

File No.: 45168

4 November 2024

Natalie Clift
4 Elizabeth Street
Rolleston
CANTERBURY 7614

Email: nat.clift91@gmail.com

Dear Natalie,

**GEOTECHNICAL INVESTIGATION FOR SUBDIVISION AND FOUNDATION
RECOMMENDATIONS: 4 ELIZABETH STREET, ROLLESTON (LOT 45 DP 239 TITLE CB8K/463)**

Davis Ogilvie & Partners Ltd. (Davis Ogilvie) has been commissioned by Natalie Clift to undertake a shallow geotechnical investigation at 4 Elizabeth Street, Rolleston. The aim of the investigation was twofold; to assess the geotechnical suitability of the land for subdivision and provide commentary on the natural hazards in accordance with Section 106 of the Resource Management Act (1991); and to determine the underlying ground conditions, estimate the ground bearing capacity, and provide foundation options for future residential development including an assessment of natural hazards in accordance with Section 71 of the New Zealand Building Act (2004).

1.0 SITE DESCRIPTION

The 1,012 m² lot (the site) is situated on the northern side of Elizabeth Street, approximately 880 m west of central Rolleston. The Selwyn River is approximately 8.7 km southwest of the site, but the nearest waterway is an unnamed stream located 1.0 km to the southwest.

The site currently contains an existing single storey dwelling and detached garage positioned in the south of the section and an additional, detached garage located in the northwest corner of the site.

2.0 REVIEW OF PUBLISHED INFORMATION

A review of published information has been undertaken for the site and surrounding area. A summary is presented in the following sections.

2.1 Site History

Historic aerial photographs¹ (dated 1940 to present) show that the surrounding area was used for agricultural purposes until 1970 when the existing dwelling and detached garage are visible. In images from 2004 the additional garage is constructed, and the remainder of the site remains unchanged.

2.2 Geology and Hydrogeology

The published geology of the site has been identified as “*Grey river alluvium beneath plains or low-level terraces*” (Q1a)². A geological boundary is located 45 m to the southwest of the site and is identified as “*Brownish-grey river alluvium*” (Q2a).

Available on the New Zealand geotechnical Database (NZGD) is a shallow geotechnical investigation from December 2023 comprising 7 Hand Augers (HA) and Dynamic Cone Penetrometers (DCP) (NZGD HA-DCP_211730 at 30 Elizabeth Street). The soil profile from these tests indicates up to 0.5 m of topsoil from the surface overlying very dense gravel to 0.8 m below ground level, the total depth of the investigation. It is noted that a layer of silt was encountered between 0.3 – 0.8 m in two test locations. Groundwater was not encountered. This is consistent with the published geology.

A review of Environment Canterbury (ECan) Well M36/0026³ located approximately 320 m west of the site, indicates an initial groundwater level of 19.5 m below ground level. The borehole log associated with this well shows topsoil from the surface to 0.3 m underlain by gravel, clayey, sandy gravel to 56.1 m below ground level, the total depth of the log.

2.3 Liquefaction Hazard and Seismicity

According to the 2006 Selwyn Liquefaction Susceptibility Map⁴, the site is in an area designated as “*very low liquefaction potential*” described as “*river sediments > 10,000 years old. There is a small chance of liquefaction of small, isolated areas during strong earthquake shaking.*”

Fault maps for the Rolleston area⁵ show the site is not in a ‘Canterbury Fault Awareness Area’. Recently active faulting in the area includes the 2011 Greendale Fault located 2.4 km north of the site and this fault scarp is generally orientated east – west. According to GNS Science, the Greendale Fault has a dextral fault sense, low slip rate, moderate single event displacement and has a recurrence interval of > 10,000 to ≤ 20,000 years⁶.

