SOIL INVESTIGATION REPORT

Lot 21
8B Dominion Ave
Cambridge
P21442

Client: Sentinel Homes
Date: 4.6.2021

By: CB
Email: James@probase.co.nz

REPORT SUMMARY

Probase Engineering has been engaged by Sentinel Homes to provide a soil investigation report for a proposed development at 8B Dominion Ave, Cambridge. This report presents the tests carried out on site, results and development recommendations. This report is intended to support the application for building consent.

SUMMARY OF FINDINGS

With reference to the subdivision report '*Rutherford Park 5 to 9 Williamson Street, Cambridge, Geotechnical Suitability Report'* report authored by HD Geo dated 26th July 2017.

Probase Engineering recommends:

Due to the clayey materials encountered, Probase Engineering recommends:

- **SED Waffle raft type foundation – to mitigate expansive site class 'M' soils:** Designed in accordance with the guidance and details provided in AS 2870:2011.
- A minimum of topsoil and near surface material to approx.
    - **100-200mm** below EGL within the area of HA1 and HA2
    - **900mm** below EGL within the area of HA4

  should be excavated below EGL to the proposed foundation subgrade and then backfilled using suitable imported granular fill *in accordance with section 3.1 Foundation Preparation.*

Due to the sloping nature of the site the following recommendations are to be undertaken during construction earthworks:

- Any cut which creates a slope exceeding 18° (1:3) and of a height greater than 1000mm must only be carried out under the supervision of a suitably qualified engineer.
- **Any fill placed must only be carried out under the supervision of a suitably qualified engineer.**
- Any retaining wall should be specifically designed to for the appropriate surcharge.
- Building platform is outside of the 5.0m preliminary building restriction zone for the upslope wall in accordance with the HD Geo report

DISTRIBUTION

Company	Number of Copies
Sentinel Homes	1 copy
Probase Engineering Ltd (file)	1 copy

1 INTRODUCTION

1.1. Engagement and Scope

Probase Engineering was engaged by Sentinel Homes to conduct a soils investigation at 8B Dominion Ave, Cambridge. It is proposed to construct a **double-level** timber framed dwelling at the above address. The scope is as follows:

- Soils investigation in accordance with NZS 3604:2011.
- Foundation recommendations.

1.2. Existing Information

The following geotechnical report was available to Probase Engineering at the time of testing:

- '*Rutherford Park 5 to 9 Williamson Street, Cambridge, Geotechnical Suitability Report'* report authored by HD Geo dated 26th July 2017

Their report is to be read in conjunction with this report regarding:

- Ground conditions
- Building Foundations
- Earthworks
- Stability

2 SOIL INVESTIGATION

2.1. Field Testing

In accordance with NZS 3604:2011, a soils investigation was conducted on the 31st May 2021. Testing was carried out at 4 test positions across the site and comprised:

- 4 Hand Augers with accompanied shear vane tests
- 1 Scala Penetrometer tests.
- A visual inspection and walk over of the site.

Field data from testing is outlined in the attached 'Soil Logs'. Test position locations and general arrangement of the site is outlined in the attached sketch 'Test Location Plan'.

2.2. Test Results

Expansive soils were encountered during shallow investigations. Therefore, soils do not meet the definition of 'Good Ground' in accordance with NZS3604:2011. The expansive soils have been classified as moderate 'M' class in accordance with AS2870:2011.

2.3. Expansive Soils

Expansive soils contain minerals (clays) that are capable of absorbing water and are subject to swelling and shrinkage during times when soil moisture contents fluctuate with seasonal conditions (wet and dry conditions). Expansive soils undergo volume changes which can exert enough force upon a building to cause damage, such as cracking of foundations and slab up lift. These soils are outside the scope of NZS3604:2011.

2.4. Expansive Soils Design Parameters

Classification	Iss Range (%)	Design (500 year) Surface Movement Return (Ys)
S	0 - 1.9	22mm
M	2.0 - 3.7	44mm
H	3.8 – 6.5	78mm
E	6.6 – 7.5	90mm

Note: *The above table is in reference to section 23C – 7.5.13.1.2 of the November 2019 "Acceptable Solutions and Verification Methods: B1 - Amendment 19".*

2.5. Slope Stability

During the site investigation, a site walkover was conducted, and a review of aerial photography and online contour maps was completed to assess the potential slope instability at the site and in the surrounding area. No indications of slope instability were observed.

