



ENGEO

Celebrating 10 YEARS IN NZ

Geotechnical Investigation

Rhodes Land

Trents Road

Prebbleton

Submitted to:

Urban Estates Ltd

181 High Street

City Centre

Christchurch 8144

ENGEO Limited

124 Montreal Street, Sydenham, Christchurch 8023

PO Box 373, Christchurch 8140, New Zealand

Tel +64 3 328 9012 Fax +64 3 328 9013

www.engeo.co.nz

07.09.2020

17637.000.000_01



Contents

1	Introduction.....	3
2	Site Description	3
3	Background Review	4
3.1	Regional Geology.....	4
3.2	Geohazards.....	4
3.2.1	Seismicity	4
3.2.2	Liquefaction	5
3.3	Flooding.....	6
3.4	ECan Boreholes	6
3.5	Mapped Groundwater	8
3.6	Subsurface Data	9
3.7	Historic Aerial Photography.....	11
4	Site Investigation	12
4.1	Geomorphology.....	13
4.2	Site Seismic Class	14
5	Liquefaction Assessment	14
6	RMA Section 106 Requirements and Suitability to Subdivide	14
7	Geotechnical Recommendations	15
7.1	Earthworks	15
7.2	Subdivision Roding	15
7.3	Foundations.....	15
8	References	16
9	Limitations	17

Tables

Table 1:	Summary of ECan Borehole Data
Table 2:	Summary of Subsurface Data from NZGD
Table 3:	Generalised Summary of Subsurface Conditions

Figures

Figure 1:	Site Location Plan
Figure 2:	Mapping produced by Geotech Consulting 2010
Figure 3:	Canterbury Liquefaction Susceptibility Mapping by GNS Science/ECan and MBIE Residential Technical Categories
Figure 4:	ECan Regional Piezometric Elevation Contours and Piezometric Wells used in various published groundwater studies.
Figure 5:	ECan Depth to Groundwater from various published studies
Figure 6:	Nearby Geotechnical Investigations
Figure 7:	1940 Aerial Photograph
Figure 8:	Hand Auger test locations and depths

Appendices

Appendix 1:	Hand Auger Logs
Appendix 2:	ECan Well Summary Sheets

ENGEO Document Control:

Report Title	Geotechnical Investigation - Rhodes Land, Trents Road			
Project No.	17637.000.000.000.000	Doc ID	01	
Client	Urban Estates Ltd	Client Contact	Brad Wilson	
Distribution (PDF)	Brad Wilson			
Date	Revision Details/Status	WP	Author	Reviewer
07/09/2020	Issued to Client	DF	ZP	NC

1 Introduction

ENGEO Ltd was requested by Urban Estates Ltd to undertake a geotechnical investigation of the property at Rhodes Land, Trents Road, Prebbleton (herein referred to as 'the site'). This work has been carried out in accordance with our signed agreement dated 18 August 2020.

We understand that the site is to be developed for rural residential use (approximately 40 lots each of around 5000 m²) and potentially higher density residential in the future. Our scope of works at this stage will support your Resource Consent application for the Rural Residential portion of the development only.

Our scope of works included the following:

- Review of published geotechnical and geological information relevant to the site.
- Site assessment by an experienced ground engineering professional.
- Shallow subsurface testing, consisting of up to ten hand auger boreholes to a maximum depth of 3 m, or practical refusal, with associated Scala penetrometer and shear vane tests for strength characteristics.
- An assessment of the liquefaction potential for the site based on our site investigations and published literature.
- Preparation of this report outlining our findings on the ground conditions and the suitability of the site for residential subdivision, including:
 - o Conceptual foundation recommendations for typical timber framed residential dwellings.
 - o Seismic Subsoil category.
 - o Address likely geohazards as required by Section 106 of the RMA.
 - o Provide general geotechnical recommendations related to the proposed development.

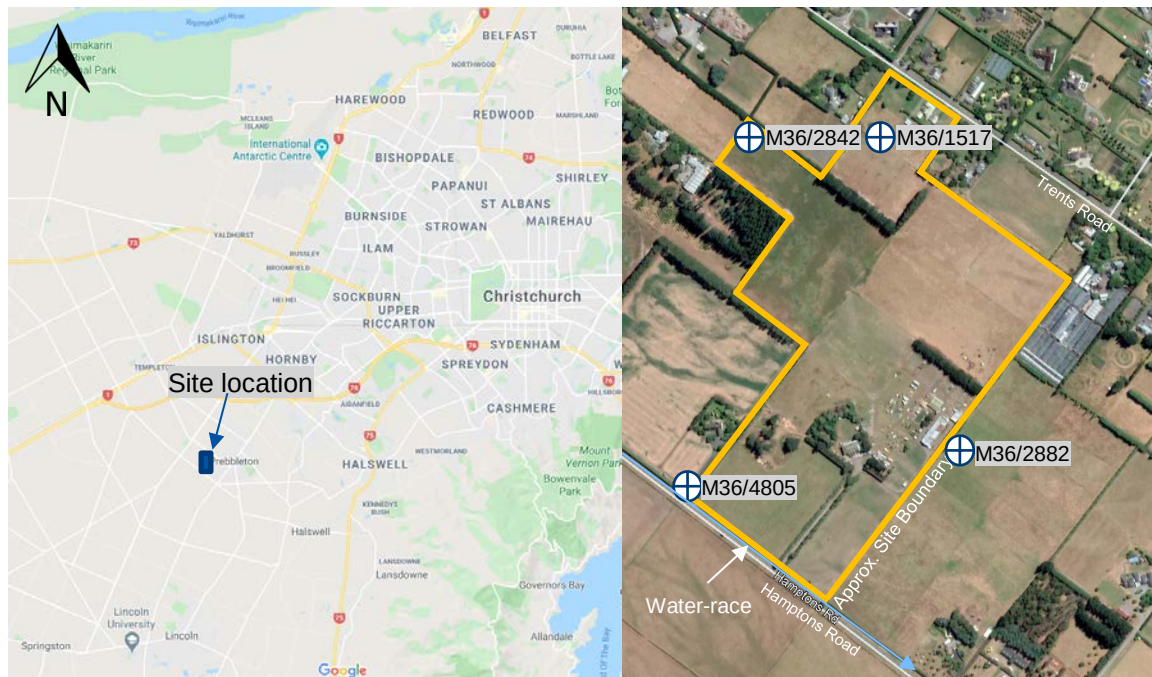
Our scope of works does not include geotechnical recommendations to a level suitable for foundation design or Building Consent.

2 Site Description

The site at Rhodes Land is located on a relatively flat area in Prebbleton, Christchurch. The site covers an area of approximately 22 hectares.

The site is currently agricultural land mostly used for light grazing. A residential dwelling and a number of garage / shed structures are located on the south side of the site, accessed off Hamptons Road. Another house and three garage / shed structures are also located at the northern end of the site accessed off Trents Road.

A roadside water-race (approx. 1.0 m to 1.5 m wide by 0.5 m 1.0 m deep) is located on Hamptons Road at the southern end of the site. Water was flowing to the southeast and appeared to be approximately 100 mm to 200 mm deep at the time of our visit.

