



ENGCO
Consulting Engineers

GEOTECHNICAL REPORT

REPORT PREPARED FOR:

Signature Homes

PROJECT LOCATION:

Lot 43 Branthwaite
Rolleston

ISSUED: 14th October 2020

REFERENCE: 20056.56

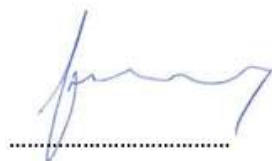
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QUALITY ASSURANCE

This report, prepared by ENGCO, at the request of our Client, is exclusively for our Client's use, is not to be relied upon by any other person, and is strictly limited to the matters herein. No responsibility or liability to any third party is accepted for any loss or damages whatsoever arising out of the use of or reliance on this report by any third party, outside of our Client. Nor may the report be used for any other property than the one specified. Liability under this report or document accrues to the engineering firm only and no liability shall accrue to the individual completing this statement. The report and its contents are not to be quoted or published without ENGCO's consent.

Rev	Date	Revision Status	Author	Reviewed	Authorised
Draft	13/10/2020	Draft for review	A. McKay	M. Cusiel	-
A	14/10/2020	Issued to Client	A. McKay	-	M. Cusiel

Prepared by:



Alex McKay
Graduate Engineer

Authorised:



Matt Cusiel
Director / Engineer
CPENG 161509

EXECUTIVE SUMMARY

Project	ENGCO Ref.		20056.56
	Site Location		Lot 43 Branthwaite, Rolleston
	Scope of Work		Site Specific Soil Investigation
Site Assessment	Investigation Date		5 th October 2020
	Site Subsoil Class		Class D – Deep or soft soil sites
	Land Classification and Land Performance	MBIE Foundation Technical Category	N/A – Rural & Unmapped Engco – TC1 Equivalent
	Hazard Exposure Category	Liquefaction & Lateral Spread	Future land damage from liquefaction is unlikely
		Site Slope	Flat
Foundation Assessment	Soil Compliant with NZ3604 definition of Good Ground		Yes
	Depth of Available Bearing Capacity	300 kPa	From existing ground surface
	Importance level of Proposed Structure		IL2
	Nature of Proposed Structures		One-Storey Dwelling
	Foundation Recommendations		Slab-on-Grade Foundation (as per NZS 3604:2011) Firth Ribraft (or similar)

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Lot 43 Branthwaite, Rolleston

1. INTRODUCTION

The Engineering Company Limited was requested to undertake a site-specific soil investigation of the property at Lot 43 Branthwaite, Rolleston. The shallow geotechnical investigation was conducted on the 5th October 2020. The purpose of the work was to evaluate the surface and subsurface conditions of the site and provide geotechnical recommendations for the proposed foundations, with reference to Ministry of Business, Innovation and Employment's (MBIE's) Guidance and building codes, as appropriate.

Our scope of works included the following:

- Desktop study of relevant publicly available geotechnical and geological publications.
- Organise a shallow subsurface exploration consisting of Hand Auger boreholes and Scala Penetrometer tests.
- Preparation of a report outlining our findings on the ground conditions and including geotechnical advice on foundation conditions and ground remediation if necessary.
- The desktop study and site walkover have been considered in the preparation of this report, together with consideration of area-wide information.

2. SITE DETAILS

2.1 Site description

The site is part of Branthwaite subdivision in Rolleston, roughly 20 km southwest of Christchurch Central City. The site is flat and vacant.

Using the Canterbury Earthquake Recovery Authority's (CERA's) zoning maps the site was confirmed to be within the green zone. Also, according to the Ministry of Business Innovation and Employment (MBIE), this area lays within a "Rural and Unmapped" zone and has not been assigned a Technical Category (TC).

It can be assumed that the site is typically suitable for the construction of a new residential building.

3. DESKTOP STUDY

3.1 Geological Setting

Using the GNS geological map (QMAP) it was found that the site has surface geology of "modern river floodplains and low-level degradation terraces. Unweathered, variably sorted gravel, sand, silt, and clay."

3.2 Areawide Investigations

Using the New Zealand Geotechnical Database (NZGD) several geotechnical tests near the site were analysed. These tests refused on dense gravels at a depth of 2.0 m and the water table was not encountered. A summary of a nearby test pit log is shown in Table 1.

Table 1: NZGD Soil Profiles.

NZGD ID: TP_100545	
Depth (m)	Soil Description
0 to 0.40	(TOPSOIL) SILT, trace to minor fine sand; Dark brown. Very soft to soft, moist, non-plastic. UBC = 200 – 300 kPa
0.40 to 0.70	(ALLUVIAL DEPOSITS) Silty fine to coarse sub-rounded to rounded GRAVEL, minor fine sand; Greyish light brown. Medium dense to dense, moist. UBC > 300 kPa
0.70 to 2.00	Fine to coarse sandy fine to coarse sub-rounded to rounded GRAVEL, trace to minor silt; Brownish grey. Dense to very dense, moist to wet. UBC > 300 kPa
2.00	END OF BORE. 2.00 METRES. TOO DENSE TO EXCAVATE

3.3 Liquefaction Potential

Using the Canterbury Maps Viewer, the site is located in a zone where “damaging liquefaction is unlikely” (ECan, 2012).

In addition, a geotechnical report for Falcons Landing states the subdivision is classified with a Technical Category 1 (TC1). This subdivision sits directly adjacent to Branthwaite. The report states that “based on the underlying ground condition, i.e. gravel from shallow depths and groundwater at depths in the order of 10 m b.g.l. and our liquefaction hazard assessment, we consider the site is consistent with a classification of Technical Category 1 (TC1)” (Aurecon, 2017).

Based on this, it can be assumed that the site has land characteristics attributable to that of an MBIE Technical Category 1 (TC1). This suggests that “future land damage from liquefaction is unlikely, and ground settlements are expected to be within normally accepted tolerances” (MBIE, 2012).