Due to the sloping nature of the site the following recommendations are to be undertaken during construction earthworks:

- Any cut which creates a slope exceeding 18^{o} (1:3) and of a height greater than 1000mm must only be carried out under the supervision of a suitably qualified engineer.
- **Any fill placed must only be carried out under the supervision of a suitably qualified engineer.**
- Any retaining wall should be specifically designed to for the appropriate surcharge.
- Building platform is outside of the 5.0m preliminary building restriction zone for the upslope wall in accordance with the HD Geo report

Due to the sloping nature of the site the following recommendations are to be observed:

2.6. Ground Conditions

Parameter	Finding
Geological Unit:	Hamilton Ash/Walton Subgroup
Site Condition:	Greenfields, Vacant Lot
Ground Contours:	Sloping generally from west to east at **20 degrees.**
Soil Composition:	Silty CLAY, clayey SILT and sandy SILT, silty SANDs at depth
Water Table Depth:	Not Encountered
Fill:	Not Encountered
Organic Soils:	Topsoil depth up to 900mm. Some organic rich SILT found at depth within HA3 outside of the proposed building platform at depth.
Expansive Soils:	M Class

3 FOUNDATIONS

3.1. Foundation Preparation

To prepare the proposed building platform:

- Topsoil and near surface material to approx.
    - **100-200mm** below EGL within the area of HA1 and HA2
    - **900mm** below EGL within the area of HA4

  should be stripped over the entire floor slab area. Excavations shall occur at a minimum of **500mm**outside of the footing lines to reach the proposed foundation subgrade level.
- Excavation depth is indicative only, there may be areas onsite that require further excavation – to be inspected during construction.
- Any soft ground, such as soft peat, soft clays and organic matter (tree stumps, roots etc.) exposed by the excavation shall also be removed.

Upon completion of subgrade excavation, the ground is to be proof-rolled prior to backfilling with a minimum of 5 passes by a 2-tonne self-propelled vibrating roller. However, this will be at the discretion of the engineer.

To bring the building platform up to the required finished floor level(s), backfill (structural fill) consisting of a suitable imported granular fill material (pit sand or similar) should be placed and compacted over the entire proposed foundation subgrade in layers not exceeding 150mm.

- Compacted fill material is required to have a bearing capacity greater than 300 kPa in accordance with NZS 3604:2011 (minimum safe bearing of 100 kPa).

3.2. Foundation Details

Due to the clayey materials encountered, Probase Engineering recommends:

- **SED Waffle raft type foundation – to mitigate expansive site class 'M' soils:** Designed in accordance with the guidance and details provided in AS 2870:2011.

4 INSPECTIONS

Subgrade Inspection - To satisfy statutory and council building requirements a suitably qualified engineer is required to inspect the excavated subgrade. This is to occur prior to backfilling in order to confirm subsurface soils exposed are representative of investigation findings.

Sand pad/ Compaction Test – Where sand is used as compacted fill and is equal to or in excess of 600mm, a suitably qualified engineer is required to test the compaction to ascertain that the sand pad has a minimum penetrometer test result of 5 blows/100mm. However, a sand pad inspection is dependent on the subgrade inspection confirming the initial report findings.

Fill - Any fill created from cut or imported material used in the creation of level building platform is required to be tested by a suitably qualified engineer prior to backfilling. Regardless of the material source, all fill must be placed in accordance with NZS 4431:1989, Code of Practice for Earth Fill for Residential Development.

Steel Check - Pre-pour steel inspection is to be carried out by a suitably qualified engineer.

5 LIMITATIONS

Recommendations given in this report are based on site data retrieved from the bore holes from discreet locations, soil exposures, Scala Penetrometer results and other test results. Inferences about subsurface soils away from the test locations at the site can be made but cannot be guaranteed. Variations in ground conditions from those described in this report could exist across the site and that ground conditions can vary with seasonal changes. Allowances for construction should be made for these conditions.

This report has been prepared specifically for our client based on their particular project brief and no responsibility is accepted for the use of any part of this report by others or for any other purpose. It contains my professional opinion regarding foundation stability based on the data retrieved from the specific tests and boreholes completed and is not to be construed as a guarantee that the whole site is suitable for the foundations originally proposed.

Contamination risks are not covered and outside the scope of this report.

