GDC Consultants Ltd
Chartered Professional Engineers & Mediators

GEOTECHNICAL ASSESSMENT REPORT
Proposed Subdivision
LOT 36 DPS 328
15 Glenfield Road, Owhata, Rotorua

- **Geotechnical Investigation & Design**
- **Structural and Civil Design**
- **Earthquake Engineering and Assessments**
- **Traffic and Safety Assessments**
- **Road Design and Asset Management**
- **Water/Wastewater/Stormwater Design and Modelling**
- **Project and Construction Management**
- **Mediation**
- **Training**

Telarc. Registered
Quality
ISO 9001

GDC Hamilton Office
489 Anglesea Street
PO Box 9403
Hamilton 3204
07 838 0090
Hamilton@gdcgroup.co.nz

GDC Auckland Office
First 1st Level, Entrance 2,
320 Ti Rakau Drive
East Tamaki
Auckland
022 159 4595
Auckland@gdcgroup.co.nz

GDC Wellington Office
Unit 109, 74 Taranaki Street,
Wellington
04 282 0405
Wellington@gdcgroup.co.nz

GDC Napier Office
HBI House
PO Box 44
Napier 4140
06 281 2270
Napier@gdcgroup.co.nz

GDC Thames Office
1st Floor, Fay Building
516 Pollen Street
PO Box 500
Thames
07 869 0640
Thames@gdcgroup.co.nz

GDC Rotorua Office
1209 Hinemaru Street
PO Box 1468
Rotorua 3040
07 282 2173
Rotorua@gdcgroup.co.nz

GDC Whitianga Office
21 Coghill Street
Whitianga
07 869 0640
Whitianga@gdcgroup.co.nz

Geotechnical Assessment for Proposed Subdivision
15 Glenfield Road, Owhata, Rotorua
February 2022

This report has been prepared for Harjeet Singh by GDC Consultants Ltd (GDC). No liability is accepted by this company or any employee or sub-consultant of this company with respect to its use by any other parties.

This disclaimer shall apply notwithstanding that the report may be made available to other persons for an application for permission or approval to fulfil a legal requirement.

Revision	0
Status	For Consent

Quality Assurance Statement		
Task	**Responsibility**	**Signature**
Prepared by:	John Kim BE (Civil), MEng (Civil) Suren Kulendran BSc. (Civil-Hons), AMIE(SL)	John Kim 21/2/22 21/02/2022
Reviewed by:	Nigel Ross BSc. (Civil) Hons, CMEngNZ	21/2/22
Approved by:	Clement Fernando CPEng. No. 202146	22/2/2022

Prepared by:

GDC Consultants Ltd
1289 Haupapa Street
PO Box 1468
Rotorua 3040
New Zealand

Telephone: 07 282 2173
Email: rotorua@gdcgroup.co.nz

File No: J003633

Table of Contents

1.0 INTRODUCTION

1.1 Project Details

Client's Name	Harjeet Singh
Site Address	15 Glenfield Road, Owhata, Rotorua Rotorua
Legal Description	LOT 36 DPS 328

1.2 Background

The client has engaged GDC Consultants Ltd to undertake a geotechnical investigation for a proposed subdivision. The site is currently occupied by a dwelling and a building. The proposed subdivision lot is at rear section of the property. No detailed subdivision plan is available at the time of report writing. The geotechnical investigation has been carried out in the rear section of the property.

This report presents the results of the geotechnical investigation for the proposed new subdivision.

1.3 Scope

This report undertakes to:
- Assess soil conditions to allow recommendations on foundation types
- Identify hazards associated with the site
- Assess detailed liquefaction hazard

This report does not include the following:
- Contamination assessment
- Stormwater assessment
- Wastewater assessment

The findings of this report will be used to support a resource consent application for the subdivision proposed in the brief.

2.0 SITE ASSESSMENT

2.1 General Site Description

The site is located approximately 90m southwest of the intersection of Glenfield Road and Coulter Road. Access to the property is via Glenfield Road. The site was grassed at the time of our investigations.

The property is in residential area with a lot area of 1014m² and it is located within the Rotorua Lake Council jurisdiction. A site location plan is given in Appendix A.

The site investigation was carried out on the new subdivision location as shown by client.

2.2 Topography

The site and surrounding areas are generally on flat ground.

2.3 Hazards on Site

Flooding
The site is not located within known Flood Hazard Zone, as indicated by the Flood Hazard Map prepared by Rotorua Lakes Council, shown in Appendix B.

Determination of finished floor level does not form part of this report.

Erosion, Subsidence, Slippage
At the time of onsite investigation, there was no visual evidence of erosion, subsidence or slippage observed.

Soft Ground
This site has been identified as being within an area of Soft Ground Potential – Zone B Huka Group sediments and Hinuera Formation (older sediments) as shown on the Rotorua Lakes Council District Plan Map. These sediments were formed in a range of environments. Sediments with soft and very soft strengths at the time of formation are likely to have consolidated over time. This map is available on their website and is also shown in Appendix C.

Geothermal Hazard
The site is not located within a Geothermal Hazard Zone as indicated on the Rotorua Lakes Council GIS Geothermal Hazard Map available on the Rotorua Lakes Council website. Refer to Appendix E for the Geothermal Hazard Map. Detailed geothermal assessment is not part of this report.

Fault Line Impact
Rotorua Lakes Council database shows no trace of known faults located adjacent to the proposed site. Active Moerangi Fault is about 3.6km south away from the site. Therefore, low risk from a fault rupture is expected within the proposed site. A copy of this map is shown in Appendix D.

