ENGEO

Expect Excellence

Geotechnical Investigation

503 East Maddisons Road

Rolleston

Canterbury

Submitted to:

Hughes Development Ltd

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ACENZ

Contents

Tables

Figures

Appendices

ENGEO Document Control:

Report Title	Geotechnical Investigation - 503 East Maddisons Road, Rolleston			
Project No.	12903.000.000	Doc ID	42	
Client	Hughes Development Ltd	Client Contact	Kelvin Back	
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Date	Revision Details/Status	WP	Author	Reviewer
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1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a geotechnical investigation of the property at 503 East Maddisons Road, Rolleston, Christchurch, as outlined in our variation proposal (ref. P2016.000.248_035).

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

Our scope of works included the following:

- Complete a desktop study of relevant available geotechnical and geological publications, including the NZ Geotechnical and Environment Canterbury Databases.
- Undertake a geotechnical site walkover.
- Undertake five 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 six test pits, including geotechnical logging of the exposed soils.
- Preparation of this report outlining our findings on the ground conditions and the suitability of the site for residential subdivision. This will include geotechnical advice on the likely foundation Technical Category, conceptual foundation recommendations for typical timber framed residential dwellings, and address likely geohazards as required by Section 106 of the RMA.

2 Site Description

The site covers a total area of 4 ha, and has the following legal description (Selwyn District Council):

- 503 East Maddisons Road - Lot 4 DP 326339.

It is located approximately 4 km south of Rolleston town centre, and is bound to the northeast by East Maddisons Road. Rural properties border the site on the remaining sides (Figure 1).

Figure 1: Site Location Plan

Aerial photograph sourced from Canterbury Maps (retrieved November 2018). Image not to scale.

3 Geological Model

3.1 Regional Geology

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

3.2 Geomorphology

The site comprises relatively flat ground, with gentle undulations and depressions in some areas. As evident on aerial imagery (Canterbury Maps, 2016) and observed during our site walkover conducted on 7 November 2018, undulating and depressed ground can be attributed to paleo-channels, which traverse the site in a general northwest to southeast trend. Based on observations, silt and sand deposits with variable thickness (up to 0.4 m) are expected to have in-filled the paleo-channels where they have not remained as channel features. Inferred paleo-channels have been mapped to give an indication of areas with potential channel in-fill (Appendix 1).

3.3 Geohazards

3.3.1 Seismicity

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

The site is located between two recently discovered fault systems, the Greendale Fault and the Port Hills Fault, the ruptures of which initiated the ongoing Canterbury Earthquake Sequence (CES). The Greendale Fault has been mapped approximately 5 km northwest / west of the site and trends roughly eastwest with a surface rupture of approximately 28 km (GNS, 2015), while the Port Hills Fault remains unmapped as the fault did not rupture at the surface. Movement on the Port Hills Fault is believed to have occurred at a depth of 1 km to 2 km below ground surface.

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

3.3.2 Liquefaction and Lateral Spreading

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

3.4 Site Investigation

Site investigations to assess the shallow subsurface material types and strength characteristics were undertaken by ENGEO on 7 November 2018. The investigations comprised five hand auger boreholes and 6 test pit investigations with associated Scala penetrometer tests.

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

Table 1: Generalised Summary of Subsurface Conditions

Soil Type	Depth to Top of Layer (m)	Layer Thickness (m)	Density / Consistency	Additional Comments
TOPSOIL	0.0	0.2 – 0.3	Stiff to Very Stiff	
SILT	0.2	0.2	Stiff to Very Stiff	Not present at all test locations
Sandy GRAVEL	0.2 – 0.4	Unknown	Dense to Very Dense	

3.5 ECan Boreholes

A review of three deep ECAN borehole logs, one located near the southern side of the site (M36/7639), one along the northern boundary (M36/4121), one near the western boundary (M36/7902), and one 900 m to the west of the property (M36/7512) was conducted (Canterbury Maps).

