



ENGEO

— *Expect Excellence* —

Geotechnical Investigation

830 Selwyn Road

Springston

Canterbury

Submitted to:

Hughes Developments Ltd.

Christchurch

ENGEO Limited

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12.12.2018

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Contents

1	Introduction.....	3
2	Site Description	3
3	Geological Model	4
3.1	Regional Geology.....	4
3.2	Geomorphology.....	5
3.3	Geohazards.....	5
3.3.1	Seismicity	5
3.3.2	Liquefaction and Lateral Spreading	5
3.4	Site Investigation	5
3.5	ECAN Boreholes	6
3.6	Groundwater.....	6
3.7	Site seismic Class	7
4	Liquefaction Assessment	7
8	Limitations	10

Tables

Table 1: Generalised Summary of Subsurface Conditions

Figures

Figure 1: Site Location Plan

Figure 2: Nearby ECAN Borehole Locations

Appendices

Appendix 1: Test Location and Paleo Channel Plan

Appendix 2: Hand Auger and Test Pit Logs

Appendix 3: ECAN Well Borehole Logs

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1 Introduction

ENGEO Ltd was requested by Hughes Development Ltd to undertake a geotechnical investigation of the property at 830 Selwyn 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 4.2 ha, and has the following legal description (Selwyn District Council):

- 830 Selwyn Road - Lot 4 DP 343803.

It is located approximately 4 km south of Rolleston town centre, rural properties border the site on all sides (Figure 1).

Figure 1: Site Location Plan

Images sourced from Google Maps and Canterbury Maps. 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, 2018) and observed during our site walkover conducted on 28 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	0.1 - 0.2	Stiff	
SILT	0.2	0.1 - 0.2	Stiff to Very Stiff	Not present at all test locations
Sandy GRAVEL	0.1 - 0.4	Unknown	Dense to Very Dense	

3.5 ECAN Boreholes

A review of three deep ECAN borehole logs was conducted. The first (M36/7902), is located on-site, towards the eastern corner of the property. The second and third ECAN boreholes are located 170 m to the north (M36/7512), and 80 m to the southwest (M36/4221).

The locations of these boreholes are indicated in Figure 2, including the well points 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. Not to scale.

3.6 Groundwater

Groundwater is recorded in the surrounding boreholes between approximately 6 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 Roding

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 0.2 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>.
- 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.
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- Selwyn District Council (2015), Selwyn District Council Operative District Plan. November 2018, <http://www.selwyn.govt.nz/services/planning/district-plan>.
- Selwyn District Council, Property Search, retrieved November 2018, from <https://www.selwyn.govt.nz/my-property/rates/search-properties>.
- Standards Association of New Zealand (1989). NZS 4431:1989. Code of Practice for Earthfilling for Residential Development.
- 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 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 Engineers NZ/ACENZ Standard Terms of Engagement.
- v. This report is not to be reproduced either wholly or in part without our prior written permission.

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

Report prepared by



Hugh Brenstrum

Engineering Geologist

Report reviewed by



Greg Martin CMEngNZ (PEngGeol)

Principal Engineering Geologist

APPENDIX 1:
Test Location and Paleo Channel Plan





DATE PLOTTED: 12 December 2018 11:42 a.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).



LEGEND

-  TP Test Pit Location
-  HA Hand Auger Location
-  Inferred Paleo-Channel
-  Approx. Property Boundary

Rev	Date	Description	Drwn	Chkd
-				

ENGEO
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Title:

PALEO CHANNELS & TEST LOCATION PLAN

Client: Hughes Developments Limited	Appendix: 1
Project: 830 Selwyn Road Rolleston, Canterbury Selwyn District Council	Designed: HB Drawn: DF Checked: - Date: 10.12.18
Proj No: 12903.000.000_41	Scale: 1:2000 Revision: -