Earthworks and Land Stability
All earthworks mentioned in section 5.1 are expected to minimise or avoid damage to the natural and physical environment to preserve the existing landscape. No bulk earthworks and steep slopes requiring an assessment of detailed slope stability or a detailed evaluation of the suitability of natural ground are required in this project. Our geotechnical assessment meets the requirements of the Regional Infrastructure Technical Specifications (RITS) that has replaced the previous of Rotorua Civil Engineering Industry Standard (RCEIS).

3.0 GEOTECHNICAL INVESTIGATIONS

3.1 Field Investigations

Investigations undertaken by GDC Consultants on 9th February 2022 included the drilling of two (2) 50mm diameter hand augered boreholes to verify the near surface soils.

Supplementary ground testing was undertaken on 15th February 2022, comprising of one (1) Cone Penetration Test (CPT), using a portable drilling rig supplied and operated by Topdrill Ltd. The results of the CPT tests are attached in Appendix H.

Soil testing included Scala Penetrometer tests adjacent to the boreholes. Descriptions of materials encountered within the boreholes are presented within the appended logs.

The hand augered boreholes were logged in accordance with the procedures in the New Zealand Geotechnical Society 'Guidelines for the Field Classification and Engineering Description of Soil and Rock for Engineering Purposes' (2005).

4.0 GEOLOGY & SUBSOIL

4.1 Geology

The geology of the site as shown in the GNS Science (2014) online map (Scale 1:250K) shows that the area comprises of Moerangi Fault which is described as "Cross-bedded pumice sand, silt and gravel with interbedded peat".

4.2 Soil Conditions

Field investigations were conducted using hand dug boreholes and Scala Penetrometer tests on site. The locations of the boreholes are shown on the Site Investigation Plan in Appendix F. During the field investigation, visual and physical examination of the soils observed on site were recorded in the borehole logs in Appendix G.

In general, the site is covered with TOPSOIL to a depth of about 0.4m. Below this top layer, soft to firm sandy SILT was found until 1.2m depth underlying by loose to medium dense SAND until 2.9m. After this layer, dense SAND was found until 4.9m depth. After this layer, stiff CLAY was found until 8.2m depth. This is then followed by loose silty SAND/sandy SILT until the end of the CPTs.

A summary of general soil profile and interpreted design parameters is given in Table1 below. Detailed descriptions soil layers encountered during the investigation are given within the appendices.

Soil Unit	Layer	Depth of the Layer (mbgl)	Ave. Cone Penetration Resistance qt (MPa)	Unit Weight γ (kN/m^3)	Internal Friction Angle ϕ'	Effective Cohesion c'(kPa)	Peak Undrained Shear Strength Cu(kPa)
1	TOPSOIL	0 – 0.4	-	-	-	-	-
2	Soft to Firm Sandy SILT	0.4 – 1.2	1.5	15	26	-	-
3	Loose to Medium dense Silty SAND	1.2 – 2.9	3.2	16	28	-	-
4	Dense SAND	2.9 – 4.9	8.1 – 13.2	18	36		-
5	Stiff CLAY	4.9 – 8.2	1.4	18	30	5	40 – 70
6	Loose Silty SAND/Sandy SILT	8.2 – 11.0	3.3	16	28	-	-

Table 1 – General Soil Profile and Interpreted Design Parameters[1]

(1) This table provides only a summary of subsoil conditions. Any geotechnical design should be based on the complete bore logs given within the appendices. The ground conditions below 3.0m ground level are inferred with no physical sample collected.

4.3 Ground Water

Groundwater was encountered during the in-situ testing and is summarized below in Table 2 in consideration of ground conditions and topographic application.

CPT	Test Depth (m, bgl)	Water Table Depth (m, bgl)
CPT01	15.1	11.3
BH01-03	3.0	Not detected

Table 2 – Encountered Groundwater Table Depth

We expect the permanent groundwater table to lie about 11m below the surface of the subjects based on the elevation of the site (RL 304-305m) relative to the surrounding watercourses (RL 292-293m) that is about 690m east away from the proposed site.

5.0 GEOTECHNICAL HAZARDS

5.1 Liquefaction Assessment

Soil liquefaction results from loss of strength during cyclic loading, such as imposed by earthquakes. Soils most susceptible to liquefaction are clean, loose, saturated, uniformly graded fine-grained sands. Empirical evidence indicates that loose to medium dense gravels, silty sands, low-plasticity silts, and some low-plasticity clays are also potentially liquefiable.

Numerical analyses have not been carried out, however based on our findings during the investigation and local knowledge of the geology we consider the potential or liquefaction of the near-surface soils to be of low risk.

As the groundwater was detected at the depth of about 11.3m below ground level in the CPT hole only, we believe groundwater to be of the order of 11m or more below ground level, giving a significant depth of non-liquefiable 'crust' deposits. This crust will protect the site and structure from surface manifestations of liquefaction such as sand boils and fissures and should mitigate against differential settlement induced by liquefaction of deeper strata.

Based on our investigations and the following assessment above, we consider that shallow founded structures should not be affected by the deep liquefaction potential of the subject site due to the significant non-liquefiable crust.

5.2 Lateral Spreading

Lateral spreading is a phenomenon associated with liquefaction, where large horizontal ground displacement can occur on land adjacent to rivers, streams, wetlands or on gentle slopes.

As the site is not vulnerable to a potential liquefaction hazard as reviewed in Section 4.3 above, damaging lateral spreading is not expected to occur.

It is important to note that liquefaction induced lateral spreading is a complex phenomenon and that factors affecting the occurrence and severity of lateral spreading include the man-made basin depth, the thickness of the liquefiable layer, and the intensity of ground shaking.

5.3 Static Settlement

Static settlement occurs when soil materials compress and consolidate under static loading. For simplicity, the various stages of static settlement can be approximated by two components: 'consolidation settlement' and 'creep settlement'.