The location of these boreholes is presented in Figure 2 and includes the well points on site that have no log data available. The logs from the three holes of interest are presented in Appendix 3 and indicate the site is broadly underlain by a mixture of sandy gravels to depths of at least 36 m below ground level.

Figure 2: Nearby ECAN Borehole Locations

Aerial photograph sourced from Canterbury Maps (retrieved November 2018). Not to Scale.

3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 8 m and 10 m depth.

3.7 Site seismic Class

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

4 Liquefaction Assessment

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

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

5 RMA Section 106 Requirements and Suitability to Subdivide

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

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

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

6 Geotechnical Recommendations

6.1 Earthworks

Earthworks carried out for the subdivision shall be in accordance with NZS 4404:2010, Land Development and Subdivision Infrastructure and NZS 4431:1989, Code of Practice for 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 pad, strip or slab foundations designed in accordance with the provisions of NZS 3604 Timber Framed Buildings.

Site specific testing will be required for Building Consent, to confirm the bearing materials and capacity. For preliminary design, we anticipate that a geotechnical Ultimate Bearing Capacity of 300 kPa may be assumed for foundations bearing on natural silt, sandy gravel or engineered fill, below any topsoil. We anticipate this to be typically below 0.3 m depth based on our subsurface investigations.

7 References

Canterbury Maps, Groundwater. Retrieved November 2018, from http://canterburymaps.govt.nz/Viewer.

Canterbury Maps, Historic Aerial Imagery. Retrieved November 2018, from https://apps.canterburymaps.govt.nz/CanterburyHistoricAerialImagery.

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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.

Selwyn District Council (2015), Selwyn District Council Operative District Plan. May 2018, from http://www.selwyn.govt.nz/services/planning/district-plan.

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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 2018, from https://www.nzgd.org.nz.

8 Limitations

i. We have prepared this report in accordance with the brief as provided. This report has been prepared for the use of our client, Hughes Development Ltd, their professional advisers and the relevant Territorial Authorities in relation to the specified project brief described in this report. No liability is accepted for the use of any part of the report for any other purpose or by any other person or entity.

ii. The recommendations in this report are based on the ground conditions indicated from published sources, site assessments and subsurface investigations described in this report based on accepted normal methods of site investigations. Only a limited amount of information has been collected to meet the specific financial and technical requirements of the client's brief and this report does not purport to completely describe all the site characteristics and properties. The nature and continuity of the ground between test locations has been inferred using experience and judgement and it should be appreciated that actual conditions could vary from the assumed model.

iii. Subsurface conditions relevant to construction works should be assessed by contractors who can make their own interpretation of the factual data provided. They should perform any additional tests as necessary for their own purposes.

iv. This Limitation should be read in conjunction with the IPENZ / ACENZ Standard Terms of Engagement.

v. This report is not to be reproduced either wholly or in part without our prior written permission.

We trust that this information meets your current requirements. Please do not hesitate to contact the undersigned on (03) 328 9012 if you require any further information.

Report prepared by

Hugh Brenstrum

Engineering Geologist

Report reviewed by

Greg Martin, CMEngNZ (PEngGeol)