¹ Canterbury Maps – imagery basemaps, available at <https://mapviewer.canterburymaps.govt.nz/> and Google Earth, accessed October 2024

² Forsyth, P.J., Barrell, D.J.A., Jongens, R. (2008) (compilers), Geology of the Christchurch Area, Institute of Geological and Nuclear Sciences

³ ECan Groundwater Monitoring Well M36/0026, P.O Box 2 Leeston, Drill date 07/01/1971

⁴ Accessed from Canterbury Maps ‘Selwyn liquefaction susceptibility – all’ layer at <https://mapviewer.canterburymaps.govt.nz/>

⁵ Accessed from Canterbury Maps

<https://mapviewer.canterburymaps.govt.nz/?webmap=f716b840dc434c009e8f74f644a271d6&extent=873489.066592548,4879818.846619797,2047561.8210527971,5447898.840835198,2193>

⁶ Accessed from GNS Active Fault Database <https://data.gns.cri.nz/af/>

2.4 Flood Potential

The Selwyn online Flooding and Coastal Hazards Portal⁷ indicates expected flood depths of <0.2 m during a 200-year Annual Recurrence Interval (ARI) due to surface flooding and / or overflows from the Selwyn River.

It is recommended that minimum floor level requirements are confirmed with Selwyn District Council (SDC) at building consent stage.

2.5 ECan Listed Land Use Register

The Environment Canterbury (ECan) Listed Land Use Register (LLUR) website⁸ indicates that at the time of enquiry there is no information about Hazardous Activities and Industries List (HAIL) for the site. Please note that this does not confirm that the site is not contaminated.

3.0 TESTING COMPLETED ONSITE

The shallow geotechnical investigation, comprising two HAs and four DCP tests was undertaken by Davis Ogilvie on 16 October 2024. Testing locations are shown on the Geotechnical Site Plan (DWG G01A) attached to this report.

3.1 Soil Testing Results

The general shallow soil profile, indicated by the site investigation, consisted of up to 0.6 m of topsoil / fill underlain by loose to very dense gravelly sand and firm to hard sandy silt to 0.9 m, followed by very dense sandy gravel. Testing did not reach the target depth (3.0 m) and was terminated at 0.7 – 1.0 m below EGL due to refusal in the dense gravel.

Summarised soil profiles are presented in Table 1. Logs and DCP test results are attached to this report.

Table1: Summarised Soil Profile from Shallow Investigation						
Summary of Soil Type	DCP (blows / 100 mm)	Relative Density / Consistency	Depth Below EGL (m)			
			DCP 01**	HA + DCP 02	DCP 03**	HA + DCP 04
TOPSOIL / FILL	2 – 16	*	0.0 – 0.3	0.0 – 0.6	0.0 – 0.2	0.0 – 0.3
Sandy SILT / Gravelly SAND	2 – 30	Firm to Hard / Loose to Very Dense	0.3 – 0.4	0.6 – 0.7	Not Encountered	0.3 – 0.9
Inferred GRAVEL	20 – 30+	Very Dense	0.4 +	0.7 +	0.2 – 0.4 +	0.9 +

* Relative density not assigned to topsoil.
** Inferred from nearby hand augers and hand excavations.

⁷ Accessed from Selwyn Natural Hazards – <https://apps.canterburymaps.govt.nz/SelwynNaturalHazards/>

⁸ <http://www.llur.ecan.govt.nz/>. Accessed October 2024.

3.2 Groundwater

Groundwater was not encountered during the Davis Ogilvie shallow investigations, but this was expected, as discussed in Section 2.2. Groundwater levels will vary spatially and seasonally.

4.0 NATURAL HAZARD ASSESSMENT

The site has been considered in relation to subdivision suitability, stability, and susceptibility to natural hazards in accordance with Section 106 of the Resource Management Act (1991) and for future development in accordance with Section 71 of the New Zealand Building Act (2004).

Based on the results of the geotechnical assessment, no natural hazards are likely to significantly affect the site. Finished floor levels should be set by SDC to mitigate any flood risk.

The results of the geotechnical review and investigation indicate a deep groundwater level and the presence of shallow dense gravels. Subsidence from seismically-induced liquefaction is therefore unlikely to significantly impact the site. We consider the site as being equivalent to MBIE (2017)⁹ category 'Low Liquefaction Vulnerability' and MBIE Foundation Technical Category TC1.

In addition, the site is free of organic or deleterious soils (apart from the topsoil / fill), and significant thicknesses of sensitive compressible cohesive soils, hence, subsidence is considered a low risk at this site under normal building loads.