Quality Assurance Statement		
Task	**Responsibility**	**Signature**
Testing and report prepared by:	Charlie Banks NZDE (Civil)	
Reviewed and approved for issue by:	James Harper NZDE, BEngTech, CMEngNZ	

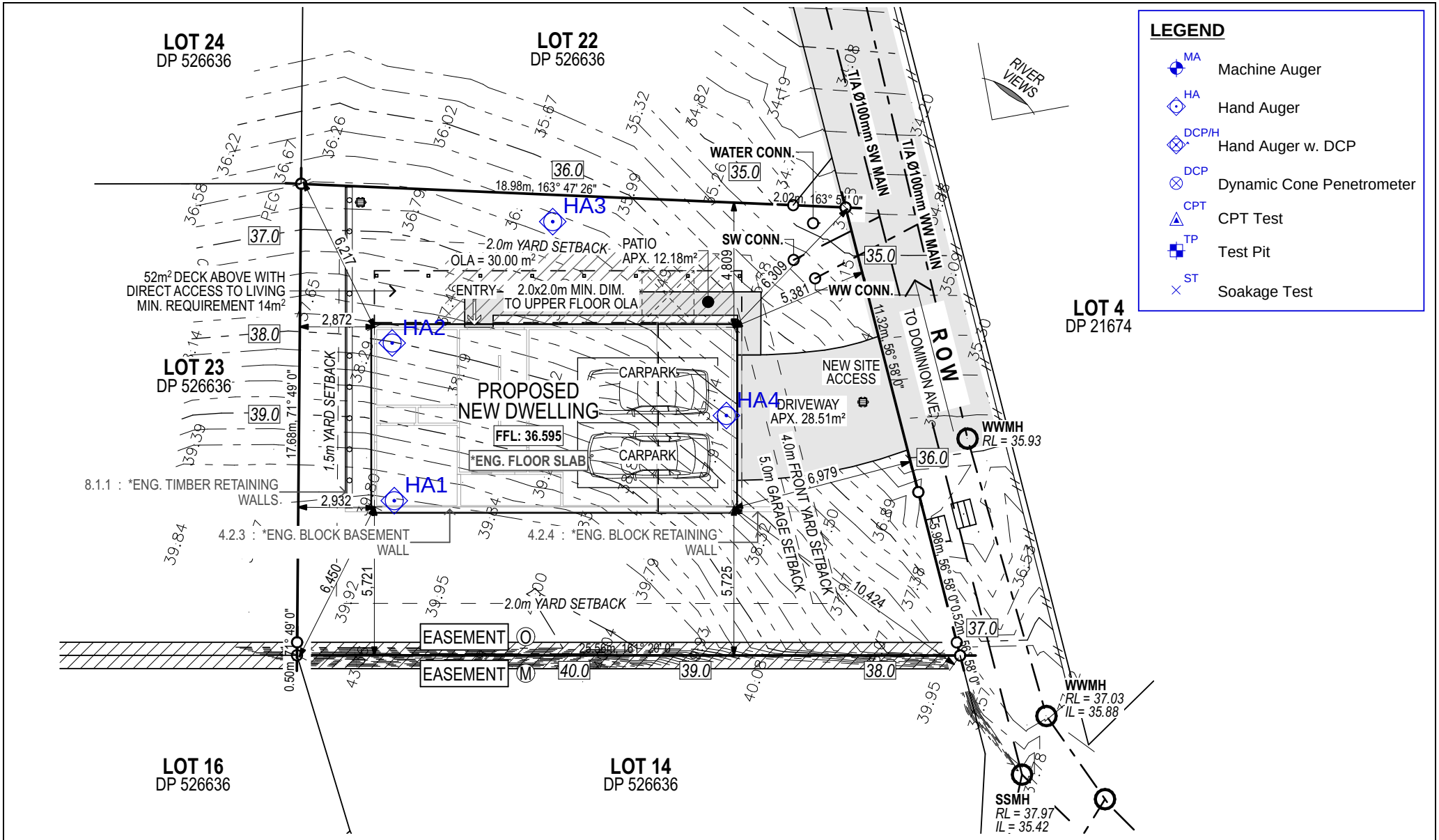
James Harper is a Chartered Member of Engineering New Zealand and a Registered Producer Statement Author for the Waikato Building Consent Group: Registration #535.

