand. Bulletin of the New Zealand Society for Earthquake Engineering, Vol 34, No. 4, pp 282-317.

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Standards Association of New Zealand (2004). NZS 1170.5:2004. Structural Design Actions Part 5: Earthquake Actions – New Zealand.

Standards Association of New Zealand (2010). NZS 3604:2010. Timber Framed Buildings.

Standards Association of New Zealand (2010). NZS 4404:2010. Land Development and Subdivision Infrastructure.

The Ministry of Business, Innovation, and Employment (2016). New Zealand Geotechnical Database. Retrieved November 2019, 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

Kristian Fairley

Engineering Geologist

Jed Watts

Engineering Geologist

Report reviewed by

Greg Martin, CMEngNZ (PEngGeol)

Principal Engineering Geologist

APPENDIX 1:

Site Plan and Inferred Paleo Channels

DATE PLOTTED: 07 November 2019 8:54:59 am BY: NFlatman

Legend

- Hand auger locations
- Test pit locations
- Flow Path
- Site boundary

Aerial: LINZ and Eagle Technology, CC-BY-3.0-NZ.
Map image: LINZ NZTopo Series, CC-BY-3.0-NZ.

PROJECTION: NZGD 2000 New Zealand Transverse Mercator

ENGEO

Christchurch Office
124 Montreal Street, Sydenham, Christchurch 8023
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Title: Site Location Plan

Client: Hughes Developments Ltd		Figure No: 1
Project: 108 Dunns Crossing Road Rolleston	Designed: NF Drawn: NF Checked: XX Date: Nov 19	Size: A3
Proj No: 12903.001.000	Scale: 1:2,000	Revision: A

ORIGINAL FIGURE PRINTED IN COLOUR

PATH: Z:\Projects\12901 to 13000\12903 - Farrington South Subdivision\052_108 Dunns Crossing Road - Enviro\05_CAD-GIS & Figures\Fig_01 landscape.mxd

APPENDIX 2:

ENGEO Hand Auger and Test Pit Logs

LOG OF AUGER HA01

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624284
Longitude : 172.375188

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
	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

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.

LOG OF AUGER HA02

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623539
Longitude : 172.375633

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
0.0	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL]. Trace gravel from 0.2 m depth.				D	St	98/15
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

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

LOG OF AUGER HA03

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624218
Longitude : 172.374109

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
0	TOPSOIL	ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			Gravel becomes minor from 0.2 m depth. Gravel, fine, subangular to subrounded.						
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA04

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624599
Longitude : 172.373074

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
0.0	TOPSOIL	ML	SILT with some sand, trace gravel, wood and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

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.

LOG OF AUGER HA05

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625011
Longitude : 172.373546

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
	TOPSOIL	ML	SILT with some sand, trace gravel, wood and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.5

1.0

1.5

>>

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA06

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.62482
Longitude : 172.372715

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
	TOPSOIL	ML	SILT with some sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine.				M	St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.8 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

LOG OF AUGER HA07

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

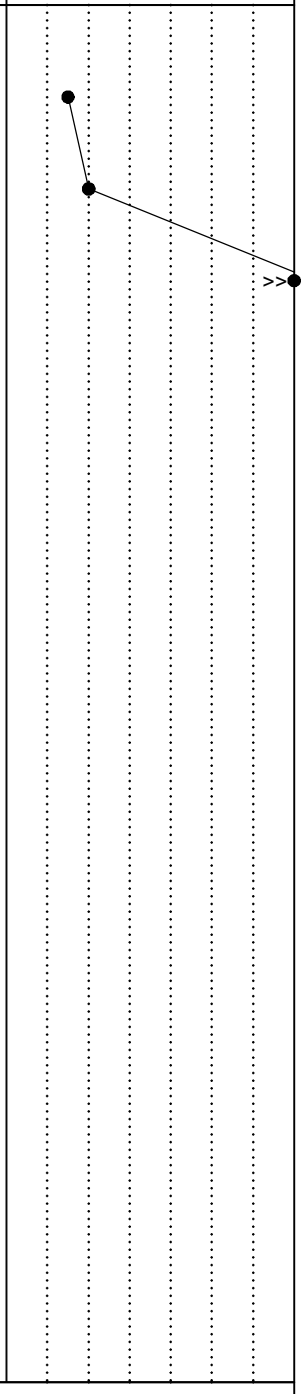
Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625244
Longitude : 172.372951

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
0	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			Trace gravel encountered from 0.2 m depth.						
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



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

LOG OF AUGER HA08

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625581
Longitude : 172.37221

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
0	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			Trace gravel encountered from 0.2 m depth.						
	A	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine to medium.					St-VSt	
0.4			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF AUGER HA09

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.625131
Longitude : 172.371905

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
	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

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.