APPENDIX 2:
Hand Auger and Test Pit Logs



LOG OF TEST PIT TP01

830 Selwyn Road

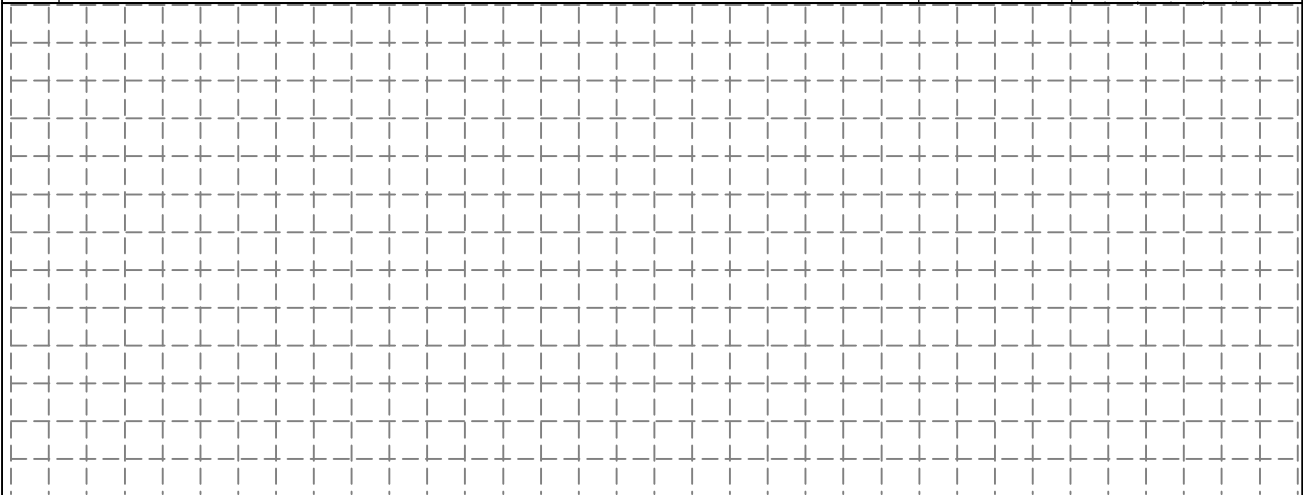
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd
Date : 30/12/18
Max Test Pit Depth : 2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm toothed/ 5t

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627775
Longitude : 172.385583

Depth (m)	Excavability (Relative Scale)		USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer					
	Easier	Harder								Blows per 100mm					
	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St							
			ML	SILT with minor fine sand; brownish grey. Low plasticity.				VSt							
0.5			GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subrounded to rounded. Sand, fine to coarse. Encountered minor cobbles from 0.6 m depth.				M							
1.0	ALLUVIUM							D - VD							
1.5															
2.0															
Depth of Excavation: 2 m Termination Condition: Target depth															

GEOSCIENCE TEST PIT LOG - PHOTOS - 830 SELWYN ROAD - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 12/12/18



Test Pit met target depth at 2 m.
Scala Penetrometer met practical refusal at 0.5 m depth.