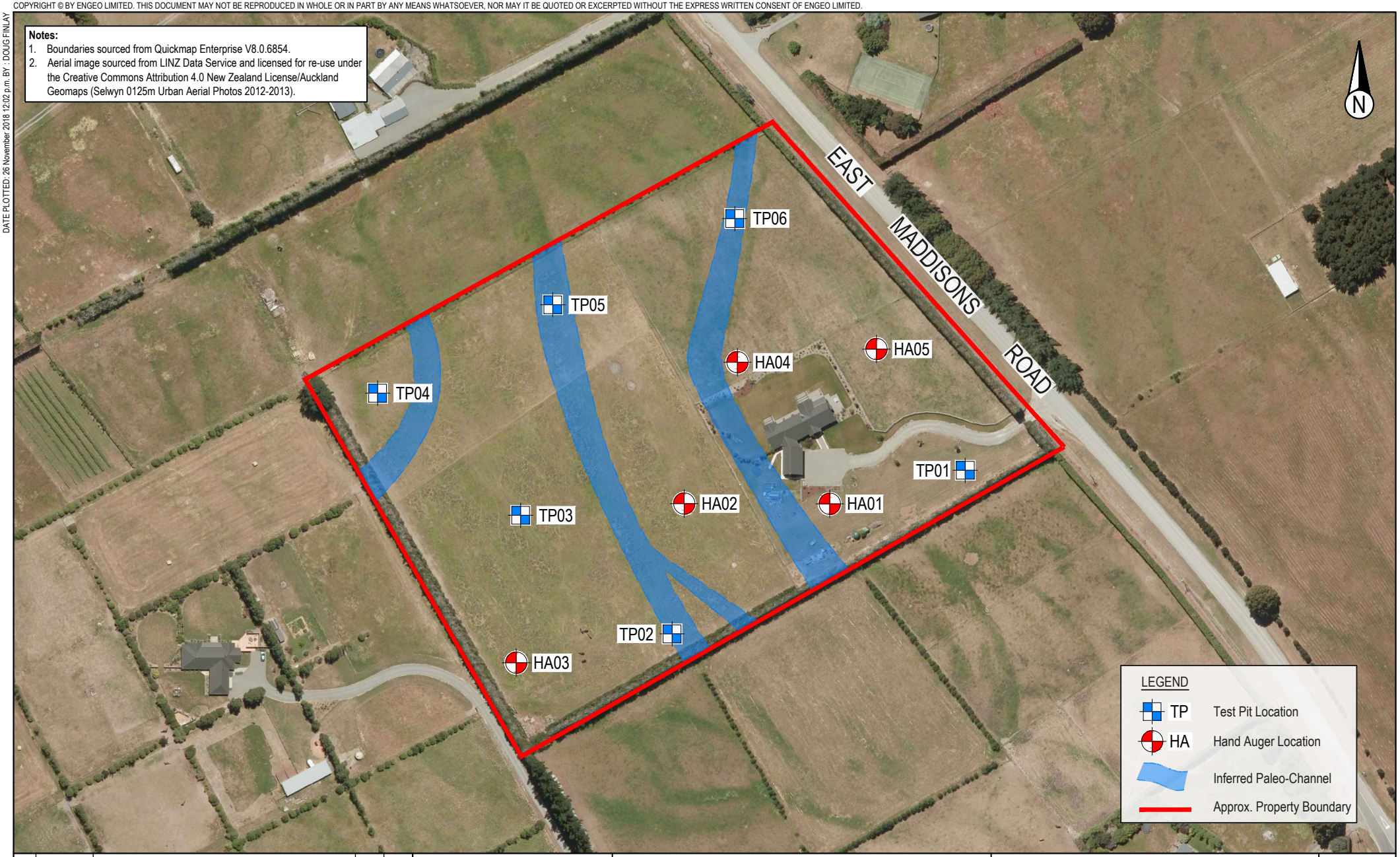
Principal Engineering Geologist

APPENDIX 1:

Test Location and Paleo Channel Plan

DATE PLOTTED: 26 November 2018 12:02 p.m. BY : DOUG FINLAY

Notes:
1. Boundaries sourced from Quickmap Enterprise V8.0.6854.
2. Aerial image sourced from LINZ Data Service and licensed for re-use under the Creative Commons Attribution 4.0 New Zealand License/Auckland Geomaps (Selwyn 0125m Urban Aerial Photos 2012-2013).



