Shire
Geotechnics

30 OPONONI HEIGHTS DRIVE

GEOTECHNICAL ASSESSMENT

Joshua Cleaver and Toni McMullen

Original Report
Reference: SD1670
Issued on: 5 December 2023

Revision History

Revision	Date	Details
-	5/12/23	Original Report

Shire Geotechnics Ltd
2/19 College Road, Auckland, 0627

VOLUME 1

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1 INTRODUCTION

Shire Geotechnics Limited was commissioned by Joshua Cleaver and Toni McMullen to carry out a geotechnical investigation to assess subsoil conditions and provide recommendations for building foundations for a new dwelling at 30 Opononi Heights Drive, Opononi.

This report has been prepared to support an application to the Council for resource and/or building consent approval in respect of the proposed development as described herein.

2 SITE DESCRIPTION

The site (legally described as Lot 15 DP 367355) is a residential site located on the southern side of Opononi Heights Drive.

The site is irregular shaped with an area of 626 m^2.

The site is bounded by Opononi Heights Drive to the north, residential to the west east, and to the south.

The site is moderately sloping down from south to north, and is currently grass covered.

3 SCOPE OF WORKS

The scope of works for the project include:

Desk Study

- Review of published geological records
- Review of NZGS Database
- Review of the Far North District Council GIS.

Fieldwork

- The drilling of 3 hand auger boreholes to depths of between 2.1 m and 2.5 m.
- The measurement of cross section by tape and clinometer.

4 PROPOSED DEVELOPMENT

We have been supplied with HM Design drawings numbered 1-3 (Draft D) dated 23 October 2023. Based on this information we understand that the proposed development will comprise:

- Construction of two storey lightweight timber frame dwelling on concrete foundations and floor slabs located at the approximate centre of the site.

The approximate location of the proposed dwelling is shown on the attached site plan drawing number SD1670 S-01.

5 EXISTING GEOTECHNICAL INFORMATION

We are not aware of any previously existing geotechnical information relating to this site.

6 GROUND CONDITIONS

6.1 Geological model

The site is predominantly underlain by Mahurangi Limestone of the Motatau Group. The Mahurangi Limestone soils comprise of micritic coccolith foraminiferal muddy limestone, commonly with redeposited beds of glauconitic sandstone.

Shire Geotechnics carried out a shallow ground investigation at the site comprising of 3 hand auger boreholes to a maximum depth of 2.5 m.

Detailed descriptions of the subsoils encountered in the boreholes are given on the attached borehole logs. The subsoils were generally found to comprise:

- Topsoil to 100 mm depth, overlying:
- Fill to 200 mm depth, consisting of stiff orange silty clay with some gravel, overlying:
- Mahurangi Limestone Soils to the termination of all boreholes, consisting of stiff to very stiff orange brown silts and clays with undrained shear strengths greater than 85 kPa.

6.2 Groundwater regime

Groundwater was not encountered in any of the hand auger boreholes during our time on site. This deep water level is considered to be representative of typical groundwater conditions on the site but groundwater levels may at times be higher following periods of heavy or prolonged rainfall and/or during wetter winter conditions.

6.3 Soil Expansivity

Plastic soils can be subject to shrinkage and swelling due to soil moisture content variations which can result in apparent heaving and settlement of buildings, particularly between seasons.

Our classification is based on experience opposed to lab testing.

This visual tactile identification of the soil was undertaken and logged by a CPEng geotechnical engineer, the upper soils comprising of Mahurangi Limestone soils.

Our company also regularly undertakes Atterberg testing, within 6 months and/or last 50 sites we have tested.

Based on our understanding of the materials encountered, and the evidence of soil shrinkage and swelling observed on site (soil creep, deep desiccation cracking in test pits), we consider that that site as a whole shall be considered as highly expansive (Class H1 in terms of AS2870 (2011)), unless specific testing within the building sites show otherwise. We consider that shallow foundations may be used but should be deepened to the depth at which significant changes in soil volume do not occur, or otherwise be designed to resist heave and suction caused by shrinkage and swelling.

7 SEISMIC HAZARD

7.1 Liquefaction

Liquefaction is a phenomenon where saturated granular soils temporarily lose strength due to high pore pressure development during rapid densification. Classically liquefaction occurs in loose silts/sands or gravels below the water table. In the event of liquefaction, loss in strength, settlement and instability (lateral spreading) may occur.

The ground investigations encountered clayey expansive type soils. Based on our experience in the area and similar geology, liquefaction is unlikely.

