Appendix B

Geotechnical Assessment

Skellerup South Plan Change

Preliminary Geotechnical Assessment Report

Rolleston Industrial Developments Limited

Reference: 773-CHCGE293048

27 September 2021

SKELLERUP SOUTH PLAN CHANGE

Preliminary Geotechnical Assessment Report

Report reference number: 773-CHCGE293048
27 September 2021

PREPARED FOR

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QUALITY INFORMATION

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EXECUTIVE SUMMARY[1]

Rolleston Industrial Developments Limited proposed a Plan Change and future subdivision of a 28Ha block on the corner of Dunns Crossing Road and Selwyn Road, Rolleston, Canterbury. This preliminary geotechnical suitability assessment report is to support a Plan Change application for the construction of residential Lots at the site.

The data from previous site investigations and preliminary liquefaction assessment indicates that the site is TC1-like. Other geotechnical hazards (erosion, slippage and inundation) are considered low to very low risk with appropriate future engineering design.

Our assessment has considered the items required by Section 106 of the RMA and in our opinion the site is considered geotechnically suitable for Plan Change and future subdivision. Further investigations and design will need to be carried out at the subdivision consent stage.

[1] This executive summary must be read in the context of the full report and the attached limitations.

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1. INTRODUCTION

Rolleston Industrial Developments Limited has engaged Tetra Tech Coffey (NZ) Limited (Tetra Tech Coffey) to carry out a geotechnical investigation and assessment of suitability for the proposed Plan Change and future subdivision of a 28Ha block on the corner of Dunns Crossing Road and Selwyn Road, Rolleston, Canterbury. The purpose of this report is to support a Plan Change application for the construction of Residential Lots at the site.

2. SCOPE

A scope of assessment work for the approximately 28Ha total area of the site was developed and carried out by Tetra Tech Coffey, as outlined below:

- Review of previous geotechnical investigations including previous work on the site and surrounding area.
- Assessment of the geotechnical hazards at the site per Section 106 of the RMA.
- Geotechnical analyses and reporting.

Tetra Tech Coffey have considered the following in the preparation of this report:

- Existing geotechnical investigation data available from the New Zealand Geotechnical Database (NZGD) and Environment Canterbury well database.
- Project correspondence with the wider Plan Change consultants engaged by Rolleston Industrial Developments Limited.

Reference has also been made to the MBIE Guidance Part D: Subdivisions, to confirm that the requirements outlined in these documents have been incorporated in this report.

3. PROPOSED DEVELOPMENT

Tetra Tech Coffey understands that the current proposal is to rezone the land for residential usage. The proposed Plan Change area comprises multiple residential land parcels on the corner of Dunns Crossing Road and Selwyn Road, south of Rolleston and west of Faringdon. The site is predominantly flat and is used for grazing and crops.

Figure 1: Proposed Plan Change area (Red)

4. SITE INVESTIGATION

The location of the previous geotechnical investigations carried out on / near the site to develop the ground model is provided in Appendix A and are summarised in Table 1. Investigation logs are presented in Appendix B.

Table 1: Skellerup South Investigation Data

Reference	Depth of test (metres below ground level)	Termination criteria	Reference	Depth of test (metres below ground level)	Termination criteria
ENGEO TP03	1.9	Target depth	ENGEO TP28	2.0	Target depth
ENGEO TP04	2.0	Target depth	ENGEO TP29	2.0	Target depth
ENGEO TP12	2.0	Target depth	ENGEO TP36	2.0	Target depth
ENGEO TP13	2.0	Target depth	ENGEO TP37	2.0	Target depth
ENGEO TP14	2.0	Target depth	CW S-2	1.5	Target depth
ENGEO TP15	2.0	Target depth	CW S-3	1.4	Target depth
ENGEO TP22	1.9	Target depth	M36/7416	47.7	Target depth
ENGEO TP24	2.0	Target depth	M36/4449	24.0	Target depth
ENGEO TP25	2.0	Target depth	M36/4387	35.6	Target depth
ENGEO TP26	2.0	Target depth	BX23/0895	53.3	Target depth
ENGEO TP27	2.0	Target depth	BX23/0735	48.0	Target depth

The test pit logs have been sourced from the ENGEO Revised Geotechnical Investigation Report[2] and our previous work on the adjacent site. ECan well logs have been sourced from ECan Well Search[3].

5. SITE PERFORMANCE

5.1 GROUND MOTION

The site is not in an area mapped for ground damage effects as part of the Canterbury Earthquake Sequence response. A report commissioned by ECan[4] mapped the site as being in an area where 'damaging liquefaction is unlikely'. An extract from the ECan report is shown in Figure 2 with the site location indicated.