Appendices

Test Location Plan

Soil Test Results

Producer Statement

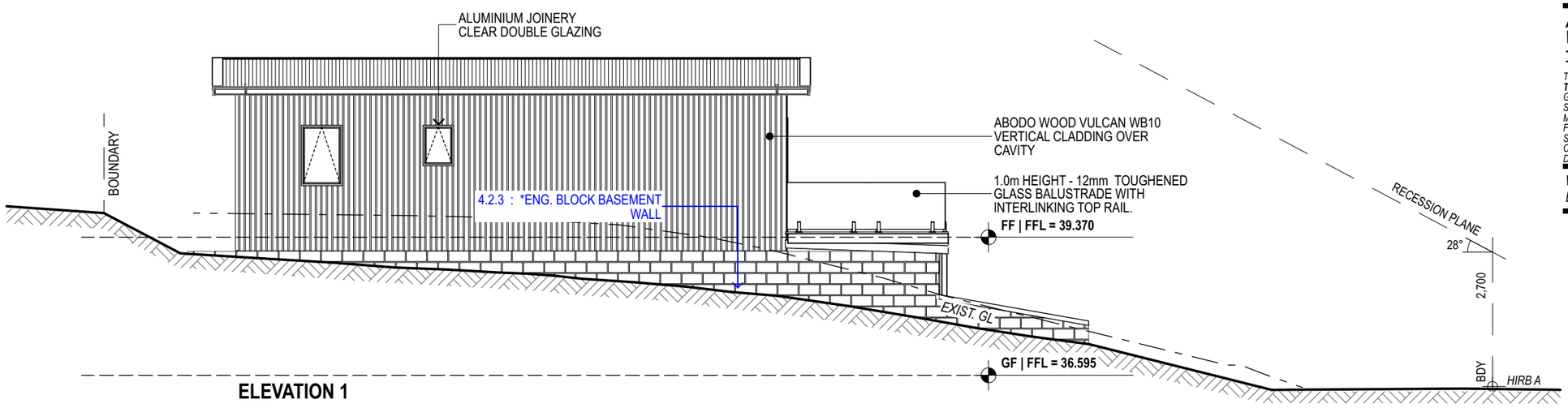


PROBASE ENGINEERING (FOUNDING EXCELLENCE)	Project Title: Lot 21, 8B Dominion Ave, Cambridge			
	Figure Title: Test Location Plan			
	Author: CB	Date: 31.05.2021	Job No: P21442	Figure: 1

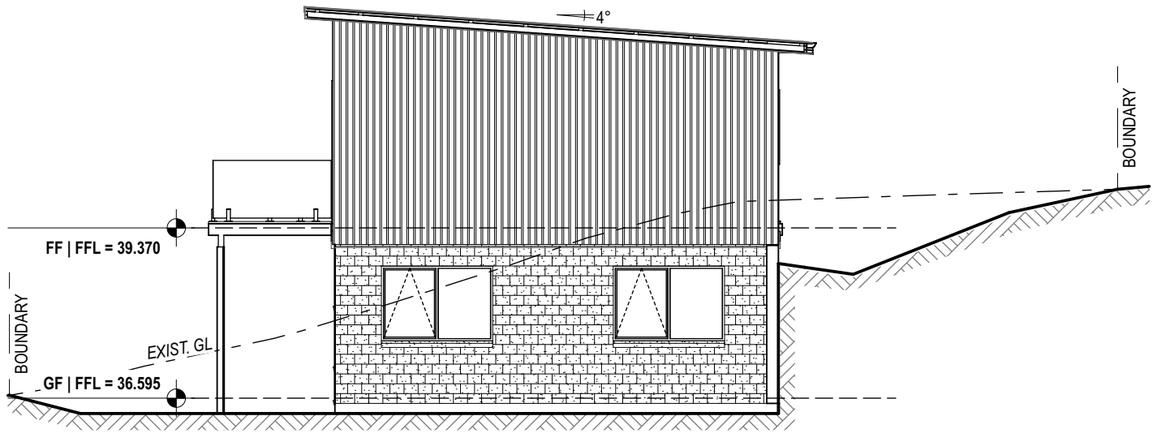
ALL PLANS TO BE READ IN CONJUNCTION WITH 'KEY NOTES SUMMARY' PAGE
- SUBJECT TO COUNCIL APPROVAL
- DO NOT SCALE OFF DRAWINGS-REFER TO WRITTEN DIMENSIONS