No noticeable layers of soft and compressible soils are present beneath the proposed site based on the test and no compressible soft cohesive layers are expected to be underlain based on the geological assessment. Therefore, the risk of long-term

settlement against the proposed development with light weight timber framed dwelling is expected to be low.

It is expected that the differential settlements are within the tolerable limits set out in NZS 3604:2011 and the Building Code. This is defined as 25mm over 6.0m.

5.4 Expansive Soils

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

The near surface soils appear to be non-plastic with a liquid limit likely below 50% or a linear shrinkage value likely below 15% based on physical characteristics observed during the site investigation. Based on the low plasticity of the subsoils, which is likely to be encountered following completion of the building platform, the foundation conditions are not considered to be expansive. Hence, no modifications to the foundation designs in NZS3604:2011 are required to mitigate risk of expansive soils.

6.0 ENGINEERING CONSIDERATIONS

6.1 Recommended Foundation System

From the results of the Hand drilled Boreholes, Shear vane tests, CPTs and Scala Penetrometer tests, with consideration to the type of soils present on-site, ultimate bearing capacities for the shallow founded structures can be inferred for this site.

Founding soils do not comply with the requirements of NZS 3604:2011 Timber Framed buildings for “good ground" with an ultimate bearing capacity of 300kPa due to the reduced bearing capacity.

For purposes of engineering calculations, the site subsoil class is taken as Class D in accordance with New Zealand Standard NZS 1170.5:2004. The following is considered to be the most appropriate foundation options for the new development:

Development on Concrete Floor

Option : Engineer Designed Raft foundation

The proposed development can be supported by an Engineer designed raft foundation.

Method: All top-soils, organic materials, uncontrolled fill materials, and unsuitable insitu materials under the building platform must be removed to a depth of 1.0m and replaced with selected and compacted granular fill to create a stable and solid building platform.

- An approved fill material shall be placed and compacted in layers no greater than 200mm thick. The granular fill shall be compacted in accordance with NZS 4431:1989 with appropriate on-site quality control.

- A maximum dry density at optimum water content of at least 95% shall be achieved in accordance with the NZS4402:1986.
- One layer of geotextile (AS280 or equivalent)/geogrid (Duragrid 30/30, TX160 or equivalent) should be placed at the base between the subgrade and the compacted granular fill.
- It is recommended that the base of the fill raft be extended 1.0m beyond the perimeter of the building platform.

A Geotechnical engineer should be engaged to inspect the dig-out stage and the compacted stage for the sub-grade and the compacted granular fill check, respectively.

Developments on Timber Floor

Option: Engineer Designed Piled Foundation

Based on soil testing, we consider that "good ground" conditions as per NZS 3604:2011 are not available at the subject site. Therefore, specific engineer-designed (SED) of piled foundations are recommended for a dwelling with a suspended timber floor based on the followings.

Either bored piles or driven piles are considered suitable. Based on the investigation results, the following options can be recommended:

- Footings are founded a minimum depth of 1.5m below existing ground level

Refer to Table 1 in Section 4.2 for the recommended geotechnical parameters for the pile bearing capacity calculations.

It is noted that eccentric loads, horizontal loads, or overturning moments applied to the foundations may result in a reduction of the ultimate bearing capacities. If any of these loads are to be applied, a geotechnical engineer's reassessment for the ultimate bearing capacities based on the design loads is recommended.

A strength reduction factor of 0.5 which is in accordance with the requirements of AS/NZS 1170 shall be adopted.

The end bearing, and skin friction values are dependent upon all loosened or disturbed spoil material being removed from the base of the pile and any smear from the side walls, prior to casting of concrete.

A Geotechnical Engineer should be engaged to inspect all foundation excavations to approve founding conditions. Should soft or unsuitable materials be encountered, they may need to be removed and replaced with either site concrete or compacted hardfill.

Driven piles should be installed to an appropriate driving set as determined by the Hiley Formula and driven to target depths.

6.2 Site Stability

The site and surrounding areas are generally on flat ground. Therefore, there is no identified site stability risk at this stage.

6.3 Retaining Structures

The site is not likely to require retaining structures to provide the required building platform. However, a qualified Engineer experienced in geomechanics and familiar with this report should be engaged to design any retaining wall structures higher than 1.5m on this property.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our investigations we make the following conclusions and recommendations:

a) Soil testing has been undertaken in reference to the proposed subdivision as indicated on the site plan provided to GDC Consultants Ltd. Further geotechnical investigations should be carried out if the location of the subdivision is changed from that indicated.

b) Foundations in accordance with Section 6.1 of this report.

c) The Client shall contact the local authority regarding the consideration of a finished floor level. Unless defined by the Territorial Authority, suspended floors and slabs on ground shall be at least 150 mm above the finished level of the surrounding ground in order to comply with E1/AS1 of the Approved Document for New Zealand Building Code “Surface water, resulting from an event having a 2% probability of occurring annually shall not enter buildings”.

d) An Engineer should inspect the building platform construction and foundation and slab construction prior to the concrete pour, to ensure that the design criteria have been met. Producer Statements PS4 – Construction Review should be issued for these inspections.

e) All stormwater collected from roofed and paved surfaces shall be controlled and piped according to the local authority regulations.

f) All wastewater shall be controlled and piped according to the local authority regulations.

8.0 LIMITATIONS

This report has been prepared for Harjeet Singh as our client in accordance with the agreed scope of services. The reliance by other parties on this document shall without our prior agreement in writing be at such parties' sole risk.

The observations noted in the investigations have been extrapolated between the various test locations to infer probable site conditions. It is noted that these inferences in no way guarantee the validity of these assumptions due to the potential variability of the site soils.