On this basis we consider the site is suitable for subdivision and include a Statement of Professional Opinion on the Suitability of Land for Subdivision.

5.0 FUTURE FOUNDATION RECOMMENDATIONS

5.1 Design Criteria

In accordance with NZS 1170.5, section 3.1.3, a site subsoil classification of "*Class D – Deep soils*" may be assumed for this site.

5.2 Geotechnical Ultimate Bearing Capacity

For future development, based on in-situ soil testing, 'Good Ground' (as defined by NZS 3604:2011) and a static geotechnical ultimate bearing capacity of 300 kPa¹⁰ was encountered below the topsoil / fill and loose sands from between 0.3 m and 0.6 m below EGL.

⁹ MBIE (2017), Planning and engineering guidance for potentially liquefaction-prone land, issued September 2017.

¹⁰ Below organic topsoil. Defined by NZS 3604:2011.

5.3 Foundation Options

For a concrete slab foundation, the following foundation solutions are considered appropriate for this low liquefaction vulnerability classified site:

- A NZS 3604:2011 tied slab foundation; or
- A proprietary TC1 waffle slab foundation.

Alternatively, shallow pile and foundation wall systems in accordance with NZS 3604 are considered suitable for suspended timber floor construction.

For a building to comply with NZS 3604:2011, all topsoil, turf and any other unsuitable fill material should be stripped from beneath the entire building footprint before the placement of foundations or gravel fill.

Placement and testing of engineered fill must be carried out in accordance with NZS 4431:2022 *“Engineered fill construction for lightweight structures.”*

6.0 GEOTECHNICAL INSPECTIONS REQUIRED DURING CONSTRUCTION

For NZS 3604:2011 foundations, subsurface conditions must be assessed by an appropriately qualified and experienced contractor (LBP, Foundations). They shall perform their own assessment to ensure the ground conditions are appropriate, and that the foundation system will comply with all relevant building standards.

During excavation, should soft, organic, suspect, or unsuitable ground conditions be encountered onsite, the builder / contractor or owner must contact Davis Ogilvie or an appropriately qualified and experienced Engineer to confirm foundation requirements. Furthermore, for specific engineered designed foundations, it is recommended that a suitably qualified and experienced engineer verify that adequate ground conditions have been achieved onsite.

Please allow 24 hours' notice prior to inspections being required.

7.0 CONCLUSIONS

It is the professional opinion of Davis Ogilvie (not to be construed as a guarantee), based on the geotechnical site investigation and the assessment of potential natural hazards onsite in accordance with Section 106 of the RMA, that the site is suitable for residential subdivision provided the recommendations outlined in this report are followed.

It is considered that the risk of the natural hazards discussed in this report can be mitigated or managed to an acceptable level through appropriate engineering design.

A Statement of Professional Opinion on the Suitability of Land for Subdivision is attached.

8.0 CLOSURE

Should you have any queries regarding this report or wish to arrange a subgrade inspection at the time of construction, please contact the undersigned.

Yours faithfully

DAVIS OGILVIE & PARTNERS LTD.

Prepared By:

KELLY LYONS

Engineering Geologist

BSc

Email: kellyl@do.nz

Reviewed By:

BJORN RAASCH

Principal Engineering Geologist

BSc (Hons), CMEngNZ (PEngGeol)

Email: bjorn@do.nz

Enclosed:

1 x Geotechnical Site Plan (DWG G01A)

