

GEOTECHNICAL INVESTIGATION

Urban Estates Ltd

Fairbairn Rd Subdivision

Fairbairn Road - Rolleston

April 2019

19830



DAVIE LOVELL-SMITH

PLANNING SURVEYING ENGINEERING



Shaping the future since 1880

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1. Introduction

Davie Lovell-Smith has been engaged by Urban Estates to undertake a geotechnical investigation of Lot 1 DP 528962 off Fairbairn Road. Urban Estates plan to develop Lot 1 into 22 residential lots. This investigation is required to assess the suitability of the ground conditions across the site for development and to fulfil the recent council requirements on the assessment of liquefaction risk in Canterbury.

A recent site investigation was conducted involving 8 scala penetrometer tests (SPT) and excavation of 8 trial pits across the site by excavator. A borelog was recorded at each test pit to a depth of 2m. See Appendix A for SPT and trial pit locations and Appendix B for the SPT results and bore logs.

Canterbury Regional Council (ECan) borelog data has also been used to estimate the groundwater level at the site. This has been downloaded from the Online ECan GIS site. A location map showing the borehole locations and borelogs is attached in Appendix C.

2. Geographical Investigation

2.1. Site Location

The site is located at Fairbairn Road, Rolleston. The total area of the site is approximately 1.8ha and is currently zoned as Living Z.

2.2. Site Description

Lot 1 DP 528962 is bounded by existing houses to the North, a recently completed subdivision to the west and current development to the East and privates to the South.

The site is generally flat with a slight slope from North to South. Remnants of an old flow path cross through the Western portion of the site. The outer boundaries of the proposed site have a combination of farm style fencing and residential fencing, with an internal fence beside the old flow path. The site also contains some small trees and stumps near the outer East boundary.

The site comprises the following lots: Lot 1 D.P. 528962.

3. Geotechnical Assessment

Geotechnical data has been obtained from the following sources: Environment of Canterbury (ECan) Borelogs and Davie Lovell-Smith site investigation.

3.1. Desktop Study

ECan borelog data has been obtained from the online ECan GIS system and is attached in full detail in Appendix C of this report. The borelog data identified from the nearby sites identified is listed below:

- Borelog M36/5053 (Ellington Mews) 90m West of site – Small to medium gravel to a depth of 6.0m, small to medium gravel siltbound to a depth of 7.4m, small to medium gravel to a depth of 8.6m, small to medium gravel cemented sandy silt to a depth 12.4m, small to medium gravel sandy to a depth 14.0m, small to medium gravel with wet yellow silt to a depth of 23.6m, small to medium gravel to depth 25.5m, sandy silt to depth 28m, orange silt to depth of 29m and small to medium gravel rounded to a depth of 36m. Initial water level was 6m below MP, calculated water level 10m B.G.L.
- Borelog M36/4866 (East Maddisons Road) 90m West of site – Small medium silt bound gravels to a depth of 4.59m, Small medium gravel with sandy silt to a depth of 26.1m, yellow silt to 28.4m and small medium gravel to depth of 36m B.G.L. Initial water level was 8.5m below MP, calculated water level 10.0m.
- Borelog M36/7195 (East Maddisons Road) 70m South of site – Topsoil to a depth of 0.1m, free dry gravels to a depth of 4.0m, claybound gravels to a depth of 9.0m, claybound sandy gravels to a depth of 17.0m, sandy gravels to a depth of 28.0m, clay to a depth of 29.0m and sandy gravels to 42.0m (42B.G.L). Initial water level was 11.2m below MP, calculated water level 9.8m.

The borelog data provides a consistent picture across the area, the site contains varying amounts of topsoil followed by gravel layers with some sand and silt content to 25m, a layer of sandy silt to 29m, and then sandy gravel layers extend to a shallowest depth of 36m. The average depth to the groundwater table identified from the available ECan data was found to be 10.0m (B.G.L).

3.2. DLS Site Investigation

The trial pits excavated show a Topsoil layer varying from 150mm to 300mm depth, then small amounts of silts in some locations. This is underlain by layers of gravels. Test pits were terminated at 2000mm.

These soil horizons were relatively consistent across the entire site; see Appendix A for trial pit locations and Appendix B for full trial pit detail.

Due to the shallow nature of the trial pits excavated, the groundwater level was not found during this site investigation. However correlation between the trial pits and ECan borelog data show a gravel horizon from 2000mm to depths exceeding 20m. This is complementary to the ECan data which shows thin topsoil followed by gravel horizons and a silt layer from 25m.

Scala penetrometer tests had refusal encountered between 300mm and 400mm due to the presence of gravels. The scala penetrometer tests were consistent across the site; see Appendix A for SPT locations and Appendix B for the SPT results.

3.3. Earthquake Risk

A review of the GNS Active Faults Database indicates that the Greendale fault is approximately 5.5km north of the proposed development. Please refer to the attached University of Canterbury trace of the Greendale Fault in Appendix E which depicts the known location of this fault and its proximity to the site.

With reference to the GNS publication “Planning for Development of Land on or Close to Active Faults” a fault avoidance zone of 20 metres either side of the known fault trace or likely fault rupture zone. This is to limit the risk of intense deformation or secondary ruptures in the near vicinity of structures. To our knowledge there is no fault trace on the site but this will be monitored during the earthworks program.