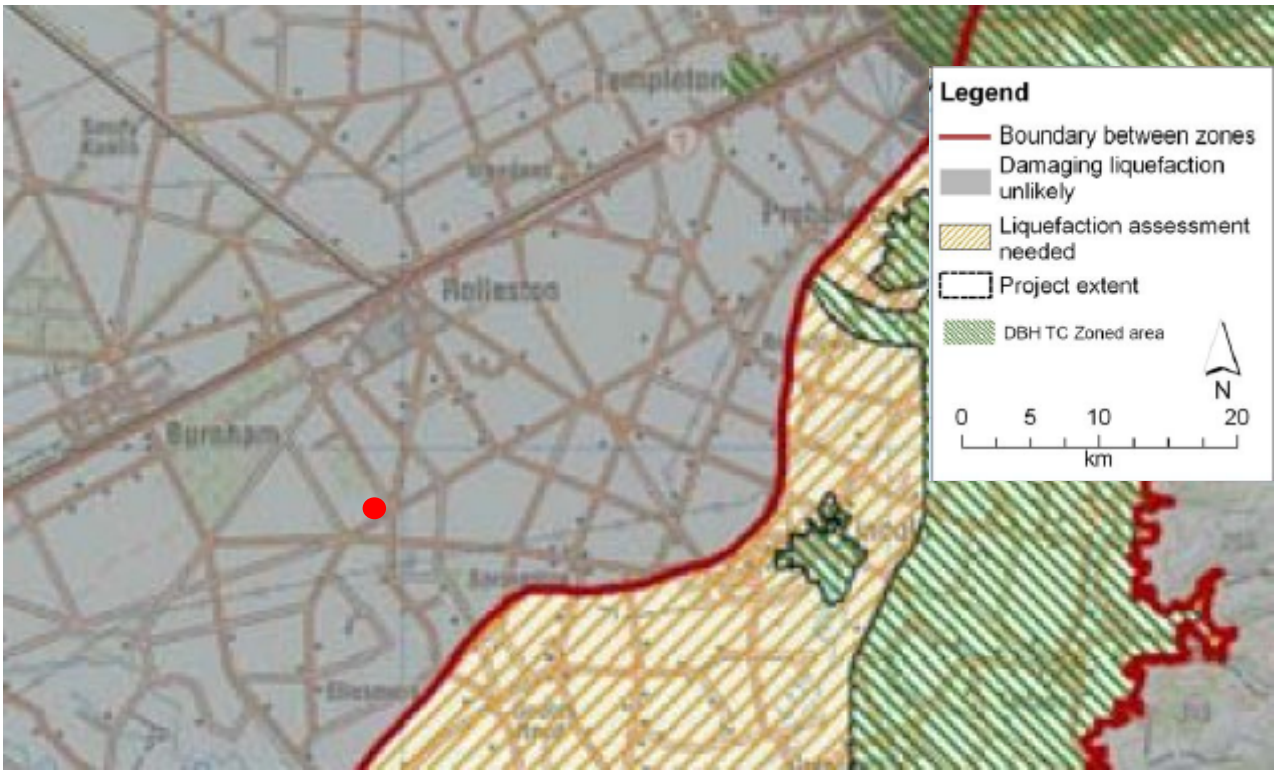


Figure 2: Extract from ECan liquefaction report (site location marked with red dot)

6. GROUND MODEL

6.1 GEOLOGY

The geological map[5] of the area indicates the site is underlain by "Brownish-grey river alluvium (Q2a)".

[2] ENGEO Revised Geotechnical Investigation Report, 92 Dunns Crossing Road, Rolleston, Christchurch. ENGEO, Ref: 12903.001.000_02. Dated: 13.12.2019
[3] https://www.ecan.govt.nz/data/well-search/
[4] ECan (2012), Review of liquefaction hazard information in Eastern Canterbury, including Christchurch City, and parts of Selwyn, Waimakariri and Hurunui Districts, Ref. R12/83
[5] Forsyth, P.J.; Barrell, D.J.A.; Jongens, R. (compilers) 2008: Geology of the Christchurch area: scale 1:250,000. Lower Hutt: GNS Science. Institute of Geological & Nuclear Sciences 1:250,000 geological map 16. 67 p. + 1 folded map

6.2 GROUNDWATER

Based on the nearby well logs, initial groundwater was encountered between 5.3 to 5.8 mbgl. We consider these groundwater levels to be relatively consistent and representative of the general area.

6.3 SUBSURFACE PROFILE

A summary of the ground model for the site is provided below:

Table 2: Ground profile

Description	Strength/ consistency	Thickness (m)	Depth to top of layer (mbgl)
Silt (topsoil)	N/A	0.10 to 0.30	0.00
Silty sand/sandy silt with some gravel	Medium dense to dense/ Stiff to very stiff	0.40 to 0.50	0.30 to 0.50
Sandy Gravel	Medium dense to dense	>30	0.30 to 0.90

6.4 SITE SUB-SOIL CLASS

In accordance with NZS1170.5, Section 3.1.3, a subsoil classification of “Class D – Deep or soft soil sites” can be assumed for the site.

7. GEOTECHNICAL HAZARD ASSESSMENT

7.1 EROSION

The site has relatively flat topography and is bounded by existing roads. Provided appropriate stormwater systems are installed as part of the development, there will be few viable sources of erosion at this site.

7.2 FALLING DEBRIS

As there are no slopes or exposed hills or rock faces surrounding the site, there are no sources of falling debris at the site, or for the surrounding area.

7.3 SUBSIDENCE

7.3.1 Liquefaction induced settlement

Saturated, loose, uniform fine grained alluvial soils are subject to seismic (liquefaction-induced) settlement during a significant earthquake. Liquefaction typically affects saturated, loose granular soils ranging from sandy silts to sands, but seismic shaking can also result in strength losses in fine-grained, cohesive soils. Liquefaction does not occur in dense, well-graded alluvial gravel soils that are present at this site.

Due to the dense nature of the gravel encountered, liquefaction risk is considered to be negligible for this project. The site is considered to be TC1-like.

7.3.2 Static settlement

Settlement is a crucial factor that can cause structure serviceability issues. Static load-induced settlement typically occurs in low-lying areas underlain by soft, compressible soils as a result of increased overburden loads. As the site is underlain by dense river gravels, static settlement is not deemed a hazard for the site provided any earthworks are carried out to the relevant standards.