TS = TOPSOIL



LOG OF TEST PIT TP02

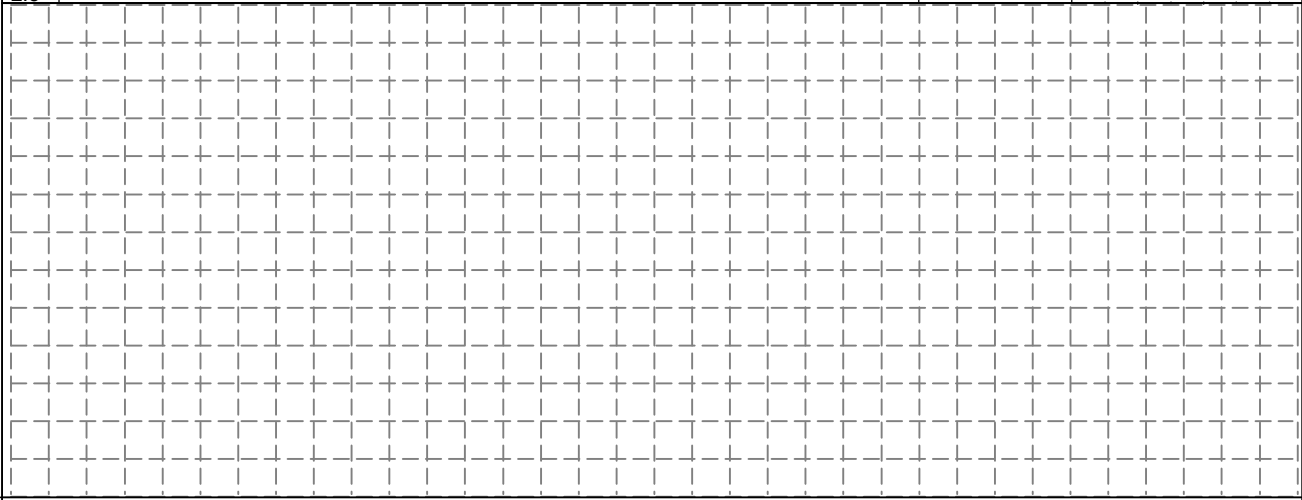
830 Selwyn Road

830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd Shear Vane No :
Date : 30/12/18 Logged By : HB
Max Test Pit Depth : 2.3 m Reviewed By :
Digger Type/Size : Bucket Excavator Latitude : -43.627301
Bucket Type/Size : 500 mm toothed/ 5t Longitude : 172.384496

Depth (m)	Excavability (Relative Scale)		USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer					
	Easier	Harder								Blows per 100mm					
0.0 - 0.3	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St		2	4	6	8	10	12
0.3 - 0.5				Sandy fine to coarse GRAVEL; brownish grey. Well graded, subrounded to rounded. Sand, fine to coarse.											
0.5 - 2.2			GW	Encountered minor cobbles from 0.5 m depth.				D - VD							
2.2 - 2.3			SW	Fine to coarse SAND; brownish grey. Well graded.				D - VD							
2.3 - 2.5				Encountered trace fine to coarse gravel from 2.2 m depth.											
				Depth of Excavation: 2.3 m Termination Condition: Target depth											

GEOSCIENCE TEST PIT LOG - PHOTOS 830 SELWYN ROAD - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 12/12/18



Test Pit met target depth at 2.3 m.
Scala Penetrometer met practical refusal at 0.3 m depth. TS = TOPSOIL



LOG OF TEST PIT TP03

830 Selwyn Road

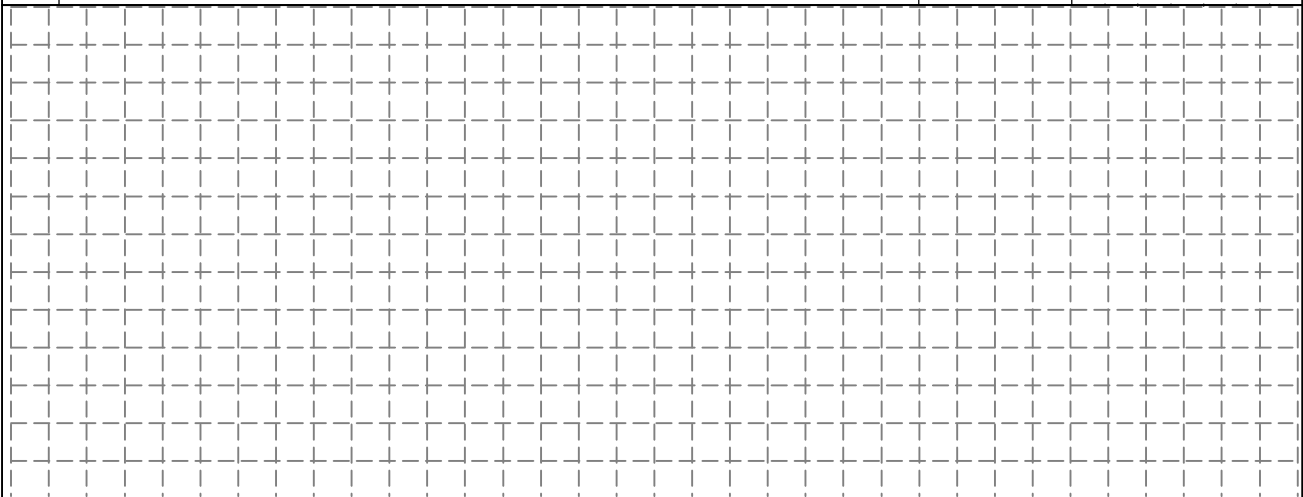
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd
Date : 30/12/18
Max Test Pit Depth : 2.2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm toothed/ 5t