Recommendations and opinions in this report are based on data obtained from the investigations and site observations as detailed in this report. The nature and continuity of subsoil conditions at locations other than the investigation bore and tests are inferred, and it should be appreciated that actual conditions could vary from the assumed model. If ground conditions are found to vary from that described or assumed, the matter should in the first instance be referred back to GDC for comment.
Please contact any of the signatories for further information. If there are any questions arising from the above or during construction, please call this office.

This report shall not be used to interpret any form of financial transaction.

Contamination, wastewater and stormwater assessments are outside of the scope of this report.

9.0 REFERENCES

GNS Science (2014), *New Zealand Geology Web Map, accessed on 18th February 2022,* <*http://data.gns.cri.nz/geology/*>.

New Zealand Geotechnical Society (2005), *Guidelines for the Field Classification and Description of Soil and Rock for Engineering Purposes (pp. 38).*

Stockwell, M.J. (1977), *Determination of allowable bearing pressure under small structures*. New Zealand Engineering (June 1977), Vol. 32, No.6 (pp. 18 – 21).

Rotorua Lakes Council, *accessed on 18th February 2022.*
<https://www.rotorualakescouncil.nz/our-services/maps>.

Rotorua District Plan Maps, Hazard Viewer, *accessed on 18th February 2022.*
<https://www.rotorualakescouncil.nz/our-ervices/planningservices/districtplan/district-plan-maps>.

MBIE Canterbury Guidelines (December 2012).

New Zealand Geotechnical Society, 2016. Earthquake geotechnical engineering practice Module 4: Earthquake resistant foundation design.

Bridge Manual_ Third edition, 2016, NZ Transport Agency.

APPENDIX A

Site Location Plan

Site Location Plan

DATA SETS
Accuracy of property boundaries +/- 0.2m - 0.3m in urban areas and up to +/- 30m in rural areas. Property boundaries, legal descriptions and legal areas sourced from LINZ.

GeyserView represents Council's most up to date compiled and published data. Council does not warrant the accuracy of the information represented by this map. LINZ Licenses. CROWN COPYRIGHT RESERVED.

Aerial Imagery
Imagery flown 2001, 2006, 2011 and 2016

Printed Date: 18-Feb-2022

0 52.75 105.5 Meters

Rotorua Lakes Council

APPENDIX B

Flood Hazard Map

Hazard coverage for

Lot 36 DPS 328

(Uses the shape associated with the SUE
4372693
for the analysis.)

All configured hazards checked.

ROTORUA LAKES COUNCIL

Fault Avoidance Zone
None found using parcel selection

Flood Level - Lake Rotoiti
None found using parcel selection

Flood Level - Lake Rotorua
None found using parcel selection

Geothermal Field
None found using parcel selection

Inundation Restrictions
None found using parcel selection

Landslide Susceptibility
1014m2 of 1014m2 (100%) - very low

Soft Ground
1014m2 of 1014m2 (100%) - Zone B: Huka Group sediments and Hinuera Formation (older sediments). These sediments were formed in a range of environments. Sediments with soft and very soft strengths at the time of formation are likely to have consolidated over time.

APPENDIX C

Areas of Soft Ground Potential Map

Operative Rotorua District Plan June 2016

WESTERN BAY OF PLENTY DISTRICT

To Tauranga

To Tauranga

To Hamilton

Ōtaramarae

Lake Rotoehu

Lake Rotoiti

Lake Rotomā

Hamurana

Mourea

Lake Rotorua

Ngongotahā

Gisborne Point

Lake Rotokawau

To Whakatane

Mamaku

WAIKATO REGION

ROTORUA

Lake Rotokawa

BAY OF PLENTY REGION

Lake Ōkataina

Site Location

Refer adjoining Urban Map 209

Ōkareka

Lake Ōkareka

Tarawera

Lake Tarawera

Lake Tikitapu

Lakes A Zone

SOUTH WAIKATO DISTRICT

Lake Rotokākahi

Lake Rotomāhana

Lake Ōkaro

Lake Rerewhakaaitu

Rerewhakaaitu

To Tokoroa

WAIKATO REGION

Lake Ngāpouri

Lake Ātiamuri

Kaingaroa

Lake Ōhākurī

Reporoa

To Murupara

Golden Springs

TAUPŌ DISTRICT

Broadlands

Waikato River

To Taupō

Zone A: Areas of volcanic-derived rocks and soils. Volcanic processes by their very nature are high-energy. No soft ground is expected in zone A as the dominant processes preclude the conditions necessary for its development.

Zone B: Huka Group sediments and Hinuera Formation. These sediments were formed in a range of environments. Sediments with soft and very soft strengths at the time of formation have consolidated over time and are now likely to meet the requirements for being defined as good ground as per the draft New Zealand Standard for timber framed buildings (DZ3604).

Zone C: Undifferentiated Holocene alluvium. Sites from a range of environmental conditions are present within this zone. Small areas of soft to very soft ground may be present as a surficial layer in some places.

Zone D: Sites of Holocene (last 10,000 years) swamp deposits and Holocene lake or delta sediments between the 9000 ka and modern shorelines. Four of the five documented sites of soft ground are located in Zone D.

0 1 2 4 6 8 10 12 14 16 18 20 Kilometres

Lakes A Zone | Zone A | Zone B | Zone C | Zone D

Lakes | District Boundaries | Regional Boundaries

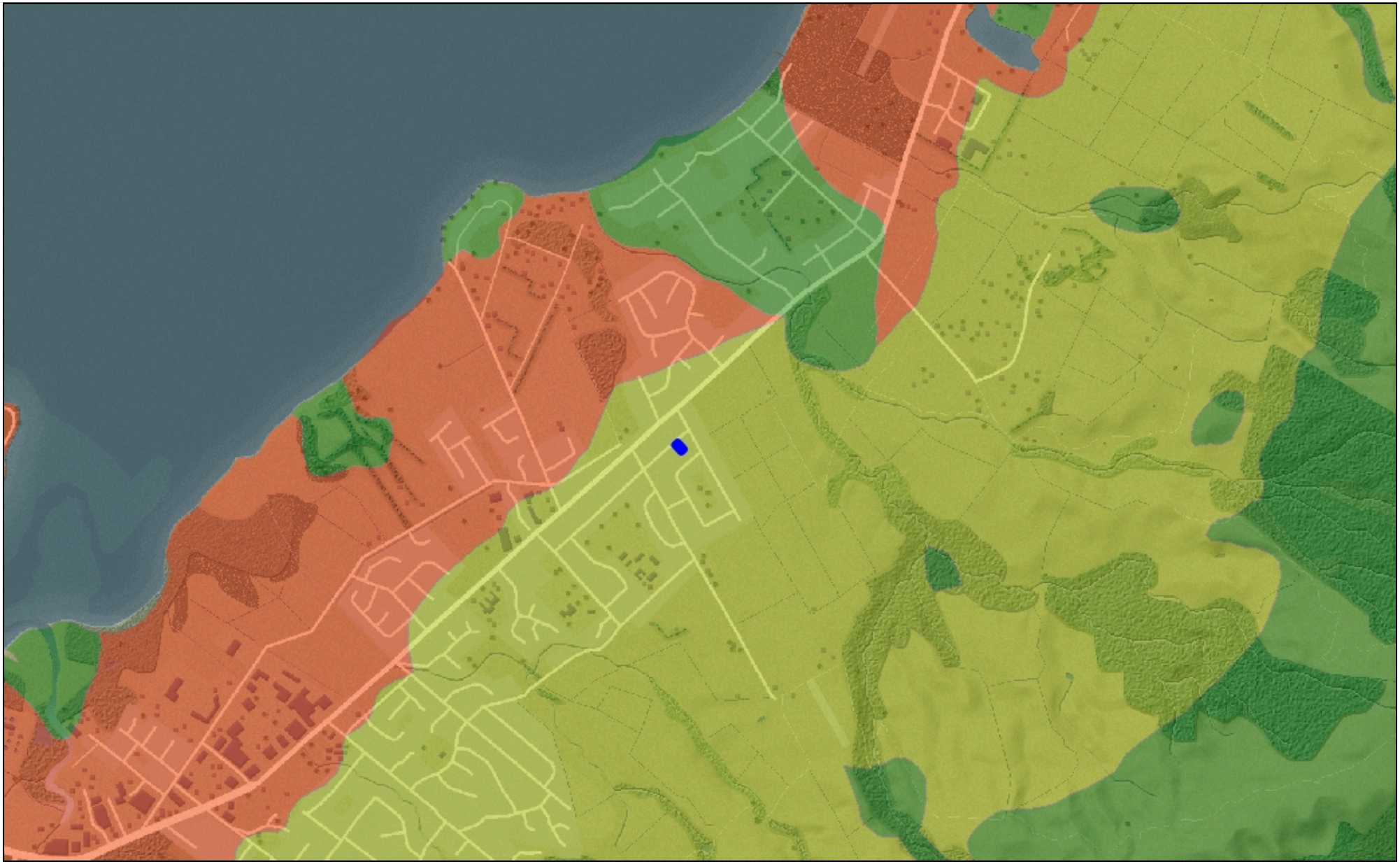
Roads | Rivers | State Highways

ROTORUA LAKES COUNCIL

N

District Plan

209 - Areas of Soft Ground Potential



Soft Ground

DATA SETS
Accuracy of property boundaries +/- 0.2m - 0.3m in urban areas and up to +/- 30m in rural areas. Property boundaries, titles, legal descriptions and legal areas sourced from LINZ.
GeyserView represents Council's most up to date compiled and published data. Council does not warrant the accuracy of the information represented by this map.

Printed Date: 18-Feb-2022

Aerial Imagery
1:1000 data set flown 2016, XY accuracy +/- 0.5m.
1:2000 data set flown 2016, XY accuracy +/- 0.5m.

0 527.47 1,054.9 Meters

Rotorua Lakes Council

APPENDIX D

Areas of Potential Fault Line Impact Map

Decisions Rotorua District Plan 2014

WESTERN BAY OF PLENTY DISTRICT

Mangorewa River

Kaituna River

Mamaku Lagoon

Kaikaitāhuna Stream

Lake Rotorua

Waiteti Stream

Ngongotaha Stream

Waingaehe Stream

Utuhina Stream

Refer adjoining Urban Map 211

Site Location

Lake Rotoiti

Lake Rotoehu

Lake Rotoma

Lake Rotokawau

Lake Rotokawa

Lake Okataina

Tarawera River

Lake Okareka

Lake Tikitapu

Lake Tarawera

Lake Rotokakahi

Lakes A Zone

Lake Rotomahana

Lake Okaro

Lake Ngahewa

Lake Rerewhakaaitu

Lake Ngapouri

SOUTH WAIKATO DISTRICT

Lake Atiamuri

Lake Ohakuri

Waikato River

TAUPO DISTRICT

WHAKATANE DISTRICT

0 1 2 4 6 8 10 12 14 16 18 20 Kilometres

Cadastral data obtained under LINZ licence agreement August 2014 Trim Ref: 65-15-861

DESTINATION ROTORUA
ROTORUA DISTRICT COUNCIL

N

Fault Avoidance Zone
Forest - Indigenous or Exotic
Lakes
Lakes A Zone
State Highways
District Boundaries
Rivers
Roads

District Plan

211 - Areas of Potential Fault Line Impact

Fault Line

DATA SETS

Accuracy of property boundaries +/- 0.2m - 0.3m in urban areas and up to +/- 30m in rural areas. Property boundaries, titles, legal descriptions and legal areas sourced from LINZ.

GeyserView represents Council's most up to date compiled and published data. Council does not warrant the accuracy of the information represented by this map.

Printed Date: 18-Feb-2022

Aerial Imagery

1:1000 data set flown 2016, XY accuracy +/- 0.5m.

1:2000 data set flown 2016, XY accuracy +/- 0.5m.

0 1,054.94 2,109.9 Meters

Rotorua Lakes Council

APPENDIX E

Geothermal Fields Map

Operative Rotorua District Plan June 2016

WESTERN BAY OF PLENTY DISTRICT

Mangorewa River
Kaituna River
Mamaku Lagoon
Tāheke
Kaikaitāhuna Stream
Lake Rotoiti
Lake Rotoehu
Tikitere
Lake Rotoiti Centre Basin
Lake Rotorua
Waitetī Stream
Ngongotahā Stream
Rotomā
Lake Rotomā
Lake Rotokawau
Lake Rotokawa
Waingaehe Stream
Utuhina Stream
Rotorua
Lake Ōkataina
Lake Ōkataina
Humphrey's Bay
Tarawera River
Refer adjoining Urban Map 212
Site Location
Lake Ōkareka
Lake Tikitapu
Lake Tarawera
SOUTH WAIKATO DISTRICT
Lake Rotokākahi
Lakes A Zone
Hot Water Beach
Horohoro
Lake Rotomāhana
Lake Ōkaro
Waimangu
Lake Ngāhewa
Lake Rerewhakaaitu
Ngākuru
Waikite
Lake Ngāpouri
Waiotapu
Ātiamuri
Lake Ātiamuri
Te Kopia
Reporoa
Lake Ōhākuri
Orakei Korako
Whāngairorohea
WHAKATĀNE DISTRICT
Waikato River
Ngatamariki
Ōhākī
TAUPŌ DISTRICT
Waikato River

0 1 2 4 6 8 10 12 14 16 18 20 Kilometres

The extent of the geothermal system is approximate only, and indicates the location of geothermal activity including hazards.

Cadastral data obtained under LINZ licence agreement April 2016 Trim Ref: 65-15-865

ROTORUA LAKES COUNCIL

N

Forest - Indigenous or Exotic

Protected
Urban Use
Development

Geothermal System Protection Status

Small Scale Commercial Use
Limited / Conditional Development

Lakes
Lakes A Zone
District Boundaries

Rivers
Roads
State Highways

District Plan

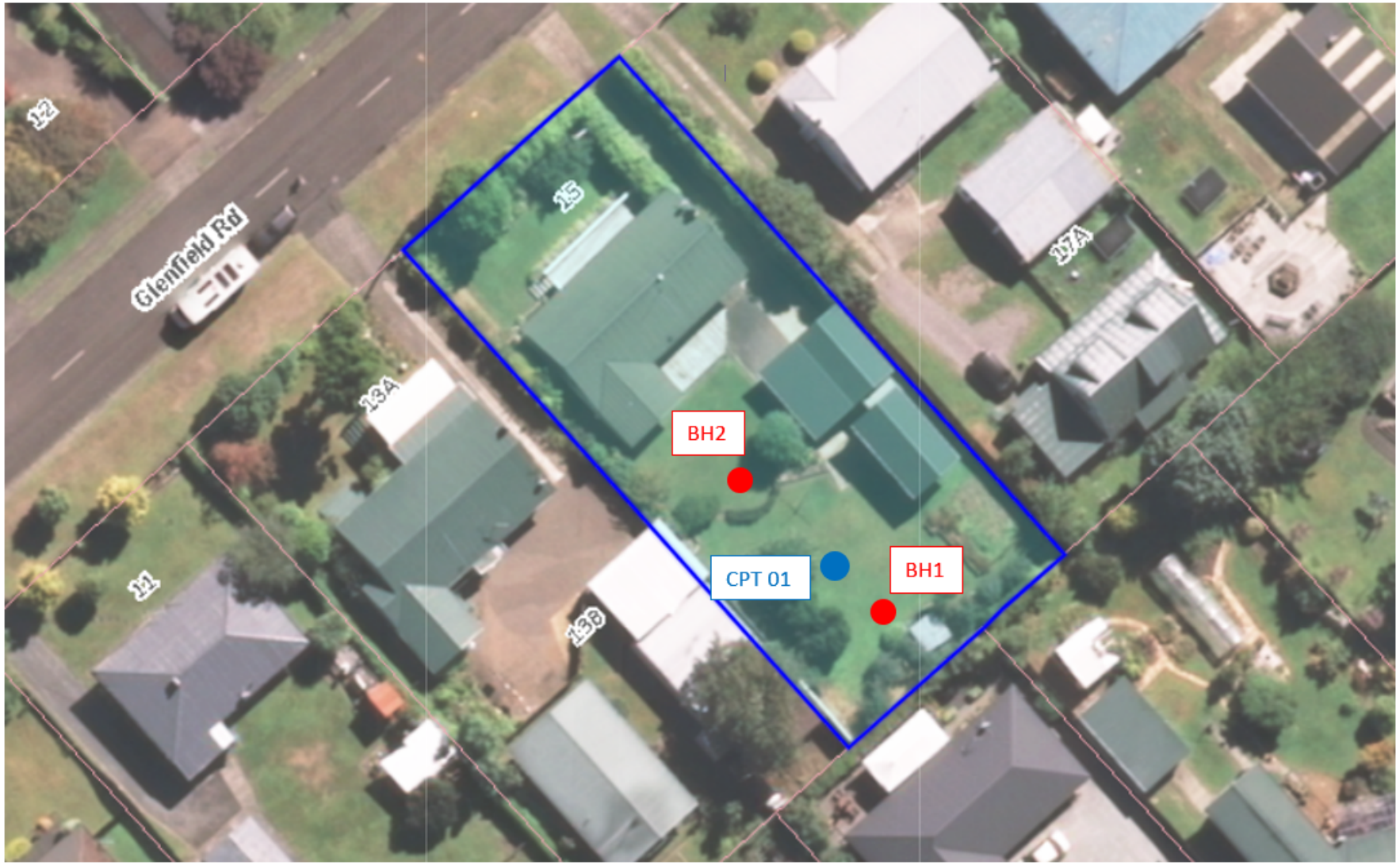
212 - Geothermal Systems of the Rotorua District

APPENDIX F

Site Investigation Plan

GDC Consultants Ltd

Site Investigation Plan February 2022 Job No: J003633



APPENDIX G

Scala Penetrometer Test Results &

Hand-augered Borehole: Logs (BH1 – BH2)

BORE HOLE LOG BH1

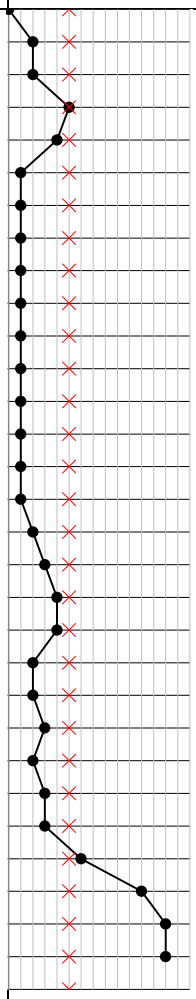
Job No.	J003633		
Project	Geotechnical Investigation of Proposed Subdivision - 15 Glenfield Road, Owhata, Rotorua		
Client	Harjeet Singh		
Borehole Location	See site plan		
Surface Elevation	Flat	Datum	
Surface Condition	Grassed		

Fill **Topsoil** **Sand** **Clay** **Silt** **Peat** **Gravel**

Depth mm	G.W.L	Graphic Log	Field Description
300			TOPSOIL
600			SILT with peat;black,dry,soft and non plastic
900			SILT;brown,dry,soft to firm and non plastic
1200			SAND;brown,dry,loose to medum dense and non plastic
1500			
1800			@1.8m trace of clay,slightly moist
2100			
2400			
2700			
3000			Coarse SAND;greyish brown,slightly moist,medium dense and non plastic
			E.O.B @3.0m , No GWL

Vane Shear Strength (kPa) Corrected (Per NZGS guideline)
25 50 75 100 125 150 175

Scala Penetrometer (blows/ 100 mm)
3 6 9 12 15



Drill Method	50mm hand auger
Date Drilled	9/2/2022
Drilled by	Dion
Shear Vane No	C377-A

NOTE : The subsurface data described above has been determined at this specific borehole location. Such data will not identify any variations away from this location

GDC Consultants Ltd
Chartered Professional Engineers & Mediators

Test Methods
Field Description of Soil and Rock, NZ Geotechnical Soc., 2005
Guideline for Hand Held Shear Vane Test, NZ Geotechnical Soc., 2001

Tests
In situ shear vane reading
Remoulded shear vane reading
Scala Penetrometer
UTP - Unable To Penetrate

BORE HOLE LOG BH2

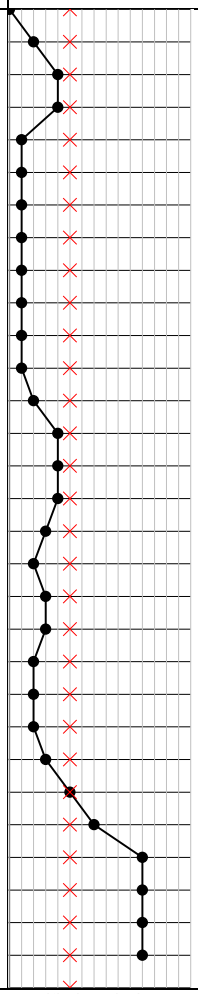
Job No.	J003633		
Project	Geotechnical Investigation of Proposed Subdivision - 15 Glenfield Road, Owhata, Rotorua		
Client	Harjeet Singh		
Borehole Location	See site plan		
Surface Elevation	Flat	Datum	
Surface Condition	Grassed		

Fill **Topsoil** **Sand** **Clay** **Silt** **Peat** **Gravel**

Depth mm	G.W.L	Graphic Log	Field Description
300			TOPSOIL
600			SILT with trace of peat;black,dry,soft and non plastic
900			
1200			SAND;brown,dry,loose to medium dense and non plastic
1500			
1800			@1.6m trace of clay,slightly moist
2100			
2400			
2700			Coarse SAND;greyish brown,slightly moist,medium dense and non plastic
3000			E.O.B @3.0m , No GWL

Vane Shear Strength (kPa) Corrected (Per NZGS guideline)
25 50 75 100 125 150 175

Scala Penetrometer (blows/ 100 mm)
3 6 9 12 15



Drill Method	50mm hand auger
Date Drilled	9/2/2022
Drilled by	Dion
Shear Vane No	C322-1

NOTE : The subsurface data described above has been determined at this specific borehole location. Such data will not identify any variations away from this location