4. FIELD INVESTIGATION

4.1 Geotechnical Investigation

Three Dynamic Cone Penetration Tests (DCP) and one Hand Auger (HA) were conducted on the 5th October 2020. The results of testing are attached in Appendix A.

4.2 Good Ground (as per NZS 3604:2011)

NZS 3604:2011, CI 3.1.1 states “if a site does not comply with the definition of ‘good ground’ the foundations shall be the subject of specific engineering design (SED) and investigation as appropriate.”

A site is considered compliant with the NZS 3604:2011 definition of ‘good ground’ if the conditions outlined in Table 2 are met.

Table 2: ‘Good Ground’ as defined in NZS 3604:2011

Category	Requirements for Compliance
Ultimate Bearing Capacity (UBC)	Soil or rock must be capable of permanently withstanding an Ultimate Bearing Capacity of 300 kPa
DCP Tests	At depths DCP equal to twice the foundation width, DCP results must show greater than 5 blows / 100 mm
	Beyond depths DCP equal to twice the foundation width, DCP results must show greater than 3 blows / 100 mm
Soil Type	Excludes potentially compressible ground such as soils with significant organic content
Land Damage	Excludes land where liquefaction and/or lateral spreading could occur

Good ground was achieved at the site. Based on the DCP tests, an Ultimate Bearing Capacity (UBC) of 300 kPa is available from the existing ground surface.

4.3 Site subsoil classification

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

5. RECOMMENDATIONS

5.1 Building Foundations

The site has a foundation Technical Category 1 (TC1). The proposed single storey dwelling has an importance level of 2 (IL2). The site has an Ultimate Bearing Capacity (UBC) of 300 kPa available from the existing ground surface.

Based on this information, the following foundation solutions will be most suitable for this site:

Slab-on-Grade Foundation (as per NZS 3604:2011)

It is recommended that a TC1 slab-on-grade foundation may be used. This shall be designed in accordance with NZS 3604:2011.

To install this foundation, the house footprint is to be excavated to a depth of approximately 200 mm below existing ground level to remove any organic material. Allow for at least 100 mm of compacted granular subgrade to be placed below the general slab area.

Edge footings shall be embedded 300mm below the existing ground level and be sized in accordance with Section 7 of NZS 3604:2011.

Firth Ribraft (or similar)

Alternatively, it is recommended that a stiffened raft, potentially a Firth Ribraft, may be used. This shall be designed and installed in accordance with the recommendations of the Code-Marked Ribraft Technical Manual.

To install this foundation, the house footprint is to be excavated level to a depth of approximately 200 mm below existing ground level in order to remove any organic material. The excavation should extend 500 mm beyond the footprint on all sides.

Following excavation, the underlying soils must be inspected by a suitably qualified engineer to confirm the soil conditions are consistent with that described in this report. Further excavation of any localised soft spots or organic soils may be required as instructed by the supervising engineer.

As dictated by the finished floor level, backfilling is to be carried out using AP65/AP40 gravel in compacted layers of maximum 150 mm up to the underside of the foundations.

Up to 25mm (max) sand blinding or crusher dust will be required at the top of the compacted gravel to provide a flat surface for the DPM layer and polystyrene pods.

6. REFERENCES

Aurecon. (2017, February 16). Falcons Landing Geotechnical Subdivision Report.

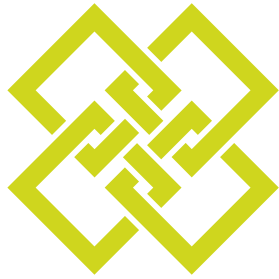
ECan. (2012). Liquefaction Assessment Area Map.

MBIE. (2012, December 1). Repairing and rebuilding houses affected by the Canterbury earthquakes.

7. LIMITATIONS

This report, prepared by ENGCO, at the request of our Client, is exclusively for our Client's use, is not to be relied upon by any other person, and is strictly limited to the matters herein. No responsibility or liability to any third party is accepted for any loss or damages whatsoever arising out of the use of or reliance on this report by any third party, outside of our Client. Nor may the report be used for any other property than the one specified. Liability under this report or document accrues to the engineering firm only and no liability shall accrue to the individual completing this statement. The report and its contents are not to be quoted or published without ENGCO's consent.

The conclusions of the report are based on the interpretation of a limited number of tests at specific locations, and information gathered from nearby sites and other sources. It shall not be relied upon for any other purpose. The reliance by other parties on the information or opinions contained in this report shall, without our prior review and agreement in writing, be at such parties' sole risk.



