



Paul Schultz
26 Balmoral Terrace, Tauranga
Proposed Subdivision
Geotechnical Assessment Report

September 2021

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Appendix A *Proposed Scheme Plan*

Appendix B *Geotechnical Test Data*

1. Introduction

Paul Schulz has engaged Stratum Consultants Ltd (Stratum) to carry out a geotechnical assessment for the proposed two lot subdivision at 26 Balmoral Terrace, Tauranga.

The purpose of this report is to support the design and subdivision application for the proposed development. The report can also be used to support a building consent application, subject to further analysis, specific design, and a geotechnical plan review.

We have assessed the nature of the proposed building area in terms of soil type, bearing capacity, and slope stability. This report describes the investigations carried out, analyses the results, and provides recommendations for the future development of the site.

2. Site Description

The site is located at 26 Balmoral Terrace, Otumoetai, Tauranga, legally described as Lot 10 DPS 13949. The site has a total area of approximately 672m².

There is an existing dwelling within the south-eastern part of the site. The topography of the site is mostly flat, with a 25-degree uphill slope present at the back of the section towards the neighboring property to the north-west. The height of the slope ranges from 5 to 6m. A stormwater line runs along the south-western boundary of the property.

The site location, existing services pipes, and proposed house site are shown in Figure 1 below, including 1.0m contour lines.

3. Proposed Development

The development comprises of subdividing the property into two lots. The proposed location of the second house site in the north-western part of the site is shown in Figure 1 below. A new driveway for the proposed new house will be constructed along the north-eastern boundary of the site.

The proposed dwelling is assumed to be a single-storey, timber-framed structure on standard NZS3604:2011 foundations. A topographic survey of the site has been completed by Stratum and is included in Appendix A.



Figure 1 – Site Location

4. Published Geology

The regional geological map¹ indicates that the site is underlain by Middle Pleistocene igneous rocks from the Chimp Formation, comprising non-welded, poorly-consolidated rhyolite ignimbrite, commonly with nearly aphyric pumice. This is expected to be overlain by recent ash fall deposits.

The geological map and GNS Active Faults Database does not identify faults near this site.

5. Site Investigations

Site investigations undertaken within the proposed development area consisted of the following:

- Site walkover;
- 4 hand auger boreholes and Scala penetrometer tests up to 5m depth.

The investigations were completed on 2 September 2020.

Test locations are shown on the test location plan, included in Appendix B. Test results are also included in Appendix B.

Nearby machine boreholes and cone penetration tests (CPTs), completed approximately 120m to the north of the site, were extended down to 25m bgl. These

¹ GNS Science QMap Rotorua, scale 1:250,000, 2010.

investigations were completed as part of slope stability assessments after the 2005 slips, as shown in the New Zealand Geotechnical Database².

6. Subsoil Conditions

The site investigations encountered the variable depth of filling within HA01, HA02, and HA04, ranging from 1.2m to 3.1m in depth. No fill material was encountered within HA03. The origin of the fill is unknown, however is assumed to be either from historical land instability or placed during the development of the existing house site.

The fill typically comprises silt and is organic within parts of the site. HA01, which was completed within the proximity of the council stormwater line, encountered buried topsoil from 2.3m to 3.1m bgl underlying the fill. The fill is variable in strength, ranging from 25kPa to 180kPa with the majority of the strength readings being less than 150kPa, the required level of compaction for engineered filling. Due to the generally low strength results, organic content, and unknown origin, the filling is classified as non-engineered or uncontrolled filling.

The soil below the fill material generally consists of a firm to stiff silty clay material up to the depth of investigations.

The nearby machine boreholes and CPTs indicate the slope typically comprises of silt and clayey silt down to termination depth of the investigations (25m bgl).

The groundwater table was encountered within HA01, HA02, and HA03 at 2.3m, 2.2m and 2.5m bgl respectively. Groundwater was not encountered within HA04.

7. Geotechnical Assessment

7.1. Introduction

It is our understanding that the proposed development within the new house site will be a single-storey, light-weight, timber-framed building construction, with no heavy, concentrated or unusual loads.

Based on our site walkover, desktop study and the results of the geotechnical site investigations, the key geotechnical aspects for this development are as follows:

- Seismic setting;
- Liquefaction potential;
- Slope stability
- Inundation risk (flooding);
- Soil bearing capacity;
- Settlement potential;
- Stormwater and Sewer disposal.