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627825
Longitude : 172.383943

Depth (m)	Excavability (Relative Scale)		USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer					
	Easier	Harder								Blows per 100mm					
0.0 - 0.1	TS		ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St		2	4	6	8	10	12
0.1 - 0.6			ML	Sandy SILT; brownish grey. Low plasticity. Sand, fine to medium.				VSt							
0.6 - 2.2	ALLUVIUM		GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subrounded to rounded. Sand, fine to coarse. Encountered minor cobbles from 0.6 m depth.			M	D - VD							
				Depth of Excavation: 2.2 m Termination Condition: Target depth											

GEOSCIENCE TEST PIT LOG - PHOTOS 830 SELWYN ROAD - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 12/12/18



Test Pit met target depth at 2.2 m.
Scala Penetrometer met practical refusal at 0.6 m depth.

TS = TOPSOIL



LOG OF TEST PIT TP05

830 Selwyn Road

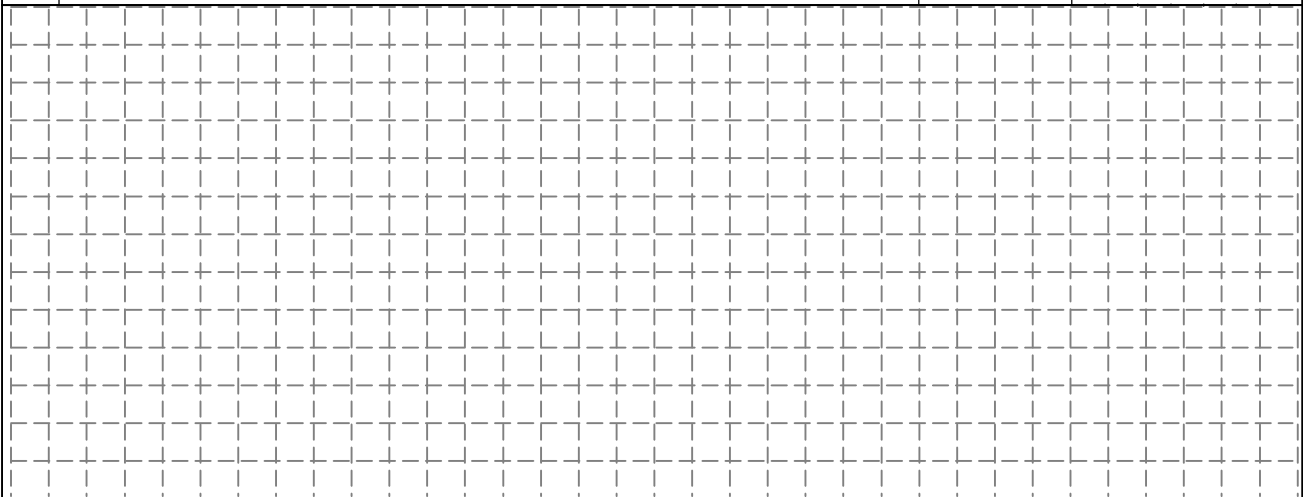
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd
Date : 30/12/18
Max Test Pit Depth : 2.2 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm toothed/ 5t

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.627964
Longitude : 172.383601