Rev	Date	Description	Drwn	Chkd
-				

ENGEO Expect Excellence
Christchurch Office
124 Montreal Street, Sydenham, Christchurch 8023
Tel: 03 328 9012, www.engeo.co.nz

Title: PALEO CHANNELS & TEST LOCATION PLAN

Client:	Hughes Developments Limited		Appendix: 1
Project:	503 East Maddisons Road Rolleston, Canterbury Selwyn District Council	Designed: HB Drawn: DF Checked: - Date: 26.11.18	Size: A4
Proj No:	12903.000.000_40	Scale: 1:2000	Revision: -

CAD File: Z:\Drafting\12001 to 13000\12903 - Faringdon South Subdivision\12903_40-TestLocPlan-503EstMaddisonsRd-1118.dwg
XREF's: selwyn-0125m-urban-aerial-photos-2012-2013

ORIGINAL FIGURE PRINTED IN COLOUR

APPENDIX 2:

Hand Auger and Test Pit Logs

LOG OF AUGER HA01

Farringdon Subdivision
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Client Ref. :
Date : 7/11/18
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627098
Longitude : 172.38771

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			D	St - VSt		
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									
1.0									

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 0.5 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA02

Farringdon Subdivision
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Client Ref. :
Date : 7/11/18
Hole Depth : 0.3 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627675
Longitude : 172.386264

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0	TOPSOIL	ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			D	St - VSt		
			End of Hole Depth: 0.3 m Termination Condition: Practical refusal						
0.5									
1.0									

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 0.5 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA03

Farringdon Subdivision
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Client Ref. :
Date : 7/11/18
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627103
Longitude : 172.387073

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
0	TOPSOIL	ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St - VSt		2 4 6 8 10 12
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						>>
0.5									
1.0									

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 HA04

Farringdon Subdivision
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Client Ref. :
Date : 7/11/18
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.626611
Longitude : 172.387223

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			D	St - VSt		
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									
1.0									

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 0.5 m depth.
Standing groundwater was not encountered

LOG OF AUGER HA05

Farringdon Subdivision
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Client Ref. :
Date : 7/11/18
Hole Depth : 0.2 m
Hole Diameter : 50 mm

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.626563
Longitude : 172.388048

Depth (m)	Material	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength (kPa) Peak/Remolded	Scala Penetrometer Blows per 100mm
	TOPSOIL	ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			D	St - VSt		
			End of Hole Depth: 0.2 m Termination Condition: Practical refusal						
0.5									
1.0									

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 0.5 m depth.
Standing groundwater was not encountered

LOG OF TEST PIT TP01

503 East Maddisons Road
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Date : 7/11/18
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator/ 5t
Bucket Type/Size : Toothed Trenching Bucket

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.626938
Longitude : 172.388435

Depth (m)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with minor cobbles; grey. Well graded, subrounded to rounded. Sand, fine to coarse.			D	D - VD		
1.5			SP	Fine to medium SAND; brownish grey. Poorly graded.				D - VD		
			GW	Sandy fine to coarse GRAVEL with minor cobbles; grey. Well graded, subrounded to rounded. Sand, fine to coarse.				D - VD		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						
2.5										

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

GEOSCIENCE TEST PIT LOG TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 23/11/18

LOG OF TEST PIT TP02

503 East Maddisons Road
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Date : 7/11/18
Max Test Pit Depth : 2.1 m
Digger Type/Size : Bucket Excavator/ 5t
Bucket Type/Size : Toothed Trenching Bucket

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627509
Longitude : 172.387013

Depth (m)	Material	Excavatability (Relative Scale) Easier – Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL; grey. Well graded, subrounded to rounded. Sand, fine to coarse.			D	D - VD		>>
1.0				Encountered some cobbles from 1.2 m depth.						
1.5										
2.0				Depth of Excavation: 2.1 m Termination Condition: Target depth						
2.5										

LOG OF TEST PIT TP03

503 East Maddisons Road
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Date : 7/11/18
Max Test Pit Depth : 1.9 m
Digger Type/Size : Bucket Excavator/ 5t
Bucket Type/Size : Toothed Trenching Bucket

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627226
Longitude : 172.386118

Depth (m)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL; grey. Well graded, subrounded to rounded. Sand, fine to coarse.			D	D - VD		
1.0										
1.5				Encountered some cobbles from 1.5 m depth.						
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth						
2.5										