4 x DCPs + 2 x HA Logs

Statement of Professional Opinion on the Suitability of Land for Subdivision

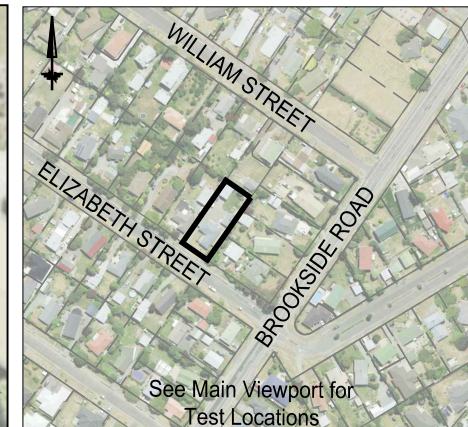
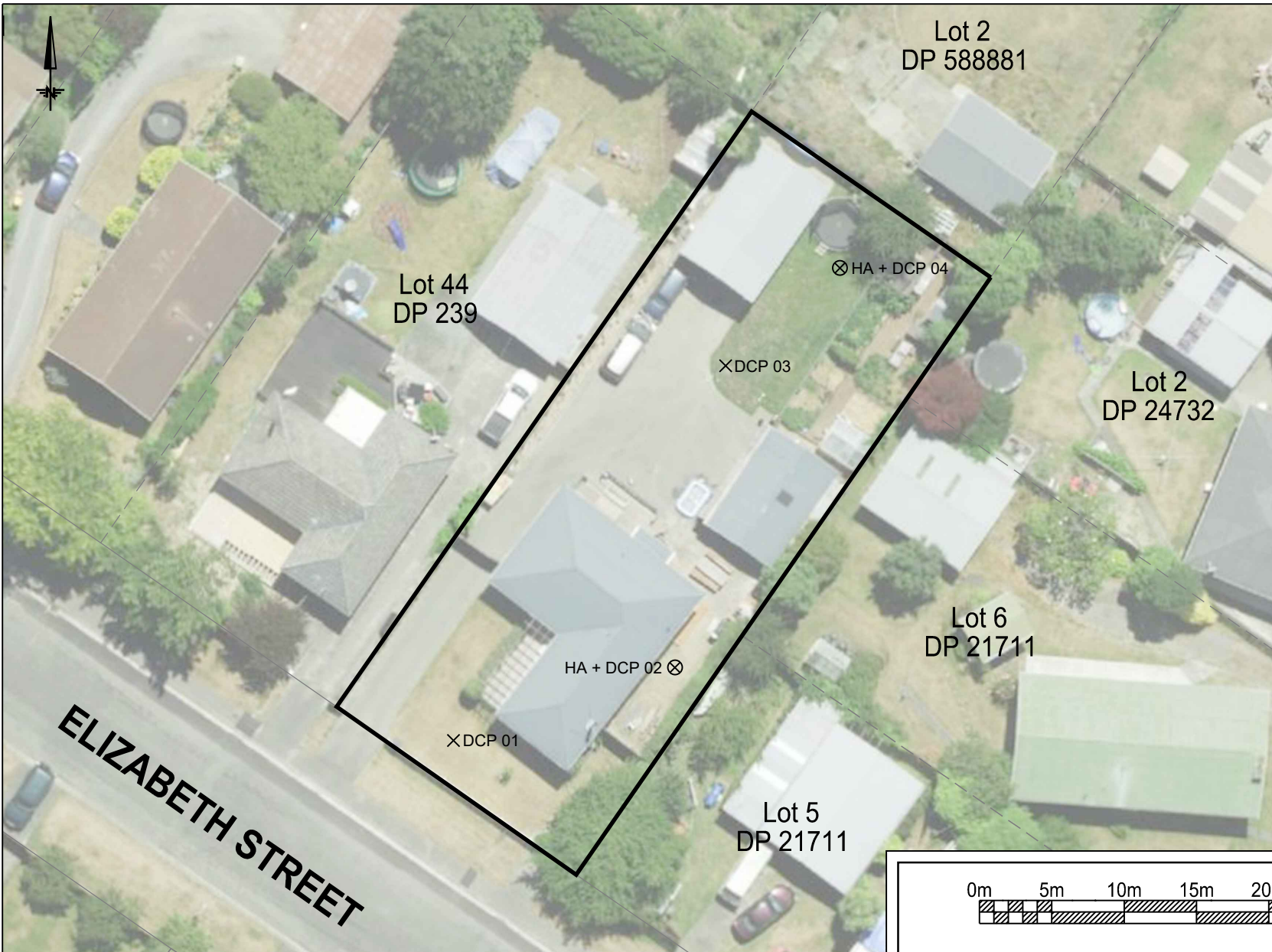
Limitations

Davis Ogilvie did not complete an assessment of all possible conditions or circumstances that may exist at the site. The report and findings are based on the information provided. Conditions may exist which were undetectable given the limited investigation of the site. Variations in conditions may occur, and there may be conditions onsite which have not been revealed by the investigation, which have not been taken into account in the report. No warranty is included—either expressed or implied—that the actual conditions will conform to the assessments contained in this report. If any unexpected suspect soils are encountered during earthworks onsite, Davis Ogilvie should be notified to confirm or reassess the foundation recommendations.