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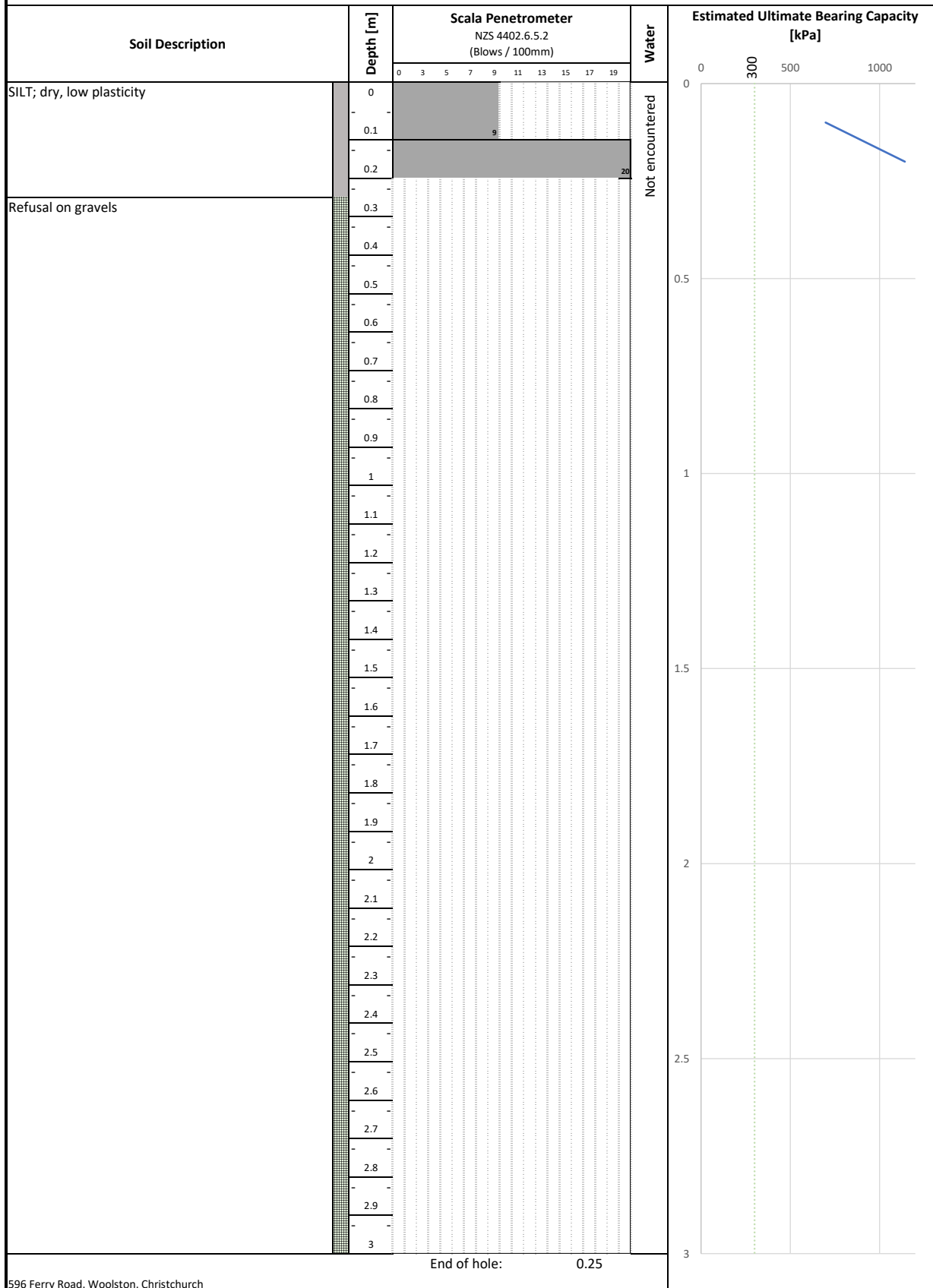
APPENDIX A:

SHALLOW INVESTIGATION LOG



DCP-1

Job Number: 20056.56 Datum: Existing Ground
 Address: Lot 43 Branthwaite, Rolleston
 Date of Testing: 05.10.2020 Operator: Joe

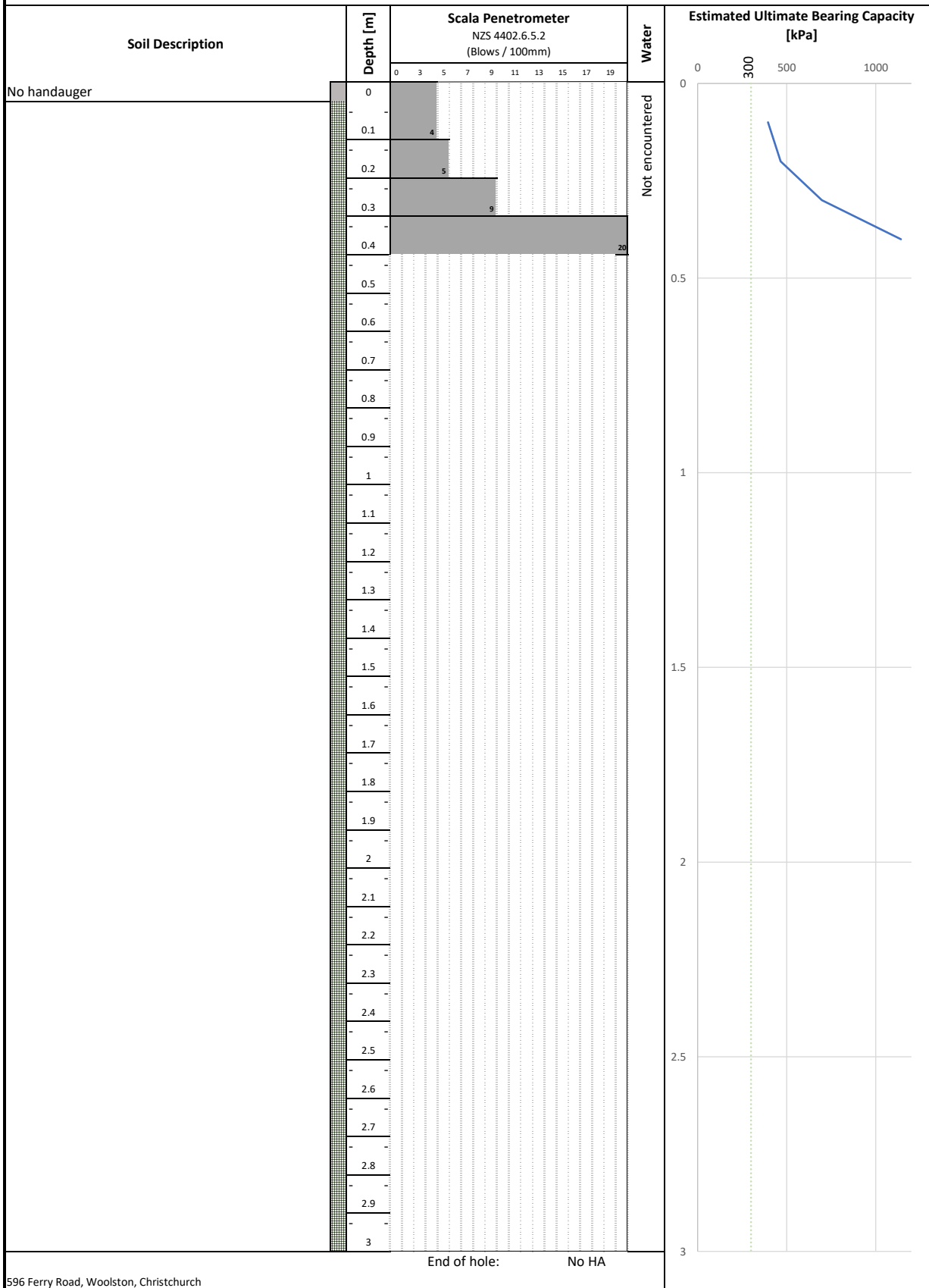


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DCP-2

Job Number: 20056.56 Datum: Existing Ground
 Address: Lot 43 Branthwaite, Rolleston Operator: Joe
 Date of Testing: 05.10.2020