3.4. Liquefaction Risk

For a soil to have liquefaction potential it needs to meet specific moisture and grading criteria. Essentially the soil needs to be a saturated sand or silt. The soil found on this site does not display any of these liquefactive properties. The groundwater is deep. Existing borelogs show this at 10.0m below ground level. From the test pits excavated by DLS the soil profile is generic, showing a sandy gravel matrix which is also confirmed in the existing ECan borelogs.

Therefore we conclude that due to the depth to groundwater and the insitu gravel conditions, this site has a low liquefaction potential.

3.5. Definition of Good Ground

Foundation soils, according to the New Zealand Standard NZS3604:2011 require that the following criteria must be met:

- No buried services under the footings.
- No evidence of land instability.
- No uncontrolled land filling.
- No buried topsoil, soft peat, very soft clay, soft clay or expansive clay.

In addition to this, the soils must meet at least one of the following:

- a) Meet a soil bearing capacity of 300kPa as detailed in the testing requirements in NZS3604.
- b) Inspection of existing structures, council records, local history and geological data shows no evidence of erosion or land instability.
- c) Geotechnical completion report in accordance with NZS4404 identifies good ground.

Under normal circumstances, the option a) would be applied. However, this testing regime does have some prerequisite requirements. For this testing to be applied, the location of the future buildings foundations need to be determined and the tests carried out in those locations. Also the number of tests to be performed is a function of the building size. Clearly, at the time of subdivision, the proposed buildings have not been designed and the testing criteria cannot be met. For these

During the construction of the site, the earthworks will be carried out in accordance with NZS4431:1989. This NZS4431 certification relates to the filling on the site but does not test the insitu soils. The insitu soils may require testing in accordance with NZS3604 at the time of Building Consent Application.

3.6. Department of Building and Housing Guidelines

Utilising the “Revised guidance on repairing and rebuilding houses affected by the Canterbury Earthquake Sequence” and the CERA technical Categories Map the Fairbairn Road site is classified as TC1 – future land damage from liquefaction is unlikely. Standard foundations for concrete slabs or timber floors can be used. An engineer should be engaged to determine the appropriate foundation design for the property, based on a site-specific investigation.

4. Conclusion

We believe that the geotechnical data obtained via the ECan borelogs combined with DLS testing and trial pits indicate that the ground conditions over the site are consistent and of acceptable bearing capacity for residential development.

Findings show:

The depth to the groundwater is approximately 10m below ground level; this in association with the insitu gravel horizons provides for a low liquefactious potential. Conditions are consistent with other geotechnical investigations in the Rolleston area and typically, a Technical Category 1 can be safely assumed.

The assessment of each lot being good ground can be assessed once construction and earthworks is complete, as a part of the Building Consent process using NZS3604.

Report prepared by

Ben Fox – Civil Engineer



Report checked by

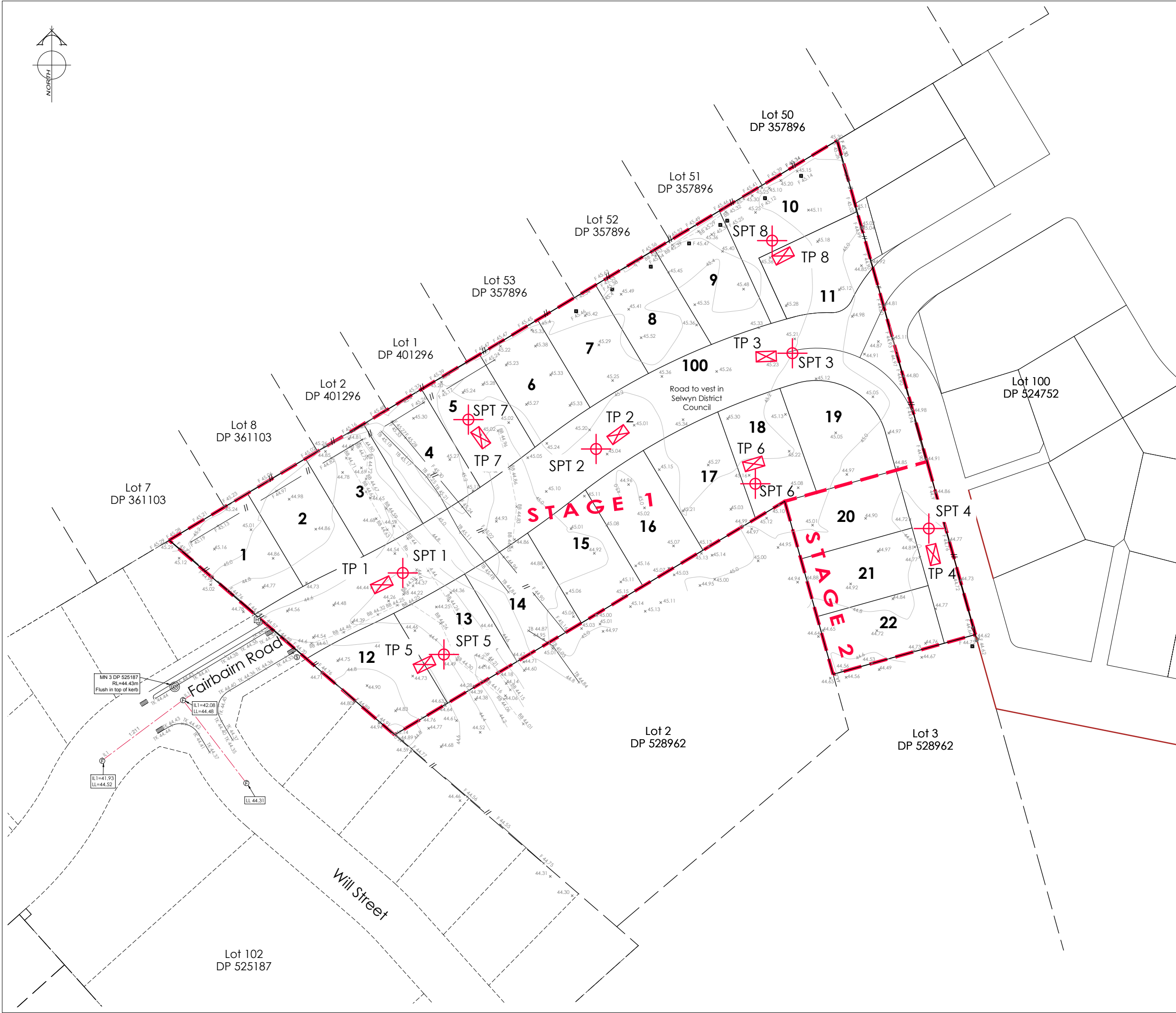
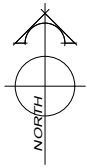
Andy Hall