This report has been prepared solely for the purposes of Natalie Clift. The information contained herein is confidential, and shall not be passed on to any third party without prior written permission of Davis Ogilvie & Partners Ltd. No responsibility is accepted for any use outside the scope of this report. This report does not cover suitability of the site (e.g., flooding).

Important Notice:

Information included in this report was obtained / created from maps and / or data extracted from the New Zealand Geotechnical Database (www.nzgd.org.nz), which were prepared and / or compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993. The source maps and data were not intended for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way.

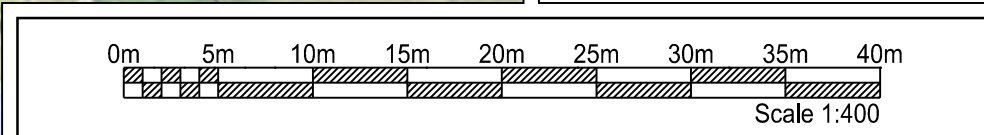


Scale 1:5000

Key:

- : Site Boundary
- : Abuttal Boundary
- : Road Boundary
- : Hand Auger (HA) + Dynamic Cone Penetrometer (DCP)
- : Dynamic Cone Penetrometer (DCP)

Test locations are approximate (scaled and aligned using aerial imagery).
 Shallow geotechnical testing undertaken 16/10/2024.
 Aerial image and boundaries obtained from GRIP®, boundaries are indicative only.



CAD ref: 241015.45168.Geotechnicalsiteplan.dwg



Davis Ogilvie & Partners Ltd - Ph. 0800 999 333

Geotechnical Site Plan

4 Elizabeth Street, Rolleston

Lot 45 DP 239

/ design KL	/ drawn TM	/ QA check CZM	/ dwg G01
/ scale @ A4 1:400	/ date 10/24	/ file 45168	/ issue A

Project: 4 Elizabeth Street, Rolleston (Lot 45 DP 239)

Date: 16/10/24

Client: Natalie Clift

Time: 10:10 a.m.

Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)

Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION <small>Soil description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005</small>	USCS	Graphic Log	Ground Water	DCP RESULTS: DCP 02 (Blows / 100mm)										R L (m)				
					1	2	3	4	5	6	7	8	9	10					
0.00 - 0.10m:	Sandy SILT with trace gravel; dark brown. Dry to moist. Sand is fine. Gravel is fine, subangular to subrounded (TOPSOIL).	TS		Groundwater Not Encountered		2													
0.10 - 0.30m:	Sandy fine to coarse GRAVEL with trace cobbles; brown. Moist. Sand is fine. Gravel is fine to coarse, subangular to subrounded. Cobbles are subangular to subrounded (POSSIBLE UNCONTROLLED FILL).	FILL																16 >>	
0.30 - 0.60m:	Sandy SILT with trace gravel; dark brown. Moist, contains trace rootlets. Sand is fine. Gravel is fine, subangular to subrounded (POSSIBLE BURIED TOPSOIL).	TS						3											
0.5							2												
									4										
0.60 - 0.70m:	Sandy SILT with some gravel; brown. Hard, moist. Sand is fine. Gravel is fine to coarse, subangular to subrounded.	ML																30 >>	
	Auger terminated at 0.70m - Refusal on gravel.																		
1.0																			

Produced with Core-GS by GeroC

Logged By: KL
Plotted By: TM
Checked By: CZM

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

SHALLOW INVESTIGATION RESULTS

Job N° / **45168**
Test N° / **HA + DCP 04**

Project: 4 Elizabeth Street, Rolleston (Lot 45 DP 239)

Date: 16/10/24

Client: Natalie Clift

Time: 10:30 a.m.

Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)

Excavation Method: Hand Auger

DEPTH (m)	SOIL DESCRIPTION <small>Soil description in general accordance with Field Description of Soil and Rock. Guideline for the Field Classification and Description of Soil and Rock for Engineering Purposes. NZ Geotechnical Society Inc, December 2005</small>	USCS	Graphic Log	Ground Water	DCP RESULTS: DCP 04 (Blows / 100mm)										R L (m)
					1	2	3	4	5	6	7	8	9	10	
0.00 - 0.30m:	Sandy SILT with some gravel; brown. Dry. Sand is fine. Gravel is fine to coarse, subangular to subrounded (TOPSOIL).	TS		Groundwater Not Encountered	4										
		TS			4										
		TS			4										
		TS			4										
0.30 - 0.70m:	Gravelly fine SAND; brown. Loose to dense, dry to moist. Gravel is fine to coarse, subangular to subrounded.	SP			4										
		SP			2										
		SP			2										
		SP			14 >>										
	Auger terminated at 0.70m - Refusal on gravel.				6										
					10										
					30 >>										
					Hammer Bouncing										

Logged By: KL
Plotted By: TM
Checked By: CZM

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Project: 4 Elizabeth Street, Rolleston (Lot 45 DP 239)

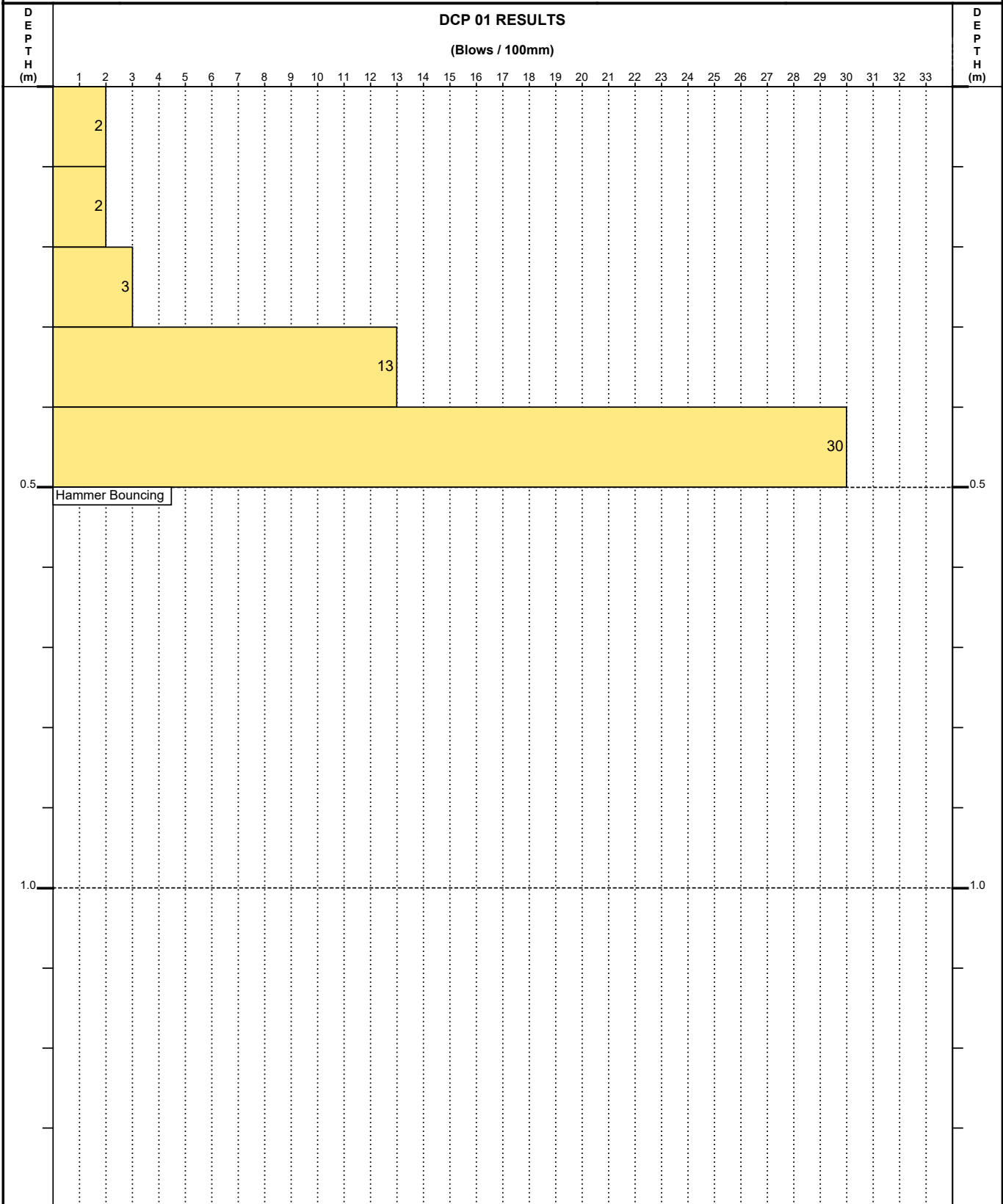
Date: 16/10/24

Client: Natalie Clift

Time: 10:00 a.m.

Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)

Method: Dynamic Cone Penetrometer



Logged By: KL
Plotted By: TM
Checked By: CZM

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

Project: 4 Elizabeth Street, Rolleston (Lot 45 DP 239)