8 SITE SEISMICITY

We consider that the site is a Class C shallow soil site as defined by NZS 1170.5 (2004) “Structural Design Actions: Part 5: Earthquake actions – New Zealand”.

9 SITE STABILITY

The site shows no obvious visual signs indicating historical or presently active deep seated instability. The ground surface across the site is level or gently sloping and was found to be underlain by competent subsoils. It is our opinion that the site is currently stable and suitable for construction of the proposed dwelling. The proposed development is considered unlikely to adversely affect the existing stability of the site provided that the recommendations provided in this report are followed.

10 RECOMMENDATIONS

10.1 General

Based on the conditions encountered in the hand auger boreholes, the buildings can be supported on footings bearing in a combination of tested and approved native soil

High plasticity clay soils are present on this site. This report provides recommendations to help mitigate the effects of soil shrinkage and expansion. However, even if these procedures are followed, some shrink/swell type movements should be anticipated.

Ideally, a minimum thickness of low plasticity engineered fill can be constructed beneath slab-on-grade floors, however this is not always practicable.

10.2 Earthworks

Areas within the limits of construction should be stripped and cleared of topsoil, fill, vegetation, soft soils and debris.

The topsoil layer was found to be 100 mm deep across the property. Unsuitable fill materials were encountered to a depth of 200 mm in borehole HA3, drilled adjacent to the proposed dwelling.

After stripping the subgrade should be inspected by a Geotechnical Engineer.

Cuts or fills less than 1.2 m in height can be formed at gradients no steeper than 1V:2H. Cuts or fills greater than 1.2 m in height should be formed at gradients no steeper than 1V:3H or otherwise retained. Cuts or fills of any height that are to be subject to surcharge loading of any sort should be supported using specifically designed retaining walls or battered to a suitable slope angle subject to specific geotechnical design recommendations.

Design recommendations for retaining walls are outlined in the Retaining Walls section below.

10.3 Building Foundations

The subsoils at this site were found to comprise stiff natural soils. The soils have adequate bearing capacity, are of relatively low compressibility and are considered suitable foundation soils for the proposed new dwelling. They are however considered to be moderately expansive and are therefore outside the criteria for “Good Ground” given in NZS3604:2011. Shallow foundations are considered to be generally appropriate, however, foundation depths should allow for the moderately expansive nature of the soils. Alternatively, a waffle raft floor slab will require specific structural design to allow for the expansive nature of the soils.

Specific recommendations are outlined below.

10.3.1 Shallow Footings

Conventional shallow pad and strip footings, generally in accordance with the requirements of NZS3604:2011, should be embedded a minimum depth of 750 mm below cleared ground level into stiff natural soils.

The following bearing capacities are considered appropriate for foundation design:

Ultimate Bearing Capacity	300 kPa
Allowable Bearing Pressure (F.O.S = 3)	100 kPa
Dependable Bearing Capacity (Φ = 0.5)	150 kPa

10.3.2 Floor Slab

Either a conventional slab on grade concrete floor, in accordance with the requirements of NZS3604:2011, or a waffle raft slab designed for highly expansive soils in accordance with the requirements of AS2870:2011 is considered appropriate.

The following bearing capacities are considered appropriate for raft floor slab design:

Ultimate Bearing Capacity	300 kPa
Allowable Bearing Pressure (F.O.S = 3)	100 kPa
Dependable Bearing Capacity (Φ = 0.5)	150 kPa

A conventional slab on grade should be founded on a layer of clean, well graded, compacted hardfill placed on ground stripped of vegetation, topsoil, fill and any soft or otherwise unsuitable material. The hardfill should be compacted using a vibratory roller and topped with a blinding layer of sand or other approved fines.

Care should be taken in the preparation of the slab subgrade so that the soil does not dry out or become excessively wet prior to pouring of the floor slab. In this respect some moisture conditioning or protection of the subgrade may be required prior to placing hardfill and/or pouring the slab.

10.4 Vegetation

Any newly planted trees should be kept well clear of the foundations of the new dwelling to avoid the potential for settlement that can occur due to the localised ground shrinkage possible as high water demand tree species mature.

10.5 Stormwater Control

Stormwater from paved areas, roofs, tank overflows and all other sources should be collected in sealed pipes and discharged into the Council stormwater system. Concentrated stormwater flows should not be allowed to discharge onto or into the ground close to the buildings or on sloping ground as this would be detrimental to foundation conditions and site stability.

10.6 Site Inspections during Construction

It is recommended that Shire Geotechnics Ltd is engaged to inspect building foundations during construction. This is to confirm expected ground conditions and to ensure compliance with the recommendations contained in this report.