GEOSCIENCE TEST PIT LOG TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 23/11/18

LOG OF TEST PIT TP04

503 East Maddisons Road
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Date : 7/11/18
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator/ 5t
Bucket Type/Size : Toothed Trenching Bucket

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.626723
Longitude : 172.385524

Depth (m)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St - VSt		
0.5	ALLUVIUM		GW	Sandy fine to coarse GRAVEL with some cobbles; grey. Well graded, subrounded to rounded. Sand, fine to coarse.			D	D - VD		
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 >>

GEOSCIENCE TEST PIT LOG TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 23/11/18

LOG OF TEST PIT TP05

503 East Maddisons Road
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Date : 7/11/18
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator/ 5t
Bucket Type/Size : Toothed Trenching Bucket

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.626328
Longitude : 172.386384

Depth (m)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			D	St		2 4 6 8 10 12
	ALLUVIUM		ML	SILT with trace fine sand; brownish grey. Low plasticity.				St - VSt		
0.5			GW	Sandy fine to coarse GRAVEL with minor cobbles; grey. Well graded, subrounded to rounded. Sand, fine to coarse.				D - VD		>>
			SP	Fine to medium SAND; brownish grey. Poorly graded.				D - VD		
1.0			GW	Sandy fine to coarse GRAVEL with minor cobbles; grey. Well graded, subrounded to rounded. Sand, fine to coarse.			M	D - VD		
1.5										
2.0				Depth of Excavation: 2 m Termination Condition: Target depth						
2.5										

LOG OF TEST PIT TP06

503 East Maddisons Road
503 East Maddisons Road
Rolleston, Canterbury
12903.000.000_035

Client : Hughes Development Ltd
Date : 7/11/18
Max Test Pit Depth : 2.2 m
Digger Type/Size : Bucket Excavator/ 5t
Bucket Type/Size : Toothed Trenching Bucket

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.626072
Longitude : 172.387305

Depth (m)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm (2 4 6 8 10 12)
0.0	TS		ML	SILT with some fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St		
	ALLUVIUM		ML	SILT with trace fine sand; brownish grey. Low plasticity.				St -VSt		
0.5			GW	Sandy fine to coarse GRAVEL with minor cobbles; grey. Well graded, subrounded to rounded. Sand, fine to coarse.			D	D - VD		>>
1.0				Encountered minor cobbles from 1.0 m depth.			M			
1.5										
2.0				Depth of Excavation: 2.2 m Termination Condition: Target depth						
2.5										

APPENDIX 3:

ECan Well Borehole Logs

Bore Log

Borelog for well M36/7639

Grid Reference (NZTM): 1550598 mE, 5169331 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 34.3 m +MSD Accuracy: < 0.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 32.0 m Drill Date: 01-Jun-2004