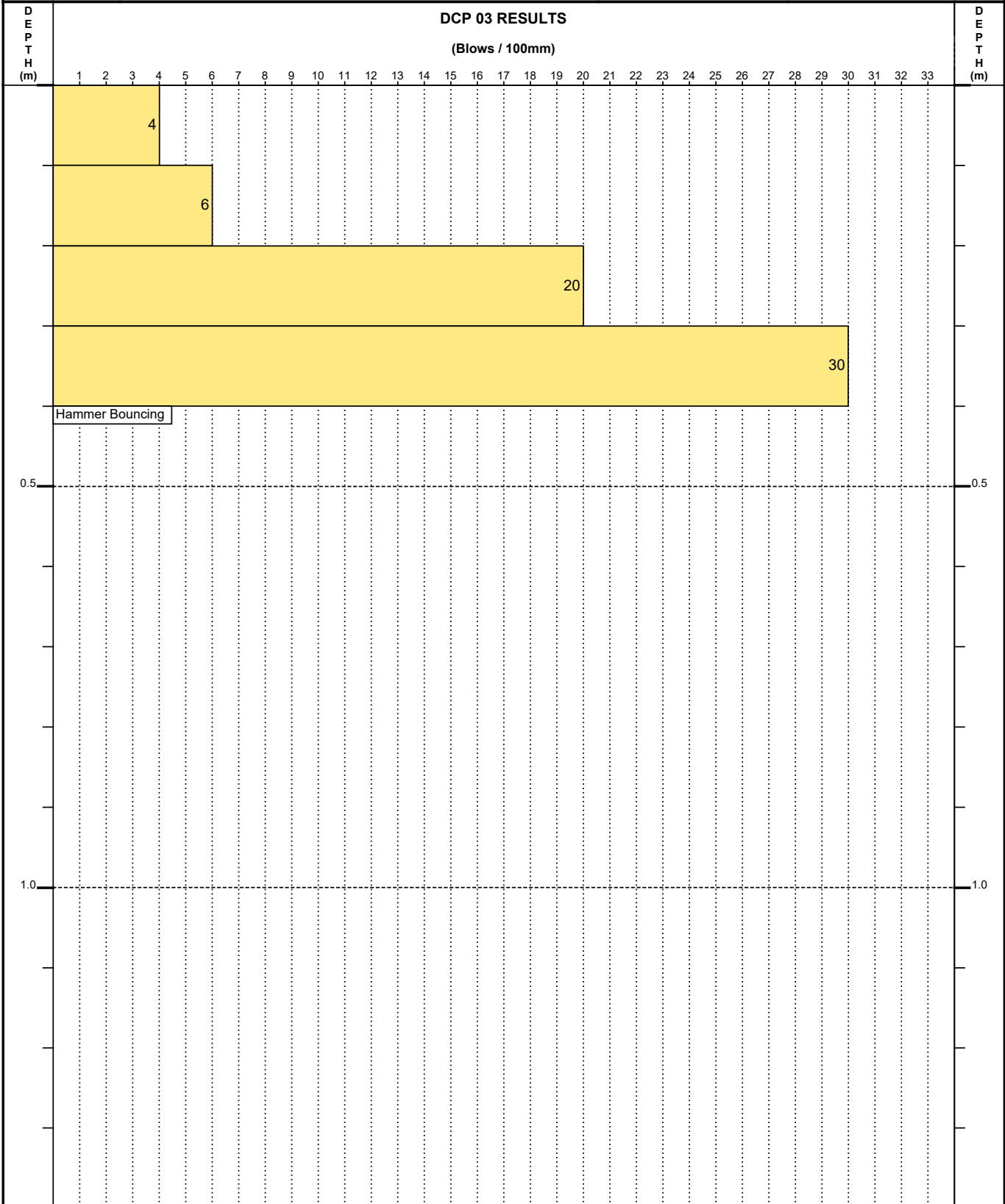
Date: 16/10/24

Client: Natalie Clift

Time: 10:20 a.m.

Test Location: Refer to attached Geotechnical Site Plan (DWG G01A)

Method: Dynamic Cone Penetrometer



Logged By: KL
Plotted By: TM
Checked By: CZM

Notes:

Dynamic Cone Penetrometer (DCP) tests and logs give an indication of the ground conditions at the location of the tests only. While they may be representative of typical conditions across the site, they do not identify variations in the ground away from the test locations. This log does not cover slope stability or suitability of the site for building.

Dynamic Cone Penetrometer tests are performed in accordance with NZS 4402 Test 6.5.2 (Procedure 1 and 2)

STATEMENT OF PROFESSIONAL OPINION ON THE SUITABILITY OF LAND FOR SUBDIVISION

Issued By:	Davis Ogilvie & Partners Ltd. (Geotechnical engineering firm or suitably qualified Geo-professional)
To:	Natalie Clift (Owner/Developer)
To be supplied to:	Selwyn District Council (Territorial authority)
In respect of:	Proposed residential subdivision of Lot 45 DP 239 (Description of infrastructure/land development)
At:	4 Elizabeth Street, Rolleston (Title CB8K/463) (Address)

I Bjorn Raasch (Geo-professional) on behalf of Davis Ogilvie & Partners Ltd. (Geotechnical engineering firm) hereby confirm:

1. I am a suitably qualified and experienced geotechnical engineer and was retained by the owner / developer as the Geo-professional on the above proposed development.
2. The geotechnical assessment report, dated 4 November 2024 has been carried out in accordance with the Ministry of Business, Innovation and Employment (Part D – *Guidelines for the geotechnical investigation and assessment of subdivisions in the Canterbury region*) and includes:
 - (i) Details of and the results of the site investigation.