It is the Client's responsibility to ensure that we are notified of any required inspections and that we are given adequate notice to carry out the inspections (at least 24 hours).

We will issue a Producer Statement – Geotechnical Review (PS4) upon successful completion of the inspected works. The inspections and preparation of the Producer Statement will be at additional cost to that of preparing this report.

11 LIMITATIONS

This report has been prepared solely for the use of our client, Joshua Cleaver and Toni McMullen, their professional advisers and Far North District Council in relation to the specific project described herein. No liability is accepted in respect of its use for any other purpose or by any other person or entity.

The opinions, recommendations and comments given in this report result from the application of normal methods of site inspection and investigation. As factual evidence has been obtained solely from boreholes that by their nature only provide information about a relatively small volume of subsoils, there may be special conditions pertaining to this site that have not been disclosed by the investigation and that have not been taken into account in the report.

If variations in the subsoils occur from those described or assumed to exist, then the matter should be referred back to us immediately.

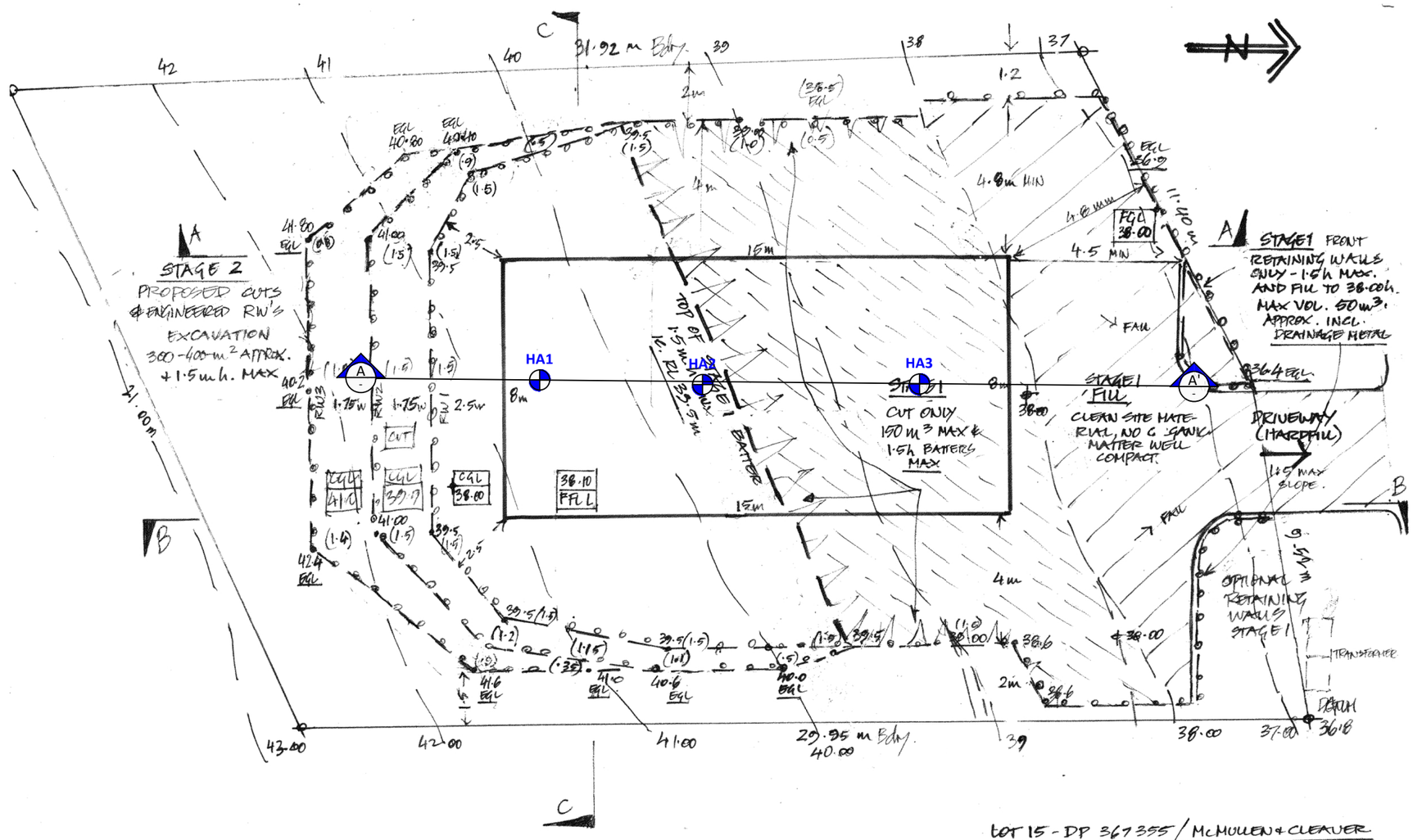
For and on behalf of Shire Geotechnics Ltd