LOG OF AUGER HA10

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.624514
Longitude : 172.372119

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
	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	A	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine to medium.					St-VSt	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

0.5

1.0

1.5

>>

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.
A = ALLUVIUM

LOG OF AUGER HA11

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.62435
Longitude : 172.371175

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
	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

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.

LOG OF AUGER HA12

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623729
Longitude : 172.371551

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
0	TOPSOIL	ML	SILT with minor sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St	
	ALLUVIUM	ML	Sandy SILT with trace gravel; greyish brown. Poorly graded. Sand, fine to medium.					St-VSt	
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal						
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

Hand auger met practical refusal at 0.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.4 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF AUGER HA13

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.622894
Longitude : 172.373074

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
	TOPSOIL	ML	SILT with some sand, minor gravel and trace rootlets; brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

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.

LOG OF AUGER HA14

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.622343
Longitude : 172.374581

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
	TOPSOIL	ML	SILT with some sand, minor gravel and trace rootlets; brown. Low plasticity. Sand, fine. Gravel, fine, subangular to subrounded [TOPSOIL].				D	F-St	
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

0.5

1.0

1.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA15

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

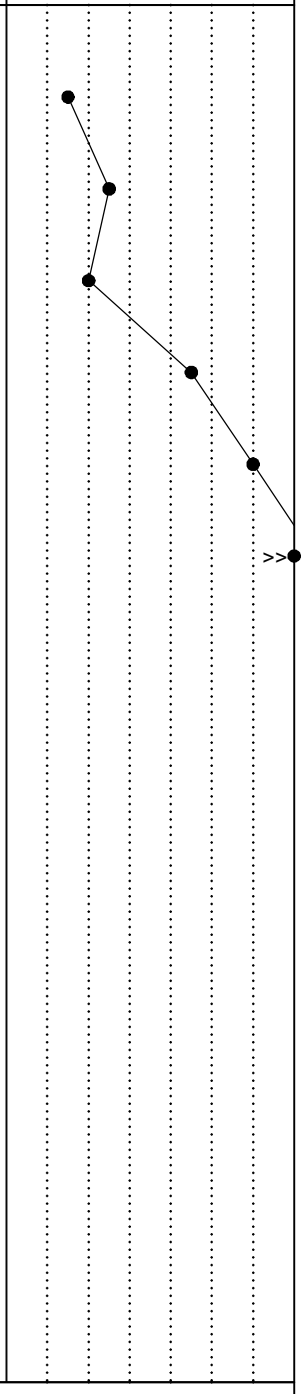
Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623853
Longitude : 172.373841

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
0	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St	
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						

Scala Penetrometer

Blows per 100mm



Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.6 m depth.
Standing groundwater was not encountered.

LOG OF AUGER HA16

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Client Ref. : N/A
Date : 6.11.2019
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : 1379
Logged By : KF
Reviewed By : JRW
Latitude : -43.623384
Longitude : 172.37346

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
	TOPSOIL	ML	SILT with minor sand and trace rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				M	F-St	
	ALLUVIUM	ML	SILT with some sand and trace gravel; greyish brown. Low plasticity. Sand, fine.					St-VSt	
			End of Hole Depth: 0.4 m Termination Condition: Practical refusal						
0.5									
1.0									
1.5									

Scala Penetrometer

Blows per 100mm

2 4 6 8 10 12

>>

>>

Hand auger met practical refusal at 0.4 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 1.3 m depth.
Standing groundwater was not encountered.
A = ALLUVIUM

GEOTECH HAND AUGER 2019.11.07 - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 7/11/19

LOG OF TEST PIT TP01

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623566
Longitude : 172.374608

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	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)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D			
0.5				Sandy fine to coarse GRAVEL; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
				Becomes moist from 0.7 m depth.							
1.0				Trace cobble from 0.9 m depth.					MD-D		
			GW					M			
1.5				Cobble becomes minor from 1.7 m depth.							
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.