*THE FOLLOWING **MUST** BE CONFIRMED (& OR LOCATED) ON SITE **PRIOR TO CONSTRUCTION**: (1) ALL MEASUREMENTS AND DIMENSIONS (2) SITE GROUND LINES AND LEVELS, INC. HIRB POINT RLs (3) ALL EXIST. STRUCTURES, TREES, SEWER AND STORMWATER MAINS, INVERTS, MANHOLES, AND ANY CONNECTION POINTS, INC. ANY OTHER SITE FEATURES. SHOULD ANY DISCREPANCIES BE FOUND, CONTRACTOR SHALL CONTACT THE DESIGNER BEFORE PROCEEDING (4) IF ANY CHANGES ARE MADE TO THE PLANS WITHOUT CONSULTING WITH THE DESIGNER, NO RESPONSIBILITY SHALL BE HELD BY THE DESIGNER*

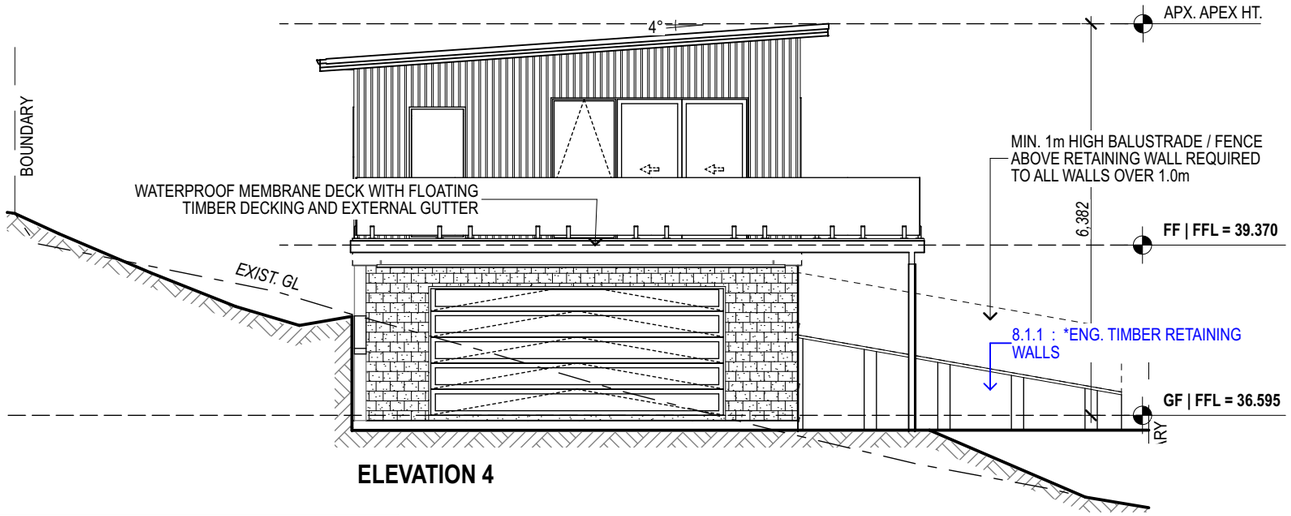
WIND ZONE:	HIGH	EXPOS. ZONE:	B
EARTHQ ZONE:	1	SNOW LOAD:	-



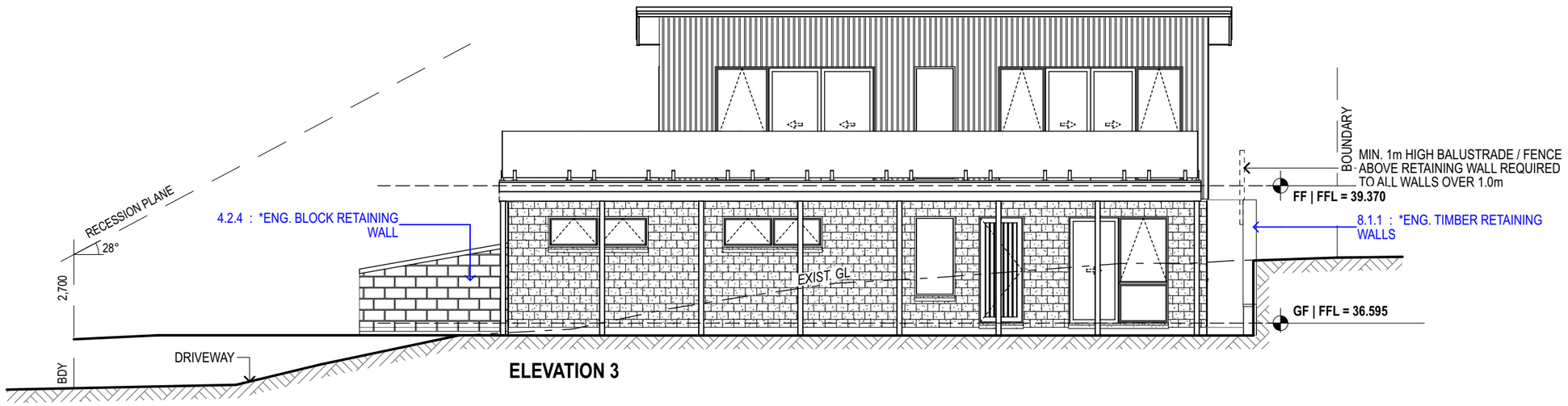
ELEVATION 1



ELEVATION 2



ELEVATION 4



ELEVATION 3

sentinel HOMES

SHANE LAWREY
LOT:21 | DP:526636
8B DOMINION AVE, CAMBRIDGE

ELEVATIONS

DWG SCALE: 1:100, 1:1 @ A3

DESIGN BY: SENTINEL HOMES
DRAWN BY: M.BAYLY
REVIEW BY: S.AUSTEN

PROJECT REFERENCE: **SHW2107 | CPT-03**
DWG DATE: 11/05/21
LAYOUT ID: **105**

CONCEPT

PROBASE ENGINEERING — FOUNDING EXCELLENCE

PROJECT:	Lot 21, 8B Dominion Ave	JOB No.	P21442
CLIENT:	Sentinel Homes	DATE:	31.05.2021
LOCATION:	Cambridge	TESTED BY :	CB
	Refer to attached Site Plan for testing locations	SHEAR VANE ID:	1592

BOREHOLE ID: HA1

Depth (m)	No of Blows[1]	Scala Penetrometer (Blows / 100mm) 2 4 6 8 10	SOIL DESCRIPTION[2]	Depth (m)	UNDRAINED SHEAR[3] (kPa)	Geologic Unit	Ground Water
			TOPSOIL; dark brown, moist			Holocene sediments/Hinuera Formation	Groundwater Not Encountered
			silty CLAY; light brown, grey, orange mottle, moderate plasticity, stiff, Moist		147/62		