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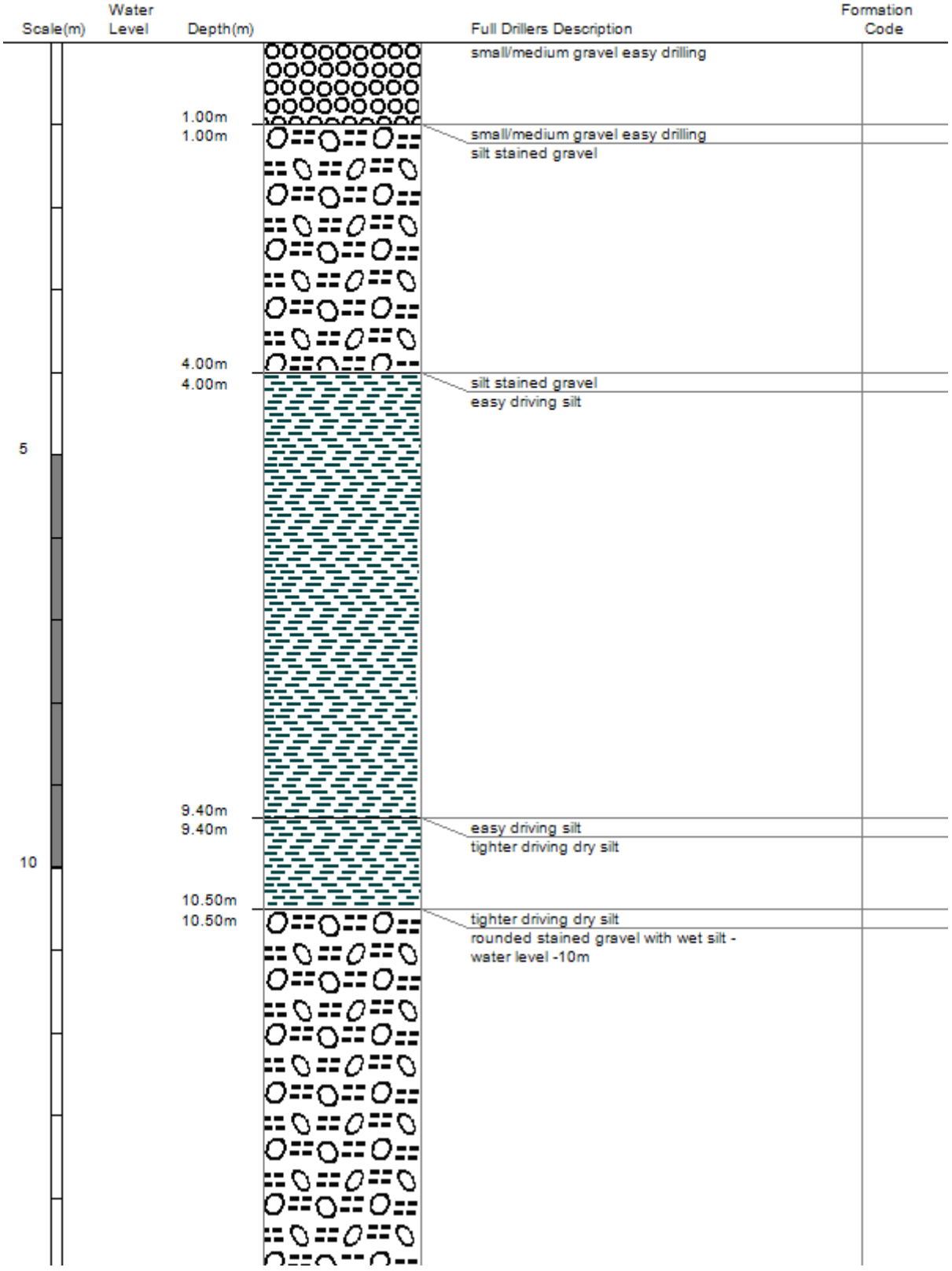

