Application No.: ..... **PO:** .....
Office Use Only

Application for a Resource Consent – Resource Management Act 1991

This application form must be provided with applications to the council for new and replacement resource consents, and changes to the conditions on an existing resource consent.

If you would like to talk or meet with a consents officer to discuss your application prior to lodging with the council, please phone **0800 002 004** or email request to **info@nrc.govt.nz**.

PART 1: Administration Matters

1 Full Name of Applicant(s) *(the name(s) that will be on the resource consent document)*

Surname: .....

First Names: .....

OR

If the application is being made on behalf of a trust, the Trustee(s) who has/have signing authority for the trust must be named.

Trust Name: .....

Trustee's Name(s): .....

OR

Company Name: Onoke Heights Limited .....

Contact Person: Mark Holland .....

Email address: mark@waibury.co.nz .....

Please Note: ***If an email address is provided, then all correspondence for this application will be via email.***

Postal address: PO Box 21100 Rototuna Hamilton 3256 .....

Telephone: *(please tick preferred contact number)*

☐ Residential ..... ☐ Business .....

☐ Mobile 0274 972 835 .....

Northland REGIONAL COUNCIL
Te Kaunihera ā rohe o Te Taitokerau

2 Details of the Address for Service of documents if different from the Applicant (e.g. Consultant). This address will be used for all documents if completed.

Company Name: Barker and Associates

Contact Person: Melissa McGrath

Email address: MelissaM@barker.co.nz

Please Note: ***If an email address is provided, then all correspondence for this application will be via email.***

Postal address: Barker and Associates, P O Box 37, Whangarei 0112

Telephone: *(please tick preferred contact number)*

☐ Residential ☐ Business

☑ Mobile 027 231 9533

3 Invoices

Charges relating to the processing of this resource consent application should be sent to:

☑ Applicant ☐ Address for service

Charges relating to the ongoing monitoring of a resource consent should be sent to:

☑ Applicant ☐ Address for service

4 Name and Address of all Owners/Occupiers of the Site relating to Application if different from the Applicant

Owner(s): Onoke Heights Limited

Postal Address: PO Box 21100 Rototuna Hamilton 3256

Telephone: *(please tick preferred contact number)*

☐ Residential ☐ Business

☑ Mobile 0274 972 835

Occupier(s):

Postal Address:

Telephone: *(please tick preferred contact number)*

☐ Residential ☐ Business

☐ Mobile

Please Note: ***If the applicant is not the owner of the land to which the activity relates, then it is good practice to submit the application with written approval from the landowner.***

5 Extending Timeframes

The Resource Management Act 1991 (RMA) specifies timeframes for processing resource consent applications (e.g. 20 working days for a non-notified application); however, these timeframes can be extended, if necessary, with the Applicant's agreement. If the council does not meet these timeframes, then it is required to refund 1% of the total processing cost of the application for each day it exceeds the timeframe up to a maximum of 50%.

Do you agree to the council extending RMA resource consent processing timeframes?

☐ **Yes**, provided that I can continue to exercise my existing resource consent until processing of this application is completed.
(Replacement application only. No refund is required to be paid until after the existing resource consent expires.)

☑ **Yes**, provided that the extension is for the specific purpose of discussing and trying to agree on resource consent conditions.

☐ **Yes**, provided that the application process is completed before this date (dd/mm/yy):

☐ No.

6 Deposit Fee

An initial minimum fee is payable with this application. These fees can be found on the council's website www.nrc.govt.nz – **Schedule of Minimum Estimated Initial Fees** information. Please contact council consents staff if you need assistance with determining the correct minimum initial fee.

Unless agreed to prior to lodging your application, the council will not commence processing your resource consent application until payment of the minimum initial fee is received (i.e. the statutory processing time for the application will not start).

This minimum initial fee may be paid online, by cheque, or by EFTPOS at one of the council's offices.

Instructions for paying online can be found on the council's website at "Pay online". Please use either the first six numbers of your resource consent (e.g. CONXXXXXX or AUT.XXXXXX), if known, or the Applicant's name as the Reference/Customer number when paying online.

If you do pay online, then please enclose evidence of payment so that the council is aware that the payment has been made.

If the costs of processing the resource consent application are greater than the minimum estimated initial fee, then the applicant will be required to pay the additional actual and reasonable costs of processing the application.

Note: Annual User Charges for Resource Consent Holders

Holders of resource consents will in most cases be required to pay a "Minimum Annual Charge" for administration of the resource consent once issued. There is also likely to be additional annual charges for the monitoring of the resource consent, which will be dependent on the type of activity the resource consent is for. These charges are detailed on the council's website www.nrc.govt.nz in the Annual Charges section of the council's **Charging Policy**.

7 Applications for Activities within the Coastal Marine Area (CMA)

Prior to lodging an application with the council to undertake any activity in the coastal marine area (CMA), the applicant is required under the Marine and Coastal Area (Takutai Moana) Act 2011 to notify the application to all groups who have applied for customary marine title in that location, and seek their view on the application. This notification should, as a minimum, include a summary of the application that provides sufficient detail for a group to understand what is being proposed

The council cannot accept an application to undertake an activity in the CMA unless the applicant for the resource consent provides evidence of this notification occurring. A response from customary marine title groups is not required by the council.

To ensure you meet the above requirement, you are advised to contact council consents staff to obtain a list of all of the current customary marine title applicant groups within the area where you are proposing to apply for a resource consent.

Information on customary marine titles is available on the **Ministry of Justice/Marine and Coastal Area Applications** website.

8 Consultation

The RMA does not require any person, including the applicant or council, to consult with anyone. It is, however, best practice to do so and will allow the council to make a more informed decision.

It is important to remember that consultation does not require reaching an agreement – it is to allow you and the council to be informed about a person's views. If you do consult, and there are concerns raised that cannot be resolved and you still want to go ahead with your application, then you should have made a genuine attempt to consult with that person(s) in an open and honest manner. Their views should be recorded so they can be taken into account by the council when considering your resource consent application.

PART 2: Application Details

1 Description of Activity

Please describe in detail the activity for which resource consent is being sought.

To undertake bulk earthworks and stormwater discharge associated with a residential development.

2 Location Description of Activity

Site Address: Dip Road, Kamo, Whangarei, Northland.

Legal Description: Lot 2 DP 99045

(Legal description can be obtained from your Certificate of Title, valuation notice, or rates demand)

3 Site Plan

On a separate page *(minimum A4 size)*, please provide a site plan showing the location of the activity, site layout, and surrounding environment in relation to property boundaries. Please include any buildings or developments on the site.

These plans should be provided electronically and be of good quality, to enable use in resource consent documentation.

If you do not have access to mapping software, we recommend you use the council's **"Property and Boundaries"** map available on our website https://localmaps.nrc.govt.nz/LocalMapsGallery/.

This council map contains aerial photography and shows property boundaries and details. You can carry out a property search and print maps of aerial photography.

4 Resource Consent(s) being Applied for

Coastal Permit

☐ Mooring ☐ Marine Farm ☐ Structure

☐ Pipeline/Cable ☐ Other *(specify)*

Land Use Consent

☐ Quarry ☑ Earthworks ☐ Dam Structure

☐ Vegetation Clearance ☐ Construct/Alter a Bore ☐ Structure in/over Watercourse

☐ Other *(specify)*

Water Permit

☐ Stream/Surface Take ☐ Damming ☐ Groundwater Take

☐ Diverting Water ☐ Other *(specify)* .....

Discharge Permit

☐ Domestic Effluent to Land ☑ General Discharge to Land ☐ Farm Dairy Effluent to Land/Water

☐ Air ☑ Water ☐ Other *(specify)* .....

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5 Is this application to replace an existing or expired resource consent(s)? ☐ Yes ☑ No

If Yes:

(a) Please state the resource consent number(s):

.....

.....

(b) Do you agree to surrender the existing resource consent once a new one has been issued:

☐ Yes ☐ No

---

6 Is this application to change a condition of an existing resource consent? ☐ Yes ☑ No

If Yes, please state the resource consent number(s):

.....

.....

---

7 Please specify the duration sought for your resource consent(s) –
Only for new or replacement applications.

35 years ..... months

---

8 Do you also require consent(s) from a district council? ☑ Yes ☐ No

If Yes, please complete the following:

Type of consent required? Land Use and Subdivison .....

Has it been applied for? ☑ Yes ☐ No

Has it been granted? *(If Yes, please attach)* ☐ Yes ☑ No

PART 3: Assessment of Environmental Effects (AEE)

1 An AEE must be provided with your application that has been completed in accordance with the requirements of Schedule 4 of the RMA.

As a minimum, your AEE must include the following:

- Description of the environmental effects of the activity.
- Description of ways in which adverse environmental effects can be avoided, remedied or mitigated.
- Names of people affected by the proposal.
- Record of any consultation you have undertaken, including with affected persons (if any).
- Discussion of any monitoring of environmental effects that might be required.
- An assessment of the activity against any relevant objectives, policies, or rules in the Regional Plans.
- For a coastal permit, an assessment of your activity against any relevant objectives and policies of the New Zealand Coastal Policy Statement.
- An assessment of effects on tangata whenua and their taonga.

This AEE needs to be provided in a separate document attached to this application form.

Any activity needing a resource consent will have some environmental effects. The council will not accept an AEE that says there are no environmental effects from the activity.

You will need to complete the AEE at a level that corresponds with the scale and significance of the effects that the activity may have on the environment. Depending on the scale of the activity, you may need to get help from an expert(s) to prepare your AEE.

The council has a set of standard AEE forms for a selection of common activities. These AEE forms do not cover the relevant objectives, policies, or rules in the Regional Plans nor effects on tangata whenua. If you use one of these forms, then you will need to provide a separate assessment of these matters. These AEE forms can be found on the council's website www.nrc.govt.nz – **"Forms and Fees"**.

It is important that you provide the council with a complete and well-prepared AEE, otherwise the council may not accept your application.

If your application is for a change to a condition of resource consent under Section 127 of the RMA, then your AEE only needs to cover the effects of the change being requested.

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2 Assessment of Effects on tangata whenua and their taonga

The Regional Plan for Northland requires that an AEE must also include an assessment of the effects on tangata whenua and their taonga if one or more of the following is likely:

- Adverse effects on mahinga kai or access to mahinga kai; or
- Any damage, destruction or loss of access to wāhi tapu, sites of customary value and other ancestral sites and taonga with which Māori have a special relationship; or

- Adverse effects on indigenous biodiversity in the beds of waterbodies or the coastal marine area where it impacts on the ability of tangata whenua to carry out cultural and traditional activities; or
- Adverse effects on taiāpure, mātaitai or Māori non-commercial fisheries; or
- Adverse effects on protected customary rights; or
- Adverse effects on sites and areas of significance to tangata whenua mapped in the Regional Plan for Northland (refer Maps |Ngā mahere matawhenua).

Your AEE must include an assessment of whether any of the above affects are likely to occur.

If they are likely to occur, then you will need to complete a Cultural Impact Assessment (CIA) and provide this with your resource consent application. The Regional Plan for Northland provides details of what must be included in this CIA, and should be referred to.

The best way to find out what the effects of your proposal may be on tangata whenua is to contact local iwi/hapū groups (who represent tangata whenua) and discuss your proposal with them. Council consents staff can provide a list of contact details for local iwi/hapū groups in the area of your proposal. You can then send a copy of your proposal to these groups and seek feedback from them prior to lodging your application. Some iwi/hapū have also developed iwi/hapū Environmental Management Plans that are useful documents that can assist to identify issues of concern to those iwi/hapū for activities occurring in their rohe. The iwi/hapū Environmental Management Plans can be obtained directly from the iwi/hapū or from the council upon request.

3 Assessment of Affected Persons

If the adverse effects of your activity on a person are likely to be minor, or more than minor, then that person is deemed to be an "affected person" for your resource consent application.

An affected person may include neighbouring land owners and occupiers, and/or organisations such as the Department of Conservation, Land Information New Zealand (LINZ), Fish and Game Council, Iwi and Hapū, and community groups.

If you do not think there will be any affected persons for your resource consent application, then you do not need to provide any details on this matter in your AEE. However, the council will still undertake an assessment of whether there are any affected persons as part of processing the resource consent application.

If there are persons you have identified who may be affected, and you have discussed your proposal with these persons, please record any comments made by them and your response, and include this information with your application. If you have written approvals from these parties, then these should be provided as well. The council has a written approval form that can be used for this purpose.

Iwi Settlement Acts

If there is an **Iwi Settlement Act** that covers the area of your application, then there may be "Statutory Acknowledgement" areas which could be adversely affected by your activity. If the location of your activity is within, adjacent to, or may have an adverse effect on, a Statutory Acknowledgement area, then you will need to assess whether the trustees of the Statutory Acknowledgement are affected persons. Information about Statutory Acknowledgements in Northland can be found on the council's webpage at "Statutory Acknowledgements in Northland".

Checklist

The following information **must** be included in your application to ensure that is not returned as incomplete under Section 88 of the RMA.

- ☑ All applicable application form details have been completed.
- ☑ Assessment of Environmental Effects in accordance with Schedule 4 of the RMA.
- ☑ Assessment of effects on tangata whenua and their taonga.
- ☑ Site plan(s). These are required to be of good quality, and preferably electronically, to enable use in resource consent documentation.
- ☑ Evidence of payment of the required minimum estimated initial fee.
- ☐ If you are applying for a coastal permit, evidence that you have provided notice of your application to all groups who have applied for customary marine title in the location of your application and that you have sought their view on the application. The council cannot legally accept an application without evidence of this.

Information Privacy Issues

The information you provide in this application is regarded as official information. It is required under the provisions of the Resource Management Act 1991 to process this application. The information will be held by the council and is subject to the provisions of the Local Government Official Information and Meetings Act 1987, and the Privacy Act 1993. The information you provide in this application will generally be available to the public.

Under Section 88 and/or 127 of the Resource Management Act 1991 (RMA), the undersigned makes this application for resource consent(s).

1 **I/We confirm that I have authority to sign on behalf of the person(s) named as the applicant(s) for this application for resource consent.**

2 **I/We have read, and understand, all of the information contained within this application form, including the requirement to pay any additional actual and reasonable costs for the processing of the application.**

3 **I/We confirm that all of the information provided is true and correct and I understand that any inaccurate information provided could result in my resource consent (if granted) being cancelled.**

Signature(s):  **Date:** 1/10/2021

Signature(s): ..... **Date:** .....

Signature(s): ..... **Date:** .....

Please note that a signature is not required if submitting application electronically.

Onoke Heights Limited

Regional Consent - Land Use

Dip Road, Kamo

Assessment of Environmental Effects and Statutory Analysis

26 November 2021

B&A
Urban & Environmental

Prepared for:
Onoke Heights Limited

B&A Reference:

18541

Status:

Final Revision

Date:

26 November 2021

Prepared by:

Melissa McGrath

Reviewed by:

Alisa Neal

Contents

Appendices

Appendix 1: Record of Title and Interests

Appendix 2: Scheme Plan and Engineering Plans (Blue Wallace)

Appendix 3: Three Waters Design Report (LDE)

Appendix 4: Rules Assessment

Appendix 5: Potentially Contaminated Site Search

Appendix 6: Geotechnical Investigation Report (LDE)

Appendix 7: Earthworks Geotechnical Letter (LDE)

1.0 Applicant and Property Details

To:	Northland Regional Council
Site Address:	Dip Road, Kamo
Applicant Name:	Onoke Heights Limited
Address for Service:	Barker & Associates Ltd PO Box 37 Whangarei 0140 Attention: Melissa McGrath
Legal Description:	Section 1 SO Plan (refer to Record of Title as **Appendix 1**)
Site Area:	6.8700 ha (total)
Site Owner:	Onoke Heights Limited
Regional Plan:	Northland Regional Plan
Regional Plan Zoning:	Operative Regional Water and Soils Plan Not identified on map showing: • Erosion Prone Land • Flood Hazard Proposed Regional Plan (Appeals Version): Groundwater Quality and quantity management units – 'Other Aquifers' River water quantity management unit – 'Coastal River' Hill Country and Low land Areas – 'Lowland Area' and 'Other' Whangārei Swimming Sites Stock Exclusion Areas – 'Upstream Catchment
District Plan Zoning:	Operative District Plan Living 1 Environment Proposed District Plan (Appeals Version) General Residential Zone Operative District Plan - Overlays

	Critical Electricity Line Living Overlay
Additional Limitations:	N/A
Brief Description of Proposal:	To enable bulk earthworks and stormwater discharge associated with a residential development as described within Section 4.
Summary of Reasons for Consent:	Regional Water and Soil Plan for Northland Resource consent is required as a controlled activity pursuant to rule 22.2.1 Diversion of Stormwater from Land Disturbance. Proposed Regional Plan (Appeals Version) Resource consent is required as a **controlled activity** pursuant to rule C.6.4.3 as the stormwater discharge does not comply with the permitted activity standards in C.6.4.1. Resource Consent is also required as a **controlled activity** C.8.3.2 as the earthworks do not comply with all of the permitted activity standards in Rule C.8.3.1, in particular the 5000m2 area limit for earthworks. A full list of reasons for consent is contained within Section 5. Overall, resource consent is required as a **controlled activity.**

We attach an assessment of environmental effects that corresponds with the scale and significance of the effects that the proposed activity may have on the environment.

2.0 Background

This report has been prepared in support of a resource consent application to undertake bulk earthworks of approximately 134,349m^3 (52,799m^3 cut and 81,550m^3 fill), over an area of 6.8ha, with a maximum cut depth of 6m and a maximum fill height of 4m and discharge of stormwater associated with the earthworks on behalf of Onoke Heights Limited in preparation for a 95 residential allotment subdivision and associated access and services located at Dip Road, Kamo. Restricted discretionary resource consent is concurrently being sought from Whangārei District Council (WDC) for the proposed development.

This Assessment of Environmental Effects (AEE) has been prepared in accordance with the requirements of Section 88 of and Schedule 4 to the Resource Management Act 1991 (the Act) and is intended to provide the information necessary for a full understanding of the activity for which consent is sought and any actual or potential effects the proposal may have on the environment.

3.0 Site Context

3.1 Site Description

The 6.8ha subject site is comprised of on a single allotment (legally defined as Section 1 SO 65970), fronting Dip Road, with access to Tuatara Drive (see **Figure 1** below).

Figure 1: Locality plan – see full scale version in **Appendix 2.**

The subject site is vacant, being grassed in pasture, with a scattering of trees within the centre of the site and along the edge of Waitaua Stream. The northern half of the site comprises of a converging south facing slope of up to 11 degrees. The southern part of the site comprises of waning slopes towards the Waitaua Stream on the southern end of the subject site. Fragmented indigenous vegetation with broadleaf forest remnants encompassing the Waitaua Stream extending along the southern boundary of the site.

The site is situated at the north-western residential edge of the suburb of Kamo, located north of Three Mile Bush Road. The site is situated between the existing residential streets of Dip Road and Tuatara Drive. A Whangārei District Council water reservoir (Designation WDC-25) is located directly north of the subject site with water pipe lines from the reservoir extending south along the eastern site boundary (subject to 3m wide easement) to Tuatara Drive. Directly to the east of the subject site is Onoke Reserve comprised of a large area of native vegetation.

Dip Road is defined as a secondary collector road by the District Plan, with two sealed lanes and a carriageway width of approximately 6.4, Dip Road has a legal width of 20m including carriageway, berms and a footpath is located on the eastern side. Dip Road has a speed limit of 80 kilometres per hour along the site frontage, reducing to 50 kilometres per hour 100m south of the proposed new intersection. There are no street trees in the road reserve adjacent to the site. However, there are a number of power poles and light poles that the proposed design has responded to.

Tuatara Drive is defined as an access road by the District Plan, with two sealed lanes being 8.2m between kerb faces and a footpath along the eastern side. It has an internal tee intersection, one leg of which continues north eastwards to existing residential development, the other being a short stub that leads to two existing houses and currently ends only 25 metres west of the intersection. Tuatara Drive has a speed limit of 50 kilometres per hour.

3.2 Records of Title

The development site is contained within a single Record of Title, copy of which are contained in Appendix 1. The only interest of relevance to the processing of this application is the water right easement.

3.3 Surrounding Locality

The surrounding locality is predominantly residential in nature, featuring a mix of single-storey and two-storey dwellings. The existing built form comprises houses that are typically set back from the street by around 5-8m, with either fully open front yards or low fencing. Interconnected suburban streets of Crawford Crescent, Tuatara Drive and Dip Road feed into Three Mile Bush Road. Hurupaki Primary School and Kindergarten are located directly south west of the site within walking distance along Dip Road.

Rural residential development is located to the north west of the site along Dip Road, with

With respect to schools and amenities, Hurupaki Primary School and Kindergarten are located immediately to the east, while Kamo Primary School is located less than 1km to the east. The Local Centre of Kamo approximately 1km east of the site providing community services, convenience shopping and Kamo High School. Neighbourhood shops are within approximately 400m of the site, including dairy and takeaway outlets.

The area is served by public transport and pedestrian infrastructure. The bus network includes services along Three Mile Bush Road within approximately 1000m walking distance from the site.

The area is well serviced by public open space networks with natural reserves within Hurupaki Cone to the west, Onoke Reserve and Hodges Park to the east. Kamo park has active open space located within Kamo Centre.

4.0 Proposal

4.1 Earthworks

The proposed earthworks involve modification of the site to enable the construction of the building platforms, site access and carparking areas, stormwater infrastructure, over an area of approximately 6.8ha. A total of approximately 134,349m^3 (52,799m^3 cut and 81,550m^3 fill) is proposed, with a maximum cut depth of 6m and a maximum fill height of 4m during earthworks. Earthworks will involve modification of the site to enable the construction of the building platforms, site access and carparking areas. Significant retaining of the site is proposed, including walls up to 5m in height (refer to **Appendix 2**, retaining wall scheme plan 20253-01-RC-203).

As previously described the topography of site is sloping, with earthworks proposed to prepare the land for residential development. Engineered retaining walls may be used to support batter slopes and increase flat areas within sites, and may be required with design beyond the cut and fill batter limitations.

An indicative earthworks cut/fill plan prepared by Blue Wallace Surveyors Ltd is provided within the application and attached as **Appendix 2** and supported by Geotechnical Report and Earthworks Geotechnical letter prepared by LDE and attached as **Appendices 6** and **7**.

4.2 Stormwater

The proposed development will be supported by a comprehensively designed stormwater system to be vested with Whangārei District Council. The servicing strategy for the proposed development is set out in the Integrated Three Waters Design report by LDE, included as **Appendix 3**, and the accompanying Engineering Drawings by Blue Wallace Surveyors, included as **Appendix 2**.

The proposed stormwater system has been designed to mitigate the 2yr, 10yr and 100yr storm events to equal or less than pre-development rates, which ensures that it does not affect downstream areas with any increases in flow rates. Additional to the 2, 10 and 100yr storm event mitigation an extended detention volume has been allowed for in the pond with a 24hr drain down period designed in accordance with Auckland Council's GD01.

This includes an onsite stormwater pond to be vested with Whangārei District Council, which will include an extended detention volume to address erosion effects on the stream network that they discharge into and provide water quality treatment for the roads within the development, based on 1/3rd of the 2 year storm.

The proposed stormwater pond is in close proximity to Waitaua stream, however the proposed system will not alter the course of the stream, fish passage will be maintained and no damage will occur to existing flood defences. There are no natural wetlands within 50m of the proposed system.

During Construction

The main source of stormwater from the site will be from surface run-off of rainwater. It is proposed to discharge all stormwater run-off to ground within the construction work area.

In order to minimise the potential for off-site discharge of contaminants from excavation of soils and waste material into stormwater, the following erosion and sediment control measures are proposed and offered as mitigation for this consent application:

- Stabilising the accessway and carparking areas (metal/concrete) as soon as practical as this will provide a safe and tidy access for the following building construction stage;
- The site will be separated into four work areas, surrounded by earth bunds with stormwater from each area being directed to sediment retention ponds (future stormwater ponds);
- Monitor the site after storm events and repair as necessary. Regular maintenance of the devices will also be necessary to ensure their effectiveness during general earthworks; and
- Adopt Auckland Council's GD05 (good guidelines for the industry) as the standard for all devices and sediment control measures.

An Erosion and Sediment Control Plan will be prepared, it is proposed that this control plan and any further detail or a Construction Management Plan be conditioned to provide an opportunity for the nominated contractor to further develop and provide site specific context.

4.3 Mitigation

The proposal includes the following mitigation offered as part of the comprehensive development of the site:

- Location of earthworks will avoid disturbance within the riparian margin of Waitaua Stream.
- Erosion and sediment control during construction (detailed further below).
- Extensive management and treatment of stormwater improving quality of stormwater entering Waitaua Stream (detailed further below).
- Protection by way of reserve the entire length of Waitaua Stream.
- Proposed accidental discovery protocol in accordance with Heritage New Zealand Pouhere Taonga Act.

5.0 Reasons for Consent

A rules assessment against the provisions of the Regional Water and Soil Plan('RWSP'), and the Proposed Regional Plan (appeals version) are attached as **Appendix 4.**

5.1 Operative Regional Water and Soil Plan for Northland (RWSP)

Rule 22.2.1

Under the provisions of the RWSP, resource consent is required pursuant to following:

- Rule 22.2.1 Diversion and discharge of stormwater: As highlighted above, controlled consent is required for a Land Disturbance Activity Rule, accordingly resource consent is also required as a controlled activity pursuant to 22.2.1 (1).

5.2 Proposed Northland Regional Plan (PRP)

Rule C.6.4.3

Under the provisions of the PRP, resource consent is required for the following:

- Rule C.6.4.3 Stormwater discharges - The proposed stormwater system and discharge will be vested with Whangārei District Council as a public stormwater network within the urban area of Whangārei City the proposed stormwater discharge is therefore a controlled activity.

Rule C.8.3.2

- C.8.3.2 Earthworks Controlled Activity - The proposed earthworks include a total area of exposed earth being approximately 6.8ha at any one time. This exceeds the permitted standards in Rule C.8.3.1 –controlled activity.

5.3 NES Contaminated Soils

The Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES Contaminated Soils) were gazetted on 13th October 2011 and took effect on 1st January 2012.

The standards are applicable if the land in question is, or has been, or is more likely than not to have been used for a hazardous activity or industry and the applicant proposes to subdivide or change the use of the land, or disturb the soil, or remove or replace a fuel storage system.

Council property search (PSC180456) was completed in November 2018 which confirms that there is no indication of current or previous activities within the area of the site that are identified as Hazardous Activities and Industries. This report is included as Appendix 5. Use of the subject site has not changed since 2018.

As a result, the NES Contaminated Soils is not applicable and no resource consents are required pursuant to it.

5.4 National Environmental Standard for Freshwater Management

The proposal is assessed as a permitted activity under the NES-FM

5.5 Activity Status

Overall, this application is for a controlled activity under the Regional Water and Soil Plan and a controlled activity under the Proposed Regional Plan.

6.0 Public Notification Assessment (Sections 95A, 95C and 95D)

6.1 Assessment of Steps 1 to 4 (Sections 95A)

Section 95A specifies the steps the council is to follow to determine whether an application is to be publicly notified. These are addressed in statutory order below.

6.1.1 Step 1: Mandatory public notification is required in certain circumstances

Step 1 requires public notification where this is requested by the applicant; or the application is made jointly with an application to exchange of recreation reserved land under section 15AA of the Reserves Act 1977.

The above does not apply to the proposal.

6.1.2 Step 2: If not required by step 1, public notification precluded in certain circumstances.

Step 2 describes that public notification is precluded where all applicable rules and national environmental standards preclude public notification; or where the application is for a controlled activity; or a restricted discretionary, discretionary or non-complying boundary activity.

In this case, the proposal is a controlled activity or a boundary activity. Therefore, public notification is precluded.

6.1.3 Step 3: If not required by step 2, public notification required in certain circumstances.

Step 3 describes that where public notification is not precluded by step 2, it is required if the applicable rules or national environmental standards require public notification, or if the activity is likely to have adverse effects on the environment that are more than minor.

As noted under step 2 above, public notification is not precluded, and an assessment in accordance with section 95A is required, which is set out in the sections below. As described below, it is considered that any adverse effects will be less than minor.

6.1.4 Step 4: Public notification in special circumstances

If an application is not required to be publicly notified as a result of any of the previous steps, then the council is required to determine whether special circumstances exist that warrant it being publicly notified.

Special circumstances are those that are:

- Exceptional or unusual, but something less than extraordinary; or
- Outside of the common run of applications of this nature; or
- Circumstances which make notification desirable, notwithstanding the conclusion that the adverse effects will be less than minor.

The development of the subject site for earthworks and stormwater discharge associated with residential subdivision and development which is anticipated by the District Plan General Residential Zoning.

It is considered that there is nothing noteworthy about the proposal. It is therefore considered that the application cannot be described as being out of the ordinary or giving rise to special circumstances.

6.2 Public Notification Conclusion

Having undertaken the section 95A public notification tests, the following conclusions are reached:

- Under step 1, public notification is not mandatory;
- Under step 2, public notification is not precluded;
- Under step 3, public notification is not required as it is considered that the activity will result in less than minor adverse effects; and
- Under step 4, there are no special circumstances.

Therefore, based on the conclusions reached under steps 3 and 4, it is recommended that this application be processed without public notification.

7.0 Limited Notification Assessment (Sections 95B, 95E to 95G)

7.1 Assessment of Steps 1 to 4 (Sections 95B)

If the application is not publicly notified under section 95A, the council must follow the steps set out in section 95B to determine whether to limited notify the application. These steps are addressed in the statutory order below.

7.1.1 Step 1: Certain affected protected customary rights groups must be notified

Step 1 requires limited notification where there are any affected protected customary rights groups or customary marine title groups; or affected persons under a statutory acknowledgement affecting the land.

The above does not apply to this proposal.

7.1.2 Step 2: If not required by step 1, limited notification precluded in certain circumstances

Step 2 describes that limited notification is precluded where all applicable rules and national environmental standards preclude limited notification; or the application is for a controlled activity (other than the subdivision of land).

In this case, the applicable rules do not preclude limited notification and the proposal is not a controlled activity. Therefore, limited notification is not precluded.

7.1.3 Step 3: If not precluded by step 2, certain other affected persons must be notified

Step 3 requires that, where limited notification is not precluded under step 2 above, a determination must be made as to whether any of the following persons are affected persons:

- In the case of a boundary activity, an owner of an allotment with an infringed boundary;
- In the case of any other activity, a person affected in accordance with s95E.

The application is not for a boundary activity, and therefore an assessment in accordance with section 95E is required and is set out below.

Overall, it is considered that any adverse effects in relation to adjacent properties will be less than minor, and accordingly, that no persons are adversely affected.

7.1.4 Step 4: Further notification in special circumstances

In addition to the findings of the previous steps, the council is also required to determine whether special circumstances exist in relation to the application that warrant notification of the application to any other persons not already determined as eligible for limited notification.

In this instance, having regard to the assessment in section 6.1.4 above, it is considered that special circumstances do not apply.

7.2 Section 95E Statutory Matters

If the application is not publicly notified, a council must decide if there are any affected persons and give limited notification to those persons. A person is affected if the effects of the activity on that person are minor or more than minor (but not less than minor).

In deciding who is an affected person under section 95E:

- Adverse effects permitted by a rule in a plan or national environmental standard (the 'permitted baseline') may be disregarded;
- Only those effects that relate to a matter of control or discretion can be considered (in the case of controlled or restricted discretionary activities); and
- The adverse effects on those persons who have provided their written approval must be disregarded.

Having regard to the above provisions, an assessment is provided below.

7.3 Matters of Discretion

Under section 104A of the Act, as a controlled activity, the consent authority must consider only those matters over which it has reserved its control in its plan, being:

7.3.1 Regional Water and Soil Plan:

22.2.1 Diversion of Stormwater from Land Disturbance.

Matters Subject to Control: The matters over which the Council will exercise control are:

(1) The permissible maximum concentration of contaminants in the discharge.

(2) The size and zone of reasonable mixing.

(3) The adequacy of the proposed stormwater management and treatment systems. (4) The adequacy of the proposed inlets to collect the stormwater at the design return period.

(5) The adequacy of the proposed measures to prevent scouring and erosion of riverbanks or river beds.

(6) The acceptable degree of flooding of adjacent properties.

(7) Information and monitoring requirements.

(8) The duration of any resource consent.

(9) Any necessary staging of works.

7.3.2 Proposed Regional Plan:

C.6.4.3 Stormwater discharges – controlled activity

Matters of control:

1) The maximum concentration or load of contaminants in the discharge.

2) The size of the zone of reasonable mixing.

3) The adequacy of measures to minimise erosion.

4) The adequacy of measures to minimise flooding caused by the stormwater network.

5) The design and operation of the stormwater system and any staging of works.

C.8.3.2 Earthworks – controlled activity

Matters of control:

1) The design and adequacy of erosion and sediment control measures with reference to good management practice guidelines, equivalent to those set out in the Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region 2016 (Auckland Council Guideline Document GD2016/005).

2) The location, extent, timing, and duration of earthworks.

3) The adequacy of site rehabilitation and revegetation measures to control erosion and sediment discharges.

4) Adverse effects on water bodies and coastal water.

5) Management of flooding effects and avoiding increased natural hazard risks on other property.

6) Adverse effects on regionally significant infrastructure.

7) Adverse effects on the following, where present in adjacent fresh waterbodies or the coastal marine area:

a) wāhi tapu, and

b) the identified values of mapped Sites and Areas of Significance to tāngata whenua (refer I Maps | Ngā mahere matawhenua).

7.4 Assessment of Effects on Adjacent Properties

The adjacent properties to be considered in the limited notification assessment under section 95B and 95E are shown in **Figure 2** below, and include:

- Onoke Reserve (North west);
- 28 Tuatara Drive (East);
- 26B Tuatara Drive (East);
- 24 Tuatara Drive (East);
- 22 Tuatara Drive (East);
- 20 Tuatara Drive (South);
- Waitaua Stream Esplanade (South);
- 50 Dip Road (West);
- 54 Dip Road (West);
- 66 Dip Road (West);
- 86 Dip Road (West); and
- WDC Water Reservoir (North).

Figure 2: Adjacent properties in relation to subject site. (Source: Emaps)

The following sections set out an assessment of effects of the proposal, and it is considered that effects in relation to the following matters are relevant:

- Erosion and Sediment Control;

- Stormwater Quality;
- Ecological Effects;
- Flooding Effects; and
- Cultural Effects.

These matters are set out and discussed below:

7.4.1 Erosion and Sediment Control and Construction effects (location, timing, extent and duration of earthworks)

Earthworks are required to modify the site to enable the construction of the building platforms and associated access, parking and services.

It is proposed to excavate approximately 134,349m^3 (52,799m^3 cut and 81,550m^3 fill) over an area of 6.8ha exposed at any one time as depicted on the earthworks plan prepared by Blue Wallace Surveyors Ltd provided in **Appendix 2**.

The topography of the site is sloping earthworks…engineered retaining walls will be used to support batter slopes and increase flat areas within sites, and may be required with design beyond the cut and fill batter limitations.

All earthworks work is anticipated to be completed within the next earthworks season (October to April), will be undertaken during standard working hours (e.g. 7am to 7pm) and working days (e.g. Monday to Saturday). Works are also expected to comply with the construction noise limits as set out within the NZS 6803: 1999 "Acoustics – Construction Noise".

Any effects associated with the construction phase of the project will be temporary in nature, and can be effectively managed through adherence to the erosion and sediment control measures which will be setup before onsite work commences to avoid any potential adverse effects on the surrounding environment. Conditions of consent requiring design and adherence to an erosion and sediment control plan is proposed (see Appendix 3) which will include measures that are designed to ensure that sediment is removed from stormwater runoff prior to discharge from the site. Key elements of the erosion and sediment control plan will include the installation of silt fences, clean water and dirty water diversion channels and a stabilised construction entrance. The proposed erosion and sediment control measures will be implemented in accordance with the Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region (2016) for the duration of the activity.

As well as measures to mitigate erosion and sediment runoff effects, measures to control dust generation and noise generation will also be implemented in accordance with standard good practice procedures.

On the basis of the above, it is considered that any adverse erosion and sediment runoff effects associated with the proposed earthworks will be less than minor.

7.4.2 Stormwater Quality

In order to reduce the potential for discharge of other contaminants from the excavation of the site, the stormwater management procedures and sediment controls outlined above will be implemented. These measures are considered to be appropriate for the scale of the works, and

will avoid or otherwise mitigate potential sedimentation of stormwater and the receiving environment.

The proposed stormwater system has been designed by LDE and is detailed in Three Waters Design Report (Appendix 4). This report concludes that the proposal will improve the quality of stormwater:

- All stormwater from site will be directed to existing and proposed public stormwater system.
- The onsite stormwater pond has been designed to collect the stormwater runoff from impervious and pervious areas of each proposed residential lot and the road reserve and an extended detention volume has been allowed for in the pond with a 24hr drain down period designed in accordance with Auckland Council's GD01. The extended detention reduces the stream erosion and increases water quality in the pond for the runoff from all the individual lots and road reserve areas and will help improve the overall quality of the stream the pond discharges to.

The proposed mitigation will ensure that the proposed earthworks and future development of the proposed residential allotments will improve the stormwater quality.

7.4.3 Ecological Effects

Earthworks associated with the development of the site will be setback from the Riparian Management Area of the Waitaua Stream and a reserve area extending the length of the stream is proposed. The earthworks does have a minimal potential to result in sediment runoff to Waitaua Stream, risk of addition of fine sediment to stream environments during construction phase of the development has the potential to alter water chemistry, increase turbidity and decrease light penetration that affects primary production and feeding for some fish species.

The proposed that all earthworks will be undertaken in accordance with best practice erosion and sediment control plans. This should ensure that any sediment/erosion related effects on water quality and habitat in the downstream receiving environment will be negligible (i.e., minimal sediment mobilization). With the implementation of appropriate silt controls during the construction phase, the effects of earthworks on water quality in the receiving environment during construction will be avoided and the overall level of effect is assessed as low.

The proposed mitigation will ensure that the proposed earthworks, stormwater run off and culvert will have less than minor ecological effects.

7.4.4 Flooding Effects

The proposed stormwater system has been designed by LDE and is detailed in Three Waters Design Report (Appendix 4). This report concludes that the proposal will improve the potential flood hazard risk for adjacent properties and downstream because:

- The onsite stormwater pond has been designed to collect the stormwater runoff from impervious and pervious areas of each proposed residential lot and the road reserve. The pond has been designed with the necessary outlet configuration to mitigate the 2yr, 10yr and 100yr storm events to equal or less than pre-development rates, which ensures that it does not affect downstream areas with any increases in flow rates.
- Additional to the 2, 10 and 100yr storm event mitigation an extended detention volume has been allowed for in the pond with a 24hr drain down period designed in accordance with

Auckland Council's GD01. The extended detention reduces the stream erosion and increases water quality in the pond for the runoff from all the individual lots and road reserve areas and will help improve the overall quality of the stream the pond discharges to.

This proposed mitigation combined with the proposed stormwater solution, will ensure that the proposed earthworks and stormwater discharge will not create or exacerbate any flooding effects on the surrounding environment.

7.4.5 Cultural (waahi Tapu) Effects

The application site is not located within an identified area of cultural significance and the regional plan does not identify recorded sites of significance to Māori within the subject site.

As the subject site is located within the rohe of Ngāti Kahu O Torongare. The importance of Waitaua Stream has been recognised, earthworks within proximity to the Waitaua Stream have been carefully designed to reduce effect on the stream and the watercourse with not be altered. The treatment of any sediment laden stormwater will be contained within the site, prior to the discharge of any 'treated stormwater' to ground. Effects of the proposed earthworks and stormwater will be mitigated by the protection by way of reserve the entire length of Waitaua Stream.

It is considered the proposed mitigation measures, will ensure that the potential for adverse effects on the cultural values of the proposed development, particularly from the proposed earthworks and stormwater discharge will be less than minor.

7.5 Summary of Effects

Overall, any adverse effects on these properties are considered to be less than minor.

It is considered, therefore, that there are no adversely affected persons in relation to this proposal.

7.6 Limited Notification Conclusion

Having undertaken the section 95B limited notification tests, the following conclusions are reached:

- Under step 1, limited notification is not mandatory;
- Under step 2, limited notification is not precluded;
- Under step 3, limited notification is not required as it is considered that the activity will not result in any adversely affected persons; and
- Under step 4, there are no special circumstances.

Therefore, it is recommended that this application be processed without limited notification.

8.0 Consideration of Applications (Section 104)

8.1 Statutory Matters

Subject to Part 2 of the Act, when considering an application for resource consent and any submissions received, a council must, in accordance with section 104(1) of the Act have regard to:

- Any actual and potential effects on the environment of allowing the activity;
- Any relevant provisions of a national environmental standard, other regulations, national policy statement, a New Zealand coastal policy statement, a regional policy statement or proposed regional policy statement; a plan or proposed plan; and
- Any other matter a council considers relevant and reasonably necessary to determine the application.

As a controlled activity, section 104A of the Act states that a council:

(a) must grant the resource consent, unless it has insufficient information to determine whether or not the activity is a controlled activity; and

(b) may impose conditions on the consent under section 108 only for those matters over which it has reserved its control in its plan.

8.2 Weighting of Proposed Plans

The Act requires that before a Plan change becomes operative, any resource consent application be considered in terms of the provisions of both the Operative Plan and a Proposed Plan/Plan Change. In this case, a number of provisions of the Operative Water and Soil Plan do not require consideration because appeals to the Proposed Regional Plan have been settled. Greater weight has been applied to the Proposed Regional Plan.

In this instance and with specific regard to the proposed bulk earthworks for the proposed development, it is considered that both the operative Regional Water and Soil Plan provisions and Proposed Regional Plan (appeals version) provisions seek similar outcomes regarding minimising erosion and discharge of sediment to water. Given this consistency, and the fact that discretionary activity resource consent is required under both plans, it is not considered necessary to undertake a full weighting assessment.

9.0 Effects on the Environment (Section 104(1)(A))

In addition to the above, the following is noted in respect to positive effects and on-site amenity effects:

9.1 Positive Effects

It is considered that the proposal will also result in positive effects as the earthworks and stormwater discharge proposed will be managed in a manner that will improve water quality, reduce flood risk downstream and protect ecological values onsite. These matters are set out and assessed below.

The earthworks and stormwater discharge are a necessary precursor to the proposed development that will enable people to meet the needs of future generations and result in positive effects for the local community.

9.2 Summary OF Effects

Having regard to the actual and potential effects on the environment of the activity resulting from the proposal, it is concluded in the assessment above that any adverse effects relating to the proposal will be acceptable.

Further, it is considered that the proposal will result in significant positive effects as described in section 8.1 above. The earthworks and stormwater discharge are a required precursor to the proposed development that will enable people to meet the needs of future generations and result in positive effects for the local community.

Overall, it is considered that when taking into account the positive effects, any actual and potential adverse effects on the environment of allowing the activity are acceptable.

10.0 Regional Plan and Statutory Documents (Section 104(1)(B))

Section 104(1)(b) of the Act sets out that when considering an application for resource consent, council shall have regard to the relevant provisions of any national environmental standards, other regulations, policy statements (national and regional, including proposed regional policy statements), or plans or proposed plans.

The following planning documents prepared under the RMA are considered relevant to this application.

- National Policy Statement for Freshwater Management
- National Environmental Standards – Fresh Water
- Northland Regional Policy Statement
- Operative Regional Water and Soils Plan
- Proposed Regional Plan (Appeals Version)

10.1 National Policy Statement for Freshwater Management

The fundamental concept of the National Policy Statement for Freshwater Management (NPS-FM) is "Te Mana o te Wai" the fundamental importance of water and recognises that protecting the health of freshwater protects the health and well-being of the wider environment. It protects the mauri of the wai. Te Mana o te Wai is about restoring and preserving the balance between the water, the wider environment, and the community. The only objective of the NPS-FM is:

2.1 Objective

(1) The objective of this National Policy Statement is to ensure that natural and physical resources are managed in a way that prioritises:

(a) first, the health and well-being of water bodies and freshwater ecosystems

(b) second, the health needs of people (such as drinking water)

(c) third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

Policies of the NPS-FM focuses upon the management of freshwater in an integrated way to ensure that the health and well-being of water bodies and freshwater ecosystems is maintained and improved.

The subject site does not contain any wetlands, the Waitaua Stream extends along the southern boundary of the subject site. Policies 2, 3, 5, and 9 are considered relevant to the proposed development. As previously detailed various aspects of the proposed development will have the potential to affect the Waitaua Stream.

During the construction phase of the proposed development bulk earthworks will be undertaken and located outside the riparian management area of the Waiaua Stream. Sediment and erosion control will be in place to mitigate potential affects to the Waiaua Stream.

The proposal will result in residential development being located north the Waiaua Stream, any future built development within the proposed residential allotments will be appropriately setback from site boundaries and physically separated by the proposed reserve. Any stormwater runoff from built form and impervious areas will be directed into the proposed stormwater system.

The proposal includes a comprehensive stormwater system which will result in an onsite stormwater pond (designed to accommodate 2yr, 10 yr and 100yr storm events). The water will discharge from this pond into the Waitaua Stream catchment into the headwaters of the catchment. The full water quality treatment volume for all areas of the development is provided within the pond.

The proposal will result in the entire area of the Waitaua Stream being protected by way of reserve including the surrounding native vegetation. This will ensure on-going protection of native vegetation and the habitat of the Waitaua Stream.

For these reasons, it is considered that the proposal is consistent with the relevant NPS-FM policies and achieves objective 1.

10.2 National Environmental Standard for Freshwater Management

The proposal is considered to be a permitted activity under the NES-FM therefore no further assessment is necessary.

10.3 Northland Regional Policy Statement

The Northland Regional Policy Statement (RPS) covers the management of natural and physical resources across the Northland Region. The provisions within the RPS give guidance at a higher planning level in terms of the significant regional issues. As such it does not contain specific rules that trigger the requirement for consent but rather give guidance to consent applications and the development of Plans on a regional level.

Objectives range from integrated catchment management, improvement of overall quality of Northland's water quality, maintaining ecological flows, protecting areas of significant indigenous ecosystems and biodiversity, sustainable management of natural and physical resources in a way that is attractive for business and investment that will improve the economic wellbeing. enabling economic wellbeing, regional form, the role of tangata whenua kaitiaki role is recognised and provided for in decision making, risks and impacts of natural hazards are minimised, outstanding natural landscapes and features and historic heritage are protected from inappropriate subdivision, use and development.

Relevant policy has been identified and summarised as follows:

- Policy 4.2.1 seeks to improve the overall quality of Northland's water resources by, establishing freshwater objectives, reducing loads of sediment, nutrients and faecal matter to water and promoting and supporting the active management, enhancement and creation of vegetated riparian margins. The propose development will have a positive effect on the fresh water of the Waitaua Stream, as sediment and nutrient run off will be reduced by the proposed stormwater management system. The stream and surrounding area will be protected by proposed reserve and protection of the indigenous vegetation.
- According to Policy 7.1.1 subdivision, use and development of land will be managed to minimise risks of natural hazards. The proposed subdivision and residential use of the site, will be managed to minimise the risk of natural hazards by way of comprehensive design of onsite stormwater management, avoidance of areas high instability hazards.

For these reasons, it is considered that the proposal is consistent with the relevant RPS provisions.

10.4 Operative Northland Regional Water and Soil Plan

The Regional Water and Soil Plan was made operative on 28 August 2004. With respect to this application, the following objectives and policies set out in Chapter 12 are the most relevant to the proposal:

12.5.1 *The protection of the soil resources including soil quality and soil quantity, from degradation or loss as a result of unsustainable land use and land use practices.*

12.5.2. *The safeguarding of the life-supporting capacity of water and ecosystems from the adverse effects of unsustainable land uses and land use practices.*

12.5.4. *Avoid, remedy or mitigate the adverse effects of activities so as to achieve the protection of areas of significant indigenous vegetation, significant habitats of indigenous fauna, natural character of water bodies and their margins; and to recognise and provide for waahi tapu and other sites of significance to tangata whenua.*

In general, these objectives and policies seek to protect soil quality, water quality, and cultural and heritage values from unsustainable land use. Further, the strategic policy direction in chapter 12 of the RWSP is to regulate earthworks to minimise erosion and discharge of sediment to water.

It is considered that the proposed works will be consistent with these objectives and associated policies. Erosion and sediment control measures will be installed and stormwater system has been comprehensively designed which will ensure that any stormwater discharge will be contained within the subject site and appropriately managed to minimise any risk of soil erosion, or surface or groundwater contamination.

10.5 Proposed Northland Regional Plan

The Proposed Regional Plan was notified in September 2017, with all rules in the Proposed Regional Plan having legal effect under Section 86B of the RMA. With respect to this application, Policy D.4.31 (and associated objectives) is the most relevant to the proposal.

D.4.31 Managing the effects of land-disturbing activities

Earthworks, vegetation clearance and cultivation must:

1) *be done in accordance with established good management practices, and*

2) *avoid significant adverse effects, and avoid, remedy or mitigate other adverse effects on:*

   a) *human drinking water supplies, and*

   b) *areas of high recreational use, and*

   c) *aquatic receiving environments that are sensitive to sediment or phosphorus accumulation.*

It is considered that the proposed development is consistent with this direction as there will be no adverse effects on water quality. As established throughout the application, appropriate sediment and erosion control measures will be implemented in accordance with the Guidelines for Land Disturbing Activities in the Auckland Region (2016) to manage any sediment laden runoff for the duration of the activity. This will ensure that any stormwater discharge will be contained within the subject site and appropriately managed to minimise any risk of soil erosion, or surface or groundwater contamination. The proposed works will be stabilised as soon as is practicable after works are complete.

10.6 Summary

It is considered that the proposed development is consistent with the relevant statutory planning documents.

11.0 Part 2 Matters

Section 5 of Part 2 identifies the purpose of the RMA as being the sustainable management of natural and physical resources. This means managing the use, development and protection of natural and physical resources in a way that enables people and communities to provide for their social, cultural and economic well-being and health and safety while sustaining those resources for future generations, protecting the life supporting capacity of ecosystems, and avoiding, remedying or mitigating adverse effects on the environment.

Section 6 of the Act sets out a number of matters of national importance including (but not limited to) the protection of outstanding natural features and landscapes and historic heritage from inappropriate subdivision, use and development.

Section 7 identifies a number of "other matters" to be given particular regard by Council and includes (but is not limited to) Kaitiakitanga, the efficient use of natural and physical resources, the maintenance and enhancement of amenity values, and maintenance and enhancement of the quality of the environment.

Section 8 requires Council to take into account the principles of the Treaty of Waitangi.

Overall, as the effects of the proposal are considered to be less than minor, and the proposal accords with the relevant Regional Plan objectives and policies, and assessment criteria, it is considered that the proposal will not offend against the general resource management principles set out in Part 2 of the Act.

12.0 Other Matters (Section 104(1)(C))

There are no other matters considered relevant to the determination of this application for resource consent.

13.0 Conclusion

Onoke Heights Ltd applies for a landuse consent from the Northland Regional Council for earthworks and stormwater discharge activities associated with the subdivision and residential development of 95 residential allotments, at Dip Kamo. A separate land use and subdivision application is being sought concurrently from Whangārei District Council.

Based on the above report it is considered that:

- The application is a controlled activity and is precluded from public notification;
- Any adverse effects in relation to the proposed activity are considered to be less than minor, and acceptable when considering the positive effects of the proposal;
- The proposal is considered to accord with the Regional Policy Statement and operative and proposed Regional Plans; and
- The proposal is considered to be consistent with Part 2 of the Act.

It is therefore concluded that the proposal satisfies all matters the consent authority is required to assess, and that it can be granted.

AUTHORS

Melissa McGrath

Associate

Alisa Neal

Associate

Barker & Associates Ltd

Date: 26 November 2021

Appendix 1

Record of Title

RECORD OF TITLE
UNDER LAND TRANSFER ACT 2017
FREEHOLD

Search Copy

R.W. Muir
Registrar-General
of Land

Identifier	**NA78D/985**
Land Registration District	**North Auckland**
Date Issued	23 May 1991

Estate	Fee Simple
Area	6.8700 hectares more or less
Legal Description	Section 1 Survey Office Plan 65970
Registered Owners	

Onoke Heights Limited

Interests

Subject to a water pipeline right created by Deed of Easement 61A/47 - 2.8.1985 at 2.35 pm

Subject to Section 27B State-Owned Enterprises Act 1986 (which provides for the resumption of land on the recommendation of the Waitangi Tribunal and which does not provide for third parties, such as the owner of the land, to be heard in relation to the making of any such recommendation)

Subject to Part IV A Conservation Act 1987

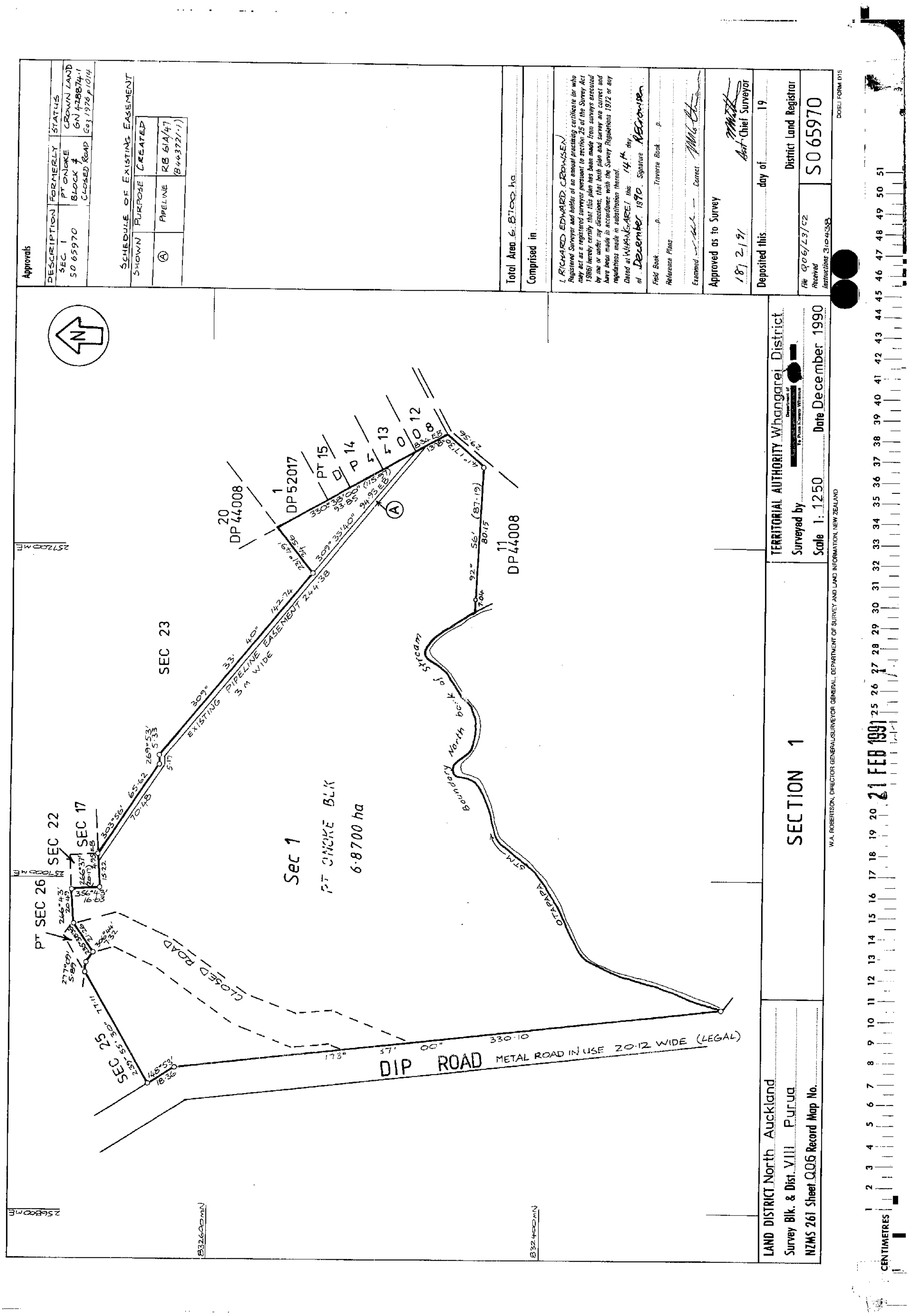
Subject to Section 3 Petroleum Act 1937

Subject to Section 8 Atomic Energy Act 1945

Subject to Section 3 Geothermal Energy Act 1953

Subject to Sections 6 and 8 Mining Act 1971

Subject to Sections 5 and 261 Coal Mines Act 1979



SEC 1
PT ONOKE BLK
6·8700 ha
SEC 23
SEC 22
SEC 17
PT SEC 26
SEC 25
DIP ROAD
METAL ROAD IN USE 20·12 WIDE (LEGAL)
CLOSED ROAD
EXISTING PIPELINE EASEMENT 3 M WIDE
Boundary North bank of Stream
OTAPAPA STM
20 DP44008
1 DP52017
PT 15 DP 41 3008
11 DP44008
SECTION 1
TERRITORIAL AUTHORITY Whangarei District
Scale 1:1250
Date December 1990
LAND DISTRICT North Auckland
Survey Blk. & Dist. VIII Purua
NZMS 261 Sheet Q06 Record Map No.
Total Area 6.8700 ha
Comprised in
Approved as to Survey
Deposited this day of 19
District Land Registrar
S O 65970
Approvals
SCHEDULE OF EXISTING EASEMENT
SHOWN | PURPOSE | CREATED
A | PIPELINE | RB 6A/47 (B443721.1)
DESCRIPTION | FORMERLY | STATUS
SEC 1 SO 65970 | PT ONOKE BLOCK 4 CLOSED ROAD | CROWN LAND GN 428874.1 Gaz 1976 p1014
21 FEB 1991
CENTIMETRES

Appendix 2

Scheme Plan and Engineering Plans

MEMORANDUM OF EASEMENTS

PURPOSE	BURDENED LAND	SHOWN	BENEFITTED LAND
RIGHT OF WAY RIGHT TO CONVEY ELECTRICITY, TELECOMMUNI-CATIONS, GAS & WATER RIGHT TO DRAIN WATER	LOT 301 HEREON	A	LOTS 26-28 HEREON
RIGHT OF WAY RIGHT TO CONVEY ELECTRICITY, TELECOMMUNI-CATIONS, GAS & WATER RIGHT TO DRAIN WATER	LOT302 HEREON	B	LOT 59 - 66 HEREON
RIGHT TO DRAIN WATER	LOT 62 HEREON	D	LOTS 59-61, 63-66,69 -72 & LOT 302 HEREON
	LOT 49 HEREON	E	LOTS 59-66,69-72 & 302 HEREON

MEMORANDUM OF EASEMENTS IN GROSS

PURPOSE	GRANTOR	SHOWN	GRANTEE
RIGHT TO CONVEY ELECTRICITY, TELECOMMUNI-	LOT 95 HEREON	C	NORTHPOWER

AMALGAMATION CONDITION

THAT LOT 301 BE HELD IN THREE UNDIVIDED ONE THIRD SHARES BY THE OWNERS OF LOTS 26 TO 28 AND NEW RECORDS OF TITLE BE ISSUED IN ACCORDANCE HEREWITH

PURSUANT TO SEC. 220(1)(b)(iv) RESOURCE MANAGEMENT ACT 1991. (SEE LINZ REQUEST.....)

THAT LOT 302 BE HELD IN EIGHT UNDIVIDED ONE EIGHTH SHARES BY THE OWNERS OF LOTS 59 TO 66 AND NEW RECORDS OF TITLE BE ISSUED IN ACCORDANCE HEREWITH

PURSUANT TO SEC. 220(1)(b)(iv) RESOURCE MANAGEMENT ACT 1991. (SEE LINZ REQUEST.....)

EXISTING EASEMENTS TO BE EXTINGUISHED

PURPOSE	BURDENED LAND	SHOWN	CREATED BY
RIGHT TO CONVEY WATER	SECTION 1 SO 65970	B SO 50428	

MEMORANDUM OF EASEMENTS IN GROSS

PURPOSE	BURDENED LAND	SHOWN	GRANTEE
RIGHT TO CONVEY WATER	LOT 79 HEREON	F	WDC
	LOT 80 HEREON	G	
	LOT 81 HEREON	H	
	LOT 82 HEREON	I	
	LOT 83 HEREON	J	
	LOT 84 HEREON	K	
	LOT 85 HEREON	L	
	LOT 86 HEREON	M	
	LOT 87 HEREON	N	
	LOT 88 HEREON	O	
	LOT 89 HEREON	P	
	LOT 90 HEREON	Q	
	LOT 91 HEREON	R	
	LOT 92 HEREON	S	
	LOT 93 HEREON	T	
	LOT 94 HEREON	U	

DIP ROAD
LEGAL ROAD
(20.12 WIDE)

TUATARA DRIVE
LEGAL ROAD
(15.24 WIDE)

Lot 595
4992m²
TO VEST AS RECREATION RESERVE IN THE WHANGAREI DISTRICT COUNCIL

Lot 300
14481m²
TO VEST AS ROAD RESERVE IN THE WHANGAREI DISTRICT COUNCIL

Lot 200
6081m²
TO VEST AS DRAINAGE RESERVE IN THE WHANGAREI DISTRICT COUNCIL

Lot 302
614m²

Lot 30
150m²

NOTE:

1) ALL AREAS AND DIMENSIONS SUBJECT TO FINAL SURVEY AND APPROVAL FROM THE WHANGAREI DISTRICT COUNCIL

2) LEGAL DESCRIPTION: SEC 1
SO 65970
(RT. NA78D/985) ML. & AL. MORTIMER, GJ. LOVELL
(RT. NA61A/47) DEED OF EASEMENT
HER MAJESTY THE QUEEN

3) TOTAL AREA: 6.8755 ha.

4) ZONE: LIVING 1

5) AERIAL PHOTO SUBJECT TO DISTORTION

6) CONTOURS SHOWN ARE DERIVED FROM SURVEY.

7) ALL LEVELS ARE IN TERMS OF ONE TREE POINT

CONTOURS SHOWN ARE EXISTING GROUND 0.50m INTERVAL

S:\2020\20253\1. PLANNING\1. SCHEME PLANS\20-253-01-PL-100-REVF.DWG

Size	Scale	Date
A3	1:1500	NOVEMBER 2021

No.	Amendment	Init.	Date	Designed		
10	PARKING BAYS & TREES ADDED	CN	15/11/21	Drawn	CN	21/08/21
11	PARKING BAYS ADDED, ROAD C CL SHIFTED	JMC	22/11/21	Checked		
12	LOT 94/95 BOUNDARY ADJUSTMENT	CN	24/11/21	Approved		

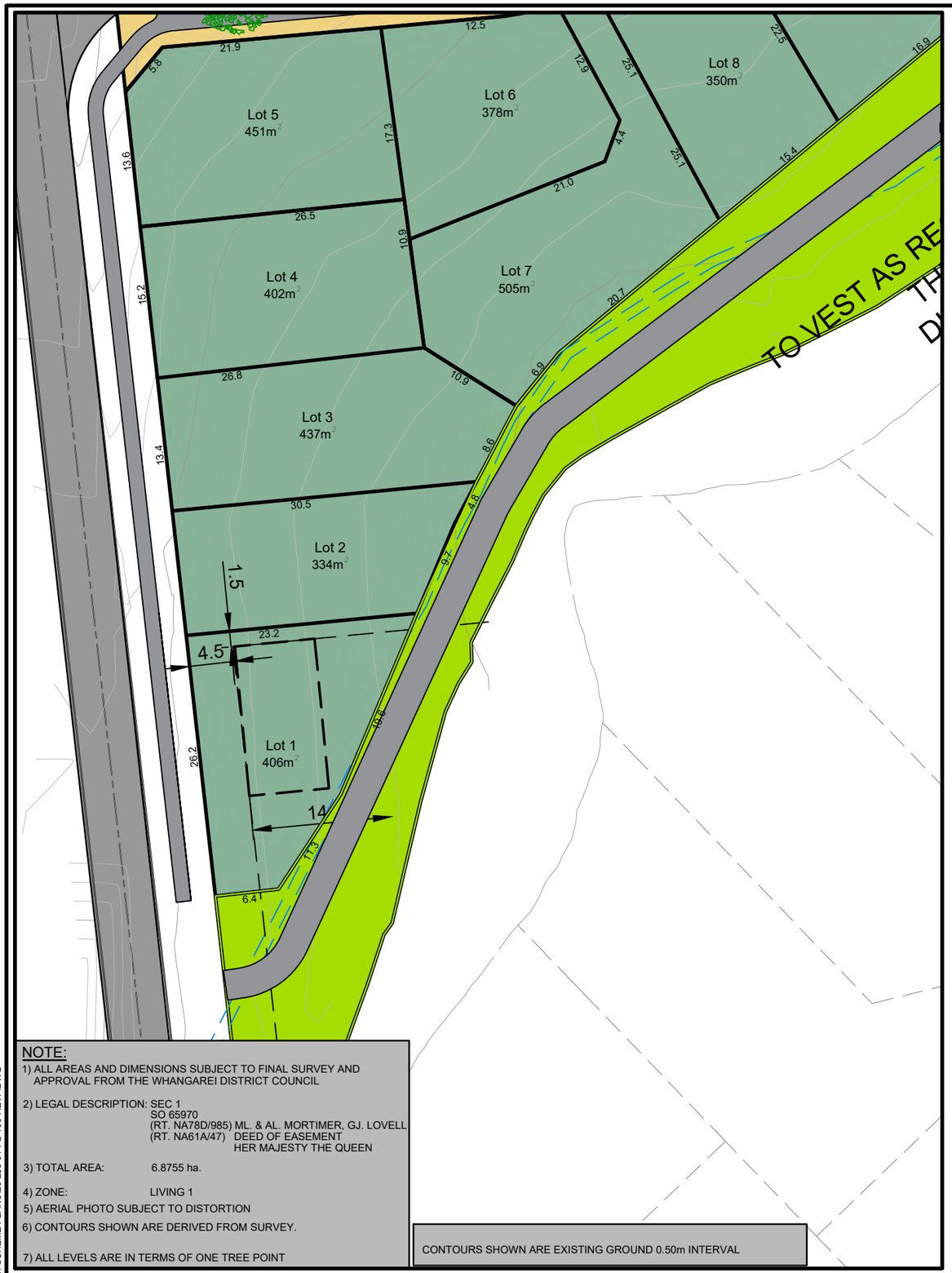
CONCEPT SCHEME PLAN
SECTION 1 SO 65970
47 DIP ROAD, KAMO, WHANGAREI
Prepared for: ONOKE HEIGHTS LIMITED

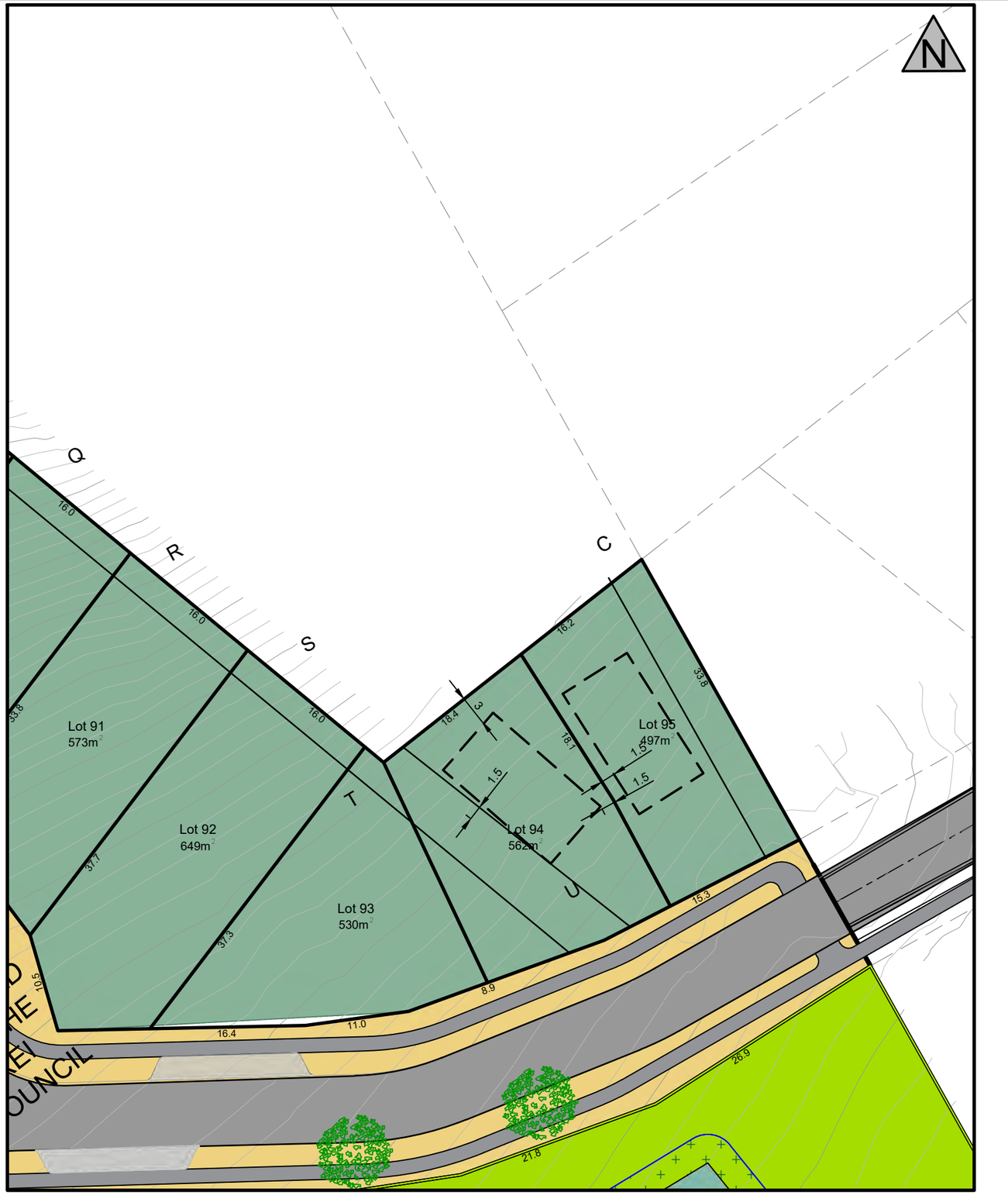
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum 1964

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-PL-102				12





NOTE:

1) ALL AREAS AND DIMENSIONS SUBJECT TO FINAL SURVEY AND APPROVAL FROM THE WHANGAREI DISTRICT COUNCIL

2) LEGAL DESCRIPTION: SEC 1
SO 65970
(RT. NA78D/985) ML. & AL. MORTIMER, GJ. LOVELL
(RT. NA61A/47) DEED OF EASEMENT
HER MAJESTY THE QUEEN

3) TOTAL AREA: 6.8755 ha.

4) ZONE: LIVING 1

5) AERIAL PHOTO SUBJECT TO DISTORTION

6) CONTOURS SHOWN ARE DERIVED FROM SURVEY.

7) ALL LEVELS ARE IN TERMS OF ONE TREE POINT

CONTOURS SHOWN ARE EXISTING GROUND 0.50m INTERVAL

S:\2020\20253\1. PLANNING\1. SCHEME PLANS\20-253-01-PL-100-REVF.DWG

Size	A3	Scale	1:500	Date	NOVEMBER 2021		
No.	Amendment	Init.	Date	Designed	CN	09/11/21	
1	ISSUED FOR INFORMATION	CN	09/11/21	Drawn	CN	09/11/21	
2	LOT 94/95 UPDATED	CN	24/11/21	Checked			
3				Approved			

BUILDING ENVELOPE DETAIL
SECTION 1 SO 65970
47 DIP ROAD, KAMO, WHANGAREI
Prepared for: ONOKE HEIGHTS LIMITED

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: One Tree Point Datum 1964

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-PL-103				2

Size	A3	Scale	1:1500	Date	September 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	09/09/21	Drawn	JMC		
2	Lifted Cul De Sac Head, Updated Volumes	JMC	11/10/21	Checked	CN		
3				Approved			

Resource Consent Plan
Existing Contours
47 Dip Road, Kamo, Whangarei
Prepared for: Onoke Heights Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-200				2

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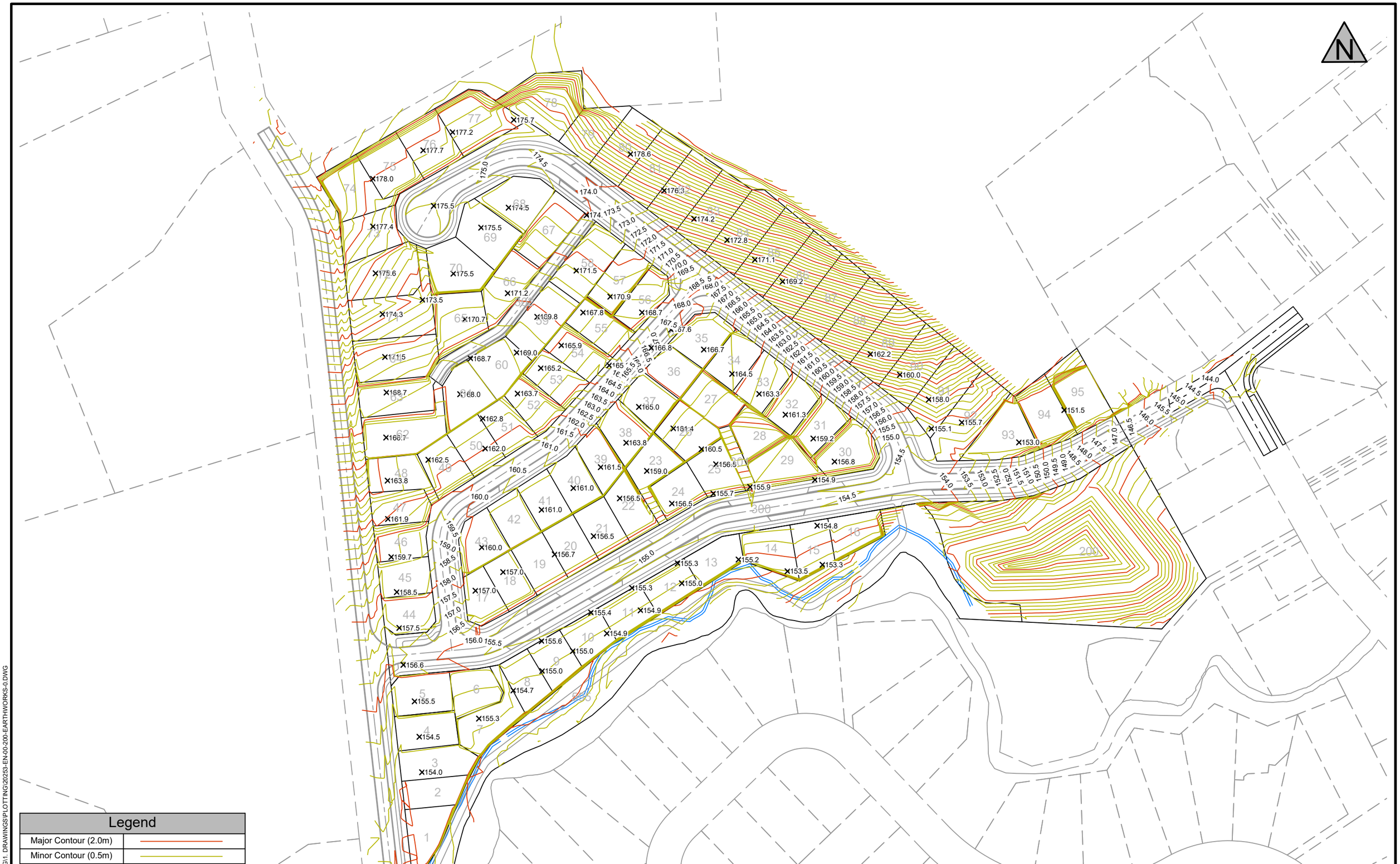

Size A3	Scale 1:1500		Date September 2021			
No.	Amendment	Init.	Date	Designed	JMC	
1	Issued For Resource Consent	JMC	09/09/21	Drawn	JMC	
2	Lifted Cul De Sac Head, Updated Volumes	JMC	11/10/21	Checked	CN	
3				Approved		

Resource Consent Plan
Design Contours
47 Dip Road, Kamo, Whangarei
Prepared for: Onoke Heights Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-201				2

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N

Surface Analysis: Elevation Ranges				
Number	Colour	Minimum Elevation (m)	Maximum Elevation (m)	Volume (m³)
1		-6.00	-4.00	475
2		-4.00	-3.00	2049
3		-3.00	-2.00	4964
4		-2.00	-1.00	9856
5		-1.00	-0.05	15429
6		-0.05	0.05	2864
7		0.05	1.00	29487
8		1.00	2.00	17810
9		2.00	3.00	7389
10		3.00	4.00	3030
11		4.00	6.40	1450

Volume

Base Surface	EG 20210423 - 250mm
Comparison Surface	Design Subgrade
Cut Factor	1.000
Fill Factor	1.250
Cut volume (adjusted)	35580.052 Cu. M.
Fill volume (adjusted)	80414.466 Cu. M.
Net volume (adjusted)	44834.415 Cu. M.<Fill>
Cut volume (unadjusted)	35580.052 Cu. M.
Fill volume (unadjusted)	64331.573 Cu. M.
Net volume (unadjusted)	28751.522 Cu. M.<Fill>

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Size A3 | Scale 1:1500 | Date September 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	09/09/21
2	Lifted Cul De Sac Head, Updated Volumes	JMC	11/10/21
3			

Designed JMC | Drawn JMC | Checked CN | Approved

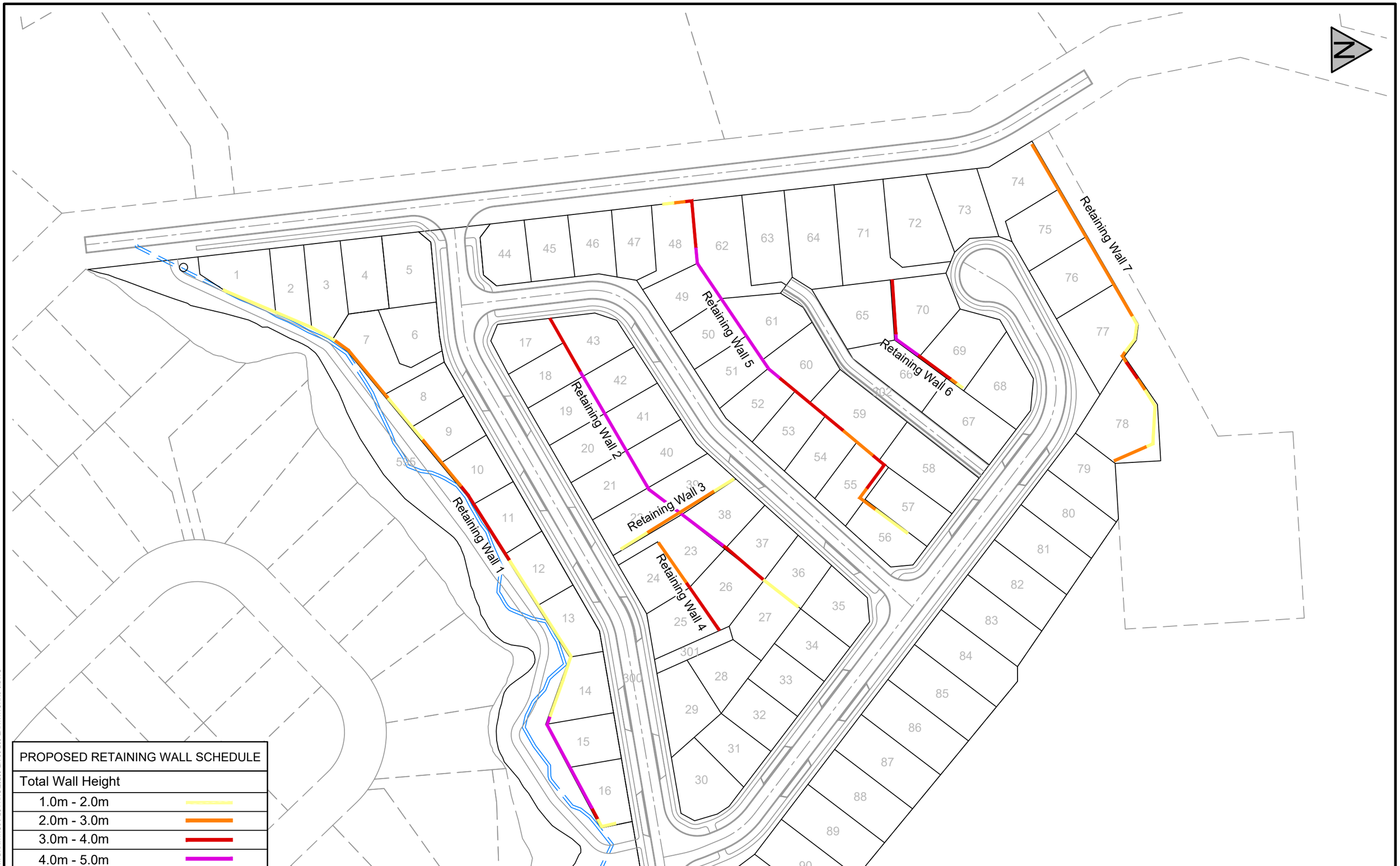
Resource Consent Plan
Cutfill Volume
47 Dip Road, Kamo, Whangarei
Prepared for: Onoke Heights Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref. 20253-01-RC-202 | Stg. | Purp. | Dwg. # | Revision: 2



PROPOSED RETAINING WALL SCHEDULE	
Total Wall Height	
1.0m - 2.0m	
2.0m - 3.0m	
3.0m - 4.0m	
4.0m - 5.0m	

S:\2020\20253\2. ENGINEERING\1. DRAWINGS\PLOTTING\20253-EN-00-200-EARTHWORKS-0.DWG

Size A3 | Scale 1:1250 | Date September 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	09/09/21
2	Lifted Cul De Sac Head, Updated Volumes	JMC	11/10/21
3	Upated Retaining Wall Schedule	JMC	19/10/21

Designed	JMC
Drawn	JMC
Checked	CN
Approved	

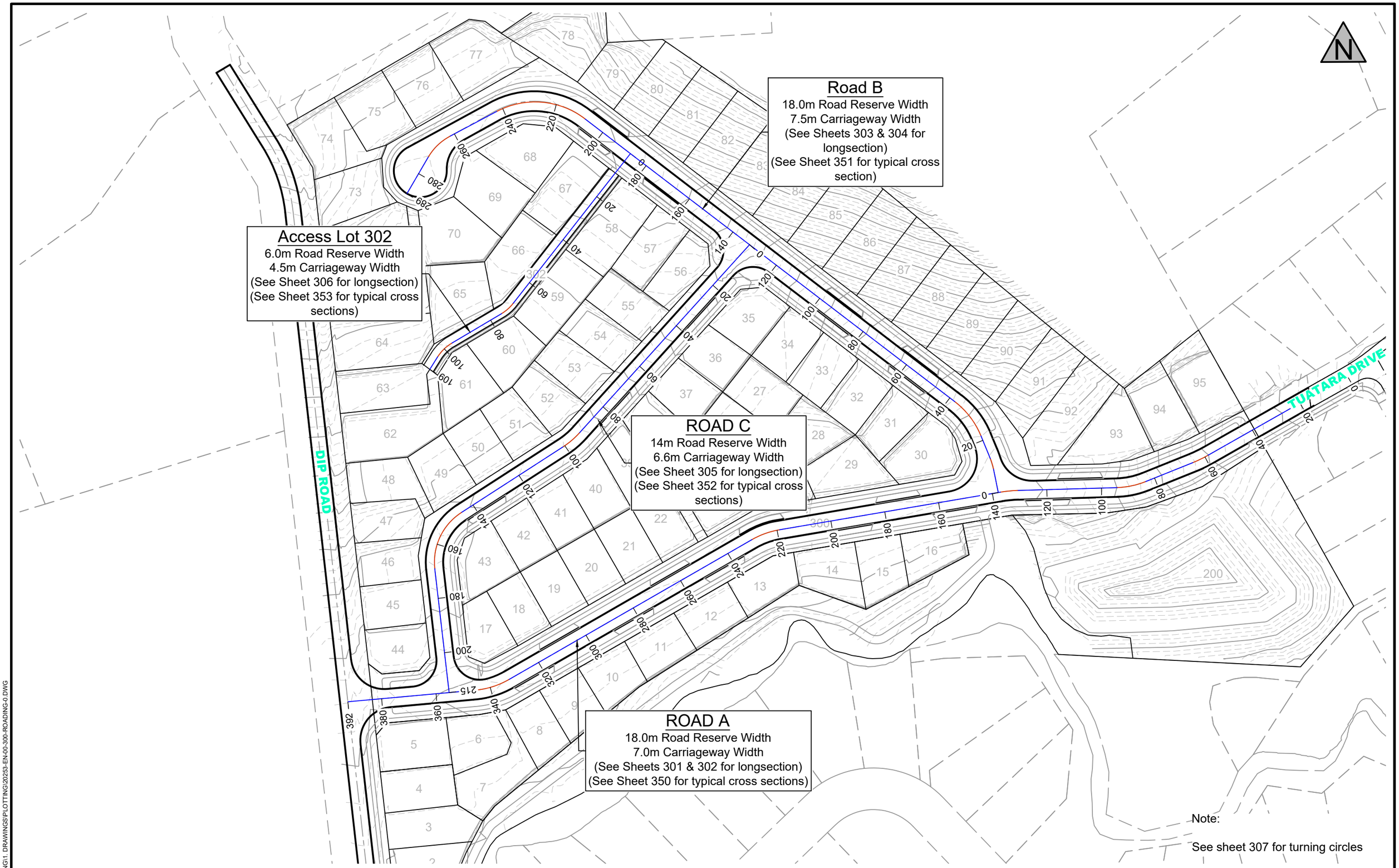
Resource Consent Plan
Retaining Wall Scheme
47 Dip Road, Kamo, Whangarei
Prepared for: Onoke Heights Limited

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-203				2



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Size	A3	Scale	1:1250	Date	November 2021		
No.	Amendment	Init.	Date	Designed			
1	Issued For Resource Consent	JMC	15/11/21	Drawn			
2				Checked			
3				Approved			

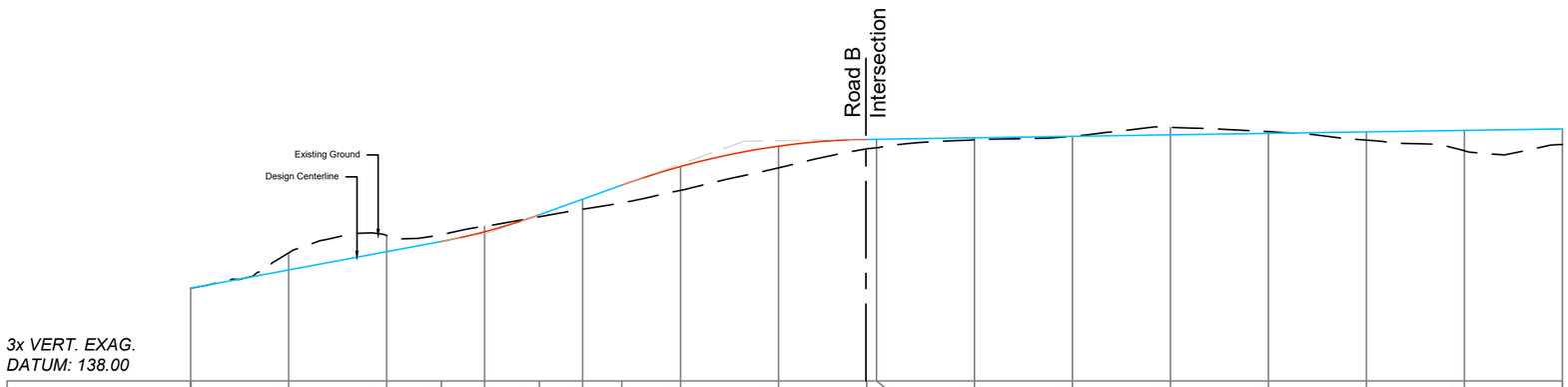
Resource Consent Plan
Roading Overview
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

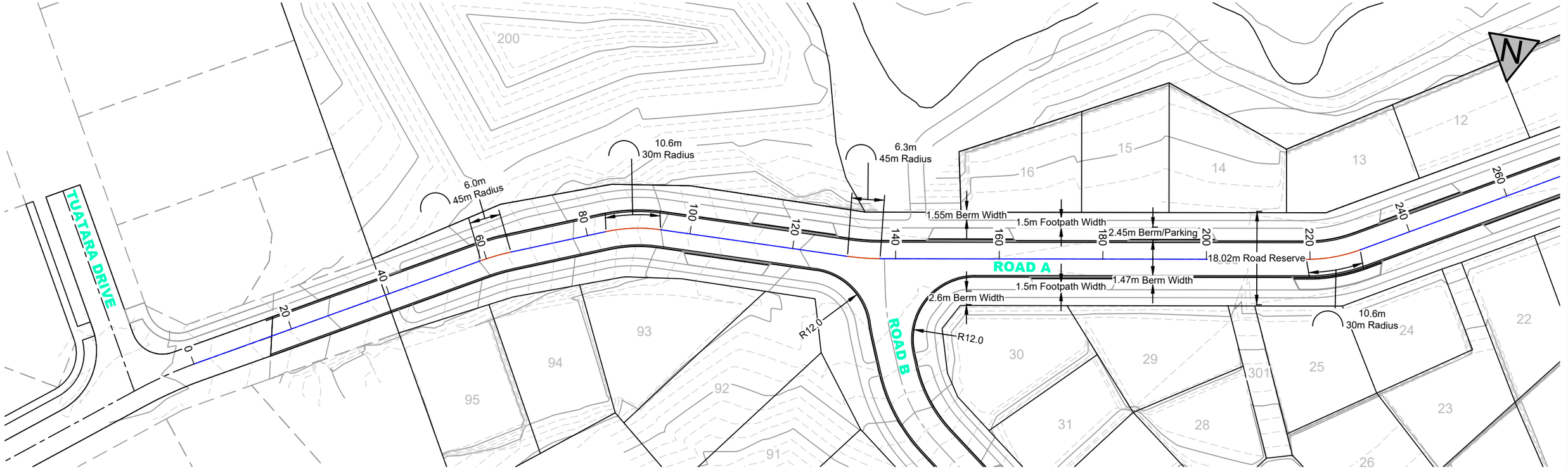
BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-300				1



3x VERT. EXAG.
DATUM: 138.00

DESIGN LEVELS	144.30	145.54	146.78	147.47	148.13	149.28	150.34	151.29	152.56	153.94	154.40	154.41	154.51	154.61	154.71	154.81	154.91	155.01	155.11
EXISTING LEVELS	144.30	146.70	147.87	147.92	148.50	149.15	149.66	150.09	150.94	152.47	153.76	153.83	154.37	154.61	155.22	154.93	154.35	153.63	154.05
CUT/FILL DEPTH	0.00	-1.16	-1.10	-0.46	-0.37	0.14	0.68	1.20	1.62	1.47	0.64	0.58	0.14	0.00	-0.51	-0.12	0.56	1.38	1.06
CHAINAGE	0.0	20	40	51.2	60	71.2	80	88.0	100	120	138.0	140	160	180	200	220	240	260	280.0
VERTICAL GEOMETRY		6.2% 51.18			VC L: 20.00 IP CH: 61.18/RL: 148.09		11.9% 16.82		VC L: 50.00 IP CH: 113.00/RL: 154.28			0.5% 177.31							

ROAD A LONG SECTION



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Size	A3	Scale	1:750	Date	November 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	15/11/21
2			
3			

Designed | Drawn | Checked | Approved

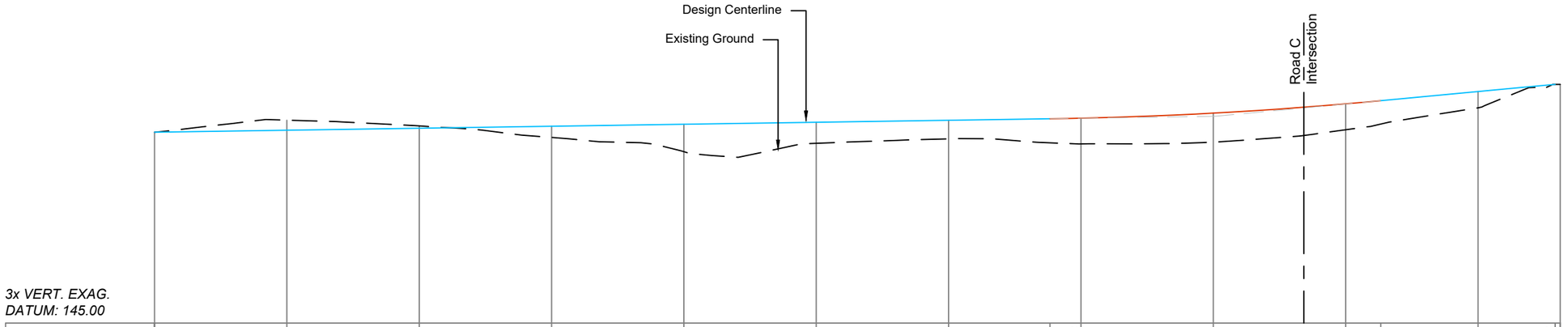
Resource Consent Plan
Road A Longsection CH 0.00 - 280.00
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

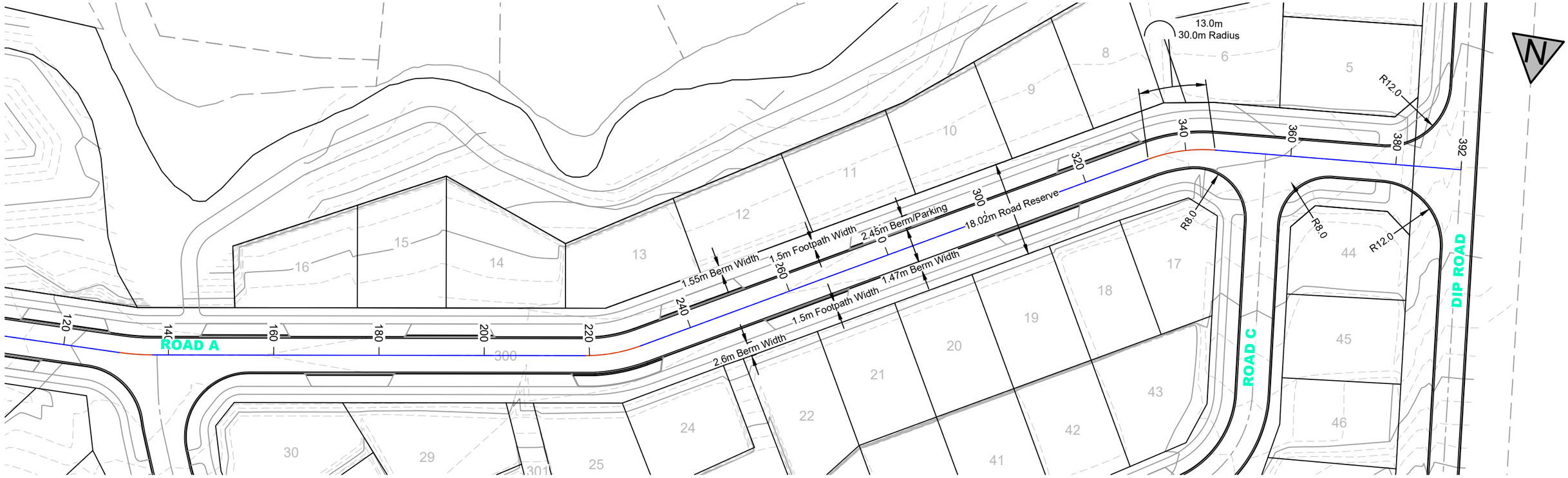
BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-301				1



3x VERT. EXAG.
DATUM: 145.00

DESIGN LEVELS	154.61	154.71	154.81	154.91	155.01	155.11	155.21	155.29	155.32	155.57	156.04	156.20	156.66	157.02	
EXISTING LEVELS	154.61	155.22	154.93	154.35	153.63	154.05	154.28	154.08	154.02	154.11	154.73	155.02	155.84	157.02	157.02
CUT/FILL DEPTH	0.00	-0.51	-0.12	0.56	1.38	1.06	0.94	1.21	1.29	1.46	1.31	1.18	0.82	0.00	
CHAINAGE	180.0	200	220	240	260	280	300	315.3	320	340	360	365.3	380	391.7	392
VERTICAL GEOMETRY		0.5% 177.31							VC L: 50.00 IP CH: 340.31/RL: 155.41				3.1% 21.41	3.0% 4.94	

ROAD A LONG SECTION



Size	A3	Scale	1:750	Date	November 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	15/11/21
2			
3			

Designed		
Drawn		
Checked		
Approved		

Resource Consent Plan
Road A Longsection CH 180.00 - 392.00
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-302				1

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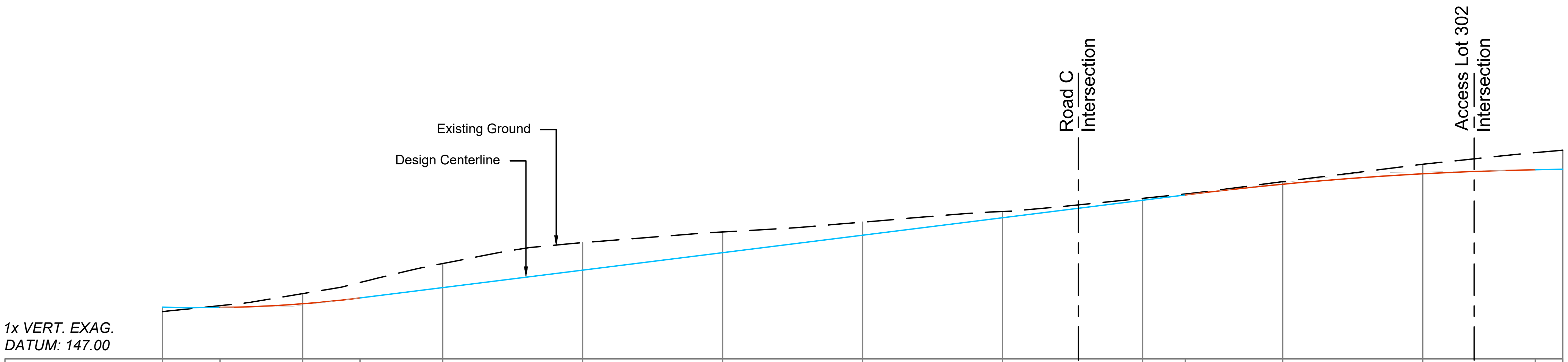
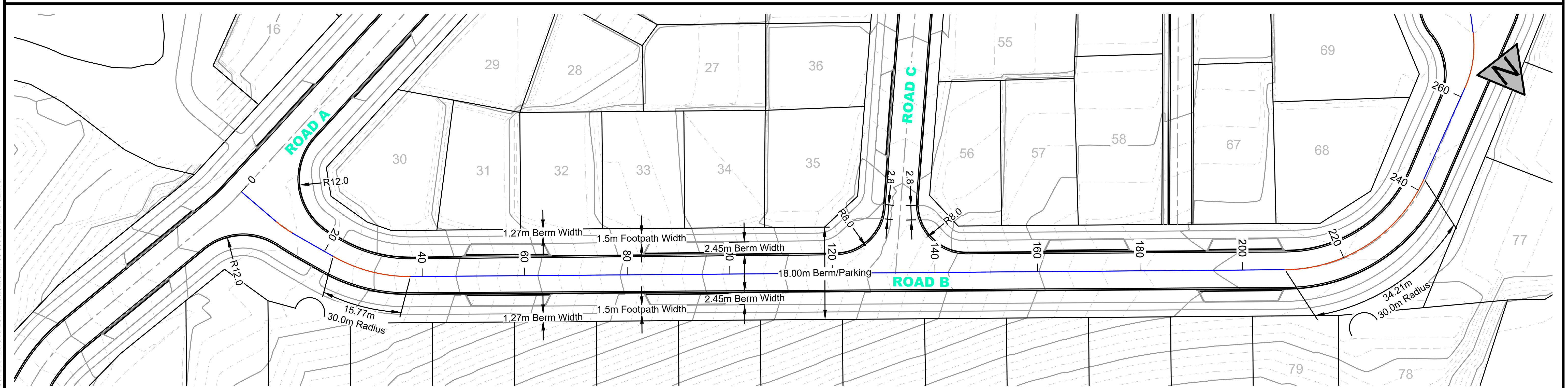
1x VERT. EXAG.
DATUM: 147.00



DESIGN LEVELS	154.40	154.35	154.87	155.70	157.18	159.68	162.18	164.68	167.18	169.68	170.44	171.97	173.46	174.04	174.12
EXISTING LEVELS	153.75	154.60	156.33	157.92	160.63	163.62	165.15	166.55	168.07	169.95	170.57	172.34	174.83	176.50	176.83
CUT/FILL DEPTH	0.65	-0.25	-1.45	-2.21	-3.45	-3.94	-2.97	-1.87	-0.89	-0.27	-0.13	-0.36	-1.36	-2.46	-2.72
CHAINAGE	0.0	8.2	20	28.2	40	60	80	100	120	140	146.1	160	180	196.1	200.0

VERTICAL GEOMETRY: 0.0% | 3.0% 0.0 | 1.0% 4.96 | VC L: 20.00 IP CH: 18.21/RL: 154.45 | 12.5% 117.88 | VC L: 50.00 IP CH: 171.09/RL: 173.56 | 1.9% 92.54

ROAD B LONG SECTION



Size A3	Scale 1:750		Date November 2021		
No.	Amendment	Init.	Date	Designed	
1	Issued For Resource Consent	JMC	15/11/21	Drawn	
2				Checked	
3				Approved	

Resource Consent Plan
Road B Longsection CH 0.00 - 200.00
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: ....

BW Ref. Stg. Purp. Dwg. #: 20253-01-EN-303
Revision: 1

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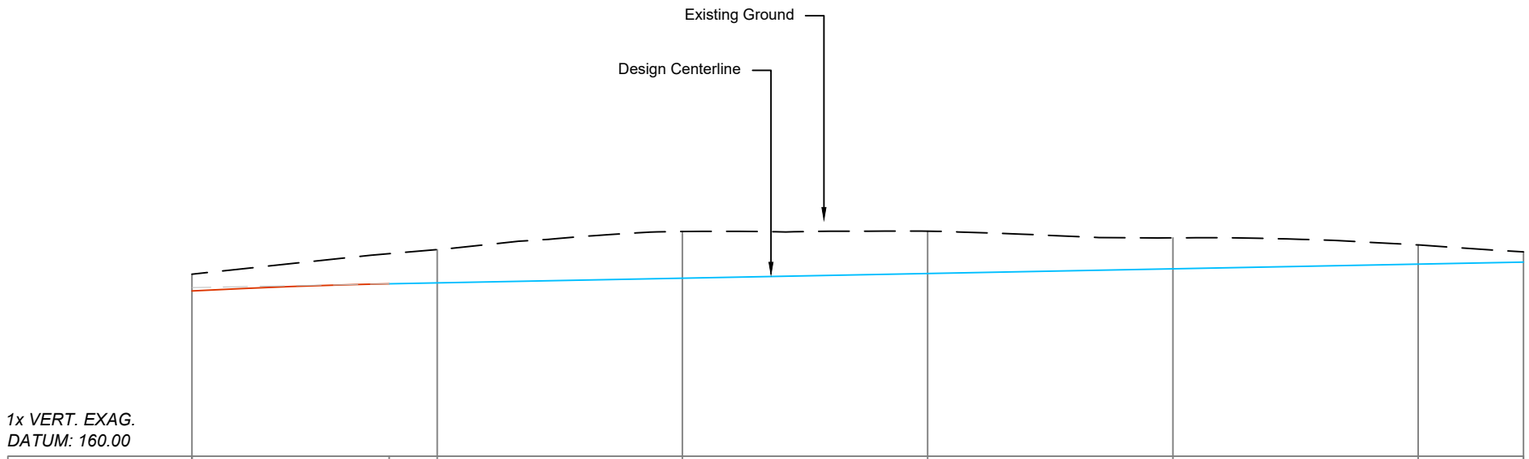
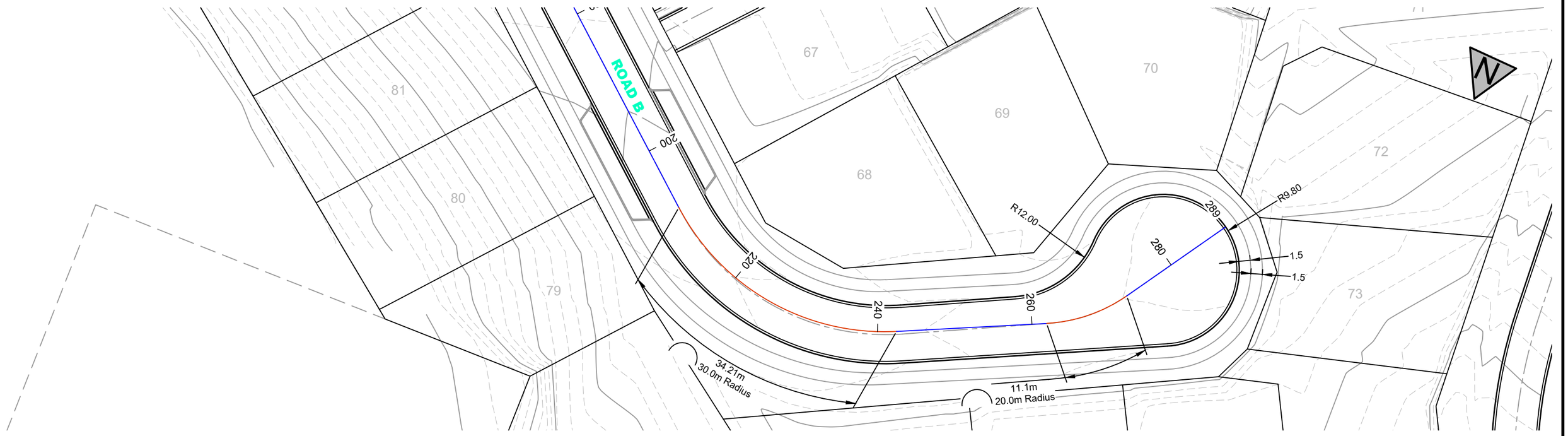


1x VERT. EXAG.
DATUM: 160.00

DESIGN LEVELS	173.46	174.04	174.12	174.50	174.88	175.26	175.65	175.81
EXISTING LEVELS	174.83	176.50	176.83	178.31	178.33	177.79	177.21	176.65
CUT/FILL DEPTH	-1.38	-2.46	-2.72	-3.81	-3.45	-2.53	-1.57	-0.84
CHAINAGE	180.0	196.1	200	220	240	260	280	288.6
VERTICAL GEOMETRY		VC L: 50.00 IP CH: 171.09/RL: 173.56		1.9% 92.54				

ROAD B LONG SECTION



Size	A3	Scale	1:500	Date	November 2021		
No.	Amendment	Init.	Date	Designed			
1	Issued For Resource Consent	JMC	15/11/21	Drawn			
2				Checked			
3				Approved			

Resource Consent Plan
Road B Longsection - CH 120.0 - 289.0
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-304				1

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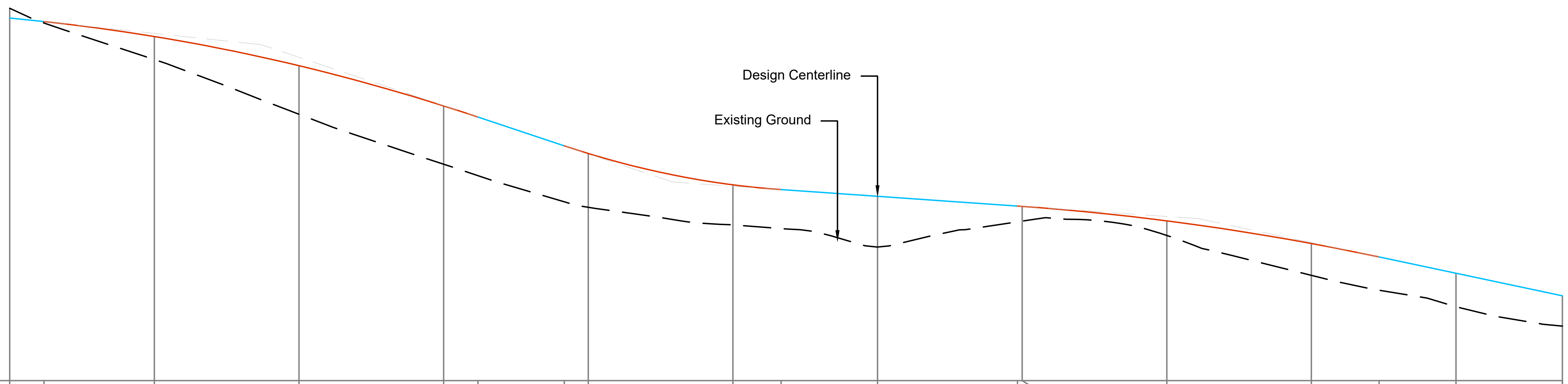
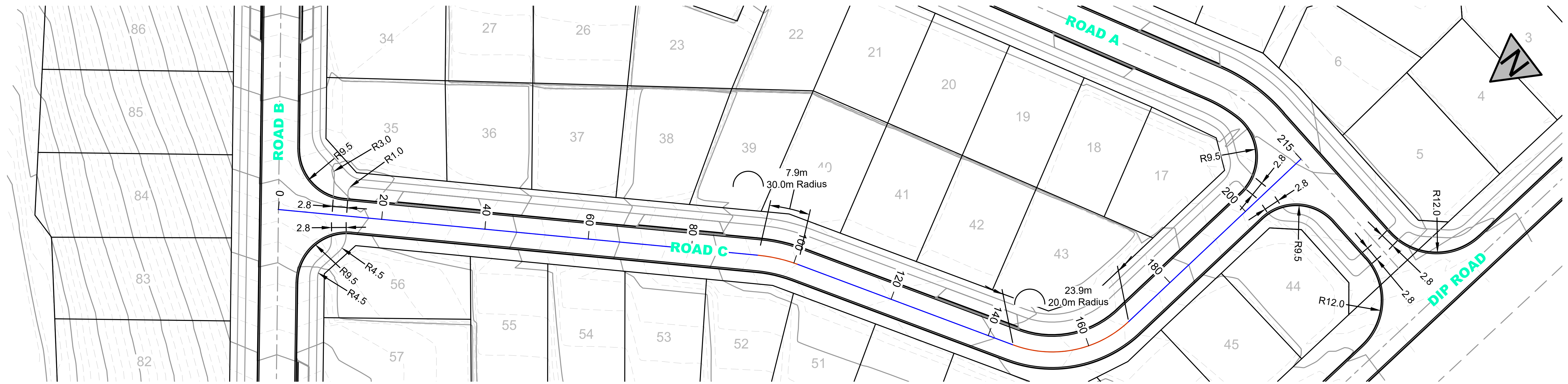


3x VERT. EXAG.
DATUM: 152.00

DESIGN LEVELS	168.72	168.55	167.87	166.52	164.67	164.15	162.82	162.47	161.03	160.81	160.50	160.05	160.03	159.37	158.32	157.70	156.95	155.91
EXISTING LEVELS	169.17	168.48	166.80	164.28	161.98	161.45	160.25	159.99	159.18	159.01	158.16	159.32	159.35	158.69	156.85	156.17	155.40	154.51
CUT/FILL DEPTH	-0.45	0.07	1.06	2.24	2.69	2.70	2.58	2.48	1.85	1.80	2.34	0.73	0.68	0.67	1.47	1.53	1.54	1.39
CHAINAGE	0.0	4.7	20	40	60	64.7	76.7	80	100	106.7	120	139.4	140	160	180	189.4	200	214.7

VERTICAL GEOMETRY								
-3.5% 4.75	VC L: 60.00 IP CH: 34.75/RL: 167.49	-11.1% 11.93	VC L: 30.00 IP CH: 91.68/RL: 161.16	-2.3% 32.67	VC L: 50.00 IP CH: 164.35/RL: 159.47	-7.1% 25.36	10.7% 20.56

ROAD C LONG SECTION



Size A3	Scale 1:750			Date November 2021	
No.	Amendment	Init.	Date	Designed	
1	Issued For Resource Consent	JMC	15/11/21	Drawn	
2				Checked	
3				Approved	

Resource Consent Plan
Road C Longsection
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953
Resource Consent Number: ....
BW Ref. Stg. Purp. Dwg. # 20253-01-EN-305
Revision: 1

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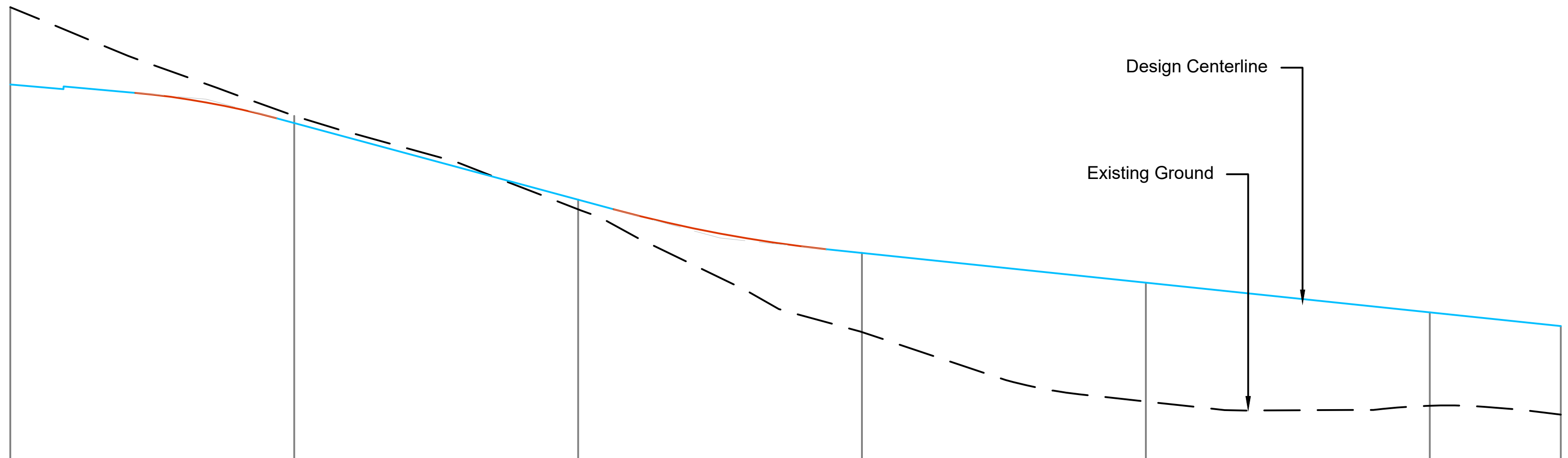
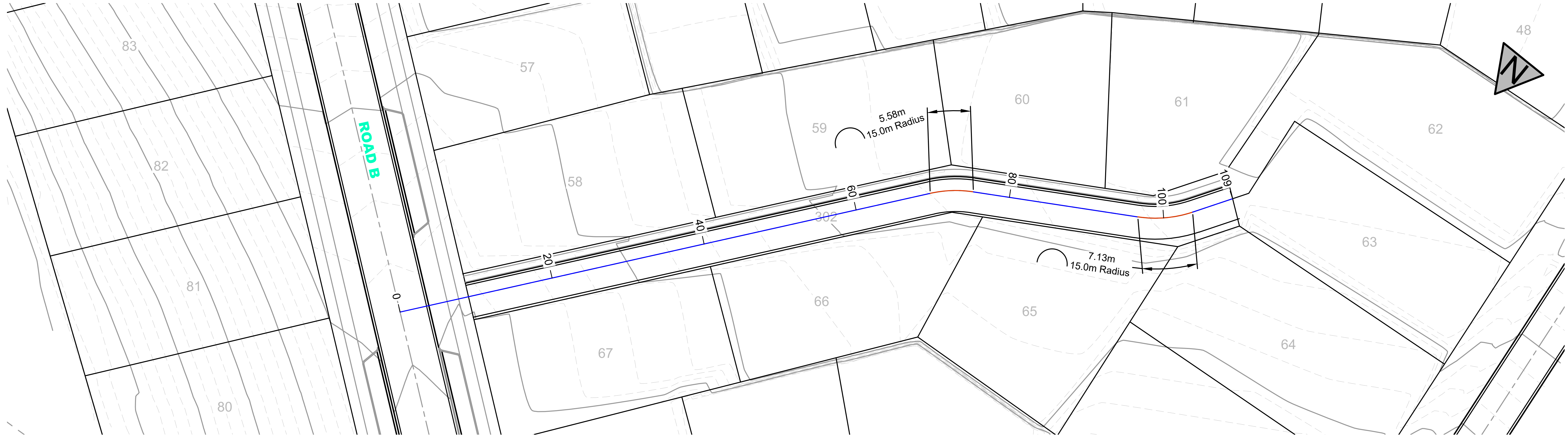


3x VERT. EXAG.
DATUM: 165.00

DESIGN LEVELS	173.78	173.59	172.99	172.88	171.08	170.86	169.92	169.83	169.14	168.44	168.12
EXISTING LEVELS	175.60	174.39	173.19	173.05	170.85	170.49	168.21	167.98	166.35	166.25	166.04
CUT/FILL DEPTH	-1.82	-0.80	-0.20	-0.17	0.23	0.36	1.71	1.86	2.79	2.19	2.08
CHAINAGE	0.0	8.8	18.8	20	40	42.5	57.5	60	80	100	109.2

VERTICAL GEOMETRY: -2.9% 3.75 | 0.0% 0.01 | -3.0% 5.05 | VC L: 10.00 IP CH: 13.81/RL: 173.44 | -9.0% 23.69 | VC L: 15.00 IP CH: 50.00/RL: 170.18 | -3.5% 51.73

ACCESS LOT 302 LONG SECTION



Size A3	Scale 1:500		Date November 2021			
No.	Amendment	Init.	Date	Designed		
1	Issued For Resource Consent	JMC	15/11/21	Drawn		
2				Checked		
3				Approved		

Resource Consent Plan
Access Lot 302 Longsection
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

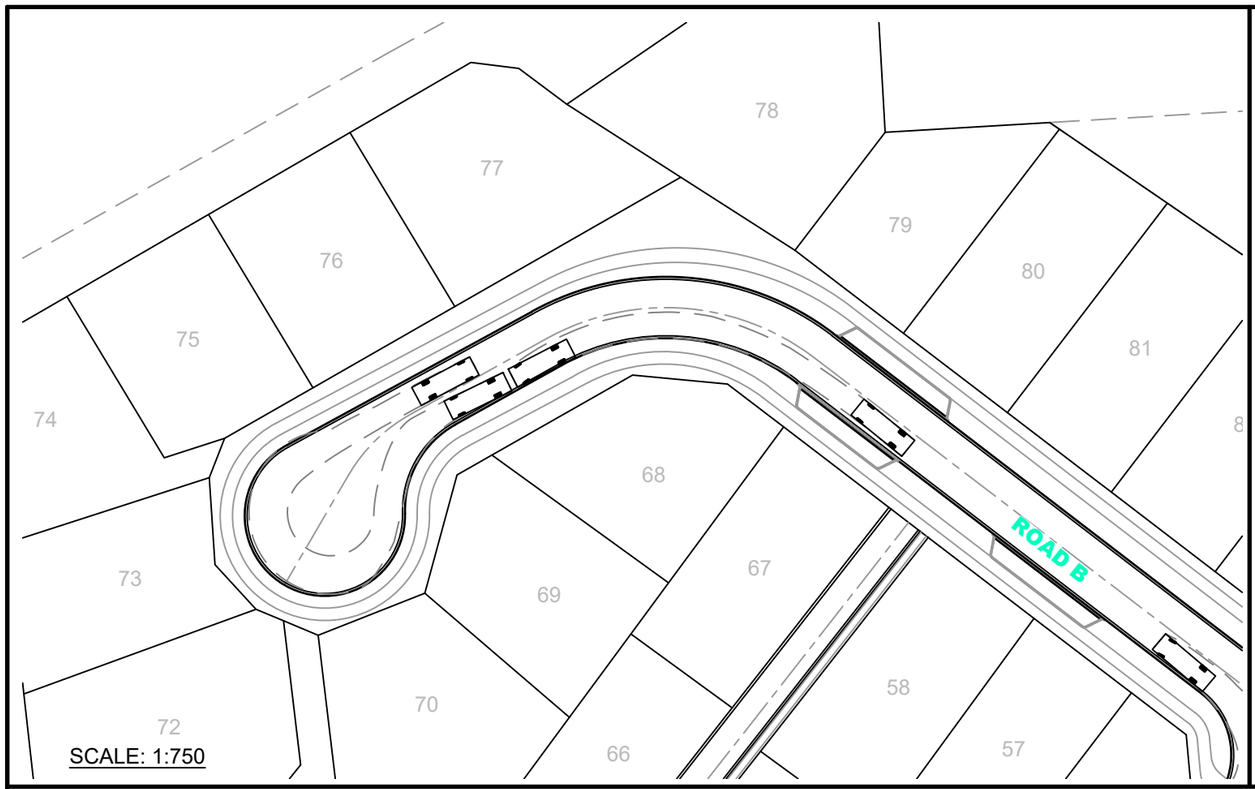
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: ....

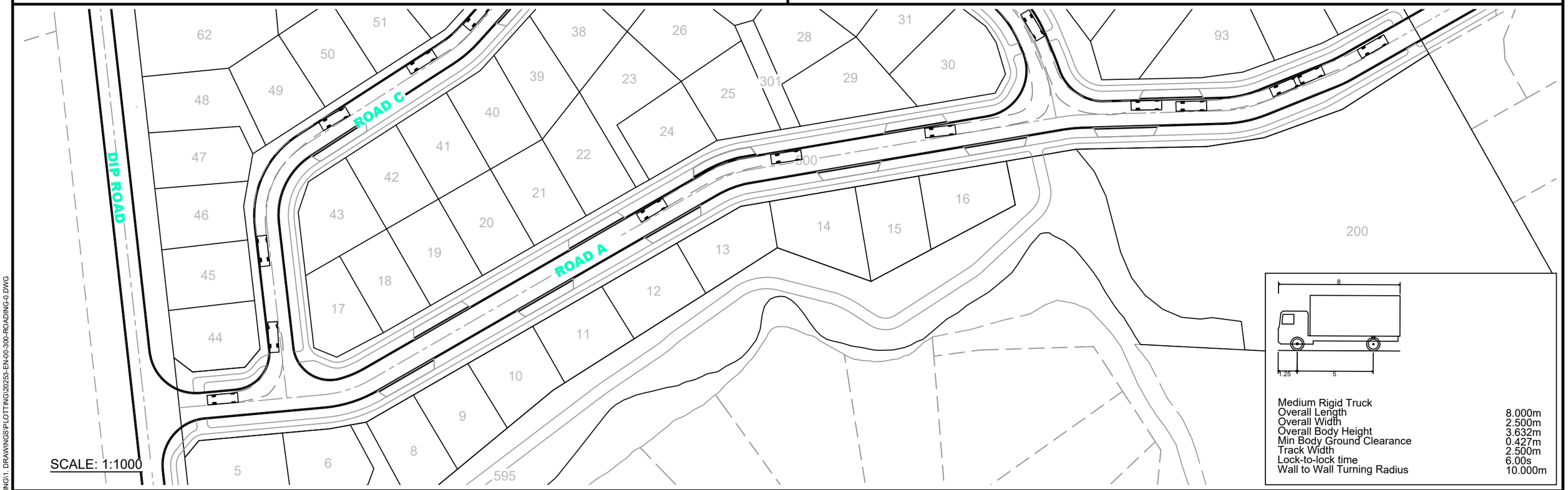
BW Ref. Stg. Purp. Dwg. #: 20253-01-EN-306
Revision: 1

S:\2020\20253\2. ENGINEERING\1. DRAWINGS\PLOTTING\20253-EN-00-300-ROADING-0.DWG



SCALE: 1:750

SCALE: 1:750



SCALE: 1:1000

Medium Rigid Truck	
Overall Length	8.000m
Overall Width	2.500m
Overall Body Height	3.632m
Min Body Ground Clearance	0.427m
Track Width	2.500m
Lock-to-lock time	6.00s
Wall to Wall Turning Radius	10.000m

Size	A3	Scale	AS SPECIFIED	Date	November 2021		
No.	Amendment	Init.	Date	Designed			
1	Issued For Resource Consent	JMC	15/11/21	Drawn			
2				Checked			
3				Approved			

Resource Consent Plan
Vehicle Tracking Curves
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-307				1

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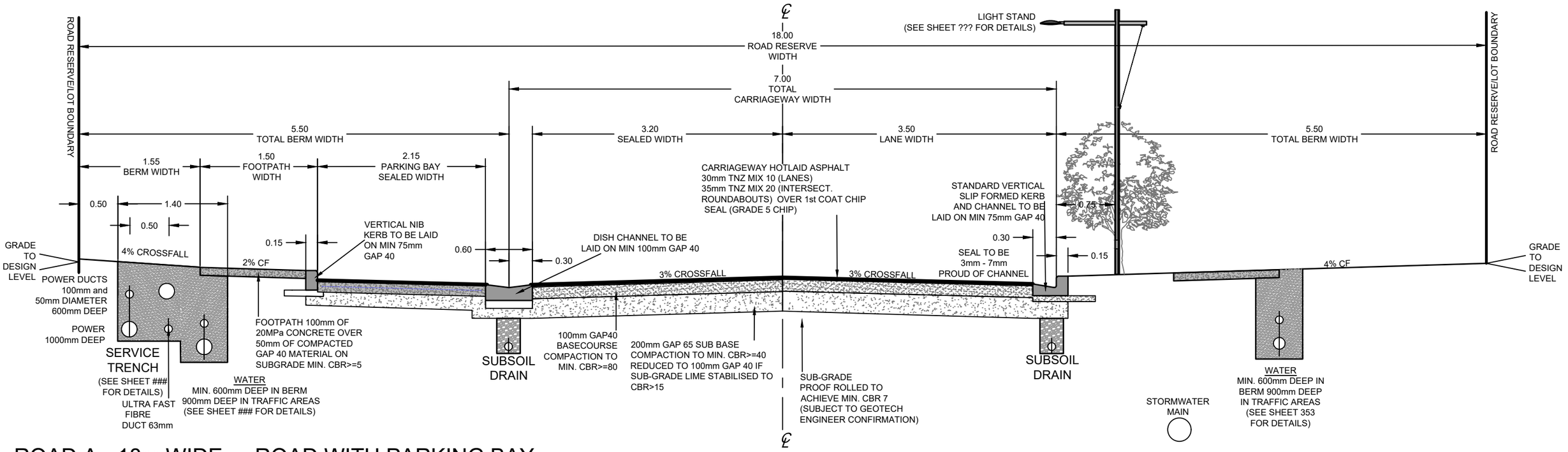
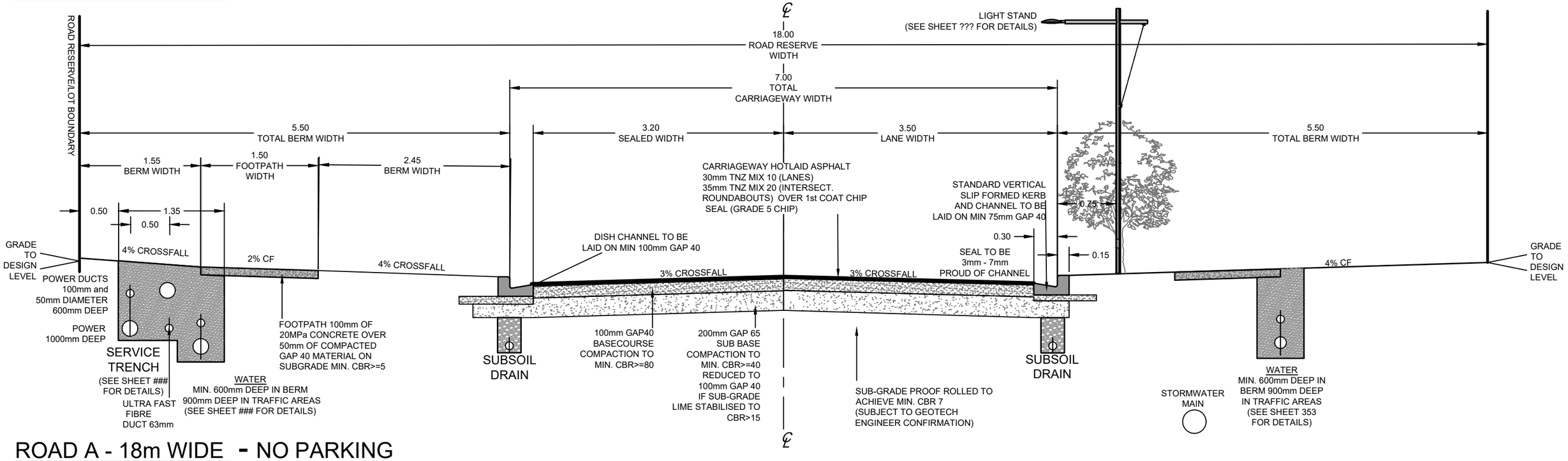


ROAD A - 18m WIDE - ROAD WITH PARKING BAY



ROAD A - 18m WIDE - NO PARKING

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Size	A3	Scale	1:50	Date	November 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/11/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

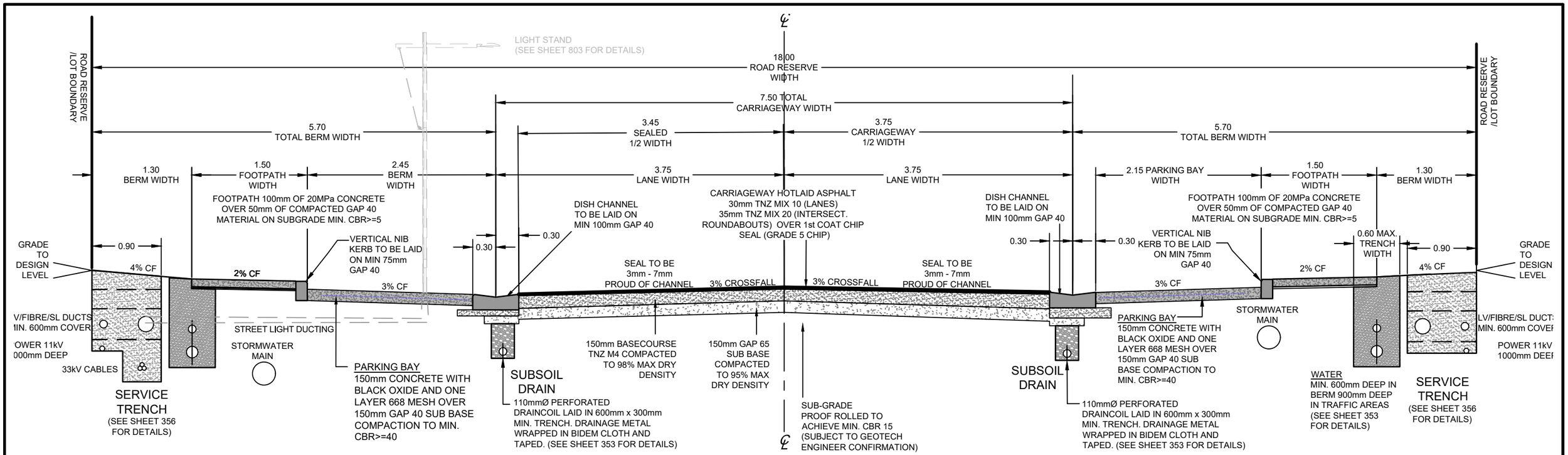
Resource Consent Plan
Road A Typical Cross Section
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

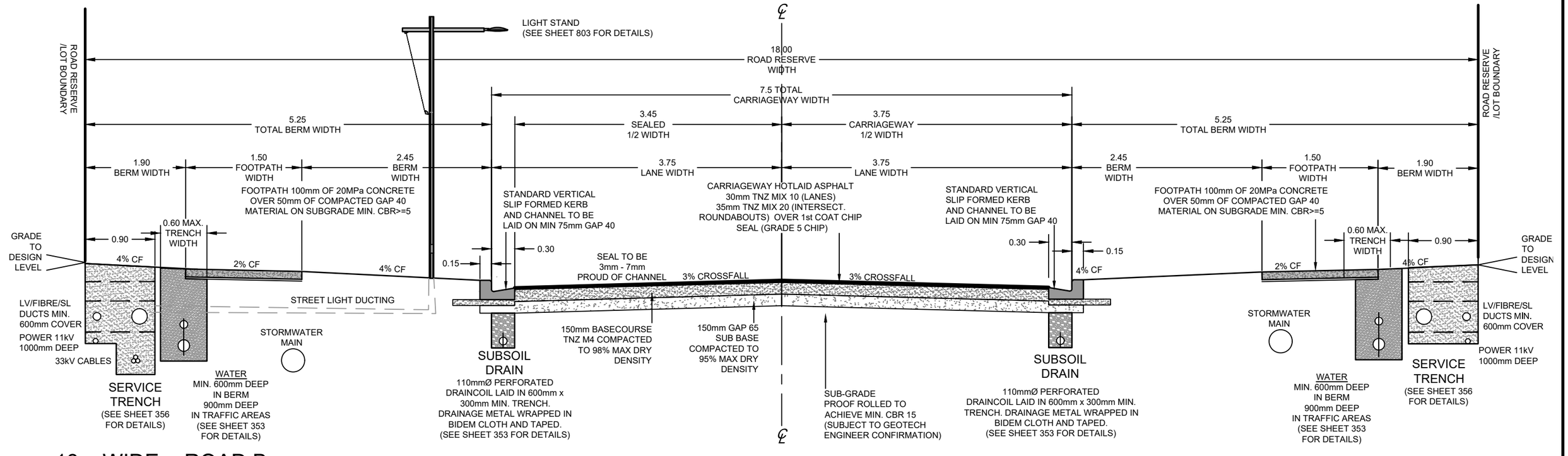
Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-350				1



18m WIDE - ROAD B WITH PARKING BAYS



18m WIDE - ROAD B

S:\2020\20253\2. ENGINEERING\1. DRAWINGS\PLOTTING\20253-EN-00-350-0-ROADING XS.DWG

Size	A3	Scale	1:50	Date	November 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/11/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

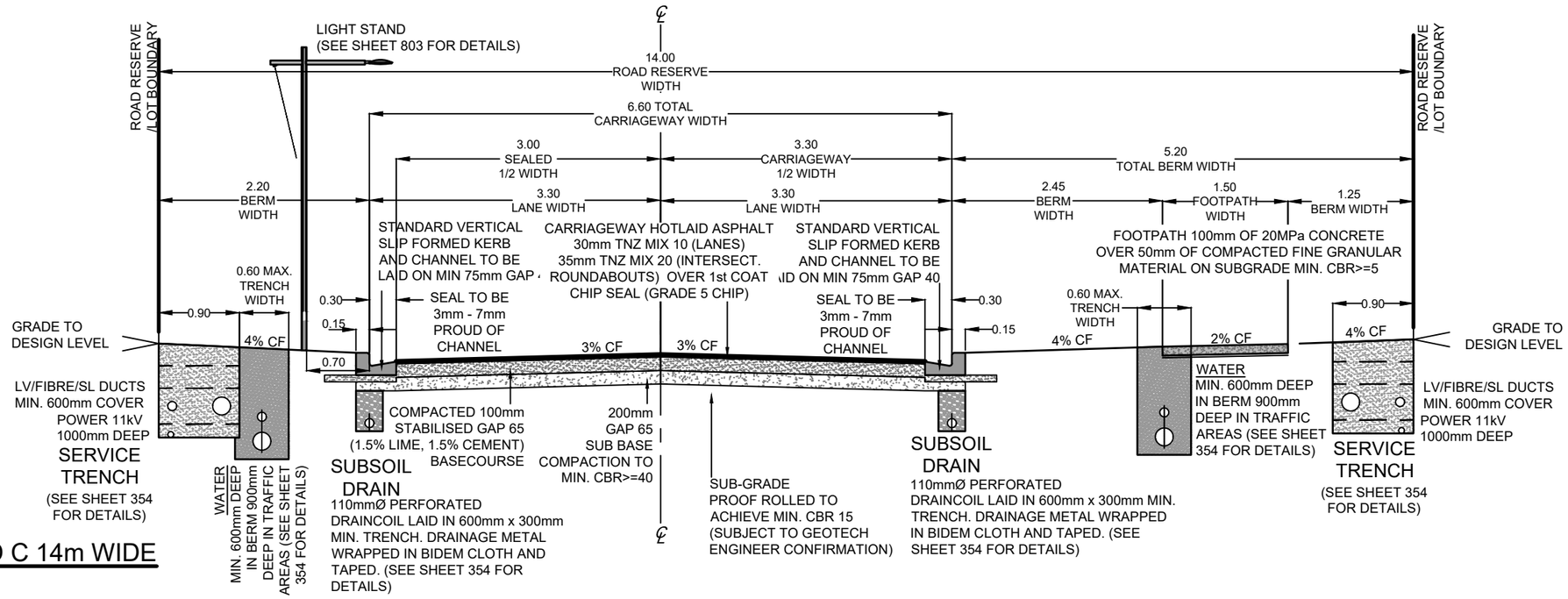
Resource Consent Plan
Road B Typical Cross Section
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

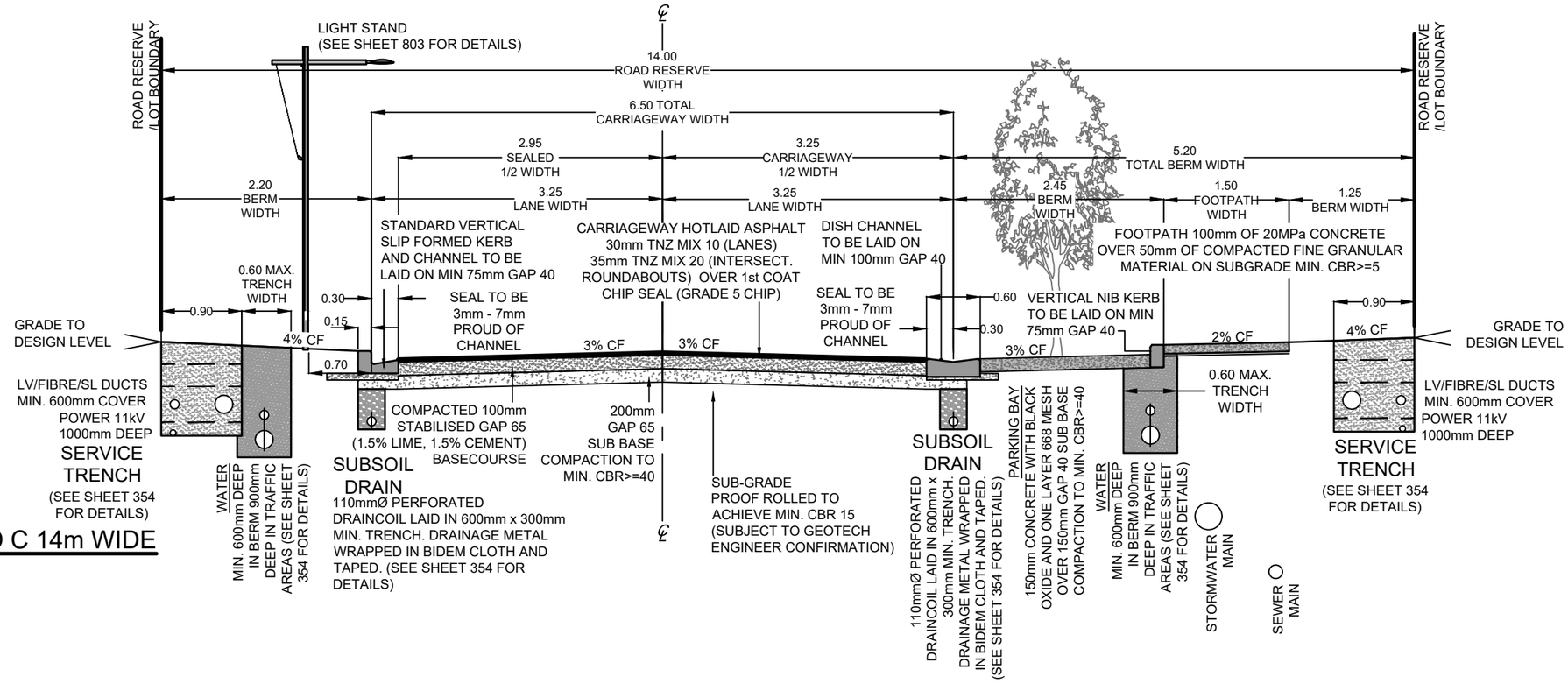
Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-351				1



ROAD C 14m WIDE



ROAD C 14m WIDE

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Size	A3	Scale	1:60	Date	November 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/11/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

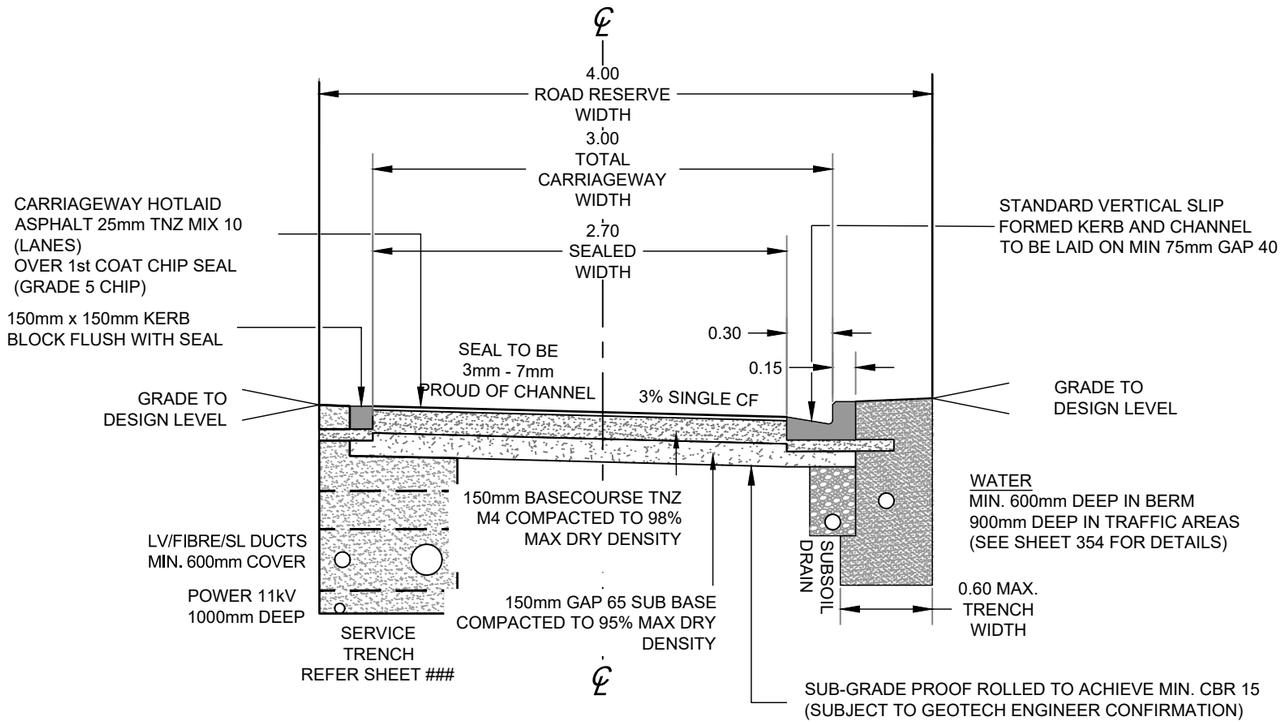
Resource Consent Plan
Road C Typical Cross Section
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

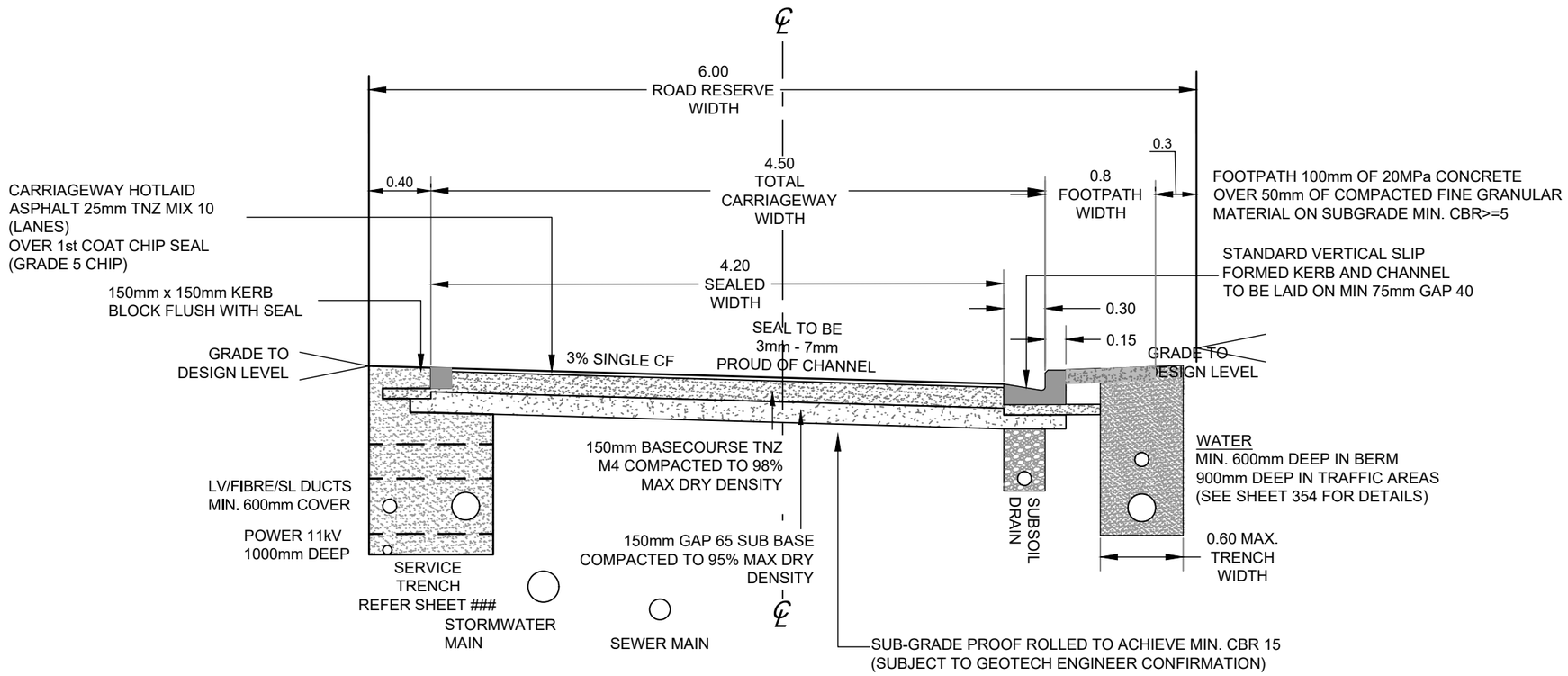
Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-352				1



R.O.W. - 4.0m WIDE



R.O.W. - 6.0m WIDE

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Size	A3	Scale	1:40_XREF	Date	November 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	17/11/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

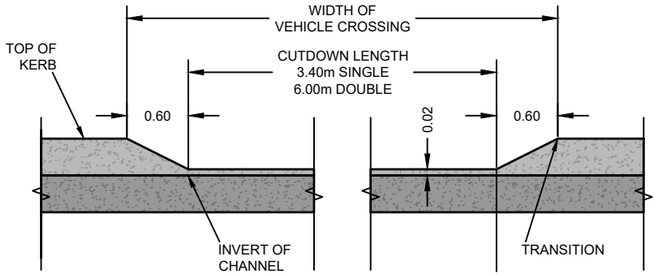
Resource Consent Plan
Road A Typical Cross Section
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

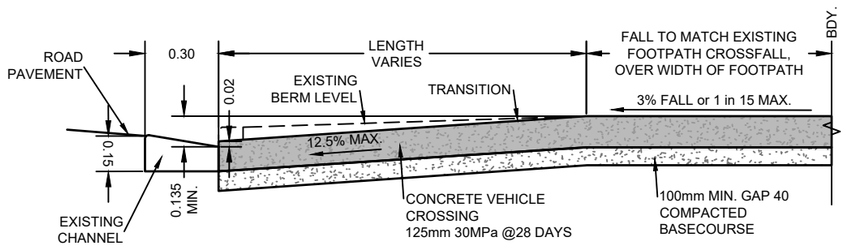
Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

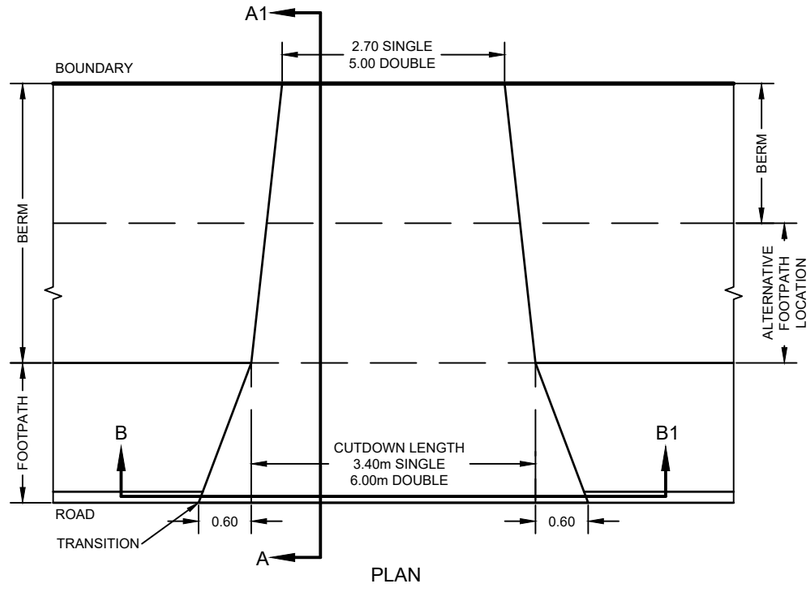
BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-353				1



SECTION B - B1



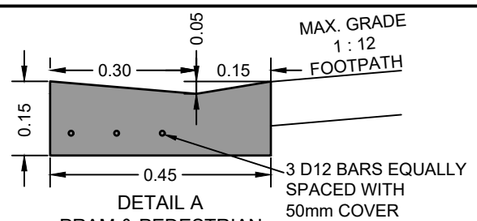
SECTION A - A1



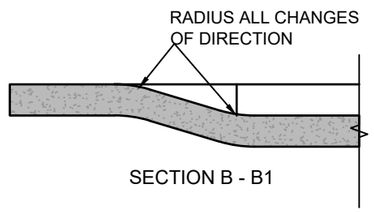
PLAN

TYPICAL CROSS SECTION

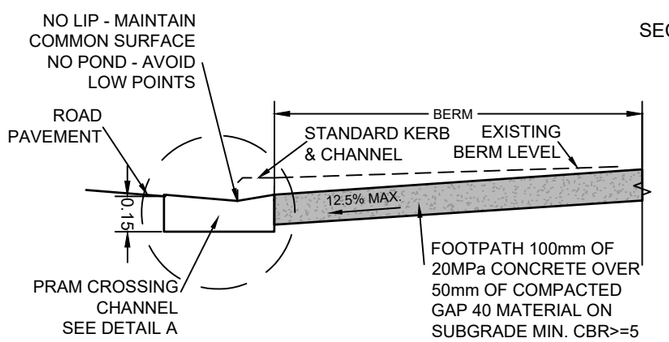
VEHICLE CROSSING DETAIL



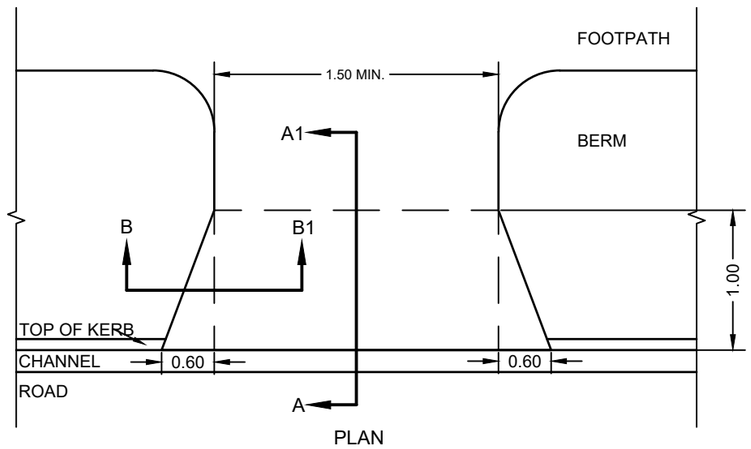
DETAIL A
PRAM & PEDESTRIAN
CHANNEL CROSSING
ON ALL ROADS



SECTION B - B1



SECTION A - A1



PLAN

TYPICAL CROSS SECTION

PRAM CROSSING DETAIL

Size	Scale	Date
A3	####	November 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	17/11/21
2			
3			

Designed	JMC
Drawn	JMC
Checked	CN
Approved	

Resource Consent Plan
Road A Typical Cross Section
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number:
.....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-354				1

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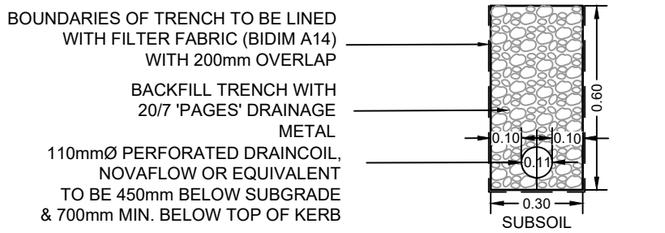
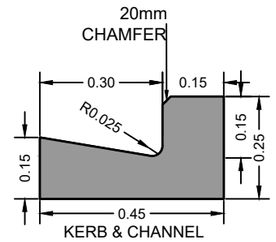


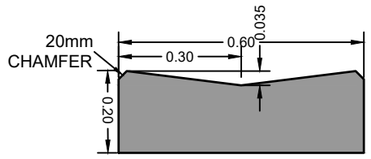
SUBSOIL DRAIN
(refer WDC - EES, Sec. 3.4.15.2)
(refer WDC - EES, Sheet 14)
SUBSOIL DRAINS TO BE CONSTRUCTED AFTER STABILISATION OF SUBGRADE

RESIDENTIAL ROAD

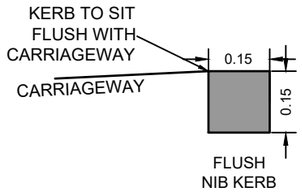
SUB SOIL DRAIN DETAIL



KERB & CHANNEL ON ALL ROADS

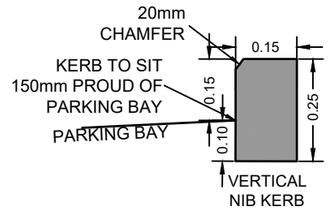


DISH CHANNEL AT FRONT OF PARKING BAYS



FLUSH NIB KERB

ON HIGH SIDE OF SINGLE CROSSFALL ACCESSWAYS

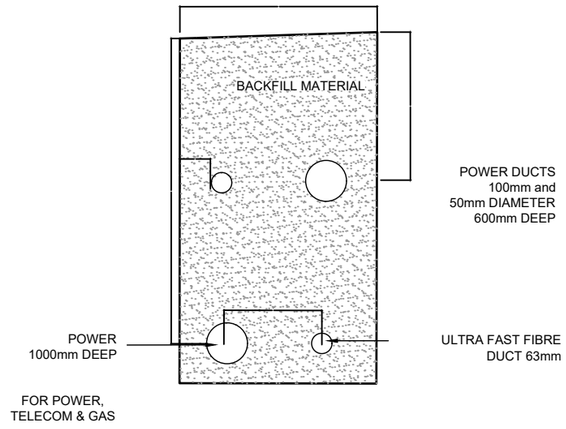


VERTICAL NIB KERB

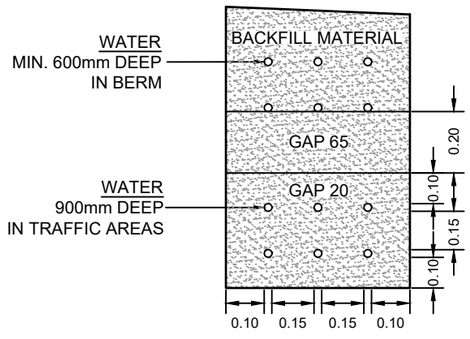
AT REAR OF PARKING BAYS BASED ON STANDARD KERB & CHANNEL WITHOUT CHANNEL

RESIDENTIAL ROAD

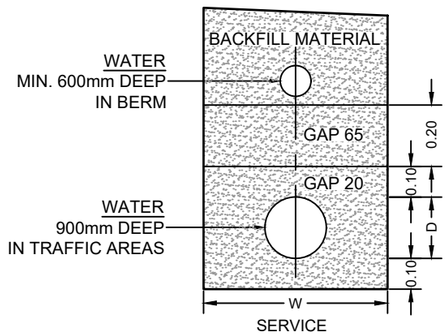
KERB DETAIL DIAGRAMS



RESIDENTIAL ROAD
UNDERGROUND SERVICES



SERVICE TRENCH FOR WATER IN PRIVATE ROADS



SERVICE TRENCH FOR WATER IN PUBLIC ROADS

W	TYPE OF PIPE
D + 400	PE

RESIDENTIAL ROAD

WATER RETICULATION

S:\2020\20253\2. ENGINEERING\1. DRAWINGS\PLOTTING\20253-EN-00-350-0-ROADING XS.DWG

Size	A3	Scale	1:60	Date	November 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	17/11/21
2			
3			

Designed	JMC
Drawn	JMC
Checked	CN
Approved	

Resource Consent Plan
Road A Typical Cross Section
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

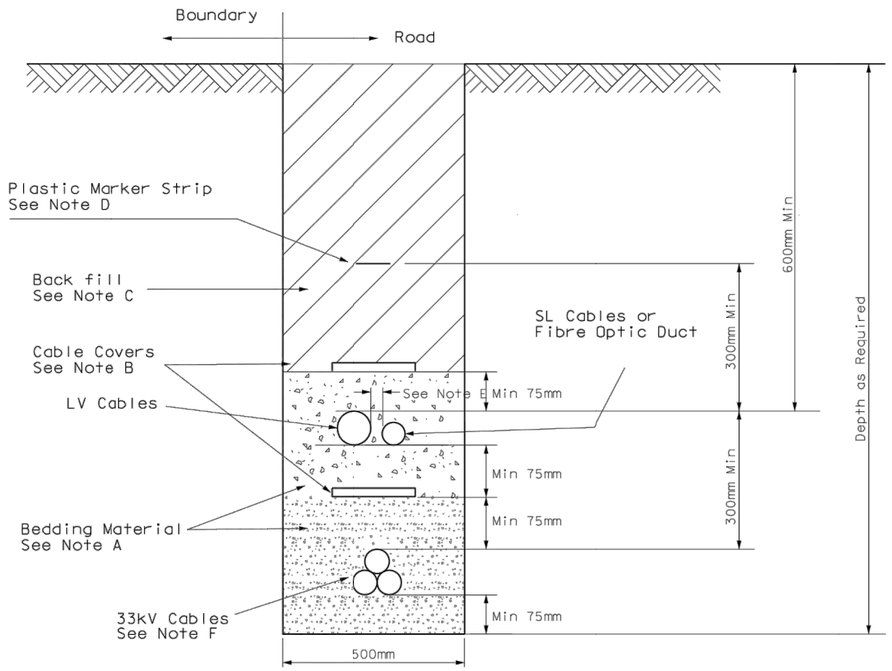
Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-RC-355				1

Power Cabling Only



Directly Laid HV & LV Cable
with Fibre Optic Duct

NOTES:

A. Bedding material either sand or 'clean' soil.
Thermal backfill to be used for 33kV Cable (Pap 7)

B. Covers to comply with AS/NZS 3000:2007 3.11.3 and 3.11.4 and AS4702-2000 and shall be located 75mm above cables and ducts. Cable covers shall be at least 150mm in width and overlap at least 40mm each side of the cable.

C. Back Fill, generally use fill from trench but ensure no large stones or sharp objects are placed back in the trench.

D. Marker strip to comply with AS/NZS 3000:2007 3.11.4.5 and be 100mm wide, coloured orange, with words 'Electrical Cable Below'.

E. Where practical provide some separation (75mm or greater) between direct laid LV and SL cable / fibre optic duct.

F. HV 11kV Cable to be minimum 450mm from boundary
(refer ENS 3.3.85 and 2F173s1)

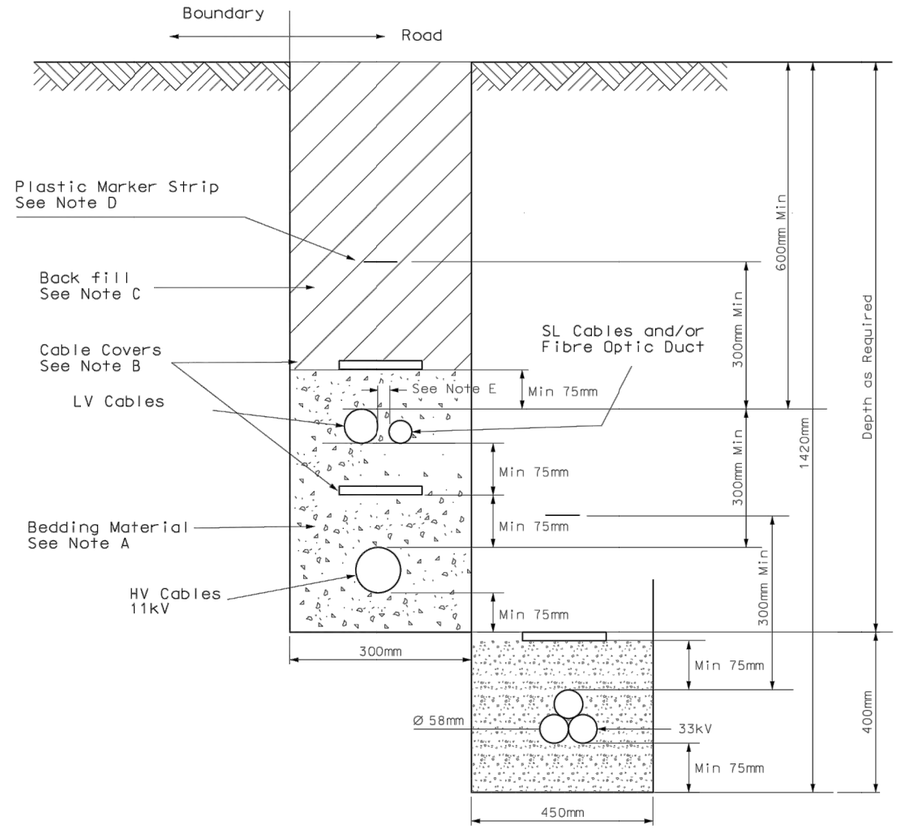
Northpower M.R. Gaillard BE M.I.P.E.N.Z. Chief Executive
Head Office
28 Mt Pleasant Road
Private Bag 9018
Telephone 0-9-430 1803
Facsimile 0-9-430 1804
http://www.northpower.co.nz

Rev	Amendments	By	Checked	Date
A.1	Initial Design	CP		
A.2	Remove Telecom	CP		

Title: 33kV Trench Profile Three Mile Bush Rd

Drawn C. Parkes Date 7/10/19
Checked Date
Approved Date
Issue A.2 Date
Plan Number 2F375s2
Scale NTS Sheet size A4

Power Cabling Only



Directly Laid HV & LV Cable
with Fibre Optic Duct

NOTES:

A. Bedding material either sand or 'clean' soil.
Thermal backfill to be used for 33kV Cable (Pap 7)

B. Covers to comply with AS/NZS 3000:2007 3.11.3 and 3.11.4 and AS4702-2000 and shall be located 75mm above cables and ducts. Cable covers shall be at least 150mm in width and overlap at least 40mm each side of the cable.

C. Back Fill, generally use fill from trench but ensure no large stones or sharp objects are placed back in the trench.

D. Marker strip to comply with AS/NZS 3000:2007 3.11.4.5 and be 100mm wide, coloured orange, with words 'Electrical Cable Below'.

E. Where practical provide some separation (75mm or greater) between direct laid LV and SL cable / fibre optic duct.

F. HV 11kV Cable to be minimum 450mm from boundary
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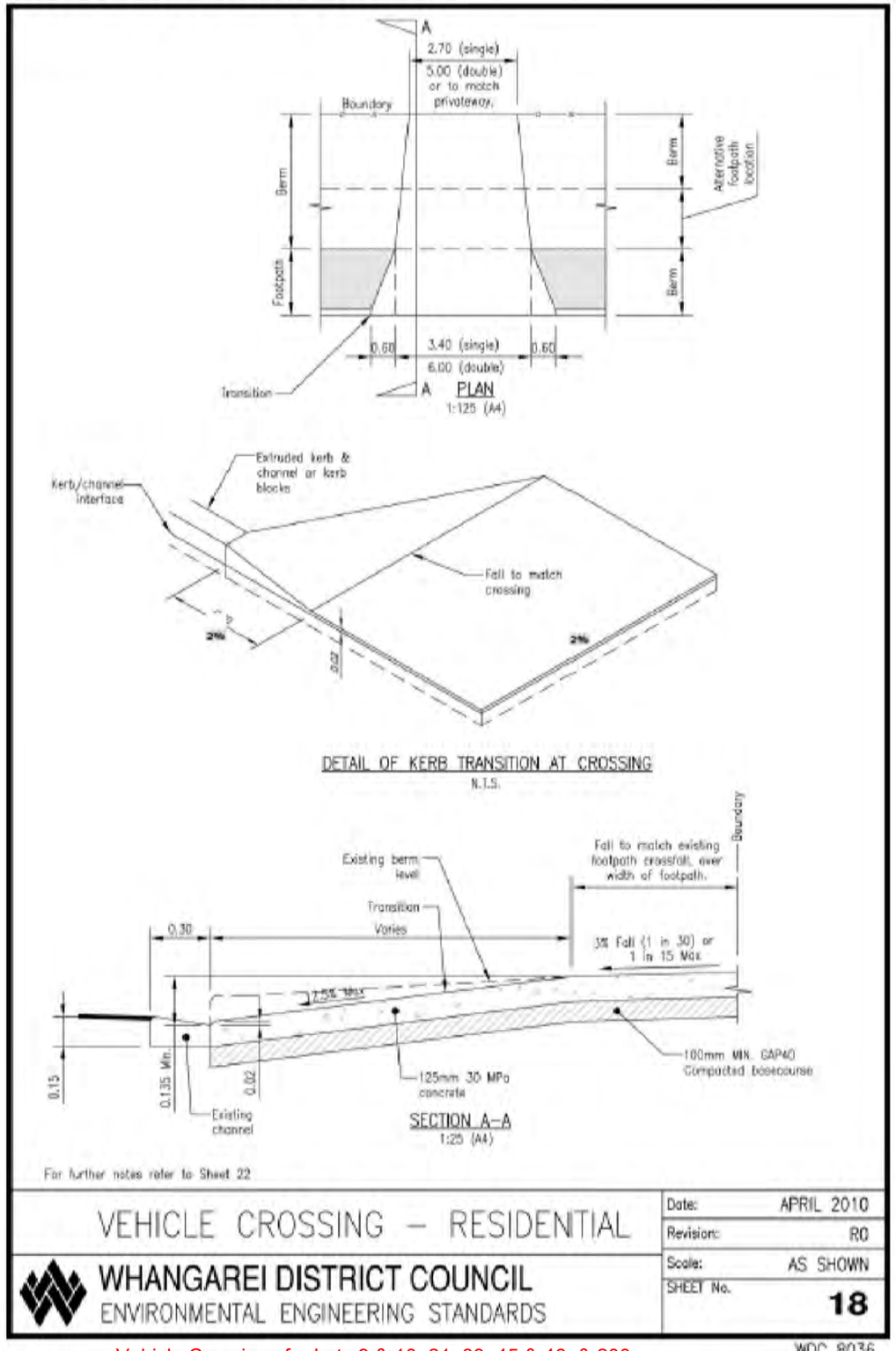
http://www.northpower.co.nz

Rev	Amendments	By	Checked	Date
A.1	Initial Design	CP		
A.2	Remove Telecom	CP		

Title: 33/11kV Trench Profile Three Mile Bush Rd

Drawn C. Parkes Date 4/10/19
Checked Date
Approved Date
Issue A.2 Date
Plan Number 2F375s1
Scale NTS Sheet size A4

Sheet 18 Vehicle Crossing - Residential

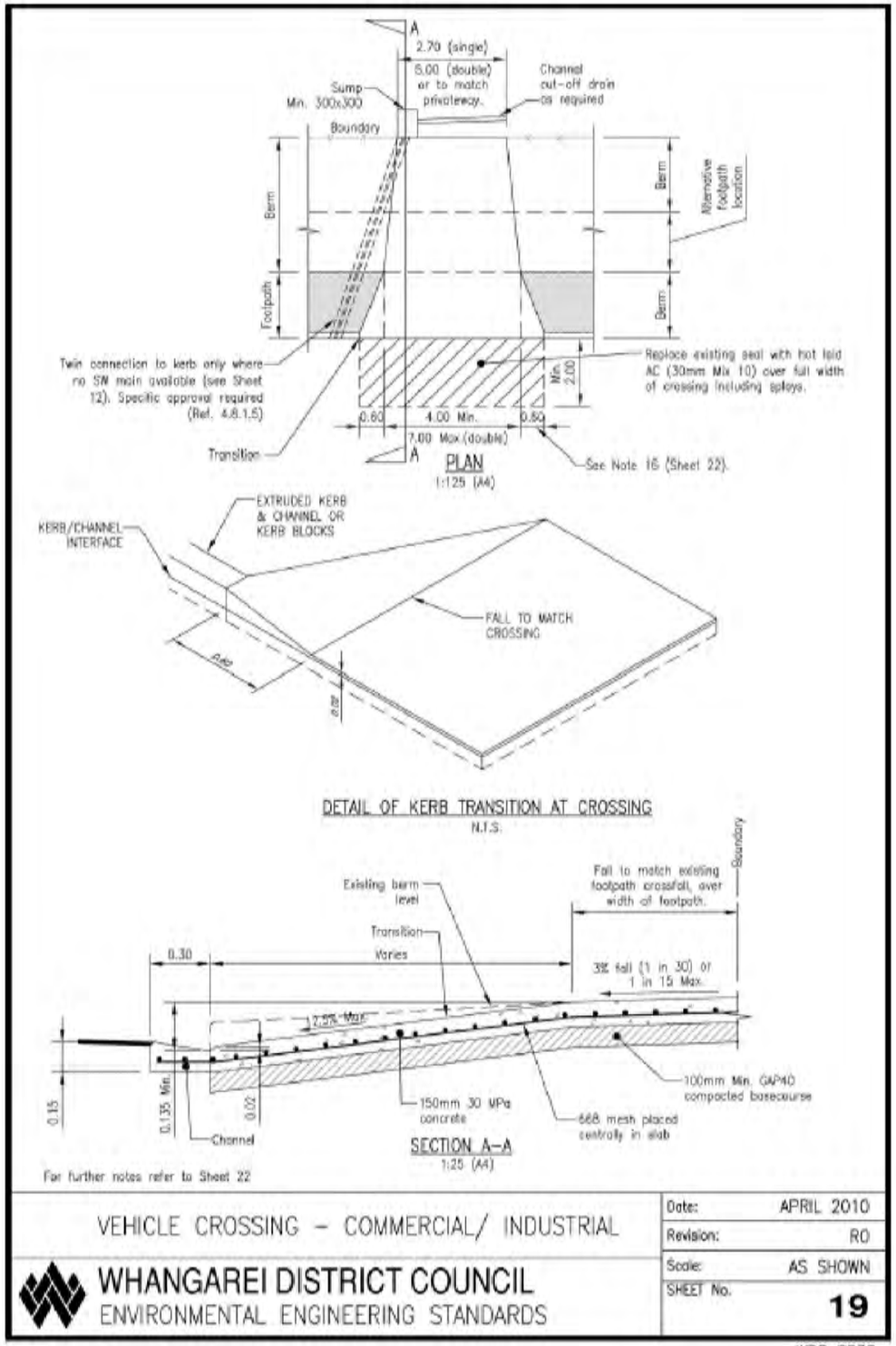


VEHICLE CROSSING – RESIDENTIAL	Date: APRIL 2010
	Revision: R0
WHANGAREI DISTRICT COUNCIL ENVIRONMENTAL ENGINEERING STANDARDS	Scale: AS SHOWN
	SHEET No. 18

WDC 8036

Vehicle Crossings for Lots 9 & 10, 21, 33, 45 & 46, & 200.

Sheet 19 Vehicle Crossing – Commercial/Industrial



VEHICLE CROSSING – COMMERCIAL/ INDUSTRIAL	Date: APRIL 2010
	Revision: R0
WHANGAREI DISTRICT COUNCIL ENVIRONMENTAL ENGINEERING STANDARDS	Scale: AS SHOWN
	SHEET No. 19

WDC 8036

Vehicle Crossings for Lots 53-55 & 35-39

Sheet 22 Vehicle Crossing Notes

RESIDENTIAL, COMMERCIAL AND INDUSTRIAL CROSSINGS

1. All concrete to be 30 MPa strength at 28 days.
2. Crossings to be constructed to match existing footpath and channel levels and be graded to give sufficient clearance to the underside of all vehicles.
3. The alternative channel crossing detailed on Sheet 20 may only be used with specific approval. It is for use only where thick overlay of existing seal precludes the standard option.
4. If no footpath, allowance shall be made for such with a 3% crossfall to the kerb.
5. Kerb transitions to be constructed of similar materials to the adjacent kerb or cast insitu concrete. See Sheet 12 for details.
6. Where the footpath or adjacent property level is below the channel level, ramp the crossing up from the channel to control surface water while maintaining vehicle clearance. A freeboard of 200mm above the channel is required to contain stormwater within the road.
7. Gradient of crossing not to exceed 12.5% (1 in 8)
8. Crossings for all private ways shall be commercial grade to Sheet 19.
9. Edges of footpath and back of channel to be saw cut.
10. All crossings require council inspection prior to pouring concrete.
11. If the edge of the crossing is within 1m of a crack or joint in an existing footpath then that section of footpath shall be replaced.
12. Commercial and industrial channels to be reinforced with an extension of the 668 mesh.
13. Where a street sump is located within the proposed crossing, the sump shall be relocated to the side of the crossing and reconnected to the council storm water system.
14. Refer to Sheet 16 for vehicle crossing over a drainage swale.
15. Stormwater kerb connections generally not permitted. (See Section 4.8.1.5).
16. Splay width may need to be increased in some circumstances to accommodate an 11.5m rigid truck.
17. For commercial crossings provide a 2m strip of hot laid AC over full width including splays.

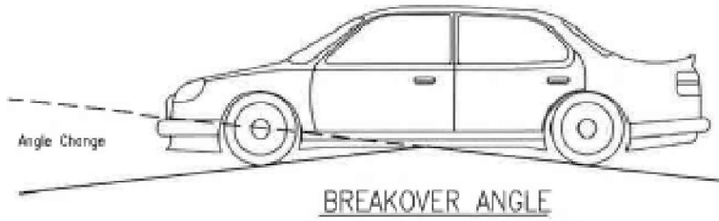
RURAL CROSSINGS

1. Pipes are to be RCRRJ Class "4" (formally Class "2").
2. Pipes are to be adequate for the upstream catchment, but not less than 300mm dia or the downstream culvert and shall be constructed to the correct line and level to maintain drainage paths.
3. Provide concrete or stonework headwalls and/or concrete aprons. Pipe ends are to extend beyond the edge of the crossing a distance that allows the gradient to invert to be no steeper than IV:3H
4. Gateways shall be located to allow vehicle parking clear of the road shoulder.
5. Minimum sight distance requirements for entrance crossings are to comply with Sheet 14.
6. All crossings adjoining sealed public roads are to be sealed or concrete, to the property boundary.
7. Concrete access ways shall start at least 0.5m outside of the existing edge of seal or 0.5m outside of the carriageway width required by the standard whichever is the further.
8. Concrete entrance crossings are to be 125mm of 30MPa concrete for light vehicle access. Heavy vehicle crossings shall be 150mm thick of 30MPa concrete reinforced with 665 mesh unless specifically designed.
9. Unsealed crossings shall comprise not less than 125mm GAP 65 and 75mm GAP40 or 200mm GAP 40 (compacted depths).
10. For application of Type 2 crossing refer to Section 3.4.10.3.
11. Where local widening is required (Types 2 and 3) the tapers shall be sealed.

VEHICLE CROSSING NOTES (FOR RESIDENTIAL, COMMERCIAL, INDUSTRIAL AND RURAL USE)	Date: APRIL 2010
	Revision: R0
WHANGAREI DISTRICT COUNCIL ENVIRONMENTAL ENGINEERING STANDARDS	Scale: AS SHOWN
	SHEET No. 22

WDC 8036

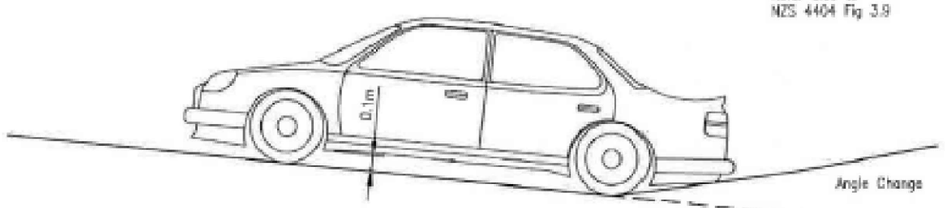
Sheet 23 Vehicle Crossing – Max Graded Profiles For Urban/Rural



BREAKOVER ANGLE

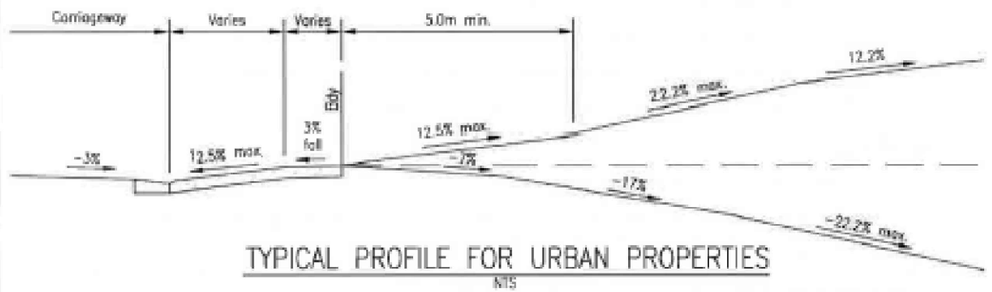
Maximum change of grade 10% (algebraic)
(5.7 degrees)

Refer also to NZS 4404 Fig 3.9

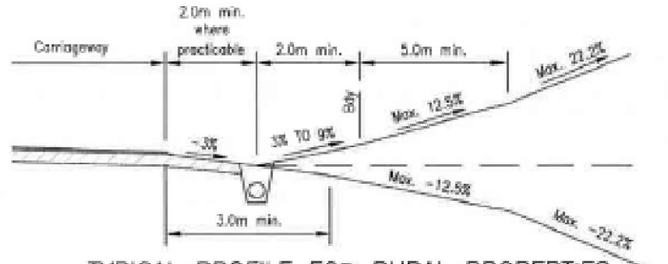


DEPARTURE ANGLE

Maximum change of grade 17% (algebraic)
(9.65 degrees)



TYPICAL PROFILE FOR URBAN PROPERTIES
NTS

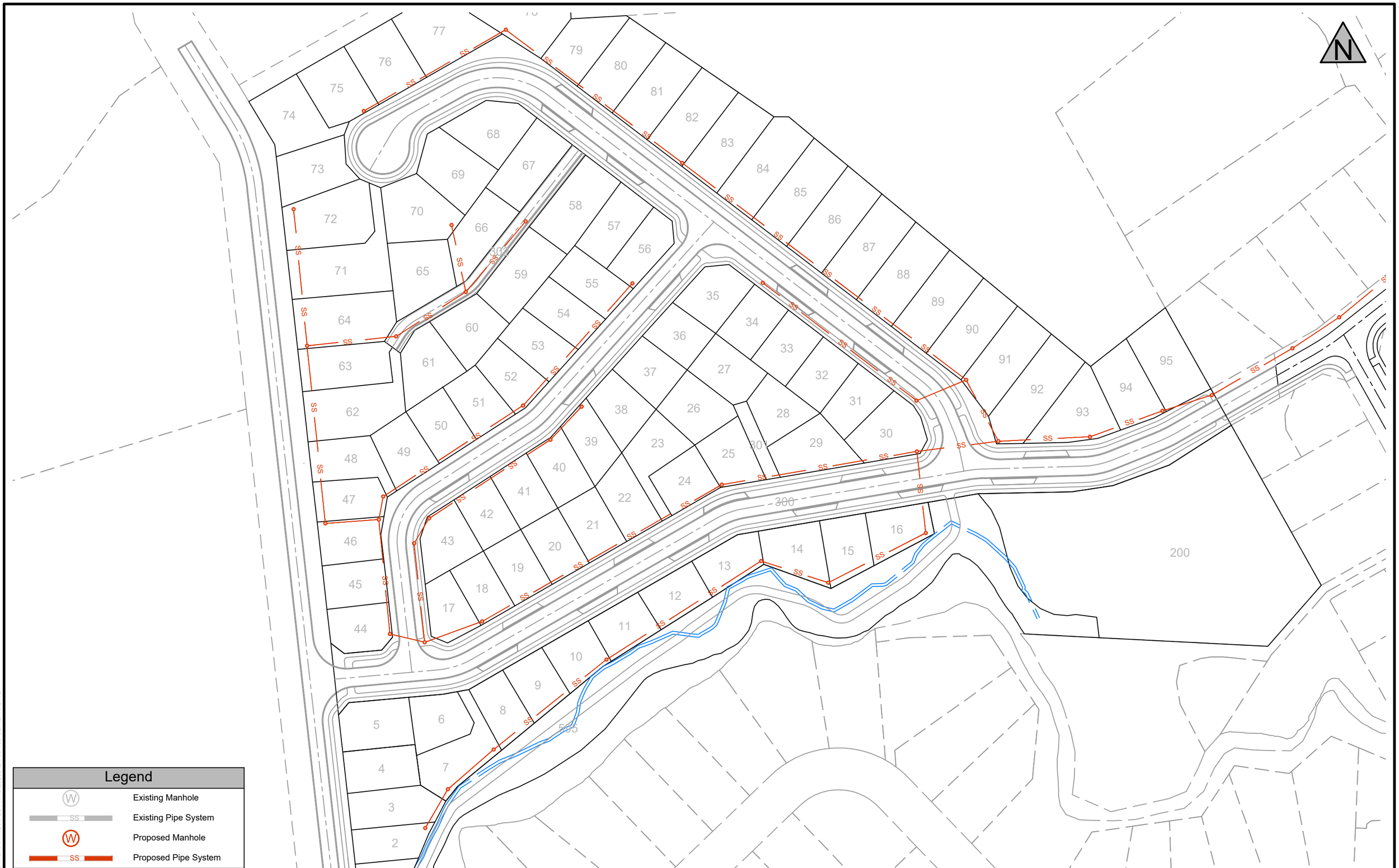


TYPICAL PROFILE FOR RURAL PROPERTIES
NTS

NOTES:
1. Maximum grade changes to occur at not less than 2.0m intervals.
2. Based on 90 percentile car as at 1990 with minimum ground clearance of 100mm.

VEHICLE CROSSING – MAXIMUM GRADED PROFILES FOR URBAN/ RURAL PROPERTIES	Date: APRIL 2010
	Revision: R0
WHANGAREI DISTRICT COUNCIL ENVIRONMENTAL ENGINEERING STANDARDS	Scale: NTS
	SHEET No. 23

WDC 8036



Size	A3	Scale	1:1250	Date	November 2021		
No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	10/05/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

Resource Consent
Sanitary Sewer Overview
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-400				1

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No.	Amendment	Init.	Date	Designed	JMC		
1	Issued For Resource Consent	JMC	10/05/21	Drawn	JMC		
2				Checked	CN		
3				Approved			

Resource Consent
Storm water Overview
47 Dip Road, Kamo, Whangarei
Prepared for: CC Developments

Blue Wallace Surveyors Ltd.
25 Harwood Street, P O Box 38,
Hamilton Central, HAMILTON.
Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

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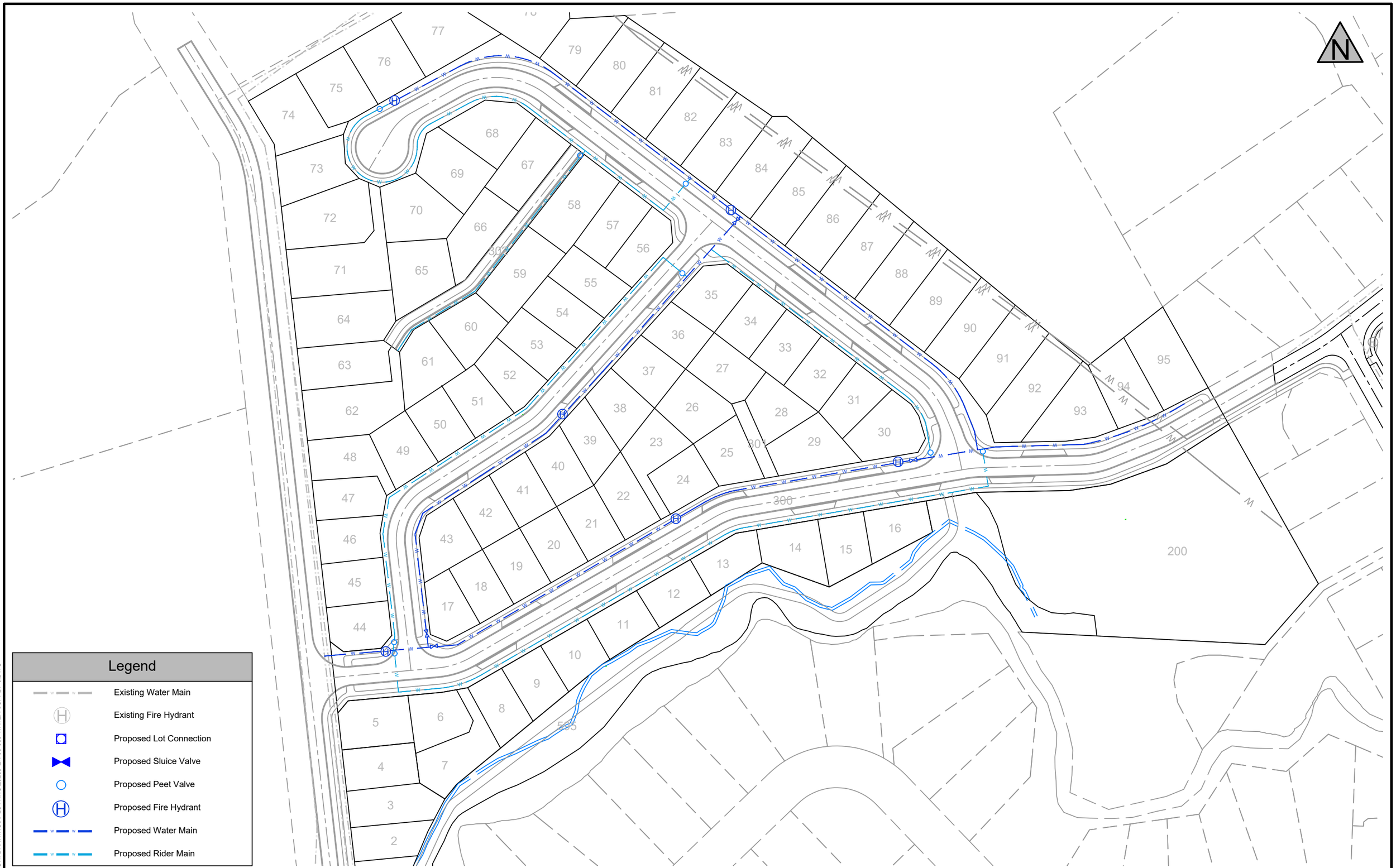

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main

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Size	Scale	Date
A3	1:1250	November 2021

No.	Amendment	Init.	Date
1	Issued For Resource Consent	JMC	10/05/21
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3			

Designed	JMC		
Drawn	JMC		
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Approved			

Resource Consent
Water Reticulation Overview
47 Dip Road, Kamo, Whangarei
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Blue Wallace Surveyors Ltd.
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Height: Moturiki Datum 1953

Resource Consent Number: .....

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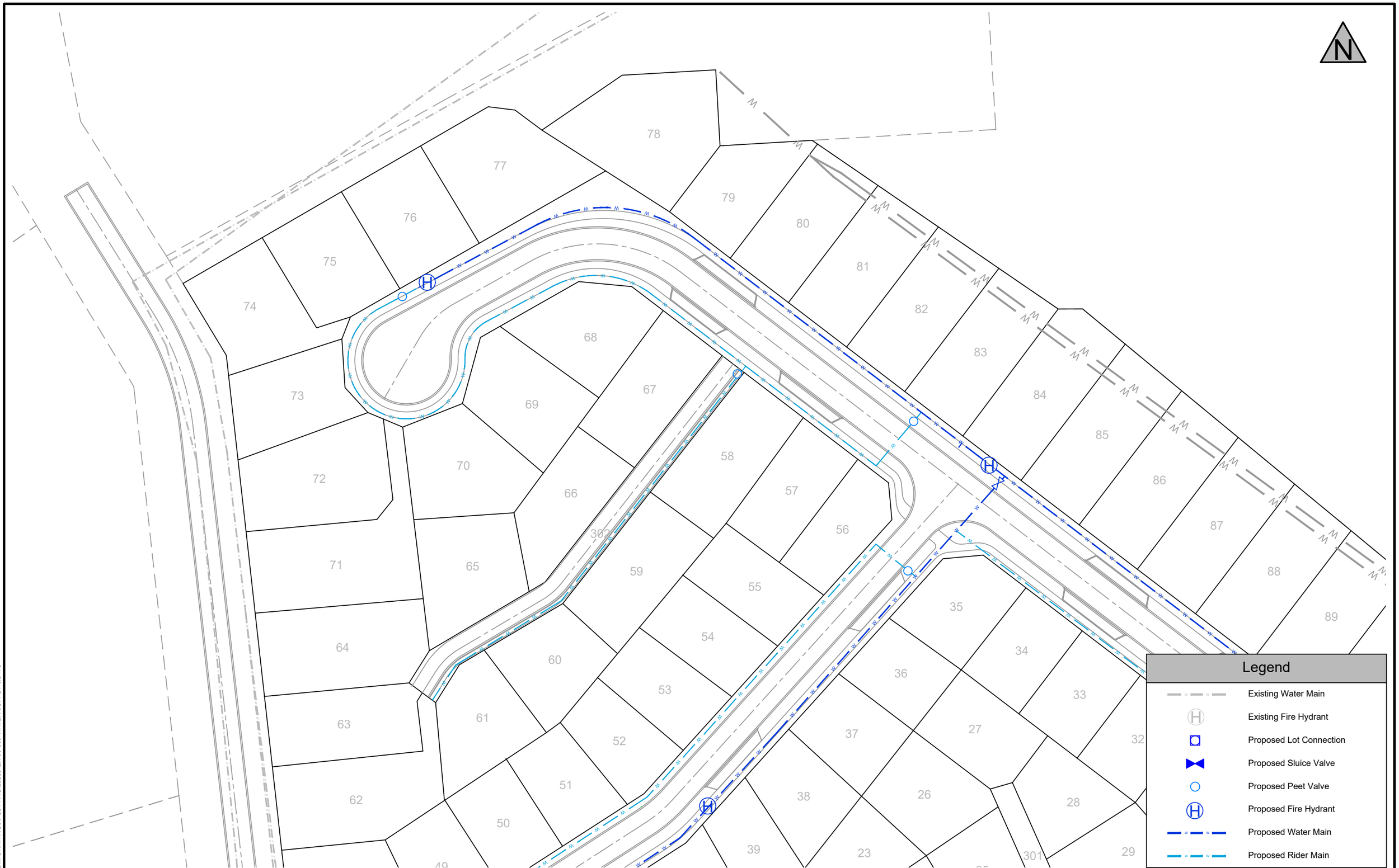

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No.	Amendment	Init.	Date	Designed	JMC		
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Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

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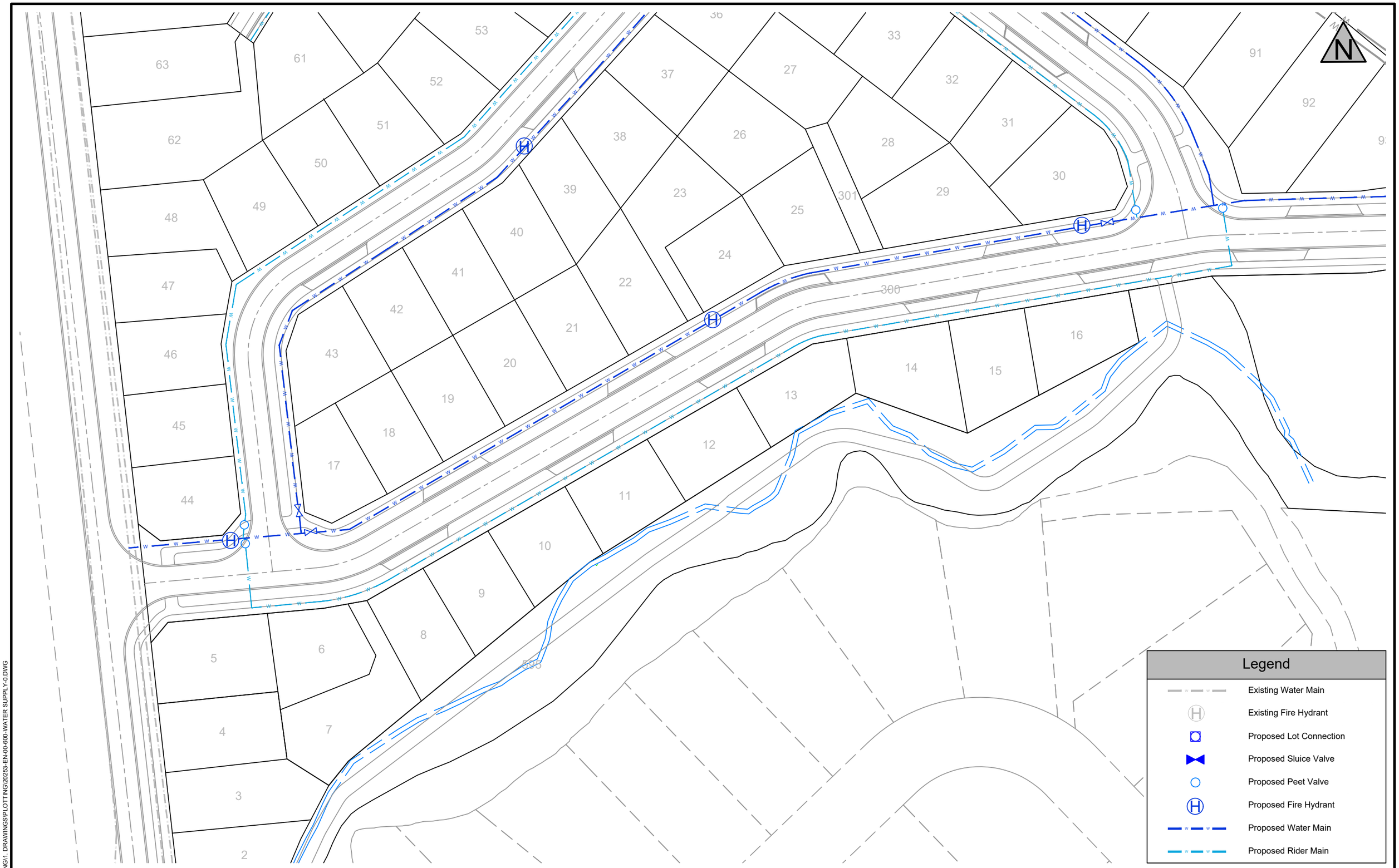

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Size A3 | Scale 1:750 | Date November 2021

No.	Amendment	Init.	Date
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3			

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Approved			

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Height: Moturiki Datum 1953

Resource Consent Number: .....

BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-602				DRAFT

Legend

- Existing Water Main
- Existing Fire Hydrant
- Proposed Lot Connection
- Proposed Sluice Valve
- Proposed Peet Valve
- Proposed Fire Hydrant
- Proposed Water Main
- Proposed Rider Main
- Existing Stormwater Manhole
- Existing Stormwater Pipe
- Proposed Stormwater Manhole
- Proposed Catchpit
- Proposed Headwall
- Proposed Stormwater Pipe
- Existing Wastewater Manhole
- Existing Wastewater Pipe
- Proposed Wastewater Manhole
- Proposed Wastewater Line

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Height: Moturiki Datum 1953

Resource Consent Number: .....

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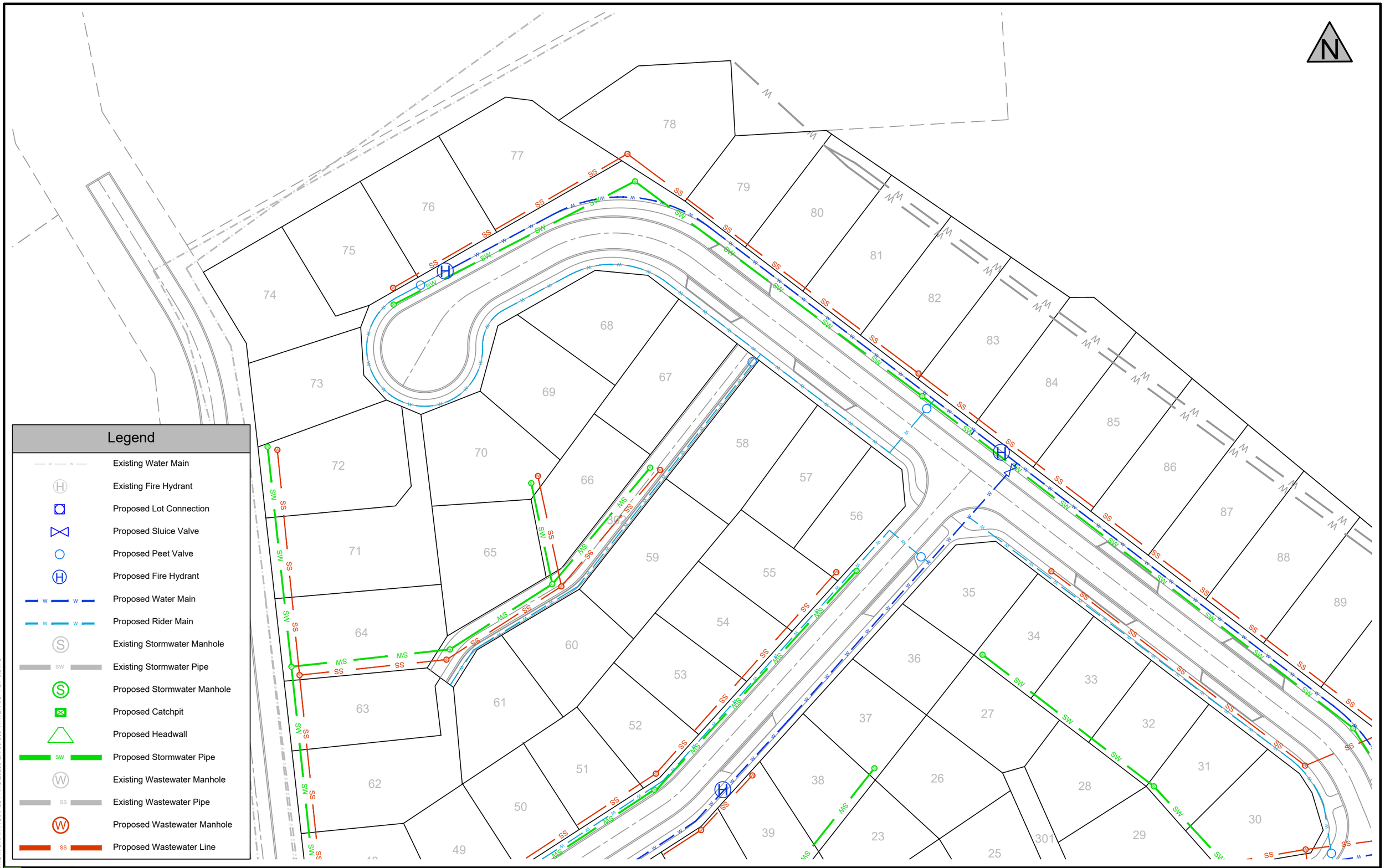

Legend

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Approved			

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Phone (07) 839 7799, Fax (07) 839 4455

Datum: Circuit: Mt Eden 2000
Height: Moturiki Datum 1953

Resource Consent Number: .....

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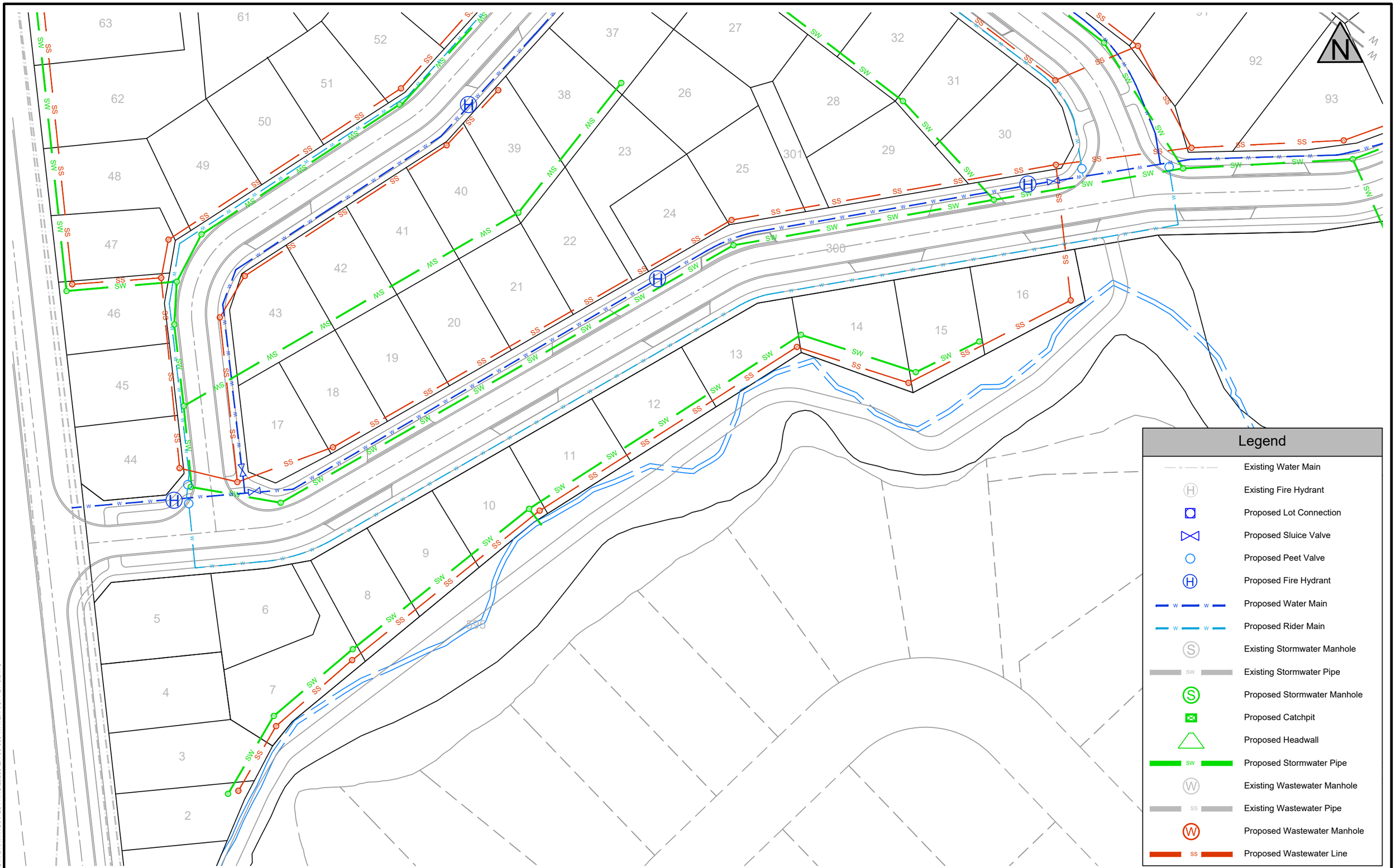

Legend

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Water Reticulation Overview
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Height: Moturiki Datum 1953

Resource Consent Number:
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BW Ref.	Stg.	Purp.	Dwg. #	Revision:
20253-01-EN-702				DRAFT

Appendix 3

Integrated Three Waters Report

B&A

Onoke Heights Limited

THREE WATERS DESIGN REPORT

19103 - 67 Dip Road, Kamo, Whangarei

Project Reference: 19103
November 25, 2021

DOCUMENT CONTROL

Version	Issued For	Date	Prepared By	Reviewed &Authorised By
C	Issued for Consent	25/11/2021	Leo Kim BE(Hons) *Civil Engineer*	Aaron Holland Civil/Structural/Geotechnical Engineer, CPEng *Civil Group Manager*

CONTENTS

1 PROJECT DESCRIPTION

LDE Ltd was engaged by Onoke Heights Limited to provide a report covering the three waters infrastructure and stormwater pond design for resource consent for the proposed residential subdivision and development at 67 Dip Road, Kamo, Whangarei.

Figure 1 - Site location plan, outlined in blue. Sourced from Whangarei District Council (WDC) GIS.

As with any new development water, wastewater and stormwater servicing and management is required.

The water supplies additional demand can be serviced either on the public network or with an onsite water supply which can consist of either an extension of the public system or the use of water tanks or water bores. As this development is to be smaller urban sized lots, an extension of the water network is proposed.

With wastewater, disposal connection to a public system is proposed due to the smaller lot sizes. Smaller lot areas below about 2000m² are not generally suitable for OSW disposal systems as there is generally insufficient land area available to install suitable disposal fields.

With stormwater, new impervious areas are created, and these areas require stormwater management devices to be utilised to minimise their impact on the environment. To attenuate runoff for the new impervious areas within the proposed site, the pre-development and post-development scenarios were modelled in HEC-HMS software. Additionally, the quality of stormwater runoff from high contaminant generating surfaces such as roads and carparks must be treated before discharge to minimise their impact on the health of the receiving ecosystem so the ponds design has incorporated water quality. Extended detention is also proposed to mitigate effects on the stream into which the proposed pond will discharge.

The design presented in this report is in accordance with Whangarei District Council's and Northland Regional Council's requirements in terms of mitigating stormwater runoff from impervious areas, with a stormwater pond providing water quality, extended detention, and stormwater attenuation to predevelopment flows for the 2, 10 and 100yr storms, including an increase of 20% for climate change.

2 WATER

The councils water reservoir is located immediately above the northern end of the site which will service the development. There are also existing public water mains running along the boundaries of the site which serve the surrounding developments. There will simply be an extension of these public water mains into the development provide both water supply to the new dwellings and firefighting water supply which we expect to come from the mains in Dip road.

The 95 new residential lots will require the following additional water supply capacity assuming 300ltrs/day/person with 4 people per dwelling.

Peak day demand = 2.0 x PF

- 2.0 x 300(l/day) x 4(people) x 95(lots) = 228,000ltrs/day

Peak hourly demand = 5 x PF/24hrs

- 5 x 300(l/day) x 4(people) x 95(lots)/24(hrs)= 23,750ltrs/hour

3 WASTEWATER

The wastewater servicing the development will be an extension of the existing public reticulation from Tuatara Road. It is not practical to connect to the reticulation network along Dip Road as this requires the network to cross the existing stream on the southern boundary of the subject site which would involve pipe bridging, as such the extension into the development is to be provided from Tuatara Road.

The additional wastewater flows that will be generated by the development are as follows:

Dry weather peak daily flow = 2.5 x ADWF

- 2.5 x 200(l/day) x 4(people) x 95(lots) = 190,000ltrs/day

Peak wet weather flow (PWWF) = 5 x ADWF

- 5 x 200(l/day) x 4(people) x 95(lots) = 380,000ltrs/day

4 HYDROLOGICAL ASSESSMENT

4.1 Pre-Development

The subject site, shown in the aerial photo in Figure 2, has an area of approximately 6.9ha which is currently covered in grass with trees. The northern half of the site comprises of a converging south facing slope of up to 11 degrees. The southern part of the site comprises of waning slopes towards the stream on the southern end of the subject site.

Figure 2 - Aerial photo of site indicated in blue. Sourced WDC GIS.

4.2 Post-Development

It is proposed to subdivide the site creating 95 new residential lots with majority of the areas between 340m^2 and 1050m^2. The lots are proposed to be accessed via an extension of Tuatara Road to Dip Road. The proposed scheme plan can be seen in Figure 3 below.

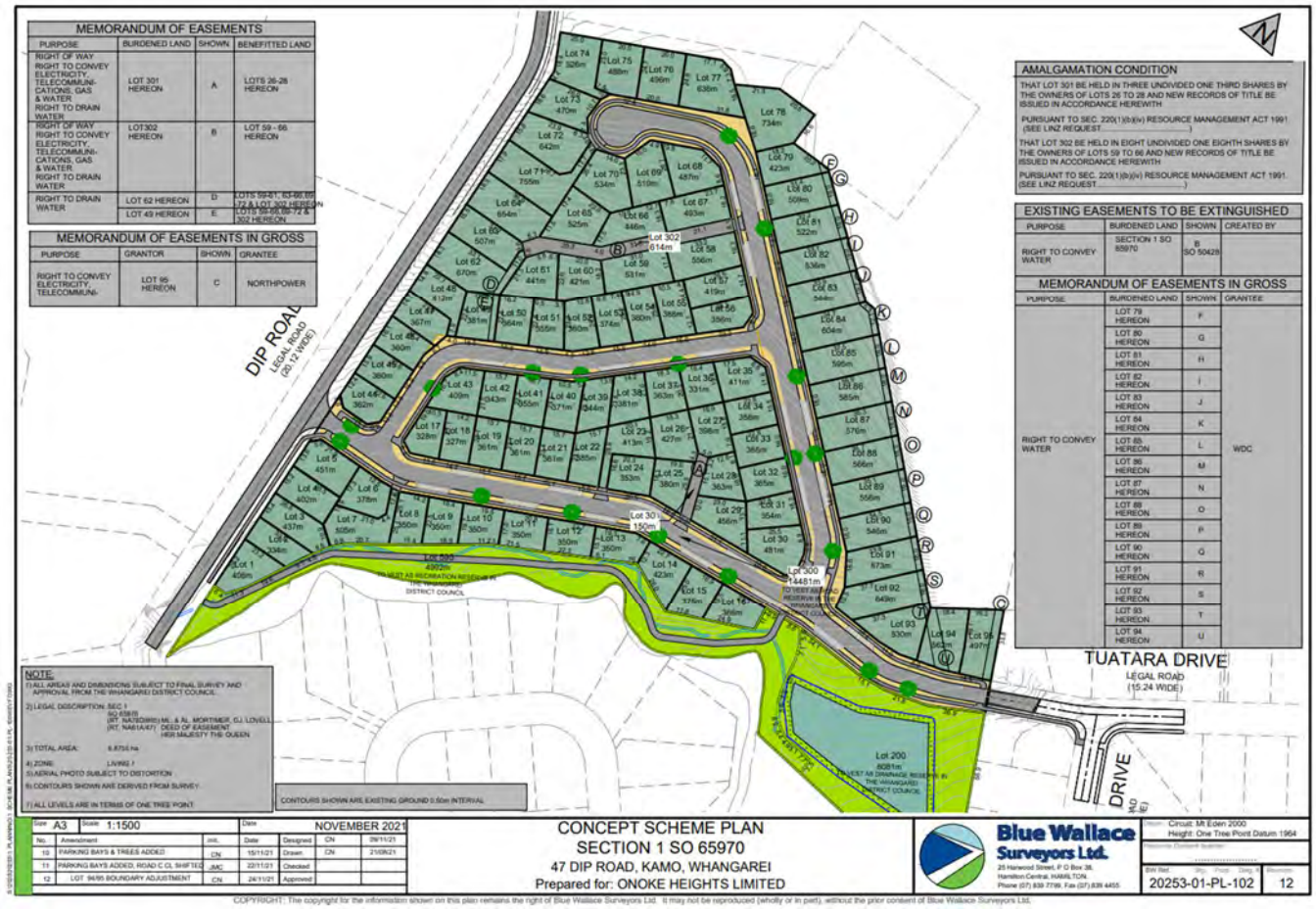


Figure 3 - Proposed scheme plan provided by Blue Wallace Surveyors Ltd.

It is proposed to construct a stormwater pond within the south-eastern end of the subdivision to provide attenuation and water quality treatment for runoff from the development. To achieve this, the pond has been designed to meet the requirements of Auckland Council's GD01.

The proposed lots have been divided into impervious and pervious components with 60% of the lot area being nominated as impervious and the remaining 40% pervious. The road reserve area was nominated a curve number of 90 based on a weighted average between the road, footpaths and berms. Refer to Figure 4 below for catchment areas and pond location.

Figure 4 – Catchment areas and pond location.

Table 1 – Pre and Post Development catchment areas and curve numbers.

Pre-Development		
Description	Curve Number (CN)	Area (m^2)
Grassed areas - Pervious	70	66,955
Total		66,955
Post Development		
Description	Curve Number (CN)	Area (m^2)
(Catchments B & C) Residential Lots - Impervious	98	21,695
(Catchments B & C) Residential Lots - Pervious	70	14,463

(Catchment D) Road Reserve (Road, Footpaths, Berms)	90	15,245
(Catchments A) Unmitigated Bush Area	70	9,375
(Catchment E) Unmitigated Lots – Pervious	70	2,471
(Catchments E) Unmitigated Lots - Impervious	98	3,706
Total		66,955

Catchment E comprises of unmitigated lots on the southern boundary that will be directly piped to the stream through its own small outfall structure and will not be attenuated by the proposed stormwater pond. Stormwater from the bush located outside the northern boundary of the site will drain into the proposed development and through the stormwater pond. Although this bush area is not part of the development, this has been taken into account into the pond design as Catchment A. Catchment G will not be developed and drains directly into the stream downstream of any developed areas.

4.3 Soil Classification

From the LDE geotechnical investigation of the site, the site is underlain by volcanic soils. For the purposes of stormwater modelling, we have assessed these soils beneath the site as being between Soil Class B&C soils as defined in the Whangarei Environmental Engineering Standards.

4.4 Flood Risk

A retaining wall is proposed on the southern boundaries of Lots 14,15 and 16 of the subject site which will sit on the edge of the 100-year flood plain outlined on WDC GIS Flood Hazard map and in Figure 5 below. A cross section was taken from the edge of the Lot 15 boundary to the adjacent side of the stream to model the peak water level for the 100-year ARI storm. Refer to Figure 5 below for location of section analysed.

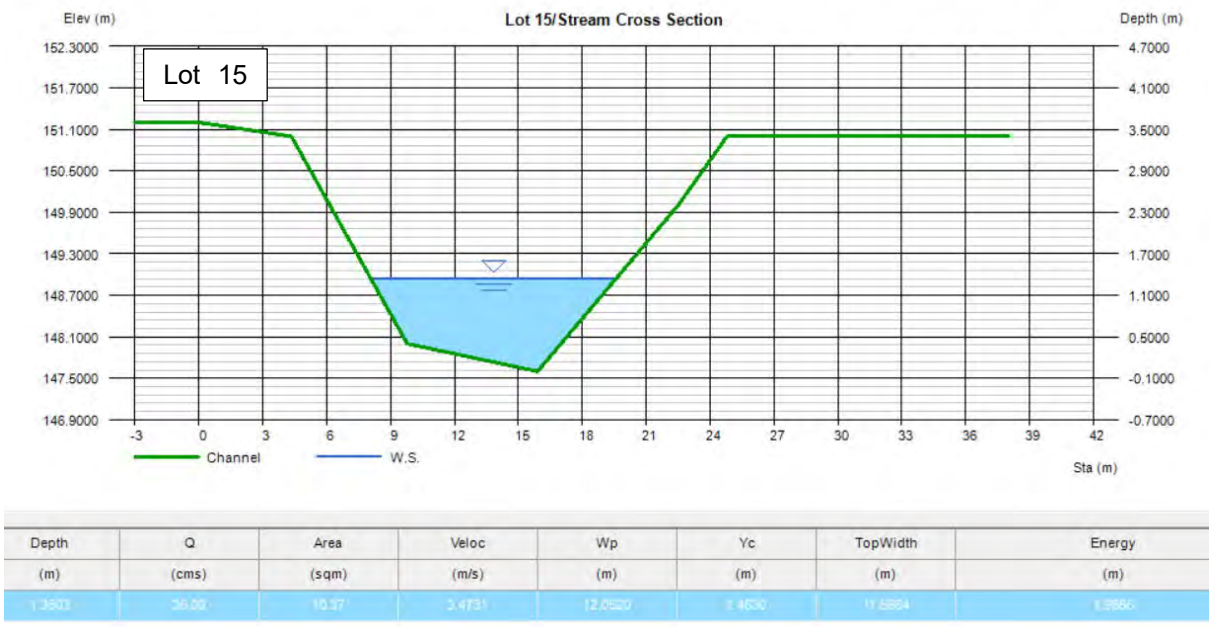
Figure 5. Cross section analysed from Lot 15 across stream.

Hydraflow Express software modelling of the stream was used to determine the peak water levels in proximity of the site. The stations and elevations of the stream were input into the user defined model to model the shape of the stream channel based on WDC GIS contours as well as the survey completed of the base of the stream.

Although the flood plain extends further into the boundary of Lot 16, the stream bed adjacent the lot is at approximately RL 144 whereas the RL of the lot 16 boundary is at approximately RL 151. There is a 7m difference

between the stream bed and the lot 16 boundary and therefore this was not considered the critical section. Instead, a section from the boundary of lot 15 through the stream was taken which was the lowest difference in elevations and the critical section, to analyse the risk of flooding.

The subject stream is assumed to have a peak flow of approximately 36m^3/s during a 100-year ARI storm (assuming an SCS type 1a storm distribution) with a catchment area of slightly less than 180 hectares with a time of concentration of 31mins. Based on the results we can see that the peak water level during a 100-year ARI storm is at RL 148.9 which is approximately 2.1m lower than the Lot 15 boundary at RL151.0 and as such, we can deem that the construction of the proposed retaining walls which will raise the platform level up to approximately RL154 along the boundaries will have no impact on the flood levels. Refer to Figure 6 below for the peak water level during a 100-year ARI storm. Note the stream channel cross section has a flow capacity well in excess of 100m3/s through this area without affecting either of the existing lots.



Depth	Q	Area	Veloc	Wp	Yc	TopWidth	Energy
(m)	(cms)	(sqm)	(m/s)	(m)	(m)	(m)	(m)
1.3503	36.00	10.37	3.4731	12.0520	1.4630	11.6864	1.9866

Figure 6. Hydraflow Express Stream model adjacent to Lot 15 existing ground levels.

5 COUNCIL REQUIREMENTS

5.1 Northland Regional Council SW requirements

Water and Soil Plan

8.3.5 Stormwater

During dry weather, contaminants such as dirt, oil, grease, and heavy metals tend to accumulate on the streets, footpaths, carparks, roofs and similar hard surfaces within urban areas. When it rains, the stormwater carries the accumulated contaminants with it into the stormwater drainage systems which in turn flow directly into nearby streams, rivers or estuaries. Such urban stormwater runoff receives little or no treatment before being discharged

into natural water bodies. Heavy metals have been found in the Upper Whangarei Harbour sediments that exceed the standards recommended for aquatic life.

These contaminants will remain in the receiving environment and will accumulate over time as stormwater discharges continue. Stormwater discharges are generally authorised by discharge permits based on a stormwater management plan. Stormwater management plans are widely used in terms of the design of the stormwater system. However, these have focused on the capacity of the stormwater system to accept runoff, with little or no attention given to stormwater quality. The plans, however, provide a useful basis upon which to institute quality controls which are available and used both in New Zealand and overseas.

8.5.6 Issues Relating to Stormwater Discharges

1. The levels of heavy metals, sediments and other contaminants, which are potentially harmful to aquatic life, in stormwater runoff.
2. The lack of attention to quality controls in stormwater system design.
3. The contribution of runoff from industrial sites to contaminant loadings in urban stormwater, including those from ancient spills.
4. The deliberate or careless disposal of oil and other household and commercial wastes to stormwater systems.

8.17 Specific Policies for Stormwater Diversions and Discharges

1. To manage the diversion and discharge of stormwater in a way that provides safeguards against flooding and maintains or enhances water quality.
2. To require the inclusion of water quality controls as far as practicable in existing stormwater management systems that are known to be causing concentrations of contaminants within the receiving environment that are in excess of applicable water quality and/or sediment quality guidelines.
3. To manage the diversion and discharge or stormwater in urban areas through long duration resource consents that are supported by comprehensive stormwater management plans.
4. To promote best practice for stormwater management design, including low impact options.
5. To promote stormwater management practices that avoid or minimise the discharge of contaminants from industrial and trade premises into stormwater drainage systems.
6. To encourage activities to operate in accordance with industry standards and/or environmental guidelines where these are intended to avoid, remedy or mitigate the adverse effects of stormwater contamination.
7. To permit the discharge of stormwater from hazardous substance storage areas and industrial or trade premises if sufficient safeguards are adopted to avoid, remedy or mitigate the potential adverse effects associated with stormwater contamination.
8. To promote public awareness of the adverse effects of stormwater discharges on natural waters, including awareness of the adverse effects of household waste introduced into stormwater systems.

5.2 Whangarei District Council Three Water Management

Three Waters Management implements provisions to manage the impact of land use and subdivision on water resources, namely stormwater, wastewater and water supply:

- Stormwater systems manage the quality and quantity of stormwater runoff to minimise flood damage and to protect people, land, infrastructure and the receiving environment from adverse effects.
- Wastewater systems collect and convey wastewater for subsequent treatment and disposal. This will normally consist of either connection to the reticulated wastewater network, or on-site treatment and disposal (either individual or communal in nature).
- A water supply is necessary to ensure that a sufficient quality and quantity of water is available to all properties.

Whangarei district council three waters policy objectives are as follows:

1. TMW-01 Connections - Ensure that connection to reticulated three waters networks is provided for within a reticulated area.
2. TWM-O2 – Reticulated Networks - Maintain the effectiveness, efficiency and sustainability of reticulated three waters networks.
3. TWM-O3 – Integrated Infrastructure - Plan and provide for three waters infrastructure in an integrated and comprehensive manner.
4. TWM-O4 – Private Systems - Ensure that private three waters systems are provided where connections are not provided to reticulated networks
5. TWM-O5 – Adverse Effects - Minimise adverse effects from stormwater and wastewater on people, property, infrastructure, the receiving environment and cultural values.

Whangarei district council policies are as follows

Policies	Explanation	Development Assessment
TWM-P1 – Three waters Infrastructure	To ensure that three waters resources are appropriately managed by requiring subdivision and development to provide three waters infrastructure that: • Is coordinated, integrated and compatible with the existing infrastructure and capacities. • Enables the existing network to be expanded or extended to adjacent land where that	The proposed stormwater ponds will limit peak flows to predevelopment level for the 2, 10 and 100yr storm events, with a 20% allowance for climate change. They will include an extended detention volume to address erosion effects on the stream network that they discharge into and provide water quality treatment for the roads within the development, based on 1/3rd of the 2yr storm.

	land is suitable for future reticulated development.	
TWM-P2 – Reticulated Areas	To sustainably and efficiently manage three waters resources by avoiding private three waters systems where connection to the reticulated network is practicable or where failure to connect may compromise the future extension of the reticulated network.	The development will provide stormwater, water and wastewater connections for each lot. Water and wastewater will connect to the existing public systems, with additional public network extensions undertaken as part of the development. Stormwater will discharge into a new public SW network that discharges into the stream. There will be one outlet point from the pond which discharges to the stream on the southern end of the site, and another smaller outfall for the lower lying lots.
TWM-P3 – Capacity	To manage the scale and design of subdivision and development where connection is provided to reticulated three waters networks to ensure that there is sufficient capacity in the reticulated networks, and where necessary require upgrades and/or extensions to the reticulated networks.	The water and wastewater networks will be extended to service the development. The new public stormwater system including the proposed stormwater pond, will mitigate effects for up to a 1% AEP. This will minimise additional effects on downstream areas.
TWM-P4 – Future Development	To ensure that reticulated three waters infrastructure is designed to accommodate planned and future development.	The water network already extends past the boundary of the proposed development, so it is not considered necessary to extend this network other than to service the proposed development. The development upstream at top of the hillside is council owned land and will not be developed, hence neither stormwater or wastewater reticulation extension is proposed.
TWM-P5 – Vested Assets	To require vested assets, and connections to vested assets, to be designed and constructed in a manner that protects the ongoing	All three waters infrastructure will be designed in accordance with relevant councils and NZ engineering standards

	operation, maintenance and upgrading of that asset.	and will be vested to council as part of the development.
TWM-P6 – Private Systems	To ensure that where connection to a reticulated three waters network is not available or practicable that provision can be made for: 1. A water supply. 2. The treatment, disposal, and where appropriate attenuation, of stormwater in a way that does not lead to significant adverse effects on or off site. 3. Management of wastewater via: a. An on-site wastewater treatment system; or b. Approval to connect to a private wastewater system.	All lots shall be able to connect into the extended public three waters network and no private systems are necessary. The water, stormwater and gravity wastewater systems will be vested to council.
TWM-P7 – Flooding	To reduce the risk of flood hazards or increased upstream and downstream flood levels resulting from stormwater discharges.	Flows from the development will be reduced to below predevelopment levels for up to a 1% AEP, and will include a 20% rainfall increase for climate change. Stormwater flows within the development will include both a piped reticulation system and secondary flow paths to manage stormwater flows up to a 1%AEP.
TWM-P8 – Integrated Three Waters Assessments	To require Integrated Three Waters Assessments for large scale developments to: 1. Manage three waters in an integrated and comprehensive manner. 2. Enable and recognise the benefits of green infrastructure and low impact and water sensitive design.	A stormwater pond will be installed as part of the development which will protect the receiving environment. The water and wastewater will be connected to the public systems to mitigate the effects of more intensive urban development.
TWM-P9 – Infrastructure	To require subdividers and developers to meet the costs of any	The subdivision will install the infrastructure necessary to service the

	upgrades or extensions of reticulated three waters infrastructure which are attributed to the impacts of the subdivision or development.	proposed development as part of its construction. No network upgrades apart from inside the subject site are required as part of the development.

With reference to Whangarei District Council's engineering standards, ponds should be designed generally in accordance with TP10/GD01, which are Auckland Council's standards for stormwater design for development and are considered a suitable set of guidelines for Northland with similar catchments and geology.

The design the stormwater ponds generally requires the following:

- An extended detention volume of 34.5mm for the site to be released over a 24hr period, This slow release volume is to minimise stream erosion and increase water quality in the pond. In accordance with the technical guidance on pond design that GD01 is based upon (TR2013-024) a 70mm (to minimise blockage risks) or larger orifice has been used to manage these flows.
- The pond is designed with capacity to mitigate post development flows to equal or less than the pre-development 24 hour 2, 10 and 100 year storm events to prevent the development increasing the flooding risks downstream.
- The Whangarei District Council's engineering standards also require new developments to apply a 20% increase to the design storm runoff figures to address future increases resulting from climate change effects this has been incorporated into the post development model.

6 PROPOSED STORMWATER MITIGATION METHODOLOGY

6.1 Proposed Devices

Due to the constraints of the site, it is proposed to mitigate the effects of the development using the following devices:

- A stormwater pond has been designed to collect the stormwater runoff from impervious and pervious areas of each lot, the road reserve and the bushed area. The pond has been designed with the necessary outlet configuration to mitigate the 2yr, 10yr and 100yr storm events to equal or less than pre-development rates, which ensures that it does not affect downstream areas with any increases in flow rates. The water will discharge from the pond into the stream running along the southern boundary of the development.
- Additional to the 2,10 and 100yr storm event mitigation an extended detention volume has been allowed for in the pond with a 24hr drain down period designed in accordance with Auckland Council's GD01. The extended detention reduces the stream erosion and increases water quality in the pond for the runoff from all the individual lots and road reserve areas and will help improve the overall quality of the stream the pond discharges to.

- The full water quality treatment volume for all areas of the development is provided within the pond (1731m^3). 50% of this shall be provided as dead storage and the rest as live storage with the extended detention storage.
- A forebay is included in the pond design to ensure settlement of sediments as required under Auckland Council's GD01. The pond will also drain completely through soakage during the drier periods.

6.2 Modelling Inputs

A HEC-HMS model was developed based on a SCS Type 1A storm profile determined from HIRDS V4 rainfall data for the site, and the hydrological parameters outlined in Table 1 above.

A time of concentration of 10 minutes was used due to the relatively small catchment lengths.

The rainfall data was increased by 20% in the post development model to account for the increases in storm intensity and frequency as a result of climate change.

6.3 Results

Table 3 below shows the pre-development and post-development peak flow rates produced by the proposed design. The full output tables from the HEC-HMS modelling are appended to this report.

Table 3 - Pre and Post Development peak flow rates from the development.

Storm Event (ARI)	Pre Development (m^3/s)	Post Development (m^3/s)
2	0.3576	0.3537
10	0.6912	0.6892
100	1.2464	1.2415

The results show that the proposed design attenuates post-development peak flows to equal or less than the pre-development peak flows.

If impermeable areas greater than those analysed in this design are proposed, then a revision of the design presented in this report will be required.

6.4 Stormwater Device Design

6.4.1 Stormwater Pond

- The footprint of the permanent pond water level covers an area of approximately 718m^2 at RL145.3m, with the depth being approximately 2.5m.

- The extended detention storage area available between the permanent water level and RL146.1m is approximately 1040m^3.
- Above the extended detention level at RL146.1m the pond as modelled will utilise 3127m^3 of volume to control up to the 100-year storm event with the expected levels during a 100 year storm to reach RL147.6m which is a maximum water depth of 4.8m from the pond base.
- The volumes and elevations for the various storm event storage are summarised in Table 5 below.

Table 4 - Pond storage at respective elevations.

Elevation (RL)	Area (m^2)	Volume (m^3)	Cumulative Volume (m^3)
142.8	38	N/A	N/A
145.3	718	945	945
145.4	863	79	1024
147.9	2204	3834	4858
148	2859	253	5112

Table 5 - Pond volumes and respective elevations for storm event storage.

Storage Event	Elevation (RL)	Cumulative Pond Volume (m^3)
Dead Storage	145.3	945
Extended Detention	146.1	1985
2 year Live Storage	146.7	3018
10 year Live Storage	147.1	3632
100 year Live Storage	147.6	4398
Total Pond Capacity	148.0	5112

- The pond will incorporate a 1m wide bench as a safety precaution to allow anyone to exit the water should anyone inadvertently enter the pond. This bench has been incorporated into the design at RL145.4m.
- The dead storage volume (945m^3) will provide water quality treatment most of which will slowly drain through soakage.
- A Ø100mm low flow outlet will control the permanent pond levels around RL 145.3, with the extended detention volume being above this level.
- The top of the pond bank is a 3m width at RL148m, this allows 0.3m freeboard from the 100yr storm event level. Additionally, the pond shall have an emergency drain into the stream installed. This is capable of discharging events in the unlikely event that the manhole overflow is blocked.
- The outfall structure of the pond will have outlets as shown in Table 6 below. A drawing of the outlet structure and pond dimensions is appended to this report.

Table 6 - Pond outlet structure summary.

Outlet	Elevation (RL)	Description
Outlet 1	145.3	Ø100mm orifice outlet
Outlet 2	146.1	Ø400mm orifice outlet

Outlet 3	146.7	Ø375mm orifice outlet
Outlet 4	147.1	Ø400mm orifice outlet
Emergency Spillway	147.7	Ø2050mm manhole overflow
Manhole Outlet	142.8	Ø1050mm outlet

- A forebay with a minimum 30% volume of 260m^3 shall be provided at the inlet to the pond to capture coarse sediments before they enter the pond. Access shall be provided to the forebay such that sediments can be cleaned out.
- A 3m wide access track shall be formed from the top of the pond down with access onto this track via a shared concrete accessway at a maximum grade of 1:4 which will also serve as the overland flow path into the pond.
- A capped 150mm PVC outlet has been installed at the base of the pond discharging into the outlet manhole, this outlet is to be only used if de-watering the pond is required for maintenance purposes, and will drain the pond completely.
- The pond will be formed so that any overflow in excess of the ponds capacity drains into the manhole and out via the outlet pipe and in an extreme case via a 3m wide spillway, should the pipe become blocked for any reason.

7 LIMITATIONS

This report has been prepared exclusively for Onoke Heights Limited with respect to the particular brief given to us. Information, opinions and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. LDE Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

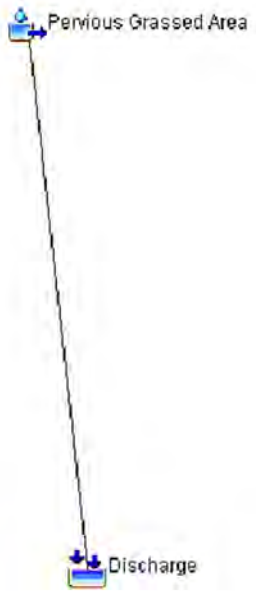
APPENDIX A
HIRDS V4 RAINFALL DATA

2, 10 AND 100 YEAR ARI STORM +20%CC RAINFALL INTENSITY (MM/H)

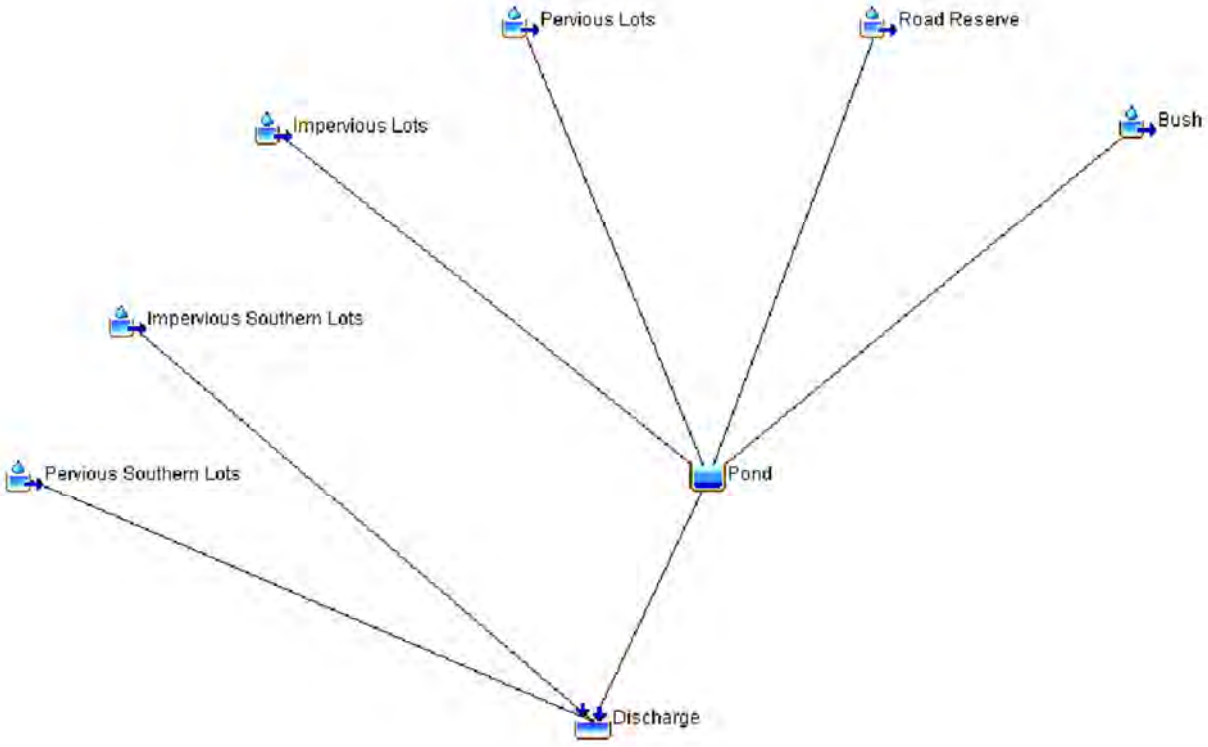
ARI	10m	20m	30m	60m	2h	6h	12h	24h	48h	72h
2	96.0	69.2	57.0	41.4	29.5	16.7	11.4	7.7	4.8	3.6
5	127.1	92.6	76.1	55.3	39.1	22.0	15.0	10.1	6.3	4.7
10	152.9	111.4	91.6	66.4	46.8	26.3	17.8	11.9	7.4	5.5
20	181.8	131.9	108.9	78.6	55.3	31.0	21.0	13.7	8.6	6.3
30	199.2	145.0	119.8	86.2	61.0	34.0	23.0	14.9	9.4	6.9
40	211.9	155.2	128.0	92.1	64.5	36.0	24.3	15.6	9.8	7.2
50	223.1	162.8	134.9	97.2	68.5	37.7	25.6	16.2	10.3	7.5
60	231.6	169.4	140.4	101.5	71.1	39.1	26.5	16.8	10.6	7.7
80	246.2	180.2	149.4	107.1	75.6	41.5	28.1	17.7	11.1	8.1
100	257.8	189.0	156.0	111.8	78.5	43.7	29.5	18.4	11.5	8.4

APPENDIX B
HEC HMS MODEL
SCHEMATICS
AND OUTPUTS

PRE DEVELOPMENT SCHEMATIC



POST DEVELOPMENT SCHEMATIC



2-YEAR ARI STORM PRE DEVELOPMENT RESULTS

Project: 67 Dip Road, Kamo Simulation Run: 2yr pre

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 10:33:24

Basin Model: Pre development
Meteorologic Model: 2yr pre
Control Specifications: 24hr

Show Elements: All Eleme... Volume Units: (●) MM ( ) 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pervious Grassed Area	0.066955	0.3576	01Jan2000, 08:00	85.628
Discharge	0.066955	0.3576	01Jan2000, 08:00	85.628

2-YEAR ARI STORM POST DEVELOPMENT RESULTS

Project: 67 Dip Road, Kamo Simulation Run: 2yr post
Reservoir: Pond

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 11:03:12

Basin Model: Post development
Meteorologic Model: 2yr post
Control Specifications: 24hr

Volume Units: (●) MM ( ) 1000 M3

Computed Results

Peak Inflow: 0.5865 (M3/S)
Peak Discharge: 0.3159 (M3/S)
Inflow Volume: 147.639 (MM)
Discharge Volume: 129.064 (MM)

Date/Time of Peak Inflow: 01Jan2000, 08:00
Date/Time of Peak Discharge: 01Jan2000, 08:25
Peak Storage: 1.925 (1000 M3)
Peak Elevation: 146.645 (M)

Project: 67 Dip Road, Kamo Simulation Run: 2yr post
Sink: Discharge

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 11:03:12

Basin Model: Post development
Meteorologic Model: 2yr post
Control Specifications: 24hr

Volume Units: (●) MM ( ) 1000 M3

Computed Results

Peak Discharge: 0.3537 (M3/S)
Volume: 131.179 (MM)

Date/Time of Peak Discharge 01Jan2000, 08:15

10-YEAR ARI STORM PRE DEVELOPMENT RESULTS

Project: 67 Dip Road, Kamo Simulation Run: 10yr pre

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 10:33:29
Basin Model: Pre development
Meteorologic Model: 10yr pre
Control Specifications: 24hr

Show Elements: All Eleme... Volume Units: (●) MM ( ) 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pervious Grassed Area	0.066955	0.6912	01Jan2000, 08:00	158.231
Discharge	0.066955	0.6912	01Jan2000, 08:00	158.231

10-YEAR ARI STORM POST DEVELOPMENT RESULTS

Project: 67 Dip Road, Kamo Simulation Run: 10yr post
Reservoir: Pond

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 11:04:32
Basin Model: Post development
Meteorologic Model: 10yr post
Control Specifications: 24hr

Volume Units: (●) MM ( ) 1000 M3

Computed Results

Peak Inflow: 0.9758 (M3/S)
Peak Discharge: 0.6205 (M3/S)
Inflow Volume: 243.893 (MM)
Discharge Volume: 224.697 (MM)
Date/Time of Peak Inflow: 01Jan2000, 08:00
Date/Time of Peak Discharge: 01Jan2000, 08:20
Peak Storage: 2.543 (1000 M3)
Peak Elevation: 147.062 (M)

Project: 67 Dip Road, Kamo Simulation Run: 10yr post
Sink: Discharge

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 11:04:32
Basin Model: Post development
Meteorologic Model: 10yr post
Control Specifications: 24hr

Volume Units: (●) MM ( ) 1000 M3

Computed Results

Peak Discharge: 0.6892 (M3/S)
Volume: 226.888 (MM)
Date/Time of Peak Discharge 01Jan2000, 08:15

100-YEAR ARI STORM PRE DEVELOPMENT RESULTS

Project: 67 Dip Road, Kamo Simulation Run: 100yr pre

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 10:33:33
Basin Model: Pre development
Meteorologic Model: 100yr pre
Control Specifications: 24hr

Show Elements: All Eleme... Volume Units: (●) MM ( ) 1000 M3 Sorting: Hydrolo...

Hydrologic Element	Drainage Area (KM2)	Peak Discharge (M3/S)	Time of Peak	Volume (MM)
Pervious Grassed Area	0.066955	1.2464	01Jan2000, 08:00	277.736
Discharge	0.066955	1.2464	01Jan2000, 08:00	277.736

100-YEAR ARI STORM POST DEVELOPMENT RESULTS

Project: 67 Dip Road, Kamo Simulation Run: 100yr post
Reservoir: Pond

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 11:03:57
Basin Model: Post development
Meteorologic Model: 100yr post
Control Specifications: 24hr

Volume Units: (●) MM ( ) 1000 M3

Computed Results

Peak Inflow: 1.5850 (M3/S)
Peak Discharge: 1.1212 (M3/S)
Inflow Volume: 395.086 (MM)
Discharge Volume: 374.280 (MM)
Date/Time of Peak Inflow: 01Jan2000, 08:00
Date/Time of Peak Discharge: 01Jan2000, 08:15
Peak Storage: 3.356 (1000 M3)
Peak Elevation: 147.611 (M)

Project: 67 Dip Road, Kamo Simulation Run: 100yr post
Sink: Discharge

Start of Run: 01Jan2000, 00:00
End of Run: 02Jan2000, 00:00
Compute Time: 24Nov2021, 11:03:57
Basin Model: Post development
Meteorologic Model: 100yr post
Control Specifications: 24hr

Volume Units: (●) MM ( ) 1000 M3

Computed Results

Peak Discharge: 1.2415 (M3/S)
Volume: 376.633 (MM)
Date/Time of Peak Discharge 01Jan2000, 08:10

APPENDIX C
LDE DRAWINGS

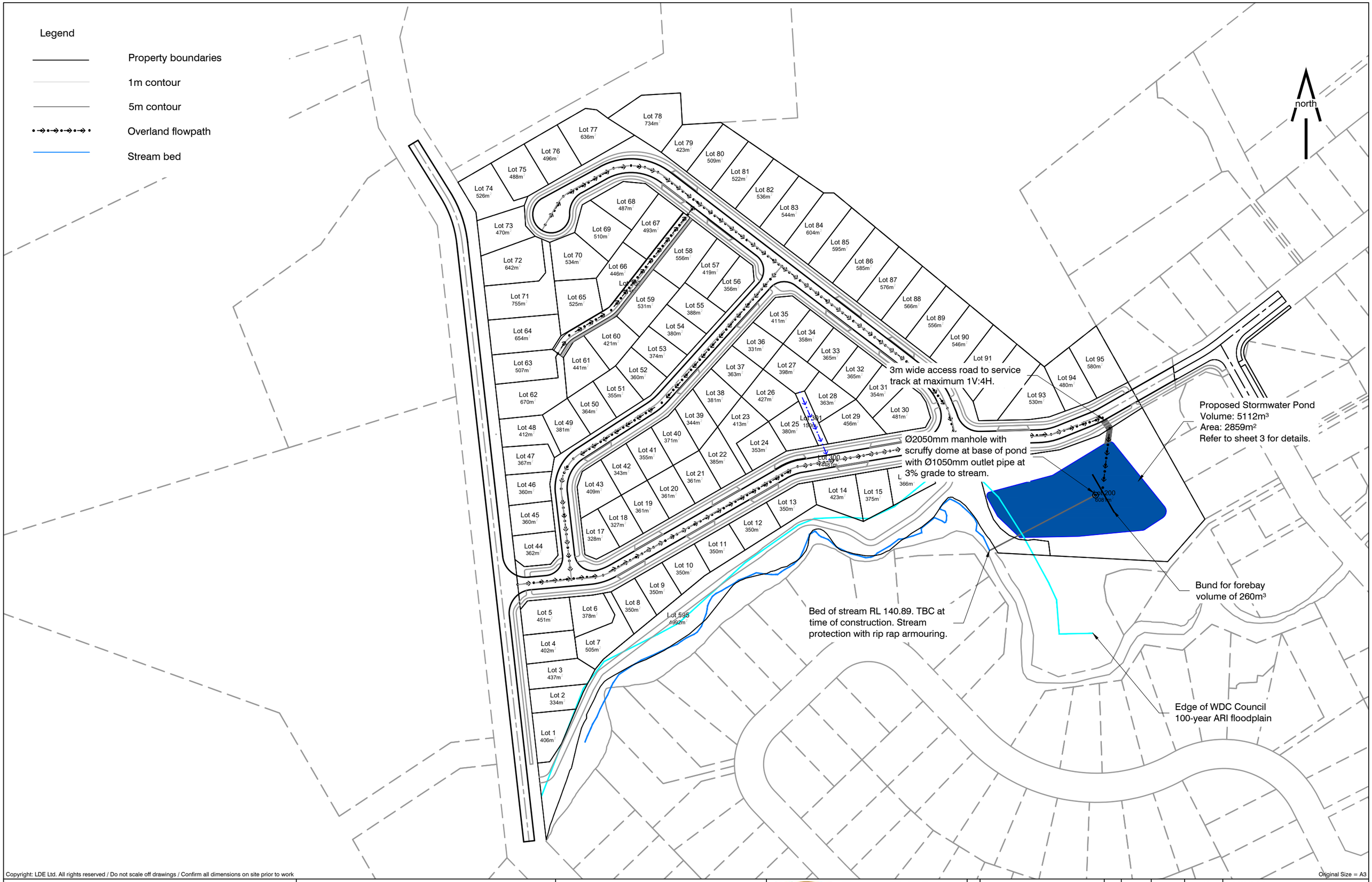
Project Number: 19103
Project Office: Warkworth
Project Manager: Aaron Holland

Stormwater Pond Drawings for

67 Dip Road, Kamo

Whangarei

CONTENTS				
SHEET	DESCRIPTION	ISSUE DATE	STATUS	REVISION
1	Stormwater Pond Location	24/11/2021	For Information	B
2	Stormwater Pond Catchment Areas	24/11/2021	For Information	B
3	Stormwater Pond Section	16/11/2021	For Information	A



Original Size = A3

CLIENT
Onoke Heights Limited

PROJECT
67 Dip Road Subdivision
Kamo, Whangarei

DRAWING TITLE
Stormwater Pond Location

LDE LAND DEVELOPMENT & ENGINEERING LTD.

No.	REVISION	BY	DATE
B	Updated lot boundaries	LK	24/11/2021
A	For Information	LK	16/11/2021

DESIGN:	LK
DRAWN:	LK
DATE:	16/11/21
CHECKED:	AH
SCALE A3:	1:1750

PROJECT STATUS: For Information
PROJECT: 19103
SHEET: 01 of 03
DRAWING No: C1
REV: B

Legend

- Property boundaries
- 1m contour
- 5m contour
- Overland flowpath
- Stream bed

north

Catchment A 9375m² (Bushed area outside of development)

Catchment B
26,014m²

Catchment D
14,481m²

Catchment C
10,294m²

Catchment E 6177m²

Catchment G 4992m² (Not included in pond design)

Original Size = A3

CLIENT
Onoke Heights Limited

PROJECT
67 Dip Road Subdivision
Kamo, Whangarei

DRAWING TITLE
Stormwater Pond Catchment Areas

LDE LAND DEVELOPMENT & ENGINEERING LTD.

No.	REVISION	BY	DATE
B	Updated catchment areas	LK	24/11/2021
A	For Information	LK	16/11/2021

DESIGN:	LK
DRAWN:	LK
DATE:	16/11/21
CHECKED:	AH
SCALE A3:	1:1750

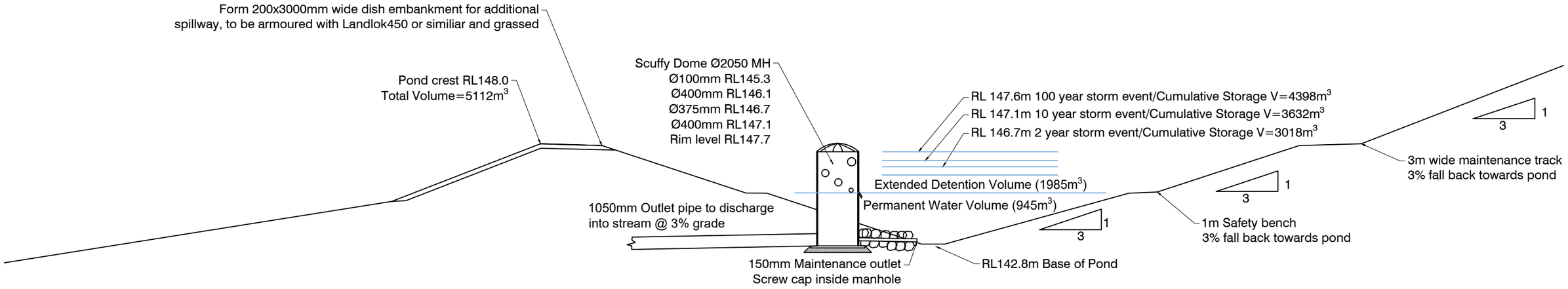
PROJECT STATUS: For Information

PROJECT: 19103

SHEET: 02of 03

DRAWING No: C2

REV: B



Original Size = A3

CLIENT
Onoke Heights Limited

PROJECT
67 Dip Road Subdivision
Kamo, Whangarei

DRAWING TITLE
Stormwater Pond Section

LAND DEVELOPMENT & ENGINEERING LTD.

No.	REVISION	BY	DATE
A	For Information	LK	16/11/2021

DESIGN:	LK
DRAWN:	LK
DATE:	16/11/21
CHECKED:	AH
SCALE A3:	NTS

PROJECT STATUS: For Information

PROJECT: 19103

SHEET: 03 of 03

DRAWING No: C3

REV: A

Appendix 4

Rules Assessment

Rules Assessment

Proposal: Earthworks and Stormwater Discharge Associated with Residential Subdivision

Address: Dip Road, Kamo

Regional Plan: Northland Regional Plan

OPERATIVE REGIONAL WATER AND SOIL PLAN FOR NORTHLAND (RWSP)		
Rule	Compliance	Non-Compliance
Chapter 21 – Rules for stormwater discharges		
21.1.1 Diversion and discharge of stormwater by way of an open constructed stormwater collection system or piped for which resource consent exists.		Does not comply. The proposal includes the establishment of a stormwater system that discharges to Waitaua Stream which does not have an existing resource consent. **Permitted Activity under Rule 21.1.2.**
21.1.2 – Permitted stormwater diversions and discharges (a) For new subdivision and development, the best practicable option for on-site stormwater disposal shall be identified and incorporated into the stormwater management design to avoid or minimise changes to stormwater flows after development for the 1 in 5 year return period storm event. (b) Where the diversion and/or discharge drains a hazardous substance storage area… (c) Where the diversion and/or discharge drains an industrial or trade premise…	Complies The proposal includes the best practicable option for onsite stormwater management for the proposed subdivision designed to accommodate the 2, 10 and 100 year storm events. The proposed stormwater diversion will not drain from a hazardous substance storage area, industrial or trade premise. The stormwater will be treated as detailed in the Three Waters Report (**Appendix 3**)	

OPERATIVE REGIONAL WATER AND SOIL PLAN FOR NORTHLAND (RWSP)		
Rule	Compliance	Non-Compliance
(d) The stormwater collection system is designed to cater for stormwater flows resulting from not less than a 1 in 5 year return period storm event and a stabilised overland flow path is provided for to allow flows up to and including a 1 in 50 year storm event in excess of the capacity of the primary collection system.	The Erosion and Sediment Control Plan and stormwater (proposed by consent conditions) will ensure that compliance is achieved during construction with the standards set out in Rule 21.1.2(a) – 21.1.2(i).	
(e) For discharges to water, the discharge does not: (i) Increase the natural temperature of the receiving water by more than 3° Celsius at or beyond a 20 metre radius from the discharge point. (ii) Cause the pH of the receiving water to fall outside of the range 6.5 to 9 at or beyond a 20 metre radius of the discharge point. (iii) Cause the production of any conspicuous oil or grease films, scums or foams, or floatable or suspended materials in the receiving water at or beyond a 20 metre radius of the discharge point. (iv) cause any emission of objectionable odour in the receiving water at or beyond a 20 metre radius of the discharge point. (v) contain more than: • 20 g/m³ of total petroleum hydrocarbons • 10 mg/m³ of total copper • 10 mg/m³ of total lead • 100 mg/m³ of total zinc • 100 g/m³ of suspended solids.	**Permitted Activity**	
(f) The discharge does not cause scour or erosion of the beds or banks of the receiving water body.		
(g) For diversion and/or discharges onto or into land, stormwater quality control measures or treatment systems such as silt, oil and grease traps are incorporated to minimise the level of contaminants prior to final disposal.		

OPERATIVE REGIONAL WATER AND SOIL PLAN FOR NORTHLAND (RWSP)		
Rule	Compliance	Non-Compliance
(h) The stormwater management or treatment systems, and any associated works or equipment shall be operated and maintained in an effective operating condition. (i) The diversion and/or discharge does not cause flooding of adjacent properties.		
Chapter 22. Rules for stormwater discharges and diversions from roads and from land disturbance activities.		
22.1.1 Permitted Activities The following diversions and discharges associated with stormwater from roads and land disturbance activities are permitted activities: 1. The diversion and discharge of stormwater into water or onto or into land where it may enter water from any land disturbance activity, which is permitted under a land disturbance activity rule in this Plan is a permitted activity, provided that: (a) The stormwater is diverted or discharged in the catchment from which it originates. (b) Water and sediment control measures (e.g. rock rip-rap, cut-off drains, sediment traps) are installed and maintained, to avoid or minimise erosion and to avoid or minimise sediment discharges to any adjacent water bodies or to any coastal waters. (c) The diversion and discharge has a no more than minor adverse effect (as determined by the relevant water quality guidelines in Section 7) on aquatic ecosystems and/or on neighbouring or downstream landowners/occupiers (e.g. deposition of sediment, exacerbation of flooding).		Does not comply. The proposed development includes the construction of a new public road to service the residential allotments. Stormwater from the road will be diverted into the proposed stormwater system. Land disturbance proposed is not a permitted activity. **Controlled Activity under 22.2.1**
22.1.2 Diversion of discharge from any road or track by way of stormwater		Does not comply

OPERATIVE REGIONAL WATER AND SOIL PLAN FOR NORTHLAND (RWSP)		
Rule	Compliance	Non-Compliance
collection system for which a resource consent exists.		No resource consent exists for the proposed stormwater system. **Controlled Activity under 22.2.1**
22.1.3 The diversion and discharge of stormwater, not otherwise permitted by Rule 22.01.02 from any road or track into water or onto or into land where it may enter water is a permitted activity, provided that: (a) The road does not form part of a stormwater collection system that is designed to divert or discharge stormwater from any of the sources otherwise regulated by rules contained in Section 21 of this Plan	Complies The proposed road will form part of the stormwater system designed to divert or discharge stormwater from the proposed residential units which is regulated under Section 21 of this plan. **Permitted** **Activity**	
22.2.1 Controlled Activities The following diversion and discharge associated with land disturbance activities or from roads is a controlled activity: 1. The diversion and discharge of stormwater into water or onto or into land where it may enter water: (1) from any land disturbance activity, where that activity is a controlled activity under a Land Disturbance Activity Rule in this Plan (refer also Section 33); or (2) from any road that does not meet the requirements of permitted activity Rule 22.01.02 and 22.01.03;	Complies The proposed road will form part of the stormwater system designed to divert or discharge stormwater from the proposed residential units. The proposed road will not comply with 22.01.02. **Controlled Activity**	
Chapter 33 - Rules for land disturbance activities		
33.1.3 – Earthworks that are not in a Riparian Management Zone	Complies No earthworks are proposed within the riparian management zone of the Waitaua Stream. **Permitted activity**	
33.2.1(1) Any earthworks which are not located in the riparian management zone where not located on erosion prone land of more than 5,000m^3 in any 12-month period	Complies The subject site is not identified as erosion prone land. **Permitted activity**	

PROPOSED NORTHLAND REGIONAL PLAN		
Rule	Compliance	Non-Compliance
C.4 Land drainage and flood control		
C.4.1.1 Land drainage – permitted activity The damming, diversion and discharge of water associated with land drainage are permitted activities, provided: 1) the activity complies with all relevant conditions of Rule C.4.1.9 Land drainage and flood control general conditions, and 2) any resulting land subsidence or slumping does not cause adverse effects on structures or infrastructure on other property, and 3) the discharge is in or from the same catchment in which the water would naturally flow, and 4) a new drain is not constructed within 15 metres of an existing wastewater disposal area. *Appealed*	Complies As detailed below the proposed stormwater system will comply with Rule C.4.1.9. No land subsidence or slumping will cause adverse effects to any structure or infrastructure onsite as per the design detailed in the Three Waters Report **(Appendix 3).** The discharge is in the same catchment from which the water would naturally flow. The proposed stormwater system will not be located within proximity to an existing waste water disposal system in the area (noting that the existing residential unit and wastewater disposal area within 189 Three Mile Bush Road will be removed). **Permitted Activity**	
C.4.1.9 Land drainage and flood control general conditions General conditions apply to activities when referred to in the rules of Section C.4.1. 1) There is no adverse flooding, erosion or over-drainage effects on other property. 2) The activity does not alter the course of a lake or continually or intermittently flowing river.	Complies 1) The proposed stormwater system has been designed to mitigate the 2yr, 10yr and 100yr storm events to equal or less than pre-development rates, which ensures that it does not affect downstream areas with any increases in flow rates. Additional to the 2, 10 and 100yr storm event mitigation an extended detention volume has been allowed for in the pond with a 24hr drain down period	

PROPOSED NORTHLAND REGIONAL PLAN		
Rule	Compliance	Non-Compliance
3) New land drainage does not occur within 50 metres of any natural wetland. 4) Drainage does not cause any change to the seasonal or annual range in water level of a natural wetland to an extent that may adversely affect the wetland's natural ecosystem. 5) No vegetation, soil or other debris generated from the activity is placed in a position where it may be carried into a river or natural wetland, lake or the coastal marine area. 6) There is no damage to a flood defence or any other authorised structure. 7) Fish passage is maintained, unless an existing authorisation provides otherwise, or temporary works to enable repair and replacement works are being carried out. 8) Eels, fish (other than pest fish), kōura (freshwater crayfish) and kākahi (freshwater mussels) unintentionally removed during mechanical clearing of drainage channels are returned to the drainage channel as soon as practicable, but no later than one hour after their removal. 9) Refuelling of machinery does not take place in the bed of a river or lake. 10) Where a discharge from land drainage enters an outstanding freshwater body or coastal water beyond the zone of reasonable mixing, the discharge does not… 11) Any discharge of sediment associated with repair and maintenance activities does not	designed in accordance with Auckland Council's GD01. 2) The proposed stormwater system does not alter the course of Waitaua Stream. 3) There are no natural wetlands within 50m of the proposed system. 4) The proposed stormwater system will not cause any change to water levels of natural wetlands. 5) Proposed works will comply. 6) No damage to a flood defence will occur. 7) Fish passage will be maintained. 8) Proposal will comply. 9) Proposal will comply. 10) Waitaua Stream is not identified as an outstanding freshwater body. 11) Proposal will comply. **Permitted Activity**	

PROPOSED NORTHLAND REGIONAL PLAN		
Rule	Compliance	Non-Compliance
occur for more than five consecutive days and must not occur for more than 12 hours on any one day. *Appealed*		
C.6 Discharges to land and water		
C.6.4.1 Stormwater discharges from a public stormwater network – permitted activity The diversion and discharge of stormwater from a public stormwater network into water or onto or into land where it may enter water is a permitted activity, provided: 1) the discharge is not from a public stormwater network servicing an urban area listed in Table 10: Urban areas, and 2) the diversion and discharge does not cause permanent scouring or erosion of the bed of a water body at the point of discharge, and 3) the discharge is not within 100 metres of a geothermal surface feature, and 4) the discharge does not contain contaminants used, stored or generated in trade or industrial premises, and 5) the discharge does not contain more than 15 milligrams per litre of total petroleum hydrocarbons, and		Does not comply. The proposed stormwater system will be vested with Council and will form a public stormwater network[1] within the urban area of Whangarei City. **Controlled Activity under rule C.6.4.3**

[1] **Public Stormwater Network:**
A system of stormwater pipes, open channels, devices and associated ancillary structures owned and/or operated by a local authority and used for conveying, diverting, storing, treating, or discharging stormwater.

PROPOSED NORTHLAND REGIONAL PLAN		
Rule	Compliance	Non-Compliance
6) the discharge does not cause any of the following effects in the receiving waters beyond the zone of reasonable mixing: a) the production of conspicuous oil or grease films, scums or foams, of floatable or suspended materials, or b) a conspicuous change in the colour or visual clarity, or c) an emission of objectionable odour, or d) the rendering of fresh water unsuitable for consumption by farm animals, or e) the rendering of freshwater taken from a mapped priority drinking water abstraction point (refer I Maps | Ngā mahere matawhenua) unsuitable for human consumption after existing treatment		
C.6.4.3 Stormwater discharges – controlled activity The diversion and discharge of stormwater into water or onto or into land where it may enter water that is not a permitted activity or discretionary activity in section C.6.4 of this Plan is a controlled activity. Matters of control: 1) The maximum concentration or load of contaminants in the discharge. 2) The size of the zone of reasonable mixing. 3) The adequacy of measures to minimise erosion. 4) The adequacy of measures to minimise flooding caused by the stormwater network. 5) The design and operation of the stormwater system and any staging of works.	Complies The proposed stormwater system will be vested with Council as a public stormwater network. The proposal is not a discretionary activity in section C.6.4. **Controlled Activity**	
C.8 Land Use and Disturbance Activities		
C.8.3.1.1) Earthworks – Permitted Activity		Does not comply 1) The amount of earthworks at a particular location or associated with a project does not comply

PROPOSED NORTHLAND REGIONAL PLAN		
Rule	Compliance	Non-Compliance
		with the thresholds in Table 8 which restricts: The earth exposed at any one time to 5000m^2. **The proposed works will occur over an area of 6.8ha.** The Erosion and Sediment Control Measures proposed via conditions of consent ensure that compliance is achieved with the standards set out in Rule C.8.3.1.1.2 – C.8.3.1.1.8. **Controlled Activity under rule C.8.3.2**
C.8.3.2) Earthworks – Controlled Activity		Does not comply 1) The amount of earthworks will exceed 5000m^2 of exposed earth at any one time within 10m of Waitaua Stream. **Discretionary Activity under rule C.8.3.4**

Appendix 5

Potentially Contaminated Site Search

Private Bag 9023 | Whangarei 0148 | New Zealand
T: 09 430 4200 | 0800 WDC INFO | 0800 932 463 | F: 09 438 7632
W: www.wdc.govt.nz | E: mailroom@wdc.govt.nz

Report of the outcome of a "Potentially Contaminated Site" Property search under Section 6 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

Application No: PCS180156

Cook Costello Limited
2 Norfolk Street
Whangarei 0110

Date report compiled: 15/11/2018

Property Search Details:

Address: Dip Road

Kamo 0112

Legal Description: SEC 1 SO 65970

PID NO: 3583

The search undertaken on Council records for this property has not identified any indication of current or previous activities in the area of the site that are included on the current version of the Hazardous Activities and Industries List (HAIL) issued by the Ministry for the Environment.

DISCLAIMER

This Report has been prepared for the purposes of Section 6 of the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 and contains all information known to the Whangarei District Council to be relevant to the land as described. It is based on a search of Council records only and there may be other information relating to the land which is unknown to Council. The Council has not undertaken any inspection of the land or any building on it for the purposes of preparing this report.

Signed

Whitney Peat |
Building Control - Contractor

Appendix 6

Geotechnical Investigation Report

GEOTECHNICAL INVESTIGATION REPORT

FOR

PROPOSED RESIDENTIAL DEVELOPMENT

SECTION 1 SO 65970, DIP ROAD, KAMO, WHANGAREI

Project Reference: 19103
2 July 2021

CONTENTS

1 INTRODUCTION

LDE Ltd was engaged by Onoke Heights Limited to undertake a geotechnical suitability assessment for a proposed residential development at Section 1 SO 65970, Dip Road, Kamo, Whangarei (Lot 1).

The proposed development is expected to comprise approximately 70 moderate to high intensity residential lots, generally ranging from 400m^2 to 700m^2. The subdivision will be serviced by a vested public road through the site, connecting Dip Road to Tuatara Drive, along with a series of .

The purpose of the investigation was to determine the nature of the ground beneath the site, assess the geotechnical hazards posed to the development, and to provide engineering recommendations for site development and future dwelling construction. The assessment of the site has been undertaken to satisfy the requirements of the Resource Management Act and Whangarei District Council Environmental Engineering Standards (WDC EES).

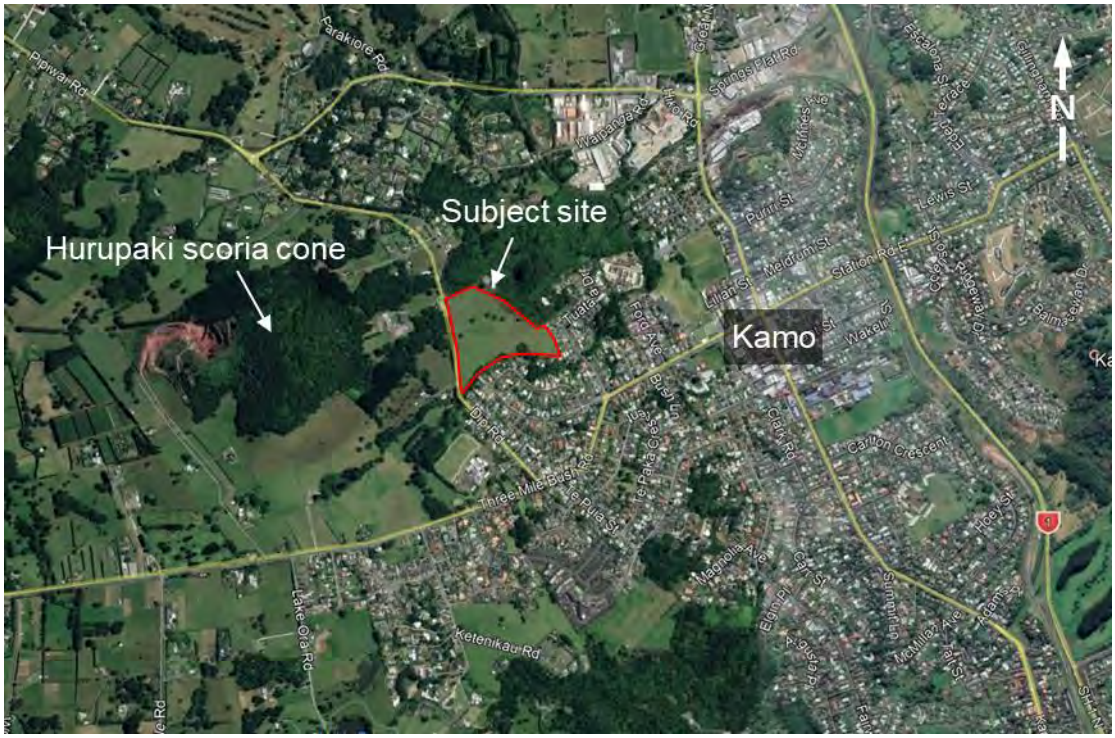


Figure 1: Location of the subject site (source: Google Earth).

2 SITE SETTING

2.1 Desktop Review

The site is legally described as Section 1 SO 65970, comprising an area of 6.87ha on the eastern side of Dip Road, approximately 5.5km northwest of Whangarei CBD. The site is

bordered by residential areas to the south and south-west, with bush to the immediate north and north east.

The site is positioned on the lower south-western slopes of an un-named hill and broadly comprises south and south-west facing slopes.

The site is entirely in pasture with some scattered native trees through the middle of the site. A small stream flows east-ward along the southern site boundary, with the banks covered in native bush.

The site is mapped entirely as low instability hazard on the Whangarei District Council Hazard Maps. The slopes to the northeast of the site are mapped as moderate instability hazard. The only high hazard area identified in the vicinity of the site is a large, narrow gully landform to the northeast of the site as shown on Figure 2.

The lower edge of the site is mapped as flooding prone, however this is confined to the banks of the stream so does not have any effect on the subject site.

No other hazards are mapped as affecting the subject site on either the WDC or NRC hazards maps.

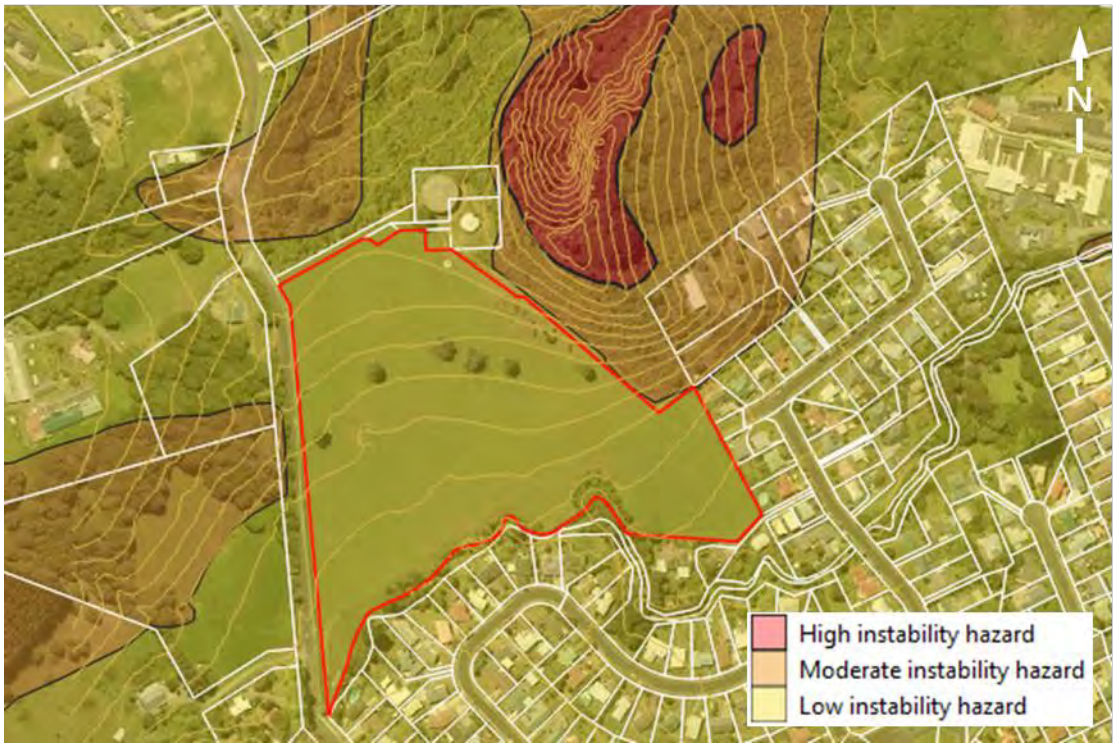


Figure 2: Stability hazard map of the subject site (data from WDC). Subject site outlined in red.

2.2 Historical Aerial Imagery

Historical aerial images of the site have been reviewed dating back to 1942. Images have been sourced from Retrolens and more recent satellite imagery has been sourced from Google Earth.

1942

The site shown to be in similar condition to existing. The bulk of the site is in pasture, with the steeper areas to the northeast being in low scrub.

Notably, a clear track is present leading into the gully feature (high instability hazard area indicated on Figure 2) directly from the railway line to the northeast. The gully itself is in scrub and the track appears overgrown. This appears to indicate that the gully is more likely a disused scoria quarry. Given the age at state of this feature by 1942, it is inferred that this was likely used in the early 1900s and was perhaps a borrow area for the construction of the North Auckland railway line.

1979

The site appears lightly overgrown by this time but no other significant changes are noted. By this time the reservoir has been constructed on the crest immediately north of the site.

Google Earth (2002 – Present)

The site was cleared prior to 2002 and appears to have remained in open pasture since this time.

In 2012 a large tree was cleared from the central-western area of the site, creating a small hollow in the slope that remains in the present topography.

No other changes are noted through the series of available images.

2.3 Published Geology

The 1:250,000 geological map of the region[1] shows the site as being underlain by Kerikeri Volcanic Group scoria across the northern edge of the site, with basalt lava flows to the south occupying the bulk of the site (Figure 3).

The geomorphology of the site is broadly consistent with the mapped geology, except that the boundary of the scoria cone is expected to align with the steepening slope, further east within the site.

[1] Edbrooke, S.W.; Brook, F.J. (compilers) 2009: Geology of the Whangarei area : scale 1:250 000. Lower Hutt: GNS Science. Institute of Geological & Nuclear Sciences 1:250,000 geological map 2. 68 p. + 1 folded map

It appears from the geological map and the wider geomorphology, that the scoria cone to the north-east of the site is a parasitic cone stemming from Hurupaki to the west of the site.

The NRC 'Managing Northland Soils' Map shows the site as being underlain by YO – Waiotu friable clay. The soils map does not recognise the scoria cone as mapped on the GNS geology map. The soils are described as well to moderately drained.

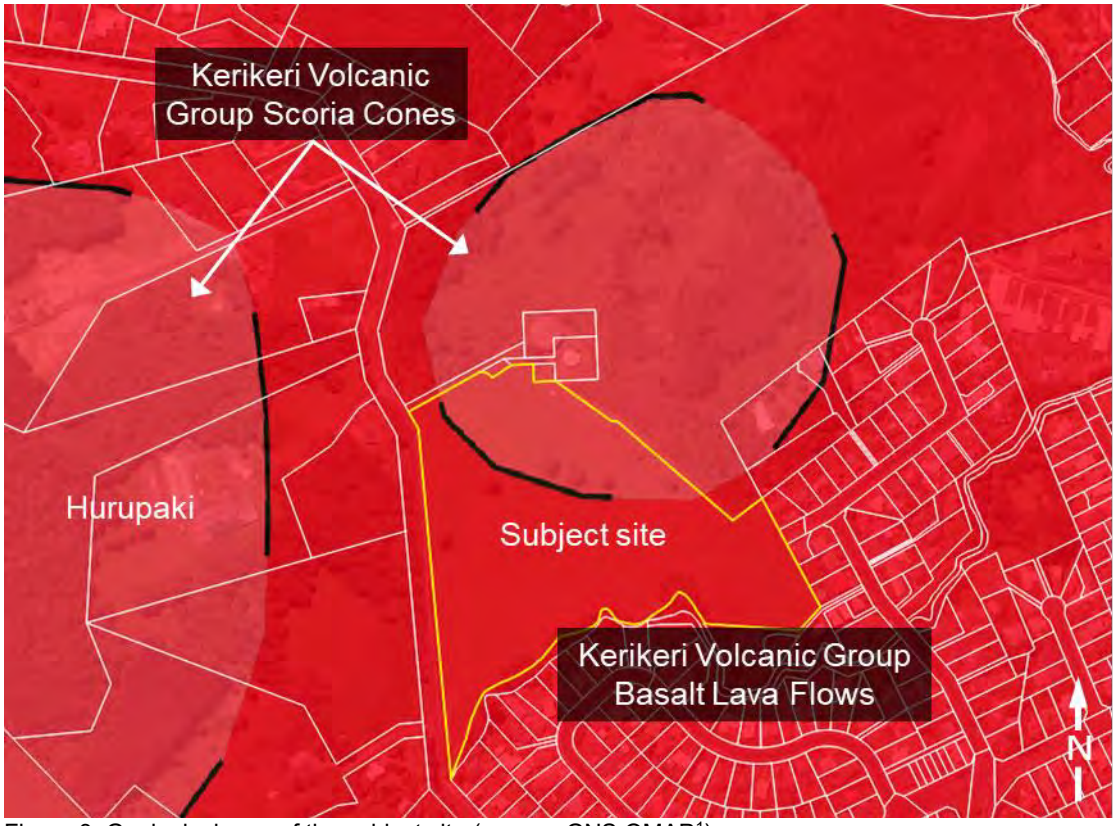


Figure 3: Geological map of the subject site (source: GNS QMAP[1]).

2.4 Site Characteristics

The topography of the site is shown on Figure 4 below, and the on the attached geotechnical investigation plan.

The northern half of the site broadly comprises a broad south facing slope of up to 1V:5H (11°). The slope is generally linear and converging towards the south. Towards the northern boundary the slopes flatten off.

The north-eastern edge of the site borders the mapped scoria cone, with the side slope of this feature forming a steep bank at the boundary, with slopes up to approximately 1V:2H (27°) (Figure 4). A rough track is cut along of the top of this slope, appearing to follow the alignment of the watermains which pass through the site.

The southern part of the site broadly comprises waning slopes which flatten towards the stream at the southern boundary of the site. The stream bank is generally a low, shallow slope. Towards the east the stream becomes more deeply incised, with an arcuate slope some 8m high at 1V:2H (27°) extending into the site at this point (Figure 5).

The stream bed appears to expose in situ basalt in places however this is more likely to be very large, displaced boulders.

Areas of erosion are noted within the steep slope at the edge of the scoria cone, and at the crest of the arcuate slope above the stream. This likely the result of livestock tracking and digging, rather than natural erosion.

Figure 4: Topographic plan of the subject site with notable site features identified. Contours shown at 1m interval with 5m major contours, falling from north to south through the site. See attached investigaiton for full scale plan.

Figure 5: Photo showing the steep slope at the north-eastern boundary.

Figure 6: View east over the crest of the arcuate stream bank slope, showing area of erosion or livestock tracking.

3 GROUND CONDITIONS

3.1 Subsurface Investigations

Our investigations of the site included the following work:

- 23 hand auger boreholes (HA01 to HA23) taken to a target depth of 3-5m or refusal, with measurements of undrained shear strength taken at 200mm increments using a shear vane.
- 13 Scala penetrometer tests carried out from the base of, or concurrent with select hand auger boreholes, to depths of up to 9.8m.

- 5 additional Scala penetrometer tests to 1.0m depth, carried out across the site for the purpose of characterising road subgrade conditions (RP01 to RP05).
- 7 Cone Penetration Tests (CPTu) tests to refusal, at depth of 7.7m to 18.0m below ground level (CPT01 to CPT07).
- 1 Flat Plate Dilatometer test to refusal and one Seismic DMT test (DMT01 and SDMT01/A).
- 1 rotary cored machine borehole to 14.8m depth (BH01).
- Laboratory triaxial testing of undisturbed push tube samples from BH01 and CPT01 targeted to zones of low strength ground.
- Allophane content testing on the same samples.

Initial shallow testing (hand augers and Scalas) was carried out in November 2019. Deep testing (CPTs, DMTs and MBH01) was undertaken in February 2021.

The investigations are summarised in Table 1 and 2 below.

Table 1: Summary of hand auger investigation. **Bold** indicates that refusal was met, all other boreholes and Scalas were taken to target depth.

Point ID	Hole depth (m)	Scala depth (m)	Depth to weathered airfall deposit (m)	Volcanic alluvium
HA01	5.00	-	1.20	-
HA02	5.00	-	1.50	-
HA03	5.00	6.80	1.10	-
HA04	3.00	**4.90**	1.70	-
HA05	3.00	4.85	1.10	-
HA06	3.00	5.80	1.70	-
HA07	3.20	-	2.50	-
HA08	**4.00**	9.80	1.50	-
HA09	5.00	-	1.80	-
HA10	3.00	-	-	-
HA11	5.00	-	3.30	-
HA12	3.00	4.85	1.50	-
HA13	5.00	-	1.90	-
HA14	3.00	**5.85**	1.40	-
HA15	3.00	**4.20**	-	✔
HA16	3.00	**3.90**	-	✔
HA17	**0.50**		-	✔

HA18	3.00	**3.15**	1.40	-
HA19	5.00	9.80	1.00	-
HA20	**3.70**	-	1.80	-
HA21	3.00	4.75	1.00	-
HA22	**3.00**	-	1.90	-
HA23	**2.50**	**3.25**	-	✔

Table 2: Summary of deep testing. All units are inferred from strength profiles at CPT and DMT tests.

Point ID	Depth (m)	Depth to weathered airfall deposit (m)	Depth to basalt (m)	Groundwater depth (m)
CPT-01	16.39	2.00	16.3	-
CPT-02	12.39	1.90	12.3	-
CPT-03	7.71	1.80	-	-
CPT-04	12.67	1.70	12.6	-
CPT-05	18.02	3.40	18	-
CPT-06	16.29	2.10	16.2	3.80
CPT-07	13.29	1.40	13.2	-
DMT-01	11.8	1.80		n/a
SDMT-01/A	11.8	1.60		n/a
MBH-01	14.8	2.25	10.6	dry

3.2 Ground Conditions

In summary, our investigation found the site to be predominantly underlain by volcanic soils associated with the Kerikeri Volcanic Group, with in situ **basalt** encountered or inferred from below 10-18m depth across the site.

The soils broadly comprised an upper unit of ash-derived **residual soil**, to 1.0 to 3.0m depth, and an underlying unit of **weathered airfall deposits** (lapilli tephra).

Volcanic clay and silt **alluvium** was encountered at several test sites around the southern edge of the site, adjacent to the stream.

These materials are described in more detail below.

3.2.1 Topsoil

Topsoil was encountered across the site, to depths of 0.1m to 0.2m, comprising generally dry to moist, slightly organic silt.

3.2.2 Alluvium

Alluvium was encountered across the lower edge of the site adjacent to the stream, within the gently sloping to flat areas (HA15 – HA17, HA23). This comprised generally very stiff to hard, low plasticity, moist, silt and clayey silt soils with variable sand and gravel. Undrained shear strengths were generally >150kPa and the soils were generally insensitive. Some low strengths (21kPa, 58kPa) were encountered near the surface at HA15, although these may be affected by gravels.

3.2.3 Residual soil

Ash-derived residual soil of the Kerikeri Volcanic Group was encountered below topsoil across most of the site, to depths ranging from 1.0m to 3.3m . This unit comprised variable low to high plasticity, very stiff to hard, homogenous clay and silt soils. Undrained shear strengths through this unit were generally >150kPa across most test sites, and the soils were typically insensitive to moderately sensitive.

CPT testing in this unit generally encountered consistent clayey silt and silty clay behaviour type with qc values of 2-4MPa (inferred undrained shear strength generally 150 to >200kPa).

3.2.4 Weathered airfall deposits (lapilli tephra)

Weathered airfall deposits were encountered below the residual ash soils, from between 1.0m and 3.3m depth.

This unit comprised predominantly low plasticity or non-plastic, moist to wet silt with variable sand, clay and gravel. Gravels consisted of generally very weak, fine to coarse basalt scoria and fine accretionary ash lapilli.

The soils notable had a greasy feel and showed and apparent moisture increase on disturbance, indicative of significant allophane content.

Vane shear strengths within this unit were highly variable but generally in the range of 50-100kPa, and typically showed moderate to very sensitive behaviour. This unit is marginally cohesive which may significantly influence the suitability of vane testing, particularly were outlying results were found.

Scala penetrometer testing in this unit generally indicated very loose soil, with test values typically around 0.5 blows per 50mm. Although some improvement with depth was noted in deeper Scalas this is likely to be influenced by skin friction and loss of efficiently with depth, rather than indicating increasing soil strength or density.

Scala refusal was met at some test sites, likely due to striking a larger, competent basalt boulder within the soil profile.

CPT testing through this unit showed highly variable cone resistance and sleeve friction. Lower-bound values through the soil profile generally indicated very low soil strength at most test sites (qc = 0.25 to 0.5MPa, inferred undrained shear strengths of 20-40kPa). DMT testing was generally consistent with CPT results, indicating similarly low shear strengths.

3.2.5 Basalt

Slightly weathered, moderately strong to strong basalt rock was encountered in MBH01 from 10.6m depth. This is expected to be intact lava flow of the Kerikeri Volcanic Group.

Basalt is inferred from below the depth of refusal at all CPT tests, possibly with the exception of CPT03 which refusals much shallower than the other tests, and may have struck a boulder within the tephra deposit.

One SPT test was carried out at the base of MBH01, refusing with no penetration (unable to seat), confirming high intact rock strong.

3.3 Laboratory Testing

Two consolidated undrained triaxial compression tests were carried out on from samples collected at 3.5m in CPT01 and 3.0m in BH01, to further characterise the strength of the weathered airfall deposit in areas where very low strength was indicated by in situ testing. Summary results are tabulated below.

Table 3: Summary of triaxial test results. Laboratory reports appended.

Test site	Sample depth (tested)	Total stress		Effective stress		Bulk density* (kN/m^3)	Dry density (kN/m^3)
		Phi (°)	C (kPa)	Phi' (°)	C' (kPa)		
BH01	3.0m (3.22-3.35)	10	22	30	11	1.38	0.67
CPT01	3.5m (3.67-3.84)	11	28	28	16	1.35	0.68

*Note bulk density is following saturation of the sample and not representative of natural condition.

The results show relatively high soil strength when compared to the very low in-situ testing results. Bulk and dry density are notably very low.

Allophane presence testing (non-quantitative) was carried out on both samples, and indicated allophane content of 5-7%.

3.4 Material Strength Parameters and Discussion

The following material strength parameters have been adopted as part of our assessment, based on the in situ and laboratory testing carried out, and our previous experience in similar materials.

The strength testing appears to show that conventional in-situ tests do not accurately predict the strength of the lapilli tephra soils (weathered airfall deposits). It is expected that this is the result of the very low soil density and open soil structure, which allows particles to redistribute before shearing under high point loads, consistent with the behaviour of collapsible soils. As a result, we expect that the CPT, DMT and DCP results significant under-predict the soil mass strength as it relates to slope stability and foundations. The triaxial tests are considered representative of lower bound in-situ effective strength parameters for this unit.

Table 4: Summary of adopted material strength parameters.

	Characteristic test values			Adopted parameters			
Unit	Shear vane (kPa)	DCP (bl/50mm)	CPT qc (MPa)	Unit weight (kN/m^3)	Su (kPa)	Eff. cohesion C' (kPa)	Eff. friction angle, Φ' (°)
Residual soil/ alluvium (very stiff to hard CLAY/SILT)	150	-	2-4	17.5	150	5	30
Weathered airfall deposits (sensitive SILT with sand and gravel)	50 - 100	0.25 - 0.5		13	50	10	30
Basalt	-	-	>50	26	-	-	-

3.5 Soil Moisture Profile and Groundwater Conditions

The soil profile across the site appears to be well draining with the near surface soils being generally dry to moist.

The allophonic soils encountered at depth across the site were found to wet up significantly on disturbance, but generally as a moist appearance when undisturbed. It is understood that this is the result of water being released from allophane as they break down.

Groundwater was encountered at CPT06 at 3.8m depth. All other CPTs were dipped at found to be dry. The machine borehole (MBH01) was dipped shortly after completion of drilling and was found to be dry, indicating both a low water table (>15m) and very rapid drainage through the basalt resulting in loss of drilling water.

Based on the observations of surface and groundwater, and the nature of the soils and rock beneath the site, it is expected that the groundwater table is near-flat lying through the site at approximately RL145 – RL150m. The water table is therefore expected to be relatively shallow across the lower edge of the site and at significant depth through the more elevated areas.

Given the free draining nature of the deeper soils and rock, the steady slope through the site, and the lack up upslope catchment, it is expected that the groundwater table is fairly steady through seasons and is unlikely to be significantly influence by extreme rainfall events. A shallow wetting front may develop during period of prolonged rainfall, however this is expected to be confined to the upper residual ash soils.

3.6 Seismic Subsoil Category and Hazard

The seismic subsoil category has been assessed in accordance with NZS1170.5 to support seismic hazard assessment and the design of future structures at the site.

Based on apparent strengths through the upper soil profile, as derived from *in situ* shear vane, Scala penetrometer, and CPT testing, the site would appear to be consistent with Class D or E, soft or very soft soil sites.

However, triaxial testing indicates relatively high strength through the same soils, and based on the inferred undrained shear strength derived from triaxial tests the site would be considered Class C, shallow soil site.

The shear wave velocity profile from SDMT01/A shows V_s values of 180 to 280m/s through the upper 10m of the soil profile. On the assumption that V_s values through the underlying basalt are high (i.e. >1500m/s), it can be inferred that the overall $V_{s\,30}$ value is likely to be greater than 360m/s, indicating site Class B. However, the depth and continuity of the basalt has not been proven, and not consideration of the underlying material has been given (likely to be Northland Allochthon mudstone).

On the balance of the site observations and inferred underlying geology at the site, a seismic subsoil category of Class C should be adopted for design purposes.

For IL2 structures (dwellings and habitable sheds) and for the design of residential retaining and earth structures, a peak ground acceleration of 0.13g for the 500-year return period ULS event, and 0.03 for the 25-year return period, SLS event should be adopted.

4 NATURAL HAZARDS AND GROUND DEFORMATION POTENTIAL

4.1 General

This section summarises our assessment of the natural hazards within the property as generally defined in Section 106 of the Resource Management Act (1991 and subsequent amendments) and Section 71 of the Building Act (2004), and the potential risk that these present to the proposed development in terms of vertical and lateral ground deformation.

4.2 Slope Instability

The site is entirely mapped as low instability hazard, while the steep scoria cone slopes above the north-east boundary are mapped as moderate instability (see Figure 2).

This is broadly consistent with our initial appraisal of the site, with the exception that

- The steep scoria cone slopes extend further downslope than the mapped moderate instability area. The steep slopes extending into the site through the north-eastern boundary should be considered moderate hazard in line with the slopes above.
- The steep arcuate slope area above the stream (at the location of HA19) appears to be of similar stability hazard to the scoria cone slopes, and should be considered as moderate hazard.

Qualitative assessment of the stability hazard through theses areas has been undertaken based on the findings of the subsurface investigation, laboratory testing, and geomorphic study. These areas are photographed in Figure 5 and 6 respectively, and are broadly delineated by the white dashed line on Figure 4.

4.2.1 Scoria Cone Slope

This slope appears to be underlain by a similar profile as that throughout the site, comprising a surficial, residually weathered fine ash deposit overlying sensitive silt soils (weathered lapilli tephra). The upper slope, above the site boundary, is expected to be underlain by more competent (higher strength) weathered scoria, overlain by similar weathered ash soils. The slope profile and engineering geological cross section are shown on the attached drawing in Appendix A.

The slope presents no evidence of recent or historical instability. The gully landform (expected to be a man-made feature through historical quarrying) to the north of the slope, comprises side

slopes at near-vertical angles, averaging 2V:1H (~65°), and show no evidence of historical failure. The ground conditions in this area are expected to be consistent with those extending into the subject site.

It can therefore be inferred that at the natural slope angle of up to 1V:1.5H, but limited to 1V:2H within the site, the factor of safety is significant higher than minimum requirements for residential development, at least with respect to deep seated failure. As a result we consider that the bulk earthworks likely to be associated with the development will have negligible effect on the deeper seated (or global) factor of safety.

Shallow seated instability is of greater concern, where minor cuts into the toe of the slope are carried out, particularly where these extend below ~1.5m depth and expose lower strength tephra soils.

It is recommended that any cuts into the toe of the scoria cone slope be support by engineered retaining structures.

4.2.2 Stream Bank Slope

This slope affects a relatively small areas of the site against the southern boundary. The slope itself is largely obscured in bush, below the fenceline, however the head of the slope is noted by an area of minor erosion and terracettes. The erosion in this area is likely the result of livestock damage.

The testing at the head of the area (HA19) showed a deep profile of tephra soils extending to below the base of the slope. Low strength is indicated by Scala testing to depth, however the soils are expected to be similar to those subject to triaxial testing, and are therefore expected to be relatively strong (and highly cohesive in particular).

The slope is steep (averaging 1V:2H, locally steeper), and appears to have been formed through stream bank erosion and the stream has incised its path below the site. As a result, it is inferred that the present slope angle is representative of its stable angle of repose (i.e. factor of safety just above 1). The establishment of bush over the slope may improve this slightly.

In any case, we consider the factor of safety in the area immediately above this area to be below the generally accepted criteria for building sites.

Without further specific assessment, we consider that a minimum building setback of 5m from slopes steeper than 1V:3H should be adopted within this area to mitigate the risk of under-slips at the edge of building sites. To avoid reducing the factor of safety of the slope, no fill should be placed within 3m of slopes steeper than 1V:3H.

4.2.3 Remainder of Site

The bulk of the site comprises gentle to moderate slopes which are considered stable. The stability is not expected to be significantly influenced by development earthworks or the loads imposed by residential buildings, provided these works are carried out in accordance with the recommendations given in Section 5 below.

4.3 Compressible Ground and Consolidation Settlement

With the exception of surficial topsoil, no compressible materials were encountered during the site investigation. The subsoils may be considered as incompressible under the expected loads of moderate earth fills and residential dwellings, subject to the recommendations given in Section 5 below.

4.4 Collapsible Soil Behaviour

The weathered airfall deposits (lapilli tephra) underlying most of the subject site, appears to display collapsible soil behaviour.

Triaxial testing appears to indicate high soil strength under confined loading conditions, however, where the soil is unconfined (such as in cut batters), or subject to very high point loads (such as highly loaded end bearing piles), much lower effective strength should be expected.

It is expected that this can be managed through careful earthworks and foundation design in accordance with the recommendations given in Section 5 below.

4.5 Ground Shrinkage and Swelling Potential

Plastic soils can be subject to shrinkage and swelling in response to seasonal changes in moisture content. The magnitude of shrinkage and swelling is a function of clay content and clay reactivity within the upper soil profile (generally within 1.5m of finished ground level).

The near surface soils (residual soil) were found to have variably low to high plasticity. The soils are derived from fine ash which is known to weather to form reactive smectite clays, and in our experience is consistent with moderately to highly expansive soils (i.e. Class M or H1 in terms of AS2870 (2011).

The underlying silt soils (weathered airfall deposits) appear to have low clay content and low plasticity. These should generally be considered as slightly expansive (Class S) unless specific testing shows that a lesser site class is appropriate.

The expansivity of these soils is somewhat mitigated by their favourable drainage properties. While the shallow soils can become extremely dry during periods of drought, extreme wetting is unlikely to occur, particularly post-development where infiltration of surface water is significantly limited by impervious areas.

Expansive soil characteristics can be exacerbated by earthworks, where the moisture content of both cut and filled ground is put out of equilibrium for a period of time until a stable state is reached.

Conventional shallow foundations should be designed for the appropriate site class depending on the finished ground level and underlying soils specific to each building platform. This should be confirmed as part of subdivision completion reporting and site specific assessment.

4.6 Tree Root Deformation

Several large trees are present across the upper part of the site. Their presence can have a significant effect on foundation perform, particularly with respect to expansive soils.

Their effect on expansive soils should be considered wherever foundations are laterally within 1.5x the mature tree height. This should be considered regardless of whether the tree remains or recently removed.

Root barriers (chemical or physical) should be considered wherever foundations are within the dripline of the tree.

Where trees are to be removed, care should be taken to ensure stumps are completely dug out and the resulting cavity is backfilled with well compacted (engineered) hardfill.

4.7 Conclusions

From our assessment of the natural hazard and ground deformation risks presented to the proposed development we consider that a building can be safely located on the site, provided that the recommendations given in Section 5 are adhered to.

5 ENGINEERING RECOMMENDATIONS

5.1 Earthworks

Earthworks for the development are expected to include large-scale cut to fill operation to form level building platforms, roads and stormwater ponds. The earthworks should be carried out in accordance with the recommendations below.

5.1.1 General Design

It is recommend that the finished ground level be designed to minimise deep cuts as far as possible (where deep is generally >3.0m), particularly for building areas, to avoid exposing potentially problematic allophanic and collapsible lapilli tephra. This can broadly be achieved by having building platforms near existing ground level and including a many small cut-fill platforms rather than forming larger platforms encompassing multiple lots.

It may be beneficial to import suitable clean fill to minimise earthworks volumes using site-won material. This will reduce risks associated with the issues outline below regarding the use of lapilli tephra as fill.

The earthworks design should be subject to geotechnical review prior to engineering approval.

5.1.2 Cuts

Unretained cuts up to 3.0m high are considered suitable within any gentle to moderately sloping areas through the subdivision Such cuts should be battered no steeper than 1V:2.5H, or otherwise retained.

On any slopes steeper than 1V:4H but not steeper than 1V:3H, unretained cuts should be limited to 1.5m in height.

Any cuts into slopes steeper than 1V:3H (being confined to the steep area along the north-eastern boundary), all cuts should be supported by engineered retaining structures, or otherwise subject to specific assessment.

Deeper cuts into the underlying tephra may become problematic. These soils are expected to stand relatively steeply un-retained, but without confinement may not support surcharge loading (i.e. for building or filling above cut slopes), and stability may become a concern. For deeper cuts into tephra (i.e. >3-4m depth), over-cutting and then capping with cohesive fill may be required to provide confinement to these soils.

5.1.3 Earth fills

The upper ~1.0 - 3.0m of the soil profile, comprising weathered ash, is expected to be generally suitable as earth fill.

The underlying tephra soils, which are expected to have high allophane content, are less suitable. Upon reworking, these soils are expected to decrease significant in strength, become

excessively wet or saturated, and lose significant volume where high compaction forces are used.

With a specifically developed methodology supported by laboratory testing and field trials, bulk filling using the allophonic soils may be possible. It is expected that this will require spreading, discing and drying for an extended period before carefully compacting to achieve the required specification for engineered fill.

Treatment of these soils using additives (e.g. lime and cement) may be feasible depending on allophane content. However, research has shown treatment with relatively low lime addition has only a temporary effect on soil properties, and significant lime addition is required to achieve lasting improvement. Discussion of this is included in a Hiway Stabilizers research paper[2]. The allophane content appears to be high enough that it will influence treatment properties and will likely require uneconomic quantities of additives to achieve lasting results.

Alternatively, imported clean fill such as quarry strippings may be used in stead of site won material. This will reduce earthworks volumes with potentially problematic materials and reduce the overall project risk that these present.

All earth fills should be placed in accordance with NZS4431 (1989). Compaction control should generally be in terms of air voids, dry density and vane strength, but should be confirmed based on the specific materials used and laboratory standard compaction testing.

It is expected that fills can be placed up to 4m thick without specific assessment, based on the strength profile of the underlying soils. Unretained fill batters should be formed at no steeper than 1V:2.5H unless otherwise approved.

If the lapilli tephra material is used as fill, it should generally not be used to form the faces of fill batters unless otherwise approved as it will require capping layers. Clean cohesive fill (imported or residual soils) should be used for this purpose.

5.1.4 Retaining Walls

Any retaining walls constructed as part of the subdivision works should be subject to specific engineering design.

Conventional cantilevered timber pole and gravity retaining systems are considered suitable for the site. The near surface soils were generally free from any large rocks which may obstruct the drilling of pile holes.

[2] http://hiways.co.nz/assets/Uploads/allophanes-conference-paper.pdf

Retaining walls should be designed for the specific ground conditions at their locations. The material strength parameters given in Section 3.4 are considered appropriate for design.

For walls founded in cut ground on lapilli tephra soils:

- Any cantilevered pole retaining walls should allow for no lateral support for the first 1m of embedment to avoid over-loading the shallow, unconfined soil.
- Shallow bearing gravity or concrete cantilevered walls should be founded a minimum of 1.0m below cleared ground level with no reliance on the first 1.0m of embedment. Walls should be designed for a geotechnical ultimate bearing capacity of 150kPa, to limit loads on shallow unconfined tephra soils. These walls may otherwise be set within a capping layer of clean cohesive clay fill.

5.2 Restricted Building Areas

The following building restrictions are provided to ensure the development of individual lots take due account for potential slope instability and ground conditions at likely foundation depths.

- Buildings should be set back a minimum of 5m from stream bank slopes steeper than 1V:3H (18°) along the southern edge of the site, without specific geotechnical assessment and foundation design.
- Any buildings on slope steeper than 1V:4H (generally along the north-eastern boundary of the site, should be subject to specific geotechnical assessment and foundation design.

These restrictions should be reviewed and confirmed at the time of subdivision completion, to take into account any earthworks or retaining constructed as part of the development.

5.3 Foundation Design

The shallow ash soils to 2m depth are of high strength and appear favourable for standard building foundations (i.e. shallow timber piles, strip footings, raft slabs).

Where building sites are cut down onto tephra soils, foundation options will need to be considered carefully. High point loadings have the potential to cause soil collapse. As a result, we expect that foundation bearing pressures will need to be limited, particularly at shallow depth where the soil is less confined.

For preliminary design shallow bearing raft-slab or shallow pile foundations should be designed for a geotechnical ultimate bearing capacity of 150kPa. Shallow gravel rafts may be adopted to spread loads to achieve this reduced bearing pressure using conventional slab designs.

For deeper pile foundations embedded into tephra soils, piles may be designed for drained soil conditions in accordance with the NZ Building Code (B1/VM4), using the effective stress soil parameters give in Section 3.4.

Conventional raft slab type foundations are expected to be suitable, and for lightly clad single level structures on-grade construction is expected to be suitable. Where a greater bearing capacity is required (i.e. for multistorey or heavy cladding/roofing materials), undercutting and backfilling with gravel hardfill may be required to distribute foundation loads more evenly.

5.4 Roading

The ash soils at existing ground level (below topsoil) appear generally favourable to support pavements, based on the result of shallow Scalas across the site (RP1-RP5). Being of high strength and well-drained, it is expected that conventional minimum pavement depths in accordance with the WDC EES will be acceptable. Likewise engineering fills of the same material are expected to be favourable.

The underlying tephra soils show very low results under Scala testing, which is conventionally used for determination of subgrade CBR and pavement design. This is thought to be due to the collapsing nature of the soils under this type of testing.

Small strain deflection testing (i.e. light weight/falling weight deflectometer, plate load testing, benkleman beam testing) on cut in-situ tephra soils is expected to yield a more reasonable result. These soils may still fall outside the limits for minimum pavements thickness (i.e. less than 7% CBR). Thickened reinforced pavements or subgrade stabilisation may be required.

It is recommended that where earthfill is required to from pavement subgrades, use of the tephra soils is avoided entirely unless a specific methodology and subgrade testing is carried out to confirm suitability. Residual soil or imported fill should be used for the purpose.

6 OTHER CONSIDERATIONS

This report has been prepared exclusively for Onoke Heights Limited with respect to the particular brief given to us. Information, opinions and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. LDE Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

This report was prepared in general accordance with current standards, codes and practice at the time of this report. These may be subject to change.

Opinions given in this report are based on visual methods, and subsurface investigations at discrete locations. It must be appreciated that the nature and continuity of the subsurface materials between these locations are inferred and that actual conditions could vary from that described herein. We should be contacted immediately if the conditions are found to differ from that described in this report.

This report should be read in its entirety to understand the context of the opinions and recommendations given.

For and on behalf of LDE Ltd

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Chartered Professional Engineer
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Find out more about LDE professionals

L:\19100 to 19199\19103 67 Dip Road, Three Mile Bush\05 Reporting\19103 GIR Onoke Heights, Dip Road, Kamo.docx

APPENDIX A

GEOTECHNICAL INVESTIGATION PLAN AND CROSS SECTION

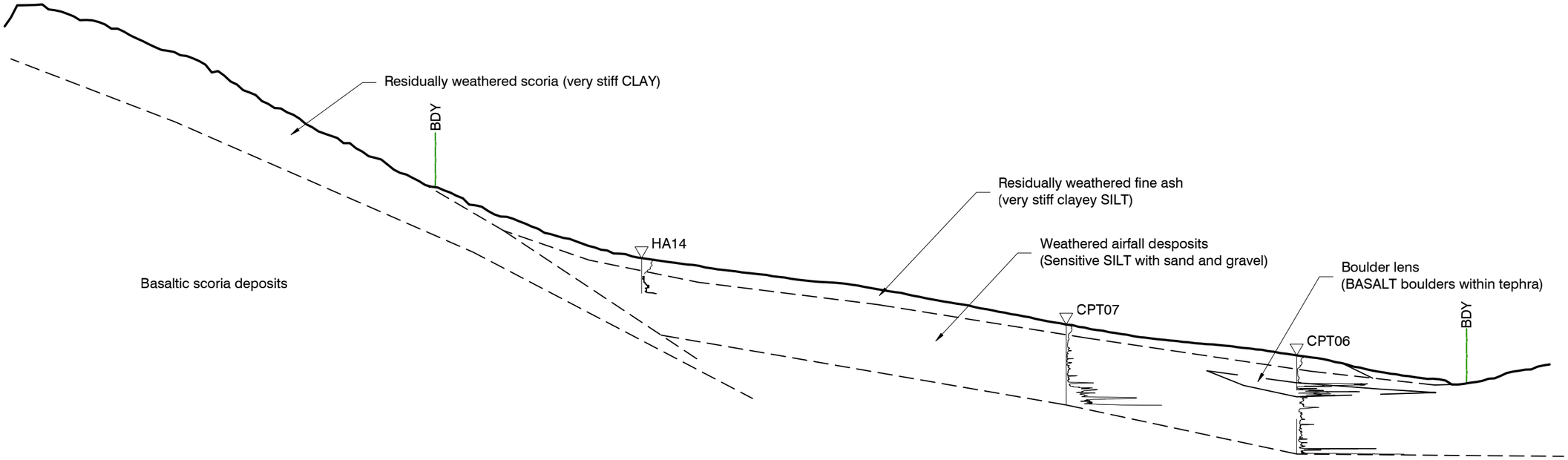
Notes:
1/ Base aerial and boundaries sourced from LINZ (cc-by 4.0)
2/ Investigaiton locations shown approximately only, located by hand held GPS.
3/ Contours derived from NRC LiDAR DEM (2018 survey).

LAND DEVELOPMENT & ENGINEERING LTD.

Geotechnical Investigation Plan

Section 1 SO 65970, Dip Road, Kamo

Project Number:	19103
Date:	25/06/2021
Drawn by:	FWH
Scale A3:	1 : 1500



Notes:
1/ Topographic section derived from NRC LiDAR DEM (2018).
2/ Investigation points show approximately, projected up to ~12m.
3/ Investigaiton data plotted for information only, see attached logs for detail profiles.
4/ All material boundaries are approximate. The wider geological boundaries and are inferred only, based on geomorphic and desktop study of the site.

0 7.5 15 22.5 30 37.5

Scale 1:750 (m)

Original Size = A3

CLIENT: Onoke Heights Ltd

PROJECT: Onoke Heights Subdivision
Section 1 SO 65970, Dip Road, Kamo
Whangarei

DRAWING TITLE: Engineering Geological Cross Section

LDE LAND DEVELOPMENT & ENGINEERING LTD.

No.	REVISION	BY	DATE
0		--	dd.mm.yy

DESIGN:	--
DRAWN:	FWH
DATE:	25.06.21
CHECKED:	--
SCALE A3:	750

PROJECT STATUS: INFORMATION

PROJECT: 19103 SHEET: 1 of 1

DRAWING No: G01 REV: 0

APPENDIX B

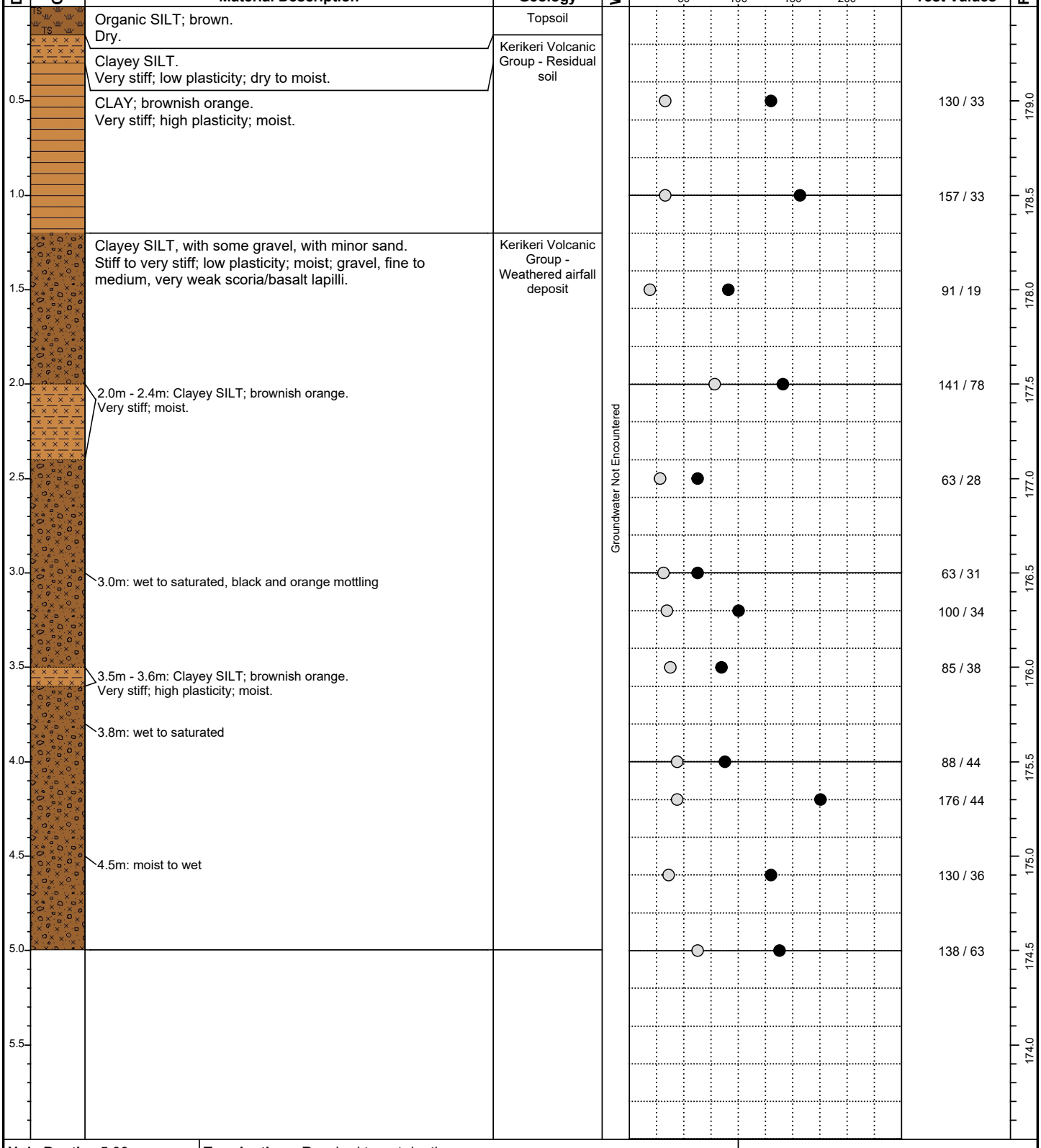
GEOTECHNICAL INVESTIGATION DATA

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA01**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050591mN, 1716613mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	179.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835



Hole Depth: 5.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA02**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050532mN, 1716588mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	175m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic SILT; dark brown. Moist.	Topsoil					175.0
	SILT; brownish orange. Very stiff; non-plastic; dry to moist.	Kerikeri Volcanic Group - Residual soil					
0.5	CLAY, with minor silt; brownish orange. Very stiff; low plasticity; moist.					141 / 44	174.5
1.0						146 / 41	174.0
1.5	Clayey SILT, with some sand and gravel; dark brownish grey. Very stiff; moist to wet; gravel, fine to medium, very weak basalt/scoria lapilli.	Kerikeri Volcanic Group - Weathered airfall deposit				122 / 31	173.5
2.0	2.1m: wet		Groundwater Not Encountered			116 / 16	173.0
	2.3m: increasing clay, moist						
2.5	2.5m - 2.7m: highly plastic, clay dominated zone					138 / 38	172.5
	2.7m: becomes gravel/scoria dominated, shear vanes may not be valid						
3.0						85 / 41	172.0
						47 / 36	
3.5							171.5
4.0						28	171.0
4.5							170.5
5.0						50	170.0
5.5							169.5

Hole Depth: 5.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA03**				
Project ID:	19103				
Sheet:	1 of 2				
Client:	Onoke Heights Limited	**Coordinates:**	6050549mN, 1716651mE	**Test Date:**	26/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	FWH
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	173.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology
0.0	Silty CLAY, with some rootlets; brownish orange. Hard; high plasticity; dry to moist; friable.	Kerikeri Volcanic Group - Residual soil
0.3	0.3m: highly plastic, moist	
1.0	Clayey SILT, with trace sand and gravel; brown, some black mno speckling. Very stiff; low plasticity; moist; gravel, fine, extremely weak basalt/scoria lapilli; friable, sensitive.	Kerikeri Volcanic Group - Weathered airfall deposits
1.4	1.4m: increasing moisture, moist to wet	
1.6	1.6m - 1.8m: brownish orange	
2.0	Sandy gravelly SILT. Non-plastic; wet to saturated; gravel, fine, extremely weak basalt/scoria lapilli; firm to stiff/very loose (marginally cohesive), friable, sensitive, allophanic - greasy. .	
3.2	3.2m: auger grinds, larger weak basalt cobble/coarse gravel	
4.0	4.0m: saturated, no inflow	
5.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm) — 2, 4, 6, 8

Shear Vane, Su (kPa) — 50, 100, 150, 200

Test Values	RL (m)
205+ / 73	173.5
205+ / 88	
205+ / 146	
203 / 134	
177 / 72	172.5
136 / 18	
121 / 32	172.0
164 / 70	
92 / 15	
101 / 26	171.5
61 / 26	
58 / 15	
73 / 44	171.0
99 / 18	
99 / 41	170.5
120 / 15	
101 / 31	170.0
101 / 38	169.5
99 / 41	
91 / 35	169.0
	168.5
	168.0

Hole Depth: 5.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA03**
Project ID:	19103
Sheet:	2 of 2

Client:	Onoke Heights Limited	**Coordinates:**	6050549mN, 1716651mE	**Test Date:**	26/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	FWH
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	173.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing	Test Values	RL (m)
				Groundwater Not Encountered	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200		

RL (m): 167.0 (6.5 m), 166.5 (7.0 m), 166.0 (7.5 m), 165.5 (8.0 m), 165.0 (8.5 m), 164.5 (9.0 m), 164.0 (9.5 m), 163.5 (10.0 m), 163.0 (10.5 m), 162.5 (11.0 m), 162.0 (11.5 m)

Hole Depth: 5.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA04**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050579mN, 1716683mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	FWH
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	177.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology	Water	In-situ Testing	Test Values	RL (m)
0.0	Organic SILT; dark brown. Dry; rootlets, friable.	Topsoil			UTP	177.5
	CLAY, with some silt; reddish brown; homogeneous. Hard; high plasticity; moist.	Kerikeri Volcanic Group - Residual soil			205+	
0.5	Clayey SILT; brownish orange; homogeneous. Very stiff to hard; high plasticity; moist; friable.					177.0
	0.8m - 1.2m: some clay, orange				196 / 91	
1.0						176.5
	1.2m - 1.7m: minor clay, brown, very friable				205+ / 96	
1.5						176.0
					161 / 35	
	Sandy SILT, with some gravel, with minor clay; dark brownish grey, some black and orange mottling. Very loose to loose; non-plastic; wet; sand, coarse; gravel, fine, clasts of extremely weak scoria/basalt lapilli; allophanic - greasy .	Kerikeri Volcanic Group - Weathered Airfall Deposit			88 / 15	
2.0					107 / 15	175.5
	2.2m - 2.3m: SILT; brown. Stiff; non-plastic; wet; homogenous.				63 / 22	
					66 / 23	
2.5					88 / 29	175.0
					79 / 22	
3.0					72 / 26	174.5
3.5						174.0
4.0						173.5
4.5						173.0
5.0					13	172.5
5.5						172.0

Groundwater Not Encountered

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

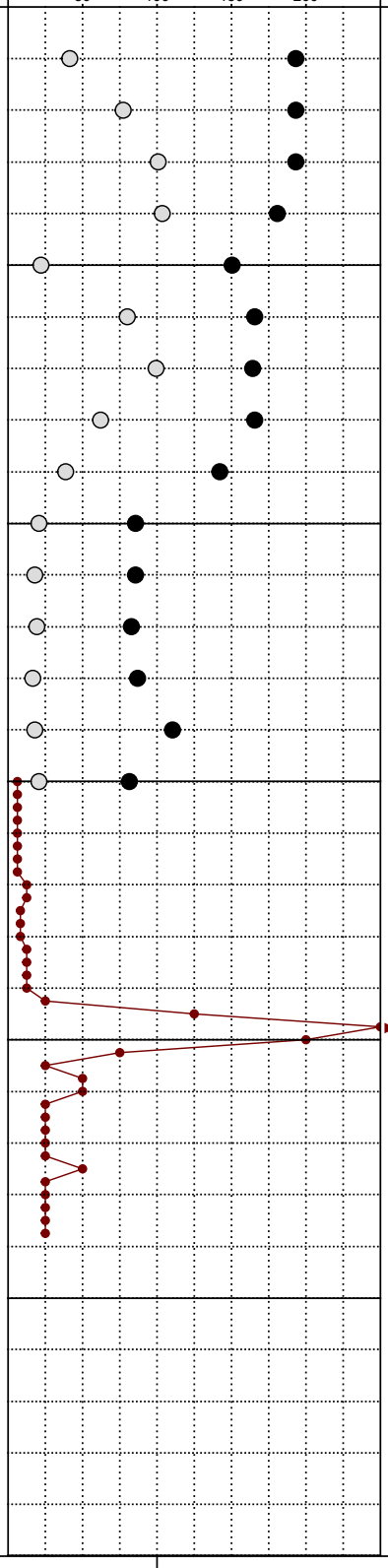
Method: 50mm hand auger, DCP

Test ID:	**HA05**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050504mN, 1716594mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	170m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology
0.0	SILT, with some rootlets/organics and sand; light brown. Dry; sand, fine.	Topsoil
	SILT, with some clay; brownish orange. Very stiff to hard; low plasticity; moist.	Kerikeri Volcanic Group - Residual soil
0.5	0.7m: trace of clay	
1.0	SILT, with trace sand; brown. Low plasticity; moist; sand, fine.	Kerikeri Volcanic Group - Weathered airfall deposit
1.5	1.3m - 1.7m: trace of clay, light brownish orange	
	1.7m - 1.9m: no clay, some fine sand, brown	
2.0	Sandy SILT, with some gravel; dark brownish grey. Stiff to very stiff; moist to wet; gravel, fine to medium, very weak bassalt/scoria lapilli; sensitive.	
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		

Groundwater Not Encountered



Test Values	RL (m)
193 / 41	169.5
193 / 77	
193 / 101	
181 / 104	
150 / 22	169.0
166 / 80	
164 / 99	168.5
166 / 62	
142 / 39	
86 / 21	168.0
86 / 18	
83 / 19	
87 / 17	167.5
110 / 18	
81 / 21	167.0
	166.5
	166.0
	165.5
	165.0
	164.5

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

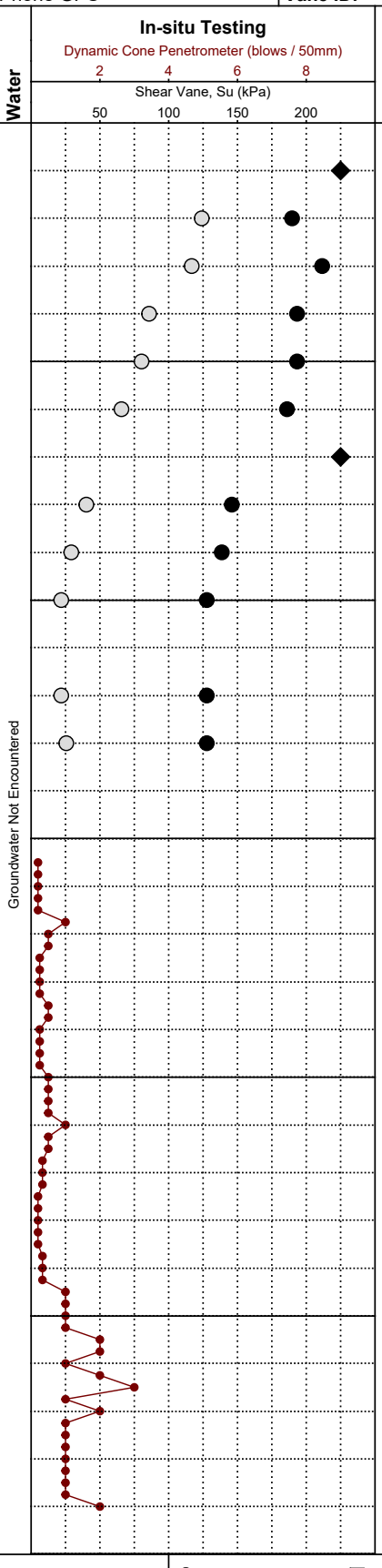
Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA06**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050503mN, 1716669mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CP
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	164.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	1945

Depth (m)	Material Description	Geology	Test Values	RL (m)
0.0	Organic clayey SILT; brown. Dry; friable, rootlets.	Topsoil	UTP	164.5
0.5	Silty CLAY, with trace gravel; reddish brown. Very stiff; high plasticity; moist; gravel, fine. 0.5m: increase silt	Kerikeri Volcanic Group - Residual soil	190 / 124	164.0
1.0	Clayey SILT, with trace gravel; reddish brown. Very stiff; high plasticity; moist; gravel, fine, very weak basalt/scoria lapilli. 1.0m - 1.7m: reddish orange, less plastic (low plasticity)		212 / 117 193 / 86 193 / 80 186 / 66 UTP	163.5
1.5				163.0
2.0	Clayey SILT, with trace gravel; brown. Very stiff; high plasticity; wet; gravel, fine, very weak basalt/scoria lapilli; sensitive.	Kerikeri Volcanic Group - Weathered airfall deposit	146 / 40 139 / 29 128 / 22	162.5
2.5	Sandy SILT, with trace gravel. Stiff to very stiff; non-plastic; saturated; gravel, fine, very weak basalt/scoria lapilli; sensitive. 2.3m: gravel becomes fine to medium (max. 20mm), saturated		128 / 22 128 / 26	162.0
3.0				161.5
3.5				161.0
4.0				160.5
4.5				160.0
5.0				159.5
5.5				159.0



Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA07**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050521mN, 1716696mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	167.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic SILT; dark brown. Dry to moist.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200		167.5
	Silty CLAY; brownish orange. Very stiff; high plasticity; moist. 0.3m: decreasing silt (some)	Kerikeri Volcanic Group - Residual soil				172 / 81	
1.0	1.0m: silty, trace of fine gravel (completely weathered scoria), low plasticity					177 / 83	166.5
	1.4m: trace of silt, high plasticity					146 / 72	166.0
2.0	2.1m: minor black/brown mottling					157 / 38	165.5
2.5	SILT, with some sand and gravel; brown. Stiff; moist to wet; gravel, fine to medium, very weak scoria/basalt lapilli.	Kerikeri Volcanic Group - Weathered airfall deposits				71 / 28	165.0
	2.8m: minor black mottling, moist					160 / 42	
3.0	3.0m: moist to wet					130 / 38	164.5
						138 / 56	
3.5							164.0
4.0							163.5
4.5							163.0
5.0							162.5
5.5							162.0

Hole Depth: 3.20m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA08**				
Project ID:	19103				
Sheet:	1 of 2				
Client:	Onoke Heights Limited	**Coordinates:**	6050553mN, 1716724mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	FWH
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	173.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology
0.0	Organic SILT; dark brownish orange. Very stiff to hard; dry to moist.	Topsoil
0.5	CLAY, with some silt; brownish orange; homogeneous. Hard; high plasticity; moist; slightly friable.	Kerikeri Volcanic Group - Residual soil
1.0	Clayey SILT; orange. Very stiff to hard; low plasticity; moist.	
1.5	Sandy SILT, with some gravel, with minor clay; dark brownish grey, some black and orange mottling. Very loose to loose/firm to stiff; non-plastic; wet; sand, coarse; gravel, fine, clasts of extremely weak scoria and basalt lapilli; allophanic - greasy.	Kerikeri Volcanic Group - Weathered airfall deposits
2.0	1.9m - 2.1m: SILT; brown. Stiff; non-plastic; wet; homogenous.	
2.5	2.2m: becoming saturated, no inflow	
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm): 2, 4, 6, 8

Shear Vane, Su (kPa): 50, 100, 150, 200

Test Values	RL (m)
205+ / 117	173.0
205+ / 143	172.5
164 / 102	172.0
117 / 18	
113 / 20	
137 / 53	171.5
83 / 29	
51 / 20	171.0
58 / 26	
56 / 26	170.5
66 / 32	170.0
66 / 25	
▶10 ▶20 ▶12	169.5
	169.0
	168.5
	168.0

Hole Depth: 4.00m

Termination: impenetrable material (gravel)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

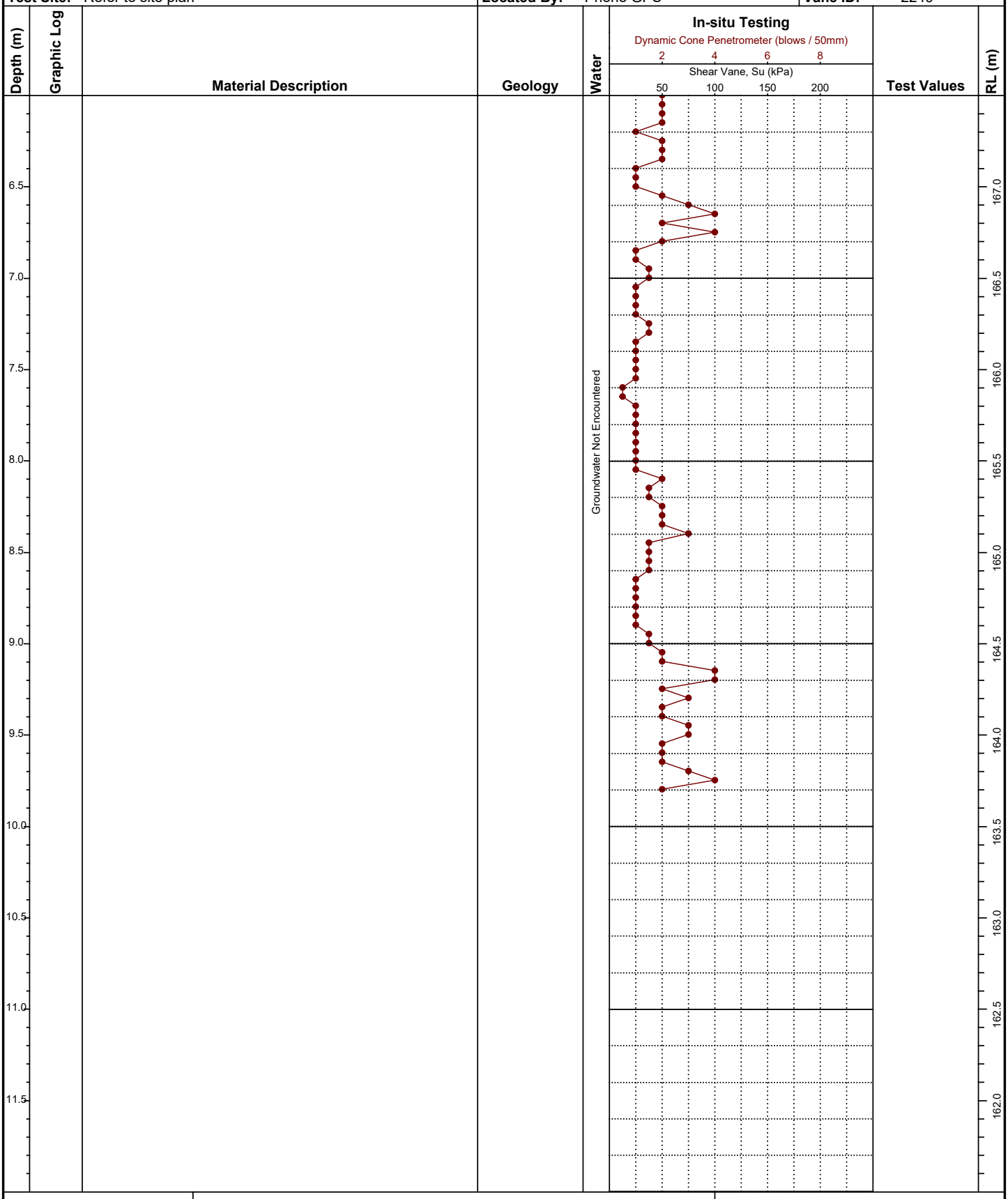
UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA08**
Project ID:	19103
Sheet:	2 of 2

Client:	Onoke Heights Limited	**Coordinates:**	6050553mN, 1716724mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	FWH
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	173.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249



Hole Depth: 4.00m

Termination: impenetrable material (gravel)

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA09**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050459mN, 1716600mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	164m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic clayey SILT; dark brown. Dry to moist.	Topsoil					164.0
	Clayey SILT; brownish orange. Very stiff; low plasticity; moist.	Kerikeri Volcanic Group - Residual soil					
0.5	CLAY, with some silt; brownish orange. Very stiff; high plasticity; moist.					172 / 91	163.5
1.0	1.1m: becomes silty, low plasticity					157 / 102	163.0
1.5						219+ / 110	162.5
2.0	SILT, with minor sand and gravel; brown. Stiff; non-plastic; moist to wet; gravel, very weak scoria/basalt lapilli.	Kerikeri Volcanic Group - Weathered airfall deposits	Groundwater Not Encountered			74 / 25	162.0
2.5						56 / 31	161.5
3.0	3.2m: wet to saturated, increasing scoria lapilli					60 / 31	161.0
3.5						58 / 36	160.5
4.0						85 / 34	160.0
4.5						81 / 34	159.5
5.0						78 / 31	159.0
5.5						85 / 49	158.5
						81 / 44	
						85 / 47	

Hole Depth: 5.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA10**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050421mN, 1716609mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	158.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic SILT; dark brown. Non-plastic; dry; rootlets.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200		158.5
0.5	Silty CLAY. Very stiff; low plasticity; moist.	Kerikeri Volcanic Group - Residual soil				169 / 47	158.0
1.0	0.8m: some silt, highly plastic					201 / 88	157.5
1.5						219+ / 75	157.0
2.0						219+ / 60	156.5
2.5						194 / 55	156.0
3.0						219+ / 74	155.5
3.5							155.0
4.0							154.5
4.5							154.0
5.0							153.5
5.5							153.0

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger

Test ID:	**HA11**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050439mN, 1716656mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	157.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology
0.0	SILT, with some rootlets; light brown. Dry.	Topsoil
	Clayey SILT; brownish orange. Hard; low plasticity; dry to moist.	Kerikeri Volcanic Group - Residual soil
0.5	0.5m: minor gravel, fine black weak basalt/scoria lapilli, moist	
3.0	Clayey SILT, with trace gravel; brown. Stiff; high plasticity; moist; gravel, fine, weak basalt/scoria lapilli; sensitive.	Kerikeri Volcanic Group - Weathered airfall deposit
3.5	3.5m: moist to wet	
3.8	3.8m: wet	
4.0	4.0m: some sand	
4.2	4.2m: no sand, moist	
4.5	Sandy gravelly SILT. Stiff and loose; non-plastic; moist; sand, fine to coarse, gravel, fine to medium, weak basalt/scoria lapilli.	
4.9	4.9m - 5.0m: becoming silty, brownish orange	
5.0		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm) — 2, 4, 6, 8

Shear Vane, Su (kPa) — 50, 100, 150, 200

Depth (m)	Test Values	RL (m)
0.0	150+ / 46	
	193+ / 120	
0.5	193+ / 117	157.0
	193+ / 98	
1.0	193+ / 97	156.5
	193+ / 135	
1.5	193+ / 178	156.0
	193+ / 92	
2.0	193+ / 128	
	193+ / 119	155.5
2.5	193+ / 163	
	193+ / 166	155.0
3.0	193+ / 98	
	193+ / 104	
3.5	193+ / 102	154.5
	150 / 66	
	72 / 30	154.0
4.0	66 / 22	
	62 / 21	
4.5	104 / 18	153.5
	110 / 54	
5.0	90 / 33	153.0
	98 / 29	
5.5	102 / 26	
	69 / 25	152.5
		152.0

Hole Depth: 5.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA12**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050462mN, 1716721mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	159m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology	Water	In-situ Testing	Test Values	RL (m)
0.0	Organic SILT; dark brown, organic stained. Dry to moist; Trace rootlets.		Groundwater Not Encountered	Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200	135 / 44	159.0
0.5	SILT, with trace clay; brownish orange. Hard; low plasticity; moist.				193 / 94	158.5
	0.6m: some clay				193 / 113	
1.0					193 / 120	158.0
	1.2m - 2.1m: trace of clay, orange				193 / 121	
1.5					193 / 108	157.5
	1.7m: minor fine sand				193 / 110	
2.0					163 / 25	157.0
	2.1m - 2.7m: trace gravel, fine, black, extremely weak residually weathered lapilli				138 / 35	
	2.3m: some fine sand				131 / 28	
2.5	2.5m: pockets of lensoidal, extremely weak, black to dark red weathered gravel/scoria lapilli				190 / 72	156.5
	Sandy gravelly SILT; cark greyish brown, black and orange mottling. Very stiff; wet; sand, fine to coarse, gravel, fine to medium, very weak basalt/scoria lapilli.				113 / 36	
3.0					83 / 25	156.0
					124 / 15	
3.5					173 / 30	155.5
4.0						155.0
4.5						154.5
5.0						154.0
5.5						153.5

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA13**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050489mN, 1716747mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	163.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic SILT; dark brown. Dry.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200		163.5
	Silty CLAY; brownish orange. Very stiff; high plasticity; moist.	Kerikeri Volcanic Group - Residual soil				166 / 55	
0.5	0.6m: trace of silt						163.0
	0.8m: some black mottling					212 / 89	
1.0							162.5
	1.2m: silty					160 / 50	
	1.3m - 1.9m: predominantly SILT, low plasticity					144 / 22	
1.5							162.0
2.0	SILT, with some gravel, with minor sand; dark greyish brown. Stiff to very stiff; non-plastic; wet; gravel, fine to medium, very weak basalt/scoria lapilli.	Kerikeri Volcanic Group - Weathered Airfall Deposit				128 / 24	161.5
	2.2m: increasing scoria					103 / 16	
2.5	2.4m - 4.0m: decreasing gravel (some), brownish orange					110 / 25	161.0
3.0	3.0m: wet to saturated					97 / 20	160.5
						71 / 22	
3.5	3.4m: trace of gravel, some black mottling, moist to wet					119 / 34	160.0
4.0	4.0m: wet					71 / 27	159.5
	4.2m: trace black mottling, wet to saturated					113 / 39	
4.5	4.5m: brownish orange					116 / 39	159.0
	4.8m: increasing scoria, saturated						
5.0						160 / 20	158.5
5.5							158.0

Hole Depth: 5.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA14**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050521mN, 1716773mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	168.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	SILT; brownish orange. Low plasticity; dry.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200	126 / 39	168.5
	Clayey SILT. Very stiff; low plasticity; dry to moist.	Kerikeri Volcanic Group - Residual soil				181 / 98	
0.5	0.5m: moist 0.6m - 0.9m: orange					174 / 101	168.0
	0.9m - 1.4m: trace fine gravel (very weak basalt/scoria lapilli), brown					150 / 99	
1.0						166 / 106	167.5
						177 / 94	
1.5	SILT, with minor sand, with trace gravel. Very stiff; non-plastic; moist; sand, fine to coarse; gravel, fine, very weak basalt/scoria lapilli. 1.7m: some gravel, fine to medium, sub angular to sub rounded	Kerikeri Volcanic Group - Weathered airfall deposit				152 / 41	167.0
						139 / 76	
						149 / 65	
2.0	1.9m: no gravel					97 / 21	166.5
	2.1m - 3.0m: variable silt, clay, sand and gravel, gravels fine to medium, brownish grey with brown and orange mottling, moist to wet					90 / 26	
2.5						57 / 22	166.0
						50 / 17	
	2.8m: mostly gravel lapilli, moist to wet, crushes under auger					UTP	
3.0						UTP	165.5
3.5							165.0
4.0							164.5
4.5							164.0
5.0							163.5
5.5							163.0
						10	
						10	
						12	

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm hand auger, DCP

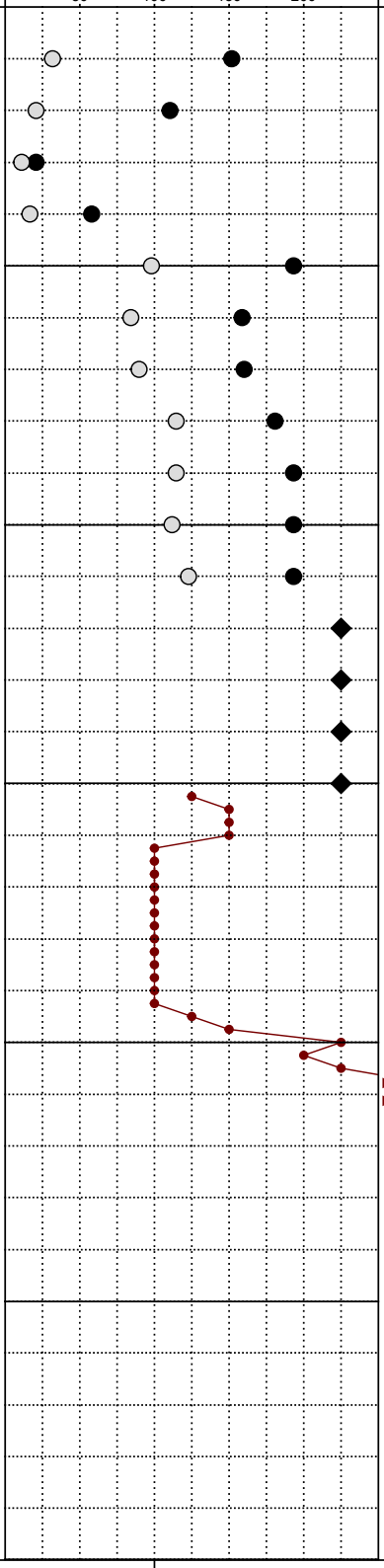
Test ID:	**HA15**				
Project ID:	19103				
Sheet:	1 of 1				
Client:	Onoke Heights Limited	**Coordinates:**	6050343mN, 1716609mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	154m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology
0.0	Organic SILT; brownish black. Dry to moist; some rootlets.	Topsoil
0.5	Silty sandy GRAVEL; brownish grey, some orange mottling. Loose; dry; gravel, fine to medium, subround, very weak basalt/scoria lapilli.	Alluvium (Kerikeri Volcanic Group derived)
1.0	Sandy SILT, with trace gravel; brownish orange, some orange mottling. Firm to stiff; non-plastic; moist; sand, fine to medium; gravel, fine.	
1.5	Clayey SILT; brownish orange. Very stiff; low plasticity; moist.	
2.0	2.1m: minor gravel, fine, black, very weak basalt/scoria lapilli	
2.5	2.5m: some gravel as above	
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		

Water: Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm)



Test Values	RL (m)
152 / 32	153.5
110 / 21	
21 / 11	
58 / 17	
193+ / 98	153.0
159 / 84	
160 / 90	
181 / 115	152.5
193+ / 115	
193+ / 112	152.0
193+ / 123	
UTP	151.5
UTP	
UTP	
UTP	151.0
	150.5
	150.0
	149.5
	149.0
	148.5

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA16**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050394mN, 1716643mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	155m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology
0.0	Organic SILT; dark brown. Dry.	Alluvium (Kerikeri Volcanic Group derived)
0.3	SILT; reddish brown. Very stiff to hard; low plasticity; dry. 0.3m - 3.0m: trace of clay, brownish orange, moist	
0.8	0.8m: some clay, increasing plasticity	
1.5	1.5m: minor gravel, black, sub angular, very weak basalt/scoria lapilli	
2.2	2.2m: trace of clay	
3.0		

Groundwater Not Encountered

In-situ Testing

Dynamic Cone Penetrometer (blows / 50mm) — 2, 4, 6, 8

Shear Vane, Su (kPa) — 50, 100, 150, 200

Test Values	RL (m)
135 / 26	155.0
193+ / 110	154.5
193+ / 126	154.0
193+ / 131	153.5
193+ / 132	153.0
193+ / 155	152.5
193+ / 156	152.0
193+ / 124	151.5
193+ / 135	151.0
193+ / 152	150.5
193+ / 167	150.0
193+ / 134	149.5
193+ / 149	
193+ / 138	
193+ / 131	
10	
11	
10	

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak — Vane residual — Vane UTP

Standing water level — Groundwater inflow — Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA17**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050385mN, 1716693mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	152m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	

Depth (m)	Graphic Log	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8 / Shear Vane, Su (kPa) 50 100 150 200	Test Values	RL (m)
0.0		Organic SILT; brown. Dry.	Topsoil	Groundwater Not Encountered			152.0
0.5		Clayey SILT, with trace gravel; brownish orange, some dark specks. Very stiff; high plasticity; moist; gravel, fine, subround.	Residual soil				151.5
		Silty CLAY; brownish orange. Very stiff; high plasticity; moist.					
1.0							151.0
1.5							150.5
2.0							150.0
2.5							149.5
3.0							149.0
3.5							148.5
4.0							148.0
4.5							147.5
5.0							147.0
5.5							146.5

Hole Depth: 0.50m **Termination:** impenetrable material

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

● Vane peak ▼ Standing water level
○ Vane residual ◁ Groundwater inflow
◆ Vane UTP ▷ Groundwater outflow
UTP = Unable to Penetrate

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Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA18**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050416mN, 1716731mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CP
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	154m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	1945

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic clayey SILT; brown. Dry; friable, rootlets.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200	UTP	154.0
	Silty CLAY, with trace gravel; reddish brown. Very stiff; high plasticity; moist; gravel, fine.	Kerikeri Volcanic Group - Residual soil				204 / 93	
0.5						212 / 106	153.5
						190 / 109	
1.0	1.2m: rare completely weathered coarse gravels/cobbles					182 / 102	153.0
						UTP	
1.5	Clayey sandy SILT, with minor gravel; dark brownish orange. Very stiff; high plasticity; moist; gravel, fine, very weak basalt/scoria lapilli.	Kerikeri Volcanic Group - Weathered airfall deposit				146 / 33	152.5
	1.8m - 2.2m: brown, wet					146 / 66	
2.0						109 / 18	152.0
	2.2m - 2.7m: brownish black					120 / 18	
2.5	2.6m: saturated					182 / 26	151.5
	Silty CLAY; greyish orange. Very stiff; high plasticity; wet.					255+	
3.0						UTP	151.0
						20	
3.5							150.5
4.0							150.0
4.5							149.5
5.0							149.0
5.5							148.5

Hole Depth: 3.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA19**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050435mN, 1716810mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	FWH
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	153.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	2249

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	SILT, with some clay; brownish orange; homogeneous. Hard; low plasticity; dry.	Kerikeri Volcanic Group - Residual soil	Groundwater Not Encountered	2 4 6 8	50 100 150 200	UTP	153.5
0.5	0.2m: moist					205+ / 126	153.0
1.0	Sandy SILT, with some gravel, with minor clay; dark brownish grey, some black and orange mottling. Very loose to loose, sensitive; non-plastic; wet; sand, coarse; gravel, fine, clasts of extremely weak scoria and basalt lapilli; allophanic greasy.	Kerikeri Volcanic Group - Weathered airfall deposits				184 / 114 191 / 134 143 / 58	152.5
1.5	1.6m: 2cm SILT layer. Stiff; non-plastic; wet; homogenous.					83 / 15 91 / 15	152.0
2.0	2.1m: wet to saturated					70 / 15 UTP	151.5
2.5						99 / 19 105 / 26	151.0
3.0						73 / 18	150.5
3.5						92 / 29	150.0
4.0	4.0m: saturated, no inflow					72 / 29 110 / 48	149.5
4.5	4.4m - 4.8m: becoming heavily black stained, MnO deposit					UTP	149.0
5.0	4.8m - 5.0m: brownish orange, heavy black mottling					137 / 32	148.5
5.5							148.0
6.0							147.5
6.5							147.0
7.0							146.5
7.5							146.0
8.0							145.5
8.5							145.0
9.0							144.5
9.5							144.0

Hole Depth: 5.00m

Termination: Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA20**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050489mN, 1716817mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	162.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Test Values	RL (m)
0.0	Organic SILT; dark brown. Dry.	Topsoil		162.5
	SILT; brownish orange. Very stiff; low plasticity; moist.	Kerikeri Volcanic Group - Residual soil		
0.5	CLAY, with trace silt; brownish orange. Very stiff; low plasticity; moist.		180 / 66	162.0
1.0	Clayey SILT; brownish orange. Very stiff; low plasticity; moist.		121 / 44	161.5
1.5	1.6m: increase SILT, low plasticity		172 / 128	161.0
2.0	SILT, with some gravel, with minor sand; dark greyish brown. Firm to stiff; non-plastic; wet; gravel, fine to medium, very weak scoria/basalt lapilli.	Kerikeri Volcanic Group - Weathered Airfall Deposits	36 / 16	160.5
	2.2m: wet to saturated		78 / 24	
2.5			85 / 25	160.0
			44 / 24	
3.0	3.0m: increasing weak scoria/basalt lapilli		94 / 25	159.5
			125 / 31	
3.5	3.6m: saturated		88 / 39	159.0
4.0				158.5
4.5				158.0
5.0				157.5
5.5				157.0

Water: Groundwater Not Encountered

In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm) 2 4 6 8; Shear Vane, Su (kPa) 50 100 150 200

Hole Depth: 3.70m **Termination:** hard material

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak; Vane residual; Vane UTP; Standing water level; Groundwater inflow; Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm hand auger, DCP

Test ID:	**HA21**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050467mN, 1716857mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	153.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	SILT, with trace rootlets; dark brown. Dry.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200	159 / 30	153.5
0.5	Clayey SILT; orange brown, trace orange mottling. Hard; low plasticity; dry to moist. 0.3m - 1.0m: brown, moist	Kerikeri Volcanic Group - Residual soil				193 / 86	153.0
	0.8m: minor gravel, fine to medium, black, basalt/scoria lapilli					193 / 98	
1.0	SILT, with some sand, with minor gravel. Stiff to very stiff; moist; sand, fine; gravel, fine to medium, very weak basalt/scoria lapilli.	Kerikeri Volcanic Group - Weathered airfall deposit				193 / 110	152.5
1.5	1.4m: trace of clay					126 / 40	152.0
2.0	Sandy gravelly SILT, with minor clay. Stiff to very stiff; non-plastic; moist; gravel, fine to medium, very weak basalt/scoria lapilli.					150 / 79	151.5
2.5	2.9m - 3.0m: becoming sandy, brownish grey with orange brown and brown mottling					138 / 66	151.0
3.0						121 / 37	150.5
3.5						108 / 26	150.0
4.0						81 / 19	149.5
4.5						79 / 26	149.0
5.0						58 / 25	148.5
5.5						55 / 26	148.0
						102 / 25	
						128 / 39	

Hole Depth: 3.00m **Termination:** Reached target depth

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

Vane peak | Vane residual | Vane UTP | Standing water level | Groundwater inflow | Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

Method: 50mm Hand Auger

Test ID:	**HA22**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050418mN, 1716861mE	**Test Date:**	05/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	CK
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	149m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Phone GPS	**Vane ID:**	835

Depth (m)	Material Description	Geology	Water	In-situ Testing: Dynamic Cone Penetrometer (blows / 50mm)	In-situ Testing: Shear Vane, Su (kPa)	Test Values	RL (m)
0.0	Organic SILT; dark brown. Dry.	Topsoil	Groundwater Not Encountered	2 4 6 8	50 100 150 200		149.0
	CLAY, with some silt; brownish orange. Very stiff to hard; high plasticity; moist.	Kerikeri Volcanic Group - Residual soil					
0.5						219+ / 81	148.5
1.0	0.9m: silty					193 / 47	148.0
1.5						196 / 53	147.5
2.0	Clayey SILT; brownish orange. Very stiff; low plasticity; moist.	Kerikeri Volcanic Group - Weathered airfall deposit				207 / 38	147.0
	2.3m: some black mottling						
2.5						219+ / 44	146.5
	2.6m - 3.0m: no clay, trace of gravel; brown; wet, non-plastic; gravel, fine very weak basalt/scoria lapilli.					63 / 28	
3.0						UTP	146.0
3.5							145.5
4.0							145.0
4.5							144.5
5.0							144.0
5.5							143.5

Hole Depth: 3.00m

Termination: impenetrable material

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Hand Auger Borehole Log

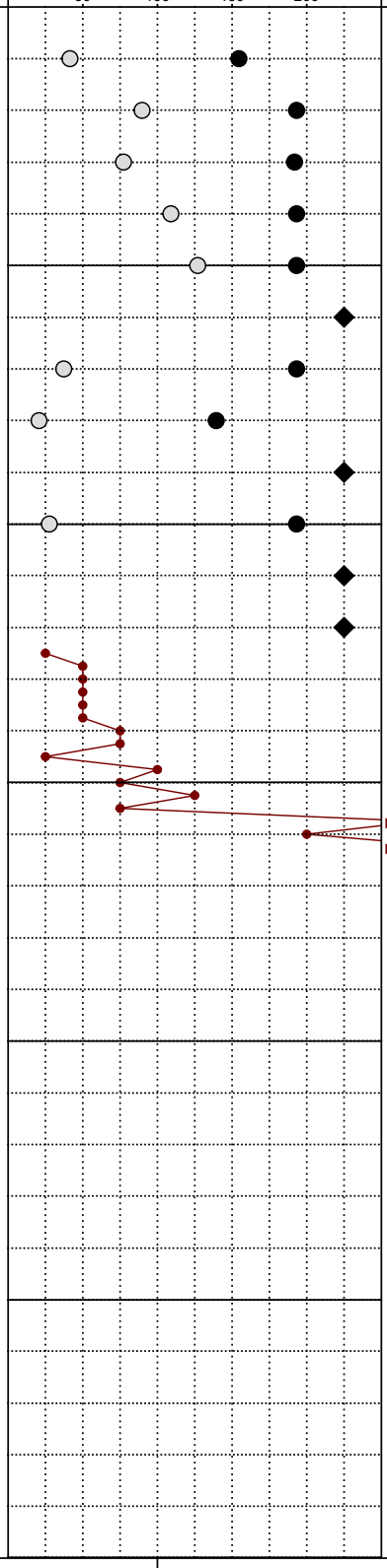
Method: 50mm hand auger, DCP

Test ID:	**HA23**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050396mN, 1716885mE	**Test Date:**	27/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	145.5m	**Checked By:**	DD
Test Site:	Refer to site plan	**Located By:**	Plan setout	**Vane ID:**	131

Depth (m)	Material Description	Geology
0.0	SILT, with trace rootlets; dark brown. Dry.	Topsoil
0.5	Clayey SILT; brownish orange. Very stiff to hard; low plasticity; dry to moist.	Alluvium (Kerikeri Volcanic Group derived)
	0.5m: minor fine gravel, sub angular, black; moist	
1.0	1.0m - 1.6m: dark brown, becomes sensitive	
1.4	1.4m: minor sand (weak scoria lapilli)	
1.6	1.6m - 2.0m: some gravel, fine to medium very weak basalt/scoria lapilli; brownish red with trace orange mottling	
2.0	2.0m - 2.5m: variable sand, silt, clay and fine gravel lapilli	
2.5		

Water: Groundwater Not Encountered



Test Values	RL (m)
155 / 41	145.0
193 / 90	
192 / 77	
193 / 109	
193 / 127	144.5
UTP	
193 / 37	144.0
139 / 21	
UTP	
193 / 28	143.5
UTP	
UTP	143.0
	142.5
	142.0
	141.5
	141.0
	140.5
	140.0

Hole Depth: 2.50m **Termination:** impenetrable material

Remarks:

Materials are described in general accordance with NZGS 'Field Description of Soil and Rock' (2005).
No correlation is implied between shear vane and DCP values.

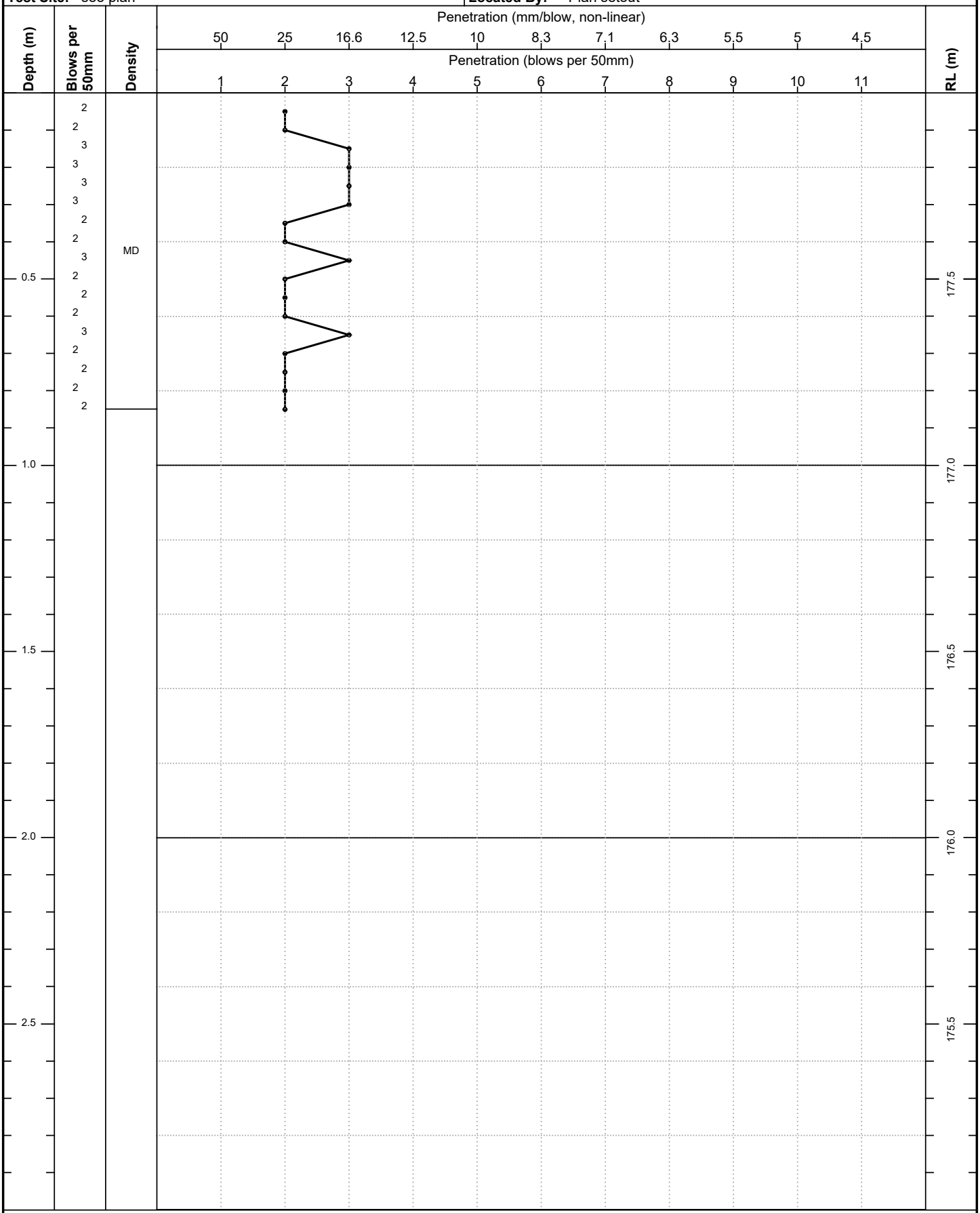
- Vane peak
- Vane residual
- Vane UTP
- Standing water level
- Groundwater inflow
- Groundwater outflow

UTP = Unable to Penetrate

Scala Penetrometer Test Log

Test ID:	**RP01**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050579mN, 1716623mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	178m	**Checked By:**	DD
Test Site:	see plan	**Located By:**	Plan setout		



Remarks: Results may be affected by skin friction, particularly where the tested depth exceeds 1.5m. Density classification in terms of NZGS Field Description of Soil and Rock (2005).

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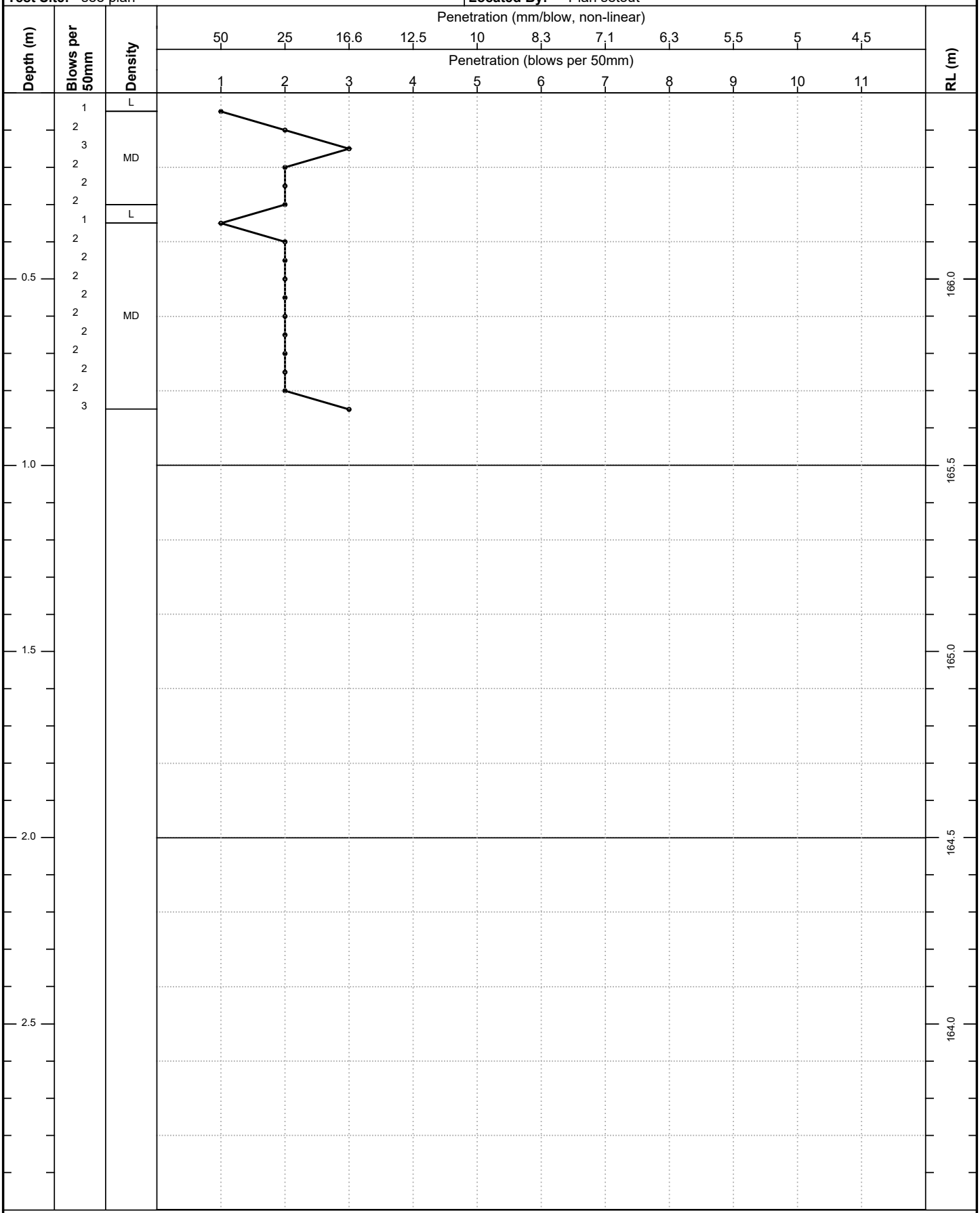
Scala Penetrometer Test Log

Test ID:	**RP02**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050513mN, 1716763mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	166.5m	**Checked By:**	DD
Test Site:	see plan	**Located By:**	Plan setout		

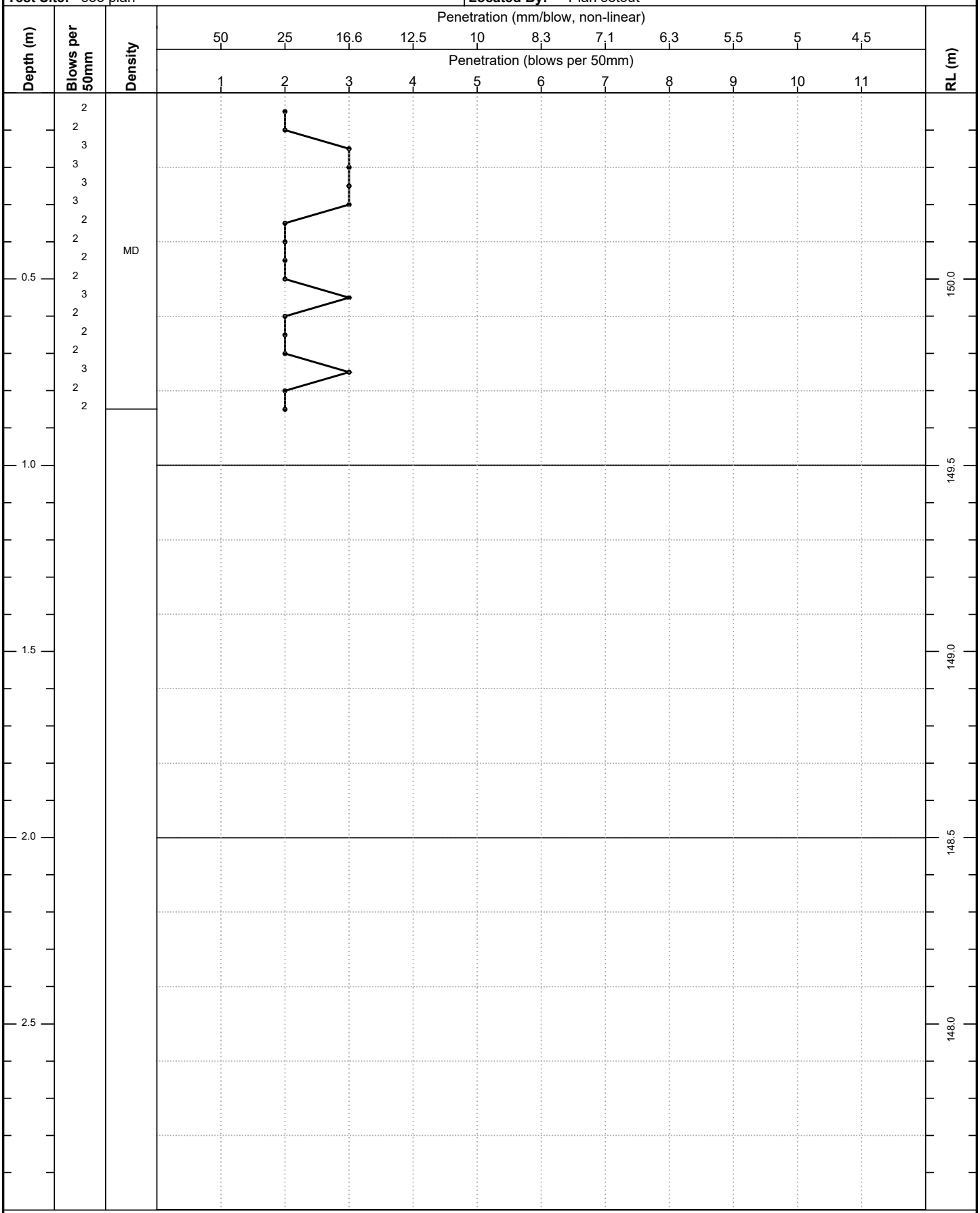


Remarks: Results may be affected by skin friction, particularly where the tested depth exceeds 1.5m. Density classification in terms of NZGS Field Description of Soil and Rock (2005).

Scala Penetrometer Test Log

Test ID:	**RP03**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050448mN, 1716867mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	150.5m	**Checked By:**	DD
Test Site:	see plan	**Located By:**	Plan setout		

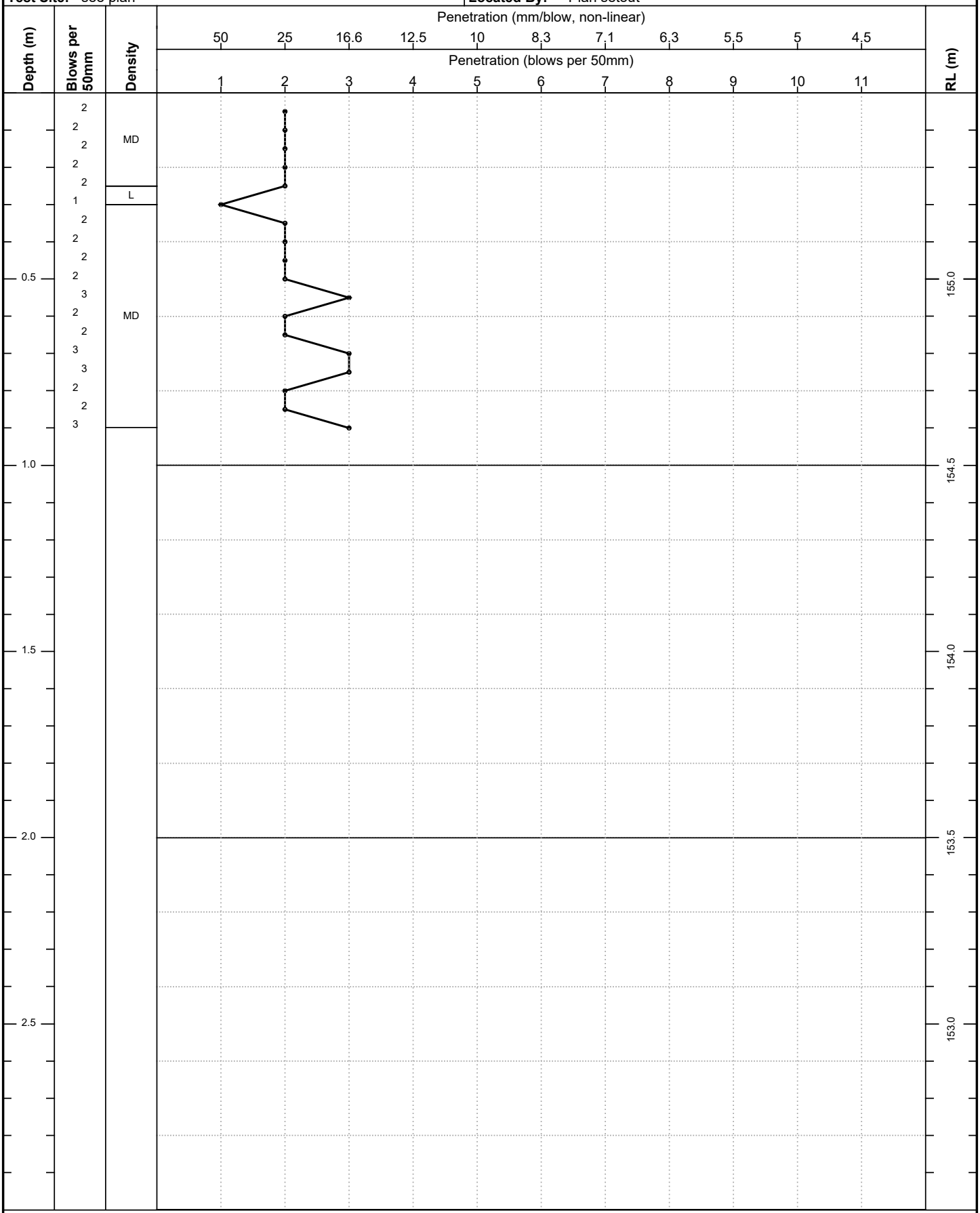


Remarks: Results may be affected by skin friction, particularly where the tested depth exceeds 1.5m. Density classification in terms of NZGS Field Description of Soil and Rock (2005).

Scala Penetrometer Test Log

Test ID:	**RP04**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050431mN, 1716728mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	155.5m	**Checked By:**	DD
Test Site:	see plan	**Located By:**	Plan setout		

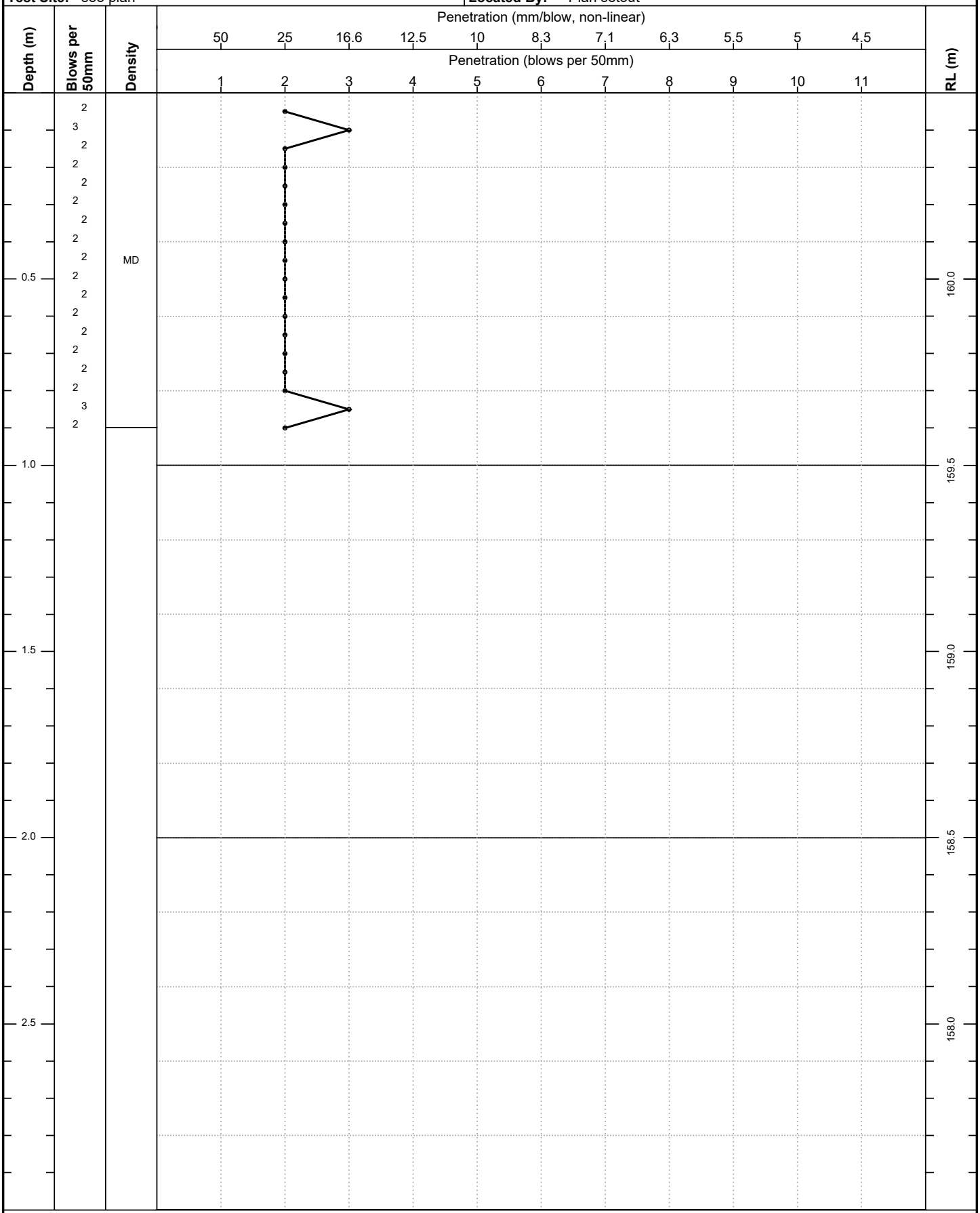


Remarks: Results may be affected by skin friction, particularly where the tested depth exceeds 1.5m. Density classification in terms of NZGS Field Description of Soil and Rock (2005).

Scala Penetrometer Test Log

Test ID:	**RP05**
Project ID:	19103
Sheet:	1 of 1

Client:	Onoke Heights Limited	**Coordinates:**	6050437mN, 1716609mE	**Test Date:**	28/11/2019
Project:	Geotechnical Suitability Assessment for Subdivision	**System:**	NZTM	**Logged By:**	AM
Location:	67 Dip Road, Three Mile Bush	**Elevation:**	160.5m	**Checked By:**	DD
Test Site:	see plan	**Located By:**	Plan setout		



Remarks: Results may be affected by skin friction, particularly where the tested depth exceeds 1.5m. Density classification in terms of NZGS Field Description of Soil and Rock (2005).

BOREHOLE LOG

HOLE NO.: MBH01

CLIENT: CC Developments LTD

PROJECT: Subdivision Suitability

JOB NO.: 19103

SITE LOCATION: 67 Dip Road, Three Mile Bush

CO-ORDINATES: 1716656mE, 6050495mN (NZTM)

ELEVATION: Ground

START DATE: 10/02/2021

END DATE: 10/02/2021

CONTRACTOR: DS Geotechnical **RIG:** LT140

DRILLER: Damian Spratt

LOGGED BY: CP

DEPTH	GRAPHIC	MATERIAL DESCRIPTION (In accordance with NZGS 'Field Description of Soil and Rock' (2005))	GEOLOGY	METHOD	TCR (%)	SPT N-VALUE (Uncorrected)	TEST DATA	WATER
0.0		Organic SILT with minor clay, dark brown, moist, rootlets	Topsoil	HQTT	100%			Groundwater Not Encountered
		CLayey SILT with minor fine sand (black), brown, moist, highly plastic	Weathered Ash - Kerikeri Volcanic Group					
		0.6m - 2.3m: grading to brownish orange and becoming increasingly greasy						
1.0								
		1.8m: becoming wet		HQTT	100%			
2.0								
		SILT with trace sand, clay and fine gravel. Brown. Low plasticity; wet to saturated: brittle/sensitive becoming greasy on disturbance (allophanic). Gravel is extremely weak angular scoria to 15mm, and fine rounded accretionary lapilli.	Lapilli Tephra - Kerikeri Volcanic Group	HQTT	46%			
	N/R	Sandy SILT with some gravel, trace clay. Brown with clasts of reddish brown, black, and yellowish brown. Non-plastic; saturated, becoming greasy on disturbance (allphanic). Gravel is extremely weak to weak angular scoria to 20mm and fine accretionary lapilli. Clasts break down to saturated clay/silt under firm hand pressure.		Push Tube Sample	100%			
3.0		2.8m - 3.0m: assumed core loss						
		3.0m - 3.4m: push tube sample (triaxial test)		HQTT	100%			
4.0								
	N/R	4.5m - 4.9m: push tube sample (not tested)		Push Tube Sample	100%			
5.0				HQTT	100%			
		5.3m: outlying scoria gravel clast, 50mm, black with minor yellow staining, very weak						
		5.3m - 9.0m: grading to brownish orange with yellow, black and reddish brown clasts						
6.0		6.0m: trrace clay		HQTT	100%			
7.0				HQTT	100%			
8.0				HQTT	100%			
9.0		Clayey SILT with some gravel. Blackish brown. Wet; highly plastic; gravel is dark grey highly vesicular basalt, weak to moderately strong, angular.		HQTT	100%			

REMARKS

Hole terminated at target depth. Borehole dry shortly after drilling.

REF	DATE / TIME	LEVEL	REMARK

LDE Whangarei

127 Bank St, Whangarei

Ph: 0800 397 566

info@lde.co.nz

BOREHOLE LOG

HOLE NO.: MBH01

CLIENT: CC Developments LTD

JOB NO.: 19103

PROJECT: Subdivision Suitability

SITE LOCATION: 67 Dip Road, Three Mile Bush

START DATE: 10/02/2021

CO-ORDINATES: 1716656mE, 6050495mN (NZTM)

ELEVATION: Ground

END DATE: 10/02/2021

CONTRACTOR: DS Geotechnical

RIG: LT140

DRILLER: Damian Spratt

LOGGED BY: CP

DEPTH	GRAPHIC	MATERIAL DESCRIPTION (In accordance with NZGS 'Field Description of Soil and Rock' (2005))	GEOLOGY	METHOD	TCR (%) (25, 50, 75)	SPT N-VALUE (Uncorrected) (10, 20, 30, 40)	TEST DATA	WATER
		[CONT] Clayey SILT with some gravel. Blackish brown. Wet; highly plastic; gravel is dark grey highly vesicular basalt, weak to moderately strong, angular.	[CONT] Lapilli Tephra -	HQTT	100%			
11.0		Slightly weathered BASALT, dark grey, highly vesicular, moderately strong to strong, yellow and black discoloration along vertical joints, iron oxide staining in vesicles.	Basalt Lava Flow - Kerikeri Volcanic Group	HQTT	100%			
12.0								
13.0				HQTT	100%			Groundwater Not Encountered
		13.4m: becoming less vesicular						
		13.8m: becoming more vesicular						
14.0		14.0m: becoming less vesicular						
		14.2m: quartz clast with serpentinization around exterior (entrained clast from country rock)		HQTT	100%			
		EOH: 14.80m					50 for 15mm N=50 for 0mm	
15.0								
16.0								
17.0								
18.0								
19.0								

REMARKS

Hole terminated at target depth. Borehole dry shortly after drilling.

REF	DATE / TIME	LEVEL	REMARK

LDE Whangarei

127 Bank St, Whangarei

Ph: 0800 397 566

info@lde.co.nz

CORE PHOTOS

HOLE NO.: MBH01

JOB NO.: 19103

0.00-3.40m

3.40-6.80m

6.80-9.60m

9.60-12.50m

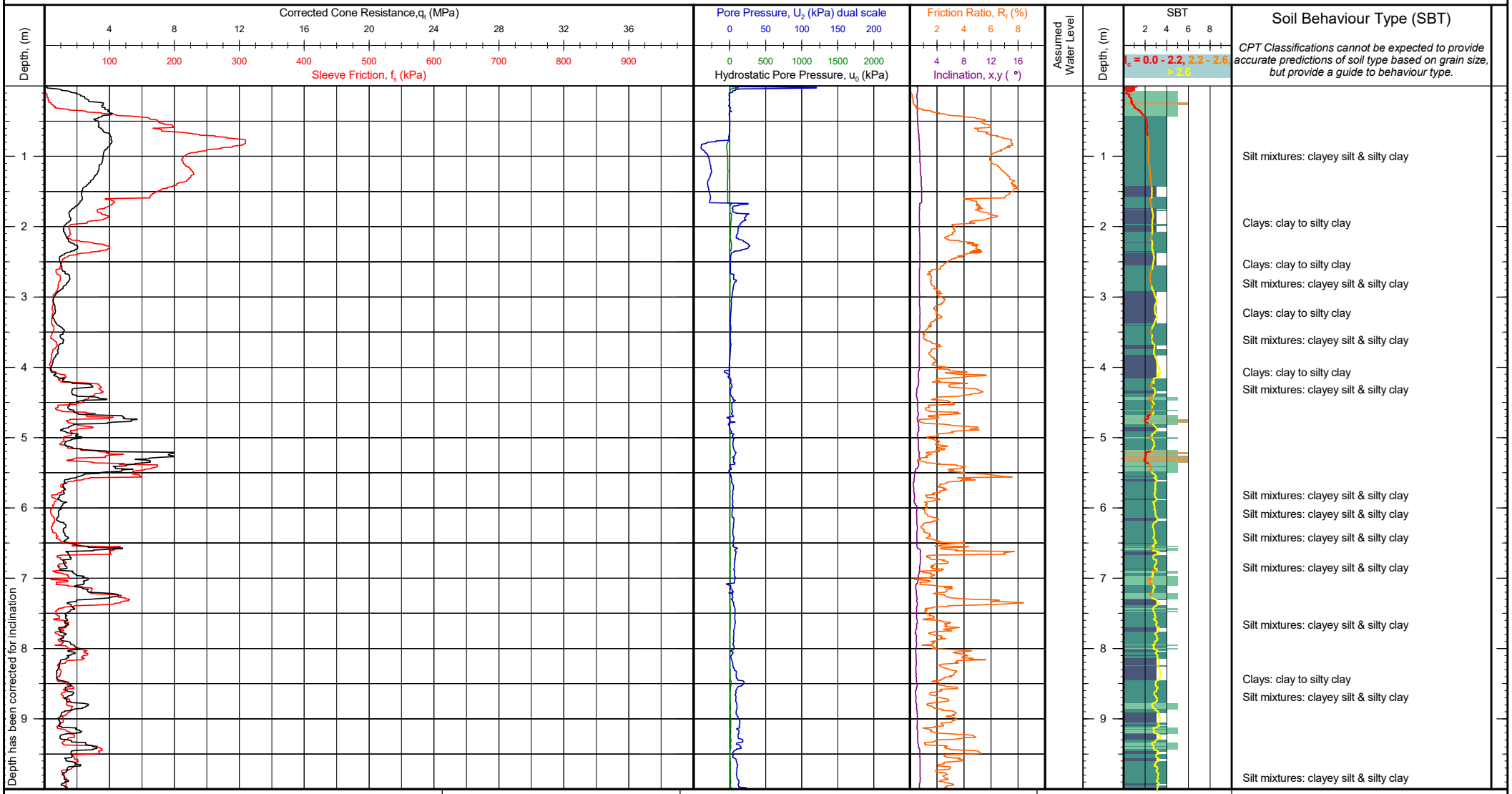
CORE PHOTOS

HOLE NO.: MBH01

JOB NO.: 19103

12.50-14.80m

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
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- Clays: clay to silty clay
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- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050565.67, 1716688.48	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.681908,174.289509	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	16.39
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

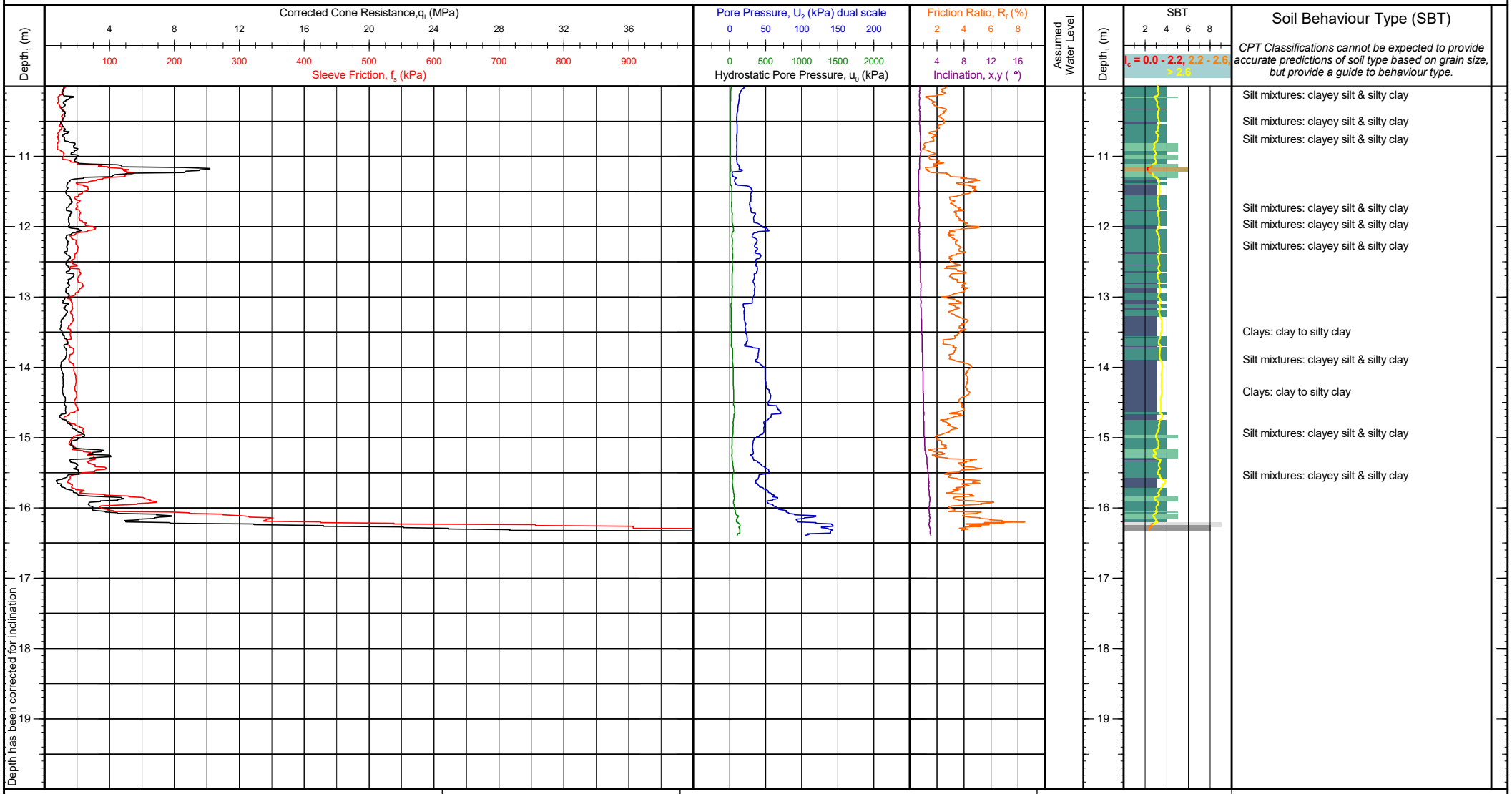
Client Reference:

Test Number: **CPT-01**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
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- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050565.67, 1716688.48	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.681908,174.289509	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	16.39
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

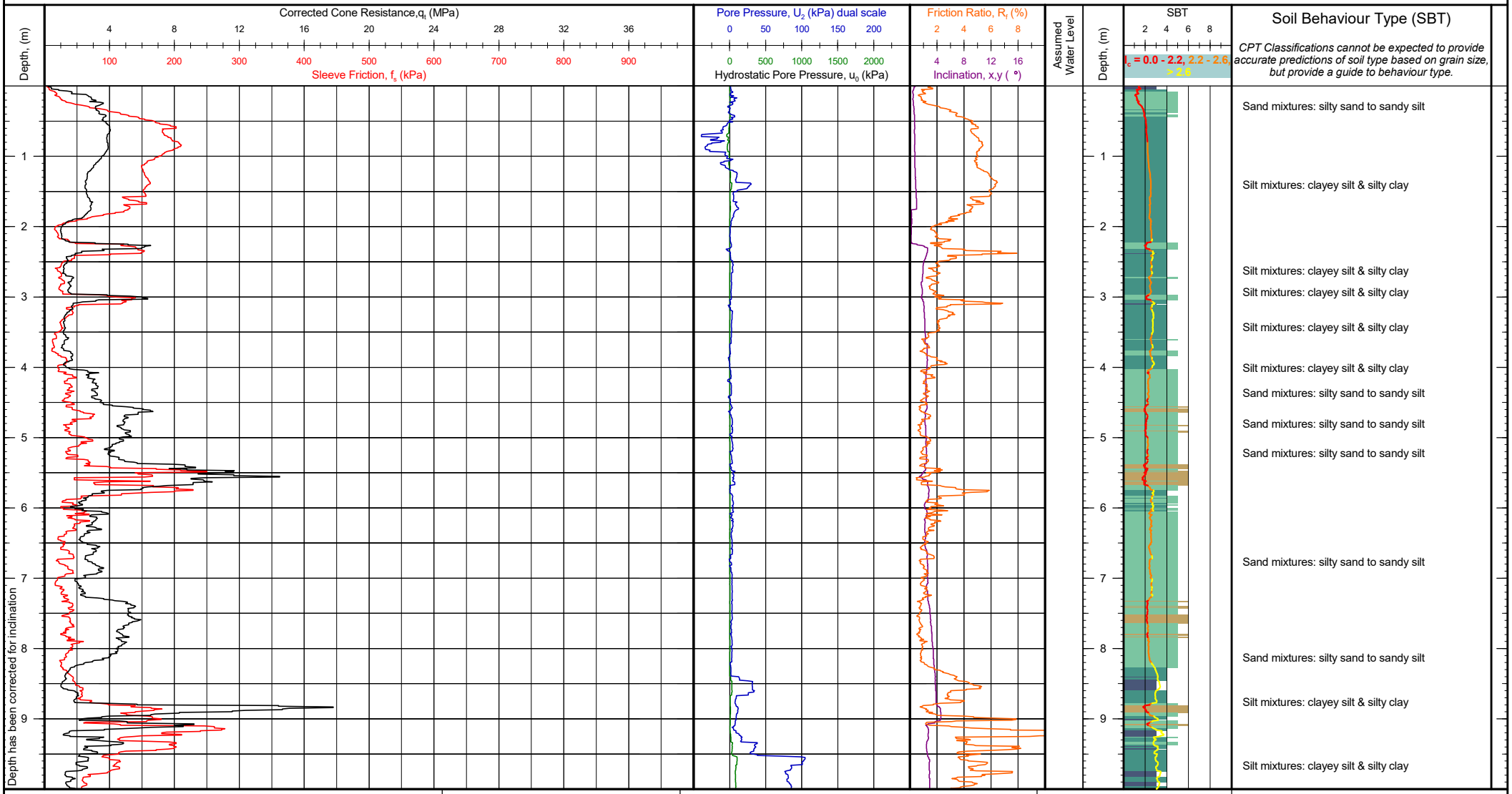
Client Reference:

Test Number: **CPT-01**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050550.22, 1716614.61	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682056,174.288695	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	12.39
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High friction resistance		

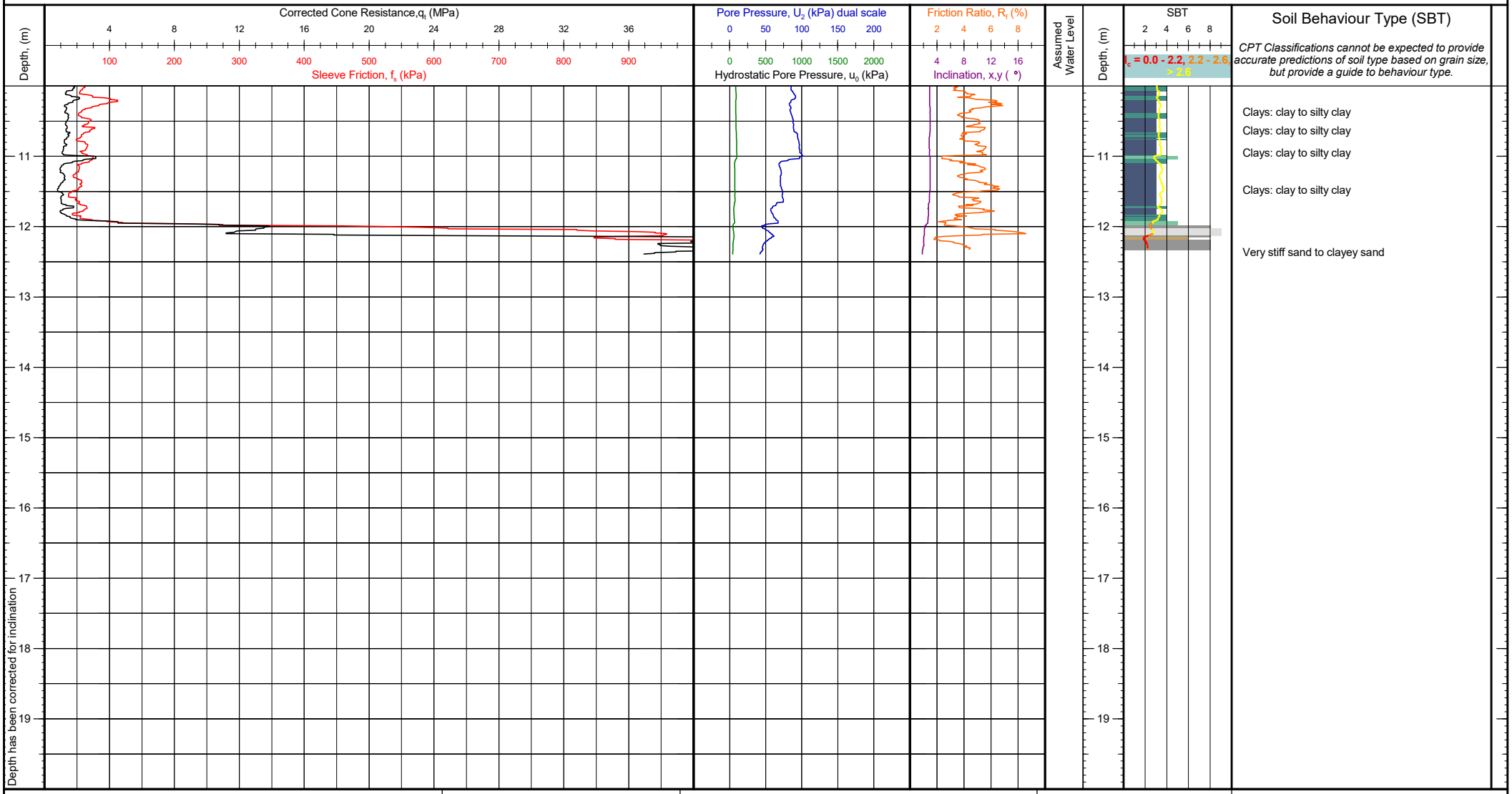
Client Reference:

Test Number: **CPT-02**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

Clays: clay to silty clay
Clays: clay to silty clay
Clays: clay to silty clay
Clays: clay to silty clay
Very stiff sand to clayey sand

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050550.22, 1716614.61	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682056,174.288695	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	12.39
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High friction resistance		

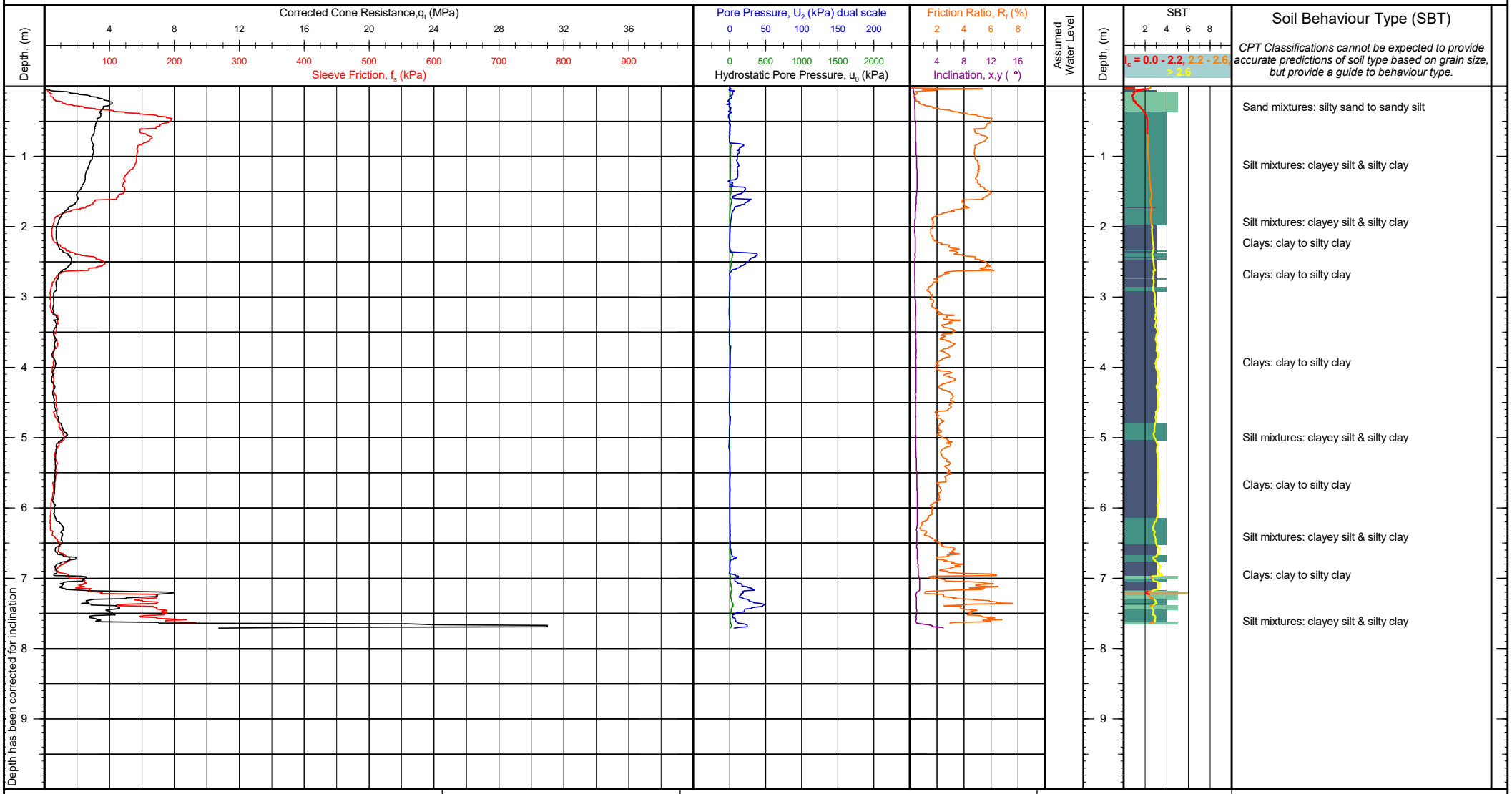
Client Reference:

Test Number: **CPT-02**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050520.21, 1716594.03	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682329,174.288472	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	7.71
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	Inclination high or rapid increase		

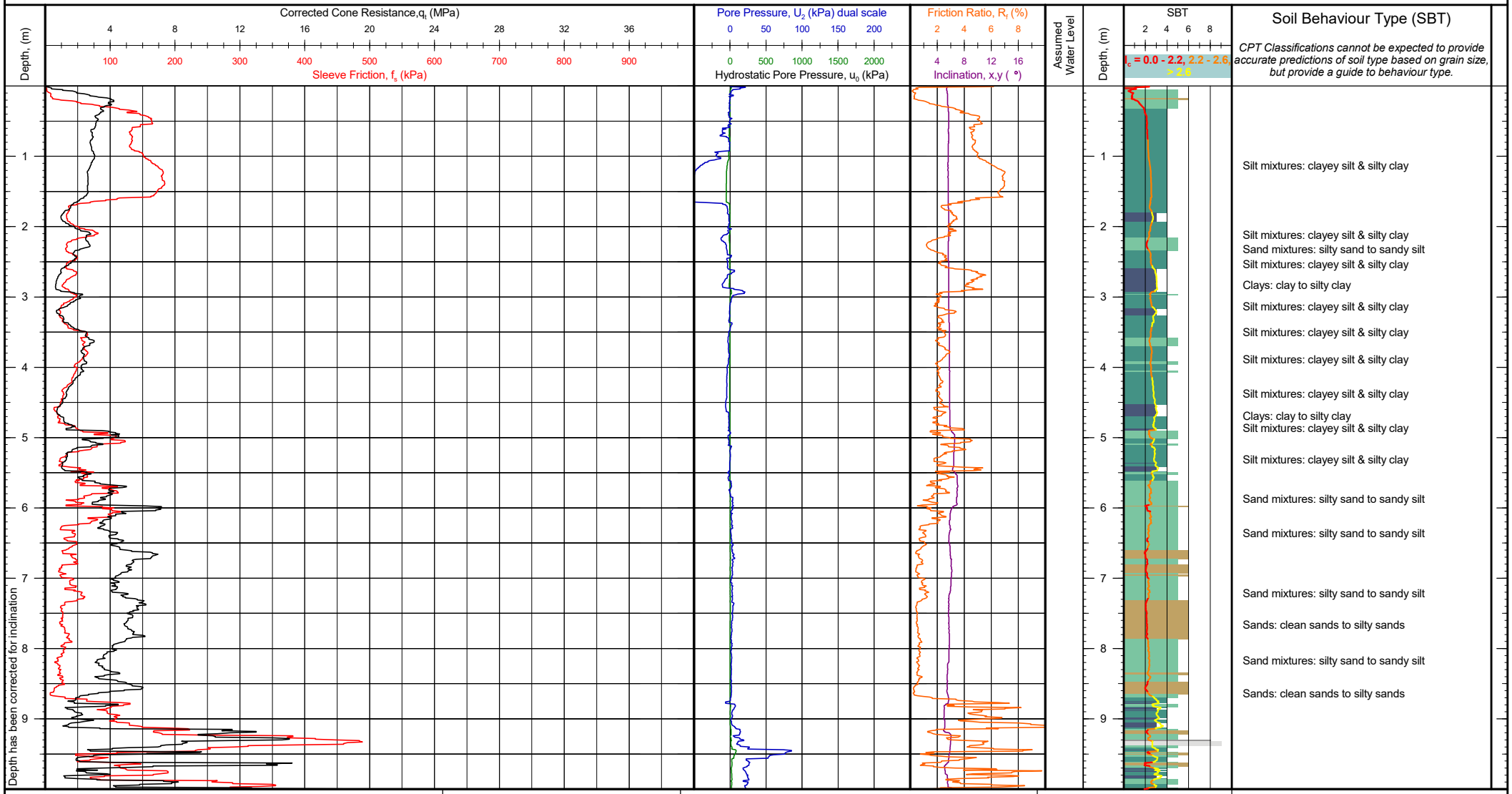
Client Reference:

Test Number: **CPT-03**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sands: clean sands to silty sands
- Sand mixtures: silty sand to sandy silt
- Sands: clean sands to silty sands

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050497.39, 1716650.30	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ291	**WGS84 (deg):**	-35.682528,174.289097	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	12.67
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

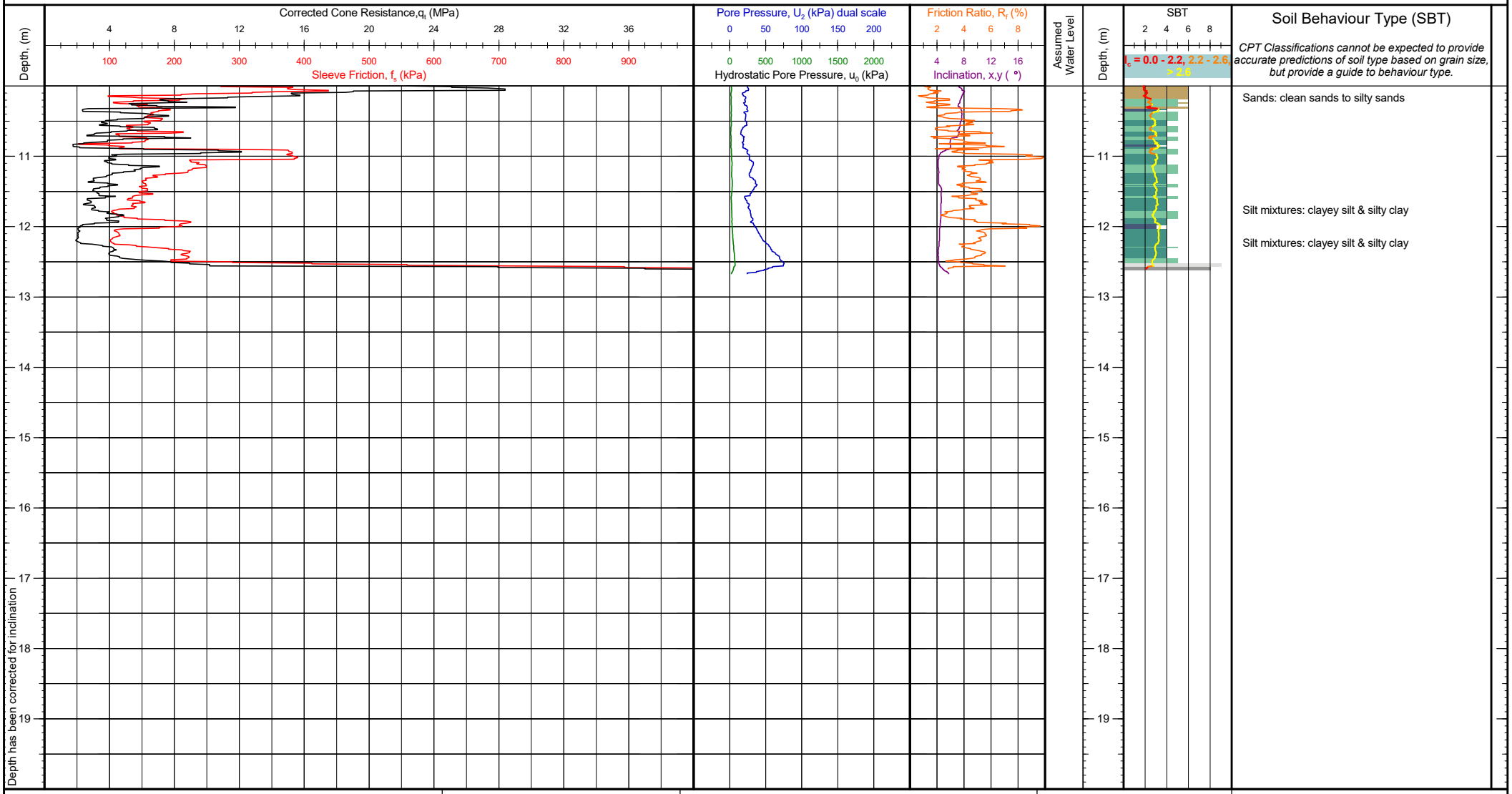
Client Reference:

Test Number: **CPT-04**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

Sands: clean sands to silty sands

Silt mixtures: clayey silt & silty clay

Silt mixtures: clayey silt & silty clay

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050497.39, 1716650.30	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ291	**WGS84 (deg):**	-35.682528,174.289097	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	12.67
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

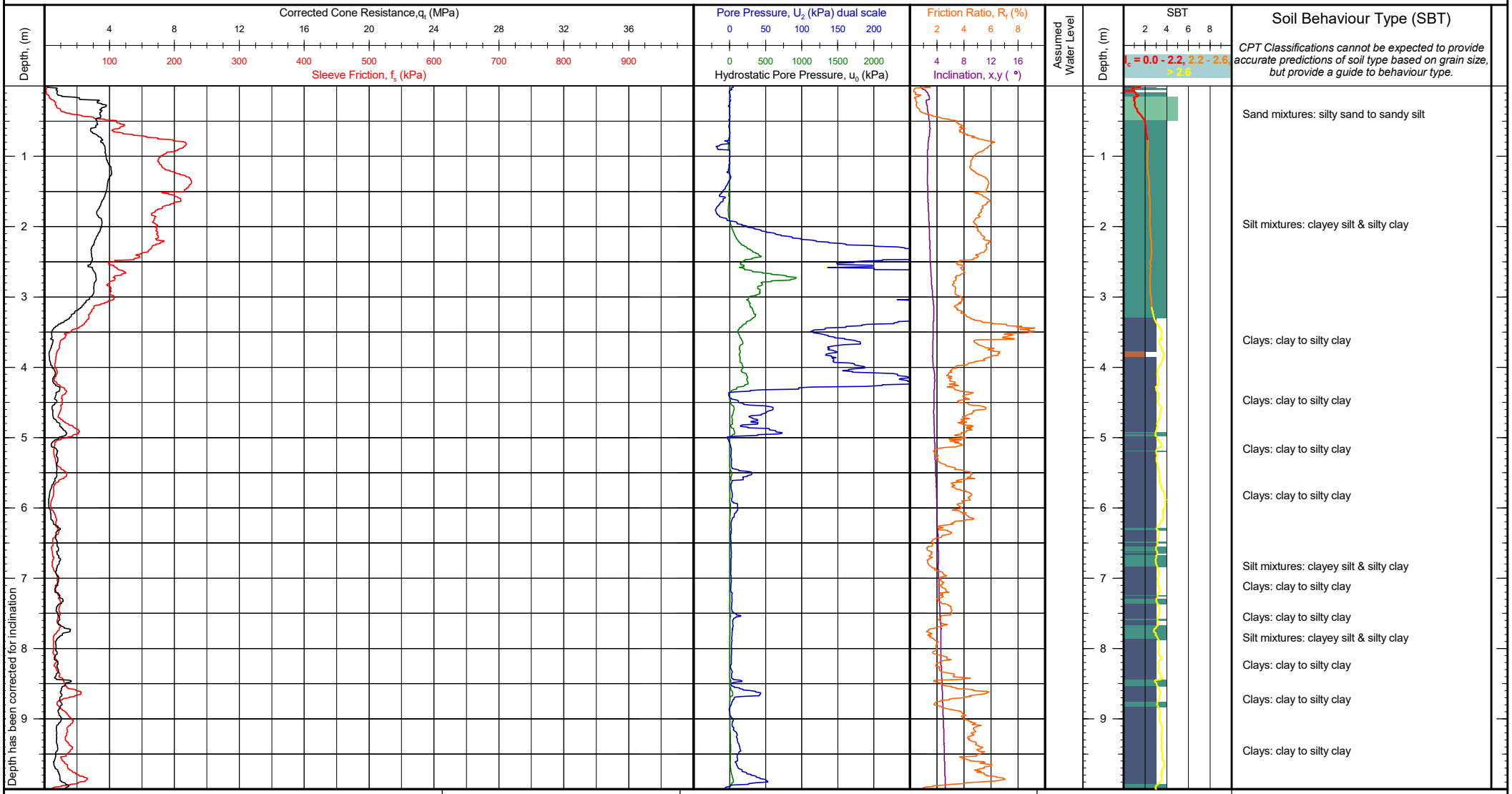
Client Reference:

Test Number: **CPT-04**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay
- Clays: clay to silty clay

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050455.93, 1716656.90	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682901,174.289176	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	18.02
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	Danger of buckling rods		

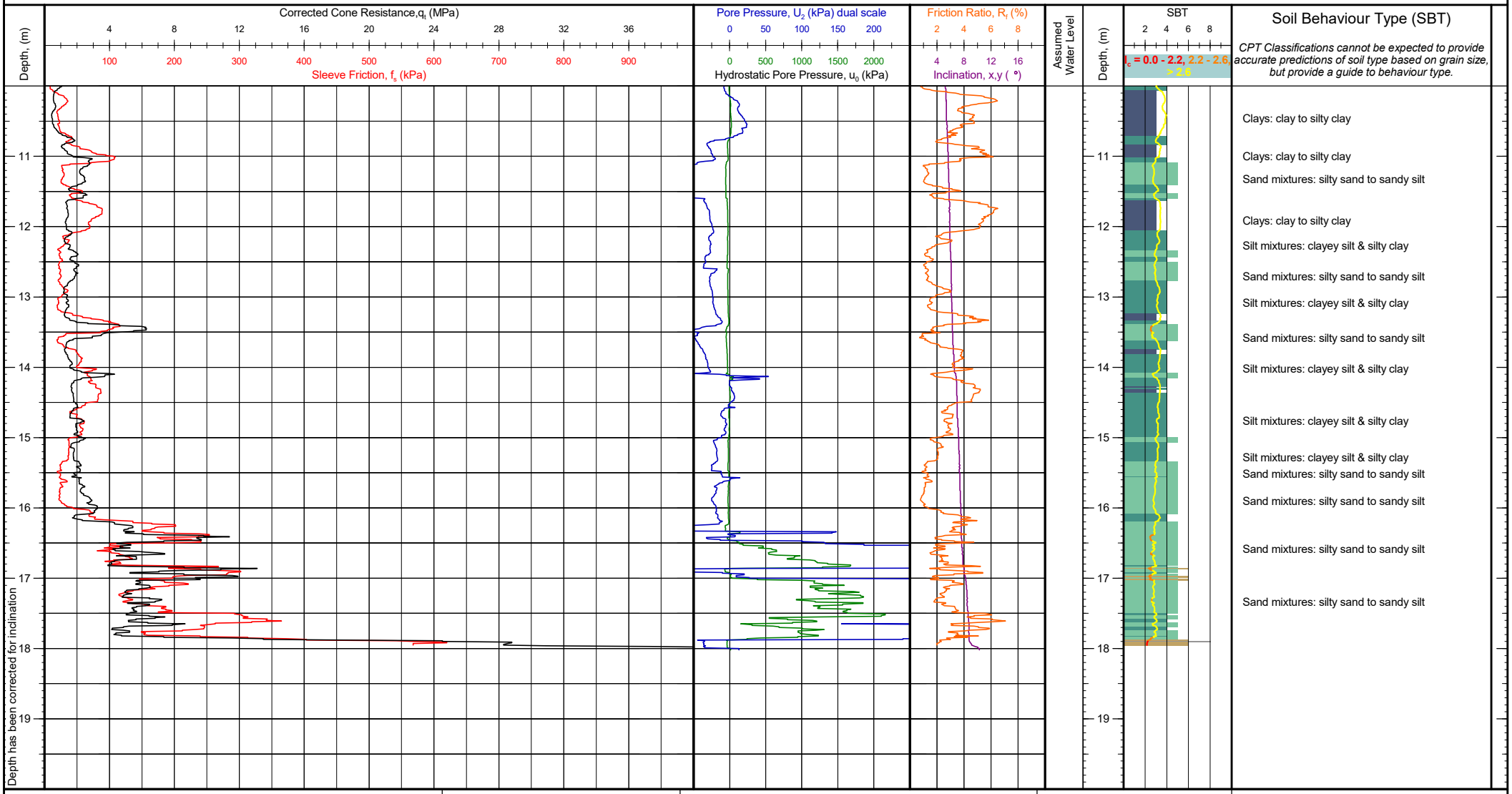
Client Reference:

Test Number: **CPT-05**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Clays: clay to silty clay
- Clays: clay to silty clay
- Sand mixtures: silty sand to sandy silt
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050455.93, 1716656.90	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682901,174.289176	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	18.02
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	Danger of buckling rods		

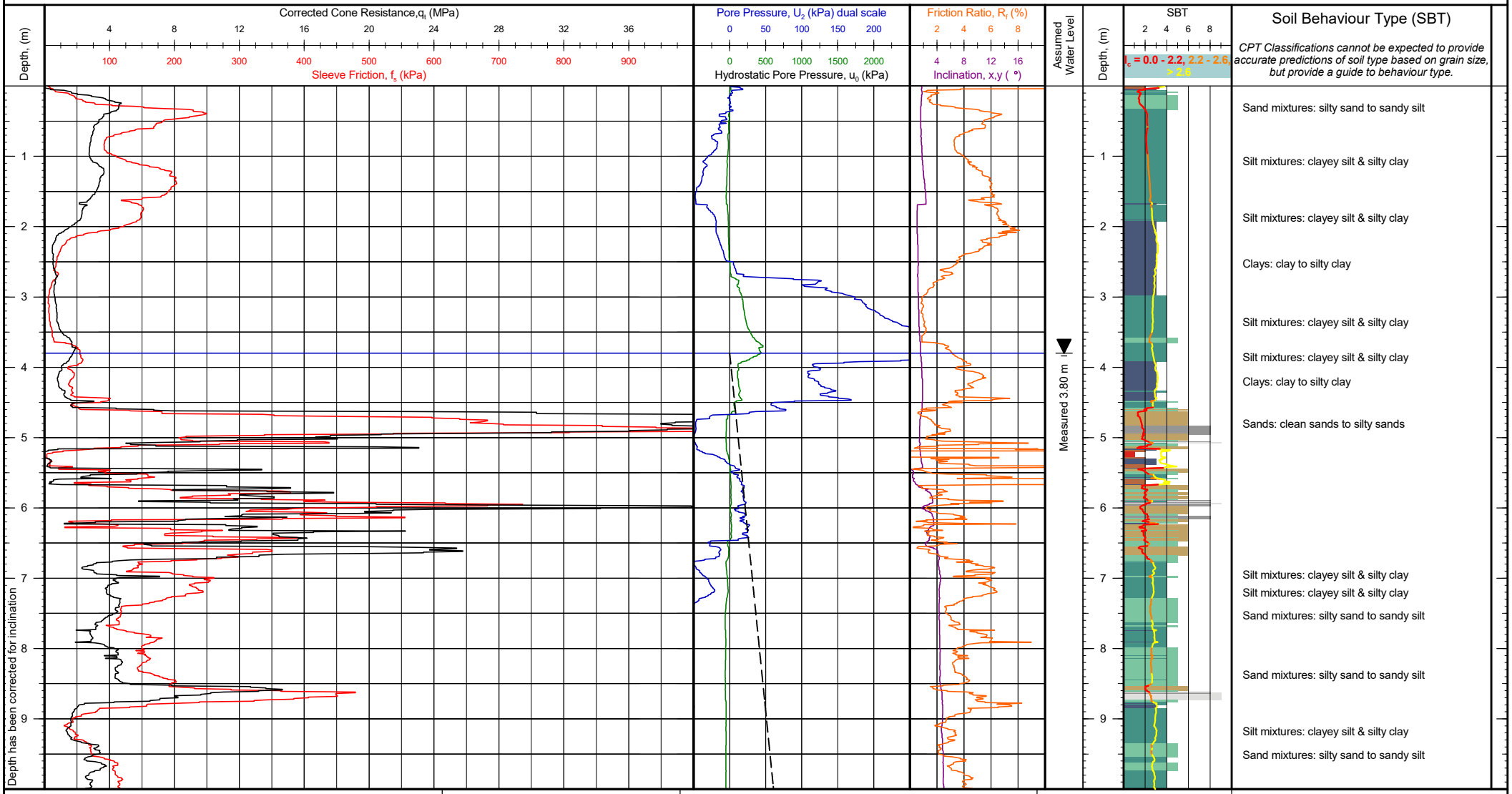
Client Reference:

Test Number: **CPT-05**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Clays: clay to silty clay
- Sands: clean sands to silty sands
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050409.56, 1716774.86	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.683305,174.290486	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	16.29
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

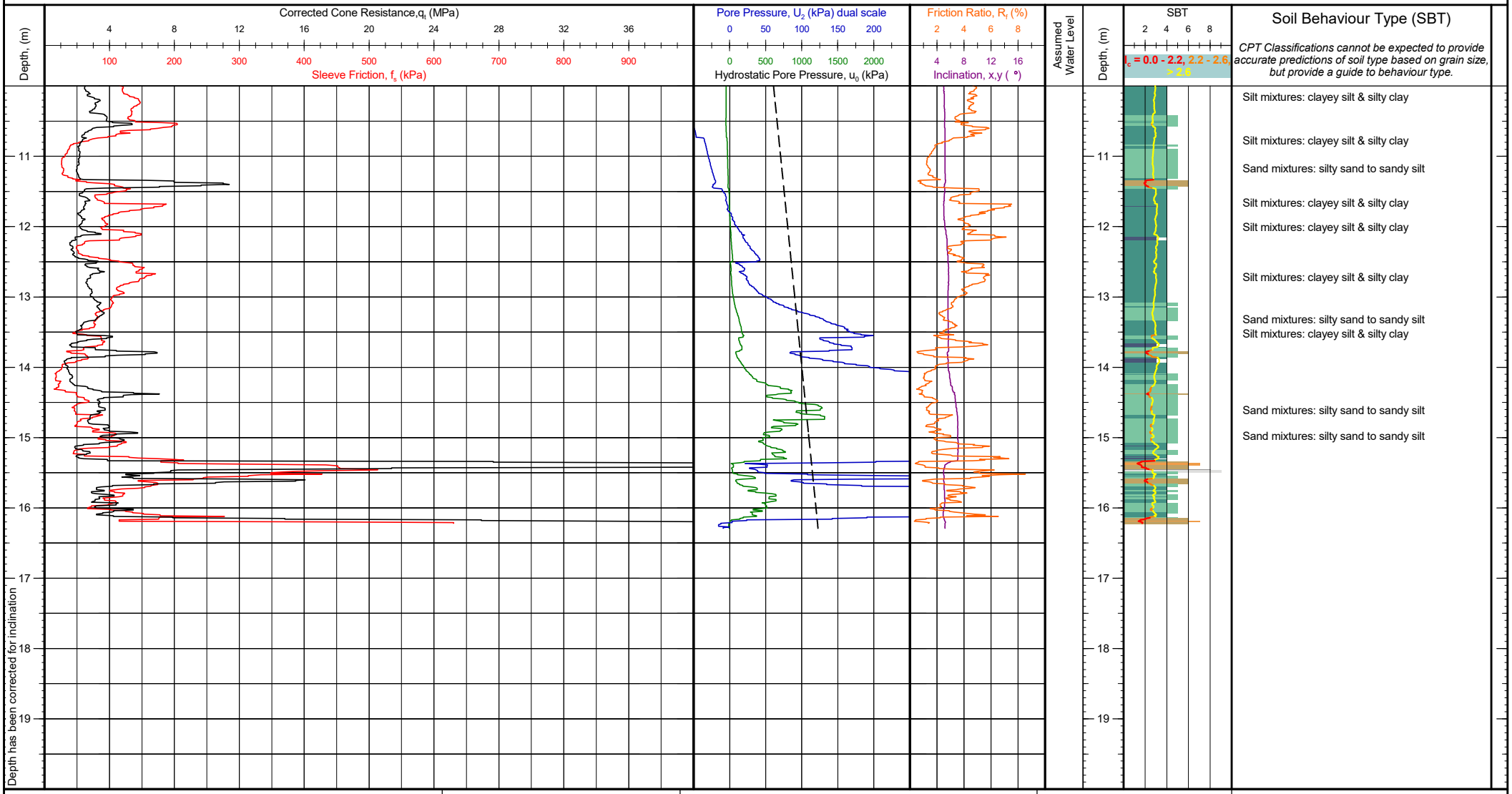
Client Reference:

Test Number: **CPT-06**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Soil Behaviour Type (SBT)

CPT Classifications cannot be expected to provide accurate predictions of soil type based on grain size, but provide a guide to behaviour type.

- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Silt mixtures: clayey silt & silty clay
- Sand mixtures: silty sand to sandy silt
- Sand mixtures: silty sand to sandy silt

Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050409.56, 1716774.86	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.683305,174.290486	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	16.29
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

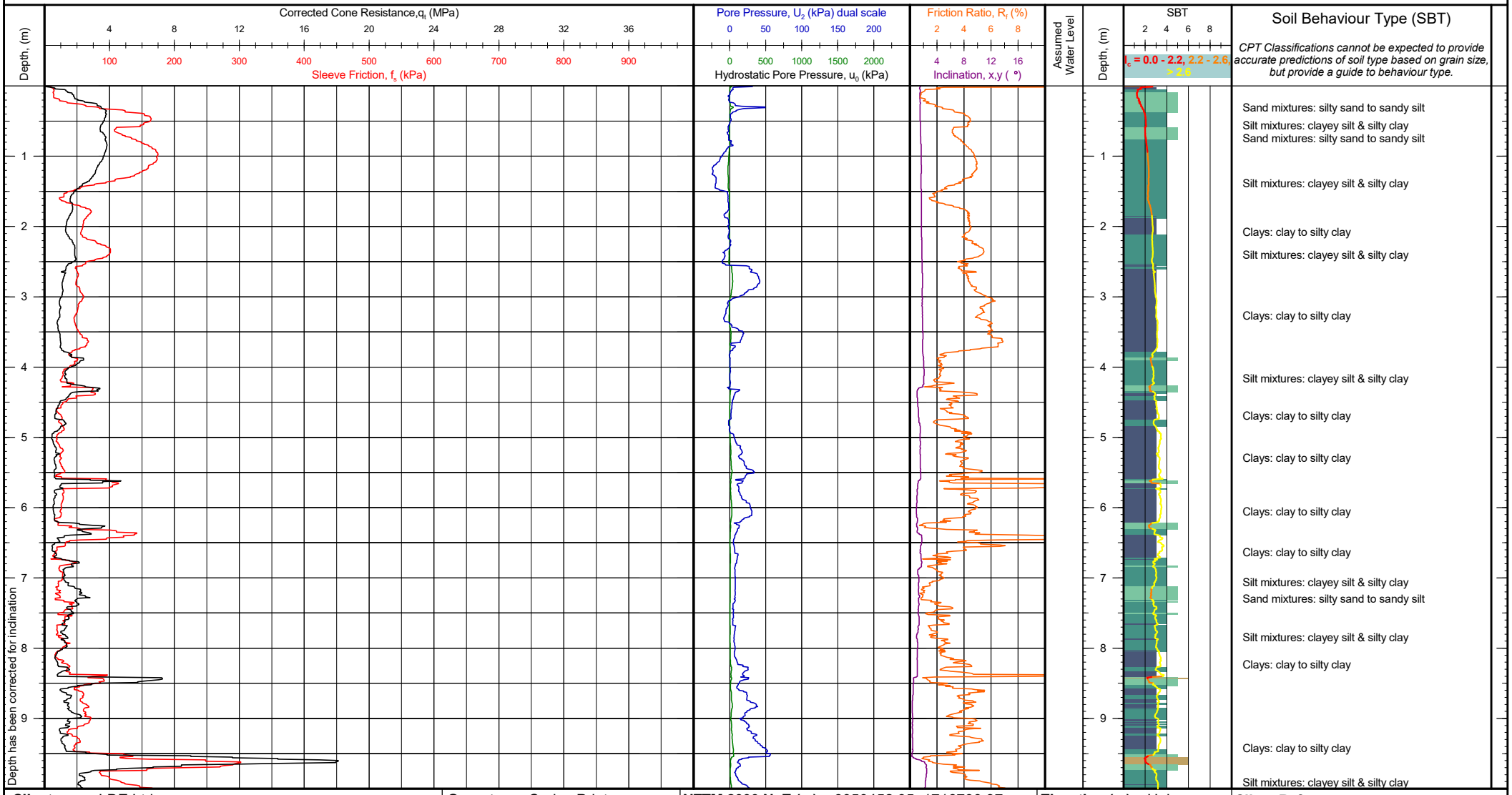
Client Reference:

Test Number: **CPT-06**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050452.95, 1716790.37	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682912,174.290651	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	13.29
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

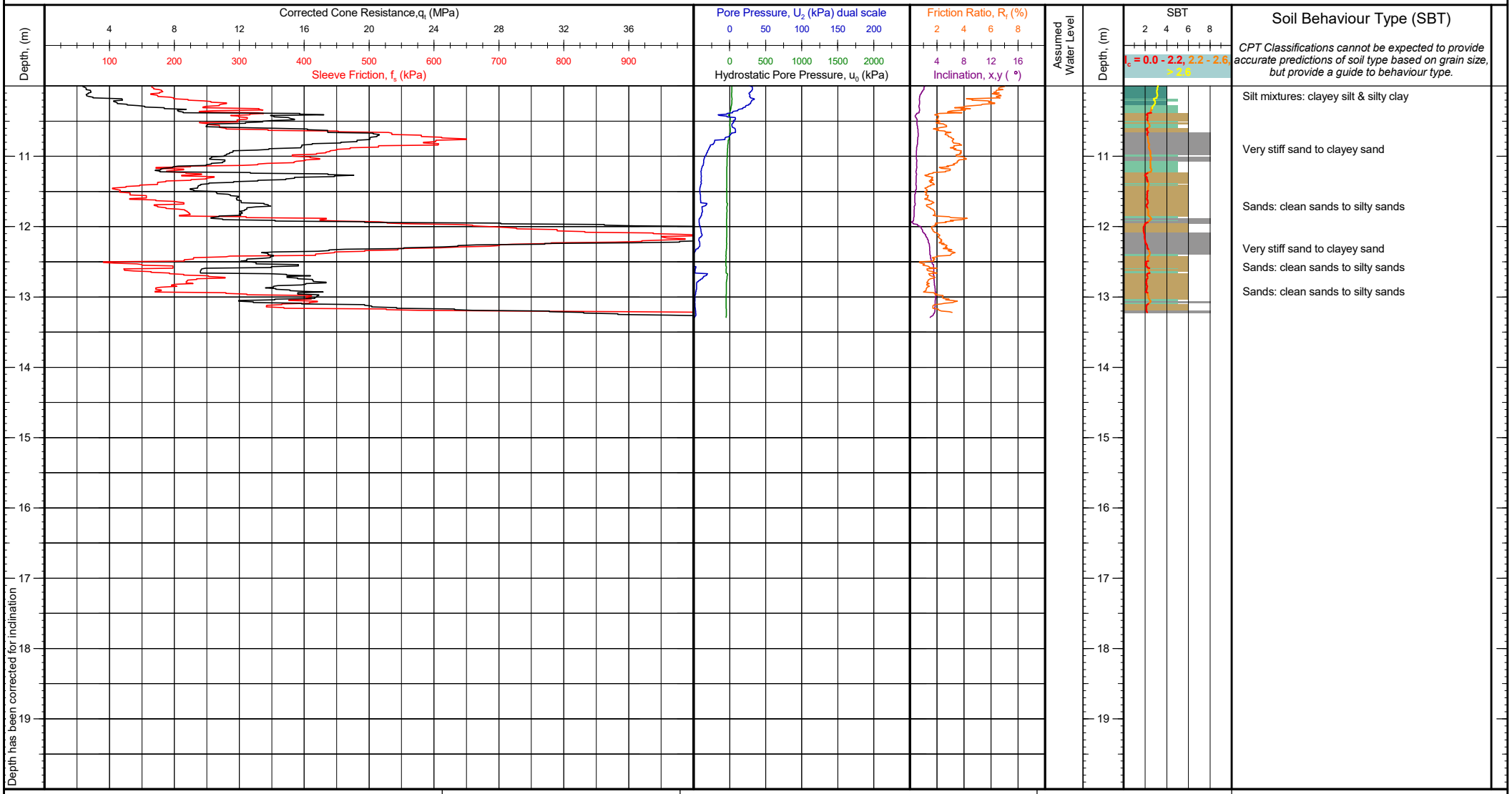
Client Reference:

Test Number: **CPT-07**

G.I. Job Ref: 210082

Comments:

CONE PENETRATION TEST (CPT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050452.95, 1716790.37	**Elevation (m):**	Unknown
Project:	Dip Road	**Cone Ref:**	MKJ325	**WGS84 (deg):**	-35.682912,174.290651	**Date of Test:**	10/02/2021
Location:	Kamo, Whangarei	**Cone Type:**	10cm^2 Compression	**Location Method:**	Handheld GPS	**Depth (m):**	13.29
Engineer:	Finlay Wallen-Halliwell	**Area Ratio:**	0.80	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**Filter Type:**	u_2	**Termination Reason:**	High cone end resistance		

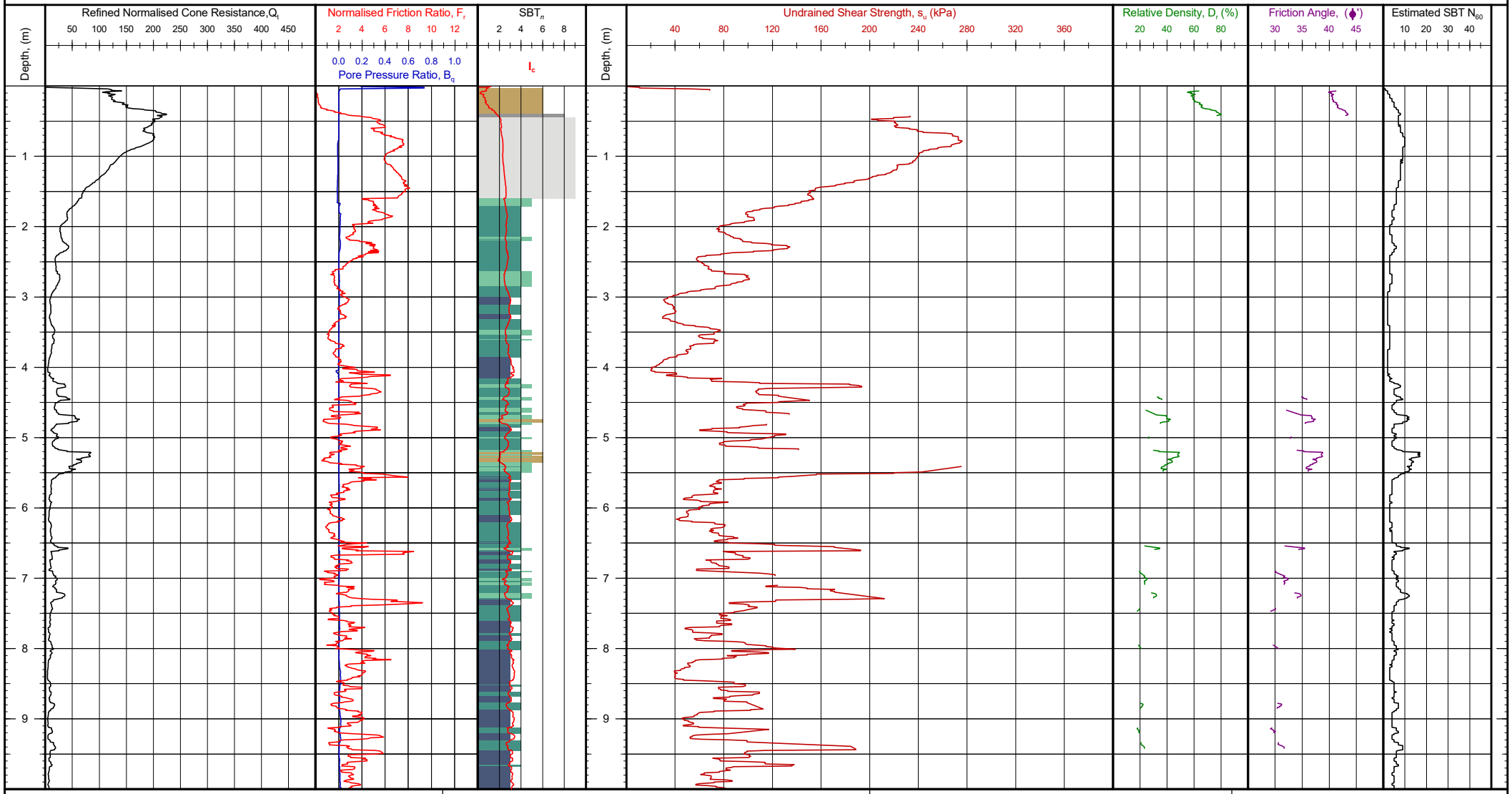
Client Reference:

Test Number: **CPT-07**

G.I. Job Ref: 210082

Comments:

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

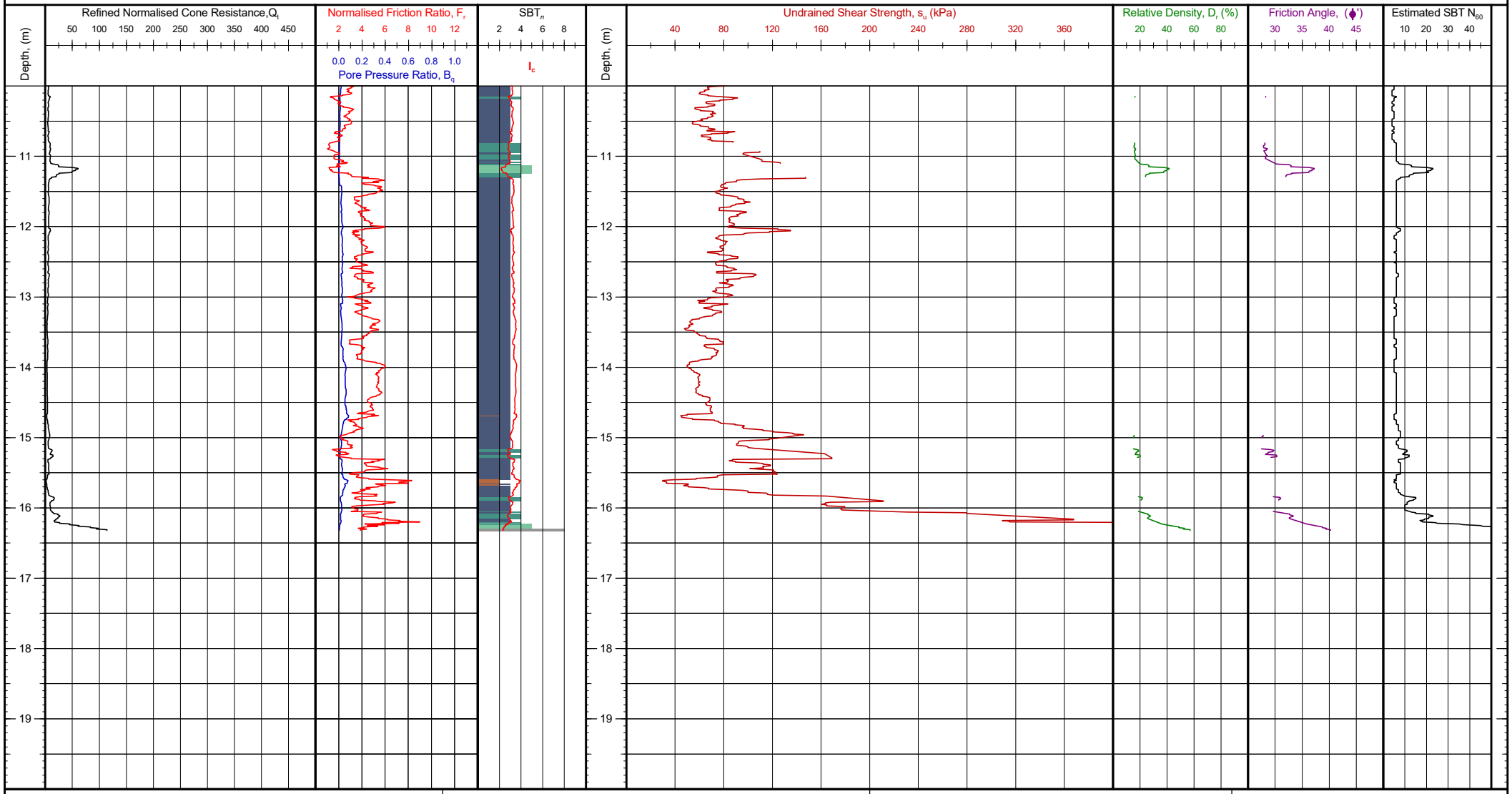
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-01**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

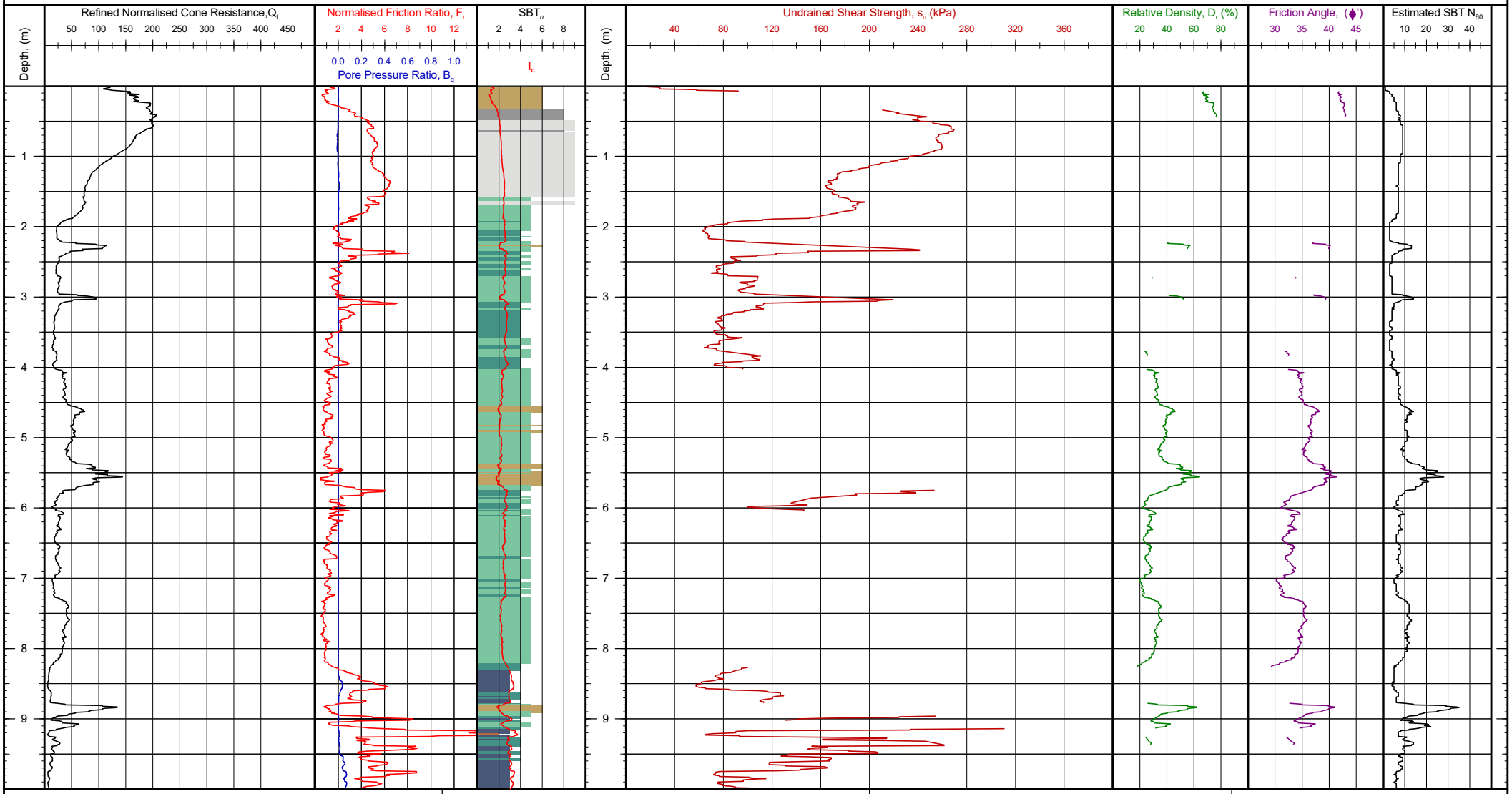
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-01**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

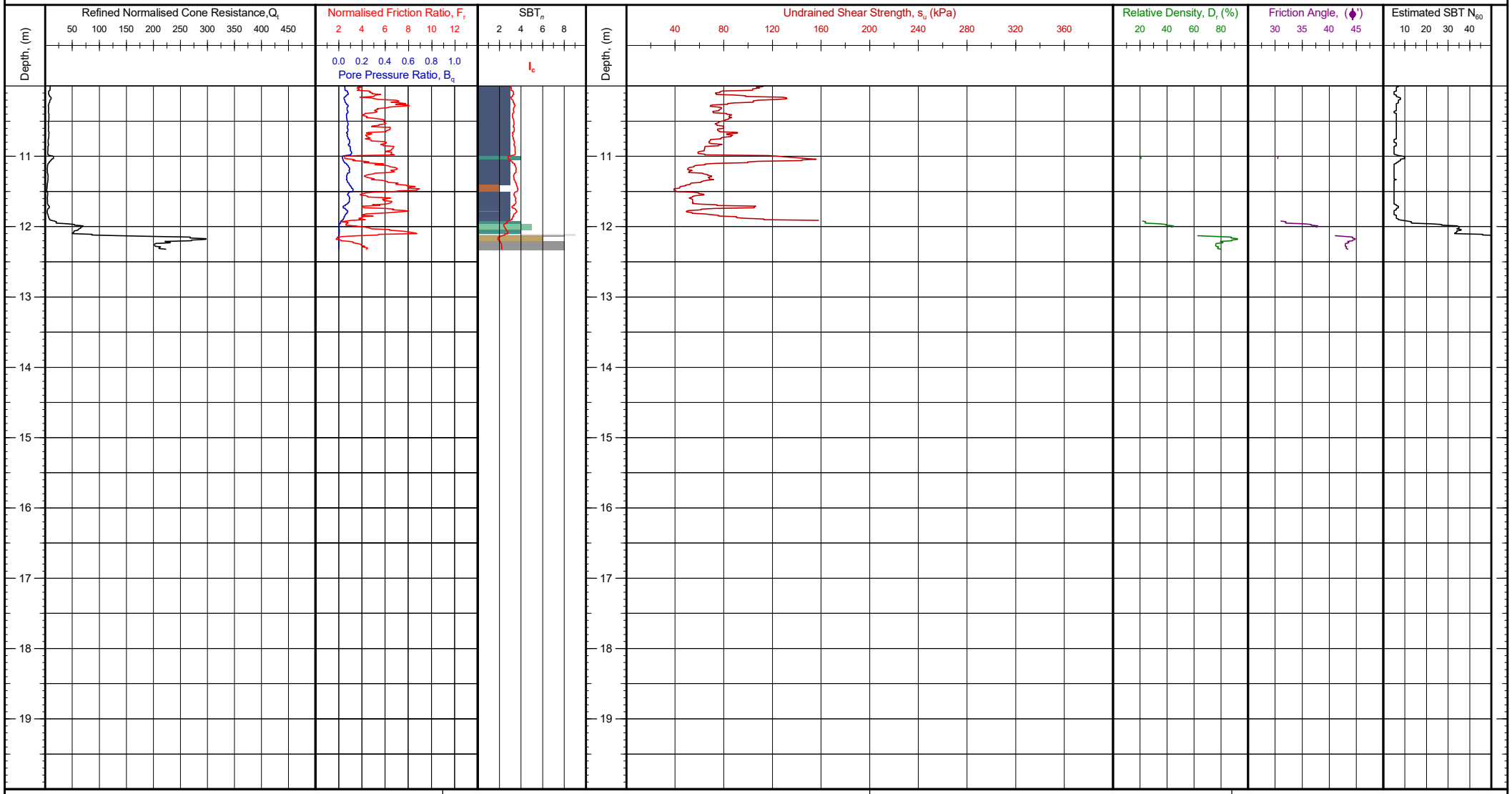
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-02**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

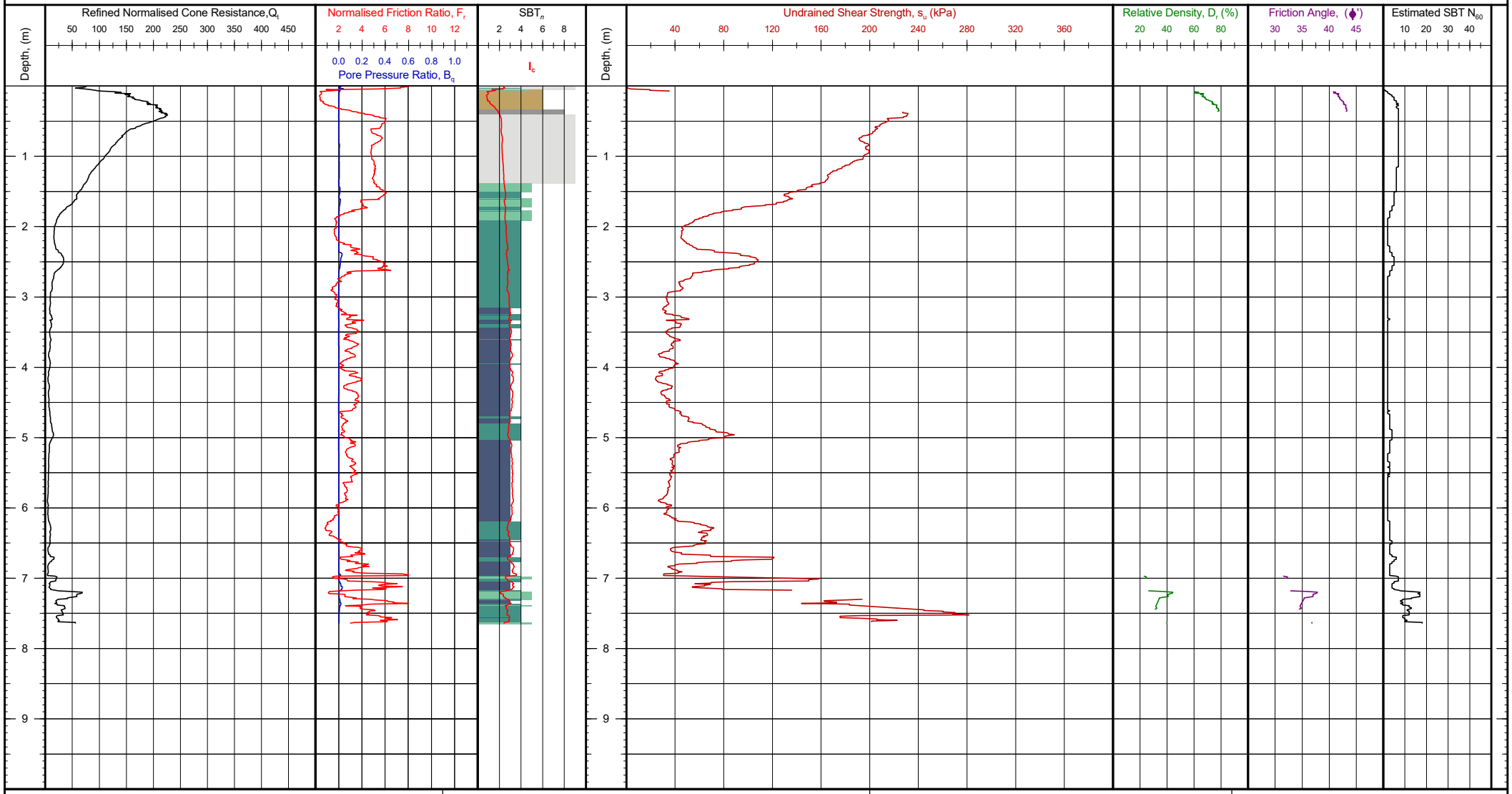
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-02**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

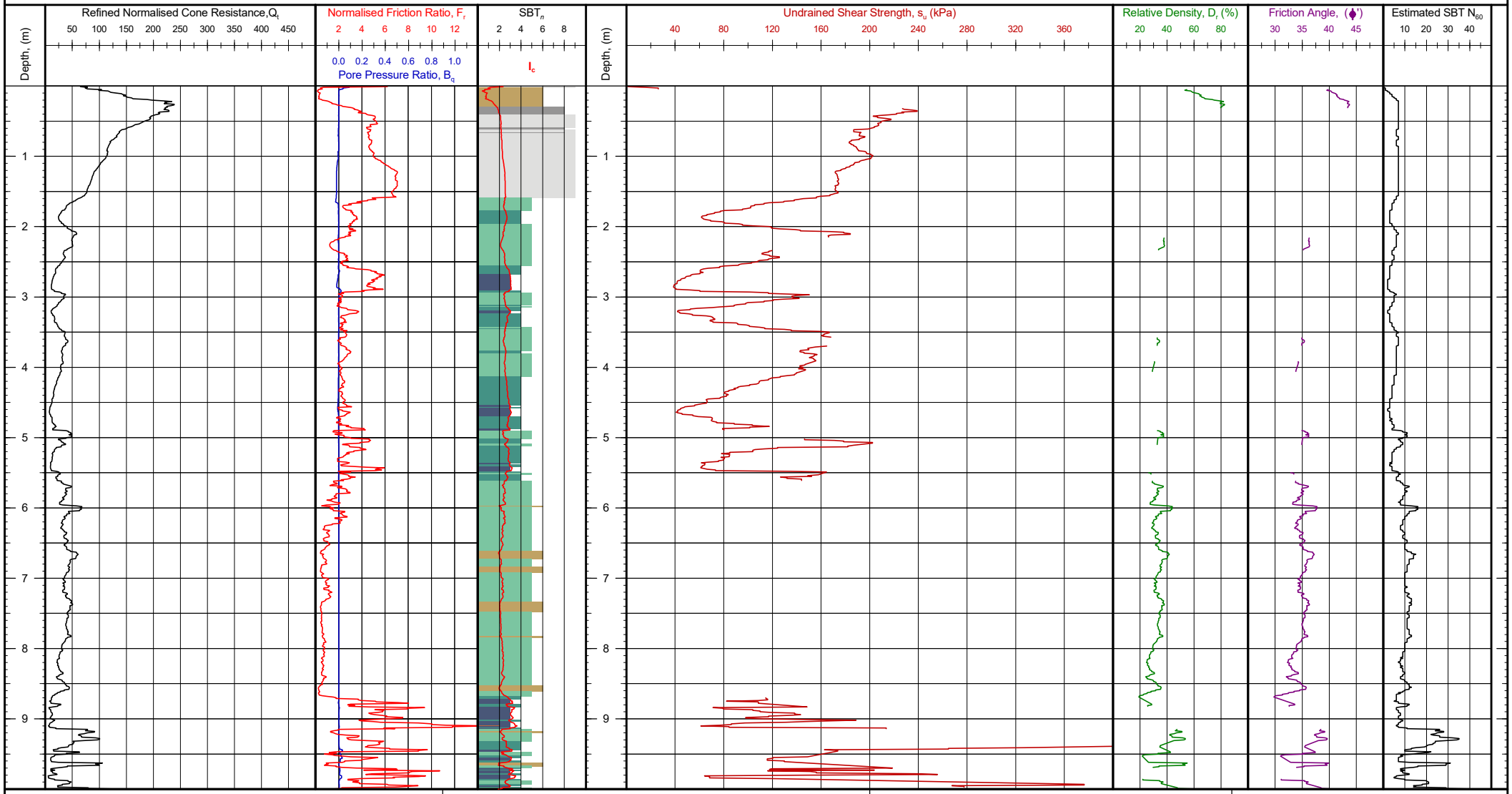
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-03**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

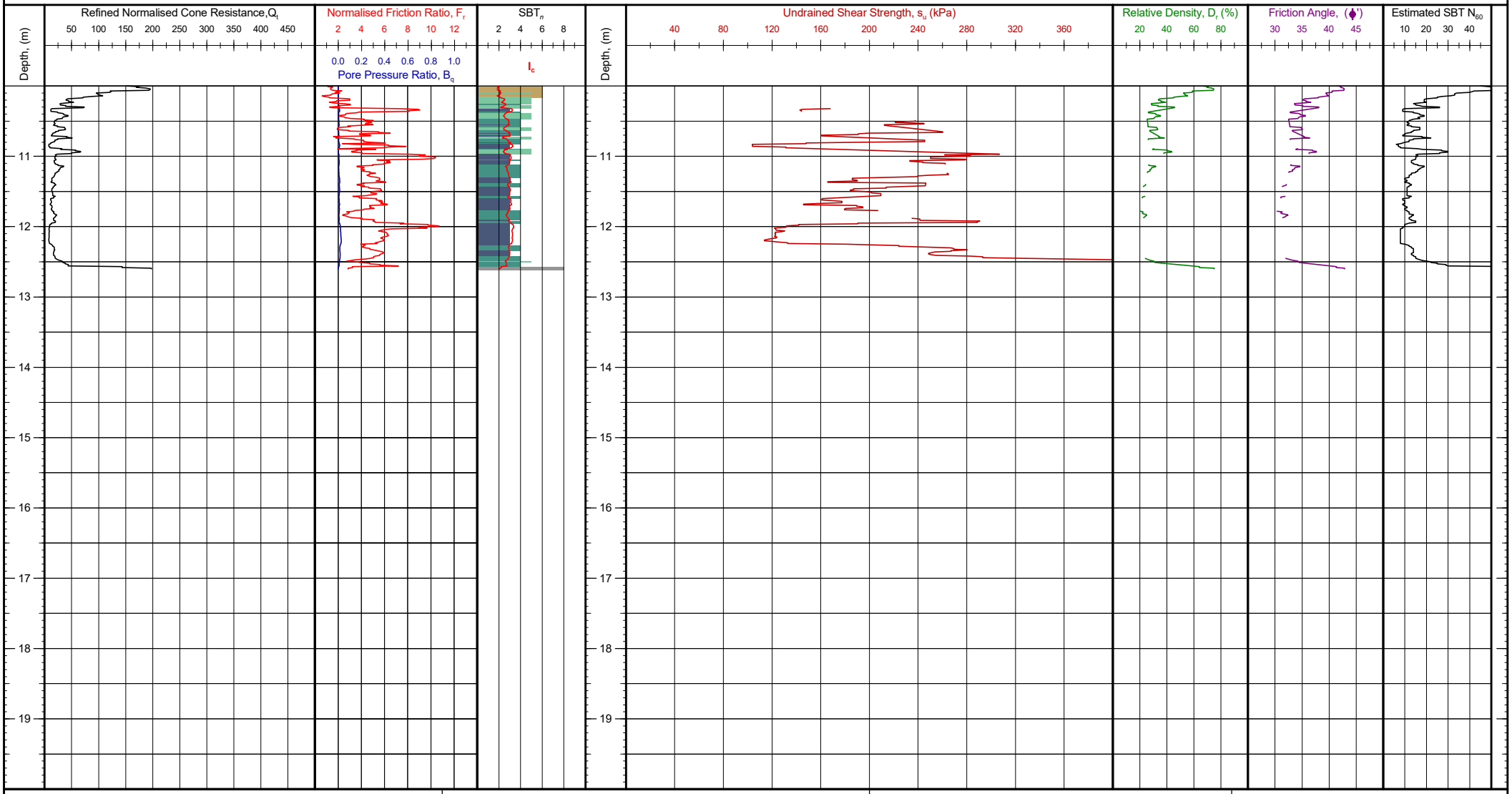
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-04**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

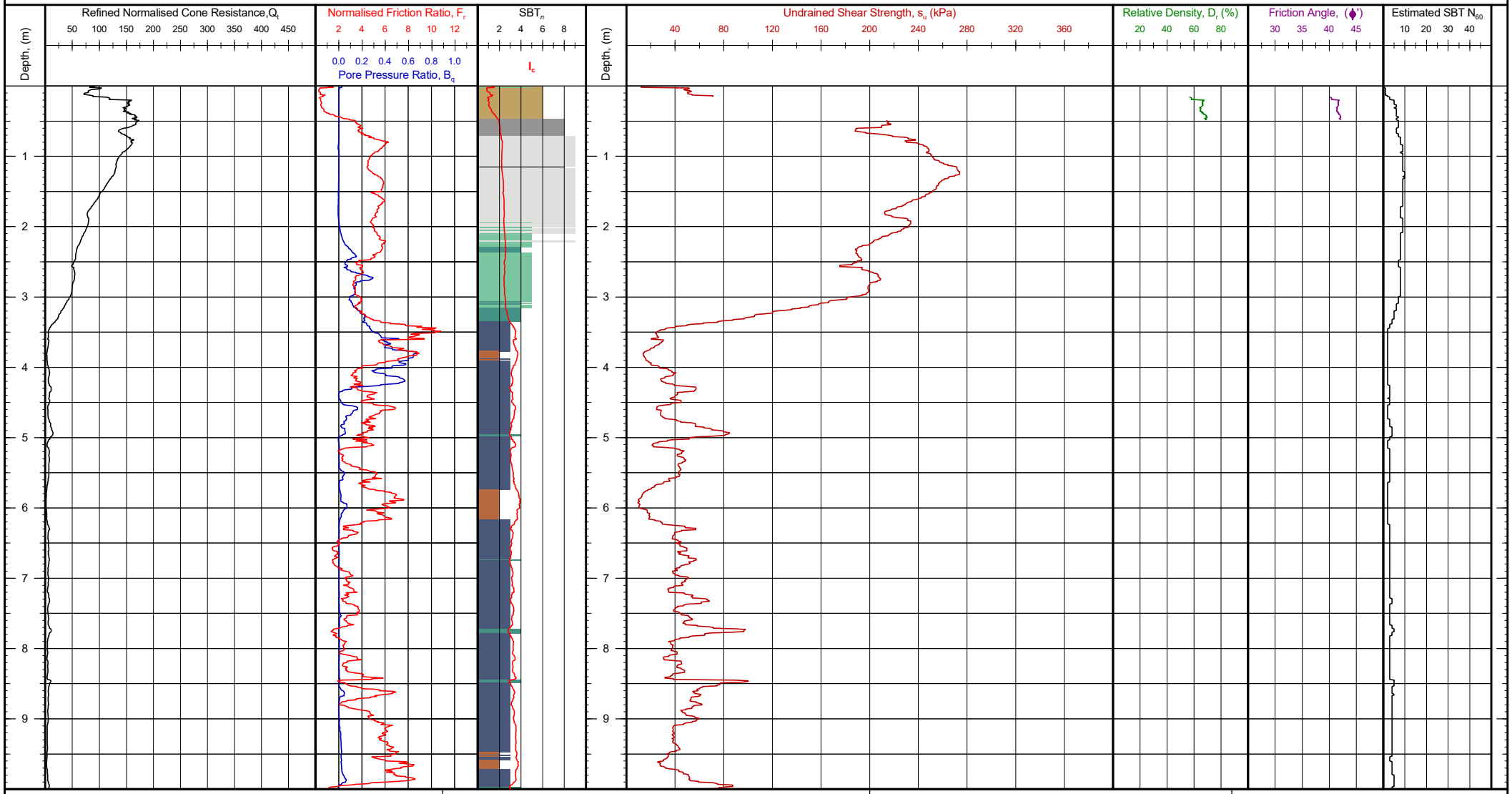
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-04**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

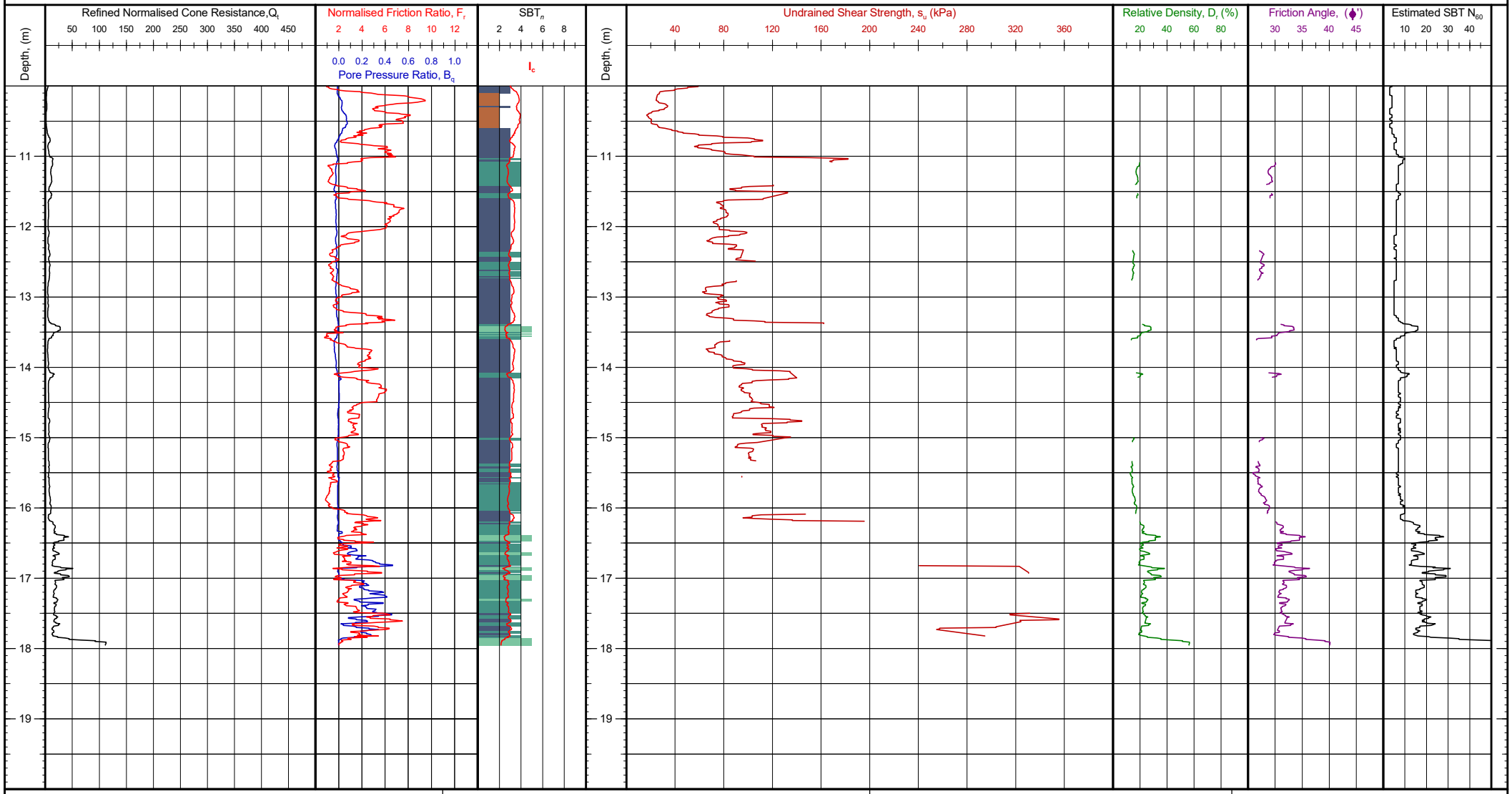
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-05**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

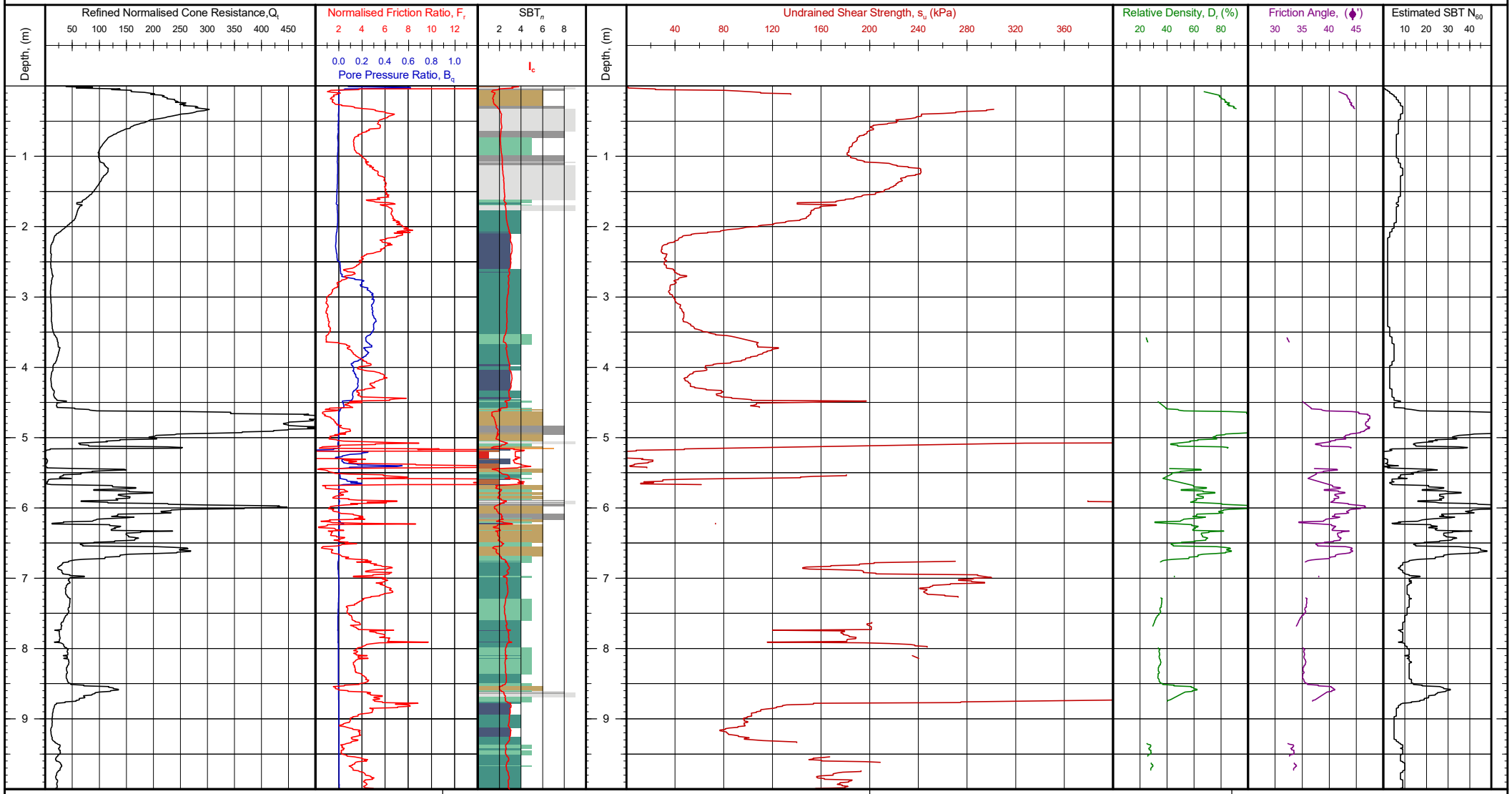
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-05**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

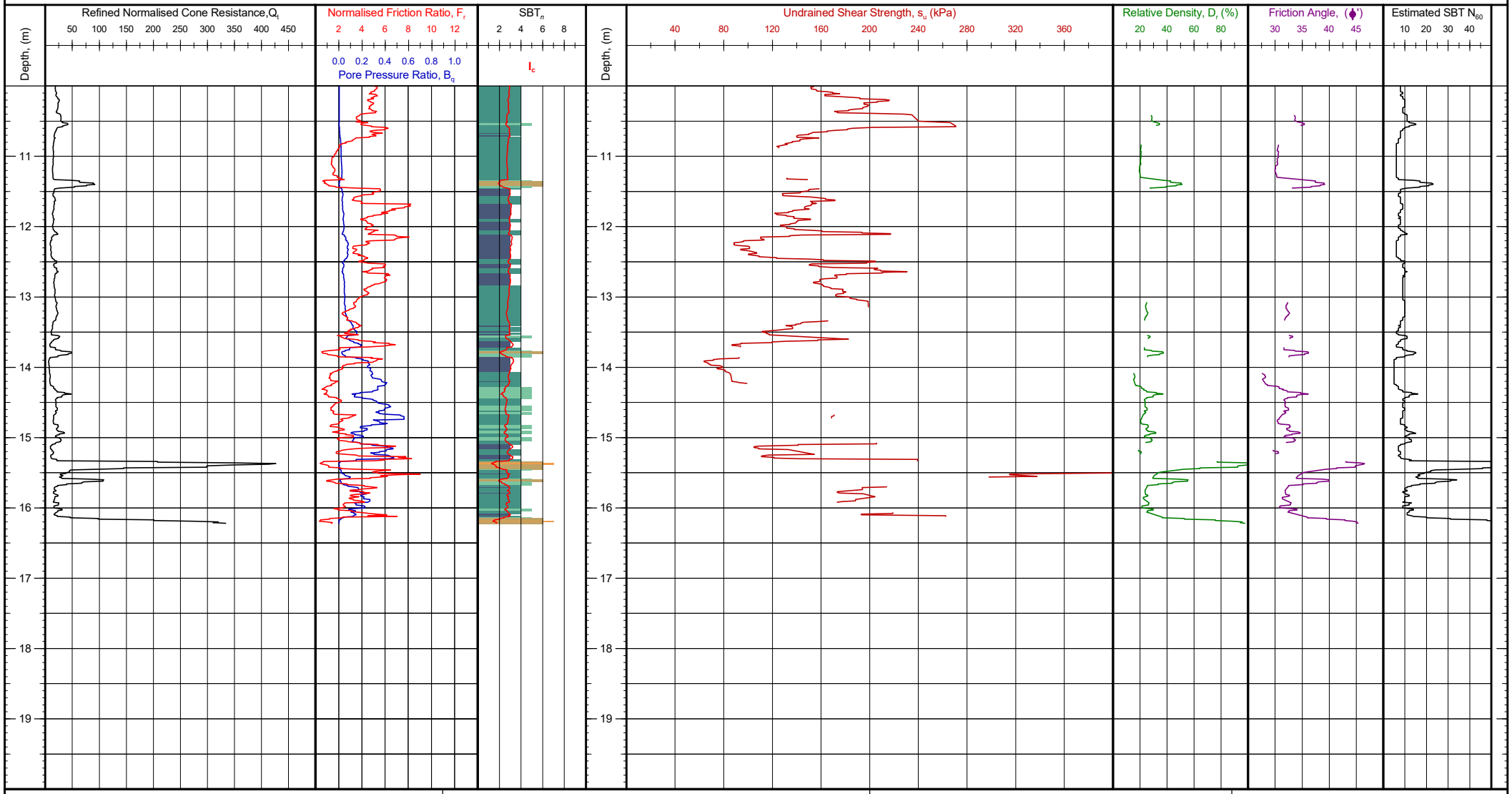
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-06**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

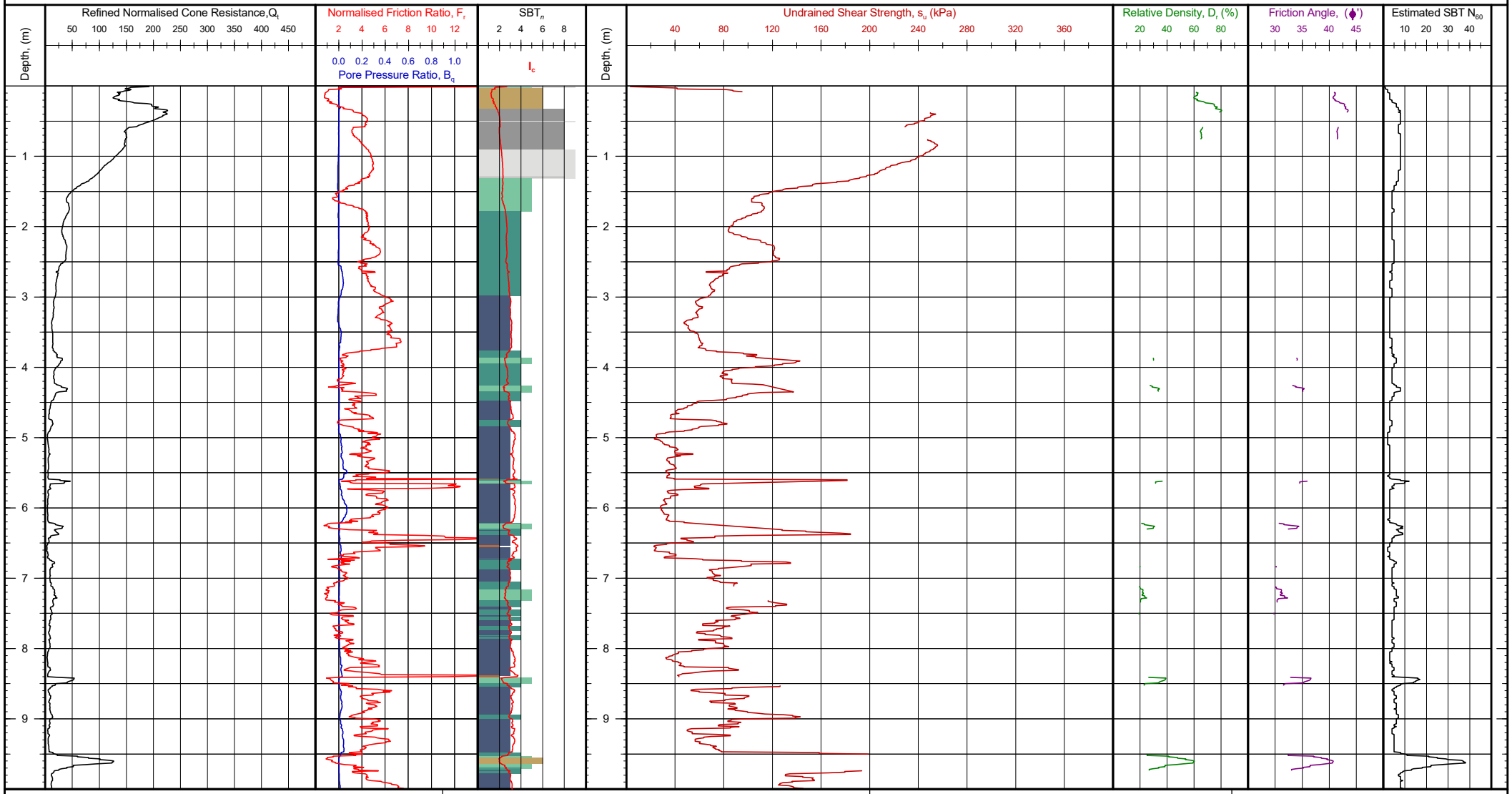
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-06**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

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

Notes and Limitations:

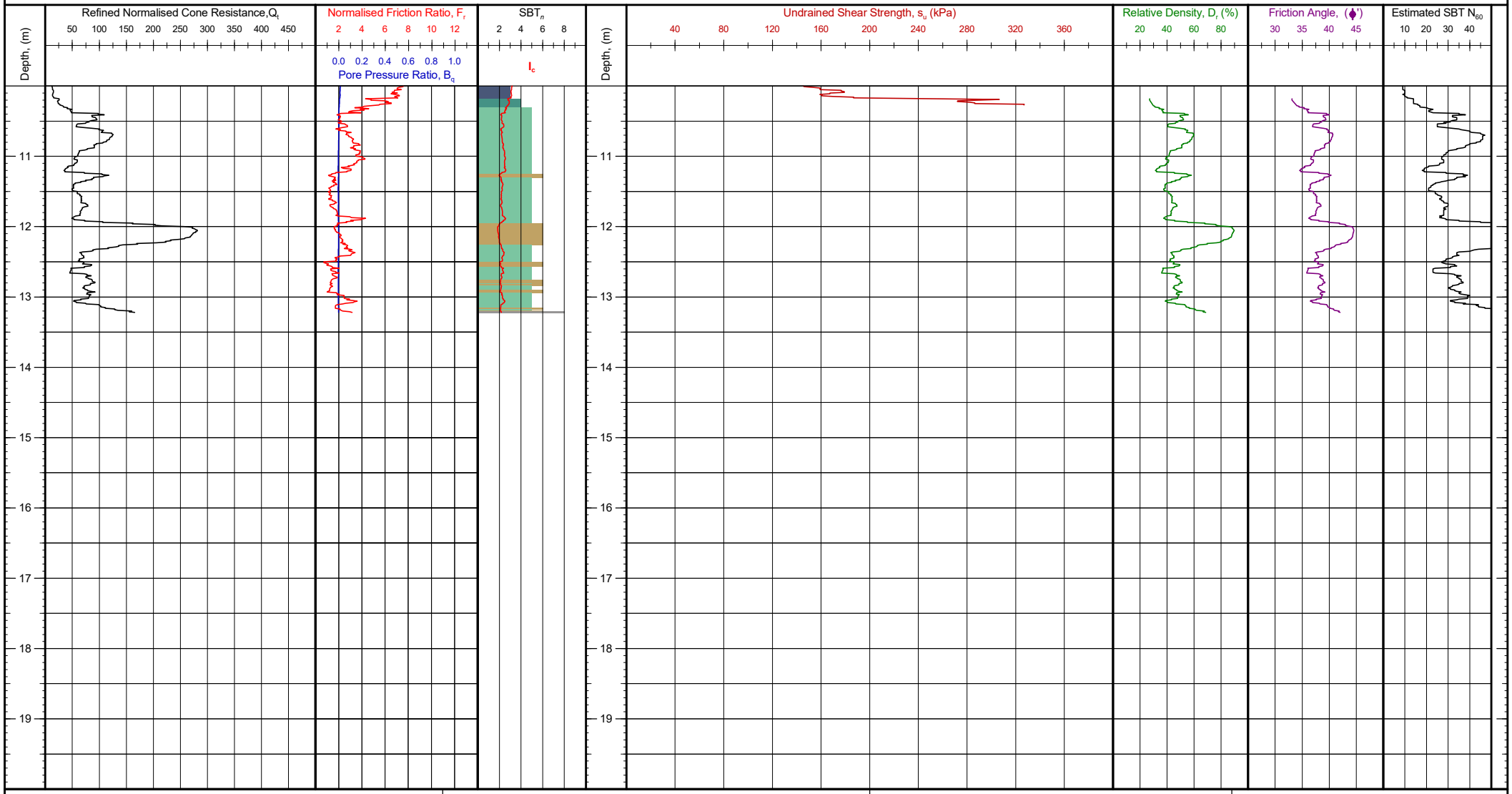
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-07**

G.I. Job Ref: 210082

CPT PARAMETER LOG



Client: LDE Ltd

Project: Dip Road

Location: Kamo, Whangarei

Engineer: Finlay Wallen-Halliwell

Contractor: Ground Investigation Ltd

Soil Behaviour Type SBT_n - Robertson et al. 1990

0	Undefined	5	Sand mixtures: silty sand to sandy silt
1	Sensitive fine grained	6	Sands: clean sands to silty sands
2	Organic: Organic clay/silt, peat	7	Dense sand to gravelly sand
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4	Silt mixtures: clayey silt & silty clay	9	Stiff silt/clay

Notes and Limitations:

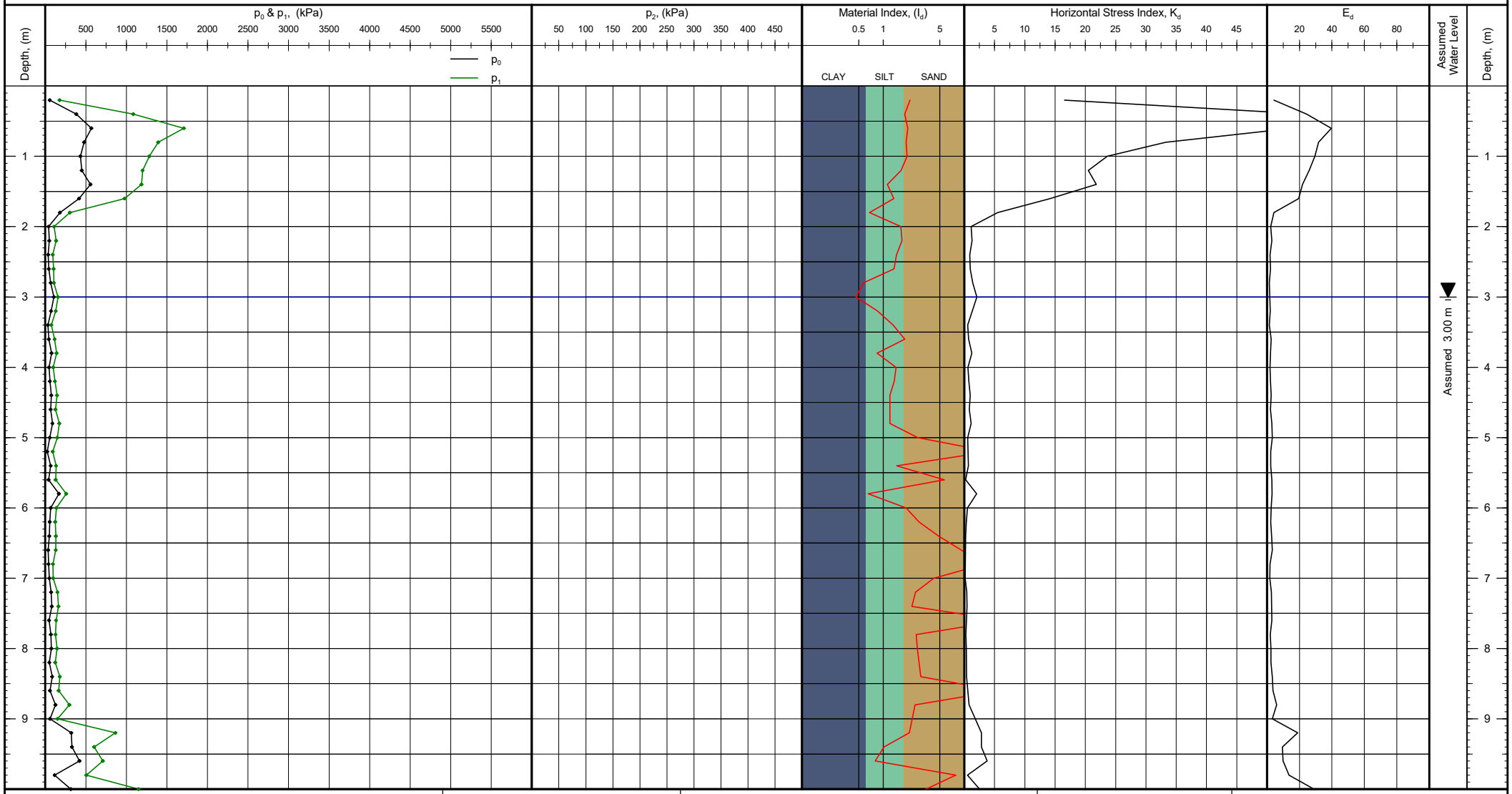
Data shown on this report has been assessed to provide a basic interpretation in terms of Soil Behaviour Type (SBT) and various geotechnical soil and design parameters using methods published in P.K. Robertson and K.L. Cabel (2010), Guide to Cone Penetration Testing for Geotechnical Engineering, 4th Edition. The interpretations are presented only as a guide for geotechnical use and should be carefully reviewed by the user. Ground Investigation Ltd. does not warrant the correctness or applicability of any of the geotechnical soil and design parameter shown and does not assume any liability for any use of the results in any design or review. The used should be fully aware of the techniques and limitations of any method used to derive data shown in this report.

Client Reference:

Test Number: **CPT-07**

G.I. Job Ref: 210082

FLAT DILATOMETER TEST (DMT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050552.71, 1716619.34	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682033,174.288747	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	11.80
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	8 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	69 kPa	**Termination Reason:**	Maximum Nominal Pressure		

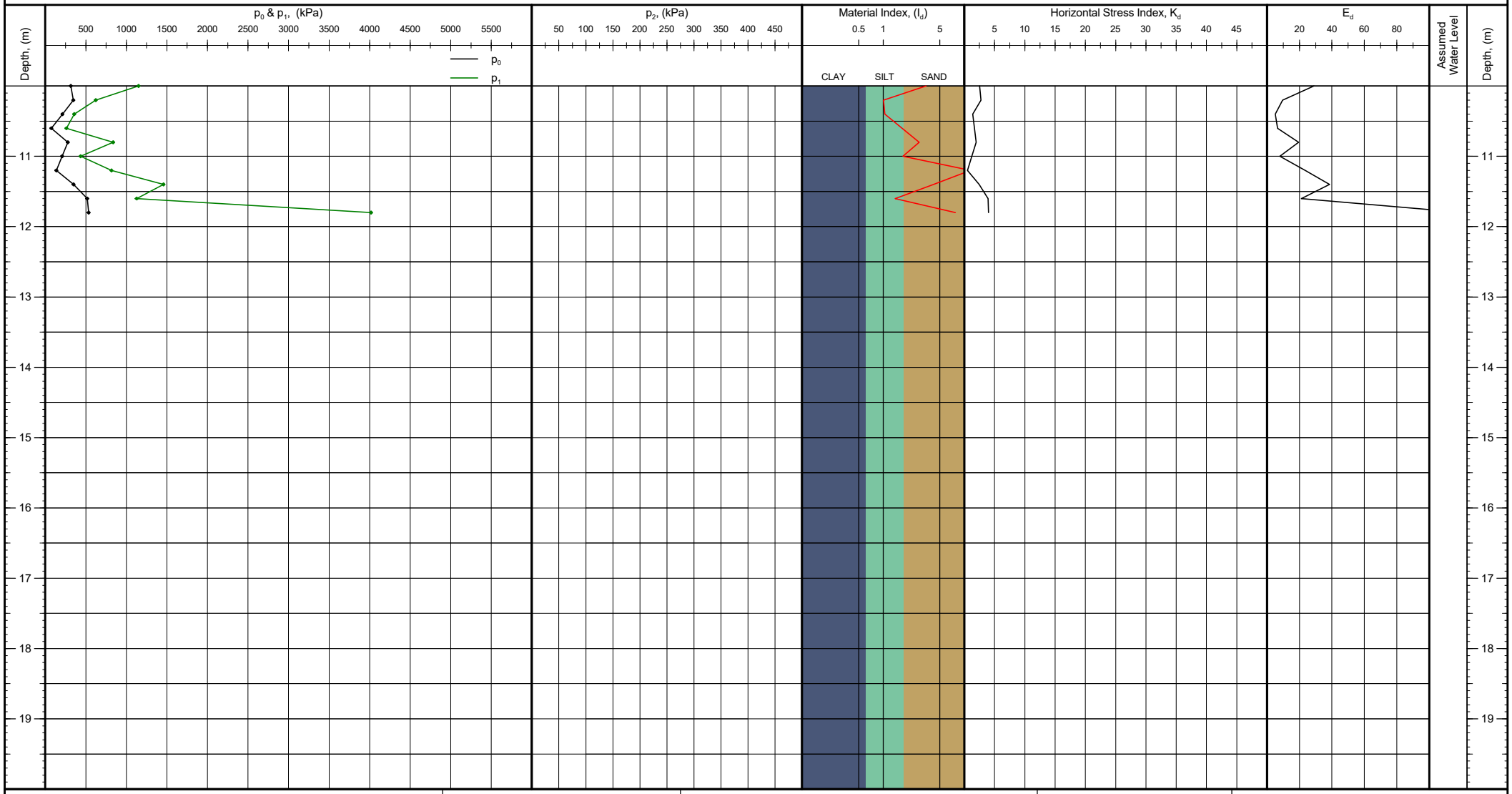
Client Reference:

Test Number: **DMT-01**

G.I. Job Ref: 210082

Comments:

FLAT DILATOMETER TEST (DMT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050552.71, 1716619.34	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682033,174.288747	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	11.80
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	8 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	69 kPa	**Termination Reason:**	Maximum Nominal Pressure		

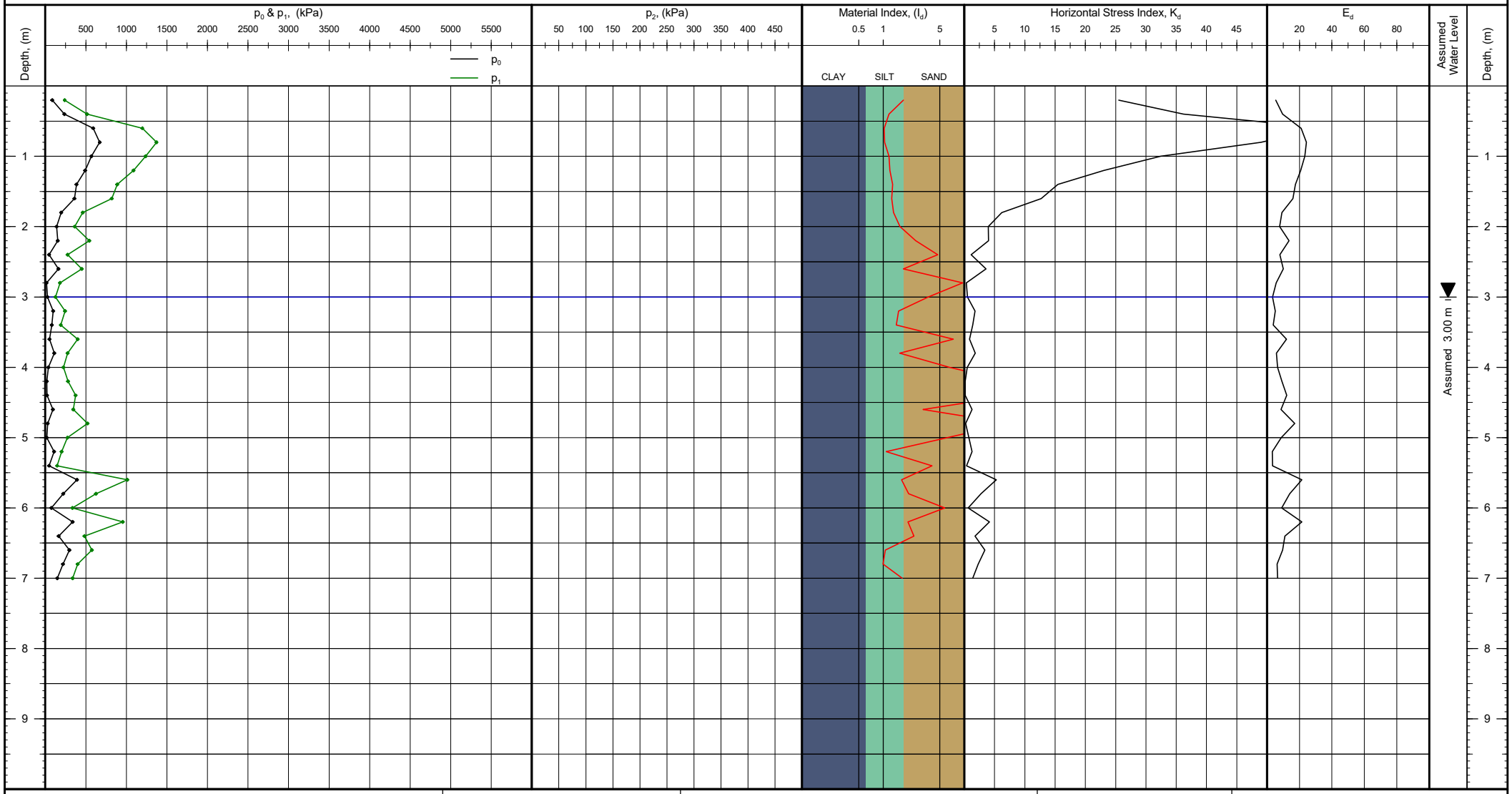
Client Reference:

Test Number: **DMT-01**

G.I. Job Ref: 210082

Comments:

FLAT DILATOMETER TEST (DMT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050496.52, 1716649.20	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682536,174.289085	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	7.60
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	8 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	74 kPa	**Termination Reason:**	Other - see notes		

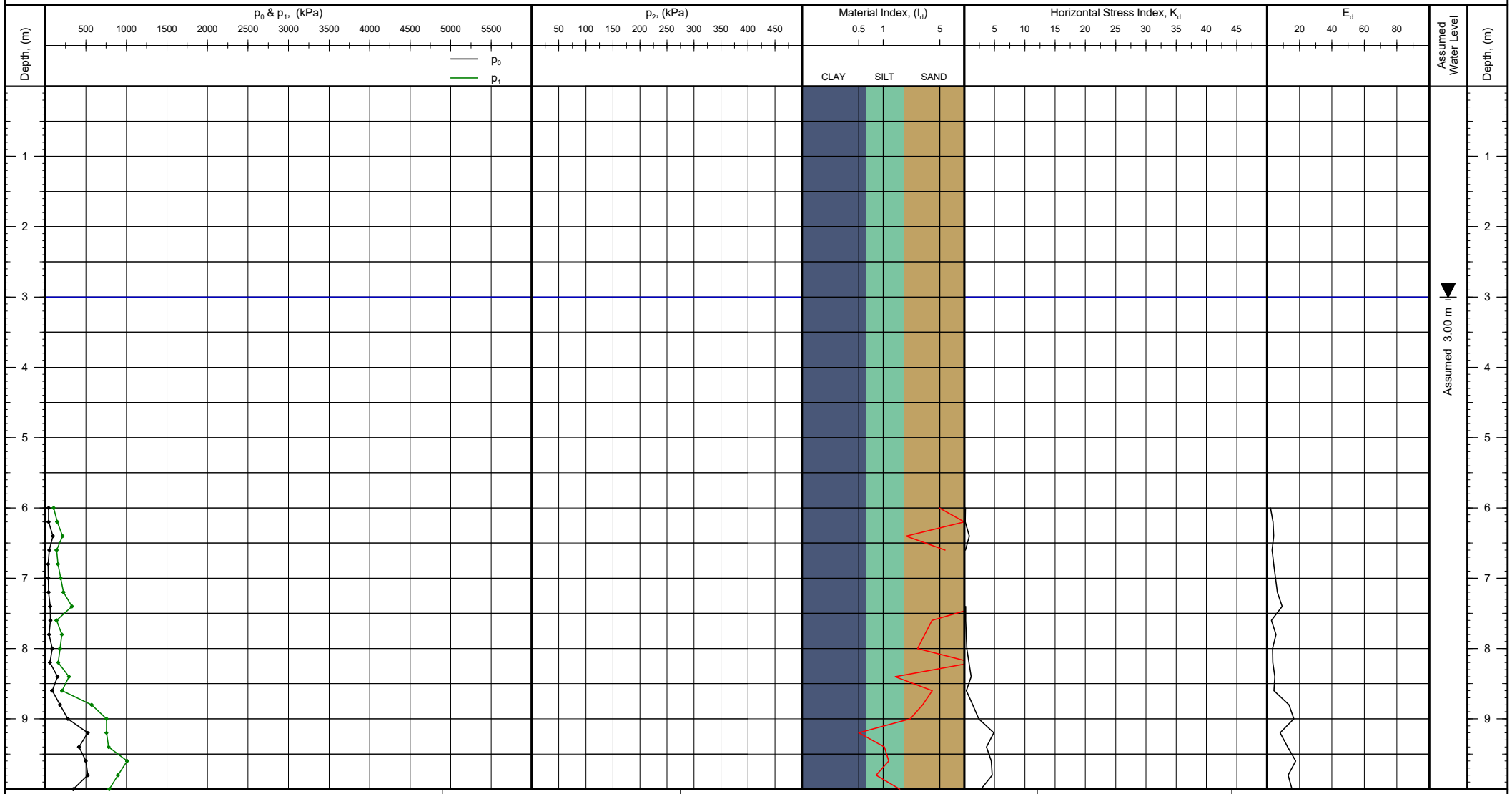
Client Reference:

Test Number: **SDMT-01**

G.I. Job Ref: 210082

Comments: Diagram overinflated, restart test from 6.00m with SDMT-01A

FLAT DILATOMETER TEST (DMT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050497.76, 1716647.50	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682525,174.289066	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	11.80
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	13 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	71 kPa	**Termination Reason:**	Maximum Nominal Pressure		

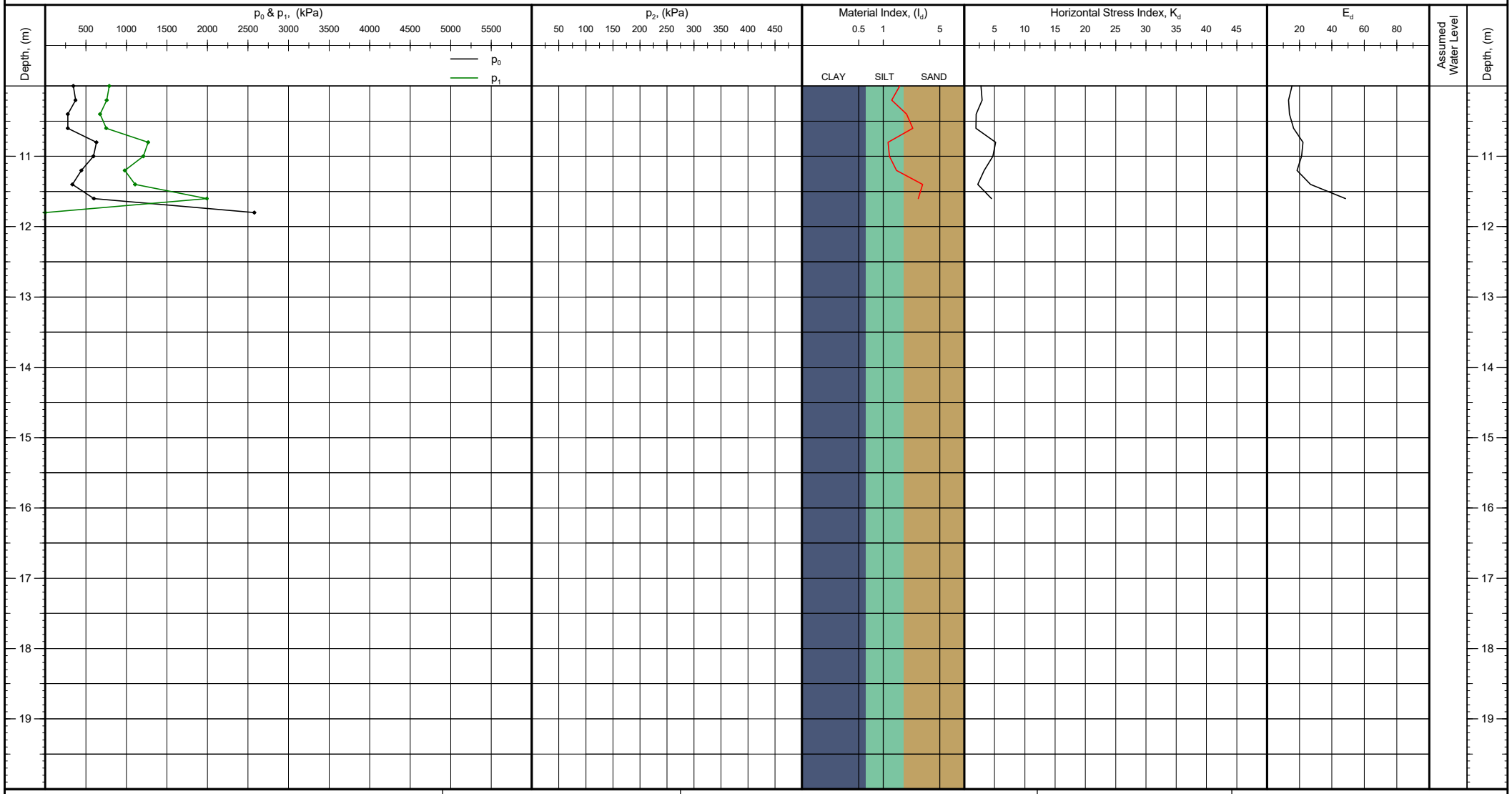
Client Reference:

Test Number: **SDMT-01A**

G.I. Job Ref: 210082

Comments:

FLAT DILATOMETER TEST (DMT) LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050497.76, 1716647.50	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682525,174.289066	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	11.80
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	13 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	71 kPa	**Termination Reason:**	Maximum Nominal Pressure		

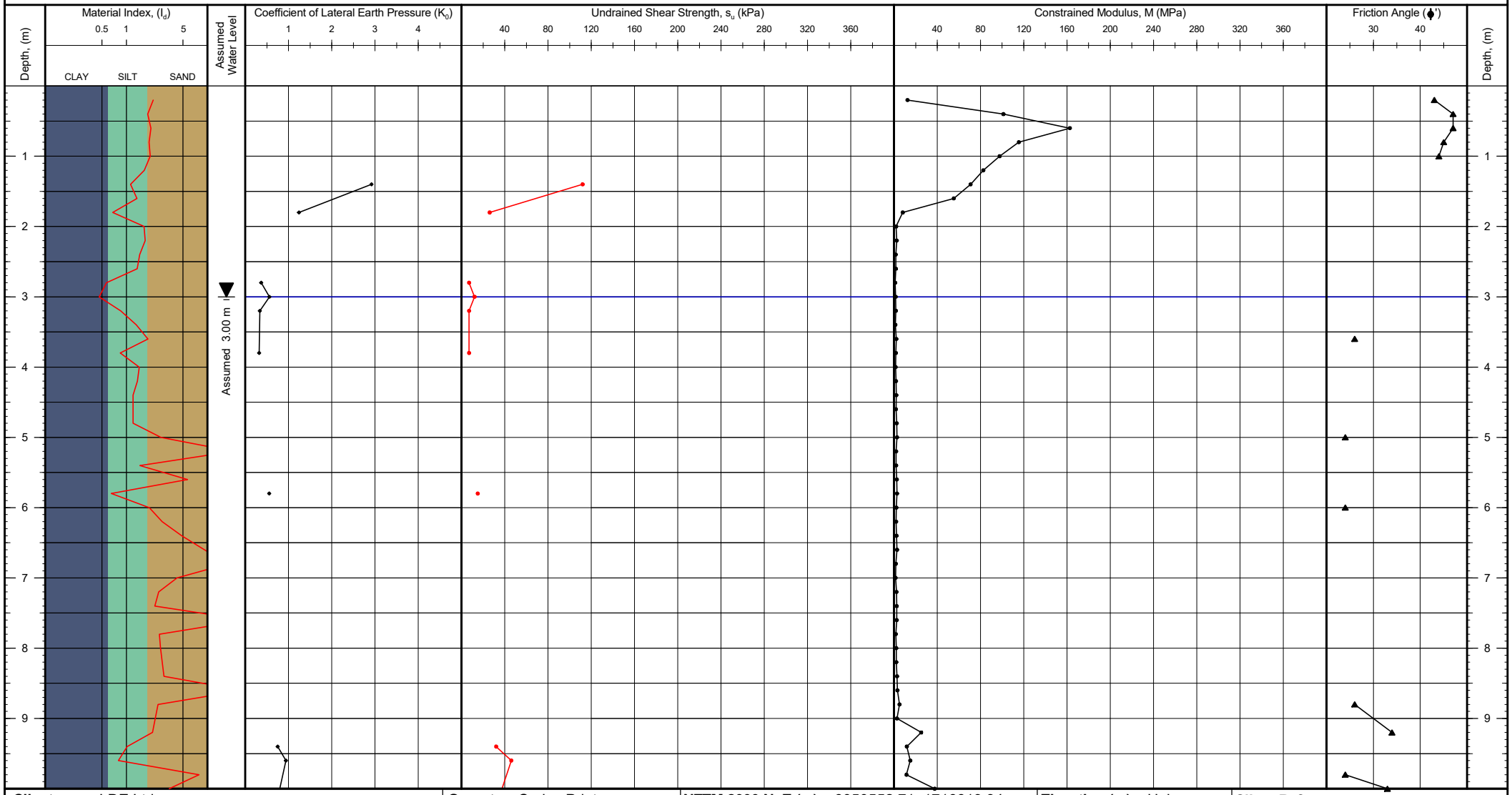
Client Reference:

Test Number: **SDMT-01A**

G.I. Job Ref: 210082

Comments:

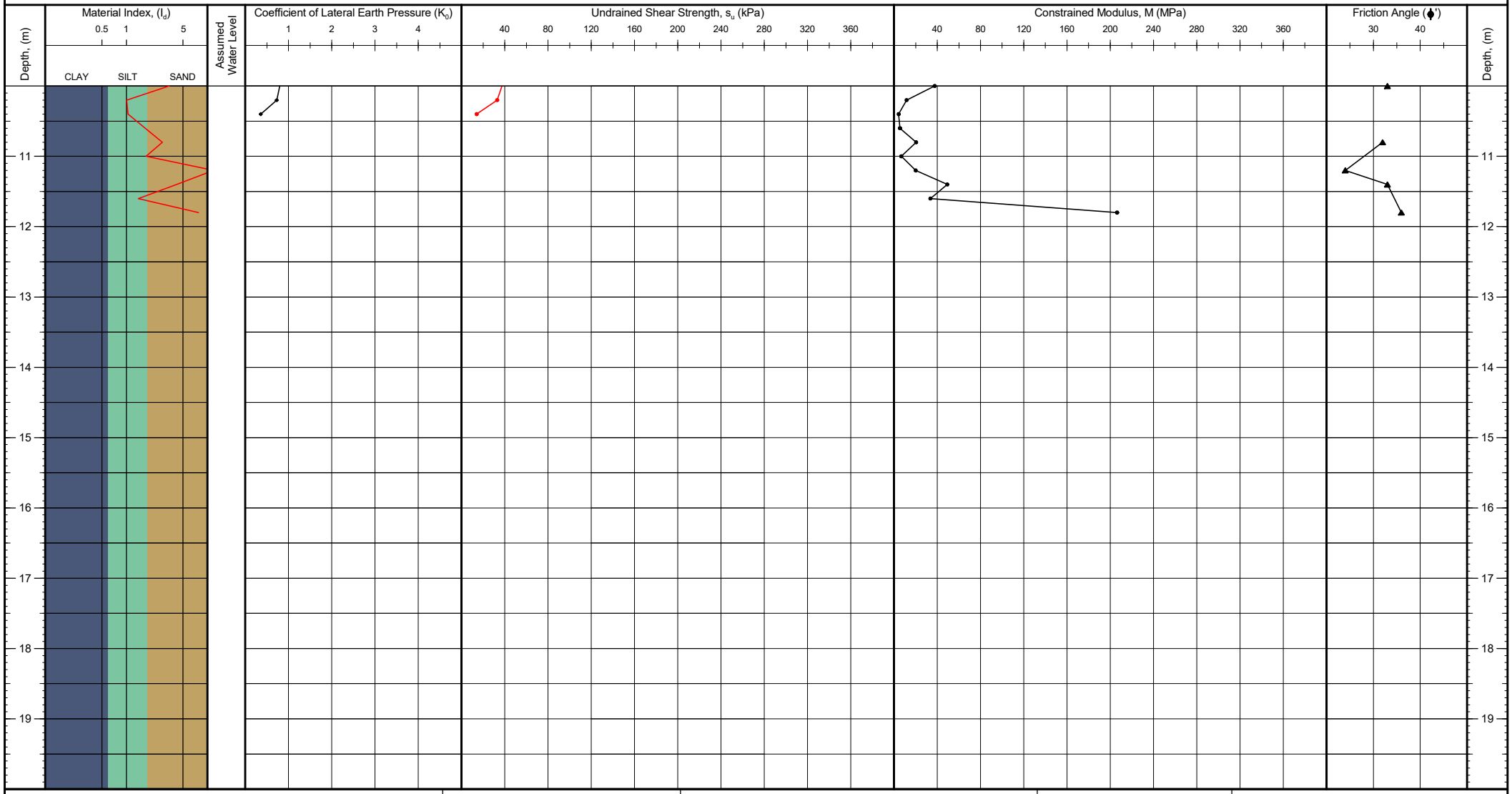
DMT PARAMETER LOG



Client: LDE Ltd	**Operator:** Carlos Prieto	**NZTM 2000 N, E (m):** 6050552.71, 1716619.34	**Elevation (m):** Unknown	**Client Reference:**	
Project: Dip Road	**Blade Reference:** N/A	**WGS84 (deg):** -35.682033,174.288747	**Date of Test:** 11/02/2021		
Location: Kamo, Whangarei	**Diaphragm Thickness:** 0.25 mm	**Location Method:** Handheld GPS	**Depth (m):** 11.80	**Test Number:**	**DMT-01**
Engineer: Finlay Wallen-Halliwell	**A-Reading Calibration:** 8 kPa	**Surveyor:**	**Pre Drill (m):** N/A		
Contractor: Ground Investigation Ltd	**B-Reading Calibration:** 69 kPa	**Termination Reason:** Maximum Nominal Pressure		**G.I. Job Ref:** 210082	

Comments:

DMT PARAMETER LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050552.71, 1716619.34	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682033,174.288747	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	11.80
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	8 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	69 kPa	**Termination Reason:**	Maximum Nominal Pressure		

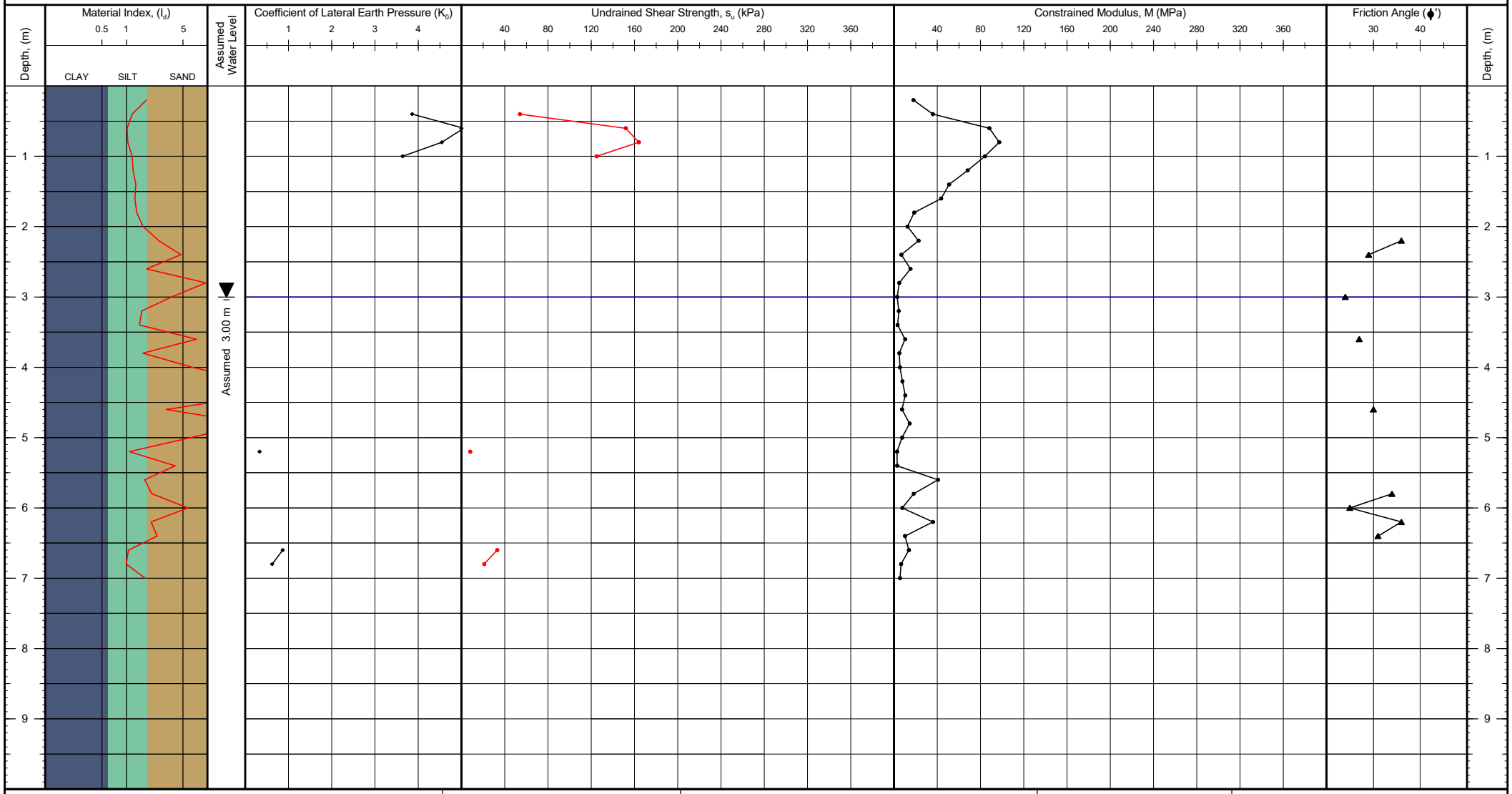
Client Reference:

Test Number: **DMT-01**

G.I. Job Ref: 210082

Comments:

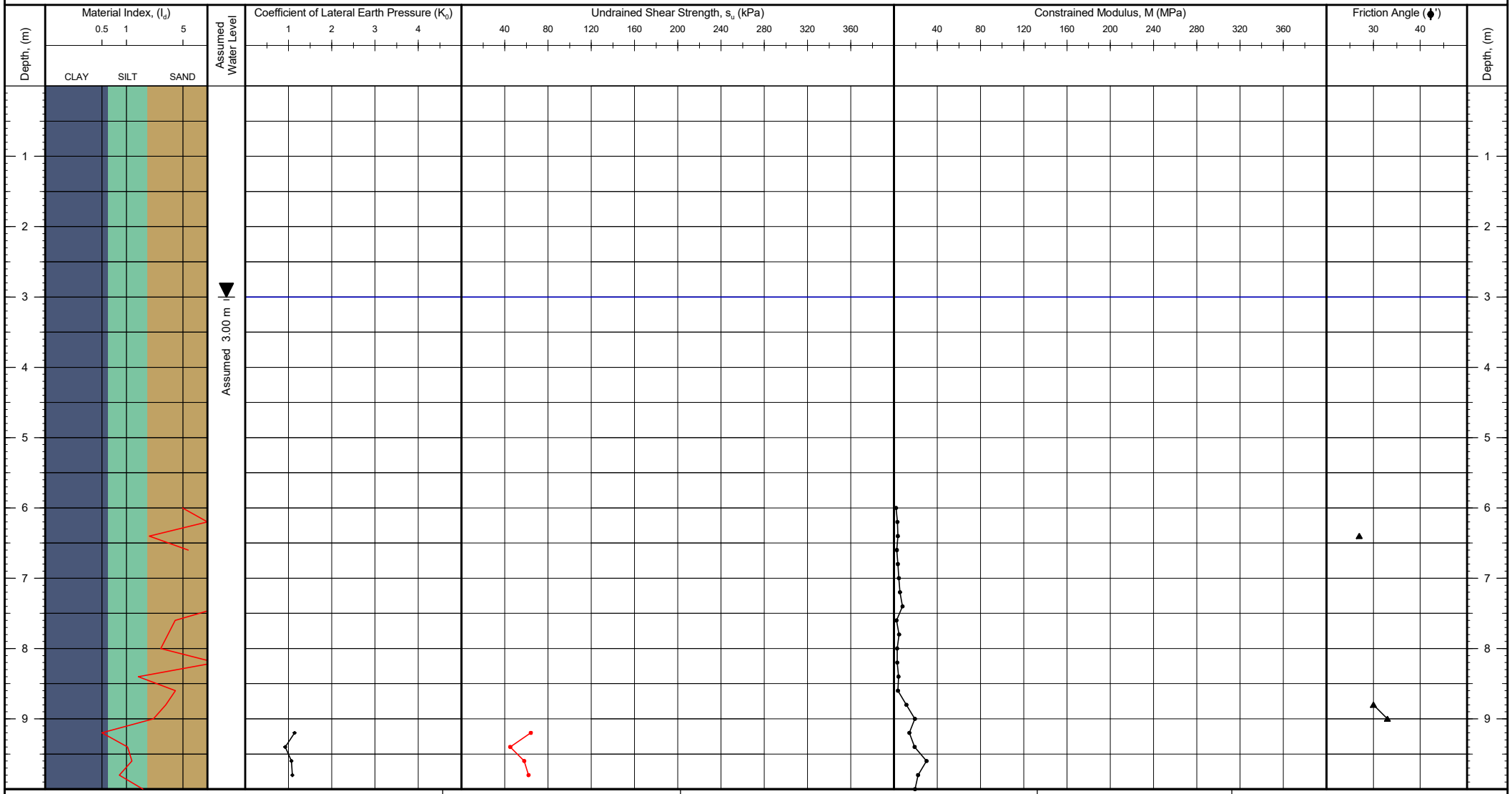
DMT PARAMETER LOG



Client: LDE Ltd	**Operator:** Carlos Prieto	**NZTM 2000 N, E (m):** 6050496.52, 1716649.20	**Elevation (m):** Unknown	**Client Reference:**	
Project: Dip Road	**Blade Reference:** N/A	**WGS84 (deg):** -35.682536,174.289085	**Date of Test:** 11/02/2021		
Location: Kamo, Whangarei	**Diaphragm Thickness:** 0.25 mm	**Location Method:** Handheld GPS	**Depth (m):** 7.60	**Test Number:**	**SDMT-01**
Engineer: Finlay Wallen-Halliwell	**A-Reading Calibration:** 8 kPa	**Surveyor:**	**Pre Drill (m):** N/A		
Contractor: Ground Investigation Ltd	**B-Reading Calibration:** 74 kPa	**Termination Reason:** Other - see notes		**G.I. Job Ref:** 210082	

Comments: Diagram overinflated, restart test from 6.00m with SDMT-01A

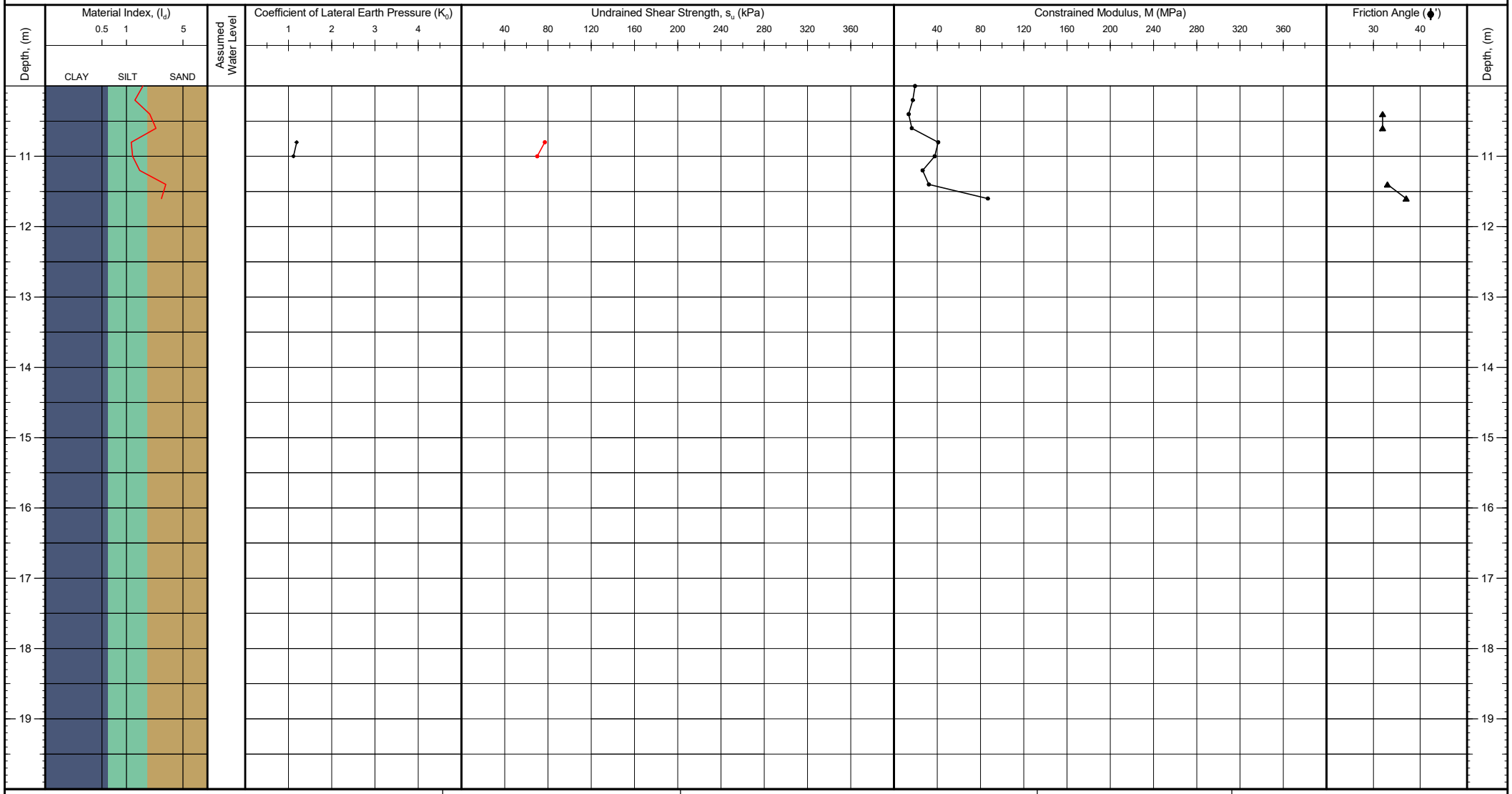
DMT PARAMETER LOG



Client: LDE Ltd	**Operator:** Carlos Prieto	**NZTM 2000 N, E (m):** 6050497.76, 1716647.50	**Elevation (m):** Unknown	**Client Reference:**	
Project: Dip Road	**Blade Reference:** N/A	**WGS84 (deg):** -35.682525,174.289066	**Date of Test:** 11/02/2021	**Test Number:** **SDMT-01A**	
Location: Kamo, Whangarei	**Diaphragm Thickness:** 0.25 mm	**Location Method:** Handheld GPS	**Depth (m):** 11.80		
Engineer: Finlay Wallen-Halliwell	**A-Reading Calibration:** 13 kPa	**Surveyor:**	**Pre Drill (m):** N/A		
Contractor: Ground Investigation Ltd	**B-Reading Calibration:** 71 kPa	**Termination Reason:** Maximum Nominal Pressure		**G.I. Job Ref:** 210082	

Comments:

DMT PARAMETER LOG



Client:	LDE Ltd	**Operator:**	Carlos Prieto	**NZTM 2000 N, E (m):**	6050497.76, 1716647.50	**Elevation (m):**	Unknown
Project:	Dip Road	**Blade Reference:**	N/A	**WGS84 (deg):**	-35.682525,174.289066	**Date of Test:**	11/02/2021
Location:	Kamo, Whangarei	**Diaphragm Thickness:**	0.25 mm	**Location Method:**	Handheld GPS	**Depth (m):**	11.80
Engineer:	Finlay Wallen-Halliwell	**A-Reading Calibration:**	13 kPa	**Surveyor:**		**Pre Drill (m):**	N/A
Contractor:	Ground Investigation Ltd	**B-Reading Calibration:**	71 kPa	**Termination Reason:**	Maximum Nominal Pressure		

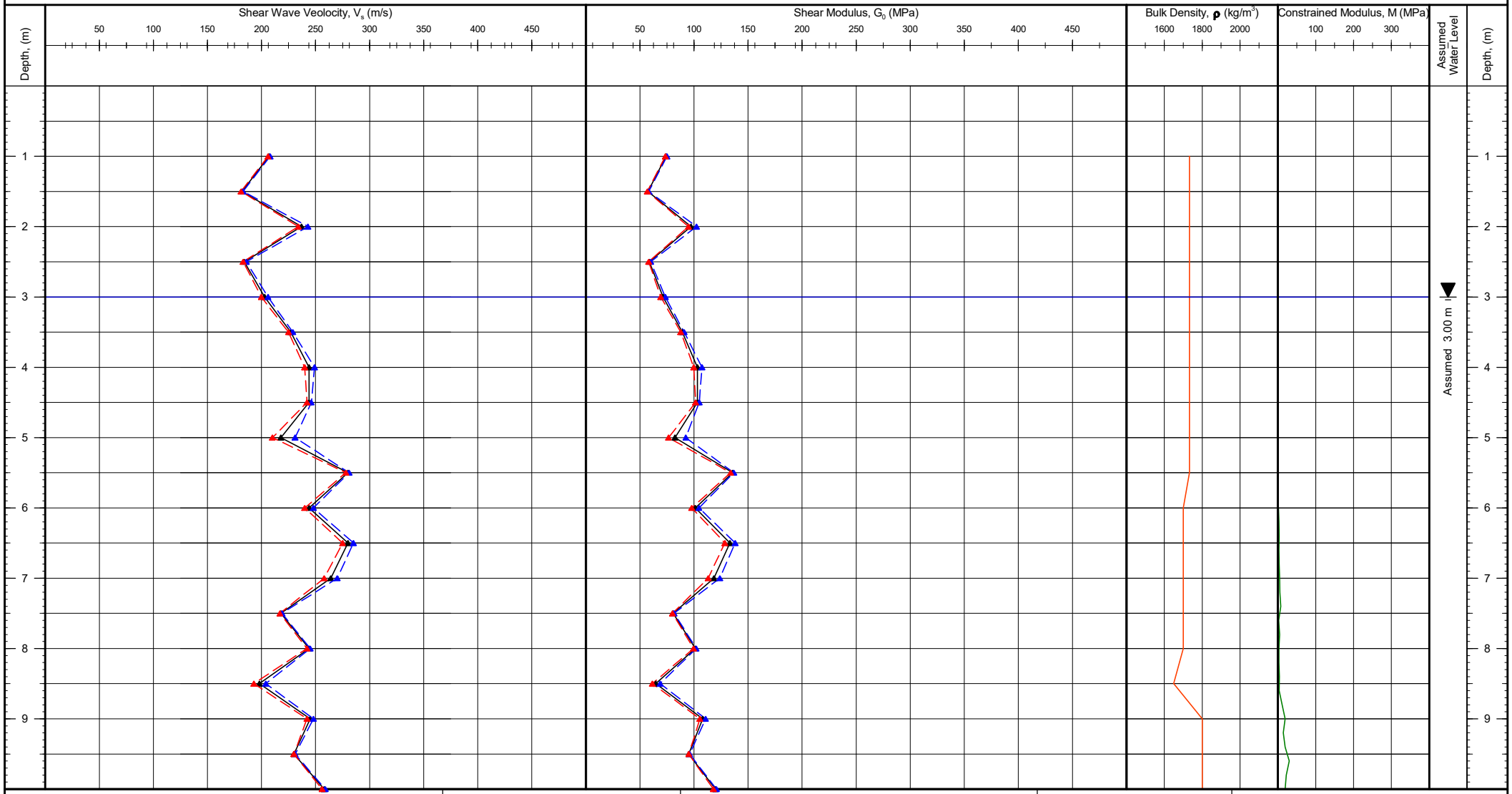
Client Reference:

Test Number: **SDMT-01A**

G.I. Job Ref: 210082

Comments:

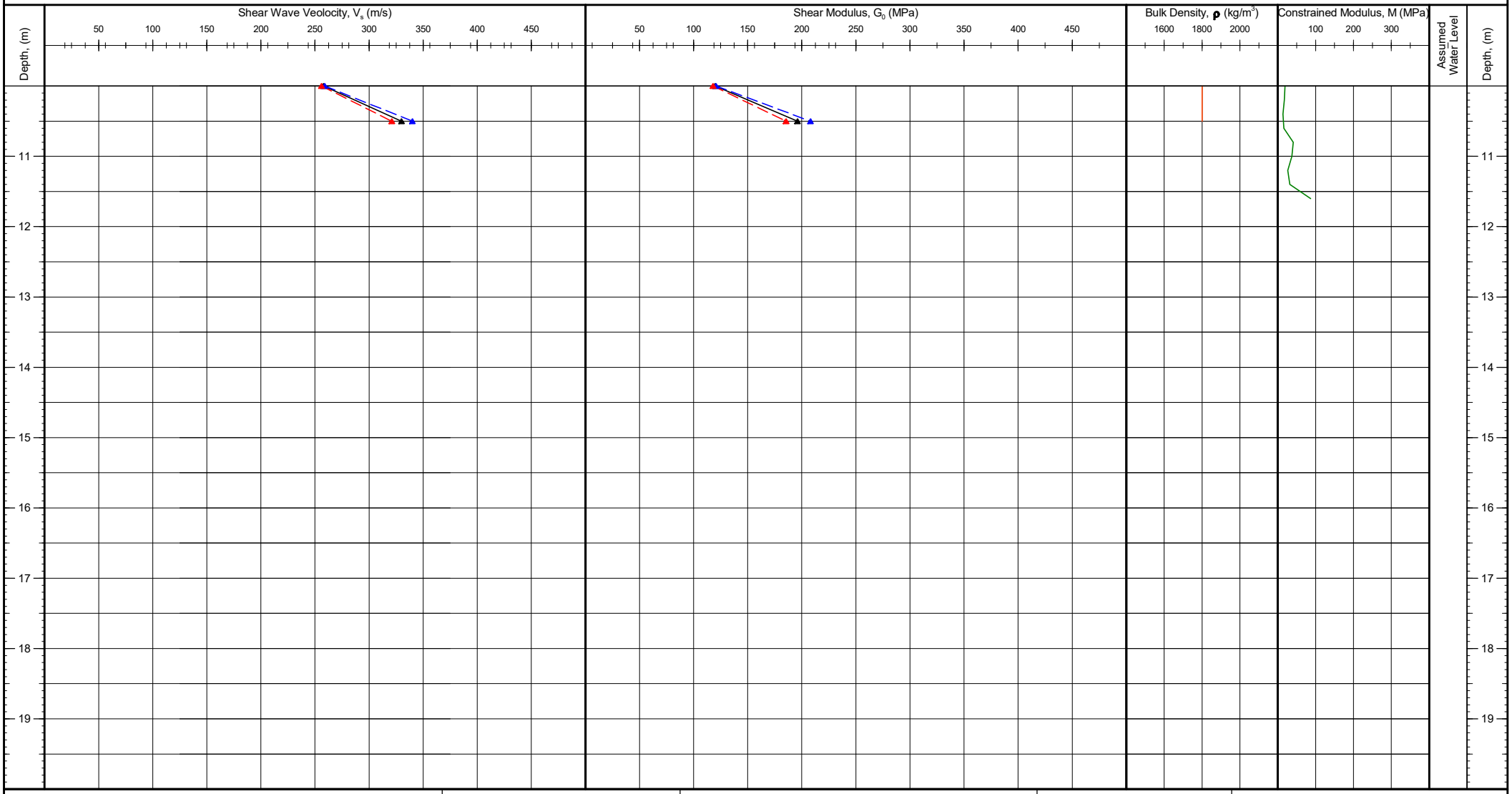
FLAT DILATOMETER TEST (DMT) SEISMIC LOG



Client:	LDE Ltd	Estimated from CPT	**NZTM 2000 N, E (m):** 6050497.76, 1716647.50	**Elevation (m):** Unknown	**Client Reference:**
Project:	Dip Road	Measured Lower Bound	**WGS84 (deg):** -35.682525,174.289066	**Date of Test:** 11/02/2021	
Location:	Kamo, Whangarei	Measured Average Bound	**Location Method:** Handheld GPS	**Depth (m):** 11.80	**Test Number:** SDMT-01A
Engineer:	Finlay Wallen-Halliwell	Measured Upper Bound	**Surveyor:**	**Pre Drill (m):** N/A	
Contractor:	Ground Investigation Ltd	ρ from G_0 Calculation	**Termination Reason:** Maximum Nominal Pressure		**G.I. Job Ref:** 210082

Comments:

FLAT DILATOMETER TEST (DMT) SEISMIC LOG



Client:	LDE Ltd	Estimated from CPT	**NZTM 2000 N, E (m):**	6050497.76, 1716647.50	**Elevation (m):**	Unknown	**Client Reference:**
Project:	Dip Road	Measured Lower Bound	**WGS84 (deg):**	-35.682525,174.289066	**Date of Test:**	11/02/2021	
Location:	Kamo, Whangarei	Measured Average Bound	**Location Method:**	Handheld GPS	**Depth (m):**	11.80	**Test Number:** SDMT-01A
Engineer:	Finlay Wallen-Halliwell	Measured Upper Bound	**Surveyor:**		**Pre Drill (m):**	N/A	
Contractor:	Ground Investigation Ltd	ρ from G_0 Calculation	**Termination Reason:**	Maximum Nominal Pressure			**G.I. Job Ref:** 210082

Comments:

CPT ZEROS AND DRIFT

G.I. Job Ref: 210082

Cone Reference	CPT Name	Push Number	Tip Resistance			Local Friction			Pore Pressure		
			Initial (MPa)	Final (MPa)	Difference (kPa)	Initial (MPa)	Final (MPa)	Difference (kPa)	Initial (MPa)	Final (MPa)	Difference (kPa)
MKJ325	CPT-01	1	23.892	23.913	21.3	0.2950	0.2950	0.0	2.8524	2.8522	-0.2
MKJ325	CPT-02	1	23.940	23.950	10.6	0.2958	0.2961	0.3	2.8515	2.8513	-0.2
MKJ325	CPT-03	1	23.950	23.865	-85.4	0.2959	0.2955	-0.4	2.8513	2.8545	3.2
MKJ291	CPT-04	1	20.142	20.137	-5.3	0.2963	0.2969	0.6	2.9389	2.9380	-0.9
MKJ325	CPT-05	1	23.924	23.876	-48.0	0.2958	0.2954	-0.4	2.8530	2.8543	1.3
MKJ325	CPT-06	1	23.945	23.897	-48.1	0.2955	0.2953	-0.2	2.8532	2.8546	1.4
MKJ325	CPT-07	1	23.956	23.902	-53.4	0.2950	0.2958	0.8	2.8521	2.8527	0.6

Client: LDE Ltd
Project: Dip Road

Location: Kamo, Whangarei
Engineer: Finlay Wallen-Halliwell

Note: Zero difference colour-coded based on application classes following ISO 22476-1:2012. Blue indicates Class 1, green Class 2, orange Class 3 and red Class 4. Grey represents if a test is below Class 4.

APPENDIX C

LABORATORY TEST CERTIFICATES

GEOTECHNICS

Our Ref: 1100731.0000/Rep1
Customer Ref: 19103
4 March 2021

LDE Ltd
192 Bank Street
Regent
Whangarei 0112

Attention: Finlay Wallen-Halliwell

Dear Finlay

67 Dip Road, Kamo, Whangarei

Laboratory Test Report

Customer's Instructions

We performed CU triaxial tests on received samples as instructed by Finlay Wallen-Halliwell in emails dating 11 and 16 February.

Sampling Procedure

Samples have been tested as received from the customer.

Sample Location Plan

Not applicable.

Samples

Three tube samples were received. Samples were labelled with reference numbers.

Date of Sample Receipt

15/02/2021

Test Method(s)

ISO 17892:2018 Part 9 - Consolidated triaxial compression tests on water saturated soils

NZS 4402: 1986 Test 2.1 - Water Content

Material Description

Descriptions are provided in the attached presentation pages.

Test Results

Test results are attached.

Test Remarks

Test remarks are included in the presentation page.

General Remarks

Samples not destroyed during testing, will be retained for one month from the date of this report before being discarded.

Descriptions are enclosed for your information, are not covered under the IANZ endorsement of this report.

This report has been prepared for the benefit of LDE Ltd, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

Please reproduce this report in full when transmitting to others or including in internal reports.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of the letterhead page.

GEOTECHNICS LTD

Report prepared by:

.....
Cameron Tier
Instrumentation Technician

Authorised for Geotechnics by:

.....
Steven Anderson
Project Director

Report checked by:

.....
Helen Wang
Triaxial Laboratory Manager
Approved Signatory

ACCREDITED IANZ TESTING LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

4-Mar-21
t:\geotechnicsgroup\projects\1100731\issueddocuments\20210304 dip road cati.rep1.docx

GEOTECHNICS
1 Hill Street
Onehunga
Auckland
New Zealand
p. +64 9 356 3510

Geotechnics Project ID: 1100731.0000
QESTLab Work Order ID:
Customer Project ID: 19103

Site: 67 Dip Road, Kamo, Whangarei
Location ID: BH01
Sample Ref.: --
Depth: 3.22 - 3.35 (m)
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (MULTI-STAGE)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES

General Sample Parameters

Initial Sample Height:	124.71	mm	Initial Water Content:	105	%
Initial Sample Diameter:	60.77	mm	Initial Bulk Density:	1.38	t/m³
Initial B Value:	36	%	Initial Dry Density:	0.67	t/m³
B Value before Consolidation:	98	%	Final Water Content:	104	%

Test Results

	At the End of Consolidation Stage					Failure Values						Failure Mode & Photo
	Effective Stress		Back	Volumetric		Deviator Stress	Vertical	Effective Stress		Corrections (kPa)		
	Horizontal σ_h'(kPa)	Vertical σ_v'(kPa)	Pressure (kPa)	Strain (%)	Rate (%/hr)	$(\sigma_v' - \sigma_h')$ (kPa)	Strain ε (%)	Vertical σ_v' (kPa)	Horizontal σ_h'(kPa)	Membrane $(\Delta\sigma_v)_m$	Filter P $(\Delta\sigma_v)_{fp}$	
Stage 1	35	36	450	0.56	0.01	66.41	1.85	80.11	13.70	1.08	0.00	
Stage 2	70	71	450	1.46	0.00	82.91	1.50	105.11	22.20	0.88	0.00	
Stage 3	140	141	450	2.93	0.00	109.62	1.60	144.82	35.20	0.93	0.00	

	Total			Effective		
Angle of Frictional Resistance:	ϕ =	10	°	ϕ' =	30	°
Cohesion:	c =	22	kPa	c' =	11	kPa
Linear Regression Coefficient:	r =	0.997		r =	1.000	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: SAND, silty, lightly packed, orangey brown with dark brown and light grey.

Test Speed: 0.022 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
It was drained from both ends in the consolidation stages.
Failure for each stage was determined by either the maximum effective stress ratio or the maximum deviator stress. Strength parameters have been derived by using a linear regression fitting method.

Approved Signatory: Date: 4/03/2021

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Geotechnics Project ID: 1100731.0000
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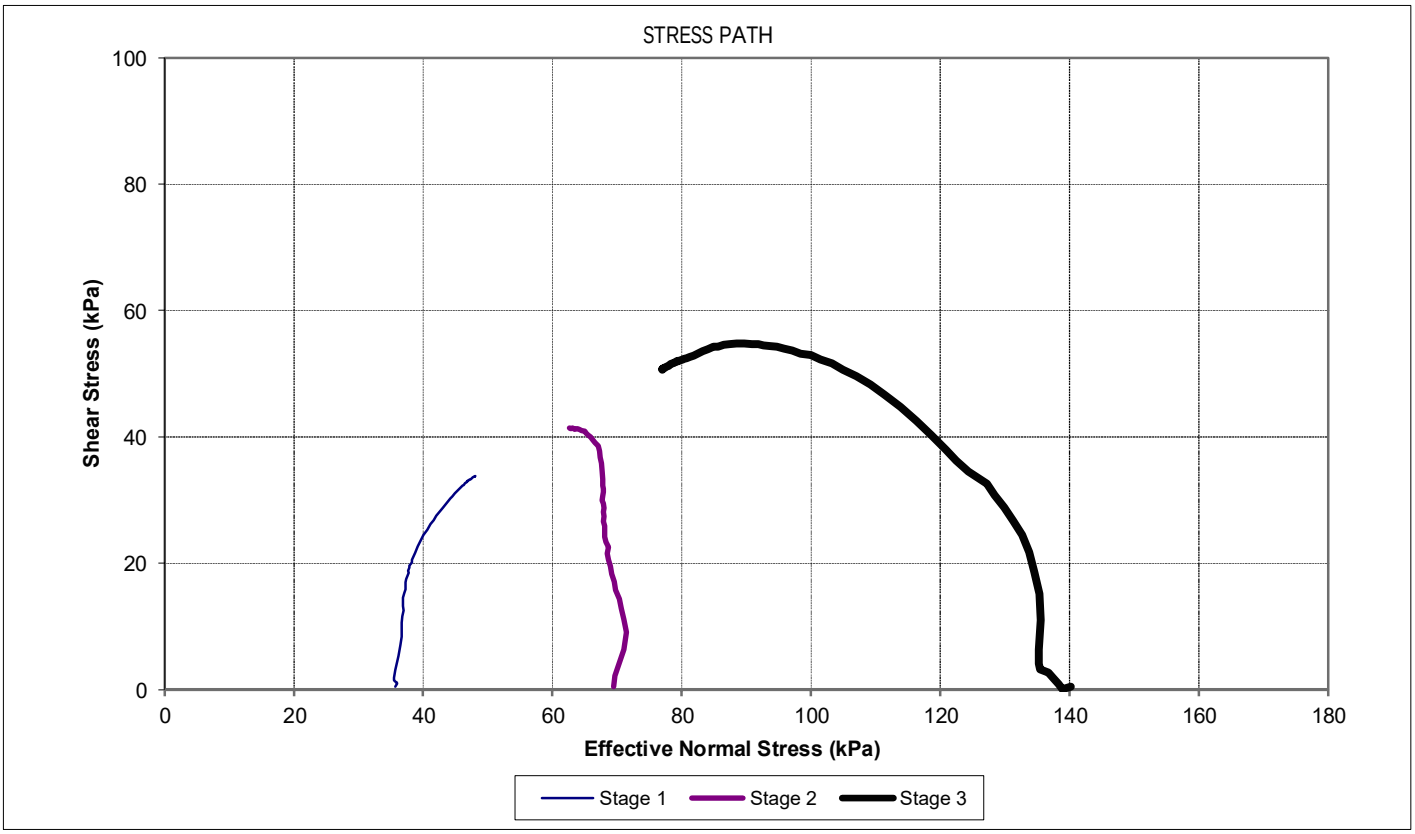
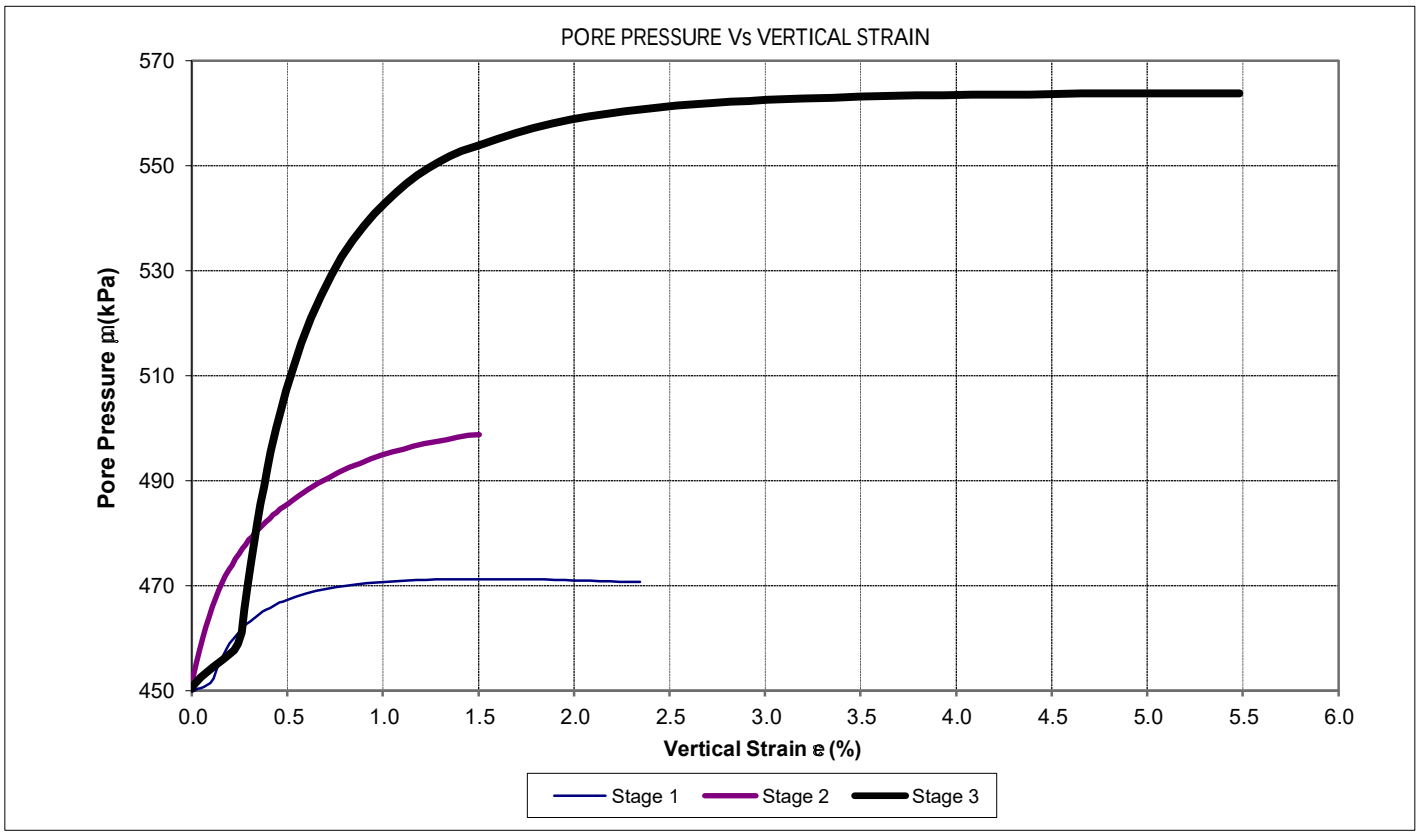
Site: 67 Dip Road, Kamo, Whangarei
Location ID: BH01
Sample Ref.: --
Depth: 3.22 - 3.35 (m)
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

GRAPHS





Approved Signatory: Date: 4/03/2021

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Geotechnics Project ID: 1100731.0000
QESTLab Work Order ID:
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Site: 67 Dip Road, Kamo, Whangarei
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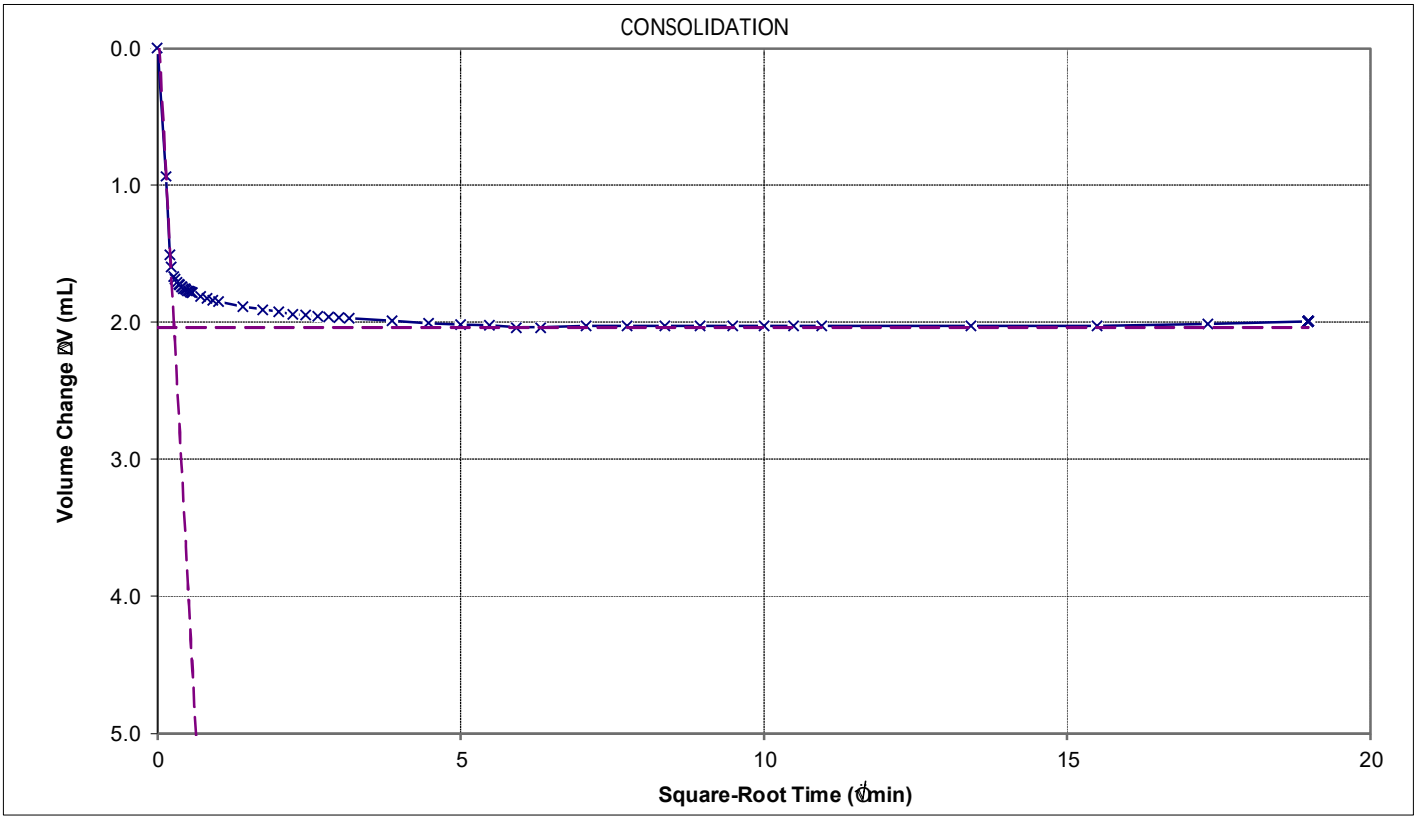
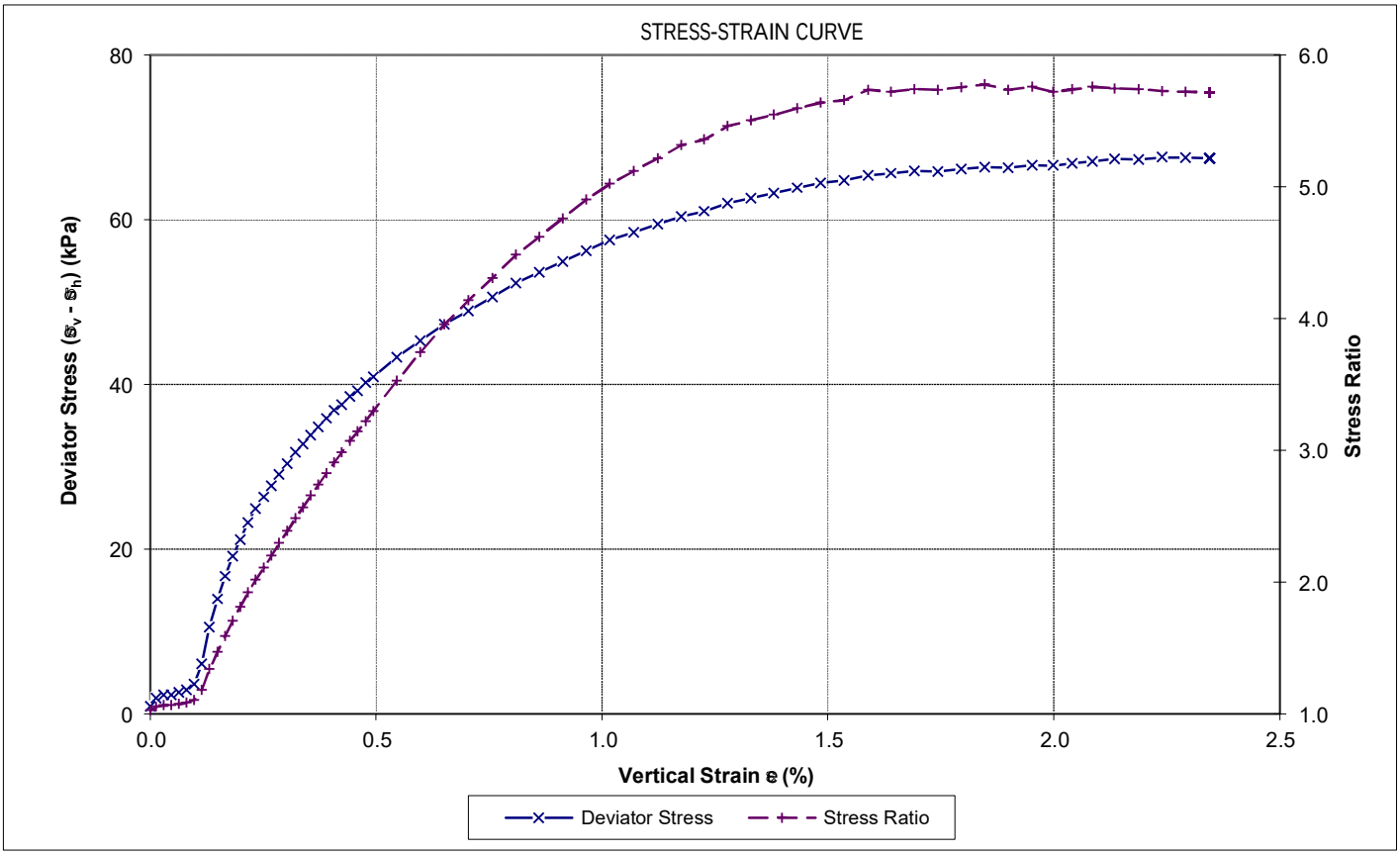
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

STAGE 1 GRAPHS





Approved Signatory: Date: 4/03/2021

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Geotechnics Project ID: 1100731.0000
QESTLab Work Order ID:
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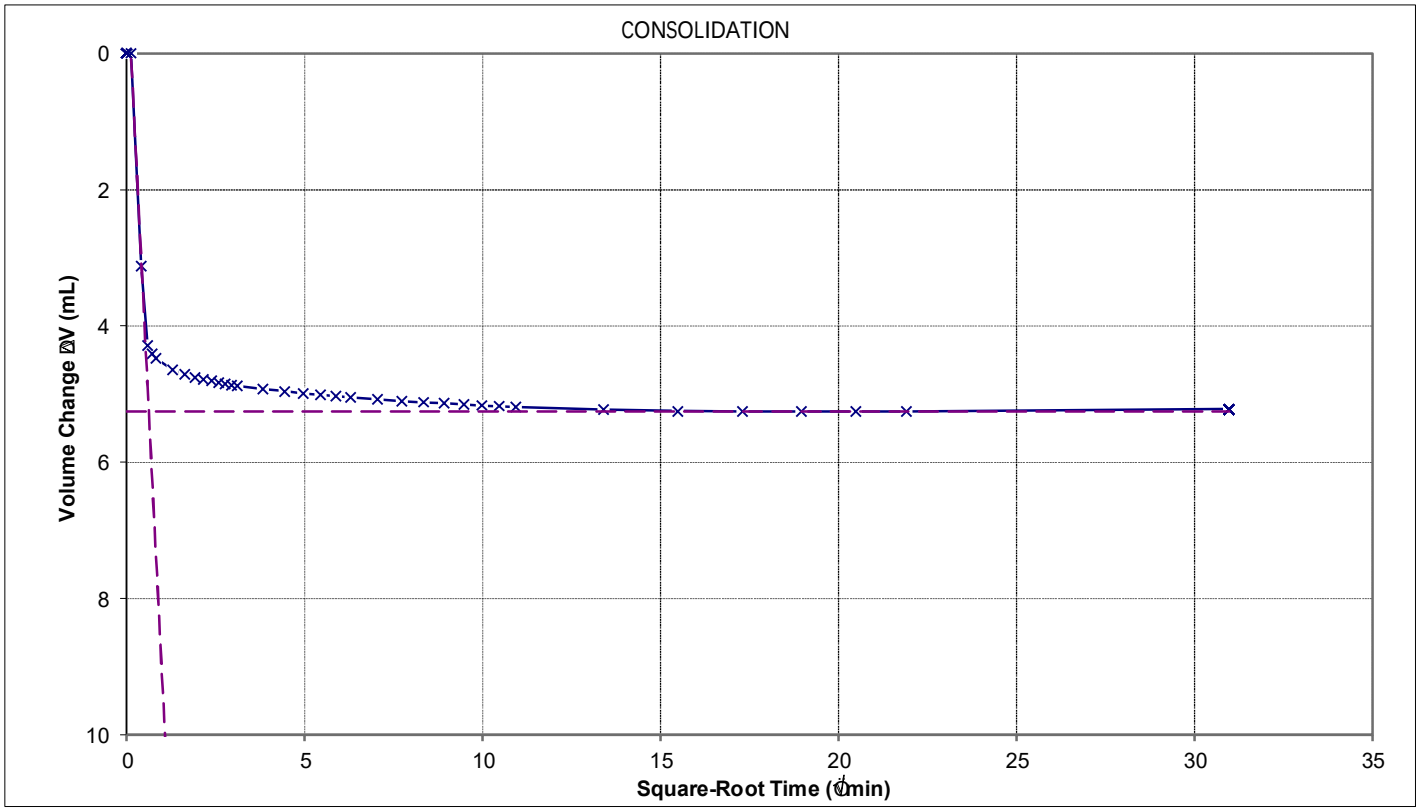
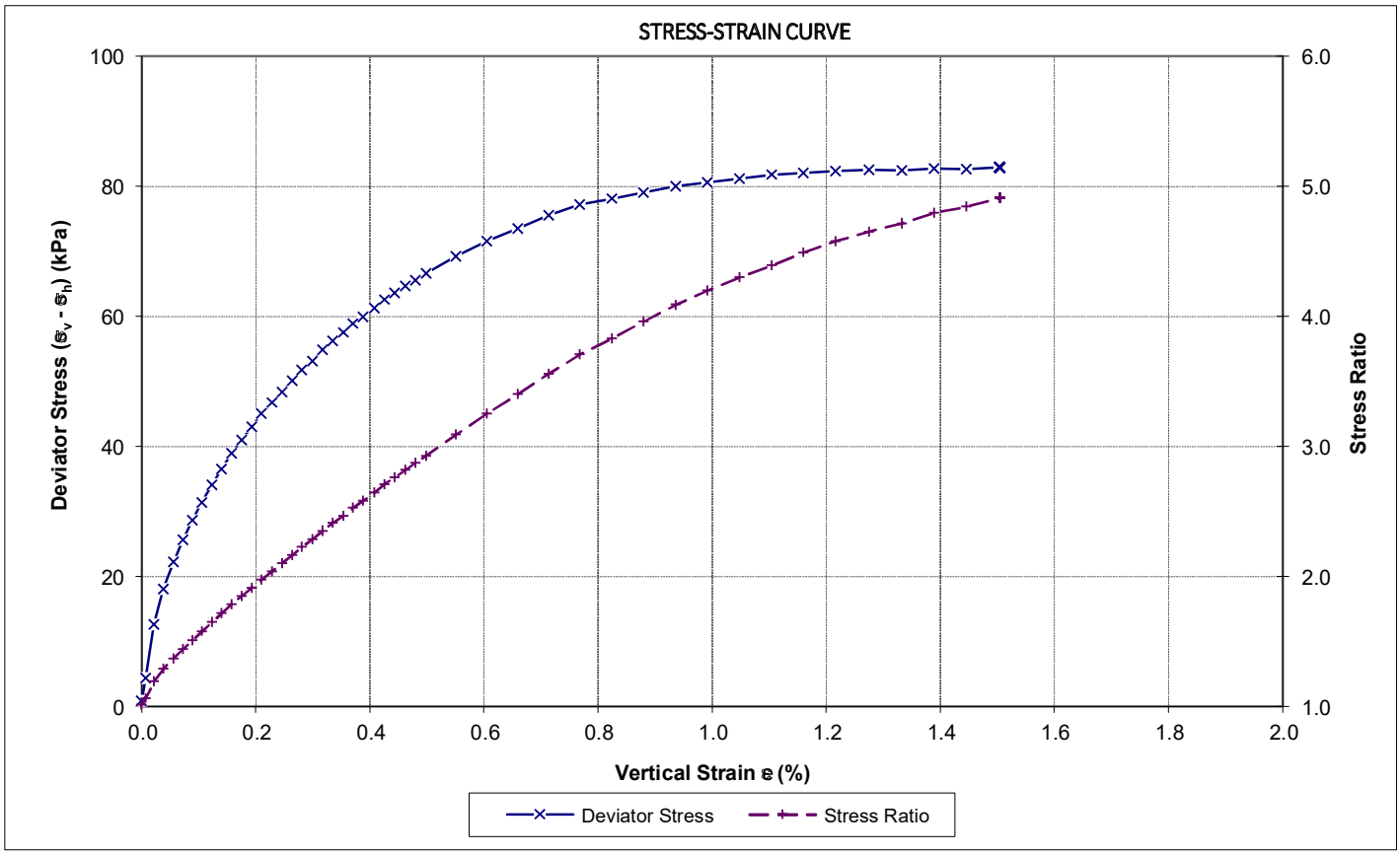
Site: 67 Dip Road, Kamo, Whangarei
Location ID: BH01
Sample Ref.: --
Depth: 3.22 - 3.35 (m)
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

STAGE 2 GRAPHS





Approved Signatory: Date: 4/03/2021

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Geotechnics Project ID: 1100731.0000
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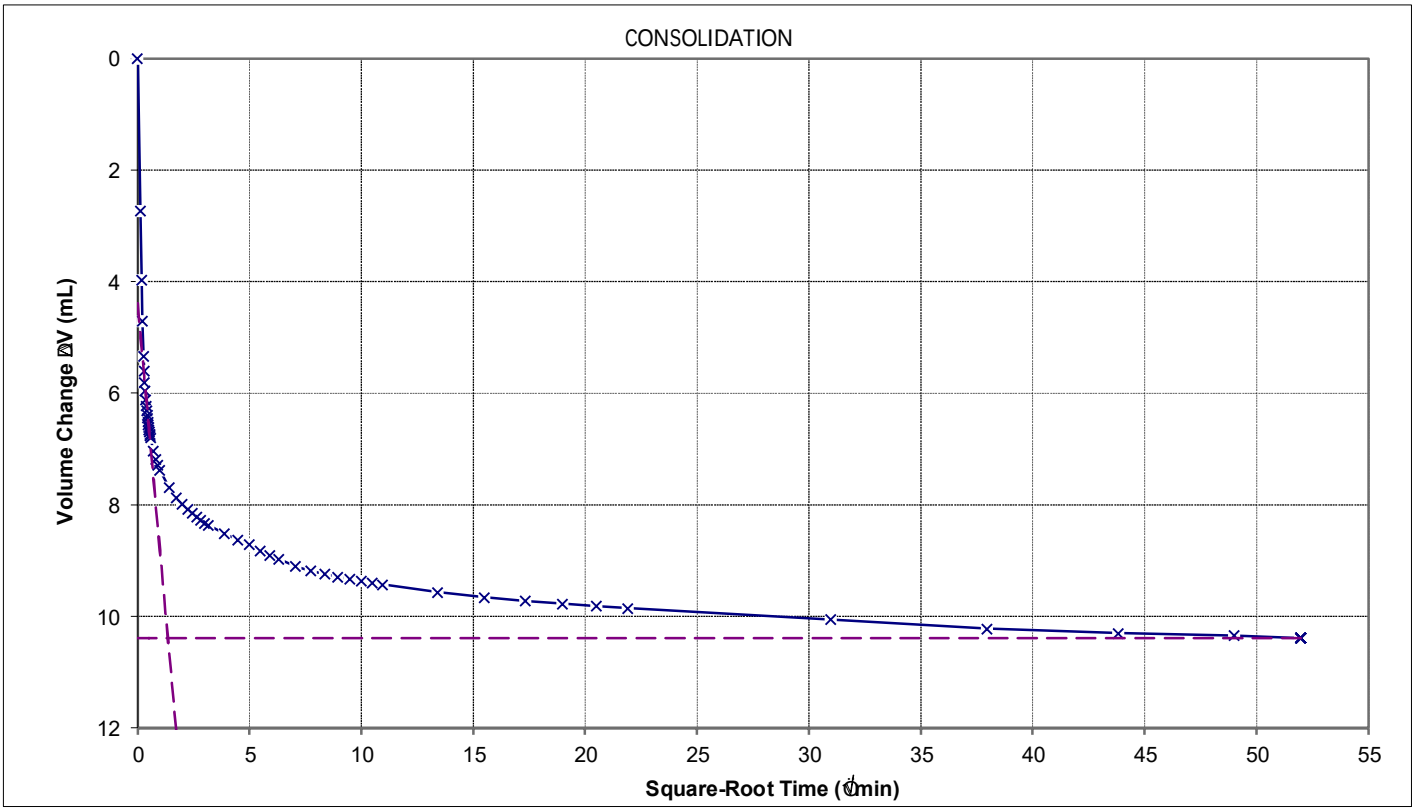
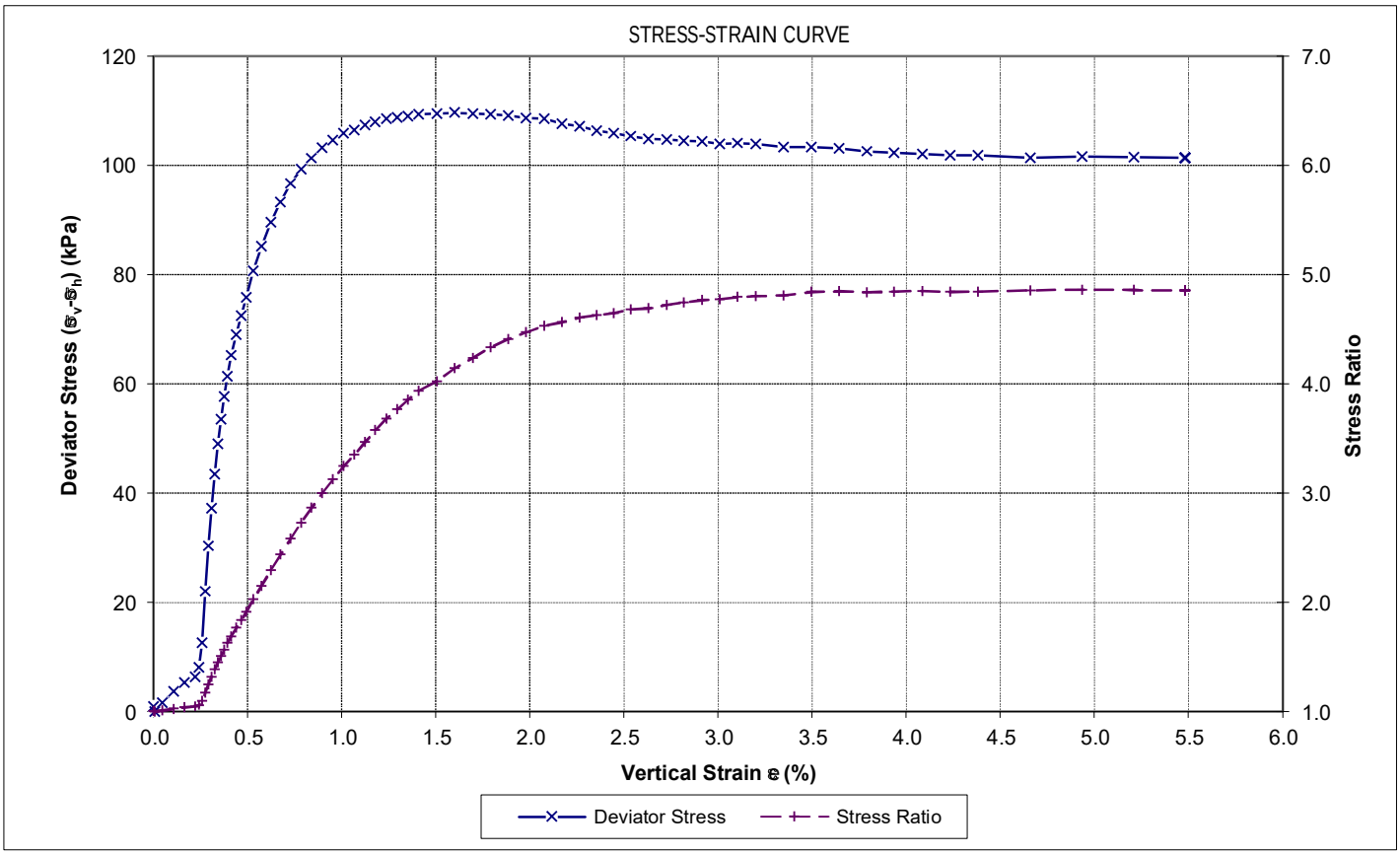
Site: 67 Dip Road, Kamo, Whangarei
Location ID: BH01
Sample Ref.: --
Depth: 3.22 - 3.35 (m)
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

STAGE 3 GRAPHS





Approved Signatory: Date: 4/03/2021

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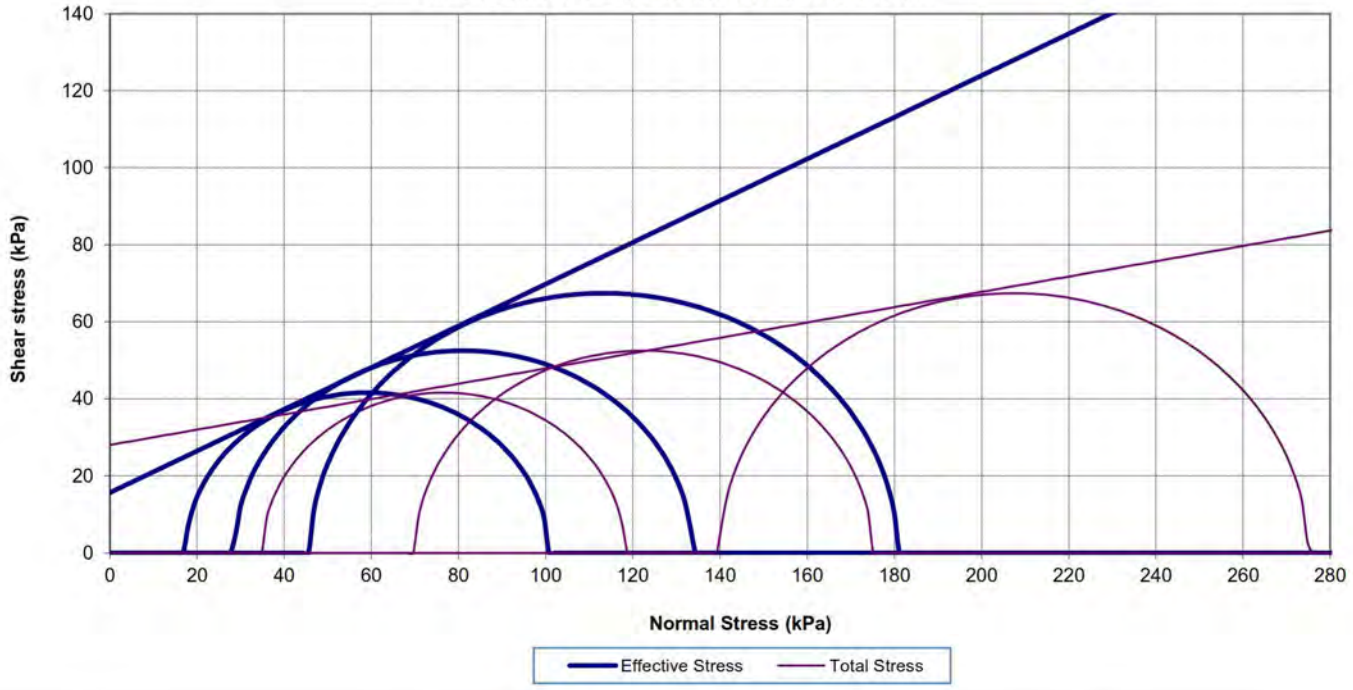
Geotechnics Project ID: 1100731.0000
QESTLab Work Order ID:
Customer Project ID: 19103

Site: 67 Dip Road, Kamo, Whangarei
Location ID: CPT01
Sample Ref.: --
Depth: 3.67-3.84 (m)
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (MULTI-STAGE)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES



General Sample Parameters

Initial Sample Height:	175.03	mm	Initial Water Content:	96.0	%
Initial Sample Diameter:	85.64	mm	Initial Bulk Density:	1.34	t/m³
Initial B Value:	30	%	Initial Dry Density:	0.68	t/m³
B Value before Consolidation:	94	%	Final Water Content:	101	%

Test Results

	At the End of Consolidation Stage					Failure Values						Failure Mode & Photo
	Effective Stress		Back	Volumetric		Deviator Stress	Vertical	Effective Stress		Corrections (kPa)		
	Horizontal σ_h'(kPa)	Vertical σ_v'(kPa)	Pressure (kPa)	Strain (%)	Rate (%/hr)	$(\sigma_v' - \sigma_h')$ (kPa)	Strain ε (%)	Vertical σ_v' (kPa)	Horizontal σ_h'(kPa)	Membrane $(\Delta\sigma_v)_m$	Filter P $(\Delta\sigma_v)_{fp}$	Planar
Stage 1	35	36	500	0.40	0.00	83.24	1.91	100.64	17.40	0.38	2.80	
Stage 2	70	71	500	1.16	0.00	105.04	1.34	133.64	28.60	0.26	1.96	
Stage 3	140	141	500	1.80	0.00	134.87	1.23	180.77	45.90	0.24	1.81	

	Total			Effective		
Angle of Frictional Resistance:	ϕ =	11	°	ϕ' =	28	°
Cohesion:	c =	28	kPa	c' =	16	kPa
Linear Regression Coefficient:	r =	0.994		r =	1.000	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: SAND, silty, lightly packed, orangey brown with dark brown, light yellow grey and black.

Test Speed: 0.025 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
It was drained from radial boundary and both ends in the consolidation stages.
Failure for each stage was determined by either the maximum effective stress ratio or the maximum deviator stress. Strength parameters have been derived by using a linear regression fitting method.

Approved Signatory: Date: 4/03/2021

GEOTECHNICS
1 Hill Street
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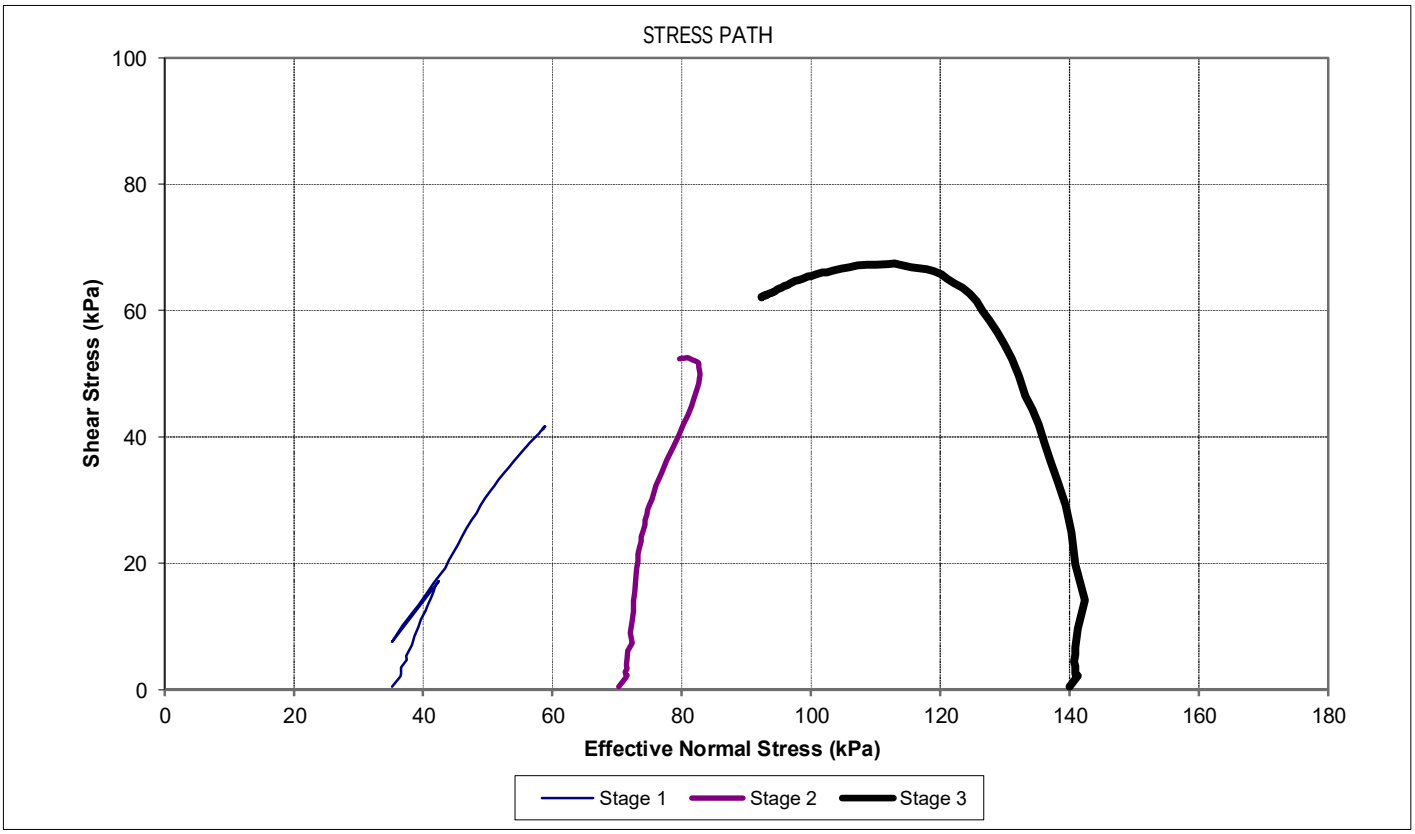
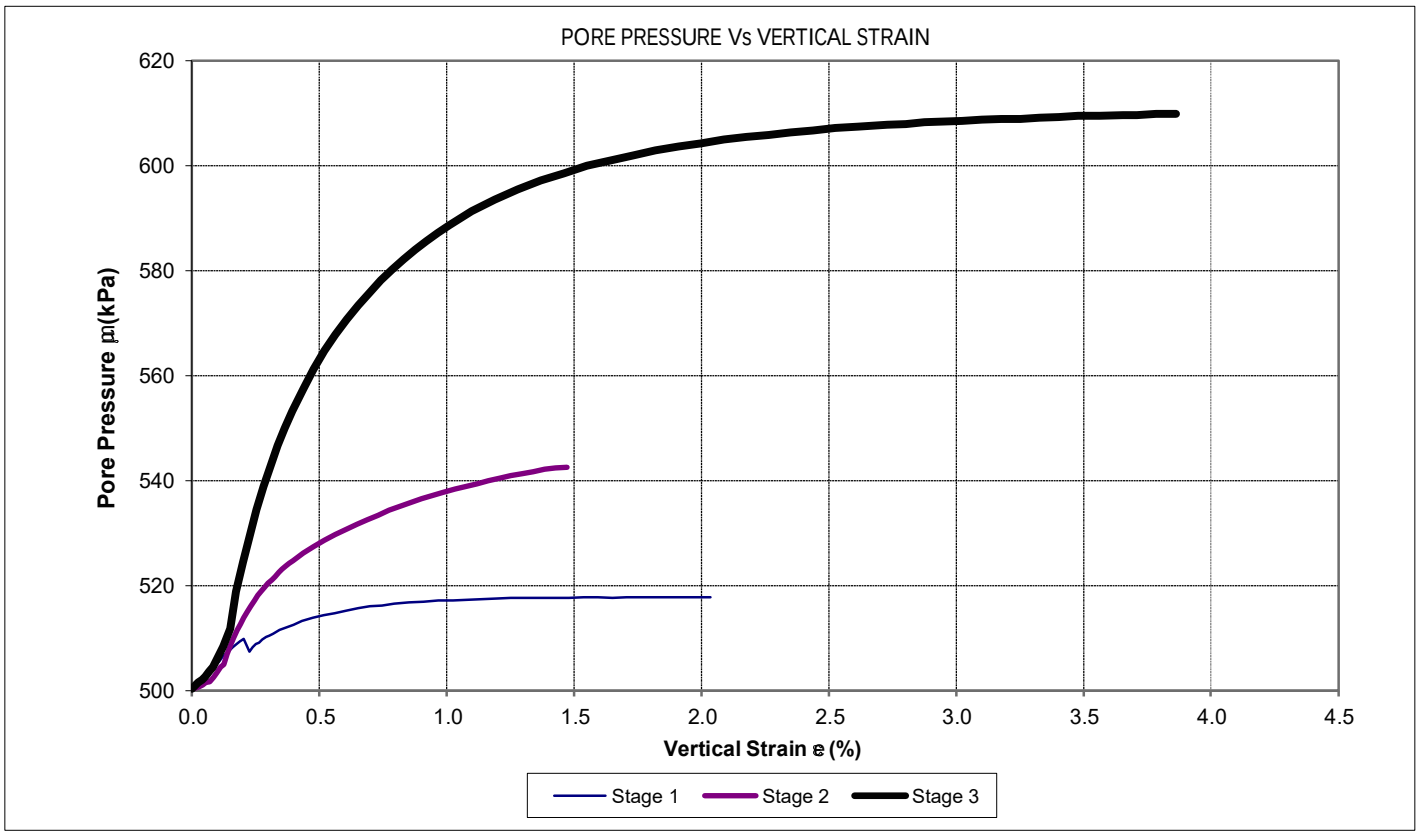
Geotechnics Project ID: 1100731.0000
QESTLab Work Order ID:
Customer Project ID: 19103

Site: 67 Dip Road, Kamo, Whangarei
Location ID: CPT01
Sample Ref.: --
Depth: 3.67-3.84 (m)
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

GRAPHS





Approved Signatory: Date: 4/03/2021

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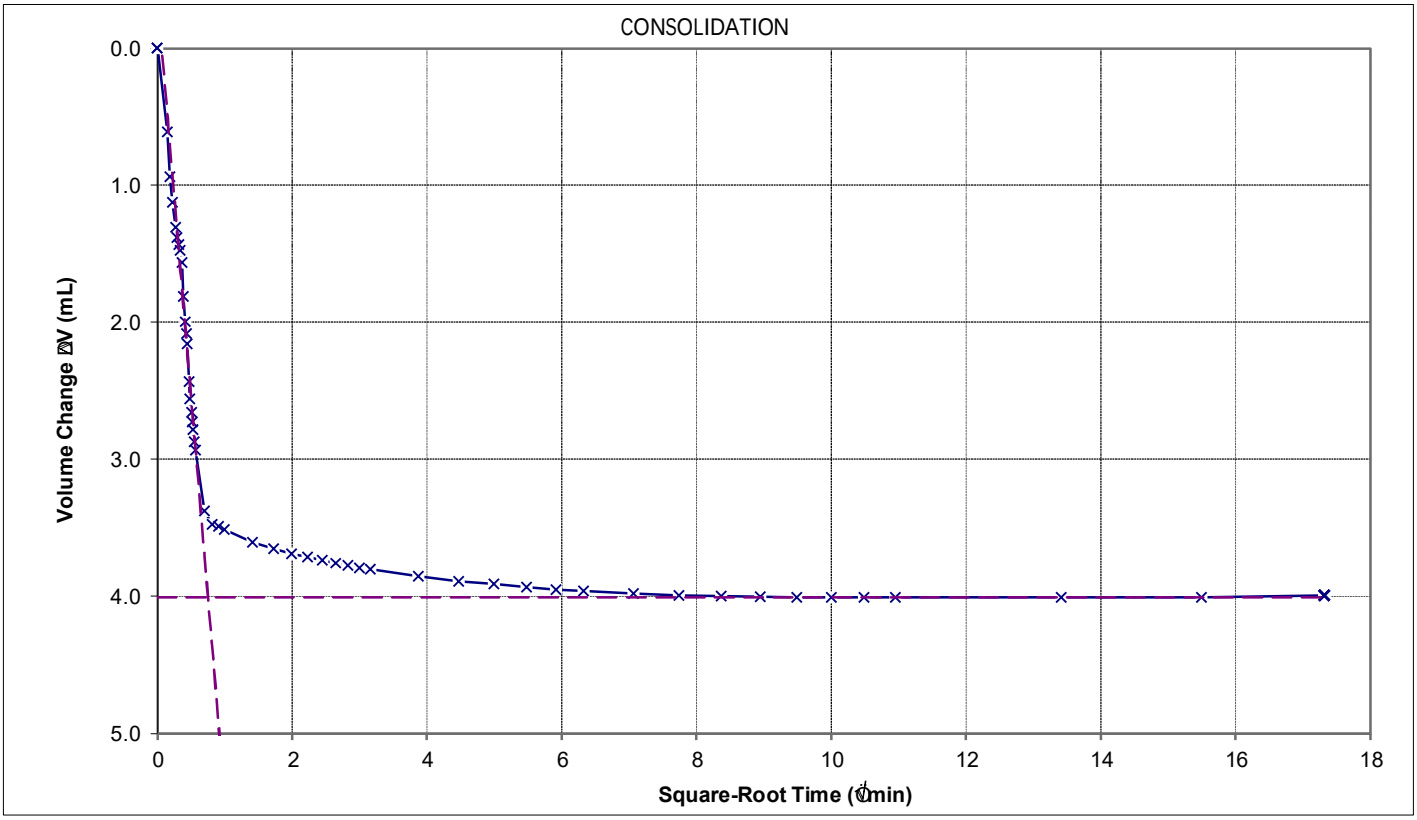
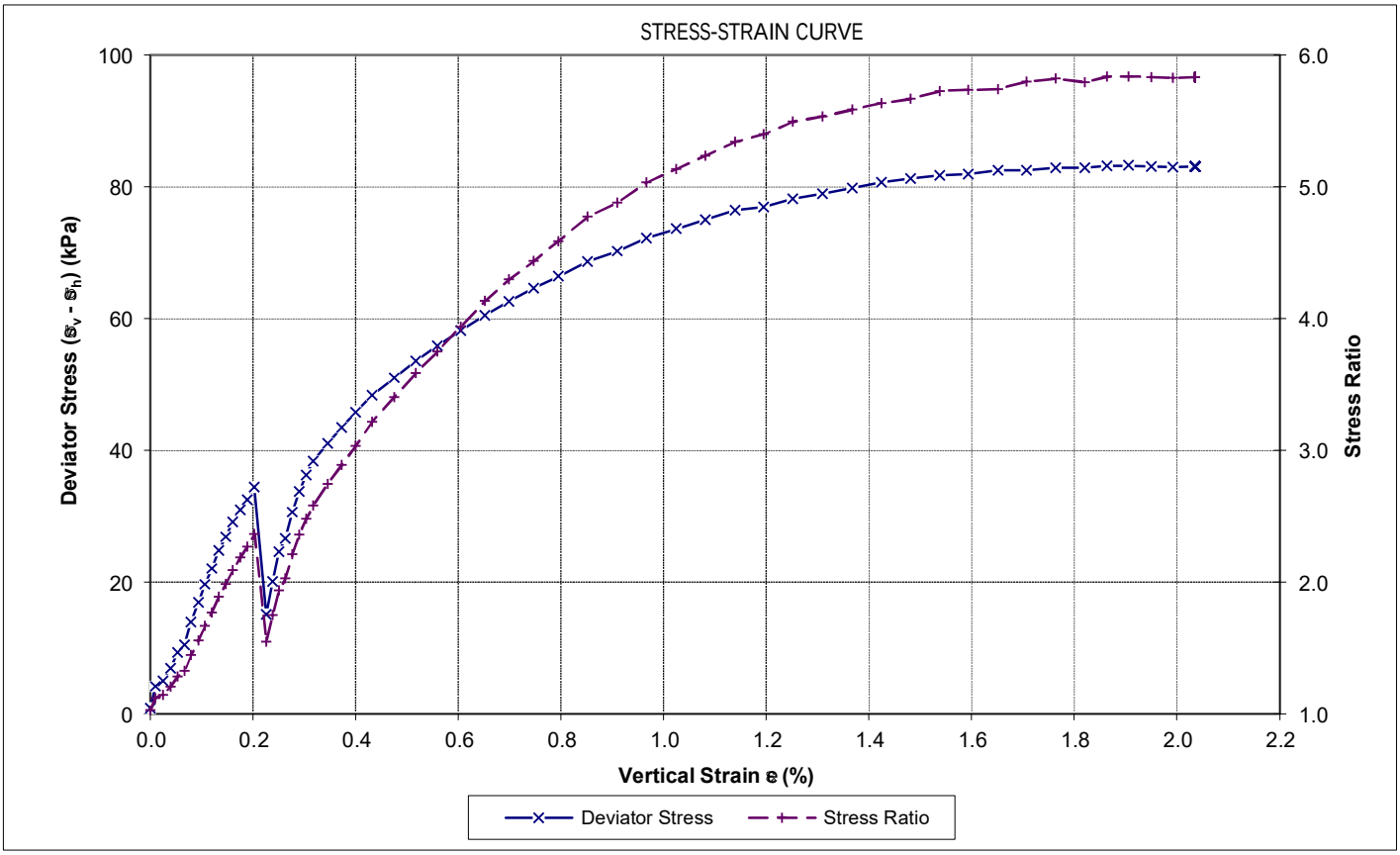
Test method used: ISO 17892-9:2018 Part 9 Isotropic consolidated-undrained triaxial compression test on water saturated soils (CIU)
NZS 4402:1986 Test 2.1 Determination of Water Content

STAGE 1 GRAPHS





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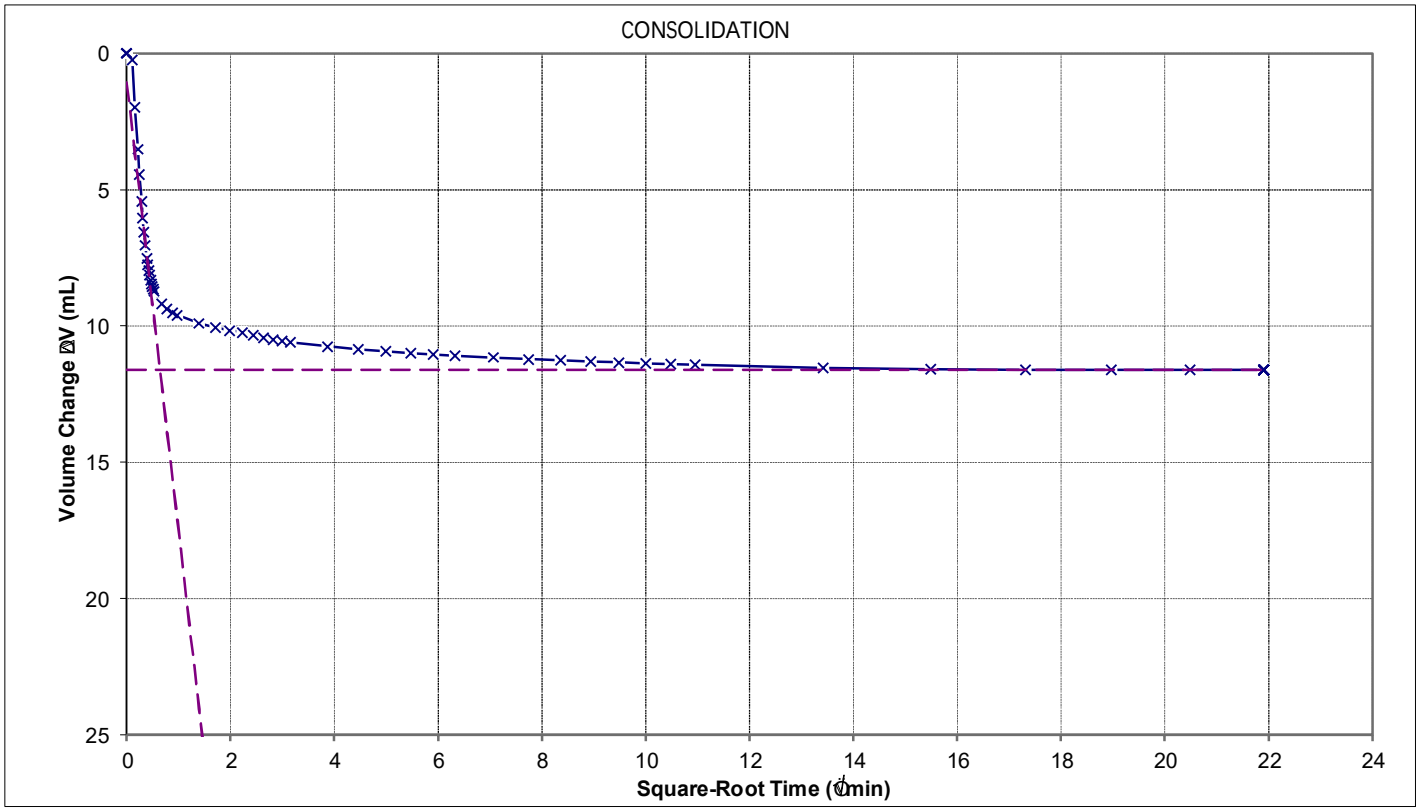
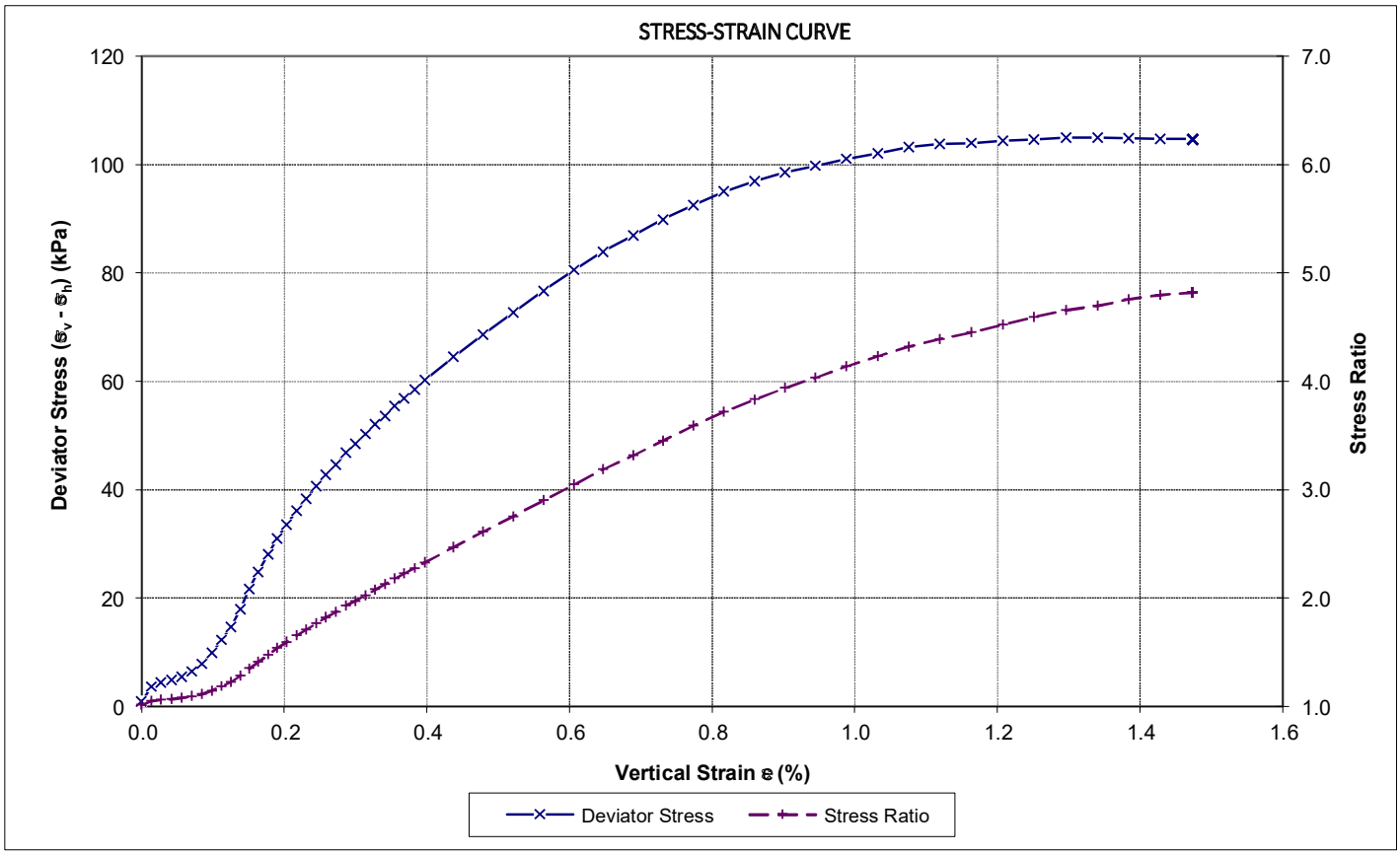
NZS 4402:1986 Test 2.1 Determination of Water Content

STAGE 2 GRAPHS





Approved Signatory: Date: 4/03/2021

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Geotechnics Project ID: 1100731.0000
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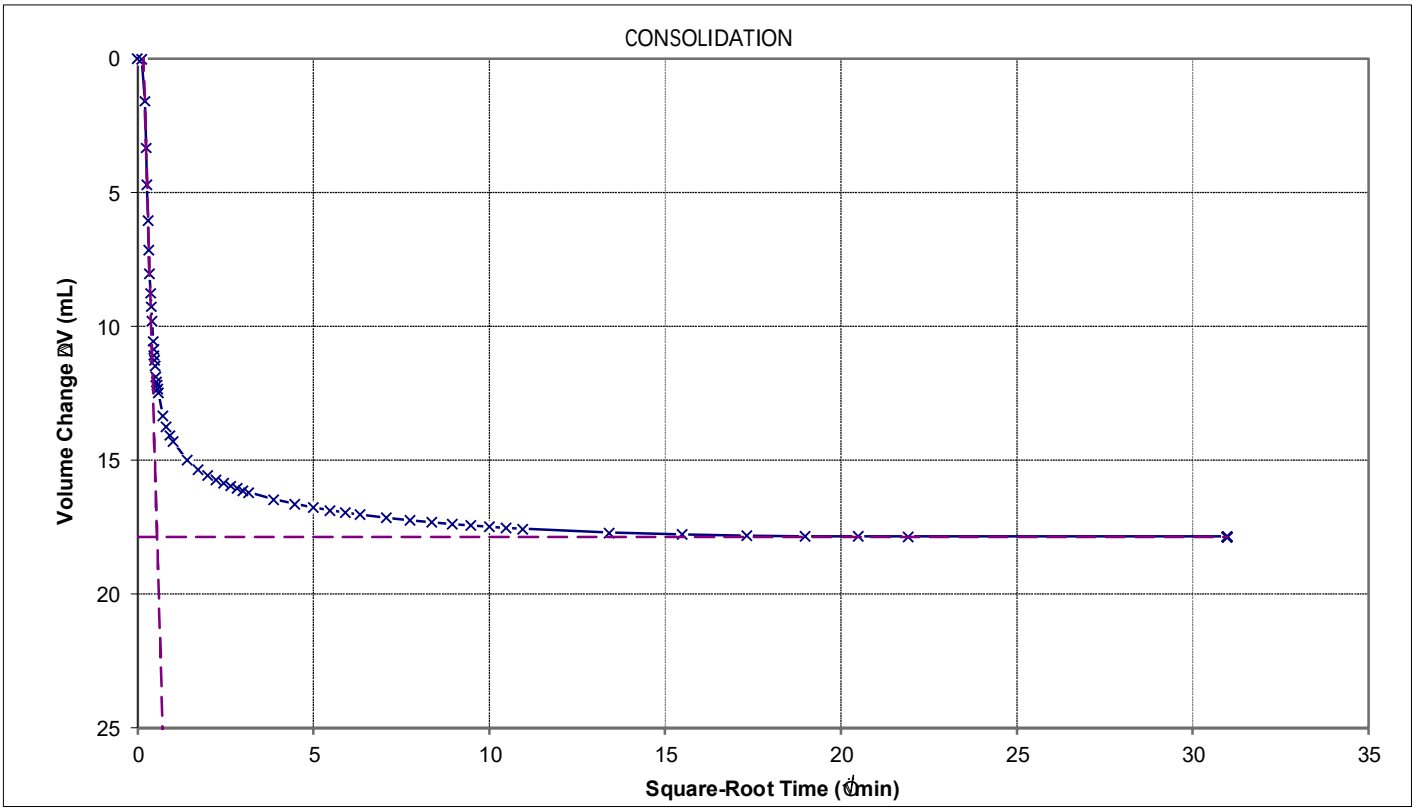
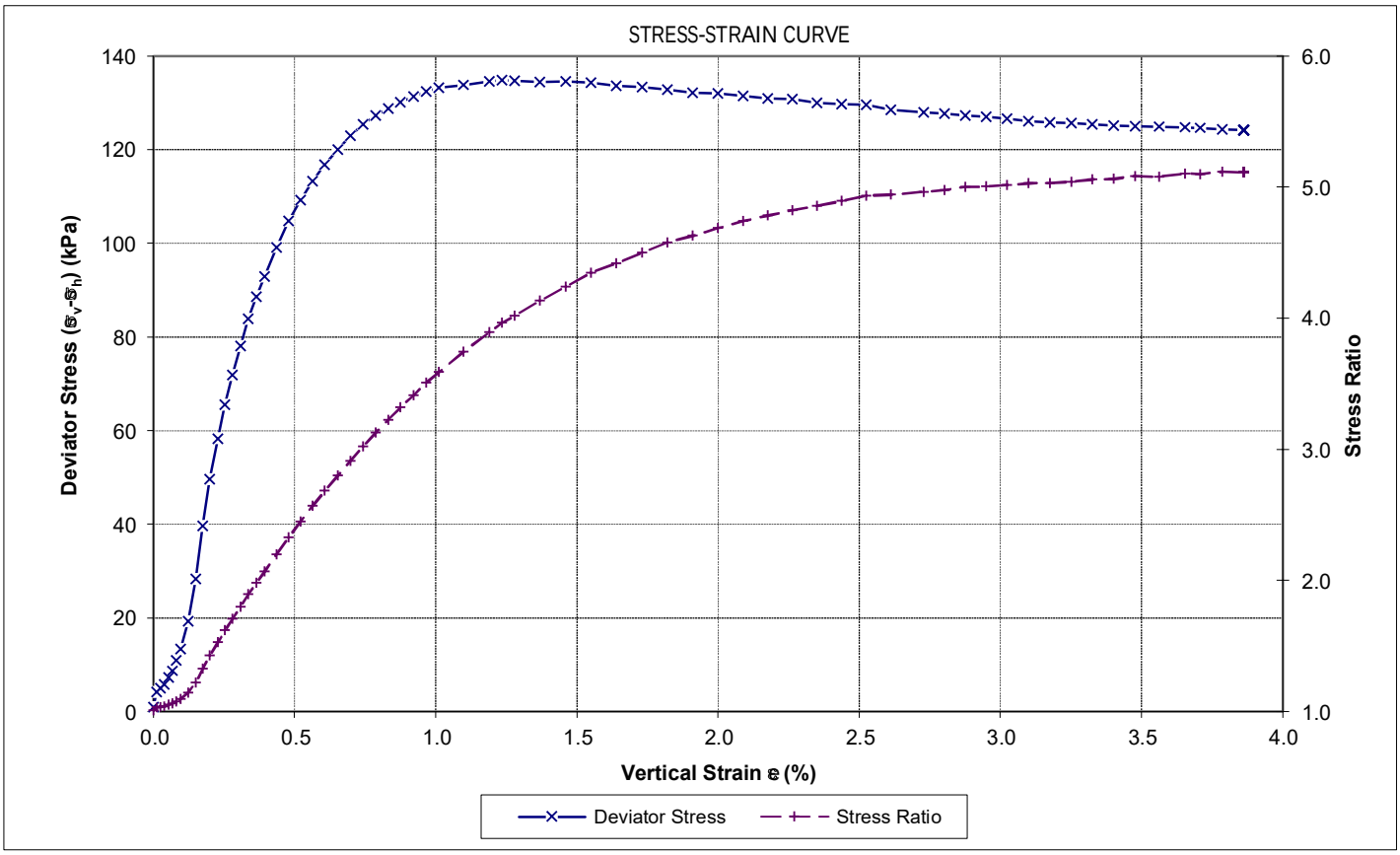
NZS 4402:1986 Test 2.1 Determination of Water Content

STAGE 3 GRAPHS





Approved Signatory: Date: 4/03/2021

GEOTECHNICS

Our Ref: 1100731.2.0.0/Rep2
Customer Ref: 19103
5 March 2021

Land Development & Exploration Limited
Warkworth
PO Box 471
0941

Attention: Finlay Wallen-Halliwell

Dear Finlay

67 Dip Road Kamo Whangarei

Laboratory Test Report

Samples from the above mentioned site have been tested as received according to your instructions and the results are included in this report. Results apply only to the sample(s) tested.

Descriptions are enclosed for your information, but are not covered under the IANZ endorsement of this report.

This report has been prepared for the benefit of Land Development & Exploration Limited, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

This report may be reproduced only in full.

Samples not destroyed during testing will be retained for one month from the date of this report before being discarded. If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of this page.

GEOTECHNICS LTD

Report prepared by:

.....
Tylah Wardrope
Laboratory Technician

Authorised for Geotechnics by:

.....
Paul Burton
Project Director

Report checked by:

.....
Ryan Milligan
Project Manager
Approved Signatory
5-Mar-21
t:\geotechnicsgroup\projects\1100731\workingmaterial\tga lab\lde 67 dip road kamo whangarei-cu.docx

ACCREDITED IANZ TESTING LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

GEOTECHNICS

15C Amber Crescent
Judea
Tauranga 3110
New Zealand
p +64 7 571 0280

Geotechnics Project Number	1100731.2.0.0
QESTLab Work Order ID	W21TG-0038
Customer Project ID	19103

Detection of the Presence of Allophane in Soils - NZS 4402:1986 Test 3.4

TEST DETAILS

LOCATION	**Description**	67 Dip Road Kamo Whangare		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S21TG000081		
	Reference	CPT01	**Top Depth**	3.85m
	Sampled By	Others, Tested As Received	**Bottom Depth**	**3.86m**
	Description	silty SAND, lightly packed, orange brown with dark brown, light yellow grey and black.		
SPECIMEN	**Reference**		**Depth**	
	Description			

TEST RESULTS

Colour Intensity	Pink to Red
Allophane Content	**5% to 7%**

This result is an approximate indication of allophane content.

Bright Red - More than 7% Allophane Presence
Pink to Red - 5 to 7 % Allophane Presence
Colourless - Less than 5% Allophane Presence

TEST REMARKS

• The material used for testing was natural. • This test result is IANZ accredited.•Date tested 05/03/2021

Approved Signatory Ryan Milligan

Date 05/03/2021

GEOTECHNICS

15C Amber Crescent
Judea
Tauranga 3110
New Zealand
p +64 7 571 0280

Geotechnics Project Number	1100731.2.0.0
QESTLab Work Order ID	W21TG-0038
Customer Project ID	19103

Detection of the Presence of Allophane in Soils - NZS 4402:1986 Test 3.4

TEST DETAILS

LOCATION	**Description**	67 Dip Road Kamo Whangare		
	Data	N/A		
SAMPLE	**Geotechnics ID**	S21TG000082		
	Reference	BH01	**Top Depth**	3.36m
	Sampled By	Others, Tested As Received	**Bottom Depth**	**3.38m**
	Description	silty SAND, lightly packed, orange brown with dark brown and light grey.		
SPECIMEN	**Reference**		**Depth**	
	Description			

TEST RESULTS

Colour Intensity	Pink to Red
Allophane Content	**5% to 7%**

This result is an approximate indication of allophane content.

Bright Red - More than 7% Allophane Presence
Pink to Red - 5 to 7 % Allophane Presence
Colourless - Less than 5% Allophane Presence

TEST REMARKS

• The material used for testing was natural. • This test result is IANZ accredited.•Date tested 05/03/2021

Approved Signatory Ryan Milligan

Date 05/03/2021

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WARKWORTH | WHANGANUI | WHANGAREI
www.lde.co.nz

Appendix 7

Earthworks Geotechnical Letter

Project Reference: 19103

24/11/2021

Onoke Heights Limited
C/- M Holland
mark@waibury.co.nz

Dear Mark,

EARTHWORKS DESIGN REVIEW

Onoke Heights, 67 Dip Road, Kamo, Whangarei

LDE Limited have been engaged to provide geotechnical engineering support for the Onoke Heights residential development at 67 Dip Road, Kamo, Whangarei.

A geotechnical suitability report has been prepared by LDE to support the resource consent for the proposed development, with preliminary recommendations for the earthworks design for the development.

A preliminary subdivision design has now been completed with earthworks plans prepared by Blue Wallace, reference 20253, and supplied to LDE for review prior to submission for resource consent.

This report outlines our review of the proposed earthworks design and is intended to support resource consent. Further investigation and analysis will be required to inform the design of specific structures for engineering plan approval and building consent.

1 PROPOSED DESIGN

The proposed design (latest version dated 23/11/2021 at time of review), broadly comprises:

- Bulk filling to form level or near level building platforms through to south-western and central areas of the site.
    - Filling is supported by a series of broad retaining walls along the base of Lots 1-16, below Lots 35 to 43, below Lots 56-62, below Lots 69 and 70, and at the northern boundary above Lots 74-78. Several other smaller walls are also proposal.
    - Retained heights up to 5m are indicated.

- Battered cuts along the north-eastern edge of the site, along the base of the small scoria cone slope, to form the road.
- A retained cut along the northern edge of the site, below the reservoir site and driveway.
- Various shallow battered cuts and fills to the southeast of the site form building platforms and the proposed stormwater pond.

2 GEOTECHNICAL ASSESSMENT

The stability of the site was previously assessed as part of the subdivision geotechnical suitability report. The site was found to be in a generally stable condition. The steep slope up to the scoria cone on the north-eastern edge of the site was deemed 'moderate' instability hazard (in accordance with WDC EES criteria), as was the steep arcuate slope into the stream on the southern boundary of the site. Further assessment has been undertaken to consider the effects of the proposed earthworks on these two areas.

Preliminary assessment of other areas of significant earthworks have also been considered, as outlined below. Further investigation and analysis of these other areas will be required.

2.1 North-eastern slope (Lots 80 – 92)

Stability analysis has been undertaken assess the stability of this slope and the proposed earthworks. The earthworks generally comprise significant down-cutting at the lower edge of the slope, to form the road. This cut will then be battered back to natural ground level towards the top edge of the sites.

The proposed cut is deepest at the south-western boundaries of Lots 88, 89 and 90, at up to approximately 5m depth. The sites are battered back from this edge at up to 1V:2.7H (20°).

The slope has been modelled as generally described in the subdivision suitability report and shown in the cross section appended to that report (drawing 19103 G-01).

Material strength parameters for the weathered and un-weathered scoria have been conservatively estimated based on assessment of existing slopes and in particular the deep quarry cut to the north-east of the hill. Parameters for the remaining units were as given in in the report. All parameters are shown on the appended printouts.

Modelling has been undertaken in general accordance with Whangarei District Council 'Land Development Stabilisation – Technical Design Requirements', April 2018[1]. Normal/design groundwater, extreme groundwater, and seismic scenarios have been analysed. The normal groundwater scenario were found to be the controlling

[1] https://www.wdc.govt.nz/Council/Council-documents/Policies/Land-Development-Stabilisation-Policy

case, as would be expected given the very low groundwater table, favourable drainage conditions, and low seismicity at the site.

The slope was found to be stable in the design case with the proposed cut, with the factor of safety for failures through the slope being >1.7. The existing design of these lots is therefore considered appropriate.

It was found that any significant steepening of the cut slope, and in particularly any deep cuts (i.e. an unsupported cut for the dwelling) would result in potential instability from the reserve land above the slope. As a result specific assessment and design would be required for any future dwellings on these sites. It is generally expected that the sites will be suitable for suspended pole houses or multistorey houses cut into the slope with retaining. At the design grade some minor cuts will be required to gain access into the sites. Cuts for access are likely to also require retaining.

2.2 Stream Bank Slope (Road)

The proposed subdivision design shows the road passing near the crest of the stream bank slope, with minor fills extending over the slope crest. This slope is inferred to be in a marginal state of stability, and is not expected to meet minimum factor of safety criteria and will require specific engineering design.

It is expected that a cantilevered timber pole retaining wall will be suitable to support the proposed fill for the road. Due to the presence of low strength tephra soils and the steep downslope angle it is likely that an engineered retaining wall will be required to achieve the required factors of safety.

2.3 Lot 78 (Reservoir Cut)

A large cut is proposed at the northern edge of Lot 78, adjacent to the Reservoir site. Earthworks plans show this being retained over 3m at the boundary.

Given the some-what unfavourable ground conditions for cantilever retaining, as noted in the geotechnical suitability report, and the potential surcharge loading that would need to be considered for the usage of the site above, it may not be practical to retain this slope. If retaining is proposed then this may need to be set within the site to reduce retained heights, which would then limit the building area.

It is recommended that this lot be graded to an even slope in a similar manner to Lots 80 to 92. The site would then be suitable for similar types of dwellings as outlined in Section 2.1 or may otherwise be cut flat and retained at the time of building consent, subject to specific engineering design.

2.4 Deep Fills

Through the central area of the site, fills up to approximately 6.5m are proposed. These are expected to be constructed as some form of MSE wall. The internal stability of the proposed fill will therefore need to be addressed as part of the geotechnical design. It is expected that global stability and bearing capacity will be

checked as part of the design. Preliminary analysis indicates that the proposed fill depths can be achieved with conventional MSE construction (e.g. Redirock walls), without significantly affected the instability hazard at the site.

Preliminary settlement analysis has been undertaken to check expected settlements under the proposed fill loads, with the primary concern being the potential consolidation of the loose tephra soil in the fill areas. Based on a lower bound oedometric modulus of 5MPa, estimated from the consolidation stages of CU triaxial tests, total expected settlement would be on the order 150 to 200mm. Further investigation and analysis are proposed as part of detailed design.

Settlement of the tephra soils is expected to be near immediate. No settlement of building sites is expected to occur beyond the completion of the subdivision.

3 CONCLUSIONS

Based on our review of the supplied earthworks design, subject to the above recommendations and detailed design requirements, the proposed works are not expected to adversely affect the stability of the site.

The building sites created by the works are expected to be suitable to support dwellings, subject to requirements for specific engineering design at some lots.

4 LIMITATIONS

This letter has been prepared exclusively for Onoke Heights Limited with respect to the brief given to us. Information, opinions, and recommendations contained in it cannot be used for any other purpose or by any other entity without our review and written consent. LDE Ltd accepts no liability or responsibility whatsoever for or in respect of any use or reliance upon this report by any third party.

This report was prepared in general accordance with current standards, codes, and practice at the time of this report. These may be subject to change.

This report should be read in its entirety to understand the context of the opinions and recommendations given.

For and on Behalf of Land Development and Engineering Ltd

Report prepared by:

Finlay Wallen-Halliwell
Engineering Geologist
BSc, PMEG

Report reviewed by:

Aaron Holland
Senior Civil & Geotechnical Engineer
CMEngNZ (CPEng)

Attached: Stability Analysis for north-eastern slope

LEGEND

Section line

Basemaps

LINZ Aerial Basemap

0 30 60 90 120 m

SCALE A3: 1:1500

NOTES

1. Aerial basemap and property boundaries sourced from LINZ Data Service (CC-BY 4.0).
2. Design surface from Blue Wallace ref. 20253 dated 23/11/2021. See full earthworks plan set for details.

CLIENT

Onoke Heights

PROJECT

Onoke Heights Development
67 Dip Road
Whangarei

DRAWING TITLE

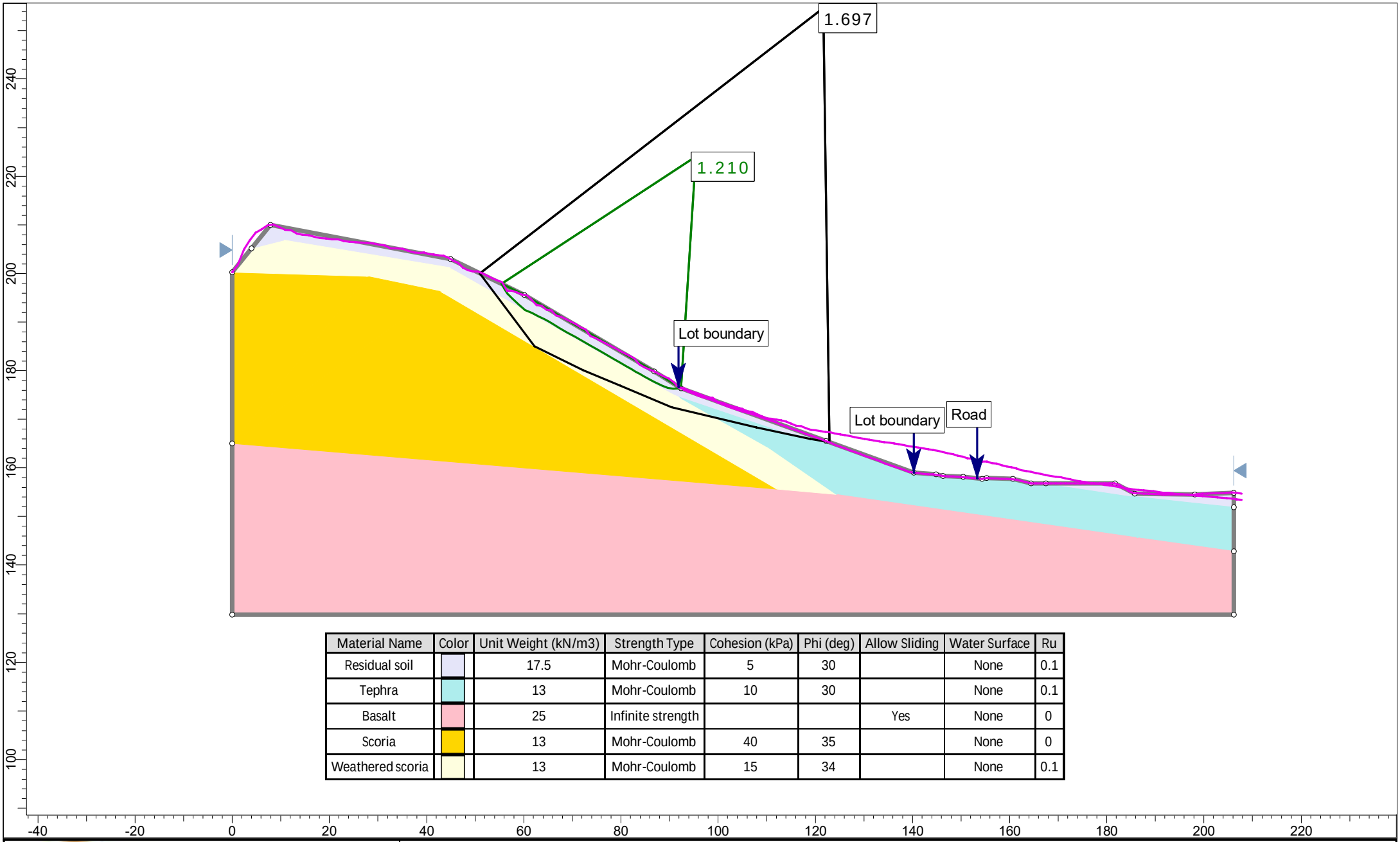
Cross section location plan

LDE LAND DEVELOPMENT & ENGINEERING LTD.

PROJECT REF	DRAWING REF	REVISION
19103	G02	A
DATE	PREPARED BY	CHECKED BY
23/11/2021	FWH	AH

FILE PATH

M-FILES\LDE - Project\0430\19103 - Dip Rd Earthworks Check\19103 Base Data v1.qgz



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Allow Sliding	Water Surface	Ru
Residual soil		17.5	Mohr-Coulomb	5	30		None	0.1
Tephra		13	Mohr-Coulomb	10	30		None	0.1
Basalt		25	Infinite strength			Yes	None	0
Scoria		13	Mohr-Coulomb	40	35		None	0
Weathered scoria		13	Mohr-Coulomb	15	34		None	0.1

LAND DEVELOPMENT & ENGINEERING LTD.

SLIDEINTERPRET 9.019

Project	Section 101 - 67 Dip Road, Kamo 19103		
Analysis Description	Group 1 - Master Scenario		
Drawn By FWH	*Scale* 1:1000	*Date* 23/11/2021	
File Name	19103 CS-101.slmd		