TS = TOPSOIL

LOG OF TEST PIT TP02

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623119
Longitude : 172.374217

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with trace silt and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
1.0			SW	Gravelly fine to coarse SAND; brownish grey. Well graded. Gravel, fine to coarse, subangular to subrounded.				M	MD-D		
1.5			GW	Sandy fine to coarse GRAVEL with trace cobble; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace rootlets encountered from 1.5 m depth.					MD-D		
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.

TS = TOPSOIL

LOG OF TEST PIT TP03

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.624211
Longitude : 172.372983

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	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)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0				No silt and trace cobbles encountered from 1.0 m depth.							
1.5				Becomes moist and grey from 1.2 m depth. Sand becomes some from 1.4 to 1.6 m depth.				M			
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.

TS = TOPSOIL

LOG OF TEST PIT TP04

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623729
Longitude : 172.372618

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		
1.0				Trace silt and trace cobbles encountered from 1.0 m depth.							
				Becomes moist from 1.2 m depth.							
1.5								M			
				Sand becomes some from 1.7 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

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

TS = TOPSOIL

LOG OF TEST PIT TP05

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne
Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.6239
Longitude : 172.374871

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.0				Sand becomes trace from 0.8 to 1.0 m depth.							
1.5				Trace cobbles encountered from 1.2 m depth.							
2.0				Depth of Excavation: 1.9 m Termination Condition: Practical refusal							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

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

Loosely packed gravel and pit collapse from 0.5 to 1.9 m depth.
TS = TOPSOIL

LOG OF TEST PIT TP06

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623947
Longitude : 172.37603

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				D	MD-D		>>
1.0				Becomes moist and trace silt encountered from 0.7 m depth.				M			
1.5				No rootlets encountered from 1.4 m depth. Trace cobbles encountered from 1.5 m depth. Sand becomes some from 1.7 to 1.8 m depth.							
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.

TS = TOPSOIL

LOG OF TEST PIT TP07

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623251
Longitude : 172.375413

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		2 4 6 8 10 12
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt, cobble and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		>>
1.0				Becomes grey from 0.8 m depth.							
1.5				Cobbles becomes minor from 1.2 m depth.							
2.0				Sand becomes some from 1.8 to 1.9 m depth.							
2.5				Depth of Excavation: 2 m Termination Condition: Target depth							

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

TS = TOPSOIL

LOG OF TEST PIT TP08

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.622696
Longitude : 172.375236

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt, cobble and rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
				Becomes grey from 0.6 m depth.							
1.0				No rootlets encountered from 0.8 to 1.2 m depth.							
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

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

TS = TOPSOIL

LOG OF TEST PIT TP09

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.622572
Longitude : 172.373809

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		SM	Silty fine to medium SAND with trace gravel; brownish grey. Poorly graded. Becomes grey with orange mottles from 0.8 m depth.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace silt and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace cobbles encountered from 1.3 m depth. Sand becomes some from 1.7 to 1.8 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

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

TS = TOPSOIL

LOG OF TEST PIT TP10

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne
Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623232
Longitude : 172.372307

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	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)
0.0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with trace silt and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.0											
1.5				No rootlets encountered from 1.6 m depth.							
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.

TS = TOPSOIL

LOG OF TEST PIT TP11

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623923
Longitude : 172.371942

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		SM	Silty fine to medium SAND with trace gravel and rootlets; brownish grey. Poorly graded.					MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

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

TS = TOPSOIL

LOG OF TEST PIT TP12

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.624622
Longitude : 172.374447

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					S-F		
	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
0.5				Sandy fine to coarse GRAVEL with trace silt, cobble and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0								M			
			GW						MD-D		
1.5				Cobbles becomes minor from 1.4 m depth.							
				No rootlets encountered from 1.6 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

Scala Penetrometer: Blows per 100mm — 2 4 6 8 10 12 (>>)

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

TS = TOPSOIL

LOG OF TEST PIT TP13

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.62475
Longitude : 172.371561