7.4 SLIPPAGE

We have not observed any sources of land instability on the site and due to the flat site topography, we consider the risk of slope failure to be very low. The appropriate design of batter slopes near waterways will mitigate this risk further.

7.5 INUNDATION

In relation to stormwater inundation, we recommend that drainage design and management at the site be addressed by specialist consultants as it is beyond the scope of this report. We expect that with appropriate stormwater and flood control systems, the risk of inundation will be low.

8. CONCLUSIONS

We consider that the site is suitable for development subject to further investigation and design at the subdivision consent stage. Based on the mapped geology and testing carried out to date, the site is considered TC1-like.

Additional geotechnical investigation (comprising test pits and DCPs) will be required to refine the ground model and address any geotechnical risks for the proposed Lots once a subdivision plan has been further developed.

9. LIMITATIONS

This report has been prepared solely for the use of our client, Rolleston Industrial Developments Limited, their professional advisers and Selwyn District Council (SDC) in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity.

It is recommended that all other parties seek professional geotechnical advice to satisfy themselves as to its on-going suitability for their intended use.

As subsurface information has been obtained from discrete investigation locations, which by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in the report. If variations in the subsoils occur from those described or assumed to exist, then the matter should be referred to us immediately.

Please also refer to the enclosed *Important Information about Your Tetra Tech Coffey Report*.

10. CLOSURE

If you have queries or require further clarification regarding aspects of this report, please contact the undersigned.

For and on behalf of Tetra Tech Coffey

Prepared by

Benjamin Chau
BSc, Prof. Mast (Engineering Geology)
Graduate Engineering Geologist

Reviewed by

Kah-Weng Ho
BE (Hons) CMEngNZ
Senior Principal

APPENDIX A: INVESTIGATION PLAN

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	RZ	BC	27.09.21

N

0 50 100 150 200

SCALE 1:6,000 (A3) METRES

Projection: NZGD 2000 New Zealand Transverse Mercator

drawn	RZ
approved	BC
date	27.09.2021
scale	AS SHOWN
original size	A3

TETRA TECH COFFEY

client: ROLLESTON INDUSTRIAL DEVELOPMENTS LIMITED

project: DUNNS CROSSING ROAD, ROLLESTON

title: SITE PLAN

project no: P293048 | figure no: 01 | rev: A

MXD ref: 293048_01_GIS001_1

APPENDIX B: INVESTIGATION DATA

LOG OF TEST PIT TP03

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.625939
Longitude : 172.372464

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TOPSOIL		ML	Sandy SILT with trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	St-VSt		
0.5	ALLUVIUM		SM	Silty fine to medium SAND with some gravel and trace rootlets; greyish brown. Well graded. Gravel, fine to medium, subangular to subrounded.				M	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL with trace silt; grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
1.5				Trace cobbles encountered from 1.7 m depth.							
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

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

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

Noticeable sand increase from 0.8 m depth.

LOG OF TEST PIT TP04

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 25/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.6271
Longitude : 172.374267

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

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

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

TS = TOPSOIL
Noticeable sand increase from 0.9 m depth.

LOG OF TEST PIT TP12

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628017
Longitude : 172.374975

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

Scala Penetrometer: 2 4 6 8 10 12 >>

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

TS = TOPSOIL

LOG OF TEST PIT TP13

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.627819
Longitude : 172.373988

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.5	ALLUVIUM		GW	Sandy fine to medium GRAVEL with some silt and trace rootlets; greyish brown with orange mottles. Well graded, subangular to subrounded. Sand, fine. Sand becomes some from 0.4 m depth.				D	MD-D		
1.0			GW	Sandy fine to coarse GRAVEL; greyish brown. Well graded, subangular to subrounded. Sand, fine to coarse. Trace cobbles encountered from 1.6 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

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

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

TS = TOPSOIL
Noticeable sand increase from 0.7 m depth.

LOG OF TEST PIT TP14

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628684
Longitude : 172.374642

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand and silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
0.5			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.0				Cobbles become minor from 1.1 m depth.				M	MD-D		
1.5											
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

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

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

TS = TOPSOIL

LOG OF TEST PIT TP15

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.628875
Longitude : 172.375619

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		4
0.4	ALLUVIUM			Sandy fine to medium GRAVEL with some silt and trace rootlets; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium. Trace silt and sand becomes some from 0.4 m depth. Trace rootlets observed from 0.6 m depth.				M	MD-D		10
1.4			GW	Fine to coarse GRAVEL with some sand and trace cobbles; grey. Well graded, subangular to subrounded.				W	MD-D		>>
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

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

TS = TOPSOIL
Loosely packed gravel encountered from 1.4 to 2.0 m depth.