Apa Fatialofa

Junior Geotechnical Engineer

J Brokenshire

Senior Engineer



(DRAFT PRELIM D)

Lot 15 - DP 367355 / McMULLEN & CLEAVER

SITE PLAN : EXCAVATION etc. 1:100/A3, Sh 1

HM DESIGN 021 2315468 Amended 23/10/23 8/9/23

Notes:

1. THIS PLAN IS BASED ON HM DESIGN DRAWING SHEET 1 (DRAFT D) DATED 23 OCTOBER 2023.
2. TEST LOCATIONS ARE APPROXIMATE ONLY.

Key:

HA — Hand auger borehole location

REV:	DESCRIPTION:	BY:	DATE:
-	-	-	-

STATUS: NOT FOR CONSTRUCTION

SHIRE GEOTECHNICS LTD
2/19 COLLEGE ROAD, NORTHCOTE, AUCKLAND 0627
P: 09 393 7230 E: www.shiregeotechnics.co.nz

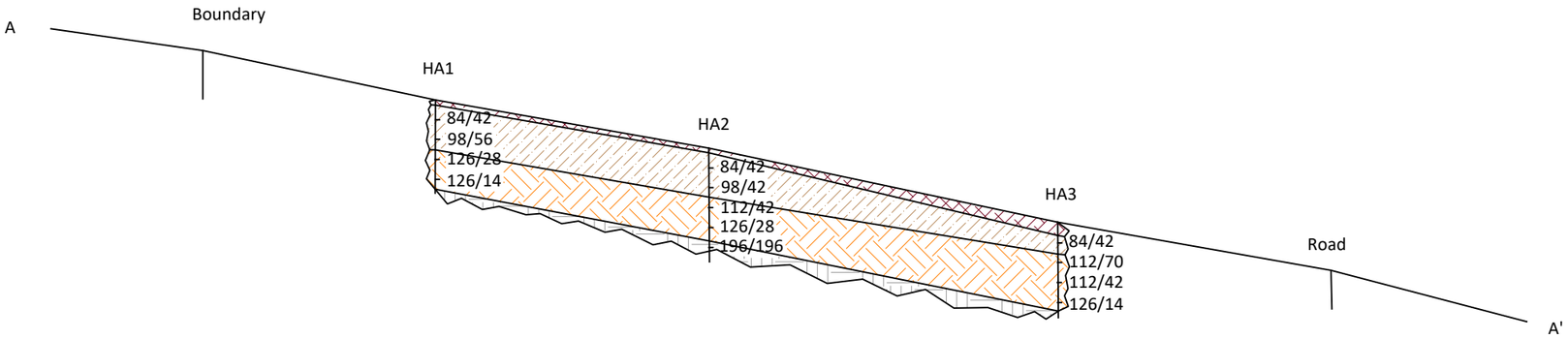
PROJECT: Joshua Cleaver & Toni McMullen PROPOSED RESIDENTIAL DEVELOPMENT

SITE: 30 OPONONI HEIGHTS DRIVE, OPONONI

TITLE: SITE PLAN

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
1:150	DEC 23	AF	JB

SHEET NO:	PROJECT NO:	SHEET NO:
1 OF 2	SD1670	S-01



Notes:

1. THIS CROSS SECTION IS BASED ON TAPE AND CLINOMETER MEASUREMENTS.
2. TEST LOCATIONS ARE APPROXIMATE ONLY.

Key:

- NON-ENGINEERED FILL/TS
- STIFF RESIDUAL EAST COAST BAYS FORMATION SOILS
- VERY STIFF RESIDUAL EAST COAST BAYS FORMATION SOILS
- HARD RESIDUAL EAST COAST BAYS FORMATION SOILS

REV:	DESCRIPTION:	BY:	DATE:
-	-	-	-

STATUS: NOT FOR CONSTRUCTION

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P: 09 393 7230 E: www.shiregeotechnics.co.nz