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. Becomes moist from 0.6 m depth. Becomes grey from 0.9 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							
2.5											

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

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

TS = TOPSOIL

LOG OF TEST PIT TP14

Geotechnical Investigation
108 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 4.11.2019
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 24 Tonne

Shear Vane No : N/A
Logged By : KF
Reviewed By : JRW
Latitude : -43.623982
Longitude : 172.370928

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	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)
0	TS		ML	SILT with some sand, travel gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	S-F		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. No rootlets encountered from 0.5 m depth. Becomes grey and trace cobbles encountered from 0.7 m depth.				M	MD-D		
1.0											
1.5				Trace rootlets encountered from 1.8 m depth.							
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.

TS = TOPSOIL

APPENDIX 3:

ECan Boreholes

Bore or Well No	M36/4449
Well Name	DUNNS CROSSING RD
Owner	TYACK GJ & FR

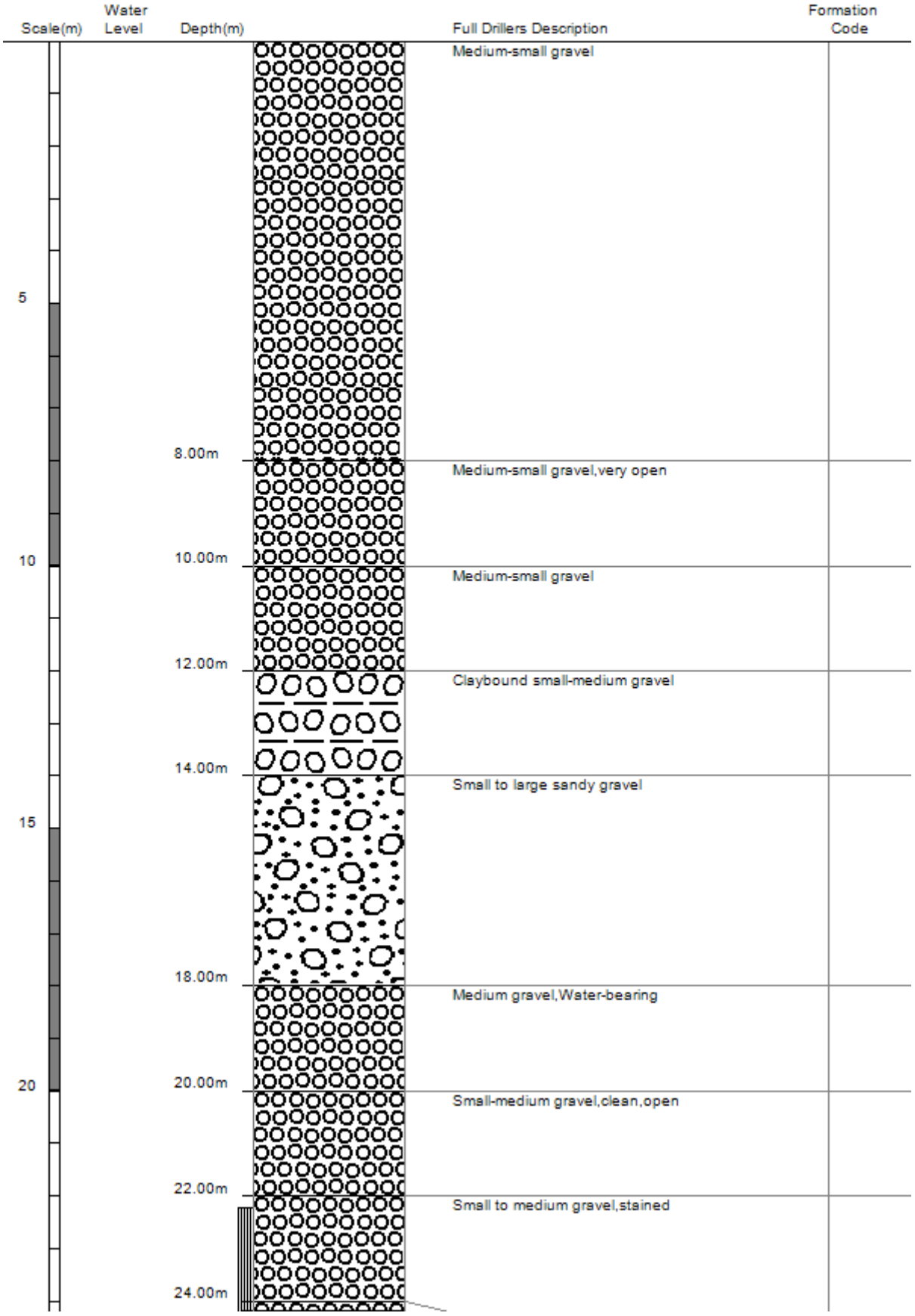
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4449	**File Number**	CO6C/02046
Owner	TYACK GJ & FR	**Well Status**	Not Used
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49508-69470
Locality	ROLLESTON	**NZTM X and Y**	1549508 - 5169470
Location Description	LOT 1	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	24.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	38.81m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	9	**Calc Min 95%**	7.70m below MP
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Jun 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	5 m
Drilling Method	Cable Tool	**Specific Capacity**	1.36 l/s/m
Casing Material		**Last Updated**	08 Nov 2013
Pump Type	Unknown	**Last Field Check**	
Water Use Data	No		

Borelog for well M36/4449

Grid Reference (NZTM): 1549508 mE, 5169471 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 38.8 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 24.2 m Drill Date: 09-Jun-1992

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Bore or Well No	M36/4450
Well Name	DUNNS CROSSING RD
Owner	Mr & Mrs L K & J C Blackmore

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/4450	**File Number**	CO6C/02046
Owner	Mr & Mrs L K & J C Blackmore	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING RD	**NZTM Grid Reference**	BX23:49388-69660
Locality	ROLLESTON	**NZTM X and Y**	1549388 - 5169660
Location Description	DP61278 LOT 2	**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Irrigation,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	25.20m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	39.62m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	8	**Calc Min 95%**	8.10m below MP
Aquifer Name	Riccarton Gravel	**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	09 Apr 1992	**Max Tested Yield**	6 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	6 m
Drilling Method	Cable Tool	**Specific Capacity**	1.00 l/s/m
Casing Material		**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	23.2	25.2				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
09 Apr 1992	1	6.1	80.50892	6.1	0

No comments for this well

Borelog for well M36/4450

Grid Reference (NZTM): 1549388 mE, 5169661 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 39.6 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 26.5 m Drill Date: 09-Apr-1992

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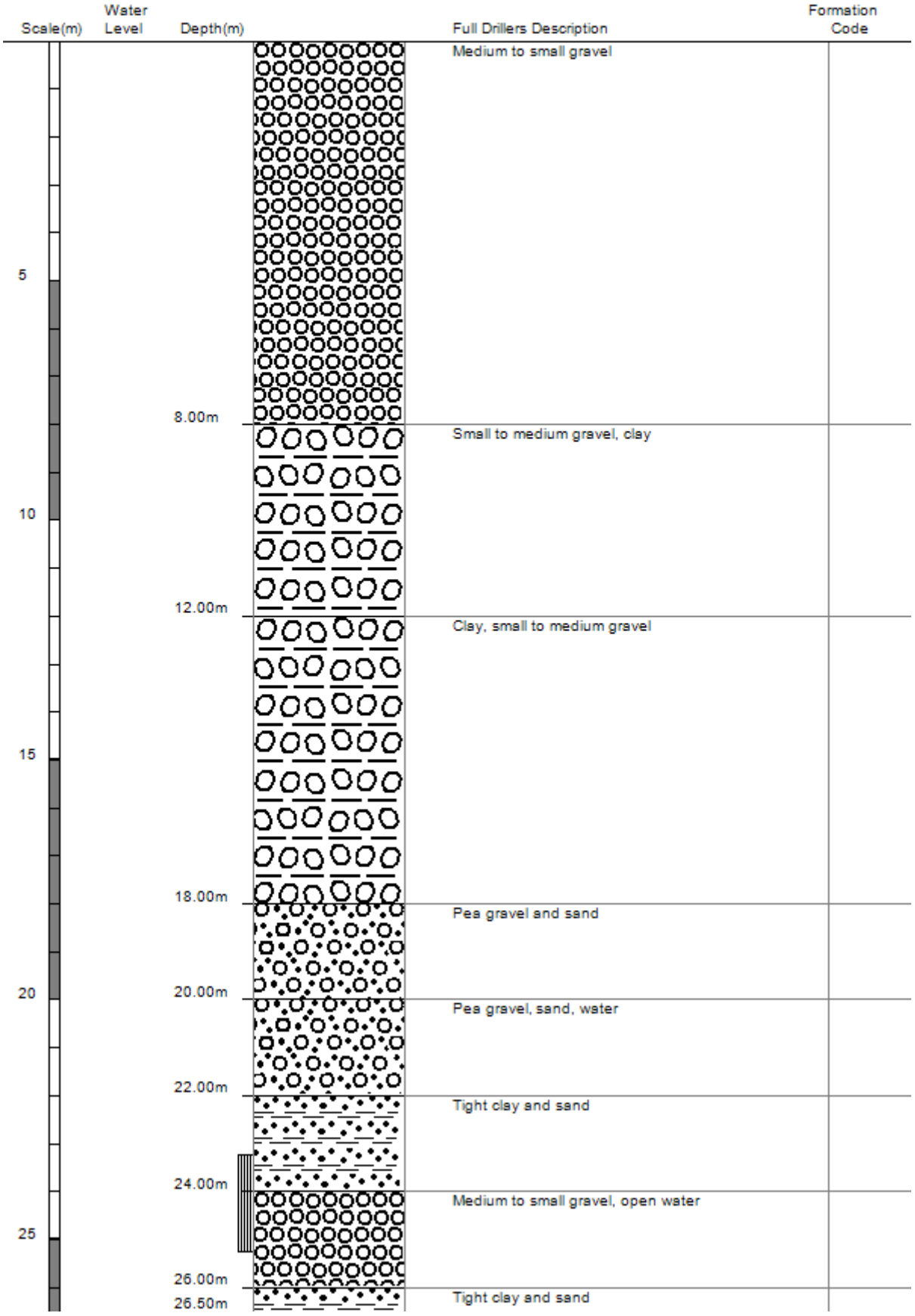

Bore or Well No	M36/5038
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Well Number	M36/5038	**File Number**	CO6C/10010
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49278-69840
Locality	ROLLESTON	**NZTM X and Y**	1549278 - 5169840
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.10m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.30m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.38m above MSL (Lyttelton 1937)	**Lowest Water Level**	
Elevation Accuracy	< 2.5 m	**First reading**	
Ground Level	0.00m above MP	**Last reading**	
Strata Layers	7	**Calc Min 95%**	8.50m below MP
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Nov 1996	**Max Tested Yield**	24 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	9 m
Drilling Method	Cable Tool	**Specific Capacity**	2.84 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	30.1	32.1				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Nov 1996	1	24.1	318.076233	8.5	2

No comments for this well

Borelog for well M36/5038

Grid Reference (NZTM): 1549278 mE, 5169841 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.4 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 32.0 m Drill Date: 01-Nov-1996