CPEng, BE (Hons)



APPENDIX A

Davie Lovell-Smith SPT and Trial Hole Locations



AMENDMENTS:		
AMENDMENT	DATE	DESCRIPTION

- NOTES:
- 1) Service easements to be created as required.
 - 2) This plan has been prepared for Geotech Investigation purposes only. No liability is accepted if the plan is used for any other purpose.
 - 3) This plan has been prepared for the use of our client and no liability is accepted in relation to any other parties.
 - 4) Any measurements taken from information which is not dimensioned on the electronic copy are at the risk of the recipient.
 - 5) Levels are in terms of Mean Sea Level (Lyttelton vertical Datum 1937) prior to Canterbury Quakes of 2010 and 2011.
 - 6) Testing locations are approximate.

LEGEND:

---	SANITARY SEWER
==	FENCE
---	KERB
BB 18.41	BOTTOM OF BANK
TD 18.41	TOP OF BANK
18.41	GROUND LEVEL
TK 18.27	TOP OF KERB LEVEL
⊙	SEWER MANHOLE
⊙	STORMWATER MANHOLE
⊠	FIRE HYDRANT
⊠	SUMP
⊠	TP 1 TRIAL PIT
⊙	SPT 1 SCALA PENETROMETER TEST



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JOB TITLE:
Fairbairn Road

SHEET TITLE:
**Geotech Investigation
 Lot 1 DP 528962**

DRAWING STATUS:
For Information

SCALE: 1:500@A1 DATE: March 2019
 1:1000@A3

CAD FILE: J:\19830\Eng\Drawings\E19830_Geotech Investigation_R0.dwg REVISION:
 DRAWING No: SHEET No:
E.19830 1 OF 1 **RO**

APPENDIX B

Davie Lovell-Smith SPT and Borelog Detail – April 2019



DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

SPT No: 1

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)	Blows Per 100mm 5 Blows/100mm = 300kPa
Topsoil		0.00 0.10 0.20	3 8	5.50 12.00	5.75 17.25	
Finer gravels		0.30 0.40	25	16.50	61.81	
Coarse gravels		0.50				
		0.60				
		0.70				
		0.80				
		0.90				
		1.00				
		1.10				
		1.20				
		1.30				
		1.40				
		1.50				
		1.60				
		1.70				
		1.80				
		1.90				
		2.00				
		2.10				
		2.20				
2.30						
2.40						
2.50						
2.60						
2.70						
2.80						
2.90						
3.00						



DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

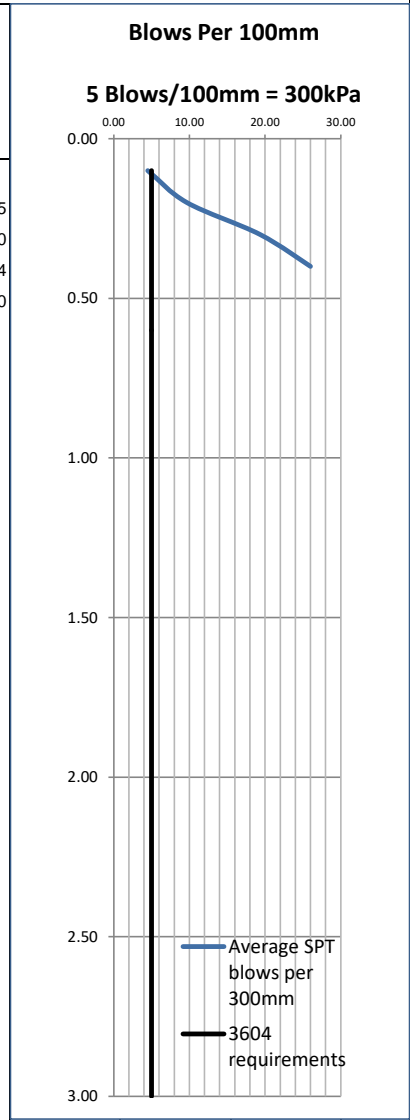
SPT No: 2

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil		0.00			
		0.10	3	4.50	5.75
		0.20	6	9.67	12.50
Silt		0.30	20	19.33	48.14
Refusal 350mm, Gravels finer		0.40	32	26.00	81.50
Gravels coarse		0.50			
		0.60			
		0.70			
		0.80			
		0.90			
		1.00			
		1.10			
		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
		1.70			
		1.80			
		1.90			
		2.00			
		2.10			
		2.20			
		2.30			
		2.40			
		2.50			
		2.60			
		2.70			
		2.80			
		2.90			
		3.00			





DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830



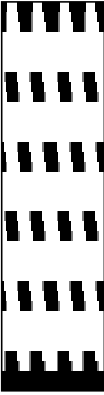
Project: Subdivision Investigation Testing

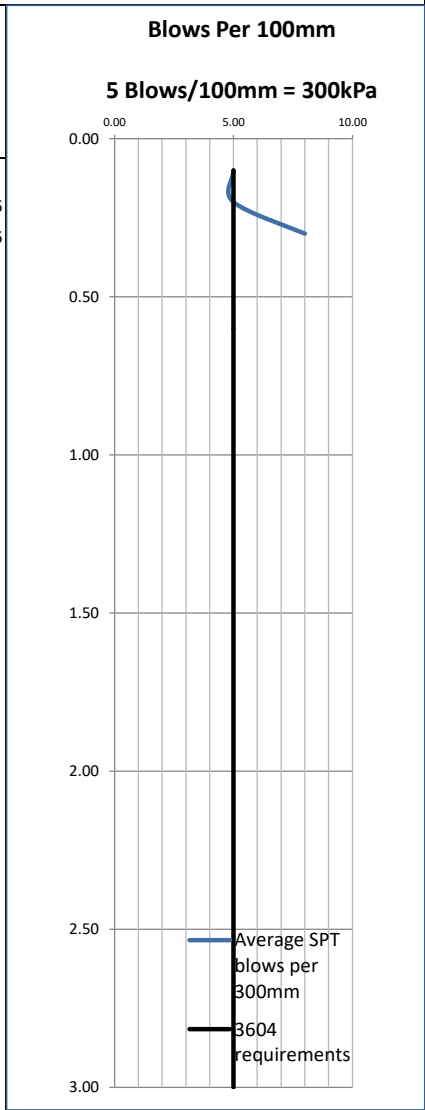
SPT No: 3

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil - scrub cleared		0.00			
		0.10	2	5.00	3.65
Refusal 150mm, Fine gravels		0.20	8	5.00	17.25
		0.30		8.00	
		0.40			
		0.50			
		0.60			
		0.70			
Coarser gravels		0.80			
		0.90			
		1.00			
		1.10			
		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
		1.70			
		1.80			
		1.90			
		2.00			
		2.10			
		2.20			
		2.30			
		2.40			
		2.50			
		2.60			
		2.70			
		2.80			
		2.90			
		3.00			





DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

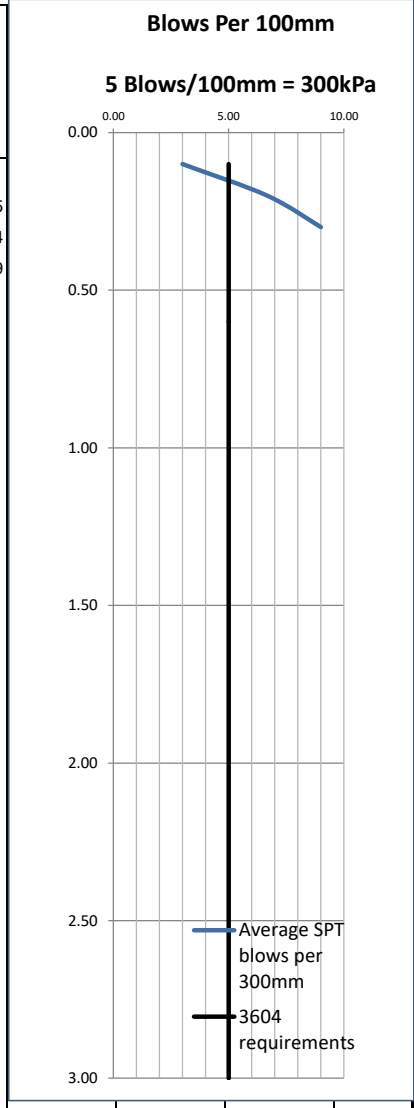
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Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil, scraped grass		0.00			
		0.10	2	3.00	3.65
		0.20	4	6.67	7.94
Refusal. Gravels		0.30	14	9.00	32.29
		0.40			
		0.50			
		0.60			
		0.70			
		0.80			
		0.90			
		1.00			
		1.10			
		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
		1.70			
		1.80			
		1.90			
		2.00			
		2.10			
		2.20			
		2.30			
		2.40			
		2.50			
		2.60			
		2.70			
		2.80			
		2.90			
		3.00			





DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

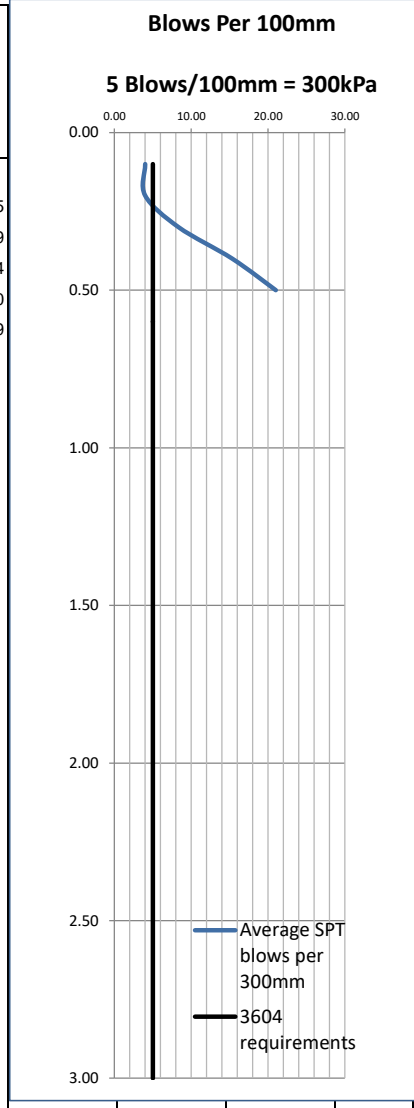
SPT No: 5

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil		0.00			
		0.10	3	4.00	5.75
		0.20	5	4.00	10.19
Sandy silt		0.30	4	8.33	7.94
Finer gravels		0.40	16	15.33	37.50
Refusal		0.50	26	21.00	64.59
Coarser gravels		0.60			
		0.70			
		0.80			
		0.90			
		1.00			
		1.10			
		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
		1.70			
		1.80			
		1.90			
		2.00			
		2.10			
		2.20			
		2.30			
		2.40			
		2.50			
		2.60			
		2.70			
		2.80			
		2.90			
		3.00			





DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

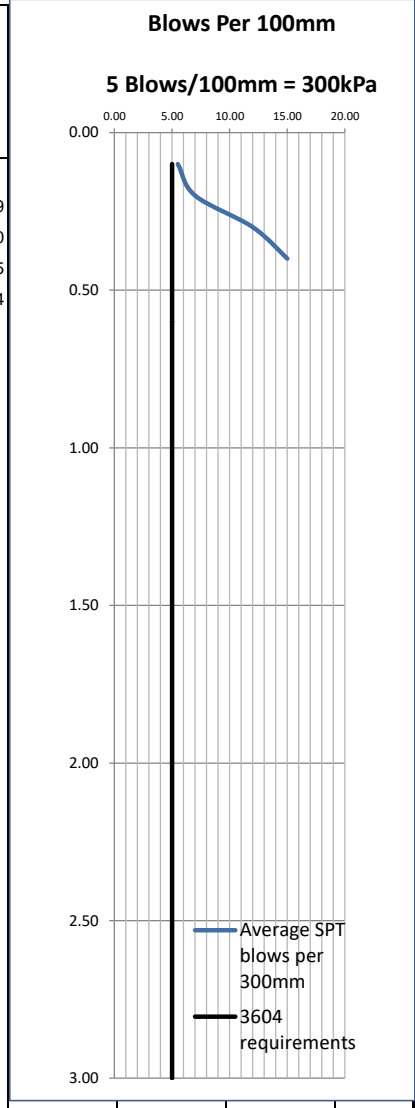
SPT No: 6

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil		0.00			
		0.10	5	5.50	10.19
		0.20	6	7.00	12.50
Gravels		0.30	10	12.00	22.15
Refusal		0.40	20	15.00	48.14
		0.50			
		0.60			
		0.70			
		0.80			
		0.90			
		1.00			
		1.10			
		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
		1.70			
		1.80			
		1.90			
		2.00			
		2.10			
		2.20			
		2.30			
		2.40			
		2.50			
		2.60			
		2.70			
		2.80			
		2.90			
		3.00			





DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

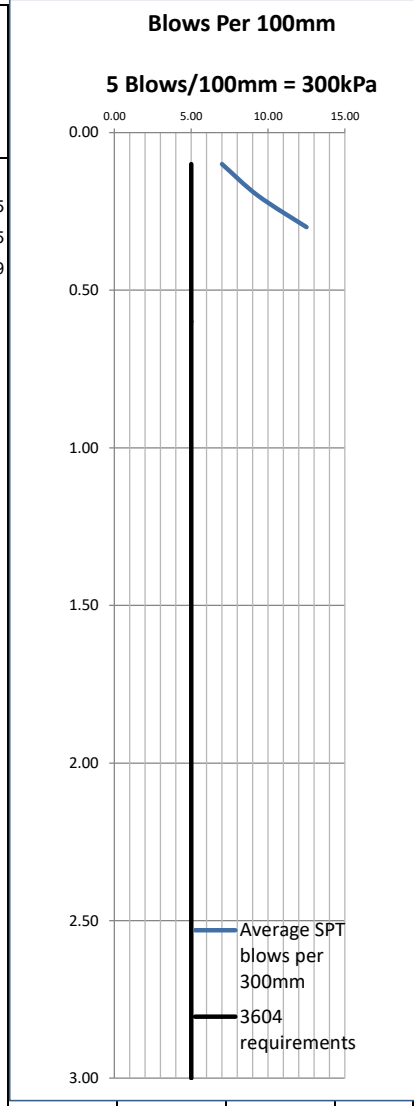
SPT No: 7

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil		0.00			
		0.10	3	7.00	5.75
Fine gravels		0.20	11	9.33	24.65
Refusal 250mm		0.30	14	12.50	32.29
		0.40			
Coarse gravels		0.50			
		0.60			
		0.70			
Fine Gravels, pebble sized		0.80			
		0.90			
		1.00			
		1.10			
Coarse Gravels		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
		1.70			
		1.80			
		1.90			
		2.00			
		2.10			
		2.20			
		2.30			
		2.40			
		2.50			
		2.60			
		2.70			
		2.80			
		2.90			
		3.00			