LOG OF TEST PIT TP22

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 1.9 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.62955
Longitude : 172.375318

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
	ALLUVIUM		ML	Sandy SILT with trace rootlets; light greyish brown. Low plasticity. Sand, fine to medium.				D	F-St		
0.5			GW	Fine to medium GRAVEL with some sand and silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium. No silt encountered from 0.6 m depth. Gravel and sand become fine to coarse from 0.8 m depth. Sand becomes trace from 1.1 to 1.3 m depth. Trace cobbles encountered from 1.4 m depth.				M	MD-D		
1.0											
1.5											
2.0				Depth of Excavation: 1.9 m Termination Condition: Target depth							

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

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

TS = TOPSOIL

LOG OF TEST PIT TP24

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator

Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.629807
Longitude : 172.376332

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
			ML	Sandy SILT with trace gravel and rootlets; greyish brown. Low plasticity. Sand, fine.					St-H		
0.5	ALLUVIUM		GW	Fine to medium GRAVEL with some sand and silt; brownish grey. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		
			GW	Sandy fine to coarse GRAVEL with trace cobbles; grey. Well graded, subangular to subrounded. Sand, fine to coarse.					MD-D		
1.0				Becomes moist from 1.0 m depth.							
				Sand becomes trace from 1.2 to 1.4 m depth.							
1.5								M			
				Sand becomes trace from 1.8 to 2.0 m depth.							
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

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

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

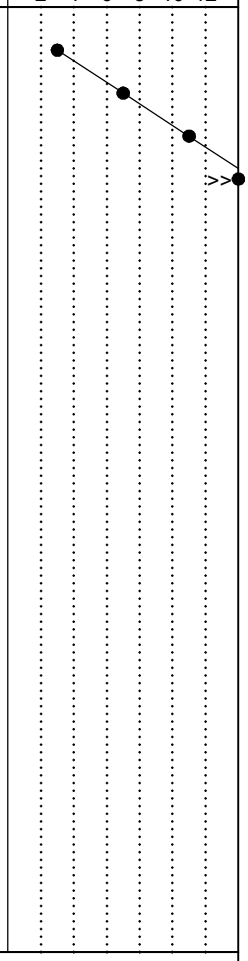
TS = TOPSOIL

LOG OF TEST PIT TP25

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 26/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.630517
Longitude : 172.376123

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					F-St		
0.3	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine. No silt observed from 0.4 m depth.				D	MD-D		
0.6			GW	Sandy fine to coarse GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine. Trace cobbles encountered from 0.9 m depth. Cobbles become minor from 1.4 m depth.				M	MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							



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

TS = TOPSOIL

LOG OF TEST PIT TP26

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.630801
Longitude : 172.377121

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium. No rootlets observed from 0.4 m depth.				D	MD-D		
0.5											
1.0			GW	Fine to coarse GRAVEL with some sand and trace rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse.							
1.5				Trace cobbles encountered from 1.4 m depth.				M	MD-D		
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

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

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

TS = TOPSOIL

LOG OF TEST PIT TP27

ENGEO

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd **Shear Vane No** : N/A
Date : 27/11/2019 **Logged By** : KF
Max Test Pit Depth : 2 m **Reviewed By** : JW
Digger Type/Size : 24 Tonne **Latitude** : -43.631612
Bucket Type/Size : Bucket Excavator **Longitude** : 172.376997

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0.0–0.2	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].				D	F-St		4
0.2–0.4	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine to medium.				D	MD-D		6, >>
0.4–2.0	ALLUVIUM		GW	Fine to coarse GRAVEL with some sand, trace cobbles and rootlets; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Cobbles become minor from 1.4 m depth.				M	MD-D		

Depth of Excavation: 2 m
Termination Condition: Target depth

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

TS = TOPSOIL

LOG OF TEST PIT TP28

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.632226
Longitude : 172.377512

Depth (m BGL)	Material	Excavatability (Relative Scale) Easier–Harder	USCS Symbol	DESCRIPTION	Graphic Symbol	Elevation (mRL)	Water Level	Moisture Cond.	Consistency/ Density Index	Shear Vane Peak/Remolded (kPa)	Scala Penetrometer Blows per 100mm
0	TS		ML	SILT with some sand, trace gravel and rootlets; brown. Low plasticity. Sand, fine [TOPSOIL].					St-VSt		
	ALLUVIUM		GW	Fine to medium GRAVEL with some sand, silt and trace rootlets; greyish brown. Well graded, subangular to subrounded. Sand, fine.					MD-D		
0.5			GW	Fine to coarse GRAVEL with some sand; grey. Well graded, subangular to subrounded. Sand, fine to coarse. Trace cobbles encountered from 0.7 m depth.				D	L-MD		
1.0											
1.5				Trace rootlets observed from 1.4 to 1.6 m depth. Becomes brownish grey from 1.7 m depth.				M			
2.0				Depth of Excavation: 2 m Termination Condition: Target depth							

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

TS = TOPSOIL
Loosely packed gravel encountered from 0.5 to 1.0 m depth.

GEOTECH TEST PIT LOG 2019.11.27 - TEST PIT LOGS.GPJ NZ MASTER DATA TEMPLATE.GDT 4/12/19

LOG OF TEST PIT TP29

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 27/11/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF
Reviewed By : JW
Latitude : -43.632008
Longitude : 172.378017

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

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

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

TS = TOPSOIL

LOG OF TEST PIT TP36

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.62611
Longitude : 172.373398

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

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

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

TS = TOPSOIL

LOG OF TEST PIT TP37

Geotechnical Investigation
92 Dunns Crossing Road
Rolleston
12903

Client : Hughes Developments Ltd
Date : 05/12/2019
Max Test Pit Depth : 2 m
Digger Type/Size : 24 Tonne
Bucket Type/Size : Bucket Excavator
Shear Vane No : N/A
Logged By : KF/CR
Reviewed By : JW
Latitude : -43.625636
Longitude : 172.37306