0.5				0.5			
					147/55		
			grey, becomes high plasticity		211/52		
1.0				1.0			
			brownish orange, dry to moist, trace to minor sand		192/71		
1.5				1.5	151/42		
			silty CLAY, some sand, brownish orange, moist, moderate palsticity		163/33		
2.0				2.0	221/42		
			End of borehole at 2.0m - Target depth.				
2.5				2.5			
3.0				3.0			
3.5				3.5			
4.0				4.0			
4.5				4.5			

Notes:

Reference:

1 = Results obtained in accordance with NZS4402, Test 6.5.2:1988

2 = Refer NZGS Field Description of Soil and Rock Dec 2005 for further information

3 = Refer to Guideline for Hand Held Shear Vane Test; NZGS August 2001

PROBASE ENGINEERING — FOUNDING EXCELLENCE

PROJECT:	Lot 21, 8B Dominion Ave	JOB No.	P21442
CLIENT:	Sentinel Homes	DATE:	31.05.2021
LOCATION:	Cambridge	TESTED BY :	CB
	Refer to attached Site Plan for testing locations	SHEAR VANE ID:	1592

BOREHOLE ID: HA2

Depth (m)	No of Blows	Scala Penetrometer (Blows / 100mm) 2 4 6 8 10	SOIL DESCRIPTION[2]	Depth (m)	UNDRAINED SHEAR[3] (kPa)	Geologic Unit	Ground Water
			TOPSOIL; dark brown, moist			TS	Groundwater Not Encountered
			clayey SILT; trace to minor sand, light brown, grey, orange mottle, moderate plasticity, stiff, Moist, sensitve		100/23	Holocene sediments/Hinuera Formation	
0.5			silty CLAY; grey, moderate to high plasticity, stiff, moist	0.5			
					116/33		
					210+		
1.0				1.0			
			brownish orange, fry, trace to minor sand		210+		
1.5			some sand	1.5	210+		
					221/42		
2.0				2.0	210+		
			End of borehole at 2.0m - Target depth.				
2.5				2.5			
3.0				3.0			
3.5				3.5			
4.0				4.0			
4.5				4.5			