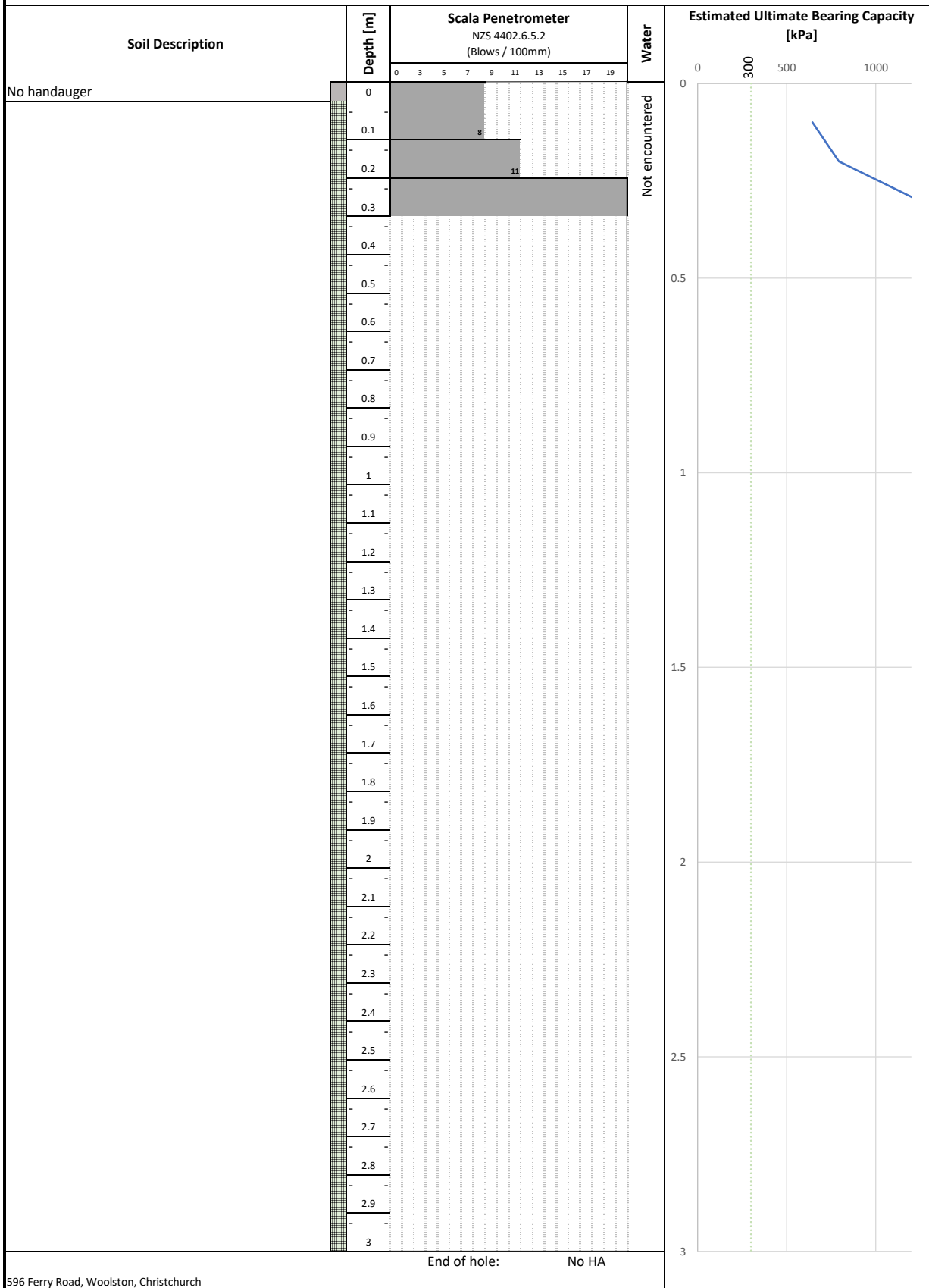


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DCP-3

Job Number: 20056.56 Datum: Existing Ground
 Address: Lot 43 Branthwaite, Rolleston
 Date of Testing: 05.10.2020 Operator: Joe



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MiTek New Zealand Limited

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Fax: 09 274 7100

CHRISTCHURCH
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 PO Box 8387, Riccarton 8440
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www.mitekknz.co.nz

Printed: 13:59:09 19 Oct 2020

MiTek 20/20 Engineering 4.7.346.0

PRODUCER STATEMENT for MiTek 20/20[®] TRUSS DESIGN - Version 4.7

ISSUED BY: MiTek New Zealand Limited

ISSUED TO: CARTERS

IN RESPECT OF: MiTek[®] Truss Designs

This producer statement covers the MiTek 20/20[®] truss design and the structural performance of the GANG-NAIL[®] connector plate for the job reference **329031C1** and may be used by a Building Consent Authority to assist in determining compliance with the New Zealand Building Code.