PROJECT: Joshua Cleaver & Toni McMullen PROPOSED RESIDENTIAL DEVELOPMENT

SITE: 30 OPONONI HEIGHTS DRIVE, OPONONI

TITLE: CROSS SECTION A-A

SCALE AT A3:	DATE:	DRAWN:	CHECKED:
1:150	DEC 23	AF	JB

SHEET NO:	PROJECT NO:	SHEET NO:
2 OF 2	SD1670	S-02

Appendix A

Hand Auger Logs

Job No: SD1670

Job Name: 30 Opononi Heights Drive, Opononi

BOREHOLE LOG HA 1

SOIL GROUP	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m)	GROUNDWATER	• Peak Corrected Vane Shear Strength(kPa) o Remoulded Corrected Vane Shear Strength(kPa) 50 100 200
TS	Topsoil, some roots, brown				
Mahurangi Limestone	Silty CLAY, grey, brown, some orange spots, moist, highly plastic Some black organics				
	Silty CLAY, light grey, orange brown streaks, moist, highly plastic		1		
	Silty CLAY, light bluish grey, orange brown, moist, highly plastic Some black mottles				
	Silty CLAY, light grey, some blue, dark orange brown streaks, some fine silt Moist, highly plastic		2		
	End of borehole at 2.1m (Shallow refusal, too hard to auger)		3 4 5		

NOTES

Shire Geotechnics

Date: 11/12/23 Logged by: AF Shear Vane No: DR6384

Job No: SD1670

Job Name: 30 Opononi Heights Drive, Opononi

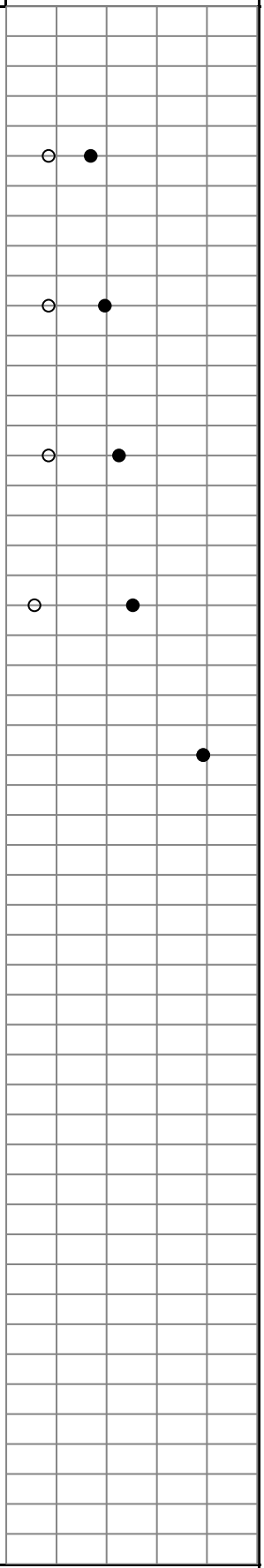
BOREHOLE LOG HA 2

SOIL GROUP	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m)	GROUNDWATER
TS	Topsoil, brown, moist, highly plastic			
Mahurangi Limestone	Sily CLAY, light grey, orange brown streaks, moist, highly plastic			
	Silty CLAY, light yellow, brown, black mottles, moist, highly plastic			
	Silty CLAY, light yellow, orange brown streaks, some blue, friable			
	End of borehole at 2.5m (Refusal, too hard to auger)			

• Peak Corrected Vane Shear Strength(kPa)

o Remoulded Corrected Vane Shear Strength(kPa)

50 100 200



NOTES

Shire Geotechnics

Date: 11/12/23 Logged by: AF Shear Vane No: DR6384

Job No: SD1670

Job Name: 30 Opononi Heights Drive, Opononi

BOREHOLE LOG HA 3

SOIL GROUP	SOIL DESCRIPTION	SOIL SYMBOL	DEPTH (m)	GROUNDWATER	• Peak Corrected Vane Shear Strength(kPa) o Remoulded Corrected Vane Shear Strength(kPa) 50 100 200
TS	Topsoil, silty CLAY, grass, roots				
Fill	Silty CLAY, brown, moist, highly plastic				
Mahurangi Limestone	Silty CLAY, light blue, orange brown streaks, some black mottles, moist, highly plastic		1		
	Silty CLAY, yellow, brown, orange, moist, highly plastic		2		
	End of borehole at 2.1m (Too hard to auger)		3 4 5		

NOTES

Shire Geotechnics

Date: 11/12/23 Logged by: AF Shear Vane No: DR6384

Appendix B

Site Photos

Photo 1 Typical view of site

Photo 2 View of the site looking north towards Opononi Heights Drive.

Photo 3 Looking south towards building platform.