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

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

TS = TOPSOIL

Open Excavation Log

Test Pit No. **TP S-2**

Connell Wagner Limited
195 Hereford St. (PO Box 1061
Christchurch New Zealand
Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Client: Selwyn Plantation Board Ltd	Location (measured using hand held GPS): 1549448, 5169261		Date: 12/09/2008
Project: SPBL Rolleston Plan Change	Logged By: CG	Weather Conditions: cloudy & dry	Job Number: 36951-001

Undrained Shear Strength (kPa) ●
Measured Using a Hand Held Shear Vane[1]
25 50 75 100 125 150
Scala Penetrometer Test[2] ×
(Blows/ 150mm)
2 4 6 8 10 12

Water	Depth (m)	Soil Symbol	FACE 1 — SOIL DESCRIPTION: Colour, structure, weathering, subordinate/ main / minor COMPONENTS.
	0		Grass over silty TOPSOIL, with large tree roots up to 60mm diameter, brown, moist.
	0.5		Gravelly SILT with boulders and minor clay. Light brown, cohesive. Gravel is medium to coarse grained, rounded, gap graded, near horizontal long-axis pebble alignment. Moist. Large tree roots in the upper part.
	1		
	1.5		End of Test pit at 1.5m (Target depth)
	2		
	2.5		

Water	Depth (m)	Soil Symbol	FACE 2 — SOIL DESCRIPTION: Colour, structure, weathering, subordinate/ main / minor COMPONENTS.
	0		
	0.5		
	1		
	1.5		
	2		
	2.5		

Test Description
1 - Hand held shear vane test in accordance with BS1377:1990
2 - Scala Penetrometer Test in accordance with NZS4402:1986 for the first three meters

Notes
Groundwater not encountered
Soak test undertaken and reported separately

Pit dimensions
1.0m
1.9m

Connell Wagner

Connell Wagner Limited
195 Hereford St. (PO Box 1061
Christchurch New Zealand

Telephone: +64 3 366 0821
Facsimile: +64 3 379 6955

Open Excavation Log

Test Pit No. **TP S-3**

Client: Selwyn Plantation Board Ltd	Location (measured using hand held GPS): 1548668, 5169475		Date: 12/09/2008
Project: SPBL Rolleston Plan Change	Logged By: CG	Weather Conditions: cloudy & dry	Job Number: 36951-001

Water	Depth (m)	Soil Symbol	FACE 1 — SOIL DESCRIPTION: Colour, structure, weathering, subordinate/ main / minor COMPONENTS.
	0		Grass over silty TOPSOIL, with large tree roots up to 60mm diameter, brown, moist.
	0.5		Silty Sandy GRAVEL with minor cobbles yellowish brown, rounded, gap graded, near horizontal long-axis pebble alignment. Sand is angular. Moist. Large tree roots in the upper part.
	1		
	1.5		End of Test pit at 1.4m (Target depth)
	2		
	2.5		

Water	Depth (m)	Soil Symbol	FACE 2 — SOIL DESCRIPTION: Colour, structure, weathering, subordinate/ main / minor COMPONENTS.
	0		
	0.5		
	1		
	1.5		
	2		
	2.5		

Undrained Shear Strength (kPa) ●
Measured Using a Hand Held Shear Vane[1]
25 50 75 100 125 150

Scala Penetrometer Test[2] ×
(Blows/ 150mm)
2 4 6 8 10 12

Test Description
1 - Hand held shear vane test in accordance with BS1377:1990
2 - Scala Penetrometer Test in accordance with NZS4402:1986 for the first three meters

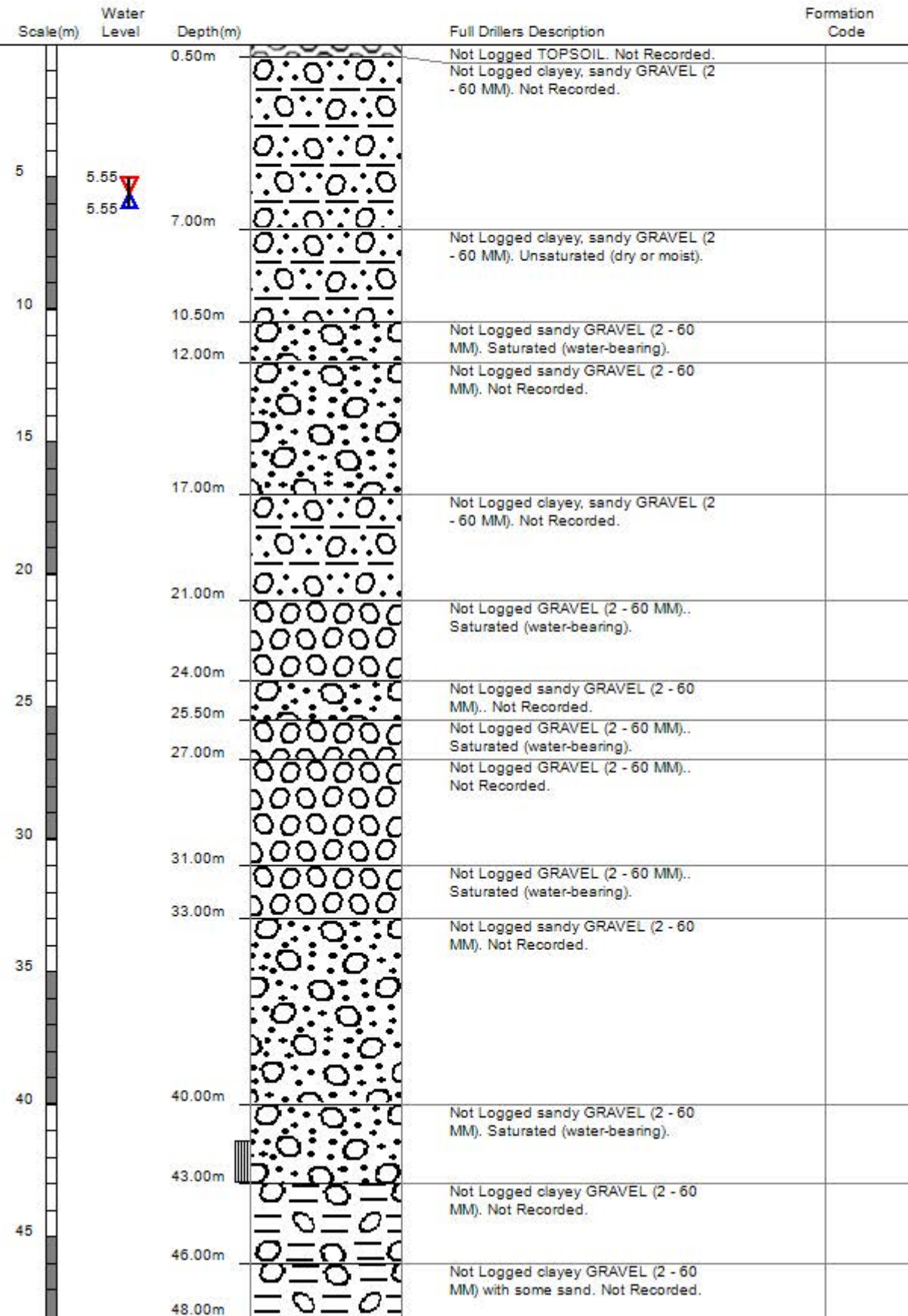
Notes
Groundwater not encountered
Soak test undertaken and reported separately