The MiTek 20/20[®] truss design program has been developed by MiTek New Zealand Limited for the design of MiTek[®] timber roof, floor and attic trusses in New Zealand. The truss designs computed by MiTek 20/20[®] are prepared using sound and widely accepted engineering principles, and in accordance with compliance documents of the New Zealand Building Code and Verification Method B1/VM1; and internationally accepted standard ANSI/TPI 1 - 2002 as an alternative solution, to satisfy the requirements of Clause B1 of the New Zealand Building Code.

On behalf of MiTek New Zealand Limited, and subject to:

- i) All proprietary products meeting their performance specification requirements
- ii) The provision of adequate roof bracing and overall building stability
- iii) Correct selection and placement of GANG-NAIL connector plates
- iv) Correct input of Truss Design Data as shown in the Fabricator Design Statement for this job
- v) The design being undertaken by the accredited fabricator under the terms of the software licence
- vi) Timber is graded to the requirements of NZS 3603:1993
- vii) Minimum timber treatment for these MiTek[®] trusses shall be in accordance with B2/AS1 Table 1A and the relevant sections of NZS 3602:2003

I believe on reasonable grounds that the trusses, if constructed in accordance with the MiTek 20/20[®] truss design and shop drawings, will comply with the relevant provisions of the New Zealand Building Code.

MiTek New Zealand Limited holds a current policy of Professional Indemnity Insurance no less than \$500,000.

On behalf of MiTek New Zealand Limited,

Date: Monday, 19 October 2020

Ian Ling Ng, BE (Hons), CPEng, IntPE, MIPENZ (ID: 146585)
 TECHNICAL SERVICES MANAGER, MiTek New Zealand Limited

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 C2020/24

CARTERS

Fabricator Design Statement : Page 1

Job: 329031C1

Client: Signature Homes
Phone:Site: Clark & Allnut
Lot 43, 3 Olivia Street
Rolleston
Selwyn District

Description: Michael & Margot Niessen Resid

Building Consent No.:

MiTek 20/20 Engineering 4.7.346.0

MiTek New Zealand Limited

Phone:

Printed: 13:59:09 19 Oct 2020

MITEK FABRICATOR DESIGN STATEMENT

This statement is issued by MiTek accredited fabricator **CARTERS**, being licensed to use the MiTek 20/20[®] software, to the client listed above and may be used by the Building Consent Authority to assist in determining compliance with the New Zealand Building Code.

MiTek 20/20[®] TRUSS DESIGN DATA

The MiTek 20/20[®] computer design for this job is based on the following design parameters entered into the program. The Fabricator shall ensure that these job details are correct and relevant to the project for the design of the MiTek[®] trusses.

Job Details	Importance Level :	2	Design Working Life :	50 years	
Roof Truss					
Timber Group:	MSG8 DDP H1.2	Pitch:	25.000 deg	Nominal Overhang:	600 mm
Roof		Ceiling		Wind	
Material:	Metal Tiles	Material:	Gib 13mm/Timber Battens	Area:	High (44.0 m/s)
Dead Load:	0.210 kPa	Dead Load:	0.200 kPa	Pressure Coeff:	Cpe = varies; Cpi = -0.30, 0.20
Restraints:	400 mm centres	Restraints:	600 mm centres	Snow	
Live Load:	Qur = 0.250 kPa Qc = 1.100 kN	Live Load:	Qc = 1.400 kN	Location:	Christchurch (N4) at 100 m
				Open Ground Load:	0.900 kPa
				Basic Roof Load:	0.441 kPa

The minimum timber treatment for these MiTek[®] trusses shall be in accordance with B2/AS1 Table 1A and the relevant sections of NZS 3602:2003. The timber for these MiTek[®] trusses shall be graded to the requirements of NZS 3603:1993. Proprietary fixings and timber connectors shall be selected in accordance with NZS3604:2011 Section 4 - Durability.

MiTek Truss List

Legend: * = detail only, ? = input only, ~~xxx~~ = failed design, Ø = non certified, Unmarked trusses = designed successfully, LB = lateral bracing required
GB = gable brace required

Truss	Qty	Span (mm)	Pitch (deg)	Spacing (mm)	Truss	Qty	Span (mm)	Pitch (deg)	Spacing (mm)	Truss	Qty	Span (mm)	Pitch (deg)	Spacing (mm)
ET1	1	1690	25.000	900	J9	2	2962	25.000	900	TR2	1	11370	25.000	900
*ET1	4	8834	18.249	900	J10	2	2962	25.000	900	TR3	1	11370	25.000	900
J1	1	2062	25.000	900	J12	1	2062	25.000	900	TR4	1	11370	25.000	900
J2	4	2062	25.000	900	J13	1	1272	25.000	900	TR5	1	11370	25.000	900
J3	1	2062	25.000	900	*R1	4	1753	25.000	900	J11	1	2962	25.000	900
J4	2	2062	25.000	900	*R2	8	891	25.000	900	J11A	1	2962	25.000	900
J5	1	2062	25.000	900	T2	2	11370	25.000	900	T1	1D	11370	25.000	900
J6	4	2062	25.000	900	T3	1	11370	25.000	660	TG1	1D	11370	25.000	900
J7	1	2962	25.000	900	T6	1	1510	25.000	900					
J8	2	2962	25.000	900	TR1	1	11370	25.000	900					

Total quantity : 52

The computer design input has been carried out by:

MiTek 20/20 Software Operator: Bruce Barrow

MiTek Candidate Number and Qualifications: 10579 - MiTek 101, 201, 301, COC

Accredited Fabricator:



Monday, 19 October 2020

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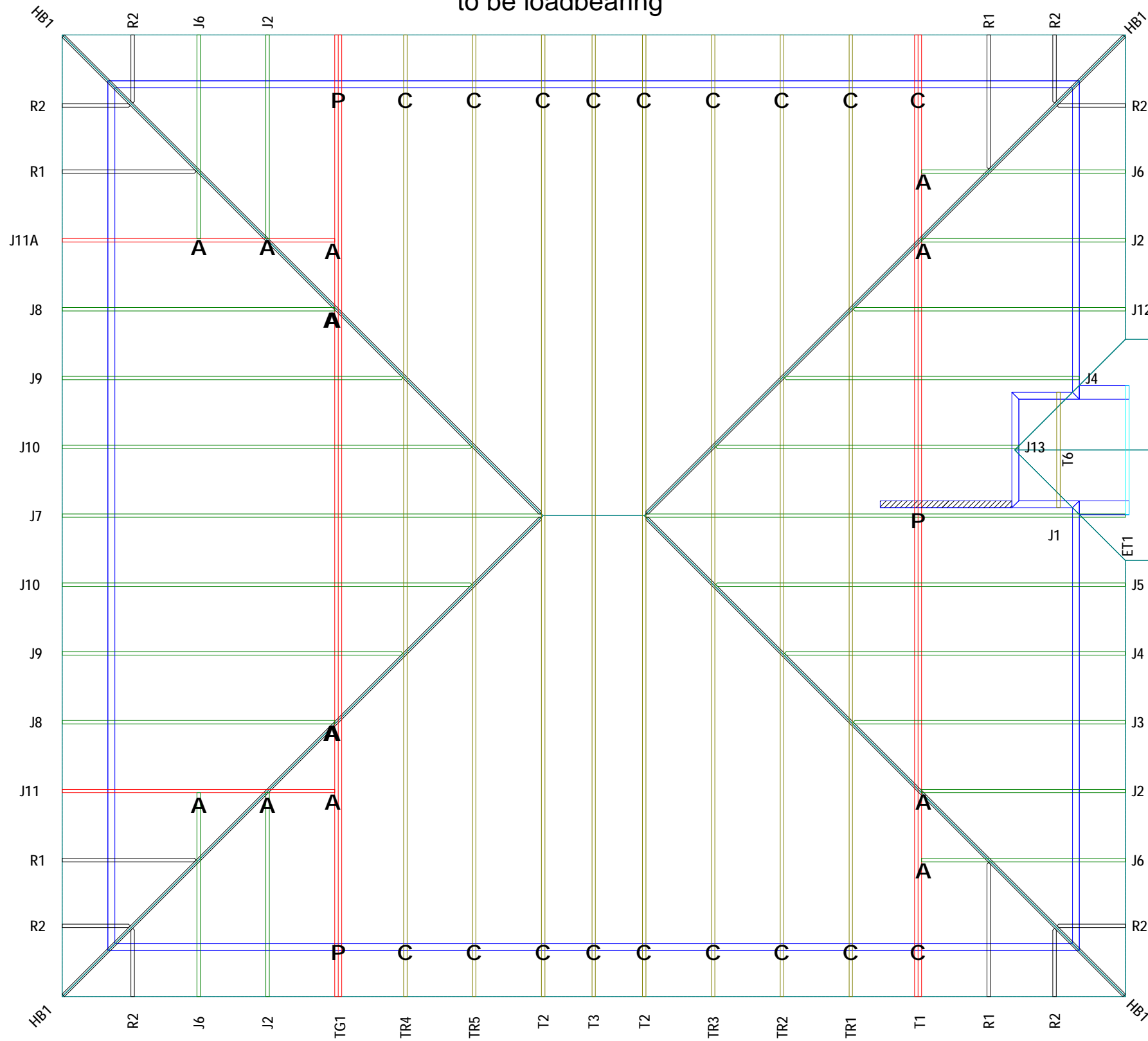
BUILDABLE CONSENT LAYOUT

For valley/saddle truss fixing unless stated otherwise use a pair of wire dogs at 900mm centres for up to and including a very high wind zone. Or a pair of CT200's at 900mm centres for extra high wind zone. This fixing is to meet the minimum requirements as per NZS3604.



Your Building Partner

Any internal walls shown on this layout are considered to be loadbearing



CARTERS
Carters National Support Office
0800 Carters

JOB No 329031C1

Client: Signature Homes
Job: Clark & Allnut
Site: Lot 43, 3 Olivia Street
Rolleston
Selwyn District

Pitch: 25.0deg
Roof Type: Metal Tiles
Overhang: 600mm
Wind Area: High
Roof Snow: 0.441kPa
Ceiling Restraint Centres 600mm

Trusses and rafters at 900mm max centres unless stated otherwise. This layout is to be read in conjunction with the Architectural plans.

DRAWN Bruce Barrow 19 Oct,2020

FIXINGS

- A = 47x90 Joist Hanger
- B = 47x120 Joist Hanger
- C = CT200 (pair)
- D = 47x190 Joist Hanger
- E = 95x165 Joist Hanger
- F = SH-140 Split Hanger
- G = SH-180 Split Hanger
- H = SH-220 Split Hanger
- J = 2x6kN Strap (12kN Total)
- K = 6kN Strap
- L = Multigrip (single)
- M = Multigrips (pair)
- N = Nailon Plate (240x110x1)
- P = 16kN Pack
- Q = 9kN Pack
- S = CPC 40 Single Cleat
- T = CPC 40 Short (pair)
- U = CPC 80 Single Cleat
- V = 16kN Uplift
- W = 24kN Uplift
- X = 25kN Uplift
- Y = 35kN Uplift
- Z = 45kN Uplift

Unless otherwise indicated, all specified truss fixings are to use L/Lok product nail fasteners (as per the MiTek On-site Guide) when the choice of using screws or nails is optional.

All truss to frame fixings require 2 additional 2/90x3.15dia skew nails.

All truss fixings not indicated as above must have 2 wire dogs for cross joints and 2/90x3.15dia nails for butt joints.

Fixings shown are for fixing trusses to the top plate. Any other point load uplift fixings down through the framing stud to top plate, stud to bottom plate, bottom plate to floor remain the responsibility of the architect / draughtsman.

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If metal ceiling battens on clips are used, 90x45 SG8 bottom chord restraints are required at 1800mm centres fixed with 2/90x3.15dia nails (skew nails if on edge).
All gable trusses are designed to suit cladding manufacturer's framing requirements.
If a gable truss requires a windbeam brace, the type of MiTek brace will be noted as such on the layout.