Figure 1: Site Location Plan

⊕ = ECan Well

3 Background Review

3.1 Regional Geology

The site has been regionally mapped by GNS (Forsyth et al., 2008) as being underlain by grey to brown alluvium, comprising silty subangular gravel and sand.

3.2 Geohazards

3.2.1 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 other faults.

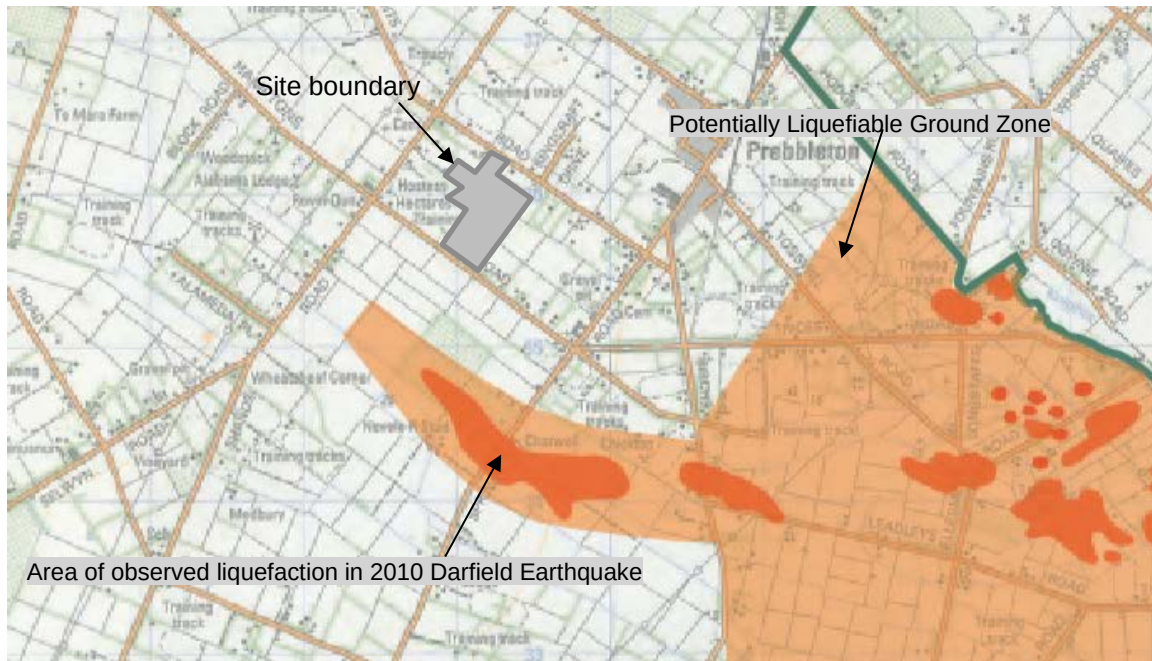
The site is located between two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 11 km west of the site and trends roughly east-west with a surface rupture of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture the surface. Movement on the Port Hills Fault is believed to have occurred at a depth of 1 km to 2 km below the 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).

3.2.2 Liquefaction

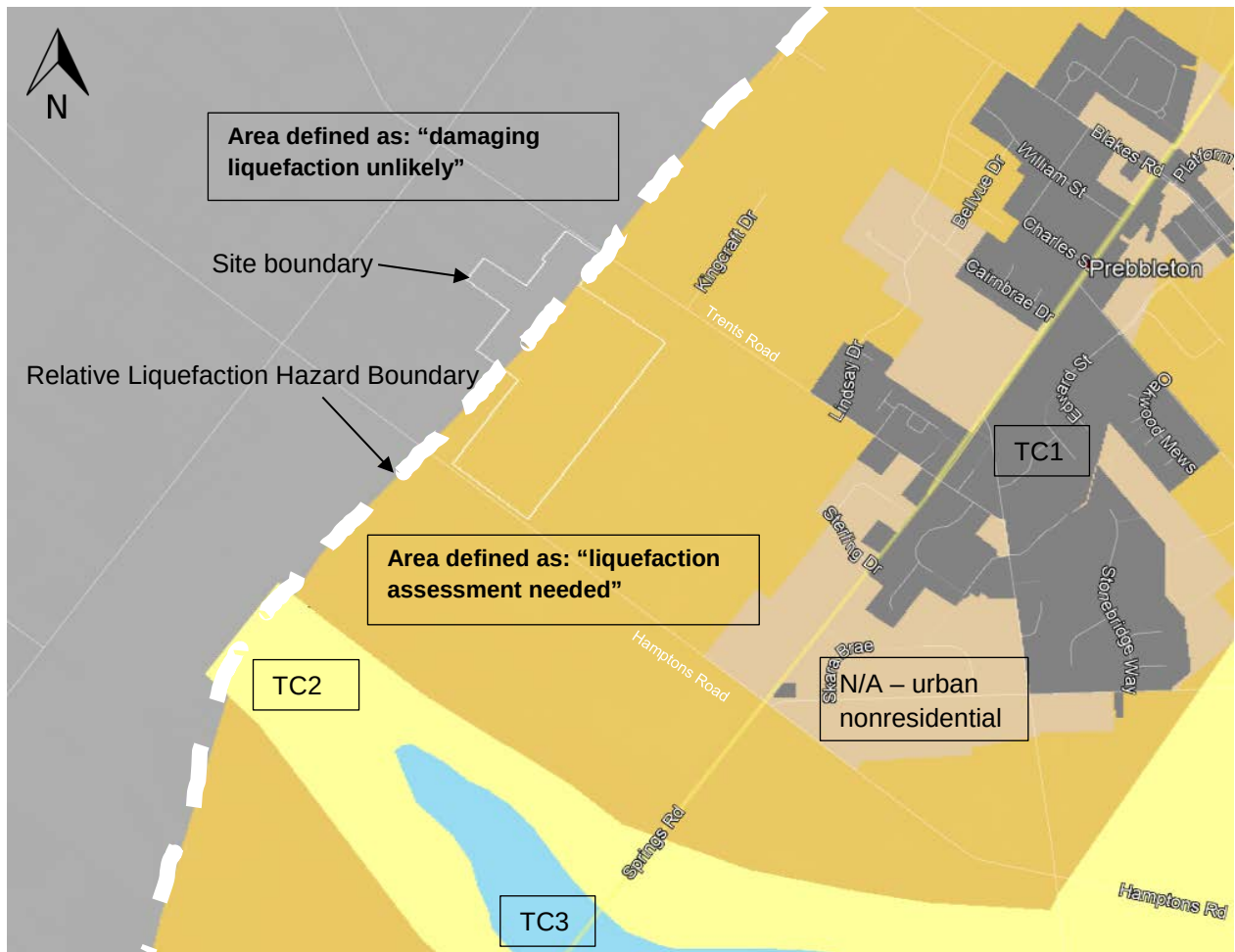
We have reviewed the mapping undertaken by Geotech Consulting in their 2010 Canterbury Earthquake Liquefaction Report, dated 8 February 2011. The mapping shows areas of observed liquefaction following the 2010 Darfield Earthquake and areas assessed as likely to be underlain by potentially liquefiable ground. The mapping shows the site is located approximately 800 m north of an area of observed liquefaction, and is not within the Potentially Liquefiable Ground Zone.