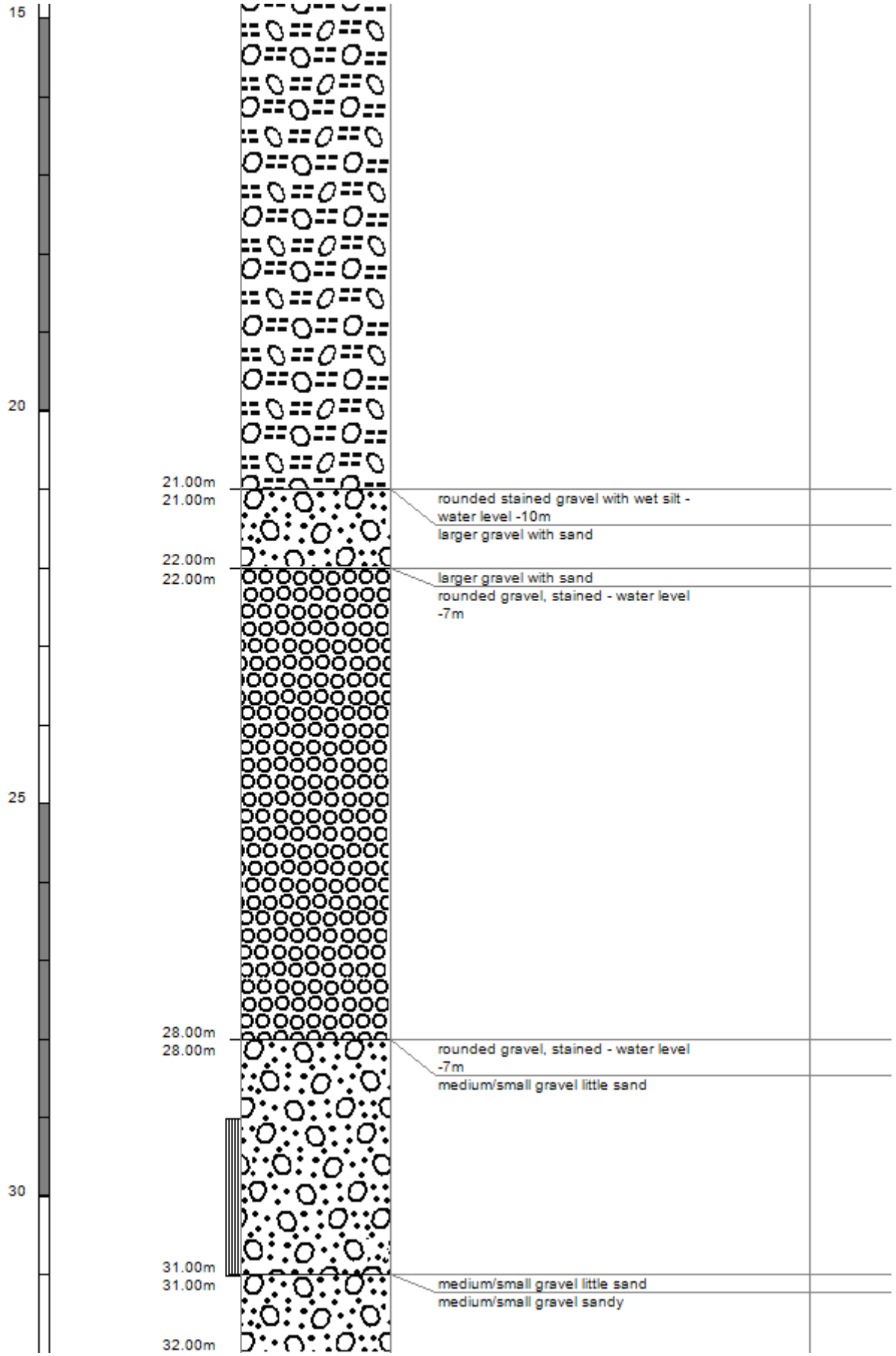
15
20
25
30
21.00m
21.00m
rounded stained gravel with wet silt - water level -10m
larger gravel with sand
22.00m
22.00m
larger gravel with sand
rounded gravel, stained - water level -7m
28.00m
28.00m
rounded gravel, stained - water level -7m
medium/small gravel little sand
31.00m
31.00m
medium/small gravel little sand
medium/small gravel sandy
32.00m

Borelog for well M36/7902

Grid Reference (NZTM): 1550408 mE, 5169271 mN
Location Accuracy: 10 - 50m
Ground Level Altitude: 34.7 m +MSD Accuracy: < 2.5 m
Driller: East Coast Drilling
Drill Method: Rotary Rig
Borelog Depth: 36.0 m Drill Date: 09-Aug-2005