7.2. Seismic Setting

In accordance with NZS1170.5, clause 3.1.3 the results of the investigation suggest subsoil flexibility is likely characterised by classification 'D' (Deep or soft soil sites).

We have calculated seismic peak ground acceleration coefficients (PGA) in accordance with the Earthquake Engineering Practice, 2016 published by the Ministry

² New Zealand Geotechnical Database, <https://www.nzgd.org.nz/ARCGISMapView/mapviewer.aspx>

of Business Innovation and Employment (MBIE) and New Zealand Geotechnical Society, for the site subsoil class D.

We have considered two different earthquake return periods. These are Serviceability Limit State (SLS) and Ultimate Limit State (ULS). We have assumed 50 years for the structural design life of the structure. The importance level has been taken as 2. The results are shown in Table 1.

Table 1: Summary of Parameters for Seismic Assessment.

Annual Probability of Exceedance	Peak Ground Acceleration (PGA)
1/25 (SLS)	0.06
1/500 (ULS)	0.30

7.3. Liquefaction Assessment

Liquefaction is a term used to describe the strength loss experienced by a saturated cohesionless soil when subjected to cyclic loading (i.e. earthquakes). Soil that is susceptible to liquefaction tends to contract when subject to cyclic stresses, which induces excess pore water pressure that leads to a reduction in shear strength. Recently deposited and loose saturated natural soils and poorly compacted fills can be highly susceptible to liquefaction.

The groundwater was encountered between 2.2m to 2.5m bgl within our investigations. The soils below the groundwater table include sand and silt layers that may be susceptible to seismically induced liquefaction. Some strength loss may occur at depth during a seismic event, which could result in some settlements or damage at the surface due to the thinner layer of 'crust' of non-liquefiable material.

As such, we consider the risk of liquefaction at the site to be medium to high and needs to be considered by further deep ground investigations and liquefaction analyses as part of the building consent application.

7.4. Slope Stability

The proposed building platform is situated on a gentle slope, however there is a 5 to 6m high, 25 degree upslope present at the back of the section towards neighbouring properties to the north-west. A relic slip has been mapped below Hinewa Road further north-west. We recommend a retaining structure is used to support the toe of the bank. The design and height of the retaining structure will be determined once the final layout of the building has been confirmed.

7.5. Inundation Risk

According to Tauranga Council Map¹ the proposed house site is outside the flooding inundation risk area.

7.6. Foundation Bearing Capacity

Our foundation assessment is based on the Scala test results and has been conducted in accordance with the NZS 3604:2011. Based on NZS3604, in order for the site to have a geotechnical ultimate bearing capacity greater than 300kPa, the Scala readings per 100mm depth must exceed five blows between 300mm and 900mm below ground level, and three blows below 900mm depth.

These depths are based on a typical NZS 3604:2011 shallow footing no more than 300mm wide and founded 300mm below ground level. Our assessment is presented in Table 2 below:

Table 2: Bearing Capacity Assessment.

Test number	Geotechnical ULS bearing > 300kPa
HA01	Yes, below 4.0m
HA02	Yes, below 3.1m
HA03	Yes, below 0.3m
HA04	Yes, below 1.4m

Buried topsoil and historical fill materials were identified at HA01, HA02, and HA04, up to 3.1m in depth. These soils are not compliant with the NZS 3604:2011 definition of 'good ground'. Specific foundation design will therefore be required.

7.7. Settlement

We have considered the potential for static settlements as a result of the proposed building loads, however, no significant settlements are expected due to the competent nature of the soils below the surficial deposits and the relatively low expected building loads.

Based on the soils identified and soil strength testing carried out, the anticipated loads from a residential dwelling are unlikely to exceed the allowable settlement limit of 25 mm given in NZS 3604:2011, provided the foundation recommendations below are followed.

7.8. Stormwater

All stormwater falling on hard surfaces including roofs, decks, driveways, and patios shall be collected and piped to the Council's reticulated stormwater system.

7.9. Effluent Disposal

Effluent disposal is to be via the Council's reticulated system.

8. Foundation Recommendations

The site investigation results indicate that the surficial soil is not suitable for NZS3604:2011 shallow foundations due to the uncontrolled filling and organic material encountered up to 3.1m bgl.

Subject to the findings of the additional testing at building consent stage, we recommend deepened driven or bored timber piles are used to support the dwelling. The deepened piles shall extend through the fill and be founded upon the underlying stiff natural silts. At this stage, we anticipate a minimum founding depth of 3.1m below ground level. The actual pile depth is to be confirmed through detailed design. A chartered professional geotechnical engineer shall prepare a specific pile foundation design prior to building consent application.