Figure 2: Mapping produced by Geotech Consulting 2010



We have also reviewed the mapping undertaken by GNS Science in their report titled "Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts", dated 2012. The site is mapped on the boundary between two zones delineating relative liquefaction risk. The northwest side of the site is mapped within an area where "liquefaction damage unlikely" and the southeast side of the site is mapped as "liquefaction assessment needed".

Figure 3: Canterbury Liquefaction Susceptibility Mapping by GNS Science/ECan and MBIE Residential Technical Categories



A site specific liquefaction assessment is discussed in Section 4.

3.3 Flooding

The site is outside of any defined flood zones in the Selwyn District Council (SDC) Operative District Plan (SDC, 2015).

3.4 ECan Boreholes

We have reviewed deep ECan borehole logs located on the site (or close to the site boundary, as shown in Figure 1), and have reviewed the monitoring well data from the three nearest monitoring wells to the site (part of the ECan Water Level Monitoring Network).

The logs for the wells located on the site, or close to the site boundary (Wells M36/2842, M36/4805, M36/2882 and M36/1517) indicate the underlying soil comprises up to 2 m of surficial sands and silts further underlain by gravels which extend to bottom of the drill holes. The groundwater levels recorded in these wells are between approximately 7.67 m and 8.84 m below ground level. The details for the wells are provided in Appendix 2 (including available drill logs).

The groundwater levels recorded in the nearest monitoring wells to the site are variable and show a range of recorded water levels. The range of recorded water levels is shown in Table 1. The recorded well monitoring data shows the lowest recorded groundwater levels are atypical and are not characteristic of the average groundwater depth. For Well M36/5716 the average depth of groundwater is approximately 5 m, for Well M36/0142 the average depth is approximately 15.5 m depth, for Well M36/0250 the average depth is approximately 9.5 m depth.

Table 1: Summary of ECan Borehole Data

Type	Well ID	Location	Material Description	Groundwater Level
On site Wells	M36/2842	Located near to the west boundary of the site	Shingle and gravel to 7 m depth.	N/A
	M36/4805	Located near to the south boundary of the site	Topsoil underlain by sand to 2 m depth, further underlain by gravels to 30 m depth.	Water level recorded at 7.67 m bgl
	M36/2882	Located near to the southeast boundary of the site	Log not available [total well depth: 21 m]	Water level recorded at 8.5 m bgl
	M36/1517	Located near to the north boundary of the site	Topsoil underlain by silt to 1.2 m depth, further underlain by gravels to 15.1 m depth.	Water level recorded at 8.84 m bgl
Water Level Monitoring Network	M36/0142	3 km west of the site	Silt to 2.09 m depth underlain by gravels to 24.4 m depth.	Highest recorded water level: 9.40 m bgl Lowest recorded water level: 16.60 m bgl Typical recorded water level appears to be approx. 15 m bgl
	M36/5716	1.8 km northeast of the site	N/A	Highest recorded water level: 3.37 m bgl Lowest recorded water level: 5.88 m bgl Typical recorded water level appears to be approx. 5 m bgl
	M36/0250	2.2 km south of the site	N/A	Highest recorded water level: 4.17 m bgl Lowest recorded water level: 10.36 m bgl Typical recorded water level appears to be approx. 9 m

3.5 Mapped Groundwater

We have reviewed the well information from ECan used in various published groundwater models and groundwater contour maps available on Canterbury Maps. Published regional mapping of groundwater shows the site is located approximately halfway between the 15 m and 20 m groundwater elevation contours. The site itself is located at an elevation of approximately 24 m to 27 m, which suggests the depth of the groundwater surface below the site is approximately 6 m to 9 m depth (Figure 4). Various other published groundwater studies available on Canterbury Maps show the site located between contour lines ranging from 5 m to 10 m (Figure 5), indicating the groundwater beneath the site is at least 5 m deep and may be up to 10 m deep. Nearby piezometric wells summarised on Canterbury Maps (shown in Figure 4) generally corroborate with mapped groundwater contours and with the groundwater information from wells described in Section 3.4.

Figure 4: ECan Regional Piezometric Elevation Contours and Piezometric Wells used in various published groundwater studies.



Source: Canterbury Maps

Figure 5: ECan Depth to Groundwater from various published studies

Source: Canterbury Maps

3.6 Subsurface Data

We have reviewed the New Zealand Geotechnical Database subsurface data and have summarised the closest geotechnical data to this site in Table 2. Investigation locations are shown in Figure 6.

The ground conditions in nearby testing locations are generally consistent and comprise shallow sand and silt overlying gravel.

Testing within an area located 800 m south of the site shows a deeper profile of sand and silt overlying gravel – liquefaction was observed in this area following the 2010 Darfield Earthquake and the land has been categorized as TC3 (see Figures 2 and 3). The area of observed liquefaction appears to be constrained to a linear area that is likely related to a deeper channel of silts and sands. We do not consider this area represents the ground conditions beneath the site.