Pit dimensions
1.0m
2.0m

Borelog for well BX23/0735

Grid Reference (NZTM): 1549221 mE, 5168386 mN
Location Accuracy: 10 - 50m
Ground Level Altitude: m +MSD Accuracy:
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 48.0 m Drill Date: 13-Jun-2017

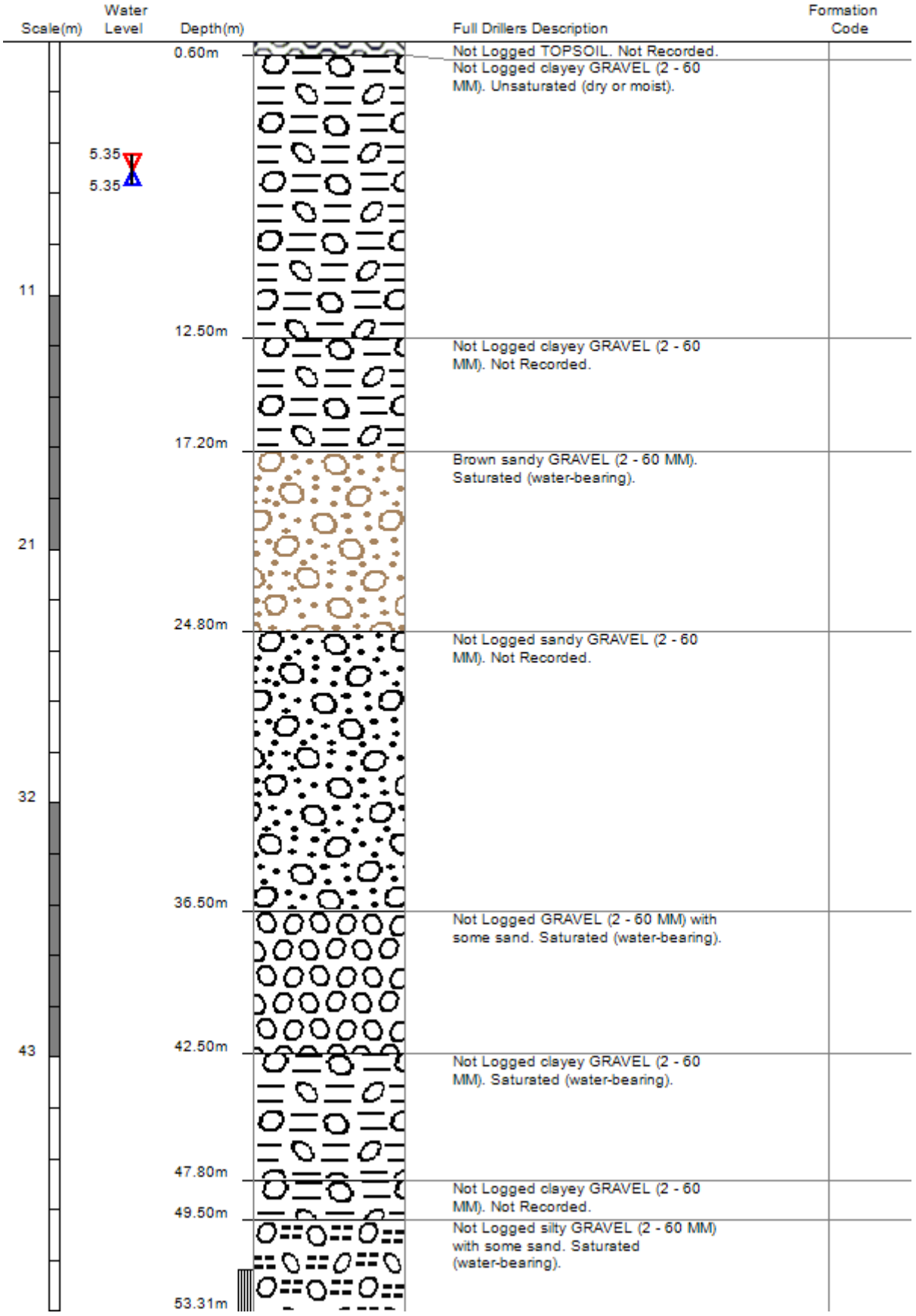
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well BX23/0895

Grid Reference (NZTM): 1549888 mE, 5168727 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: m +MSD Accuracy:
Driller: Clemence Drilling Contractors
Drill Method: Rotary/Percussion
Borelog Depth: 53.3 m Drill Date: 16-Apr-2019

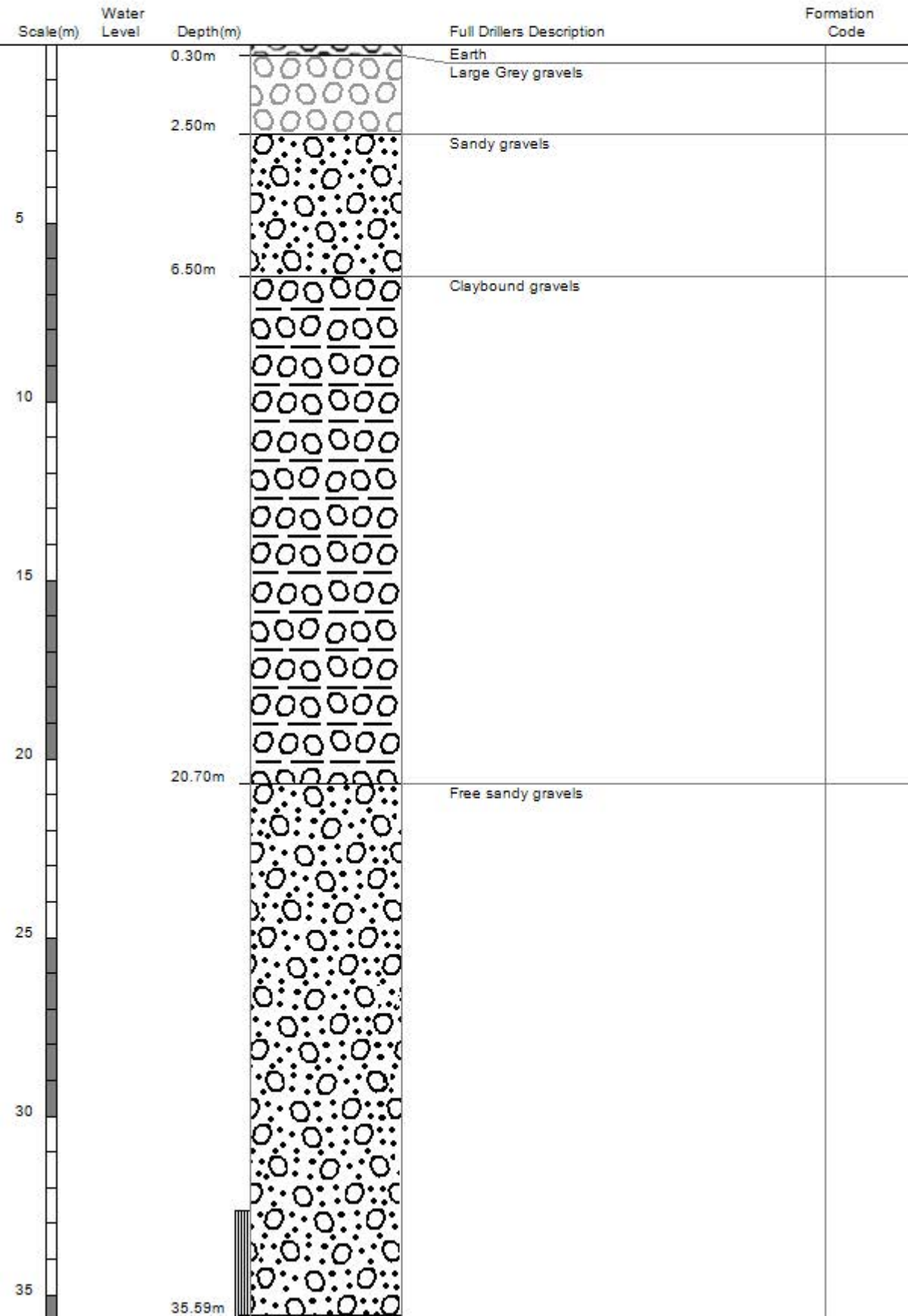
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/4387

Grid Reference (NZTM): 1549704 mE, 5168988 mN
Location Accuracy: 2 - 15m
Ground Level Altitude: 36.5 m +MSD Accuracy: < 2.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 35.6 m Drill Date: 11-Oct-1991