Depth (m)	Material	Excavability (Relative Scale)		USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer					
		Easier	Harder								Blows per 100mm					
											2	4	6	8	10	12
0.0 - 0.1	TS			ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St							
0.1 - 2.2	ALLUVIUM			GW	Sandy fine to coarse GRAVEL; brownish grey. Well graded, subrounded to rounded. Sand, fine to coarse. Encountered minor cobbles from 0.4 m depth.			M	D - VD							
Depth of Excavation: 2.2 m Termination Condition: Target depth																

GEOSCIENCE TEST PIT LOG - PHOTOS 830 SELWYN ROAD - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 12/12/18



Test Pit met target depth at 2.2 m.
Scala Penetrometer met practical refusal at 0.4 m depth.

TS = TOPSOIL



LOG OF TEST PIT TP06

830 Selwyn Road

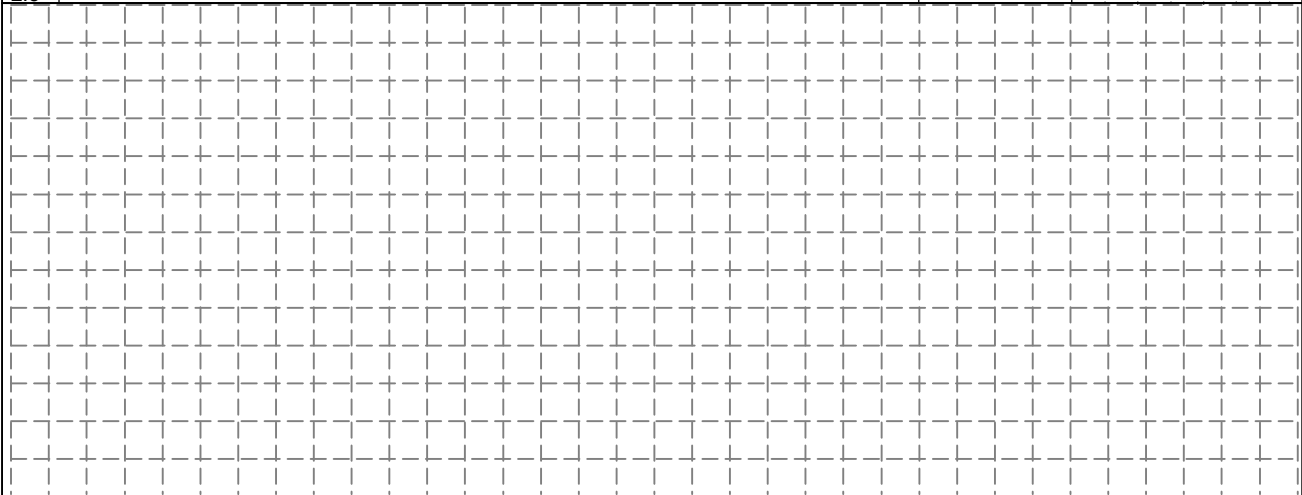
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd
Date : 30/12/18
Max Test Pit Depth : 2.3 m
Digger Type/Size : Bucket Excavator
Bucket Type/Size : 500 mm toothed/ 5t

Shear Vane No :
Logged By : HB
Reviewed By :
Latitude : -43.628756
Longitude : 172.383198

Depth (m)	Material	Excavability (Relative Scale)		USCS Symbol	DESCRIPTION	Graphic Symbol	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Undrained Shear Strength Peak/Remolded (kPa)	Scala Penetrometer						
		Easier	Harder								Blows per 100mm						
											2	4	6	8	10	12	
0.3	TS			ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St								
0.5					Sandy fine to coarse GRAVEL; brownish grey. Well graded, subrounded to rounded. Sand, fine to coarse. Encountered minor cobbles from 0.5 m depth.												
1.0																	
1.5	ALLUVIUM			GW													
2.0																	
2.3					Depth of Excavation: 2.3 m Termination Condition: Target depth												

GEOSCIENCE TEST PIT LOG - PHOTOS 830 SELWYN ROAD - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 12/12/18



Test Pit met target depth at 2.3 m.
Scala Penetrometer met practical refusal at 0.3 m depth.