Table 2: Summary of Subsurface Data from NZGD

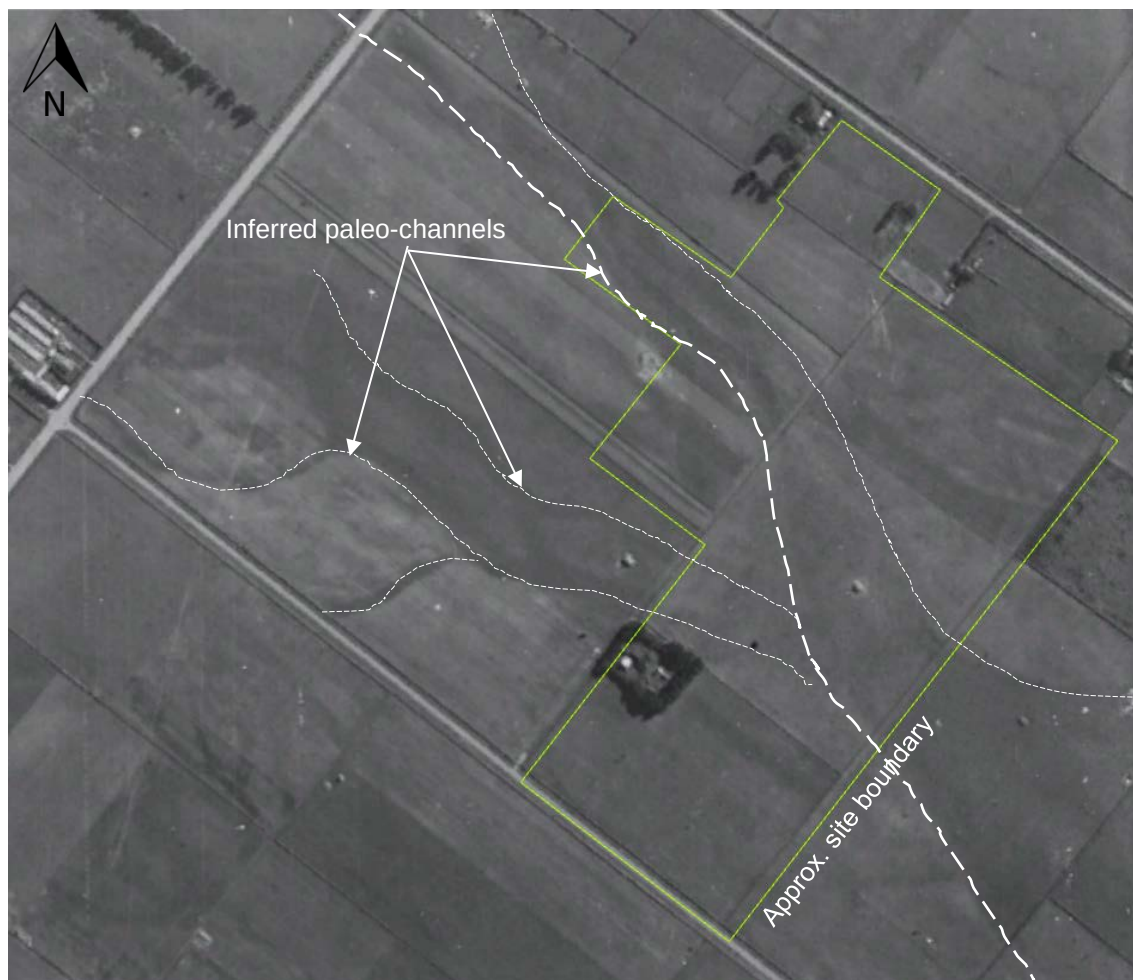
Investigation Identifier	Position Relative to Site	Depth of Exploration (m)	Material Summary
HandAugerScala_12489-12493	Approximately 300 m to the northwest	0.7 – 1.0	Silt to between 0.7 m and 1 m underlain by gravel
HandAugerScala_103242 (BH1-3)	Approximately 500 m to the east	0.7-1.2	Silt to between 0.7 m and 1.2 m underlain by (inferred) gravel.
HandAugerScala_55490	Approximately 500 m to the northeast	2.2	Silt and sand to 2.2 m underlain by gravel.
Test Pits_140389-140393	Approximately 800 m to the east	3.2 - 3.6	Silt to between 0.6 m and 1.0 m, underlain by gravels.
CPT_138923 and HandAugerScala_140146 (1-7)	Approximately 800 m to the south	CPT: 7.77 Hand Augers: 3.0	Silt and sand to 7.7 m underlain by gravel (inferred based on tip refusal)

Figure 6: Nearby Geotechnical Investigations

3.7 Historic Aerial Photography

We have reviewed historic aerial photographs dating back to 1940. It appears that land use at the site has included general rural farming activities with no significant ground modifications identified in the available photographs. Linear features trending northwest-southeast were identified in several historic and recent aerial photographs and are interpreted to be related to paleo-channels (presumably from large flood events), these features are shown in Figure 7 below.

Figure 7: 1940 Aerial Photograph



4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on May 2017. The investigations comprised of ten hand auger boreholes with associated Scala penetrometer and shear vane tests as well as ten additional Scala penetrometer tests. Appendix 1 includes a site plan showing investigation locations.

The investigations revealed subsurface conditions across the site are consistent with the published geological mapping, as summarised in Table 3 below.

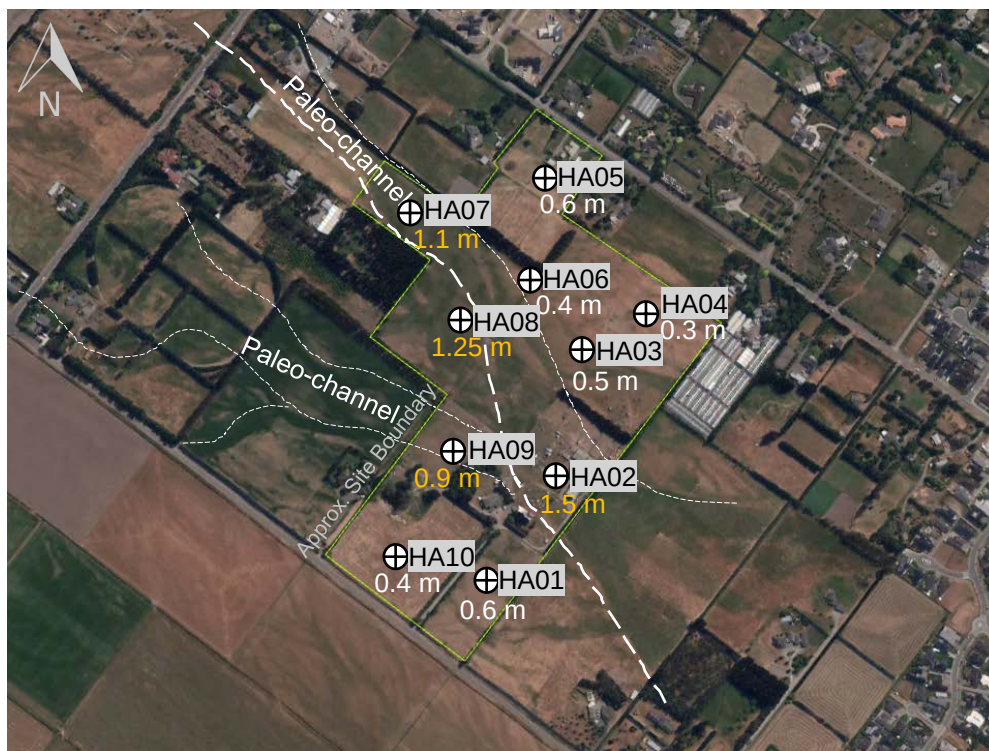
Table 3: Generalised Summary of Subsurface Conditions

Soil Type	Depth to top of layer (m)	Layer Thickness (m)	Density / Consistency
TOPSOIL	0.0	0.3 to 0.4	N/A
SILT / SAND	0.3 to 0.4	0.1 to 1.1	Firm to Hard / Medium Dense to Dense
GRAVEL ¹	0.3 to 1.5	>10	Medium Dense to Very Dense (inferred)

¹From NZGD test pit data and onsite wells.

Standing groundwater was not encountered in any of the hand auger investigations.

Hand auger logs, showing detailed soil descriptions, as well as raw Scala data are presented in Appendix 1.

Figure 8: Hand Auger test locations and depths

Note: Hand auger depths shown in orange text are interpreted to be within inferred paleo-channels.

4.1 Geomorphology

The site comprises relatively flat ground, with gentle undulations and shallow depressions in some areas. A low area in the central part of the site is interpreted to be a paleo-channel and is visible in historical aerial photography. Hand auger boreholes HA02, HA07, HA08 and HA09 (which encountered slightly deeper sand and silt than the other on-site tests) appear to be located within the inferred paleo-channels.

4.2 Site Seismic Class

For the purpose of seismic design, we consider the soil classification in line with NZS 1170.5:2004 to be 'Class D – Deep or soft soil sites'.

5 Liquefaction Assessment

We have considered the liquefaction potential for the site based on our geotechnical testing and published geotechnical information.