Truss Layout



Whiterock Consulting Ltd
 638 Carrs Rd
 RD2 Rangiora, 7472
 T: 03 312 8830, M: 027 480 4883
 Email: fiona@whiterockconsulting.co.nz

16 October 2020

Martyn Glynn
 Signature Homes Ltd
 PO Box 11351
 Christchurch 8042

Dear Martyn

SOAK PIT SIZING FOR LOT 43 BRANTHWAITE, ROLLESTON

1. Introduction

The Selwyn District Council (SDC) requires specific soak pit design for all new soak pits. Soak pits can either be designed using actual soakage test results from the site to show compliance in accordance with E1/VM1 or using an Alternative Solution. If an Alternative Solution is used, then evidence and supporting documentation is required to support the design soakage rate used to size the soak pits.

The discharge of roof water at this site needs to meet the conditions of the permitted activity rule in the Regional Plan and the Building Code (E1). To do this the discharge of stormwater to land needs to be sized to dispose of stormwater from the 10 year, 24 hour duration storm and for there to be 1 m separation from the base of the soak pit and the highest expected groundwater.

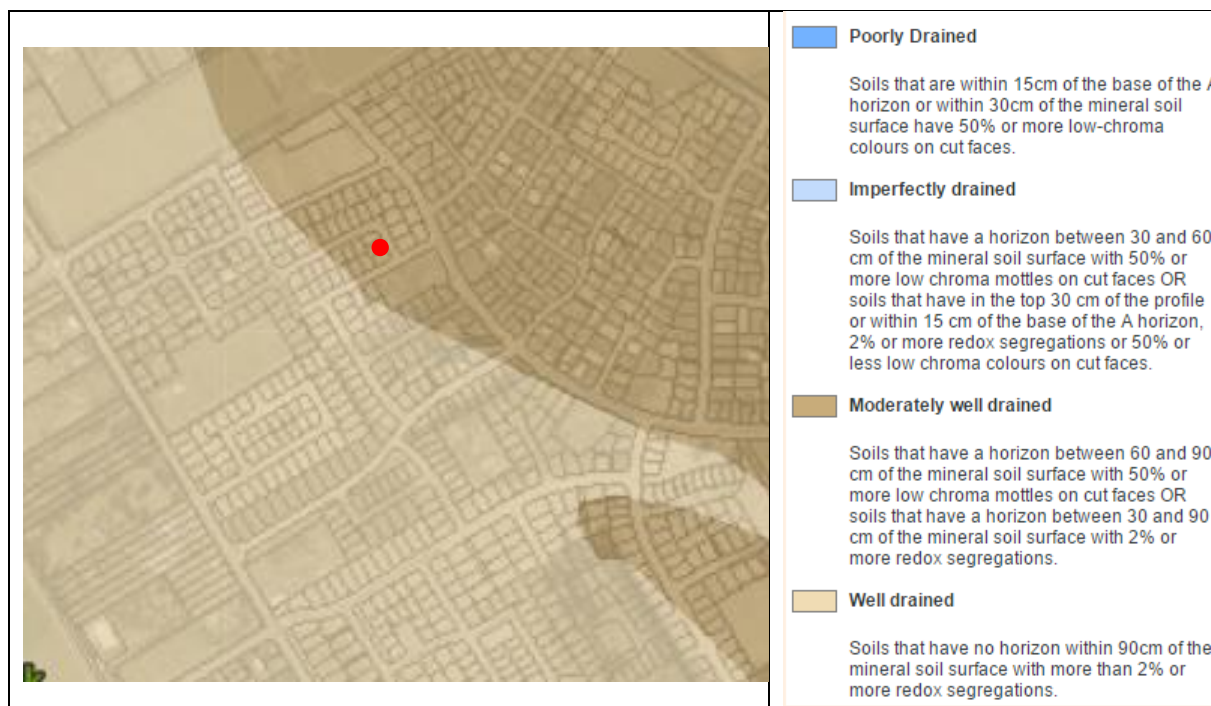
The site is shown on the Landcare Research soils mapping database SMaps to be moderately well drained (see below; red dot marks the site location). The stormwater consent application for the roading network describes the site geology to be:

- Topsoil to 0.3 – 0.4 m bgl
- Stiff silt to 0.6 – 1.2 m bgl
- Dense sandy gravel to the base of the test pits are 0.7 – 2.0 m bgl

Soakage testing was not reported in the application. The Engineers (Survus) assumed a soakage rate of 4,000 mm/hr based on testing in nearby subdivisions. A rate of 3,000 mm/hr was used in the example soak pit calculations. A drainlayer who has been installing soak pits in this subdivision has reported excellent soakage at depths ranging from 2 and 3.5 m.

Therefore, the soakage rate is expected to be relatively high, which is consistent with many parts of Rolleston. Testing of sites by Whiterock Consulting Ltd in the Farrington Subdivision has found that the soakage rate ranged from 2,000 mm/hr to over 20,000 mm/hr. For this site a soakage rate of **1,000 mm/hr** has been used to size the soak pits. This is expected to be conservatively low to allow for partial blockage of the soak pit over time and to account for the natural variation of the gravels

in the general area. However, the drain layer will be responsible for confirming free draining gravels are present.



With respect to the separation depth to groundwater, the site is located over an area shown on Canterbury Maps to have a depth to groundwater greater than 6 m. The soak pit is estimated to be 2- 3.5 deep and therefore there will be 1 m separation to the highest expected groundwater.

2. Soak Pit Sizing

The ECan permitted activity requires the soak pit to be sized to contain and dispose of stormwater from all events up to and including the 10 year, 24 hour duration storm. For sites with rapid soakage, as is expected at this site, the critical duration (the storm that results in the largest soak pit) is the 1 hour duration event. The Building Code (E1) requires the soak pit to be sized for the 10 year, 1 hour event.

The SDC Engineering Code of Practice, Part-5-Stormwater has been used to select the rainfall data. This is summarised below:

- Rolleston scaling factor: 1.03 * Christchurch Aero Rainfall
- Additional scaling: + 16% for climate change

Design rainfall depth for site (10 yr, 1 hr): $1.03 \times 19 \text{ mm/hr} \times 1.16 = \mathbf{22.7 \text{ mm/hr}}$.

The site details used to size the soak pit are presented in Table 1.

Parameter	Value	Unit
Total roof area	176.4	m ²
Total hardstand area	35.0	m ²
Runoff C	0.9	
Design infiltration rate (base only)	1,000	mm/hr
Design i (10 yr, 1 hr)	22.7	mm/hr

(SDC rainfall data +16% for climate change)

Table 2 presents the minimum soak pit size for the proposed soak pit. It is recommended that the soak pit is located at the front of the site to assist in any future maintenance.

Contributing Area [m ²]: roof + drive	211.4
Length (minimum - can be longer) [m]	2.0
Width (minimum - can be wider) [m]	1.5
Depth (This is an assumed depth, drainlayer to check and excavate to free draining gravels) [m]	2.5
Soak Pit base area [m²]	3.0
Total Soak Pit volume [m³]	7.5
Porosity	0.38
R _c : Volume of water to soak pit [m ³]	4.3
V _{soak} : Volume infiltrated [m ³]	3.0
V _{stor} : Storage volume in soak pit [m ³] [L*W* D-0.3 m*0.38] Note: it is assumed that the top 0.3 m of the soak pit is not available for storage	2.5
Total volume discharged/stored [m ³]	5.5
Volume exceeding soak pit storage (needs to be 0 or <0) [m ³]	-1.2

change dimensions until 'Volume remaining' is 0 or <0

3. Summary and Recommendations

A soakage test has not been undertaken at the site. A design infiltration rate of 1,000 mm/hr has been adopted for the design of the soak pit at this property. The soak pit size based on this assumption is presented in Table 2. The length and width of the soak pit can be altered to suit the site, but the base area and total volume presented in Table 2 must be maintained. The depth presented in the table is assumed and the **drainlayer is to ensure that the base of the soak pit is installed into free draining gravels.**

It is recommended that the soak pit is located next to the drive so that it is accessible if it needs to be replaced in the future.

If you have any questions please do not hesitate to contact me.

Yours Sincerely

WHITEROCK CONSULTING LTD

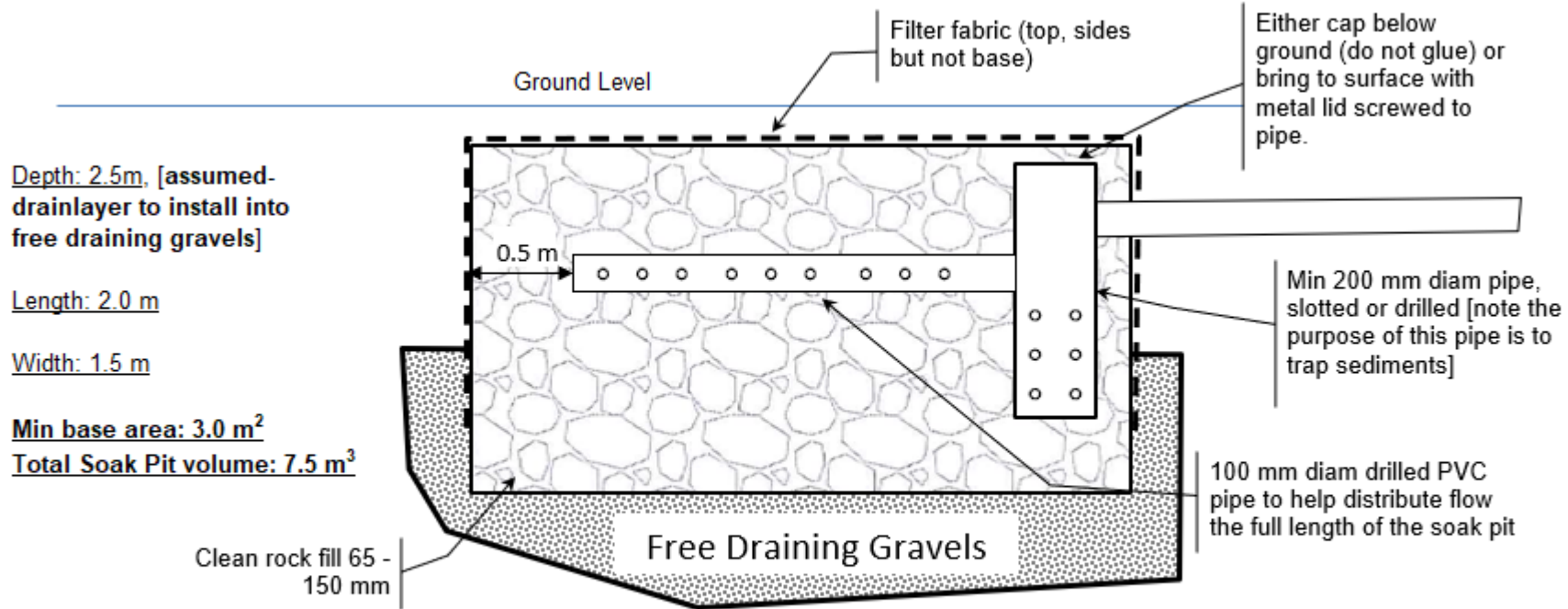
A handwritten signature in blue ink, appearing to read 'Fiona Ambury', is displayed within a light blue rectangular box.

Fiona Ambury

Natural Resources Engineer, Director
CPEng, CMEngNZ, IntPE(NZ)

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Soak Pit Cross Section



NOT TO SCALE

Prepared by: Whiterock Consulting Ltd
Date: 16/10/2020