 - (ii) Recommendations proposing measures to avoid, remedy or mitigate any potential hazards on the land subject to the application, in accordance with the provisions of Section 106 of the Resource Management Act 1991.
3. In my professional opinion, I consider that Council is justified in granting consent incorporating the following conditions:
 - (i) Foundations for proposed Lots within this MBIE TC1 categorised site can be designed to NZS 3604:2011 (concrete and timber) standard. 'Good ground' and a static geotechnical ultimate bearing capacity of 300 kPa was encountered between 0.3 m and 0.6 m below existing ground level.
4. This professional opinion is furnished to the territorial authority and the owner/developer for their purposes alone, on the express condition that it will not be relied upon by any other person and does not remove the necessity for the normal inspection of foundation conditions at the time of erection of any building. It is limited to those items referred to in clause 2 only.

5. This statement shall be read in conjunction with the geotechnical report referred to in Clause 2 above and shall not be copied or reproduced except in conjunction with the full geotechnical completion report.
6. Liability under this statement accrues to the geotechnical firm only and no liability shall accrue to the individual completing this statement.
7. The geotechnical engineering firm issuing this statement holds a current policy of professional indemnity insurance of no less than \$2,000,000.00 (Minimum amount of insurance shall be commensurate with the current amounts recommended by EngNZ, ACENZ, TNZ, INGENIUM).

Bjorn Raasch



.....
(Signature of Engineer)

Date: 4 November 2024

Qualifications and experience:
Principal Engineering Geologist
BSc (Hons), CEngNZ (PEngGeol)