DAVIE LOVELL-SMITH

Scala Penetrometer Log

Job No: 19830

Project: Subdivision Investigation Testing

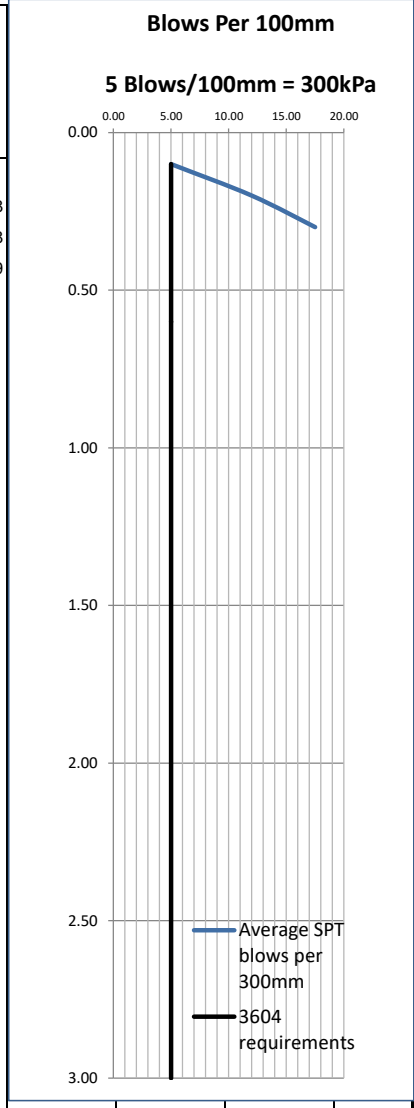
SPT No: 8

Date: 29/03/2019

Location: Fairbairn Road, Rolleston

Logged By: Ben Fox

Description of Soils	Graphic	Depth (m)	SPT blows	Average SPT blows per 300mm	CBR (%)
Topsoil, scrub scraped		0.00			
		0.10	1	5.00	1.68
		0.20	9	12.00	19.68
Refusal. Finer gravels		0.30	26	17.50	64.59
		0.40			
Coarse gravels		0.50			
		0.60			
		0.70			
		0.80			
		0.90			
		1.00			
		1.10			
		1.20			
		1.30			
		1.40			
		1.50			
		1.60			
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		3.00			