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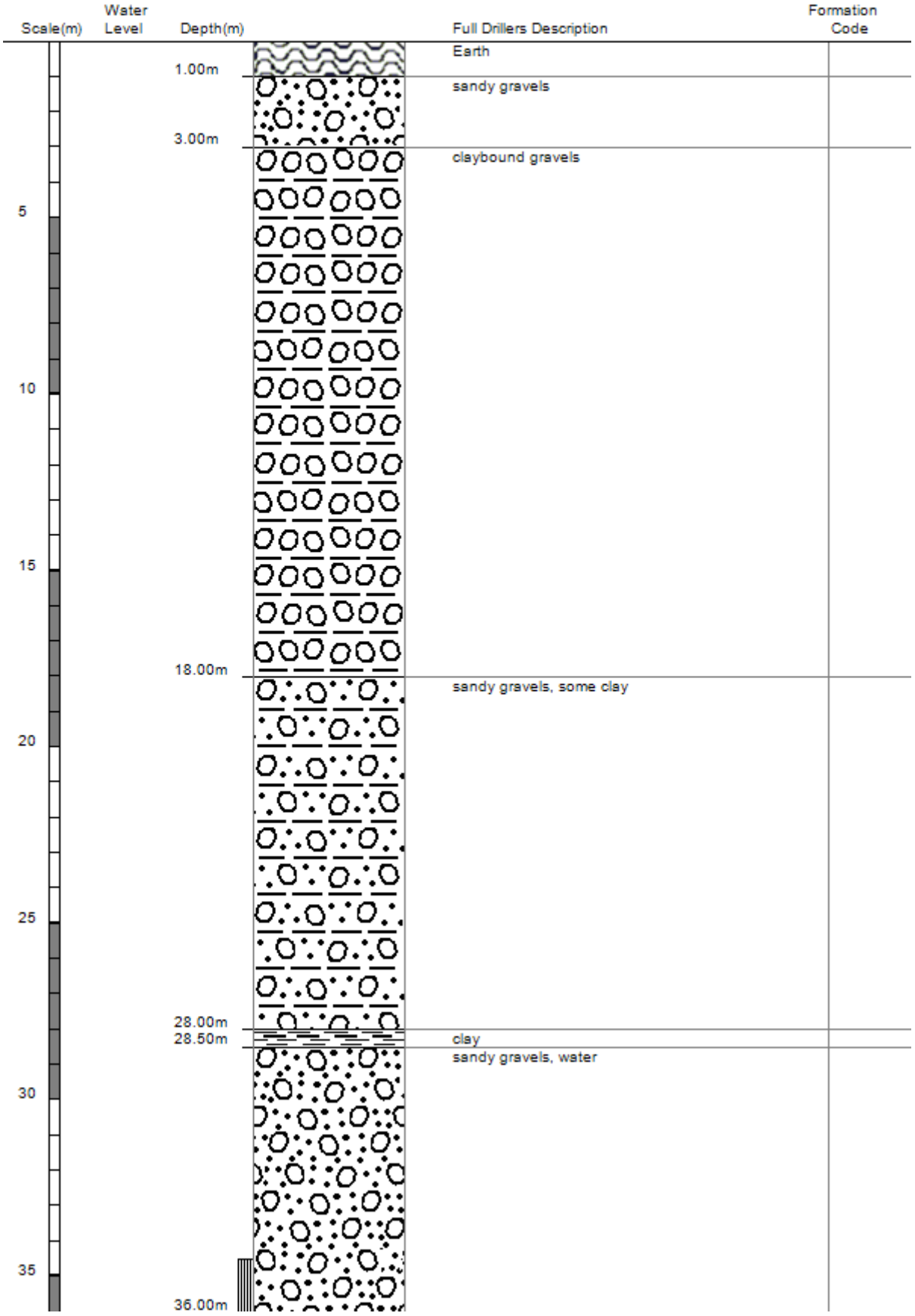

Borelog for well M36/7512

Grid Reference (NZTM): 1550238 mE, 5169431 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 34.9 m +MSD Accuracy: < 0.5 m
Driller: Dynes Road Drilling
Drill Method: Cable Tool
Borelog Depth: 29.0 m Drill Date: 01-Dec-2003

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