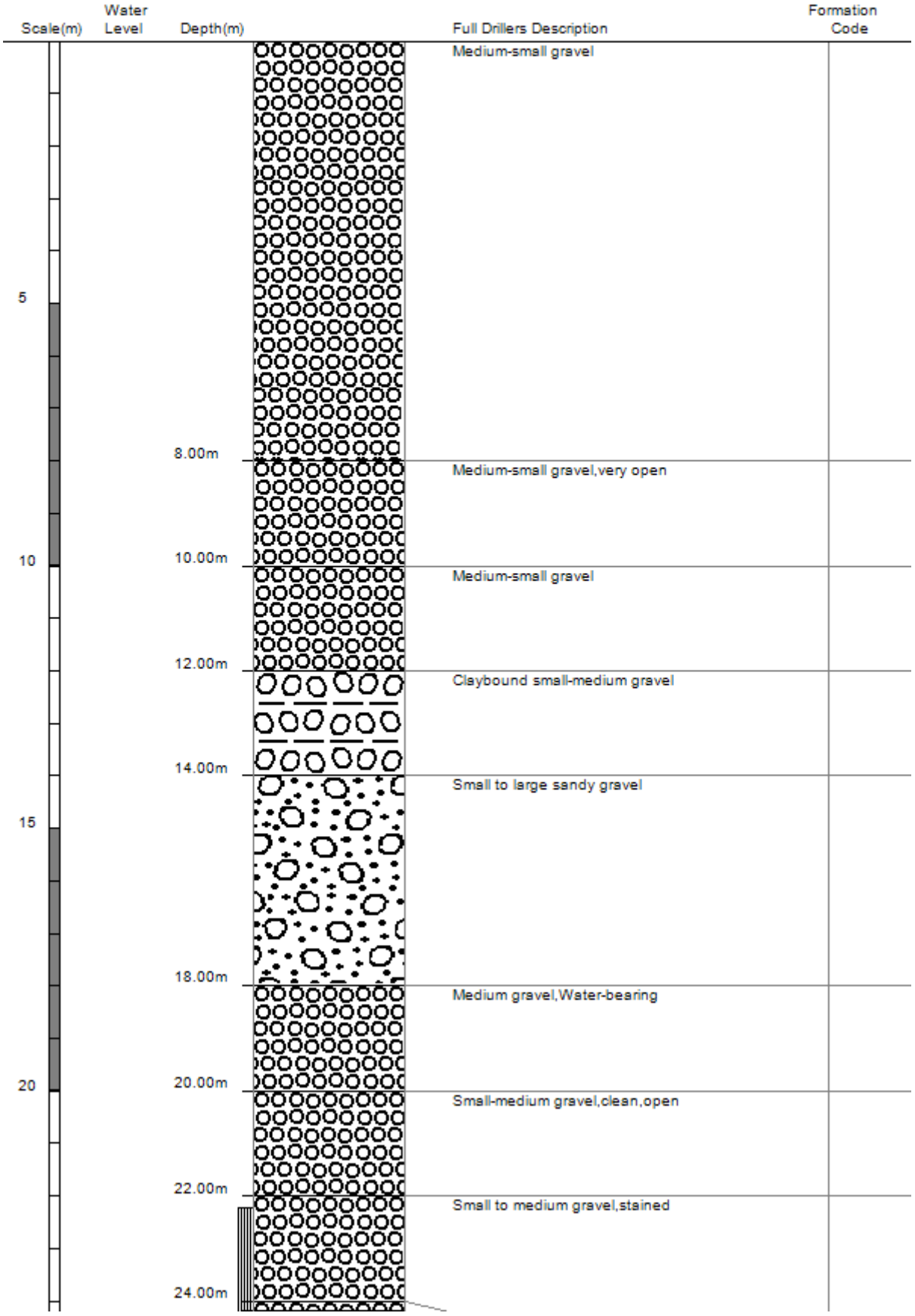
Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/4449

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

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha



Borelog for well M36/7416

Grid Reference (NZTM): 1549058 mE, 5168781 mN
Location Accuracy: 50 - 300m
Ground Level Altitude: 35.5 m +MSD Accuracy: < 0.5 m
Driller: McMillan Drilling Ltd
Drill Method: Rotary/Percussion
Borelog Depth: 47.7 m Drill Date: 18-Aug-2003

Environment Canterbury Regional Council
Kaunihera Taiao ki Waitaha

Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
		0.30m	Earth and gravels	
		0.30m	Earth and gravels	
			Sandy gravels	
5		5.60m		
		5.60m	Sandy gravels	
			Wet claybound sandy gravels	
10		11.00m		
		11.00m	Wet claybound sandy gravels	
			Water-bearing claybound sandy gravels	
		13.10m		
		13.10m	Water-bearing claybound sandy gravels	
			Water-bearing claybound sandy gravels	
		14.70m		
15		14.70m	Water-bearing claybound sandy gravels	
			Medium water-bearing stained gravels, some sand	
		16.80m		
		16.80m	Medium water-bearing stained gravels, some sand	
			Small to medium water-bearing gravels	
		19.70m		
20		19.70m	Small to medium water-bearing gravels	
			Medium water-bearing stained gravels	
		22.50m		
		22.50m	Medium water-bearing stained gravels	
			water-bearing sandy gravels	
25		26.40m		
		26.40m	water-bearing sandy gravels	
			Medium water-bearing lightly stained gravels	
30		33.20m		
		33.20m	Medium water-bearing lightly stained gravels	
			Medium water-bearing lightly stained gravels	
35				
40				
		43.70m		
		43.70m	Medium water-bearing lightly stained gravels	
			Medium to large well stained sandy gravels	
45				
		46.80m		
		46.80m	Medium to large well stained sandy gravels	
		47.70m		