Notes:

Reference:

1 = Results obtained in accordance with NZS4402, Test 6.5.2:1988

2 = Refer NZGS Field Description of Soil and Rock Dec 2005 for further information

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PROJECT:	Lot 21, 8B Dominion Ave	JOB No.	P21442
CLIENT:	Sentinel Homes	DATE:	31.05.2021
LOCATION:	Cambridge	TESTED BY :	CB
	Refer to attached Site Plan for testing locations	SHEAR VANE ID:	1592

BOREHOLE ID: HA3

Depth (m)	No of Blows	Scala Penetrometer (Blows / 100mm) 2 4 6 8 10	SOIL DESCRIPTION[2]	Depth (m)	UNDRAINED SHEAR[3] (kPa)	Geologic Unit	Ground Water
	1		TOPSOIL; dark brown, moist			TS	Groundwater Not Encountered
	2		clayey SILT; trace to minor sand, light brown, grey, orange mottle, moderate plasticity, stiff, Moist, sensitve			Holocene sediments/Hinuera Formation	
	1				116/26		
	1						
0.5	2			0.5			
	1				144/33		
	1		silty CLAY; brown orange, moderate to high plasticity, stiff, moist				
	2						
	2				211/52		
1.0	3			1.0			
	3		grey. Minor sand				
	4				132/36		
	3						
	4		sandy SILT, minor organic wood material; dark grey, moist to wet				
1.5	3			1.5	221/42		
	5						
	6						
	7						
	7						
2.0			trace wood material	2.0			
2.5				2.5			
3.0			sandy SILT grading to silty fine to medium SAND; pumiceous grains, bluish grey, moist,	3.0			
3.5			End of borehole at 3.0m - Target depth.	3.5			
4.0				4.0			
4.5				4.5			

Notes:

Reference:

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3 = Refer to Guideline for Hand Held Shear Vane Test; NZGS August 2001

Waikato Building Consent Group

Working together

Waikato Local Authority SHARED SERVICES

Better Together

Waikato Local Authority
Shared Services Ltd
PO Box 1198
Cambridge
Waikato

Producer Statement Author

Registration #0535

This is to recognise that **James Harper** is approved by The Waikato Building Consent Group as a producer statement author for the following scope of works:

Scope of Work (This approval is limited to items):

Engineering - Geotechnical, Wastewater and Stormwater Systems

Relevant PS type and limitations:

PS1, PS4
NA

Insurance Expiry Date: **14/02/22**

- Limited in validity to a period of one year to **01/07/2021** unless cancelled in writing sooner.
- This author can be removed from the register at anytime for any reason if the review panel find this person unfit to provide producer statements.

Kelvin French

Build Waikato

PROJECT:	Lot 21, 8B Dominion Ave	JOB No.	P21442
CLIENT:	Sentinel Homes	DATE:	31.05.2021
LOCATION:	Cambridge	TESTED BY :	CB
	Refer to attached Site Plan for testing locations	SHEAR VANE ID:	1592

BOREHOLE ID: HA4

Depth (m)	No of Blows	Scala Penetrometer (Blows / 100mm) 2 4 6 8 10	SOIL DESCRIPTION[2]	Depth (m)	UNDRAINED SHEAR[3] (kPa)	Geologic Unit	Ground Water
0.5			TOPSOIL; dark brown, moist	0.5		Topsoil	Groundwater Not Encountered
1.0			silty CLAY; light brown, grey, orange mottle, moderate plasticity, stiff, Moist	1.0		Holocene sediments/Hinuera Formation	
1.5				1.5	84/33 141/30		
2.0			sandy SILT, yellowish grey, moist, moderate plasticity	2.0	210+		
2.5			End of borehole at 2.0m - Target depth.	2.5			
3.0				3.0			
3.5				3.5			
4.0				4.0			
4.5				4.5			

Notes:

Reference:

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