Once the piles are founded within the natural silts, the piles can be assumed to have a geotechnical ultimate bearing capacity of at least 300kPa (100kPa allowable bearing capacity).

Any piles within close proximity to the council stormwater main will be required to be extended a minimum of 0.6m below the invert of the pipe, as per the requirements outlined in drawing T553 of the Tauranga City Council Infrastructure Development Code. The piles would also still need to found the minimum depth into natural silts as outlined above.

8 Further Work

Any earthworks comprising cutting and filling operations within the zone of influence of the proposed building structure shall be completed once the appropriate resource or building consent has been obtained, and be observed, tested, and certified by a Chartered Professional Geotechnical Engineer as per NZS4431.

Due to the shallow groundwater level and cohesionless soil layers at depth, a CPT test is recommended prior to the building consent application to assess the effects of liquefaction on the proposed building foundations.

A geotechnical review of the final building plans will be required prior to submitting for building consent, to ensure the recommendations in this report have been interpreted as intended.

Upon completion of the foundation construction works and site observations, we would then be in a position to issue a Producer Statement – Construction Review (PS4) to Council. Stratum will require a minimum of 24 hours notice for construction observations, prior to commencement of foundation excavations.

9. Limitations

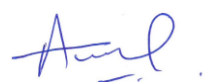
The assessment given in this report is based on limited site data from discrete test locations. Variations in ground conditions could exist across the site. The nature and continuity of subsoil conditions away from the test sites are inferred and it must be appreciated that actual conditions could vary from the assumed model.

This report has been prepared for the sole benefit of Paul Schultz with respect to the proposed subdivision at 26 Balmoral Terrace, Tauranga. It is not to be relied upon or used out of context by any other person without reference to Stratum Consultants Ltd. The reliance by other parties on the information or opinions contained in the report shall, without prior review and agreement in writing, be at such party's sole risk.

STRATUM CONSULTANTS LTD

Prepared by:

Reviewed by:



Atma Khanal

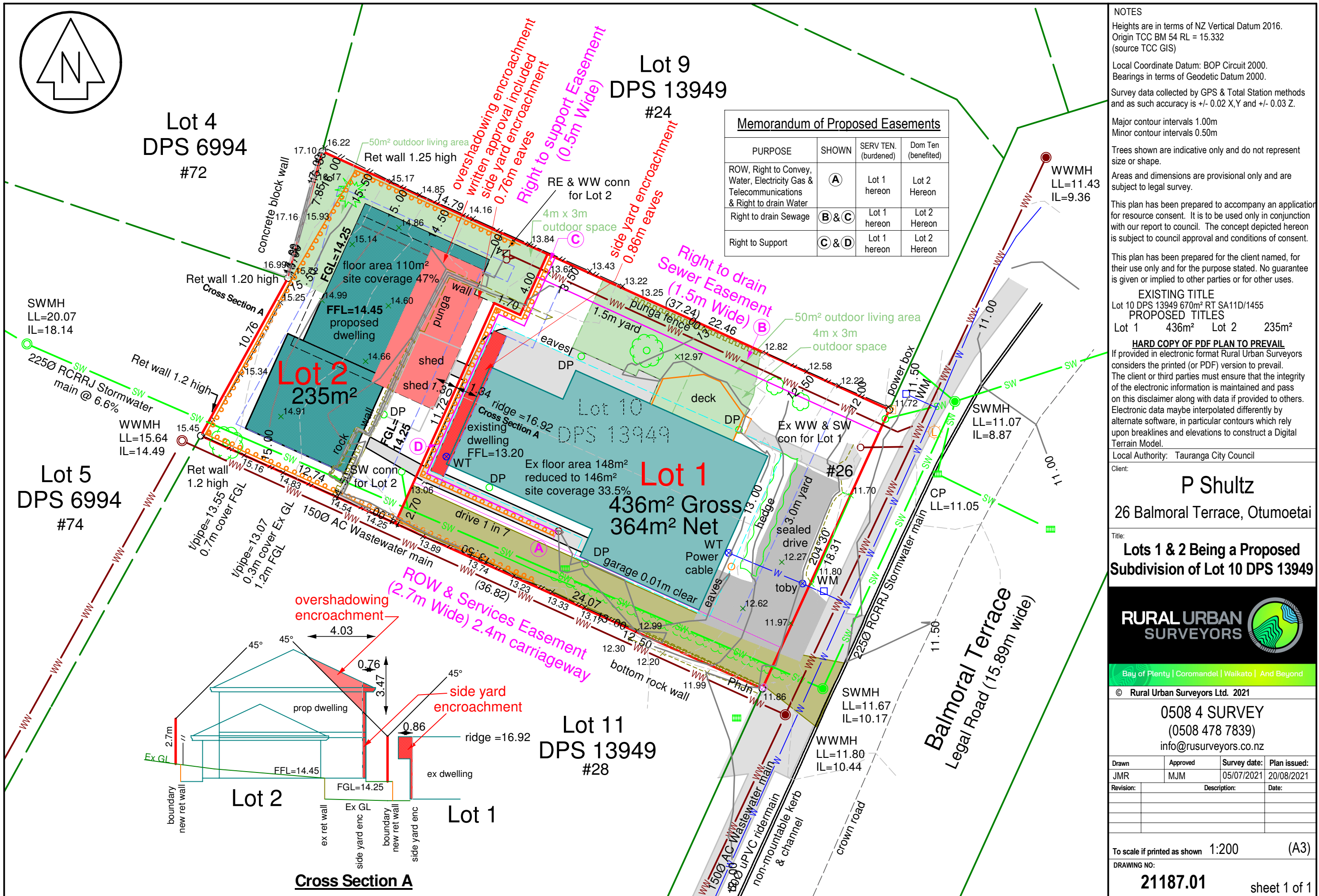
Elles Pearse-Danker

Senior Geotechnical Engineer
(CPEng, TCC Cat 1)

Senior Geotechnical Engineer
(CPEng, TCC Cat 1)

Appendix A

Proposed Scheme Plan



sheet 1 of 1

Appendix B

Geotechnical Test Data

Client: Paul Schultz
Project Title: Geotech investigation for proposed house site.

Page: 1
No of Pages: 6

Site Address: 26 Balmoral Terrace
City: Tauranga
File Number: 658111-GEO-S001