Our ground model for the site is based on the shallow testing at the site which indicates shallow sand and silt overlying gravel, nearby geotechnical information which indicates similar soil profiles to the shallow on-site tests, and drill logs from wells drilled on-site. The well logs also indicate the gravel layers extend to at least the base of the drill holes (up to 30 m depth). While liquefaction can occur in gravel layers in the right conditions, it is generally not expected to be extensive and is unlikely to contribute to significant liquefaction induced settlements at the site.

Bowen and Jacka (2013) found that a crust of 3 m to 3.5 m thickness was sufficient to reduce liquefaction damage to lightweight buildings supported on shallow foundations even if the underlying soils were to liquefy. All nearby drillholes in the ECan database show groundwater is located at depths in excess of 5 m, and thus a dry, non-liquefiable crust of at least 5 m is present across the site.

We have therefore assessed the likelihood of liquefaction triggering and post-liquefaction induced vertical settlement occurring at the site to be low.

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

6 RMA Section 106 Requirements and Suitability to Subdivide

Section 106 of the Resource Management Act 1991 states a consent authority may refuse to grant 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; and
- Inundation, which may be sourced from streams, coastal processes or excess precipitation.

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

7 Geotechnical Recommendations

7.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for Earth filling 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 the 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 un-retained batters of pond and stormwater drains constructed with the native sandy gravel material should be at an inclination of 1V:3H, with protection schemes in place to control erosion of the formed batters within the waterways.

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

7.2 Subdivision Roading

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

7.3 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, confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 200 kPa may be assumed for foundations bearing on native alluvium or engineered fill, below any topsoil. We anticipate this to be below 0.3 m to 0.4 m depth based on our subsurface investigations.

8 References

Bowen, H. J. & Jacka, M. E. (2013). Liquefaction induced ground damage in the Canterbury earthquakes: predictions vs. reality. Proc. 19th NZGS Geotechnical Symposium. Ed. CY Chin, Queenstown

Canterbury Maps, Groundwater. Retrieved August 2020 from <http://canterburymaps.govt.nz/Viewer>.

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.

Geotech Consulting (2011), 2010 Canterbury Earthquake Liquefaction Report.

GNS Science (2012), Review of liquefaction hazard information in eastern Canterbury, including Christchurch City and parts of Selwyn, Waimakariri and Hurunui Districts.

New Zealand Geotechnical Database (NZGD). Retrieved August 2020 from <https://www.nzgd.org.nz/>

Selwyn District Council (2015), Selwyn District Council Operative District Plan. Retrieved August 2020, from <http://www.selwyn.govt.nz/services/planning/district-plan>.

Selwyn District Council (2015), Property Search. Retrieved August 2020, from <https://www.selwyn.govt.nz/my-property/rates/search-properties>.

The Ministry of Business, Innovation, and Employment. (2012). Guidance-Repairing and rebuilding houses affected by the Canterbury earthquakes. Christchurch: The Ministry of Business, Innovation, and Employment.

We also acknowledge the New Zealand GeoNet project and its sponsors EQC, GNS Science and LINZ, for providing data used in this report.

9 Limitations

- i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Urban Estates 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



Zeb Paterson

Engineering Geologist

Report reviewed by



Neil Charters, CMEngNZ (CPEng)

Principal Geotechnical Engineer

APPENDIX 1:
Hand Auger Logs



LOG OF AUGER HA01

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : ZP
Latitude : -43.586245
Longitude : 172.493885

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.					N/A							
0.5	ALLUVIUM	SP	Fine to medium SAND with trace silt, light brown. Poorly graded.				M	L							
			End of Hole Depth: 0.6 m Termination Condition: Practical refusal												
1.0															
1.5															
2.0															
2.5															

Hand auger met practical refusal at 0.6 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered



LOG OF AUGER HA02

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 1.5 m
Hole Diameter : 50 mm

Shear Vane No : 2022
Logged By : JC
Reviewed By : ZP
Latitude : -43.584684
Longitude : 172.494955

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
										2	4	6	8	10	12
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.					N/A							
0.5	ALLUVIUM	ML	Sandy SILT, light greyish brown with orange mottles. Low Plasticity. Sand is fine to medium.				M		203/55						
1.0		SW	Fine to coarse SAND with trace silt and gravel, grey. Well graded.					VSt-H / MD-D	223/40						
1.5		ML	Sandy SILT with trace gravel, light greyish brown with orange mottles.												
			End of Hole Depth: 1.5 m Termination Condition: Practical refusal												

Hand auger met practical refusal at 1.5 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 1.5 m depth.
Standing groundwater was not encountered



LOG OF AUGER HA03

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.5 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : ZP
Latitude : -43.583202
Longitude : 172.49557

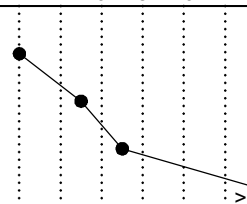
Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
										2	4	6	8	10	12
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.					N/A							
	ALLUVIUM	SM	Silty fine to medium SAND with trace rootlets and gravel, light brown. Poorly graded.				M	L							
0.5			End of Hole Depth: 0.5 m Termination Condition: Practical refusal												
1.0															
1.5															
2.0															
2.5															

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



Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No : N/A
 Logged By : JC
 Reviewed By : ZP
 Latitude : -43.582792
 Longitude : 172.497016

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
										2	4	6	8	10	12
	TOPSOIL	SM	Silty fine to medium SAND with some gravel and trace rootlets, brown. Poorly graded. Gravel is fine to coarse.				M	N/A							
0.5	End of Hole Depth: 0.3 m Termination Condition: Practical refusal														

GEOTECH HAND AUGER HAND AUGER LOGS_RHODE LAND.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20



LOG OF AUGER HA05

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.6 m
Hole Diameter : 50 mm

Shear Vane No : 2022
Logged By : JC
Reviewed By : ZP
Latitude : -43.580846
Longitude : 172.495083

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.					N/A							
0.5	ALLUVIUM	ML	Sandy SILT, light brown with orange mottles. Low plasticity.				M	VSt-H							
End of Hole Depth: 0.6 m Termination Condition: Practical refusal										226+					
1.0															
1.5															
2.0															
2.5															

Hand auger met practical refusal at 0.6 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.7 m depth.
Standing groundwater was not encountered



LOG OF AUGER HA06

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : ZP
Latitude : -43.582212
Longitude : 172.494501

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
										2	4	6	8	10	12
	ALLUVIUM TOP SOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.				M	N/A							
		SM	Silty fine to medium SAND with trace rootlets and gravel, light brown. Poorly graded.					MD							
0.5			End of Hole Depth: 0.4 m Termination Condition: Practical refusal												
1.0															
1.5															
2.0															
2.5															

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

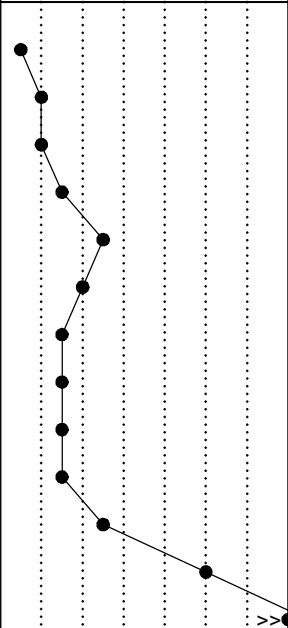
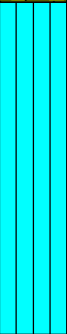