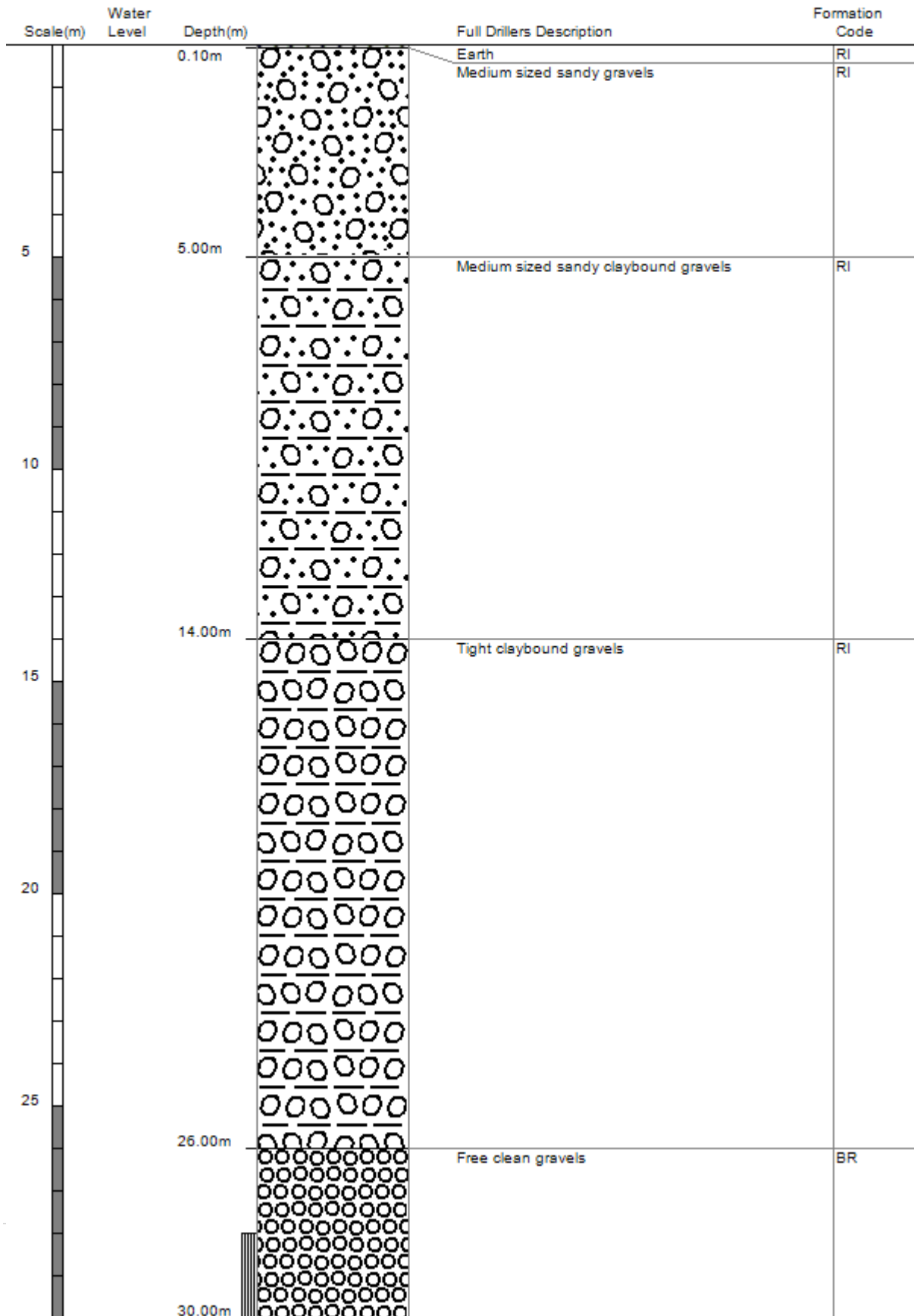
APPENDIX C

Canterbury Regional Council (ECan): Well Borehole information



Borelog for well M36/4253

Grid Reference (NZTM): 1549838 mE, 5170451 mN
 Location Accuracy: 50 - 300m
 Ground Level Altitude: 41.9 m +MSD Accuracy: < 2.5 m
 Driller: McMillan Drilling Ltd
 Drill Method: Rotary/Percussion
 Borelog Depth: 30.0 m Drill Date: 06-Jul-1990



Borelog for well M36/4866

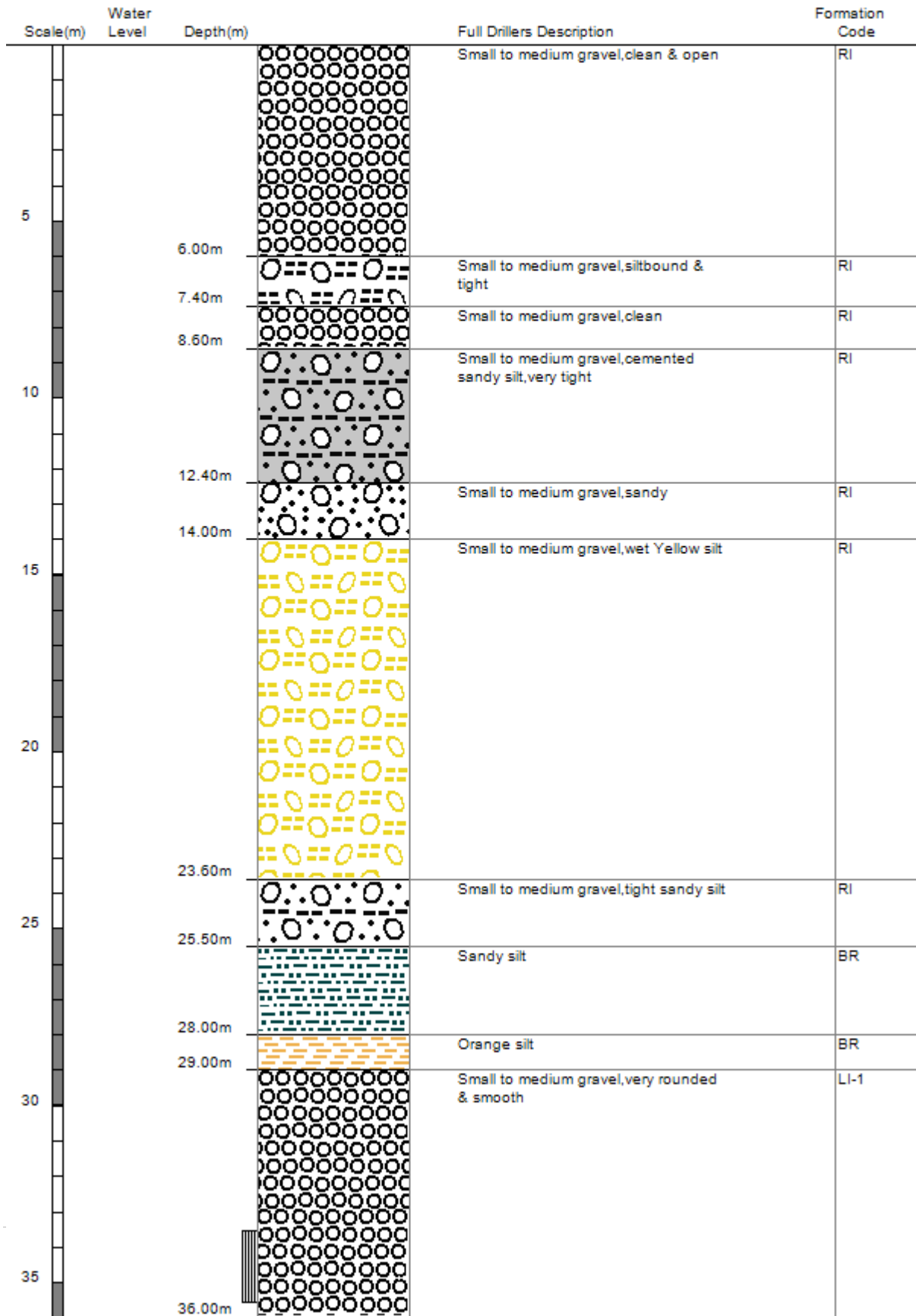
Grid Reference (NZTM): 1549608 mE, 5170691 mN
 Location Accuracy: 50 - 300m
 Ground Level Altitude: 44.1 m +MSD Accuracy: < 2.5 m
 Driller: Dynes Road Drilling
 Drill Method: Cable Tool
 Borelog Depth: 36.0 m Drill Date: 01-Oct-1994