Date Started: 2/09/2021
Date Finished: 2/09/2021
Logged By: TETS



Test Location Sketch



Client: Paul Schultz

Project Title: Geotech investigation for proposed house site.

Page: 2

No of Pages: 6

Site Address: 26 Balmoral Terrace

City: Tauranga

File Number: 658111-GEO-S001

Date: 2/09/2021

Logged By: TETS

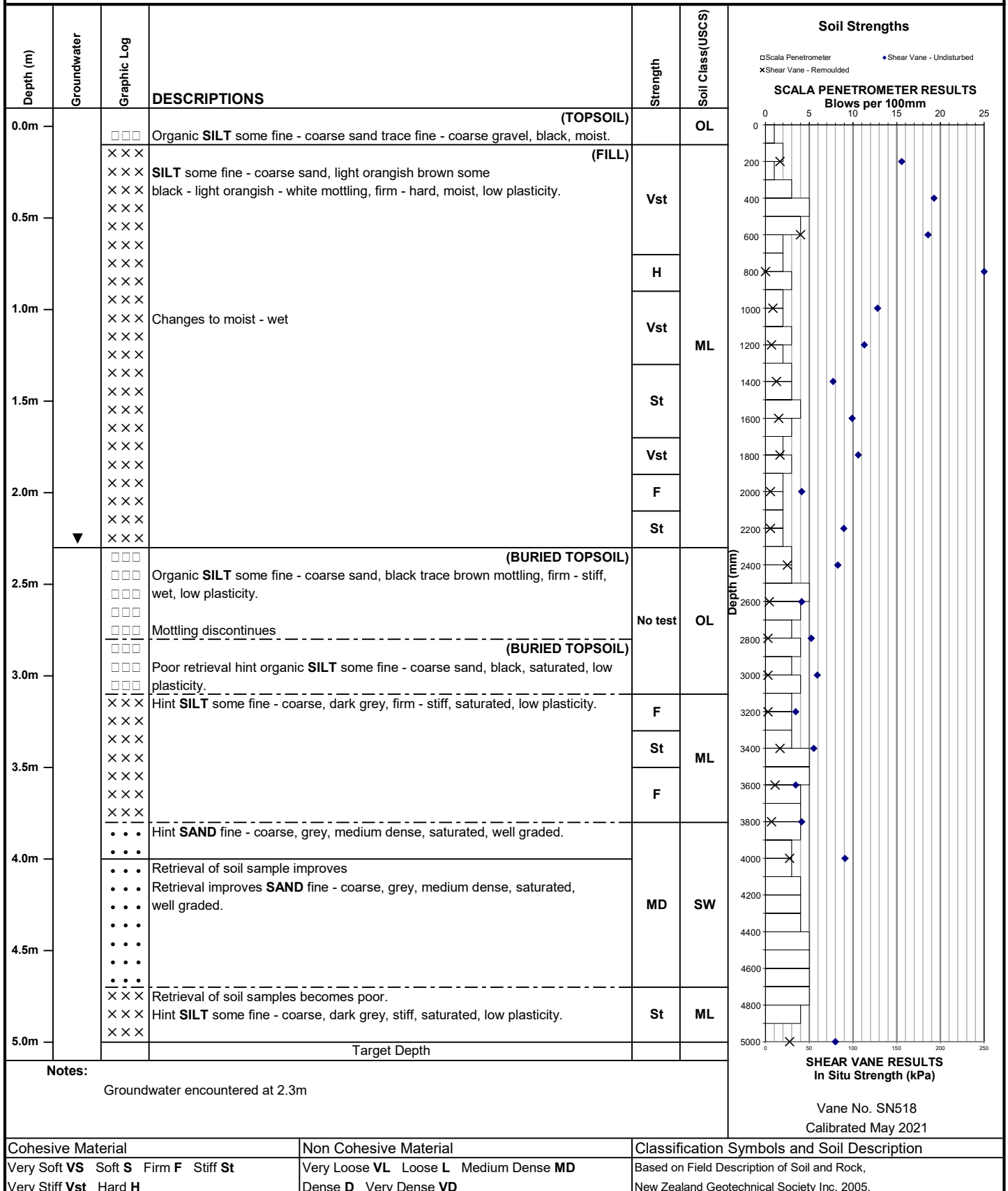
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Hand Augered Borehole