TS = TOPSOIL



LOG OF AUGER HA01

830 Selwyn Road
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd Shear Vane No :
 Client Ref. : Logged By : HB
 Date : 30/12/18 Reviewed By :
 Hole Depth : 0.1 m Latitude : -43.627416
 Hole Diameter : 50 mm Longitude : 172.385392

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						
									2	4	6	8	10	12	
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			M	St								
End of Hole Depth: 0.1 m Termination Condition: Practical refusal															
0.5															

GEOSCIENCE HAND AUGER 830 SELWYN ROAD - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 12/12/18

Hand auger met practical refusal at 0.1 m depth on inferred gravel.
 Scala Penetrometer met practical refusal at 0.3 m depth.



LOG OF AUGER HA03

830 Selwyn Road
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd Shear Vane No :
 Client Ref. : Logged By : HB
 Date : 30/12/18 Reviewed By :
 Hole Depth : 0.1 m Latitude : -43.627313
 Hole Diameter : 50 mm Longitude : 172.383572

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						
									2	4	6	8	10	12	
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			M	St								
End of Hole Depth: 0.1 m Termination Condition: Practical refusal															
0.5															

GEOSCIENCE HAND AUGER 830 SELWYN ROAD - HAND AUGER LOGS.GPJ - NZ DATA TEMPLATE 2.GDT 12/12/18

Hand auger met practical refusal at 0.1 m depth on inferred gravel.
 Scala Penetrometer met practical refusal at 0.3 m depth.



LOG OF AUGER HA04

830 Selwyn Road
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd Shear Vane No :
Client Ref. : Logged By : HB
Date : 30/12/18 Reviewed By :
Hole Depth : 0.3 m Latitude : -43.628373
Hole Diameter : 50 mm Longitude : 172.382905

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						
									2	4	6	8	10	12	
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].				St								
	ALLUVIUM	ML	SILT with minor fine sand; brownish grey. Low plasticity.			M	VSt								
End of Hole Depth: 0.3 m Termination Condition: Practical refusal															
0.5															

GEOSCIENCE HAND AUGER 830 SELWYN ROAD - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 12/12/18

Hand auger met practical refusal at 0.3 m depth on inferred gravel.
Scala Penetrometer met practical refusal at 0.5 m depth.



LOG OF AUGER HA05

830 Selwyn Road
830 Selwyn Road
Springston, Canterbury
12903.000.000

Client : Hughes Development Ltd Shear Vane No :
 Client Ref. : Logged By : HB
 Date : 30/12/18 Reviewed By :
 Hole Depth : 0.2 m Latitude : -43.628353
 Hole Diameter : 50 mm Longitude : 172.383922

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					
									2	4	6	8	10	12
	TOPSOIL	ML	SILT with minor fine sand and trace rootlets; brown. Low plasticity [TOPSOIL].			M	St							
End of Hole Depth: 0.2 m Termination Condition: Practical refusal														

GEOSCIENCE HAND AUGER 830 SELWYN ROAD - HAND AUGER LOGS.GPJ NZ DATA TEMPLATE 2.GDT 12/12/18

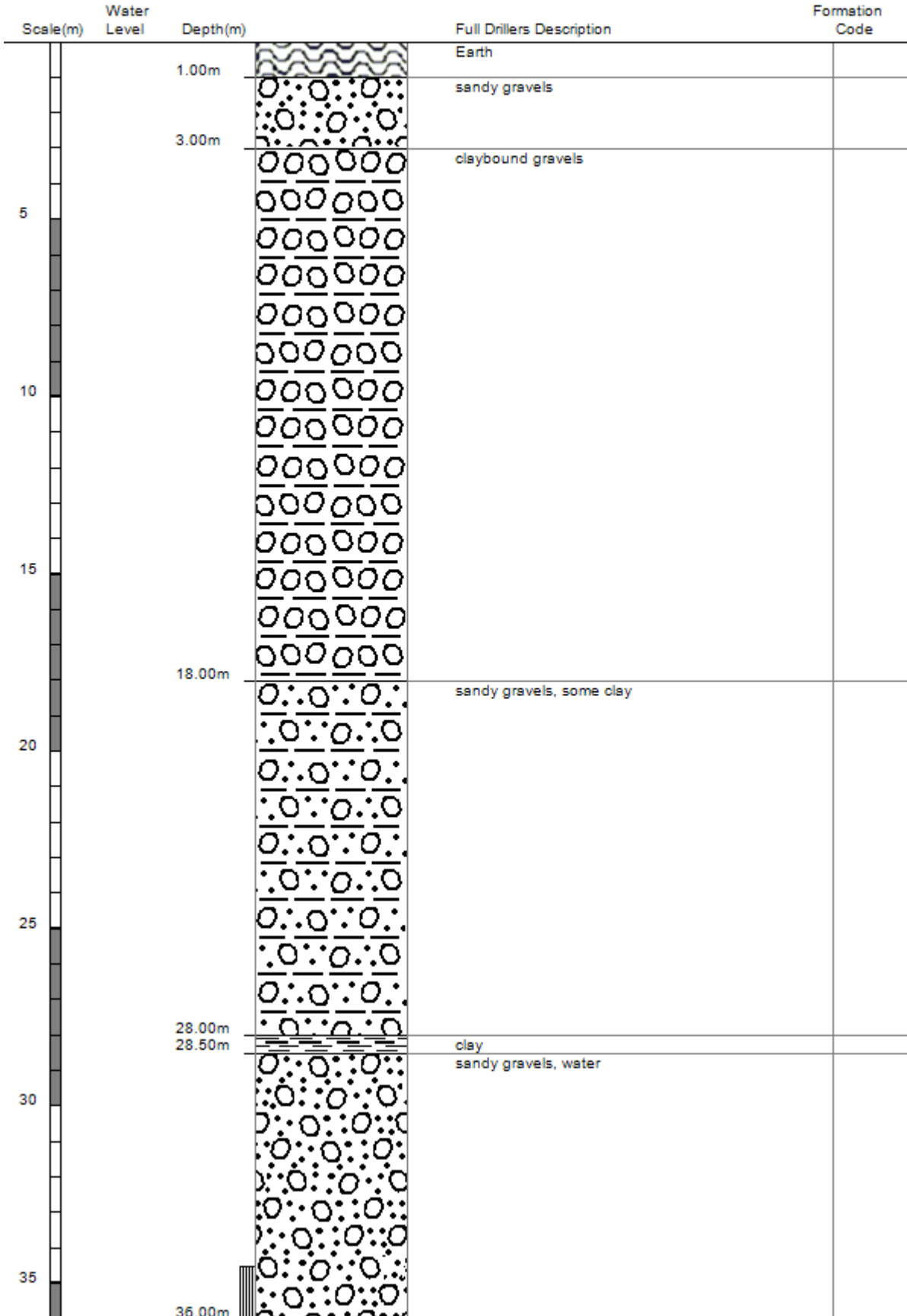
0.5

Hand auger met practical refusal at 0.2 m depth on inferred gravel.
 Scala Penetrometer met practical refusal at 0.4 m depth.

APPENDIX 3:
ECAN Well Borehole Logs

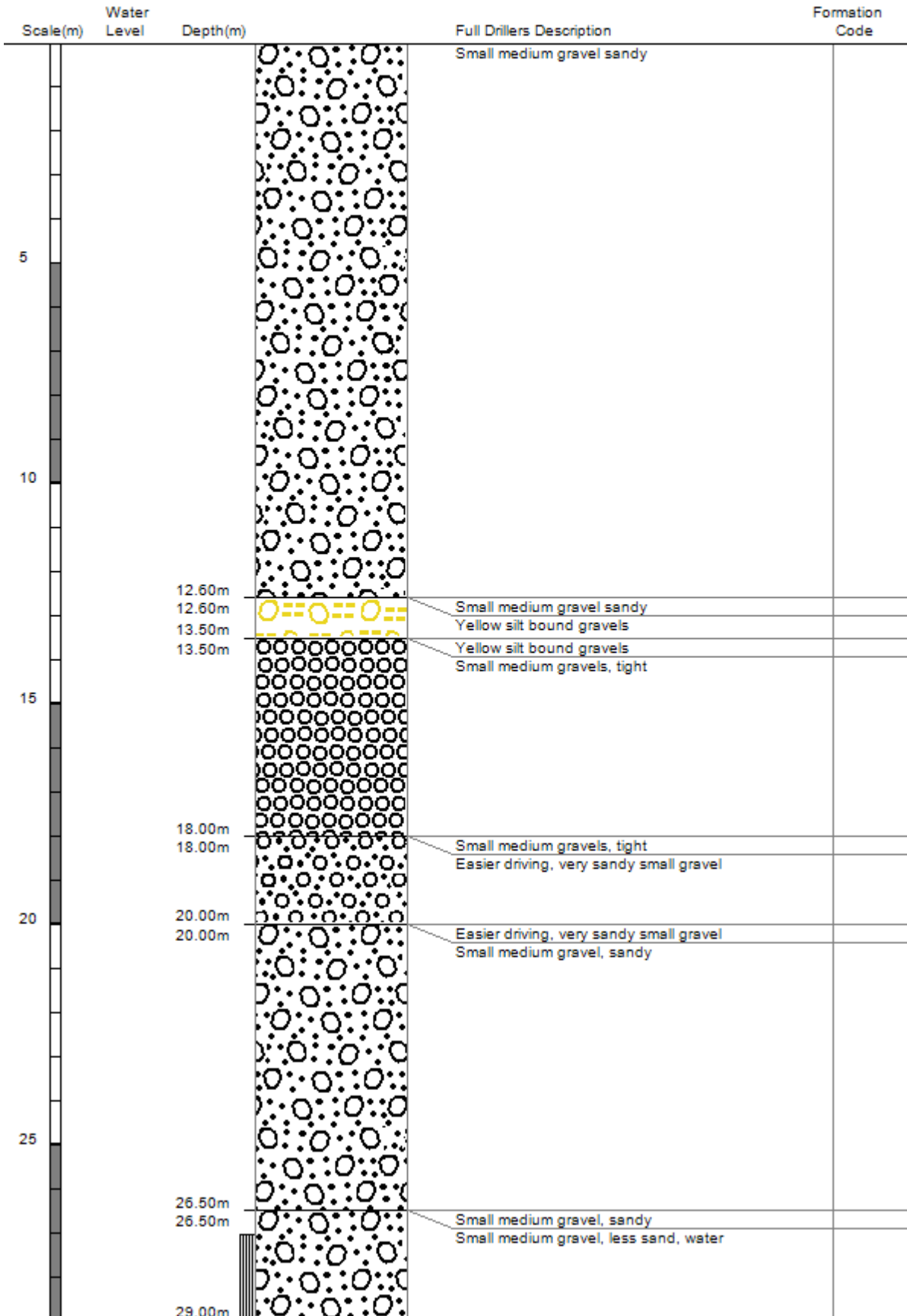
Borelog for well M36/7902

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



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



Borelog for well M36/4221

Grid Reference (NZTM): 1550161 mE, 5169165 mN
 Location Accuracy: 2 - 15m
 Ground Level Altitude: 35.5 m +MSD Accuracy: < 2.5 m
 Driller: Weedons WellDrilling
 Drill Method: Rotary/Percussion
 Borelog Depth: 21.4 m Drill Date: 04-Feb-1991



Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		0.50m	Topsoil	RI
			Light sandy gravels	RI
5		4.50m	Very sandy gravels	RI
		6.00m	Claybound gravels	RI
		8.00m	Sand	RI
10		9.00m	Very sandy Water-bearing gravels	RI
		12.00m	Clean Water-bearing gravels, yield increasing with depth	RI
15				
20				
		21.44m		