GDC Consultants Ltd
Chartered Professional Engineers & Mediators

Test Methods	Tests
Field Description of Soil and Rock, NZ Geotechnical Soc., 2005	In situ shear vane reading
Guideline for Hand Held Shear Vane Test, NZ Geotechnical Soc., 2001	Remoulded shear vane reading
	Scala Penetrometer
	UTP - Unable To Penetrate

APPENDIX H

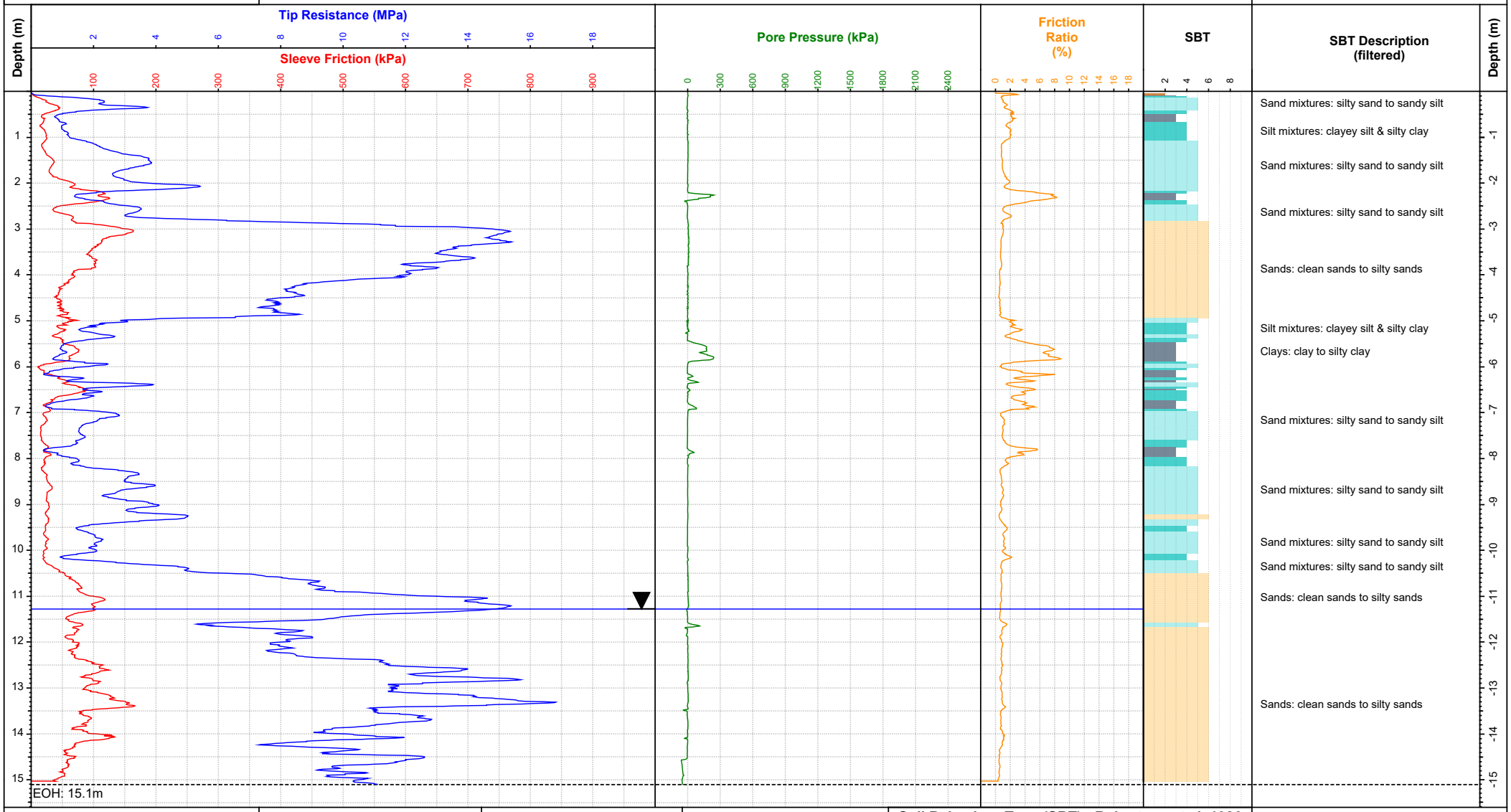
CPT Result (CPT01)

Topdrill Geotech

CONE PENETRATION TEST LOG

Test No: CPT01

Client Ref.: J003633



Client: GDC Consultants Ltd

Project: CPT Investigations

Location: 15 Glenfield Road, Rotorua

Contractor: Topdrill Ltd

Remarks:
GWL dipped onsite at 11.28m

Termination Reason:
Target depth

Northing:	5774508.77
Easting:	1889531.59
System:	NZTM
Elevation:	Ground
Datum:	N/A
Method:	Garmin GPS

Rig:	Pagani TG 63 - 150
Cone ID:	MKs632
Cone Area:	10cm²
Sleeve Area:	150cm²
Area Ratio:	0.79
Predrill:	0.00

Soil Behaviour Type (SBT) - Robertson et al. 1986

0 Undefined	5 Sand mixtures: silty sand to sandy silt
1 Sensitive fine-grained	6 Sands: clean sands to silty sands
2 Clay - organic soil	7 Dense sand to gravelly sand
3 Clays: clay to silty clay	8 Stiff sand to clayey sand
4 Silt mixtures: clayey silt & silty clay	9 Stiff fine-grained

Test No:	CPT01
Topdrill Ref.:	TD20324
Client Ref.:	J003633
Depth (m):	15.1
Date:	15/02/2022

Topdrill Geotech

TIP RESISTANCE (q_c)

Test No:	CPT01
Client Ref.:	J003633