Borehole No : HA01

Associated Penetrometer No : SP01



Cohesive Material	Non Cohesive Material	Classification Symbols and Soil Description
Very Soft VS Soft S Firm F Stiff St	Very Loose VL Loose L Medium Dense MD	Based on Field Description of Soil and Rock,
Very Stiff Vst Hard H	Dense D Very Dense VD	New Zealand Geotechnical Society Inc, 2005.

Client: Paul Schultz
Project Title: Geotech investigation for proposed house site.

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No of Pages: 6

Site Address: 26 Balmoral Terrace
City: Tauranga
File Number: 658111-GEO-S001

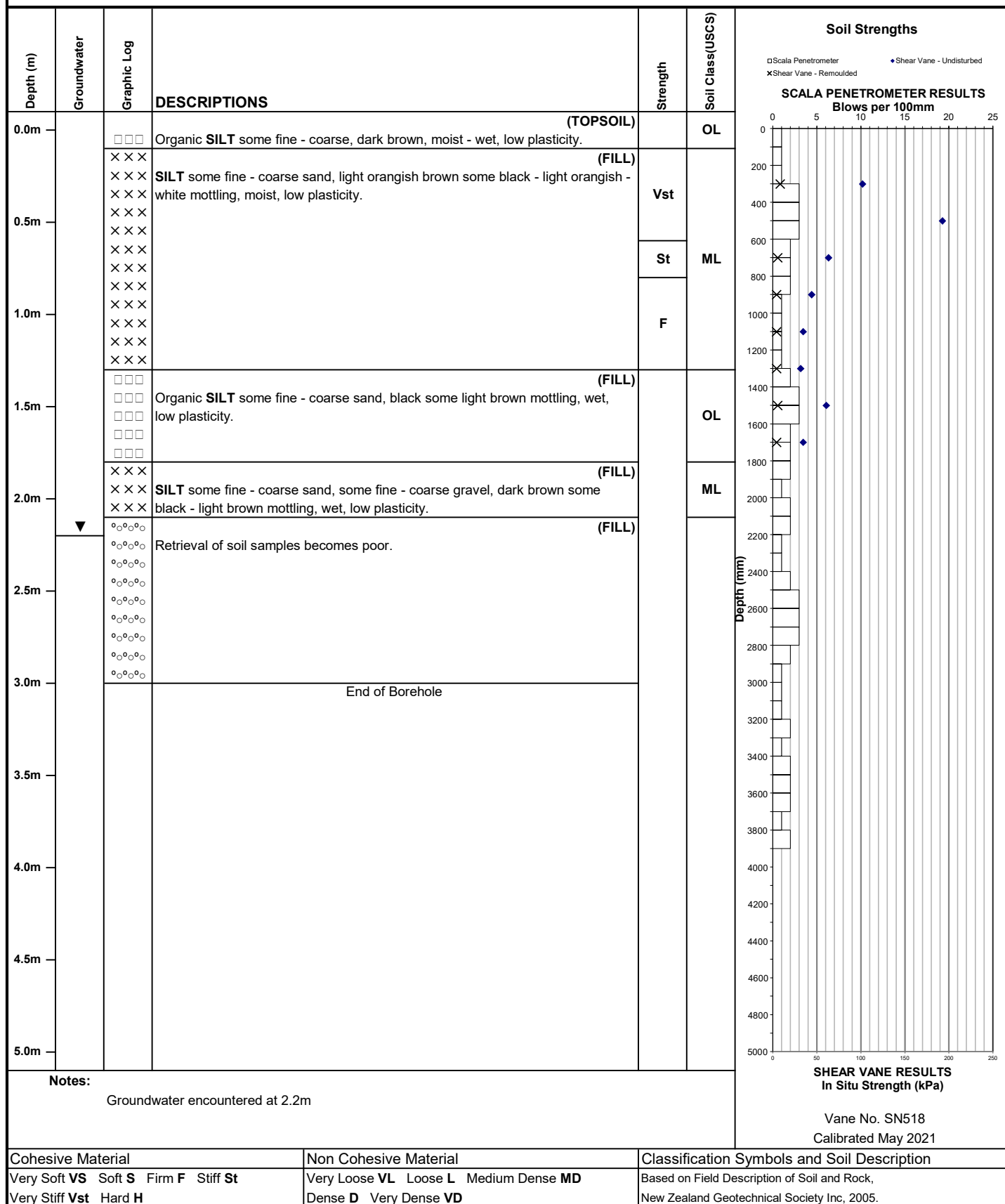
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Logged By: TETS
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Hand Augered Borehole