LOG OF AUGER HA07

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 1.1 m
Hole Diameter : 50 mm

Shear Vane No : 2022
Logged By : JC
Reviewed By : ZP
Latitude : -43.581358
Longitude : 172.492381

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer						
										Blows per 100mm						
										2	4	6	8	10	12	
0.5	TOPSOIL	ML	Sandy SILT with trace rootlets, brown. Low plasticity. Sand is fine to medium.				M	N/A	226+							
	ALLUVIUM	ML	Sandy SILT, light greyish brown with orange mottles. Low plasticity. Sand is fine to medium.					VSt-H								226+
1.0	End of Hole Depth: 1.1 m Termination Condition: Practical refusal															
1.5																
2.0																
2.5																
Hand auger met practical refusal at 1.1 m depth on inferred gravel. Scala Penetrometer met practical refusal at 1.3 m depth. Standing groundwater was not encountered																



LOG OF AUGER HA08

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 1.25 m
Hole Diameter : 50 mm

Shear Vane No : 2022
Logged By : JC
Reviewed By : ZP
Latitude : -43.582975
Longitude : 172.493024

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
										2	4	6	8	10	12
	TOPSOIL	ML	Sandy SILT with trace rootlets, brown. Low plasticity. Sand is fine to medium.					N/A							
0.5		ML	Sandy SILT, light greyish brown. Low plasticity. Sand is fine to medium.				M	VSt-H	226+						
1.0	ALLUVIUM	SM	Silty fine to medium SAND, light greyish brown with orange mottles. Poorly graded.					MD-D	UTP						
			End of Hole Depth: 1.25 m Termination Condition: Practical refusal												
1.5															
2.0															
2.5															

Hand auger met practical refusal at 1.25 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 1.3 m depth.
Standing groundwater was not encountered



LOG OF AUGER HA09

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.9 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : ZP
Latitude : -43.584398
Longitude : 172.493431

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
	TOPSOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.					N/A							
0.5	ALLUVIUM	SP	Fine to medium SAND with minor silt, light brown. -0.6 becomes light greyish brown with orange mottles.				M	L-MD							
1.0	End of Hole Depth: 0.9 m Termination Condition: Practical refusal														
1.5															
2.0															
2.5															

GEOTECH HAND AUGER HAND AUGER LOGS RHODE LAND.GPJ NZ DATA TEMPLATE 2.GDT 3/9/20

Hand auger met practical refusal at 0.9 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.9 m depth.
Standing groundwater was not encountered



LOG OF AUGER HA10

Geotechnical Investigation
Rhodes Land
Prebbleton
17637

Client : Urban Estates Ltd
Client Ref. : N/A
Date : 24/08/2020
Hole Depth : 0.4 m
Hole Diameter : 50 mm

Shear Vane No : N/A
Logged By : JC
Reviewed By : ZP
Latitude : -43.585845
Longitude : 172.49233

Depth (m BGL)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer					
										Blows per 100mm					
										2	4	6	8	10	12
	ALLUVIUM TOP SOIL	SM	Silty fine to medium SAND with trace rootlets, brown. Poorly graded.				M	N/A							
		SP	Fine to medium SAND with trace silt and gravel, light brown. Poorly graded.					L							
0.5			End of Hole Depth: 0.4 m Termination Condition: Practical refusal												
1.0															
1.5															
2.0															
2.5															

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

APPENDIX 2:
ECan Well Summary Sheets



Bore or Well No	M36/1517		
Well Name	404 TRENTS ROAD		
Owner	BOULTON W.R.		
Well Number	M36/1517	File Number	
Owner	BOULTON W.R.	Well Status	Active (exist, present)
Street/Road	404 TRENTS ROAD	NZTM Grid Reference	BX23:59204-74589
Locality	PREBBLETON	NZTM X and Y	1559204 - 5174589
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic and Stockwater,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	--
Depth	15.10m	Water Level Count	0
Diameter	150mm	Initial Water Level	8.84m below MP
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	27.28m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	4	Calc Min 80%	9.34m below MP (Estimated)
Aquifer Name	Riccarton Gravel	Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	05 Feb 1982	Max Tested Yield	5 l/s
Driller	McMillan Drilling Ltd	Drawdown at Max Tested Yield	0 m
Drilling Method	Cable Tool	Specific Capacity	30.67 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	Galvanised (Nold)	13.4	15.1				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
05 Feb 1982	1	4.6	60.7116432	0.15	0

No comments for this well

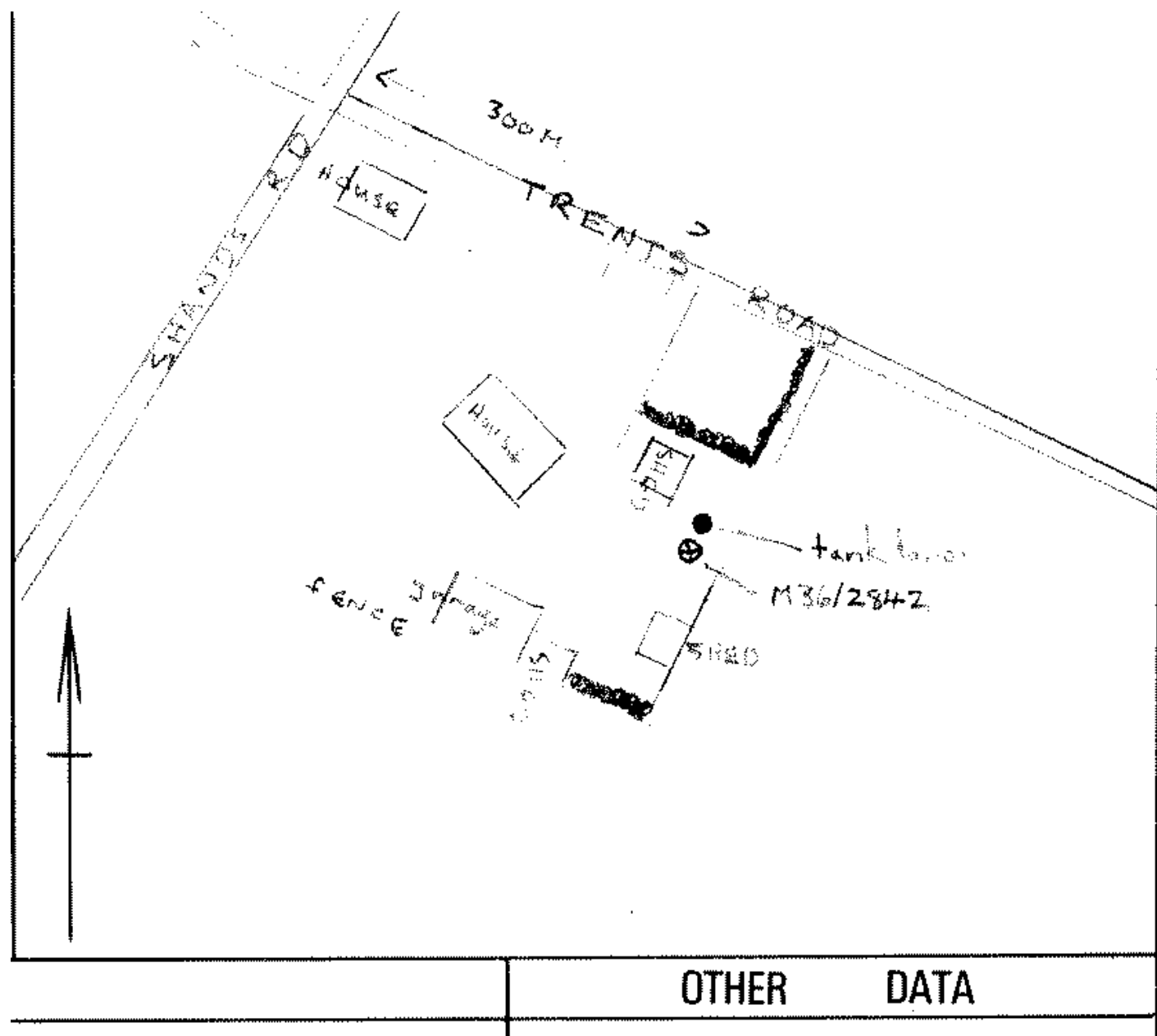
**Environment
Canterbury**
Regional Council
Kaunihera Taiao ki Waitaha

Borelog Depth: 15.1 m Drill Date: 05-Feb-1982





Bore or Well No	M36/2842		
Well Name	TRENTS RD		
Owner	HAY LAURIE		
Well Number	M36/2842	File Number	
Owner	HAY LAURIE	Well Status	Active (exist, present)
Street/Road	TRENTS RD	NZTM Grid Reference	BX23:59004-74589
Locality	PREBBLETON	NZTM X and Y	1559004 - 5174589
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	--
Depth	24.40m	Water Level Count	0
Diameter	100mm	Initial Water Level	
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	27.53m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	2	Calc Min 80%	11.28m below MP (Estimated)
Aquifer Name	Springston Formation	Aquifer Tests	0
Aquifer Type	Water Table	Yield Drawdown Tests	1
Drill Date	06 Mar 1980	Max Tested Yield	1 l/s
Driller	Smith, J R & I G	Drawdown at Max Tested Yield	19 m
Drilling Method	Cable Tool	Specific Capacity	0.06 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type	Unknown	Last Field Check	
Water Use Data	No		



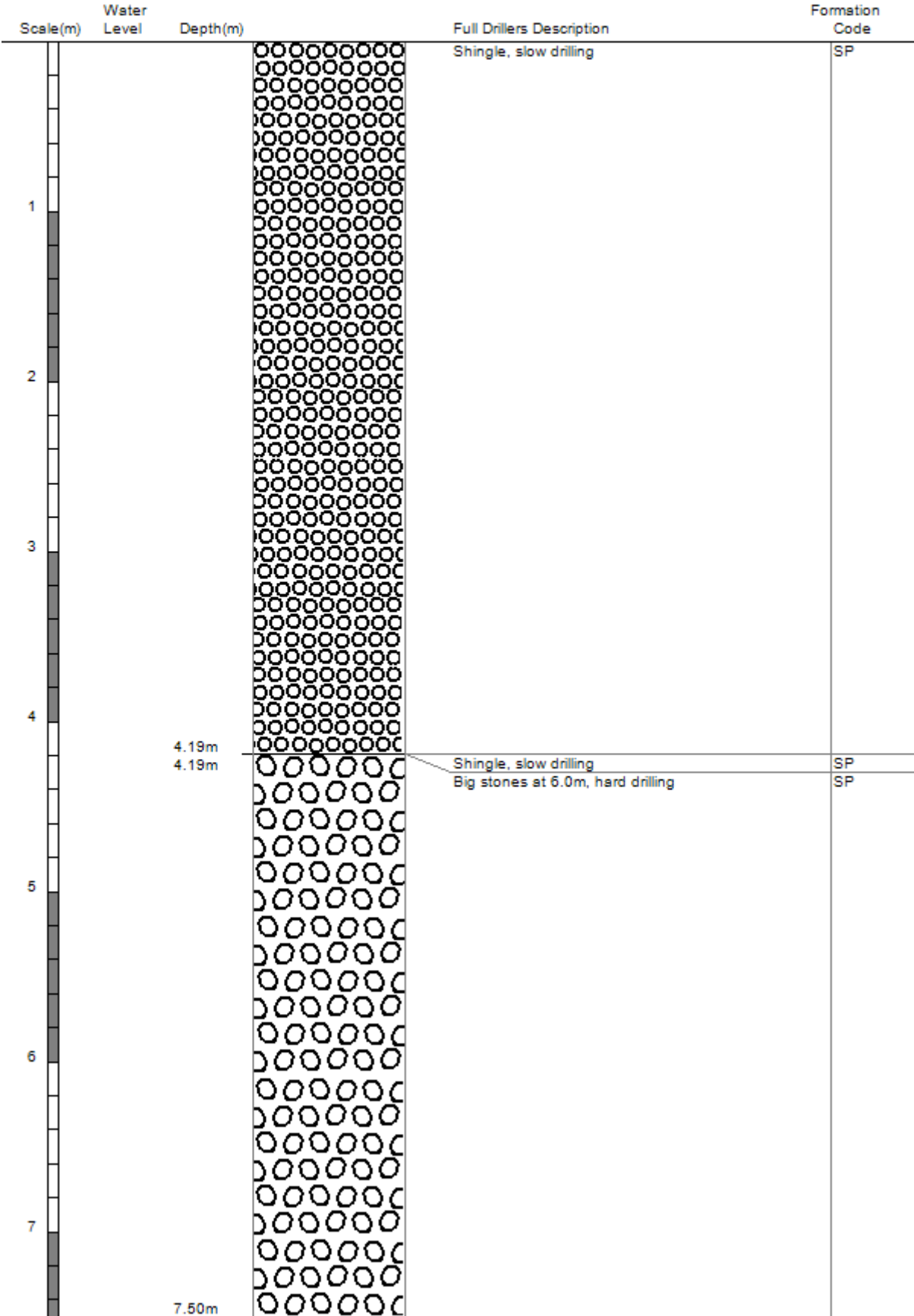
No screen data for this well

Step Tests

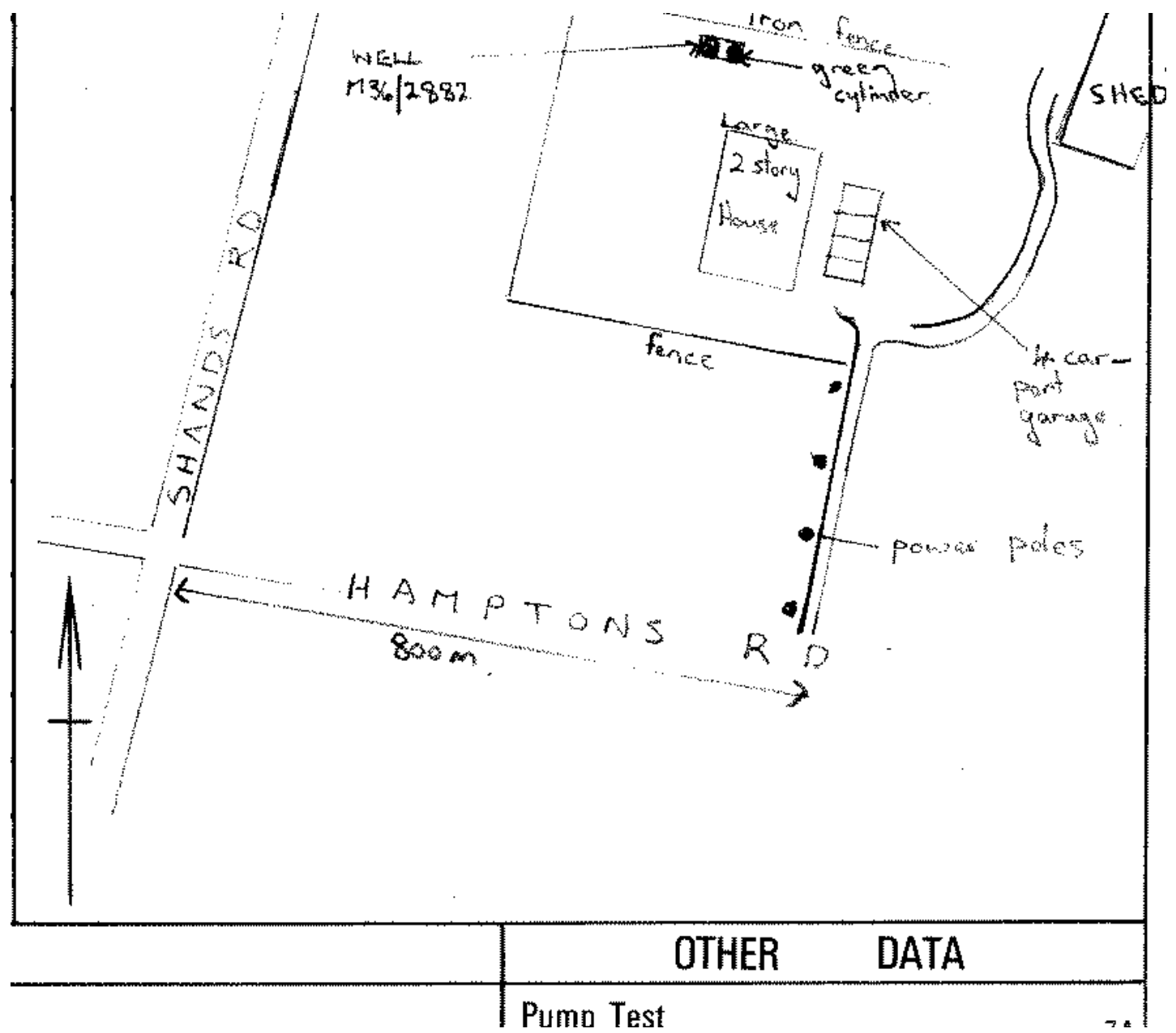
Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
06 Mar 1980	1	1.1	14.5180025	18.9	0

Borelog for well M36/2842

Grid Reference (NZTM): 1559004 mE, 5174590 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 27.5 m +MSD Accuracy: < 0.5 m
Driller: Smith, J R & I G
Drill Method: Cable Tool
Borelog Depth: 7.5 m Drill Date: 06-Mar-1980



Bore or Well No	M36/2882		
Well Name	HAMPTONS RD		
Owner	RHODES, G.F.		
Well Number	M36/2882	File Number	
Owner	RHODES, G.F.	Well Status	Active (exist, present)
Street/Road	HAMPTONS RD	NZTM Grid Reference	BX23:59304-74089
Locality	PREBBLETON	NZTM X and Y	1559304 - 5174089
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Domestic Supply,
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	--
Depth	21.00m	Water Level Count	0
Diameter	150mm	Initial Water Level	8.50m below MP
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	25.94m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	0	Calc Min 80%	10.19m below MP (Estimated)
Aquifer Name		Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	25 Mar 1977	Max Tested Yield	1 l/s
Driller	Smith, J R & I G	Drawdown at Max Tested Yield	3 m
Drilling Method	Cable Tool	Specific Capacity	0.52 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type	Unknown	Last Field Check	
Water Use Data	No		



No screen data for this well

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
25 Mar 1977	1	1.4	18.477457	2.7	0

No comments for this well



Bore or Well No	M36/4805		
Well Name	HAMPTONS ROAD		
Owner	SMITH, T.J.		
Well Number	M36/4805	File Number	CO6C/04945
Owner	SMITH, T.J.	Well Status	Active (exist, present)
Street/Road	HAMPTONS ROAD	NZTM Grid Reference	BX23:58914-74039
Locality	PREBBLETON	NZTM X and Y	1558914 - 5174039
Location Description		Location Accuracy	50 - 300m
CWMS Zone	Selwyn - Waihora	Use	Irrigation, Domestic and Stockwater
Groundwater Allocation Zone	Selwyn-Waimakariri	Water Level Monitoring	--
Depth	32.70m	Water Level Count	0
Diameter	150mm	Initial Water Level	7.67m below MP
Measuring Point Description		Highest Water Level	
Measuring Point Elevation	26.41m above MSL (Lyttelton 1937)	Lowest Water Level	
Elevation Accuracy	< 5 m	First reading	
Ground Level	0.00m above MP	Last reading	
Strata Layers	8	Calc Min 80%	10.46m below MP (Estimated)
Aquifer Name	Riccarton Gravel	Aquifer Tests	0
Aquifer Type	Unknown	Yield Drawdown Tests	1
Drill Date	20 Dec 1994	Max Tested Yield	14 l/s
Driller	McMillan Drilling Ltd	Drawdown at Max Tested Yield	21 m
Drilling Method	Rotary Rig	Specific Capacity	0.67 l/s/m
Casing Material	STEEL	Last Updated	08 Nov 2013
Pump Type	Unknown	Last Field Check	
Water Use Data	Yes		

Screens

Screen No.	Screen Type	Top (m)	Bottom (m)	Slot Size (mm)	Slot Length (mm)	Diameter (mm)	Leader Length (mm)
1	Stainless steel	30.7	32.7				

Step Tests

Step Test Date	Step	Yield	Yield GPM	DrawDown	Step Duration
20 Dec 1994	1	13.9	183.454742	20.8	0

No comments for this well

Borelog for well M36/4805 page 1 of 2

Grid Reference (NZTM): 1558914 mE, 5174040 mN

Location Accuracy: 50 - 300m

Ground Level Altitude: 26.4 m +MSD Accuracy: < 0.5 m

Driller: McMillan Drilling Ltd

Drill Method: Rotary Rig

Borelog Depth: 32.7 m Drill Date: 20-Dec-1994