Environment Canterbury Regional Council
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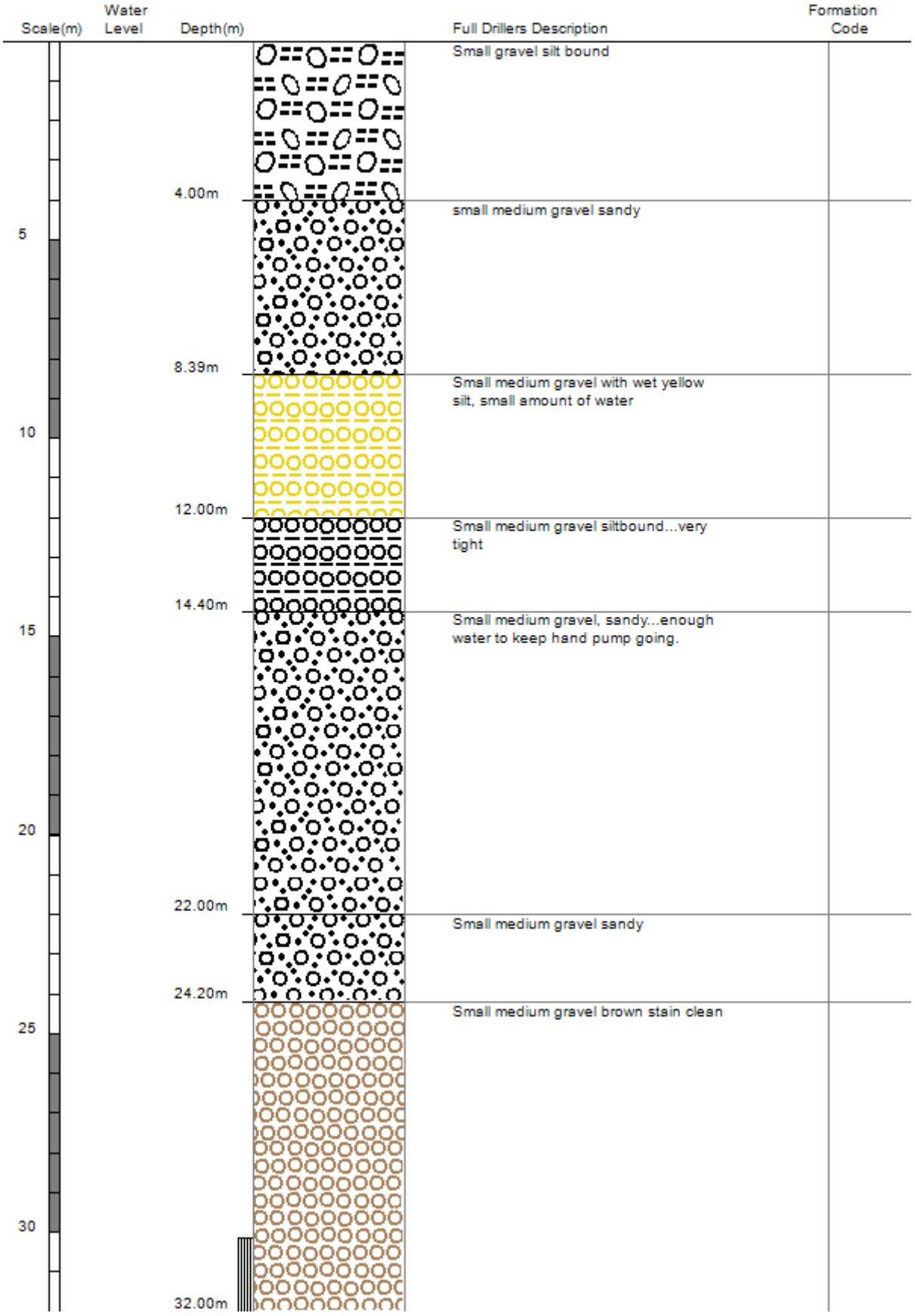

Bore or Well No	M36/5041
Well Name	DUNNS CROSSING ROAD
Owner	KAJENS TRADING DEVELOPMENT LTD

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Well Number	M36/5041	**File Number**	CO6C/10302
Owner	KAJENS TRADING DEVELOPMENT LTD	**Well Status**	Active (exist, present)
Street/Road	DUNNS CROSSING ROAD	**NZTM Grid Reference**	BX23:49507-69990
Locality	ROLLESTON	**NZTM X and Y**	1549507 - 5169990
Location Description		**Location Accuracy**	50 - 300m
CWMS Zone	Selwyn - Waihora	**Use**	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	**Water Level Monitoring**	--
Depth	32.00m	**Water Level Count**	0
Diameter	150mm	**Initial Water Level**	6.80m below MP
Measuring Point Description		**Highest Water Level**	
Measuring Point Elevation	40.47m 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%**	8.60m below MP
Aquifer Name		**Aquifer Tests**	0
Aquifer Type	Unknown	**Yield Drawdown Tests**	1
Drill Date	01 Feb 1997	**Max Tested Yield**	5 l/s
Driller	Dynes Road Drilling	**Drawdown at Max Tested Yield**	13 m
Drilling Method	Cable Tool	**Specific Capacity**	0.40 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	30	32				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
01 Feb 1997	1	5.1	67.31074	12.8	2

No comments for this well

Borelog for well M36/5041

Grid Reference (NZTM): 1549508 mE, 5169991 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 40.5 m +MSD Accuracy: < 2.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 34.0 m Drill Date: 01-Feb-1997

Environment Canterbury Regional Council
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