Borehole No : HA02

Associated Penetrometer No : SP02



Client: Paul Schultz

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Project Title: Geotech investigation for proposed house site.

No of Pages: 6

Site Address: 26 Balmoral Terrace

Date: 2/09/2021

City: Tauranga

Logged By: TETS

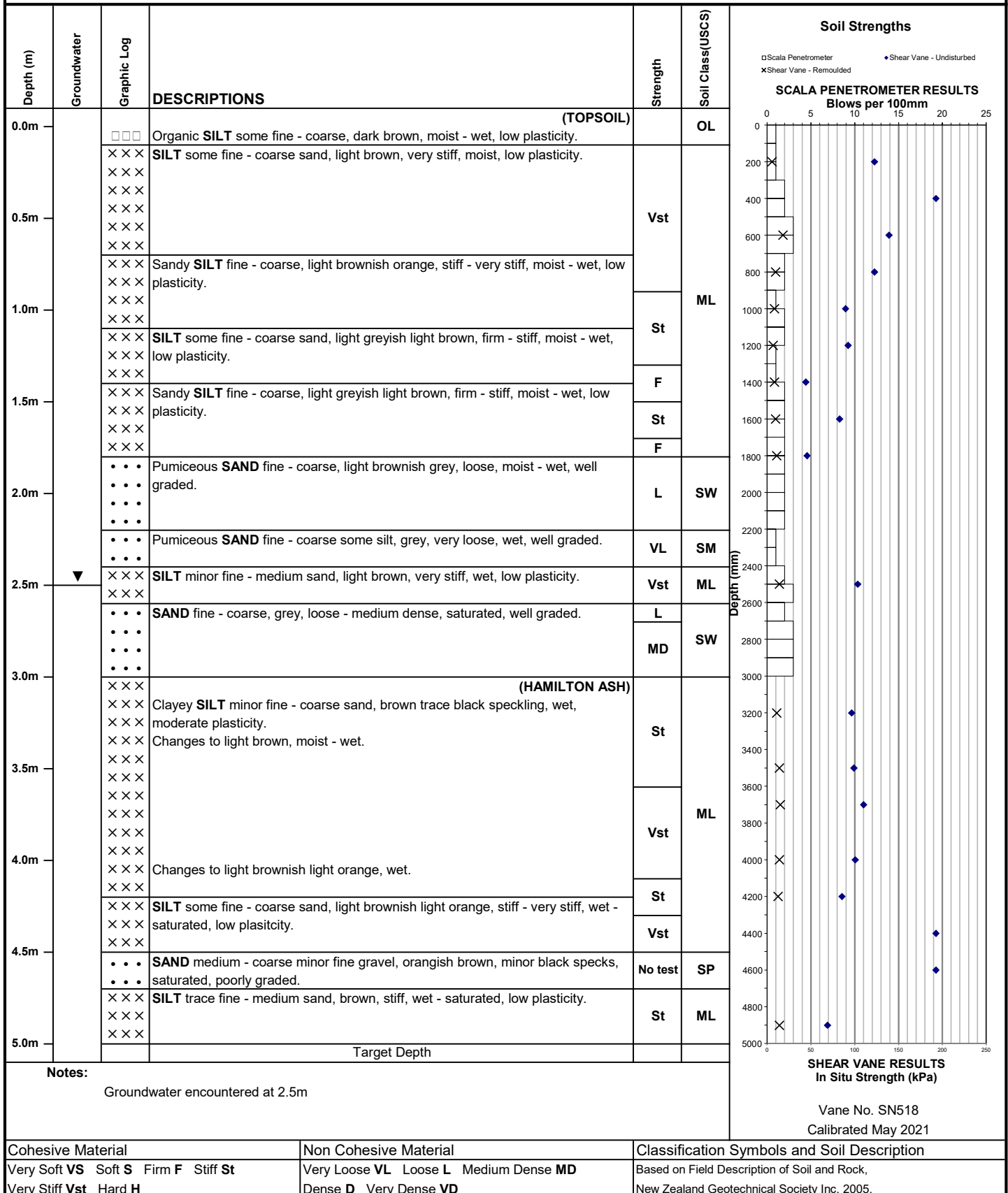
File Number: 658111-GEO-S001

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**Hand Augered Borehole**

Borehole No : HA03

Associated Penetrometer No : SP03



Client: Paul Schultz

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Project Title: Geotech investigation for proposed house site.