Scale(m)	Water Level	Depth(m)	Full Drillers Description	Formation Code
			Small medium silt bound gravels	RI
5		4.59m	Small medium gravel sandy silt	RI
10				
15		17.50m	Small medium gravel sandy, first water	RI
20		19.20m	Small medium gravel, wet silt	RI
		20.60m	More open small medium gravel sandy less silt	RI
25		24.20m	Small medium gravel sandy open easy driving	RI
		26.10m	Yellow silt	BR
30		28.40m	Small medium gravel sandy	LI-1
35		36.00m		

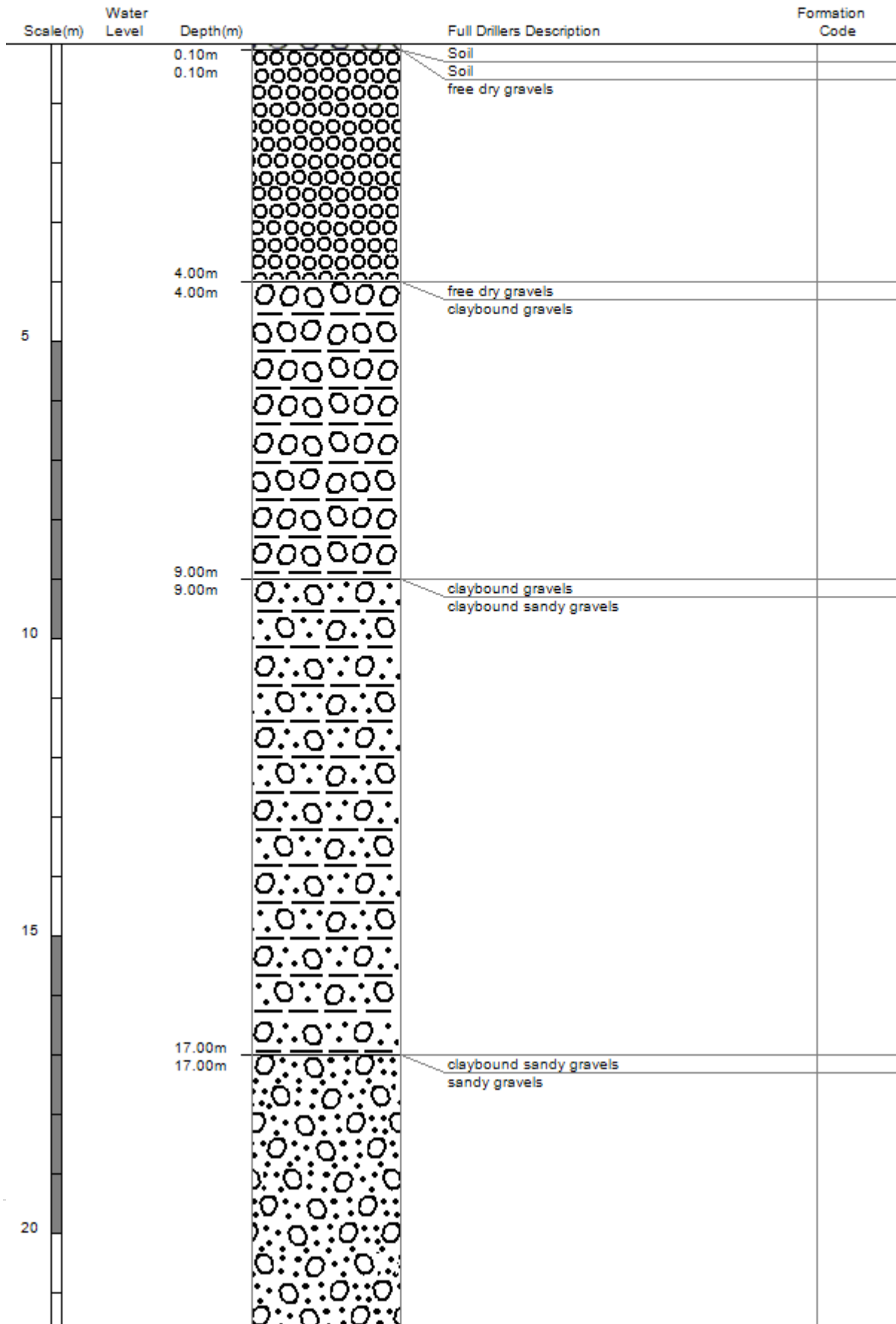
Borelog for well M36/5053

Grid Reference (NZTM): 1549608 mE, 5170731 mN
 Location Accuracy: 50 - 300m
 Ground Level Altitude: 44.4 m +MSD Accuracy: < 2.5 m
 Driller: Dynes Road Drilling
 Drill Method: Cable Tool
 Borelog Depth: 36.1 m Drill Date: 01-Aug-1996



Borelog for well M36/7195

Grid Reference (NZTM): 1549708 mE, 5170621 mN
 Location Accuracy: 50 - 300m
 Ground Level Altitude: 45.3 m +MSD Accuracy: < 0.5 m
 Driller: Smiths Welldrilling
 Drill Method: Rotary Rig
 Borelog Depth: 42.0 m Drill Date: 10-Feb-2005



APPENDIX D

GNS Science: Greendale Fault and its proximity to Fairbairn Road Subdivision