No of Pages: 6

Site Address: 26 Balmoral Terrace

Date: 2/09/2021

City: Tauranga

Logged By: TETS

File Number: 658111-GEO-S001

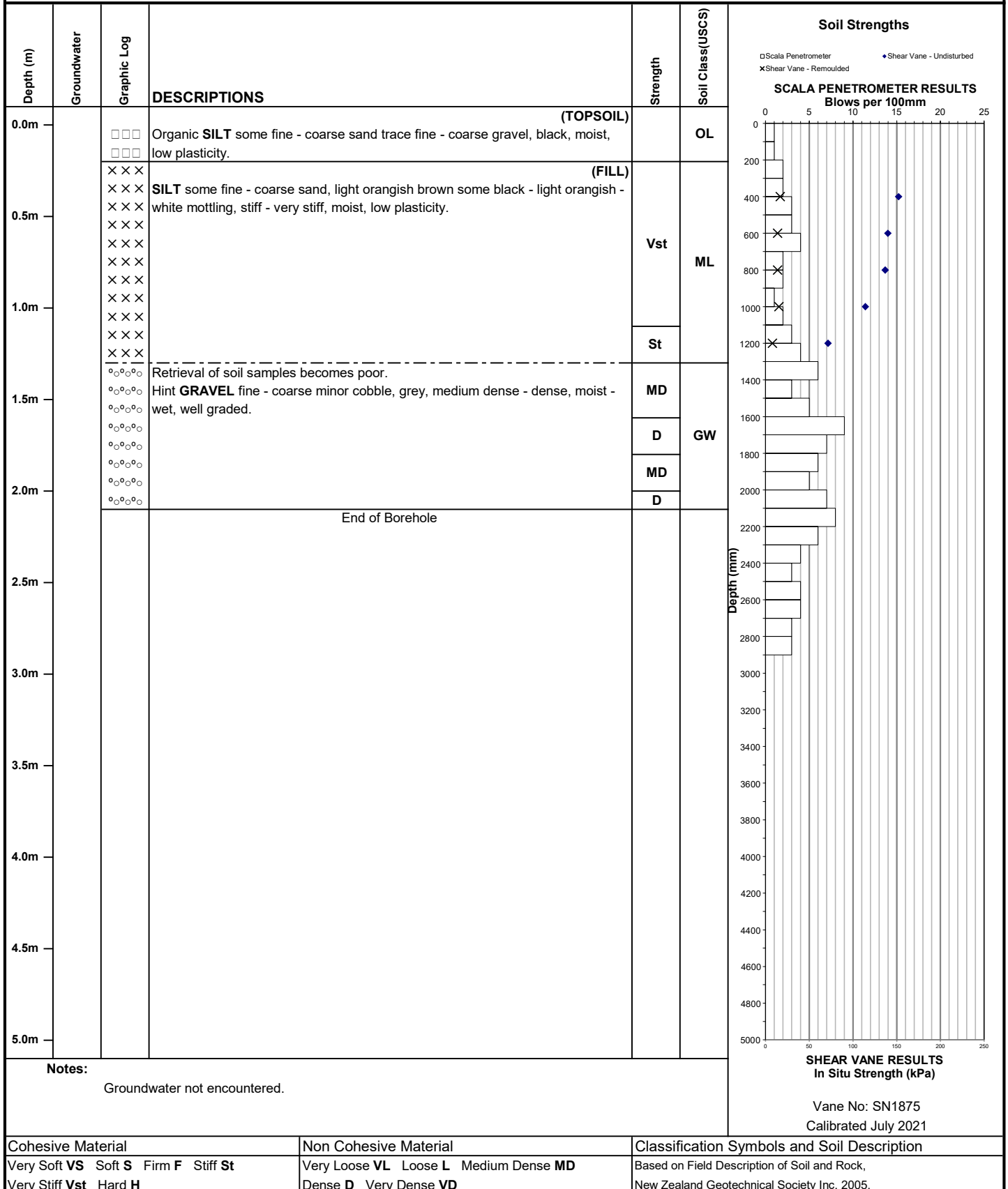
Checked: TETS



Hand Augered Borehole

Borehole No : HA04

Associated Penetrometer No : SP04



Notes:
Groundwater not encountered.

Cohesive Material	Non Cohesive Material	Classification Symbols and Soil Description
Very Soft VS Soft S Firm F Stiff St	Very Loose VL Loose L Medium Dense MD	Based on Field Description of Soil and Rock,
Very Stiff Vst Hard H	Dense D Very Dense VD	New Zealand Geotechnical Society Inc, 2005.

Client: Paul Schultz

Page: 6

Project Title: Geotech investigation for proposed house site.

No of Pages: 6

Site Address: 26 Balmoral Terrace

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City: Tauranga

Date Finished: 2/09/2021

File Number: 658111-GEO-S001

Logged By: TETS



Scala Penetrometer Results

Probe description: 9kg hammer falling 500mm striking a steel anvil driving a 16mm diameter rod fitted with a 20mm diameter cone

Depth of penetration begins at the existing ground level. Scala Penetrometer readings are used to designate soil strength for non-cohesive soils only unless otherwise specified.

Depth of Penetration	SP01	SP02	SP03	SP04	SP02b	SP04b		
GL Start (mm)	Blows Per 100mm	Blows Per 100mm	Blows Per 100mm	Blows Per 100mm	Blows Per 100mm	Blows Per 100mm		
0								
100	1	1	1	1	-	-		
200	2	1	1	1	-	-		
300	1	1	1	2	-	-		
400	3	3	2	2	-	-		
500	5	3	2	3	-	-		
600	4	3	3	3	-	-		
700	2	2	3	4	-	-		
800	2	2	2	2	-	-		
900	3	2	2	2	-	-		
1000	2	1	1	1	-	-		
1100	2	1	2	2	-	-		
1200	3	1	2	3	-	-		
1300	2	1	1	4	-	-		
1400	3	2	1	6	-	-		
1500	3	3	2	3	-	-		
1600	4	3	2	5	-	-		
1700	3	2	2	9	-	-		
1800	2	2	2	7	-	-		
1900	3	2	2	6	-	-		
2000	2	1	2	5	-	-		
2100	2	2	2	7	-	2		
2200	2	2	2	8	-	1		
2300	2	1	1	6	-	1		
2400	3	1	1	4	-	0		
2500	3	2	2	3	-	0		
2600	5	3	3	4	-	0		
2700	4	3	2	4	-	1		
2800	3	3	3	3	-	1		
2900	4	2	3	3	-	1		
3000	3	1	3		-			
3100	4	1			2			
3200	3	1			1			
3300	3	2			1			
3400	3	1			1			
3500	5	2			1			
3600	5	2			2			
3700	4	2			1			
3800	4	1			1			
3900	4	2			1			
4000	3							
4100	3							
4200	4							
4300	4							
4400	4							
4500	5							
4600	5							
4700	5							
4800	5							
4900	4							
5000								

Notes: