

Ryman Healthcare Limited

Ngataringa Road, Narrowneck

Volume Two

Appendices



November 2015

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APPENDIX A

Certificate of Title



COMPUTER FREEHOLD REGISTER UNDER LAND TRANSFER ACT 1952




R. W. Muir
Registrar-General
of Land

Search Copy

Identifier 547720
Land Registration District North Auckland
Date Issued 25 March 2011

Prior References

PROC 13742

Estate Fee Simple
Area 1426 square metres more or less
Legal Description Lot 4 Deposited Plan 20927

Proprietors

Whai Rawa Property Holdings LP

Interests

Subject to Part IVA Conservation Act 1987 (but sections 24(2A), 24A and 24AA of that Act do not apply)

Subject to Section 11 Crown Minerals Act 1991

9705089.1 Lease Term 150 years commencing 8 May 2014 CT 655591 issued - 8.5.2014 at 1:57 pm

LAND TRANSFER OFFICE

RECEIVED: 17/9/1917 PROV. No. 20927
TITLE REF. 156/158 201/163

REFERRED TO DRAUGHTSMAN: 26/9/1917
L.T. DRAUGHTSMAN: 21/10/17
EXAMINED BY: J. A. Barry
TRAN. NO.: VOL. FOL.
FIELD BOOK. No. 37 PAGE 22
COMPI. Bk. No. REPORT No.
REF. PLANS: 156/158 201/163
202/207

FILE:

correct
J. A. Barry
J. S. Draughtman
8/10/17

FOR SURVEYS UNDER THE LAND TRANSFER ACT ONLY.
NORTH AUCKLAND LAND DISTRICT

PARTIAL OF TAKAPUNA
BORO' OF DEVONPORT

VI, RANGITOTO S.D.

HANLAN ST
DVOROV
BEACH ST
LAKESIDE
WESLEY ST
NGATARINGA ROAD
NGATARINGA BAY

SEC I
ALLOT 4
ALLOT 3
Lot 1
Lot 2
Lot 3
Lot 4
Lot 5

Total Area 11 - 1 - 00-88

PLAN OF SUBDIVISION OF ALLOT 3, SEC I, PHO TAKAPUNA
Surveyed for Mr R. Duder & Ors.
Comprised in C.T. 503/156/158 501/163
Surveyed by J. A. PARRY, Licensed Surveyor, December, 1926

DECLARATION.
I, J. A. PARRY, of the County of Auckland, Licensed Surveyor, do solemnly and sincerely declare that this plan has been made from surveys executed by me (or under my supervision) in accordance with the provisions of the Land Transfer Act, 1924, and that both plan and survey are correct, and have been made in accordance with the regulations of the Surveyors' Board, dated the 30th day of March, 1925.

Approved,
R. H. Duder
Agent for Registered Owners.

20927



COMPUTER FREEHOLD REGISTER UNDER LAND TRANSFER ACT 1952




R. W. Muir
Registrar-General
of Land

Search Copy

Identifier 547719
Land Registration District North Auckland
Date Issued 25 March 2011

Prior References

PROC 13742

Estate	Fee Simple
Area	4.1089 hectares more or less
Legal Description	Lot 5 Deposited Plan 20927

Proprietors

Whai Rawa Property Holdings LP

Interests

Subject to Part IVA Conservation Act 1987 (but sections 24(2A), 24A and 24AA of that Act do not apply)

Subject to Section 11 Crown Minerals Act 1991

9705089.1 Lease Term 150 years commencing 8 May 2014 CT 655591 issued - 8.5.2014 at 1:57 pm

Register Only



COMPUTER INTEREST REGISTER UNDER LAND TRANSFER ACT 1952




R. W. Muir
Registrar-General
of Land

Search Copy

Identifier **655591**
Land Registration District **North Auckland**
Date Registered 08 May 2014 01:57 pm

Prior References

547719 547720

Estate	Leasehold	Instrument	L 9705089.1
Area	4.2515 hectares more or less	Term	150 years commencing 8 May 2014
Legal Description	Lot 4-5 Deposited Plan 20927		

Proprietors

Healthcare Shelf Company No. 24 Limited

Interests

LAND TRANSFER OFFICE
RECEIVED: 17/4/12 PROV. No. 30927
TITLE REF. 303/156, 158, 159, 160, 161, 162
REFERRED TO DRAUGHTSMAN: 20/9/12
L.T. DRAUGHTSMAN: 2/10/12
EXAMINED: 2/10/12
TRAV. REVENUE: VOL. 1
FIELD-BOOK: No. 127, PAGE 42
COMPA. No.: REPORT No.
REF. PLANS: 2287, 1989, 1023, 303/156, 158, 159, 160, 161, 162
FILE:

FOR SURVEYS UNDER THE LAND TRANSFER ACT ONLY.
NORTH AUCKLAND LAND DISTRICT
PARISH OF TAKAPUNA
BORO OF DEVONPORT
VI, RANGITOTO S.D.

This space to be reserved for Deposit No.
DEPOSITED this 5th day
of DECEMBER, 1927
W. Johnston
District Land Registrar

SEC 1
REGEN ST
WESLEY ST
NGATARINGA ROAD
HANLAN ST
BEACH ST
WATSON ST
ALLOT 4
ALLOT 3
NGATARINGA BAY
Lot 5
Lot 4
Lot 3
Lot 2
Lot 1
Total Area 11 - 1 - 00-88
Note: All Areas are in square feet

Approved as to Survey.
J. A. PARRY
Licensed Surveyor
2/10/1927

Approved,
R. H. Duder
District Land Registrar
2/10/1927

PLAN OF SUBDIVISION OF PART OF ALLOT 3, SEC 1, PARISH OF TAKAPUNA
Surveyed for MR R. Duder & Ors.
Comprised in C.T. 303/156, 158, 159, 160, 161, 162
Surveyed by J. A. PARRY, Licensed Surveyor, December, 1926

DECLARATION.
I, J. A. PARRY, of the District of North Auckland, Licensed Surveyor, do solemnly and sincerely declare that this plan has been made from surveys executed by me in accordance with the provisions of the Land Transfer Act, 1908, and that both plan and survey are correct, and have been made in accordance with the regulations of the Surveyors' Board, dated the 30th day of March, 1913.
And I make this solemn declaration conscientiously believing the same to be true, and by virtue of the provisions of the provisions of the Justices of the Peace Act, 1908.
Declared at _____ day of _____ 1927
J. A. PARRY
Licensed Surveyor

20927

Land-N.31

APPENDIX B

Infrastructure Report, Woods (2015)

Date: 17 November 2015

Job no: 61071

RYMAN HEALTHCARE

**7-37 NGATARINGA ROAD
NARROW NECK DEVONPORT**

INFRASTRUCTURE REPORT

FOR RESOURCE CONSENT



WOODS

Engineers. Surveyors. Planners.

WWW.WOODS.CO.NZ

DOCUMENT CONTROL RECORD

Client	Ryman Healthcare Limited
Project	7 -37 Ngataranga Road, Narrow Neck, Devonport.
Document	7 -37 Ngataranga Road, Narrow Neck Retirement Village Infrastructure report

ISSUE AND REVISION RECORD

Date of Issue	17 November 2015
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Originator



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Checked/Approved



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2 INTRODUCTION

Woods have been engaged by Ryman Healthcare to undertake a preliminary engineering design for the Earthworks and Civil components of the proposed retirement village on the parcel of land located at 7-37 Ngataranga Road Narrow Neck, Auckland.



Figure 1: Site Plan

The site which is legally defined as DL/AK Navy 294-381 Lot4 DP 20927, Lot 5 DP 20927. (4.2525 Hectares) has a North Shore district plan zoning of Residential 4B. In the proposed Auckland Unitary Plan, the zoning is Mixed Housing Suburban.

The property is the site of a former naval facility where the buildings were removed in 2003. The former roads, paved areas and underground services are still evident on the ground.

The site slopes down from Ngataranga Road through a series of benches of varying size to a waterfront bank on the Ngataranga Bay estuary.

The vegetation on the site is in two areas. The Ngataranga Road frontage has scattered medium size specimen trees. The coastal reserve has a large variety of well-established native species including Rimu and Puriri in a dense stand along the entire coastal property boundary.

Ryman Healthcare are proposing a principally apartment style Retirement Village to be situated on the site. The capacity in the existing Auckland Council owned infrastructure in and around the site is sufficient to service the village.

This report outlines the proposed design philosophy for each component of the infrastructure servicing the village and the proposed earthworks associated with its construction.

3 EARTHWORKS

3.1 Description

The proposed retirement village consists of 5 apartment style buildings being constructed on the main part of site and a 6th smaller apartment style building being constructed on the Lake Road frontage part of the site. These buildings all have proposed basement car parking.

Earthworks will be required to provide flat building platforms and suitable access to the basement car parking.

3.2 Existing Site Topography

The site is essentially rectangular in shape, sloping from RL 27.5m - 18m at the Ngataranga Road frontage down to around RL 10m along the coastal boundary. This is an average slope of around 12%.

The land is undulating with a series of benches of varying size. While generally of moderate grade, some slopes are as steep as 25% adjacent to Ngataranga Road and the coastal boundary.

3.3 Geotechnical considerations

A preliminary geotechnical assessment has been undertaken by Tonkin and Taylor Ltd.

The assessment found that the site is predominantly underlain by residual soils over East Coast Bays formation weathered to un-weathered rock and suggests that lightly loaded buildings could be founded on shallow foundations while piled foundations will need to be adopted for larger buildings.

The assessment was limited by the need to attain approval for further excavation to be undertaken in areas of the site which house archaeological features. The assessment recommends that further investigation be undertaken to confirm the conclusions reached from the initial investigations.

The assessment indicated that the cliffs south of the site are stable, but recommends a 10m specific design zone from the cliff top where specific geotechnical design will be required for building footings within this zone.

It is likely that uncontrolled fill will be found at the site. Further investigation will be needed to establish the location and condition of this fill material before a decision can be made on how to remediate it.

The Geotechnical assessment has indicated that a CBR of 3% should be used for the preliminary design of road pavements.

3.4 Preliminary Design

A preliminary terrain model has been created in the 3-dimensional modelling package 12d.

The earthworks design surface has been based on the proposed finished floor levels (FFL) of the apartment buildings. A 900mm deep foundation depth has been allowed below these FFL and the excavations have been modelled to be battered back to existing ground at approximately 60 degree slopes.

Based on this preliminary modelling the expected earthworks volume is approximately 85,000m³ of cut. Approximately 8,500m³ of this material could be retained on site and used as fill on completion of the temporary works.

The above volumes do not allow for any bulking factors and excludes gullet material from the proposed access ways, any surplus material from the drainage or services trenches and any unsuitable material that may need to be cut from the subgrade areas.

The excess material will be removed from site and will be disposed of in an appropriate manner.

The proximity of the proposed excavations for building platforms and retaining walls to the existing site boundaries and trees has been assessed. The batters from the excavations will not extrude outside of the site boundaries or affect the trees to be retained on the site. Where the standard batter slope of 60 degrees is not sufficient to keep batters away from site trees specific design, using “top down” constructed retaining walls, will be undertaken to ensure these features are maintained.

Site plans including proposed contours and depth contours have been included in appendix A.

3.5 Sediment and Erosion Control Strategy

The following sediment and erosion control strategy has been developed based on the earthworks design described above and is in accordance with the Auckland Regional Council Technical Publication No. 90: Erosion and Sediment Control document (ARC TP90).

A preliminary sediment and erosion control strategy has been developed for the site based on the project being constructed in 4 stages. This staging has been driven by the proposed building programme and staged completion and occupation of the retirement village. It is noted that this building program is preliminary only and may change.

It is proposed that a sediment pond be constructed on the site sized to treat the first and largest of the construction stages. Once work in the 1st stage nears completion it will be possible to discharge storm water into the new storm water network freeing up capacity in the pond for the following stages. The flows from stages 2 and 3 will then be directed to the sediment pond.

Stage 4 of the earthworks involves the construction of building 6, a smaller apartment building on the lake road frontage. The works will be treated via silt fence around the construction area.

Refer to the sediment and erosion control plan 035-RCT_401_C0-017 in appendix A for details on the earthworks staging and proposed controls.

4 ROADING

4.1 Description

The site is bordered on its northern boundary by Ngataranga Road, and on its western boundary by Wesley Street. There is also a short section of road frontage onto Lake Road to the east. There are existing vehicle crossings into the site from all 3 frontages.

It is proposed to widen Wesley Street to an 8m carriageway and then construct a site access road from the existing vehicle crossing Ngataranga Road through the site to the newly constructed Cul de sac head of Wesley Rd.

A second access is proposed off Wesley Street into the basement of Building 4.

The existing vehicle crossing on Lake Road will be modified to allow it to service Building 6's proposed driveway.

Access roads within the site will be 5.5m in width generally with dual cross fall asphalt carriageways flanked by concrete kerb and channels. Ramps with steep gradients down to building basements will be with a single cross fall concrete pavements.

All access roads within the site are proposed to remain in private ownership and will be maintained and operated by Ryman Healthcare.

A series of footpaths link the buildings and the access road allowing pedestrian access throughout the site.

4.2 Design Philosophy

It is proposed to retain the vertical geometry Wesley Street as part of the proposed widening. The road will be widened to have total width of 8m (kerb face to kerb face). Signage and line marking with the intersection with Ngataranga Road will be upgraded to conform to current Auckland Transport standards. It is also proposed to increase the diameter of the Wesley Street turning head to approximately 14.3m.

All vehicle crossings into the site will be constructed in accordance with current Auckland Transport standards.

The access roads through the site will have a carriageway width of 5.5m (kerb face to kerb face).

The main access road will be dual cross fall and have a maximum gradient of 10% and a minimum gradient of 0.5%. The first 75m of the access road through the site from Ngataranga Road will be constructed on the same alignment as the existing driveway to avoid damaging the adjacent trees.

Basement access roads will have a maximum grade of 20%. Where steep grades are present concrete pavements will be used on the access ramps.

Storm water runoff will be collected via kerb and channels draining into cess-pits and the storm water network.

The main access road also provides a secondary overland flow path through the site. Refer to the storm water section for further details on the overland flow path.

5 STORM WATER

5.1 Existing Infrastructure

An existing 150mm diameter storm water line passes through the eastern end of the site and discharges into Ngataranga Estuary. At the western end of the property a 225mm diameter line runs down Wesley Street and also discharges into the estuary.

Multiple other unrecorded outlets have been created from the site down to the estuary as part of the defence force occupation. These range from non-perforated novacoil pipes to steel pipes with little to no outlet structures at their discharge points to the estuary.

There are no streams or watercourses on the site. The Auckland Council GIS data indicates that an overland flow path crosses the site but further investigation shows that this is not the case and that the overland flow will instead follow the existing roads around the site. Refer to the storm water drawing 035-RCT_401_C0-055 in appendix A for further details.

5.2 Proposed changes to catchment

The proposal is to develop this site into a residential retirement village with buildings, access roads and hard stand areas. As a result of these works there will be an increase to the total impervious area of the site and a resulting increase in the storm water run-off.

5.3 Storm water Management Plan

A storm water management plan has been developed for the site in accordance with TP10 & TP108 as well as meeting the relevant requirements of “Stormwater Management – Flow and Quality Rules of the Proposed Auckland Unitary Plan” outlined in TR035 and the recently released Storm water Code of Practice.

5.3.1 Storm water conveyance

The storm water runoff from the roads, buildings and paved areas will be collected into a piped storm water network sized to contain the 10 year ARI storm event.

Storm events larger than the 10 year ARI will be conveyed via a secondary overland flow path which follows the main access road to just west of the bowling green before travelling south to the estuary.

5.3.2 Storm water treatment and retention

The site is located on the Ngataranga Estuary edge and is not within a storm water management area for flow control under the proposed Auckland Unitary Plan requirements (SMAF area).

The site is located within the SMA5 zone in the North Shore City Plan. The requirements on this zone are that treatment be provided to TP10 standards, the zone rules do not require any attenuation or retention of storm water flows.

It is proposed to treat the run off from the access roads and car parking areas utilising a proprietary storm water treatment device such as the storm water 360 storm filter system (or similar). This device will be located adjacent to the bowling green beneath the carpark area.

The piped storm water system has been designed so as to allow the majority of the roof run off to bypass this device as it does not require treatment and allows the device to operate more efficiently.

It is not proposed to attenuate the post development storm water flows from the site although some of roof run-off will be retained for reuse on the site in a holding tank located between buildings 2 and 3. This is not a storm water code of practice requirement but is a design guideline requested by Ryman Healthcare.

5.4 Preliminary Design

It is intended to service the retirement village with reinforced concrete piping ranging in size from 225mm diameter to 675mm diameter to be installed in accordance with the Auckland Council Storm water Code of Practice. Refer to the storm water drawing 035-RCT_401_C0-040 in appendix A for further details on the proposed storm water reticulation network layout.

It is proposed to upgrade the 150mm diameter line at the eastern end of the site to a 675mm diameter pipe that discharges into the Estuary. An outlet structure will be required to ensure flow energy is sufficiently discharged prior to entering the estuary. Refer to storm water drawing 035-RCT_401_C4-050 in appendix A for further details on the outlet structure.

The proposed proprietary storm water treatment device will be sized to treat the water quality storm event run-off. The drainage network has been designed to allow roof run-off to bypass this device where possible. The storm water treatment device will only treat the water quality storm, larger flows will bypass the device within the storm water system and continue down the storm water reticulation network.

A secondary overland flow path is provided by the main access road through the site. This flow path has been designed to channel the flow to the low point in the access road west of the proposed Bowling Green. From the low point west of the bowling green the flow will flood over the kerb and travel south to the Ngataranga Estuary. Refer to the storm water drawing 035-RCT_401_C0-055 in appendix A for further details.

6 SANITARY SEWER

6.1 Existing infrastructure

The site is currently serviced by a 300mm diameter public wastewater sewer which exits the site on Lake Road. A 150mm diameter earthenware line follows the eastern site boundary and a 225mm diameter line traverses the coastal boundary for the length of the property. A short 150mm line runs into the site from the 225mm line.

The 300 mm line on Lake Road goes to a pump station at the corner of Lake Road and Sea Breeze Road.

6.2 Design Philosophy

It is intended to connect the main section of the site to the 150mm line that runs into the site. A second connection into the manhole at the start of the 300mm line will be made to service Building 6.

It is proposed that the site will utilise a low pressure sewer network for its internal reticulation.

6.3 Preliminary Design

All new sanitary sewers will be designed in accordance with Watercare Services Water and Wastewater Code of Practice.

For the purpose of the preliminary design the following parameters have been established:

- Average dry weather flow (ADWF) = 160 l/person/day
- Dry Weather Peak factor (DWPF) = 3
- Peak Wet weather flow (PWWF) = 1500 l/person/day

The below table calculates the expected design flows for the sanitary sewer based on the expected population and number of proposed apartments.

Building	Units	Eqv Population/unit	Population	ADWF (l/s)	DWPF (l/s)	PWWF (l/s)
Building 1:						
Assisted living suites	78	1	78	0.144	0.433	1.354
Care Beds	120	1	120	0.222	0.667	2.083
Apartments	2	1.3	2.6	0.005	0.014	0.045
		subtotal	200.6	0.371	1.114	3.482
Building 2:						
Apartments	56	1.3	72.8	0.135	0.404	1.264
Building 3:						
Apartments	49	1.3	63.7	0.118	0.354	1.106
Building 4:						
Apartments	27	1.3	35.1	0.065	0.195	0.609
Building 5:						
Apartments	53	1.3	68.9	0.128	0.383	1.196
Building 6:						
Apartments	8	1.3	10.4	0.019	0.058	0.181
Total			451.5	0.836	2.508	7.839

Table 1: Sewer design flows

Peak sewer flow expected from the site is 7.85 l/s. This flow can be accommodated within the existing infrastructure capacity. During the due diligence investigations Chris Allen, Watercare Services Limited Developments Manager for New Developments

discussed our proposed development of the site for a retirement village with their planning team and they confirmed that there are no capacity issues in the Ngataranga area.

7 WATER SUPPLY / FIRE FIGHTING

7.1 Existing infrastructure

An existing 150mm PE public water main reticulation is located on the northern side of Ngataranga Road has two 150mm diameter street crossing leads on to the site at houses No. 12A and No.24 Ngataranga Road.

On Lake Road there are two 300mm diameter bulk supply mains as well as a 50mm PE line which currently supplies the house on Lot 4 DP 20927.

7.2 Preliminary Design

Potable Water usage for the village is expected to be 200 l/resident/day. This equates to a daily draw of 90.3m³ of water. Additional capacity will need to be available in the mains to allow for firefighting proposes.

It is expected that the existing water mains adjacent to the site will provide sufficient potable and firefighting water supply to the proposed retirement village. Flow testing will be undertaken on site to confirm that there is sufficient capacity in the mains.

It is proposed to take advantage of the multiple connection points on the site to provide a looped network through the site. See the Potable Water Drawing 035-RCT_401_C0-060 in Appendix A for details.

As the water network servicing the retirement village will be private, provision will be made for the installation of back flow prevention devices on the lines supplying the fire sprinklers and healthcare amenities.

8 POWER, GAS AND COMMUNICATIONS

8.1 Power

No issues have been identified with supplying power to the site.

It is expected that a transformer will be needed for the retirement village. The proposed siting and normal protection safeguards for the transformer will be taken into account in the detailed design stage of the village.

8.2 Gas

Gas is available along both Ngataranga Road and Lake Road past the site.

No issues have been identified with supplying the site with gas.

8.3 Communications

No issues have been identified with supplying communication services to the site.

9 APPENDIX A - DRAWINGS

Drawing list

1. 035-RCT_401_C0-000 - Drawing Index and Location Plan
2. 035-RCT_401_C0-001 - General Arrangement
3. 035-RCT_401_C0-010 - Earthworks Contours - Existing
4. 035-RCT_401_C0-011 - Earthworks Contours - Proposed
5. 035-RCT_401_C0-012 - Earthworks Depth Contours
6. 035-RCT_401_C0-017 - Earthworks – Erosion and Sediment Control Plan
7. 035-RCT_401_C4-018 - Earthworks – Sediment Control Pond Details
8. 035-RCT_401_C4-019 - Earthworks – Erosion and Sediment Control Details
9. 035-RCT_401_C0-025 - Roads – Wesley St Widening - Plan
10. 035-RCT_401_C4-034 - Roads – Wesley St Widening – Sections
11. 035-RCT_401_C0-040 - Storm water Plan
12. 035-RCT_401_C4-050 - Storm water Detail – Outlet to Estuary
13. 035-RCT_401_C0-055 - Storm water – Overland Flow path
14. 035-RCT_401_C0-060 - Potable Water Plan
15. 035-RCT_401_C0-070 - Sewer Plan

APPENDIX C

Transportation Assessment Report, Commute Transportation (2015)



**Ryman Healthcare Retirement Village
Narrowneck, Auckland**

Transportation Assessment Report

18 November 2015





Suite 5, Level 1, 18 Broadway
Newmarket 1023
Auckland
www.commute.kiwi

Project: Ryman Healthcare Retirement Village
Report title: Transportation Assessment Report
Document reference: Narrowneck_Traffic_Assessment_Report_final
Date: 18 November 2015

Report Status	Prepared By	Reviewed By	Approved By
Final Report	G Norman 	L Hills 	L Hills 

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1. Introduction

This report addresses the transport planning implications of the proposed Ryman comprehensive care retirement village (“retirement village”) in Narrowneck, Auckland.

The 4.2ha site is located at 7- 37 Ngataranga Road, Narrowneck (“site”). This assessment considers the transportation effects of the proposed retirement village, comprising 195 Independent Apartments, 78 Assisted Living Suites, 40 Resthome rooms, 40 Hospital rooms and 40 Dementia rooms.

The site is zoned Residential 4B in the Auckland District Plan: Operative North Shore Section 2002 (District Plan).

This report assesses the transport-related matters of the proposal, including:

- A description of the site and its surrounding traffic environment.
- A description of the key transportation-related aspects of the proposed retirement village.
- The proposed form of access and egress.
- The adequacy of the proposed parking supply in relation to anticipated parking demands.
- The servicing arrangements that are proposed for the retirement village.
- The nature and expected volumes of vehicular traffic likely to be generated by the retirement village.
- The expected impact of the additional traffic flows on the surrounding road network.

These and other matters are addressed in detail in this report. By way of summary, this report concludes that the establishment of the proposed retirement village, as detailed in this report, can be undertaken in a way so that its effect on the function, capacity and safety of the surrounding road network will be minimal.

2. Existing Environment

Figure 1 is a map showing the site in relation to the surrounding area. The site is located in Narrowneck on Auckland's North Shore. Access is provided from Ngataranga Road, which connects to Lake Road. Lake Road is the primary north-south arterial providing access to Devonport, Cheltenham, Northhead and Stanley Point.

The site is located approximately 2km north of the Devonport Wharf along Lake Road. It is also approximately 4km southeast of the Takapuna town centre.

The area surrounding the site is mainly residential in nature with some recreational/open space land, in particular the Waitemata golf course to the southeast and the Ngataranga Park to the south.

The nearest shops are situated on the corner of Kawerau Avenue and Lake Road to the north of the site. The Belmont town centre is located approximately 800m north of the site, and is centred around the Bayswater Avenue/Lake Road intersection. A number of retail, business and restaurant amenities are available here.



Figure 1: Site location

2.1 The Transport Environment

The site is bound by Ngataringa Road to the north, Wesley Street to the west and Lake Road to the east. Ngataringa Road and Wesley Street are classified as local roads. Wakakura Crescent is a private road on the proposed site. Lake Road to the east is classified as a primary/regional arterial in the operative district plan.

Ngataringa Road intersects with Lake Road with a priority controlled (stop sign) intersection (Figure 2). A right turn bay is provided on the southbound Lake Road approach. Motorway access is 4.5km from the site heading North West, which is around a ten-minute drive outside of peak times. From this point, motorists can travel either north towards Whangarei or south towards the Auckland CBD.



Figure 2: Lake Road/Ngataringa Road intersection

The area served by Ngataringa Road is suburban residential in nature with a posted speed limit of 50km/h. The cross-section of Ngataringa Road, in the vicinity of the proposed retirement village, consists of a 8.5m wide carriageway made up of one traffic lane in each direction. Parking is permitted on both sides of the road.

2.1.1 Existing Vehicle Crossings

Vehicle access to the site currently occurs via three access points.

The first is provided on Ngataringa Road at the north-eastern corner of the site via an intersection between Wakakura Crescent (private internal access way) and Ngataringa Road. The access resembles a local road intersection but lacks any priority. The intersection is approximately 16m wide at the kerb line and provides 6m radii for turning into and out of the sight.

The second access point is situated at the western extent of the site on Wesley Street.

A third access point is provided directly onto Lake Road which currently provides access for 2 dwellings, and as proposed will only provide access to the B06 apartments.

2.2 Public Transport

Two bus services pass the proposed retirement village. The first, service 815, travels between Westwell Road and the Devonport ferry terminal. This service uses Ngataranga Road and has stops situated directly adjacent to the proposed retirement village. This service operates in the peak periods only.

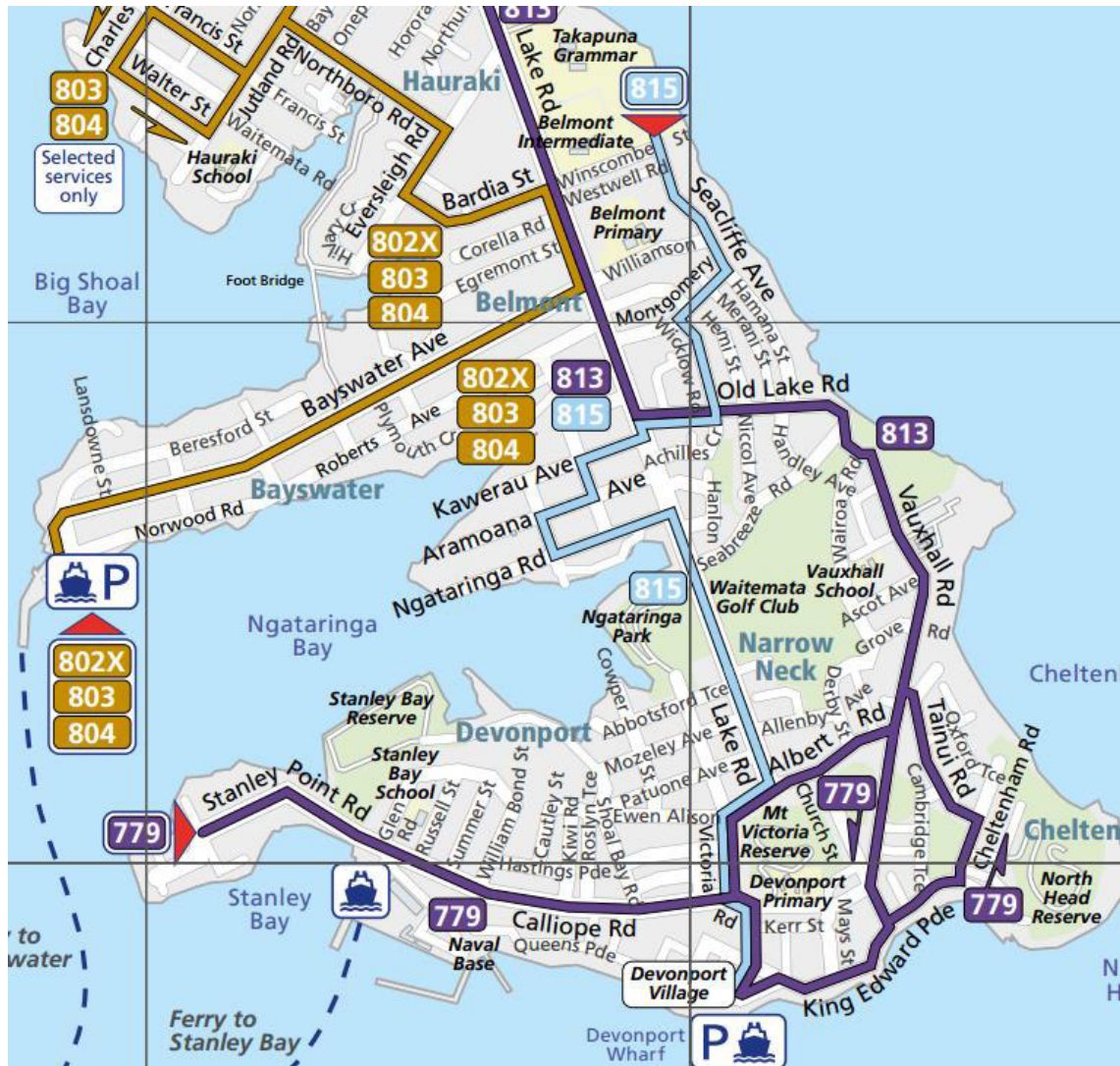


Figure 3: Public transport services

The second service, service 813, makes use of Lake Road providing connection between Devonport and Takapuna. This service makes use of Old Lake Road with a bus stop located approximately 300m north of the site. From Takapuna, passengers can connect with other services on the northern busway providing connection to the city centre. A southbound stop (for route 815 only) is located on Lake Road within 20m of the Ngataranga Road intersection. The closest northbound stop is approximately 300m north of the Lake Road / Ngataranga Road intersection. This service operates at a 15-minute frequency in the peak periods.

Ferry services are provided from both the Devonport and Bayswater wharves. Ferry services offer connection to the Auckland CBD at varying frequency throughout the day. Parking is provided at both locations.

The high frequency of services to the various destinations on offer means that public transport would be a viable option for travel to and from the retirement village.

Auckland Transport released the layout of the proposed changes to the public transport network for consultation in June/July 2015. Over 3000 submissions were received and the submission period is now closed. Decision is expected in early 2016. The proposed changes remove the services which make use of Ngataringa Road, but retain services along Old Lake Road. This means the closest services would be some 300m north of the proposed retirement village.



Figure 4: Proposed changes to the bus network

2.3 Existing Traffic Volumes

2.3.1 Daily Traffic

Traffic count data has been extracted from Auckland Transport for Ngataringa Road and Lake Road.

The following table summarises the average daily traffic (ADT) volumes recorded.

Street	Location	Date	5 Day Av	7 Day Av
Ngataringa Road	75m W Lake Road 50kph	17/06/2014	1139	1116
Lake Road	50m N Seabreeze Road 50kph	26/02/2014	18495	18243
Lake Road	50m S Hanlon Crescent 50kph	27/02/2013	18555	17907

Table 1: Average Daily Traffic Volumes (veh/day)

Table 1 shows that the most recent five-day ADT on Ngataringa Road is approximately 1,150 veh/day in both directions and the most recent five-day ADT on Lake Road is 18,500 veh/day in both directions.

2.3.2 Peak Hour Turning Counts

To obtain a more accurate and current snapshot of the relevant traffic volumes around the site, peak period traffic surveys were undertaken to measure traffic volumes using the intersection of Ngataringa Road/Lake Road.

The survey was undertaken during the morning and evening commuter peak periods of Thursday, 20 May 2015 (7-9am and 4-6pm) as well as the midday period of Saturday, 15 May 2015 (11-2pm). The observed peak hour traffic volumes are shown in the following Figures 3 to 5.

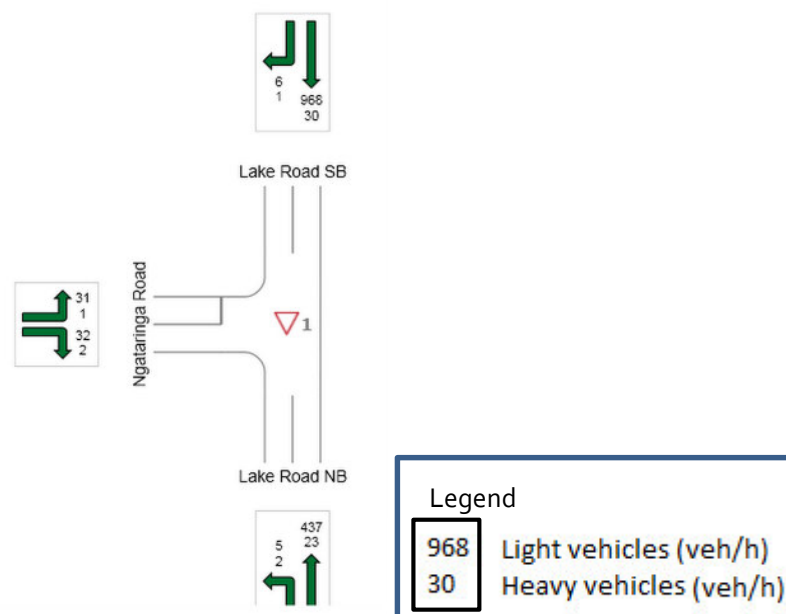


Figure 5: Weekday AM Peak Traffic (7-8am)

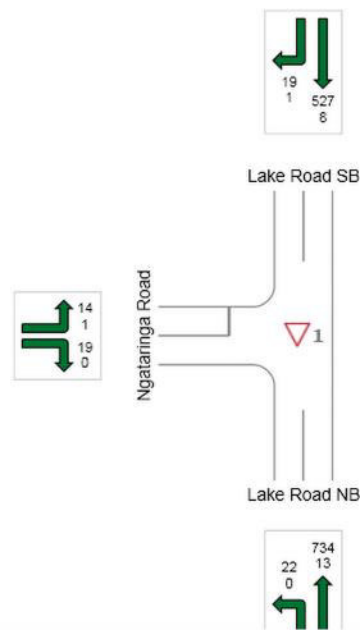


Figure 6: Weekday PM Peak Traffic (4-5pm)

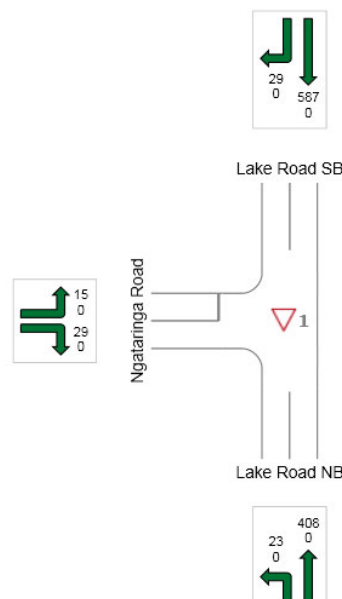


Figure 7: Saturday Middy Peak Traffic (12-1pm)

The busiest period was found to be between 7-8am during the weekday morning survey followed by the weekday evening peak and the Saturday Middy peak.

2.4 Road Safety

A search of the NZTA's Crash Analysis System (CAS) has been carried out to identify all reported crashes in the vicinity of the site during the five year period 2010 - 2014 inclusive. The search involved the following area



Figure 8: Crash Assessment study area

A collision diagram of crashes within the study area is provided in Figure 9. In the wider area, one accident occurred on Lake Road where a drunk driver lost control while travelling south near the Aramoana Avenue intersection. Three further minor injury crashes occurred at other intersections with a failure to give way as the cause.

The intersection between Ngataringa Road and Lake Road experienced one crash over the 5 year period. This was a rear end type crash, which resulted in no injuries.

Accordingly, it is concluded that there is no road safety deficiency that would in any way compromise, or be compromised by the proposed retirement village.

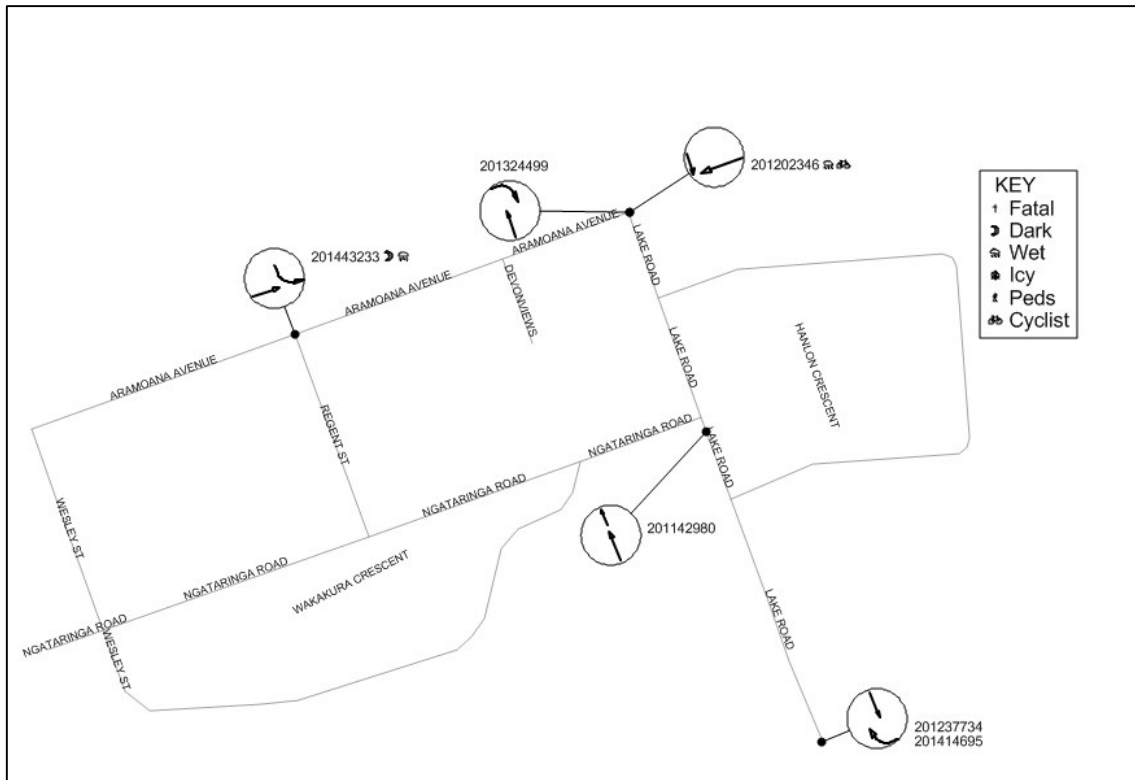


Figure 9: CAS collision Diagram

3. Proposal

The proposal is to develop a comprehensive care retirement village with six separate apartment buildings. The village will consist of the following:

- 195 Independent Apartments
- 78 Assisted living suites
- 120 care beds
- 245 internal parking spaces in buildings 1-6
- 24 external parking spaces (269 spaces in total)

Figure 10 shows the proposed layout of the site.



Figure 10: Retirement Village layout

4. Access

4.1 Access Driveways

As noted previously, the site currently has three formed access points to the adjacent road network. As shown in Figure 10, the proposal is to maintain the primary access via the existing vehicle crossing on Ngataringa Road.

Two secondary access points are proposed on Wesley Street.

A fourth crossing is provided on Lake Road serving 8 apartments which is not connected (in terms of vehicular access) to the main part of the site however internal resident connectivity is provided.

4.1.1 Ngataringa Road Access

The Ngataringa Road vehicle crossing will continue to operate as a two-way vehicle crossing, accommodating all turning movements. Photographs 1 and 2 below show the sight distance in both directions along Ngataringa Road.

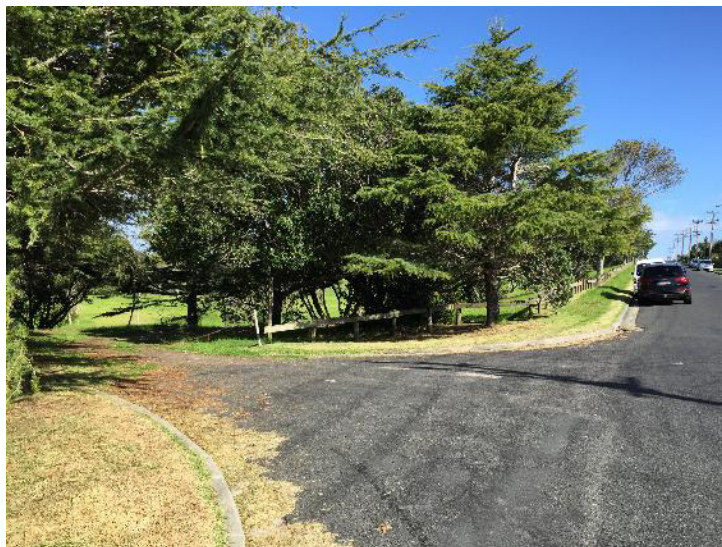


Photo 1: Proposed site access point on Ngataringa Road



Photo 2: Sight distance to the east from retirement village access, Ngataringa Road



Photo 3: Sight distance to the west from retirement village access, Ngataringa Road

The sight distance to the east has been measured at 125m, which exceeds the 40m required by the NZTA RTS 6 guideline for a high volume driveway on local road and an operating speed of 50km/h. The available sight distance to the southwest is in excess of 200m and therefore also easily meets RTS6 guidelines.

4.1.2 Wesley Street Accesses

4.1.2.1 *Wesley Street (general)*

Wesley Street has a carriageway width of approximately 4m, which widens at the Ngataringa Road intersection and at the cul-de-sac end. Wesley Street drops away from Ngataringa Road and reaches a maximum gradient of 18% for a short stretch before levelling out at the cul-de-sac. The width of the carriageway effectively means a 50m stretch operates as a one-way lane. In the existing situation, this section provides for limited dwellings so this operates without issue. With the proposed retirement village, additional traffic will be added to this stretch of Wesley Street.

As a result, Wesley Street is proposed to be widened to accommodate two-way traffic. The Auckland District Plan: North Shore section recommends a local street to have a minimum carriageway width of 8.0m. Wesley Street is proposed to be widened to 8.0m carriageway (plus a new footpath), with additional width provided within road reserve.

From Section 5, Wesley Street is expected to cater for an additional 250 vehicles per day (vpd) associated with the retirement village. Overall, with the existing three dwellings, Wesley Street will therefore cater for approximately 300 vpd. This level of traffic is well within a local street capacity with an 8m carriageway which can cater for volumes near 5,000 vpd.

4.1.2.2 Village access

A secondary 5.5m wide access to the retirement village is situated towards the southern end of Wesley Street within the cul-de-sac head as seen in Photograph 4. As a result, no sight distance issues will arise from this access point as it is at the end of a cul-de-sac road. The existing area provided for vehicle turning at the southern end of the cul-de-sac will be maintained.



Photograph 4: Looking south on Wesley Road towards turning area

4.1.2.3 Building B04 access

Building B04 will have accesses onto Wesley Street via a 5.5m wide vehicle crossing. This connection occurs 30m south of the Wesley Street/Ngataringa Street intersection as shown in Photograph 5.



Photograph 5: Looking south on Wesley Road on mid-section

In terms of sight distance, clear lines of sight are achieved in the northern direction (30m) to the Wesley Street / Ngataranga Street intersection and to the end of cul-de-sac (60m) in the southern direction.

Given the nature of Wesley Street, the speed environment is likely to be less than 40km/h. For a low volume (less than 200 movements per day) access on a local road at 40km/hr, a sight distance requirement in terms of NZTA RTS 6 guideline of 30m is required. This is met in both directions.

The District Plan (12.4.2.8) outlines requirements for spacing of a vehicle crossing from an intersection. Given Ngataranga Road is a local road; the driveway needs to be spaced at least 25m from the intersection. As the vehicle crossing is 30m south of the intersection between Wesley Street and Ngataranga Road, this requirement is met.

4.1.2.4 Lake Road access (Bo6)

The proposed retirement village includes a minor access point onto Lake Road. This access provides for 8 apartments and 10 parking spaces. The access point is situated at the southern extent of site adjacent the current pedestrian path.

An existing vehicle crossing is provided at 29 Lake Road (Photograph 6). This will be removed as part of the work and relocated against the southern extent of the property. The proposed crossing is 6.5m wide at the property boundary.

The sight distance to the north and south has been measured at over 200m, which easily exceeds the 115m required by the NZTA RTS 6 guideline for a low volume driveway on an arterial road and an operating speed of 60km/h.



Photograph 6: Current vehicle crossing on Lake Road

4.2 Internal Road Layout

The proposed retirement village will create a new (private) internal road network as shown in Figure 10. The main access way through the site has a maximum grade of 10%, and a minimum width of 5.5m which provides for two-way access, while moderating vehicle speeds. These dimensions are in accordance with the recommended movement lane dimensions of a 'live and play' land use is a suburban area - primary access to housing contexts contained in NZS4404:2010 Land Development and Subdivision Infrastructure. These dimensions have been used extensively at other similar Ryman Healthcare sites around New Zealand without issue.

Appendix A1 shows 90th percentile cars tracking through the site without difficulty. Overall, it is considered that the internal access way network will provide a high level of convenience for residents and staff, and will be simple for visitors and staff to negotiate.

4.3 Other Road Users

4.3.1 Private Village pedestrian network

Pedestrian access to and within the village for staff and visitors will be provided in a number of locations around the proposed site. On Ngataringa Road, two pedestrian access points will be provided (one at the main vehicle entrance and one near the middle of the site). Private pedestrian access will be provided via the Wesley Street vehicle access.

A private pedestrian path is currently provided between the site and Lake Road along the southern boundary of the site as shown in Photograph 7. This private connection is intended to be retained as part of the proposed village.



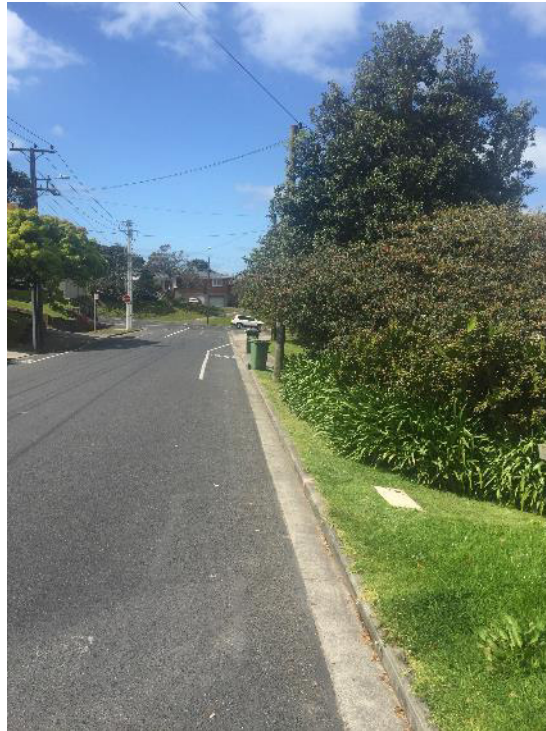
Photograph 7: Private pedestrian path connection to Lake Road

As shown in Figure 10 there is an extensive footpath network planned for the site. The connections from the site to the surrounding footpath network create good connectivity for pedestrians.

4.3.2 Public footpath network

Pedestrian access for residents of the village around the site is good. Footpaths are generally provided on both sides of the surrounding roads with the exception of the Ngataringa Road frontage where no footpath is provided. This is not considered to be required as the proposed retirement village will not front Ngataringa Road itself. Pedestrian footpaths are provided onsite to cater for movement east-west across the site and allow access to Ngataringa Road adjacent to the proposed vehicle access.

In this regard, there is a short 35m gap in the existing footpath on the south side of Ngataringa Road east of the subject site entrance. Photograph 8 shows this gap. It is recommended that a footpath be provided in this location linking the subject site with Lake Road and has been included in the village plans.



Photograph 8: Section of no footpath on Ngataranga Road

Currently a bus stop is situated on the southern side of Ngataranga Road along the proposed site frontage. No footpaths are provided on either side of this stop. As discussed in Section 2.2, Service 815 that uses the stop as present is not included in the recently consulted new network. If the bus stop is retained on Ngataranga Road, a pedestrian connection to the stop is recommended as per Figure 11.

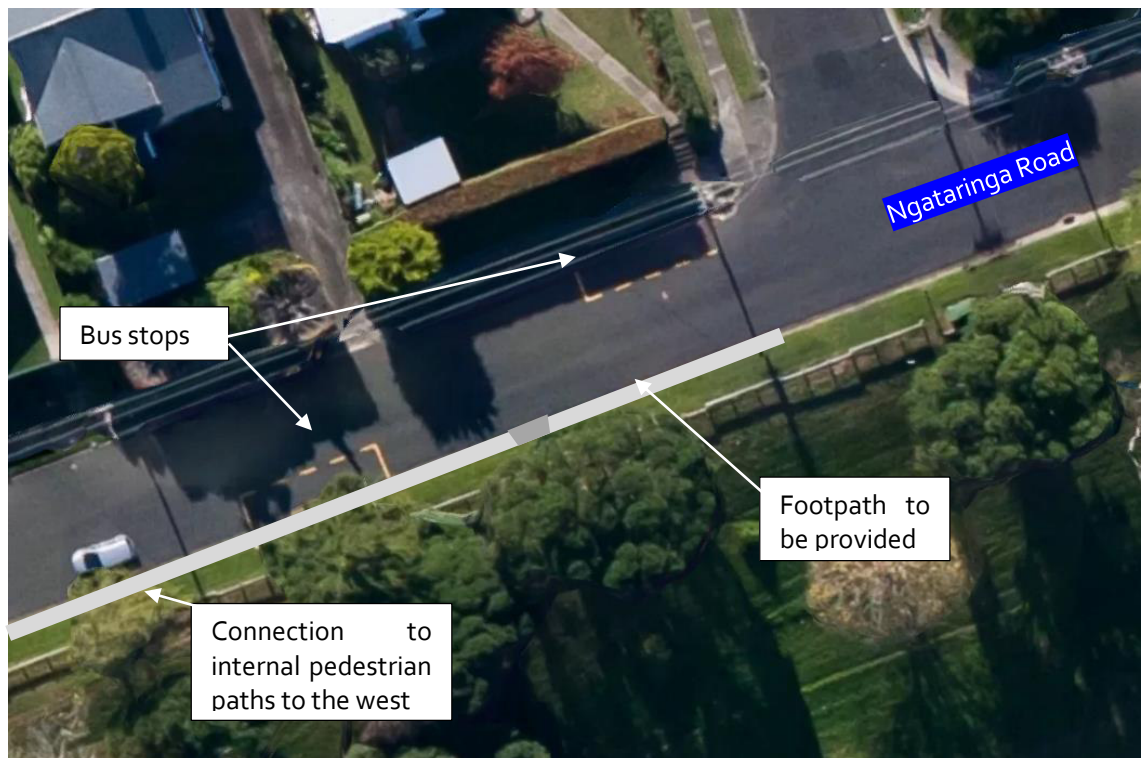


Figure 11: Proposed changes around Ngataranga Road Bus stops

For staff and visitors, the site is within easy walking distance of a group of shops on Lake Road. Access to these shops will be via Lake Road and the existing pedestrian crossing point north of Kawerau Avenue directly north of the site.

Overall, subject to the improvement outlined above, public pedestrian amenities surrounding the site are good and nothing about the proposed retirement village will compromise pedestrian safety.

5. Traffic effects

5.1 Anticipated Trip Generation (Policy)

The current zoning of the site is Residential 4B in the Operative District Plan. Within this zone, residential activities are considered a permitted activity with a development density of 450sqm per unit. This can be reduced to 400sqm per unit (as a controlled activity) for developments of three or more units.

The total site of the proposed retirement village is approximately 4.2ha in size. Based on previous experience with residential subdivisions accounting for topographical features, a total of 20% can be reasonably considered to be removed from the site to accommodate private road reserves and open spaces. As such, approximately 3.36ha or 33,600sqm of site area could be retained for building sites. Based on one dwelling per 450sqm lot (permitted activity), this equates to 75 dwellings that could be subdivided on the site under the current Residential 4B zoning as a realistic development scenario. This is considered a very conservative number of dwellings as the site lends itself to an apartment scheme with a significantly higher number of dwellings.

Trip rates for urban residential units in New Zealand have been extensively researched in the RTA “Guide to Traffic Generating Developments”. The research confirms a residential traffic generation rate of 9 trips per unit per day. Table 2 below shows the expected trips from typical residential unit developments:

Dwelling	Daily trip rate	Peak hour	Daily trips	Peak hour trips
75 (anticipated)	9 per unit	0.85 per unit	675	63

Table 2: Anticipated Residential Development Trip Generation

The current zoning of the site therefore anticipates the site would generate 675 vehicle movements per day and 63 vehicle movements per hour. This is considered a realistic development scenario for the site.

5.2 Proposed Trip Generation

Trip rates for the proposed retirement village activities have been researched from the New South Wales (NSW) Roads and Traffic Authority Guide to Traffic Generating Developments (RTA) and the NZTA research reports, as well as from empirical data surveyed at other Ryman Healthcare sites in New Zealand.

The RTA guide notes the following rates for housing for aged and disabled persons which are considered applicable:

- Daily vehicle trips 1-2 per dwelling
- Weekday peak hour vehicle trips 0.1 - 0.2 per dwelling.

The expected trip generation of retirement villages is also reported in the Transfund New Zealand Research Report No. 210¹ with survey data from 10 rest home sites. Of these sites, the Birchleigh Retirement Village in Dunedin (listed as Sites 255 to 257) is

¹ Douglas, M., McKenzie, D. 2001. Trips and Parking Related to Land Use. Volume 2: Trip and Parking Surveys Database. Transfunds New Zealand Research Report 210.

established in a similar manner to the subject site whereby it consists of townhouse units (comparable to independent apartments), serviced rooms (assisted living suites) and rest home beds (care beds and care suites). For the Birchleigh Retirement Village, the townhouse units showed daily traffic generation rate of 1.4 resident trips, 0.5 visitor trips and 0.1 service trips per unit (2.0 in total).

The serviced rooms and rest home beds generated 0.6 visitor trips, 0.6 staff trips and 0.3 service trips per day. These are similar in quantity to the RTA rate and are considered appropriate for the subject site.

Notably, these rates have been used and accepted in numerous resource consent applications throughout New Zealand for similar Ryman comprehensive retirements villages, including villages in Whangarei, Orewa, Auckland, Tauranga, Wellington and Christchurch. In particular Auckland Council have recently accepted these rates for Ryman retirements villages in both Birkenhead and Campbell road (Greenlane).

Accommodation	Trips per day per unit	Total units at proposed site	Total trips per day
Independent apartments / townhouses	2.0 resident and visitor trips	196	390
Assisted living suites / care beds / care suites	0.6 visitor trips	198	119
	0.6 staff trips		119
	0.3 service trips		59
Total			687

Table 3: Trips Generated by Proposed Retirement Village

As shown in Table 3, a total of 687 vehicle trips can be expected to be generated by the retirement village per day. This equates to approximately 1.75 trips per unit and therefore lies towards the upper trip generation rate recommended for the assessment of traffic generation effects by the RTA Guide.

It is therefore observed that the 687 vehicles per day (vpd) projected trips associated with the proposed retirement village will be similar to the 675 vpd that could potentially be generated by a realistic residential development on the proposed site. This correlates to around 69 trips in the peak hour.

As the site would generate over 100 vehicles per day (with either the proposed retirement village or under a realistic residential development scenario), it would also be classified as a Limited Discretionary Activity as outlined in section 12.4.1.2 of the District Plan. As such, according to the requirements of the District Plan, it would be required to avoid, remedy or mitigate any adverse effects on the nearby intersection performance, accident rates and link capacity. Accordingly, an additional assessment of the effects of traffic generated by the retirement village has been undertaken in sections 5.3.

5.3 Traffic Distribution and Effects

Given the site is located between the main centres of Devonport (south) and Takapuna (north) it is expected that traffic generated by the retirement village will be split between the north and south direction. Given the nature of the topography all traffic is expected to travel east on Ngataranga Road before turning onto Lake Road.

Traffic surveys of the Ngataranga Road / Lake Road intersection suggest turning movements to / from Ngataranga Road from Lake Road were split nearly evenly between right and left turning movements (ie 50% to / from the north and 50% to/from the south).

The site itself has four access points to the local network, the main access via direct connection to Ngataranga Road, two further access points are provided via the cul-de-sac Wesley Street, and a minor access is proposed directly onto Lake Road (provides for 10 parking spaces and 8 units) which is not connected to the internal road network. Traffic has been distributed between access point based on the portion of car parking which each access serves.

The southern access point on Wesley Street will be used by residents that are situated in B03. Parking associated with B04 will use Wesley Street as this is the buildings sole access point. Building B06 provides direct access to Lake Road, so all associated movement will use this access point.

The assumed village traffic distribution is set out in Figure 12. Survey information from other Ryman villages indicate a 50% split between vehicles entering the site and vehicles exiting the site within peak periods. This accounts for staff arriving and residents leaving in the morning and staff leaving and residents arriving in the evening.

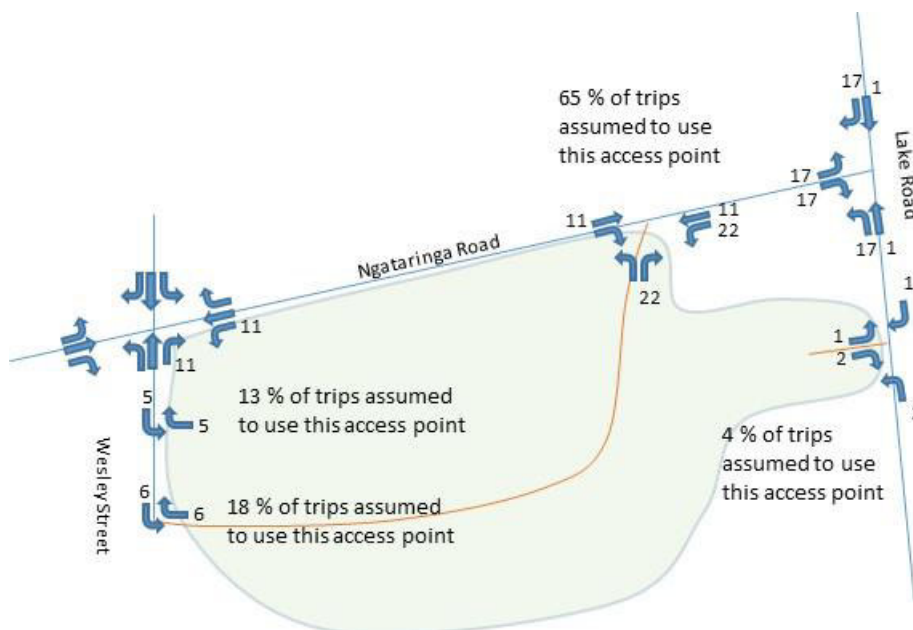


Figure 12: Distribution of retirement village traffic (all peaks)

The following assumptions have also been made:

- (i) A nominal amount of trips will have origins or destinations in the immediate surrounding area west of the site.
- (ii) All trips generated from the main part of the village use Lake Road/Ngataranga Road intersection.

- (iii) The Entry / Exit volume ratio for both morning, evening and Saturday peak has been assumed to be 50:50 to account for staff arriving and residents leaving in the morning and staff leaving and residents arriving in the evening.

The trip distribution assumptions are considered to represent a worst case with all traffic assumed to make use of the Ngataranga Road/Lake Road intersection. Given the road network in the area, a number of alternative routes (as shown in Figure 13) are available should the Ngataranga Road/Lake Road become congested during peak time.

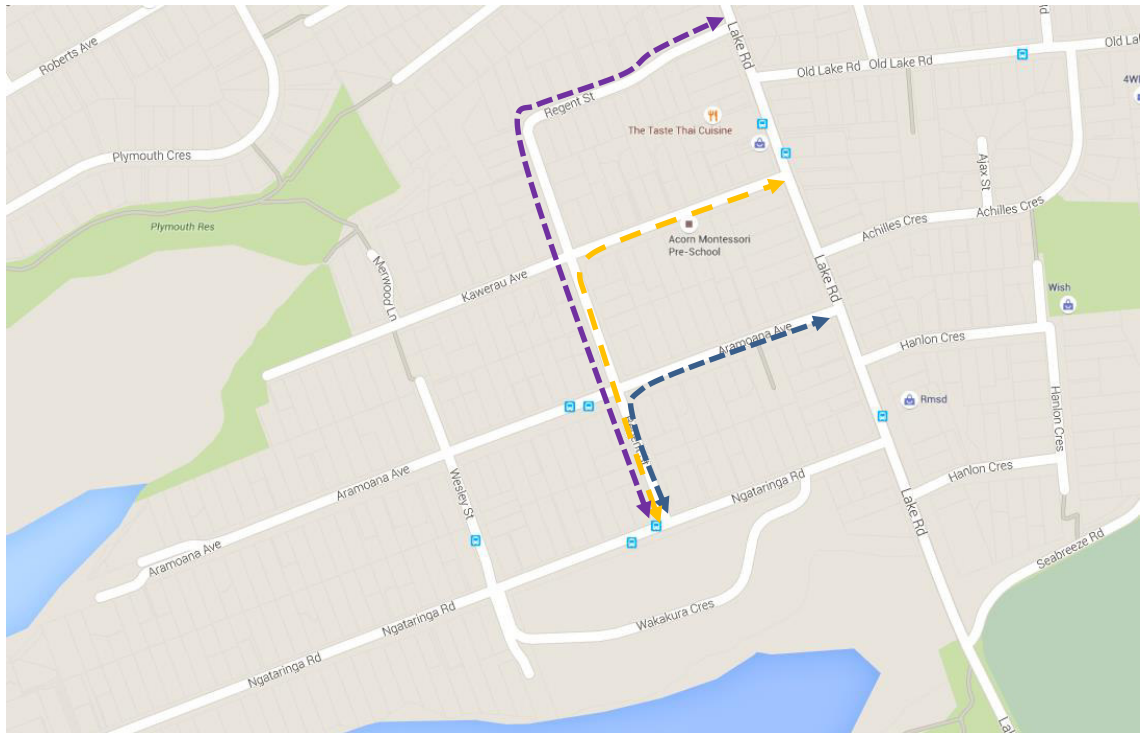


Figure 13: Alternative routes available

5.3.1 SIDRA Intersection Modelling

The performance of the Ngataranga Road/Lake Road intersection has been modelled using SIDRA Intersection 6.0 (Sidra), an industry standard tool for assessing the performance characteristics of intersections and road networks. Assessments of the proposed weekday morning, evening and Saturday midday peak hours were carried out using surveyed traffic flows. Full turning counts were undertaken at the Ngataranga Road / Lake Road intersection on the 20th May 2015 (weekday) and the 16th May 2015 (weekend). The models have been calibrated to the existing observed queue / delay as well as observations relating to platooning (particularly related to the traffic signals and pedestrian crossing to the north).

The Sidra results presented below include the average delay, level of service (LOS)^[1] and the 95th percentile queue length for each turning movement at the Ngataranga Road/Lake Road intersection during all three peak periods.

^[1] LOS for the intersection has been calculated using the HCM 2010 (Transportation Research Board. 2010. *Highway Capacity Manual*. Washington D.C.: Transportation Research Board.) method, as a function of delay; according to the Sidra Output Guide LOS A and B are very good and indicative of free-flow conditions; C is good; D is acceptable; and E and F are indicative of congestion.

5.3.1.1 Weekday Morning Peak Period

The surveyed base turning volumes and the anticipated traffic volumes as a result of the retirement village are shown in Figure 14.

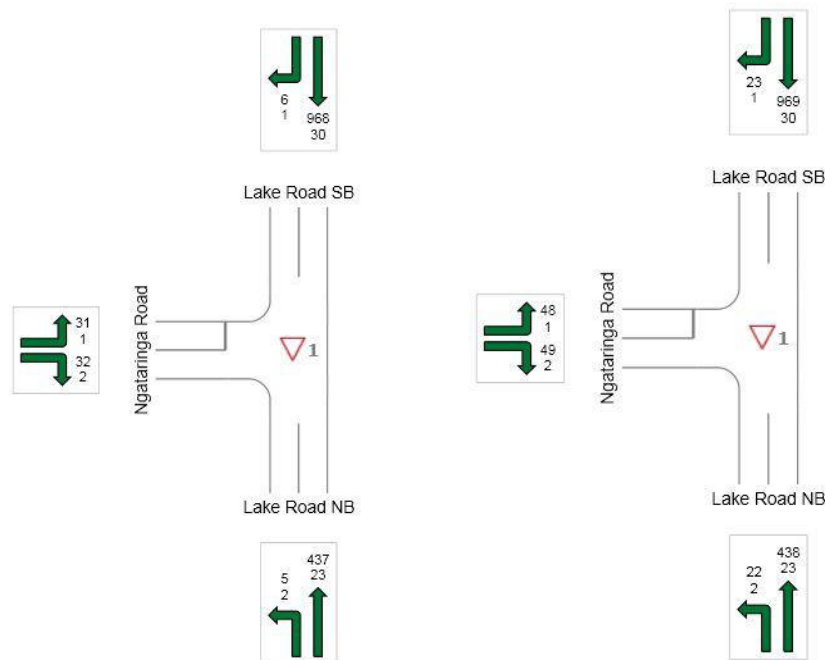


Figure 14: Weekday AM Peak turning counts for Base (left) and proposed retirement village (right)

Table 4 shows the Sidra results for the surrounding road network performance during the weekday morning peak period for the base traffic scenario. Table 5 provides the Sidra results for the proposed retirement village scenario.

Leg	Turning Movement	Average Delay (sec)	Level of Service	95 th Percentile Back of Queue (m)
Lake Road northbound	Left	4.8	A	0
	Through	0	A	0
Lake Road southbound	Through	0.2	A	0
	Right	7.5	A	0.2
Ngataranga Road	Left	10.1	B	1.1
	Right	41.9	E	7.0

Table 4: Weekday Morning Peak – Base scenario Sidra Results

Leg	Turning Movement	Average Delay (sec)	Level of Service	95 th Percentile Back of Queue (m)
Lake Road northbound	Left	4.6	A	0
	Through	0	A	0
Lake Road	Through	0	A	0

southbound	Right	7.3	A	0.7
Ngataranga Road	Left	10.1	B	1.7
	Right	47.8	E	11.1

Table 5: Weekday Morning Peak –Proposed retirement village scenario Sidra Results

The intersection operates well in the base scenario with minor delay associated with turning movements with the exception of the right turn movement out of Ngataranga Road. The right turn movement operates with a LOS E with a 95th percentile queue of 7m or one vehicle. Vehicles undertaking this movement have an average delay of 42 seconds.

As the proposed village traffic is added, the intersection remains operating within capacity. Again, the right turn from Ngataranga Road is critical and experiences an increase in delay of 6 seconds and an increase to 95th percentile vehicle queues to between 1-2 vehicles.

5.3.1.2 Weekday Evening Peak Period

The surveyed base turning volumes and the anticipated traffic volumes as a result of the retirement village are shown in Figure 15.

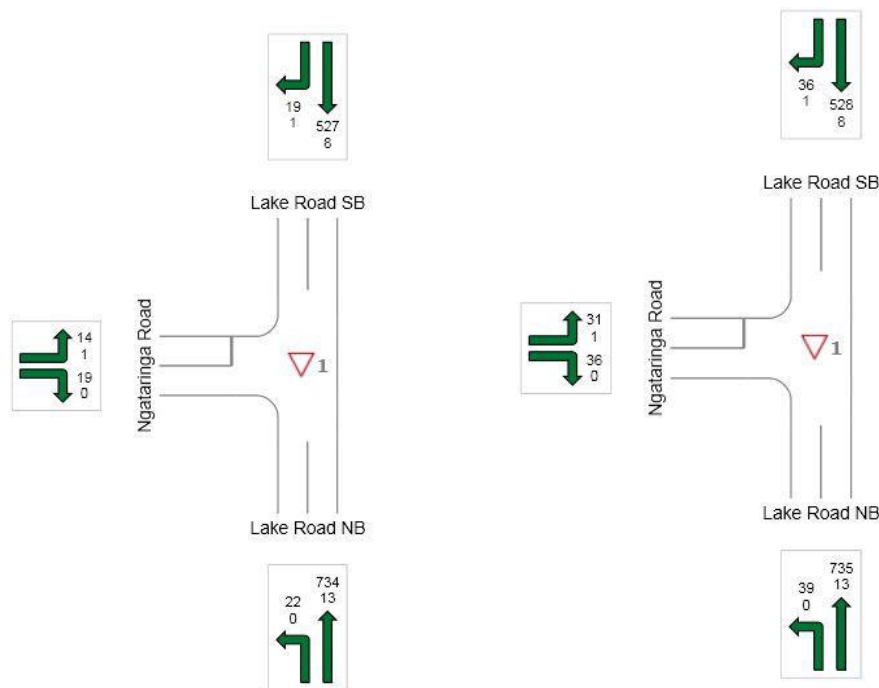


Figure 15: Weekday Evening Peak turning counts for Base (left) and development (right)

Table 6 shows the Sidra results for the surrounding road network performance during the weekday morning peak period for the base traffic scenario. Table 7 provides the Sidra results for the proposed retirement village scenario.

Leg	Turning Movement	Average Delay (sec)	Level of Service	95th Percentile Back of Queue (m)
Lake Road northbound	Left	4.6	A	0
	Through	0.1	A	0

Lake Road southbound	Through	0	A	0
	Right	10.7	B	0.9
Ngataranga Road	Left	13.8	B	0.8
	Right	25.4	D	2.3

Table 6: Weekday Evening Peak – Base scenario Sidra Results

Leg	Turning Movement	Average Delay (sec)	Level of Service	95 th Percentile Back of Queue (m)
Lake Road northbound	Left	4.6	A	0
	Through	0.1	A	0
Lake Road southbound	Through	0	A	0
	Right	10.8	B	1.7
Ngataranga Road	Left	13.5	B	1.7
	Right	27.7	D	4.7

Table 7: Weekday Evening Peak – Proposed retirement village scenario Sidra Results

The intersection operates well in the base scenario with minor delay associated with turning movements. Turning movements into and out of Ngataranga Road are critical and vehicles undertaking this movement experience small amounts of delay and minor (less than one vehicle) queuing.

As the proposed village traffic is added, the intersection remains operating within capacity. Again, the right turn from Ngataranga Road is critical and experiences a slight increase in delay. The movement remains within capacity and the vehicle queuing reflects a single vehicle waiting at the stop line.

The effects of the additional traffic on the operation of the intersection are minimal.

5.3.1.3 Saturday Midday Peak Period

The surveyed Saturday peak hour (12pm-1pm) turning volumes and the anticipated traffic volumes as a result of the proposed retirement village are shown in Figure 16.

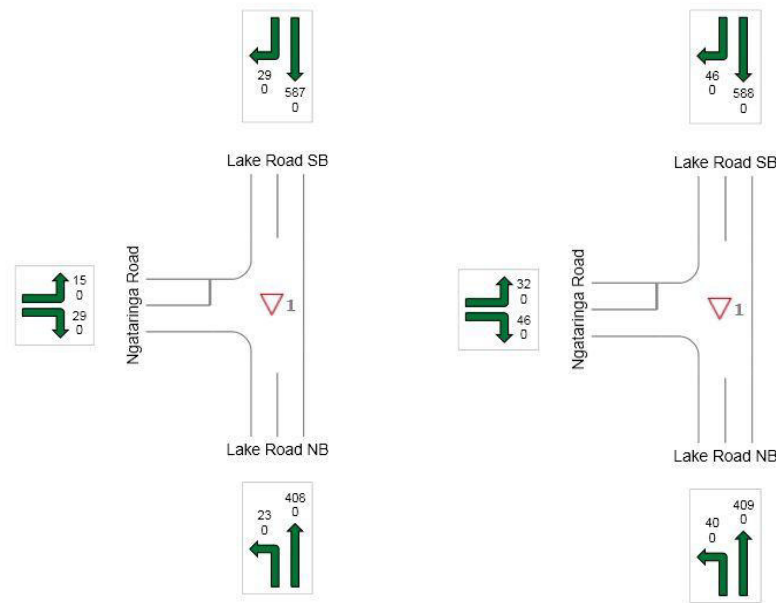


Figure 16: Weekend peak turning counts for Base (left) and proposed retirement village (right)

Table 8 shows the Sidra results for the surrounding road network performance during the weekend peak period for the base traffic scenario. Table 9 provides the Sidra results for the proposed village scenario.

Leg	Turning Movement	Average Delay (sec)	Level of Service	95 th Percentile Back of Queue (m)
Lake Road northbound	Left	4.6	A	0
	Through	0	A	0
Lake Road southbound	Through	0	A	0
	Right	6.7	A	0.8
Ngataranga Road	Left	9.4	A	0.4
	Right	16.8	C	2.1

Table 8: Weekend (Saturday) Peak – Base scenario Sidra Results

Leg	Turning Movement	Average Delay (sec)	Level of Service	95 th Percentile Back of Queue (m)
Lake Road northbound	Left	4.6	A	0
	Through	0	A	0
Lake Road southbound	Through	0	A	0
	Right	6.9	A	1.2
Ngataranga Road	Left	9.5	A	1.0
	Right	17.5	C	3.5

Table 9: Weekend (Saturday) Peak –Proposed retirement village scenario Sidra Results

The SIDRA assessment indicates the intersection is operating well in the weekend peak period with minimal delay to all vehicles. Site observations during the survey period indicated the presence of large vehicle queues on Lake Road in the northbound direction. The queue was observed to frequently block back through the Ngataranga Road intersection. While this is not reflected in the intersection modelling, this did not necessarily effect the delay experienced by vehicles turning onto Lake Road from Ngataranga. As traffic was frequently queued past the intersection, driver courtesy allowed vehicles from Ngataranga to turn onto Lake Road with minimal delay. As such, the SIDRA model is considered to accurately reflect the operation of the intersection.

As the proposed village traffic is added, the intersection remains operating within capacity. Again, the right turn from Ngataranga Road is critical and experiences a slight increase in delay. The movement remains within capacity and the vehicle queuing reflects a single vehicle waiting at the stop line. While queues on Lake Road are expected to continue due to upstream constraints, this will ensure traffic is slow moving and gaps are provided for vehicles wanting to turn out of Ngataranga road.

The effects of the additional traffic on the operation of the intersection are minimal.

5.3.2 Effects Discussion

Considering the Sidra results above, it is considered that the nearby critical intersection of Lake Road / Ngataranga Road will operate efficiently with the addition of the retirement village traffic. The additional traffic generated by the retirement village adds no more than 5% to each peak period which ensures any increase in delay is minimal.

Right turning vehicles out of Ngataranga Road onto Lake Road (particularly during AM peak hour) may experience delays of up to a maximum of 48 seconds (6 seconds more than existing) during the morning peak. The 95th percentile back of queue is around one to two vehicles. This level of increase in delay is considered minimal especially as the analysis assumes all generated traffic use this intersection when there are a number of other routes available.

In terms of impact on Lake Road the retirement village is expected to add approximately 35 vehicles per hour to any one section of Lake Road (being split 50/50 at Ngataranga Road intersection) and thus will add approximately 3-4% to Lake Road traffic. It is important to recognise that the proposed village, while providing increased dwelling numbers from the currently vacant site, due to the nature of the activity, will generate a similar level of traffic when compared with likely use of the land.

Village residents are likely to avoid peak travel periods, as their trips tend to be flexible in nature. Further, Ryman Healthcare also schedules staff shift times to avoid peak traffic periods. This will further reduce the need for travel during the peak commuter periods.

Overall the village proposal will cause minimal traffic / transportation effects to Lake Road and the surrounding road network.

6. Parking

6.1 Operative District Plan

The following minimum parking requirements of the Operative North Shore Section of the Auckland Council District Plan are considered applicable to the proposed retirement village:

Table 12.1 Parking Standards	
Activity	Parking Spaces Required
Housing for the Elderly and Disabled Means 10 or more residential units designed specifically to meet the needs of elderly or people with disabilities, and which are occupied by elderly or persons with disabilities and their spouses. (Developments of less than ten units fall outside this definition, come under the definition for residential units, and are thus subject to the rules for residential units applying in the relevant zone).	One for every three units
Rest Home Means premises for the care of the elderly but does not include a hospital.	One for every five people the facility is licensed to accommodate, plus one for every two employees
Retirement Complex Means a comprehensive residential development including housing, recreation, welfare or medical facilities which is intended principally or solely for elderly or retired persons.	One per unit, plus one per four units (all other uses to be assessed separately)

Table 10: District Plan Parking Rates

The proposal includes a mix of care beds, assisted living suites and one to three bedroom apartments. It is considered that for carparking purposes, the care beds and assisted living suites are most closely classified as either 'Housing for the Elderly and Disabled' or 'Rest Home'. The parking rate for 'Housing for the Elderly and Disabled' activities is considered arbitrary compared to the more comprehensive parking rates for 'Rest Home' activities. The 'Rest Home' parking rate results in a slightly higher number of required spaces so has therefore been used in this assessment. This result is based on care rooms and assisted living suites having a known occupancy of 1 person per room.

The retirement village will have approximately 50 staff at any one time.

The independent apartments are considered to all fit under the 'Retirement Complex' classification. It is considered that the 'plus one (park) per four units' applies to the visitor parking requirement.

The District Plan parking requirements are summarised in table 11 below.

Activity	Unit Type	Number of Units	Occupants	Parking Rate	Required Number of Car Parks
Rest Home	Assisted living suites	78	78	1 per 5 occupants	16
	Care beds	120	120		24
	Staff	-	50	1 per 2 staff	25
Retirement Complex	Independent Apartments	195	-	1.25 per unit	244
	Total	394			309

Table 11: District Plan Parking Requirements

As shown above, the District Plan requires the provision of 309 car parks. As 245 spaces will be provided in the internal car park areas and a further 24 spaces provided on grade, the proposal will have a shortfall of 40 spaces (269 spaces vs 309) in parking spaces compared with the District Plan.

6.2 Proposed Unitary Plan

The proposed Auckland Unitary Plan will eventually replace the 13 existing district and regional plans in Auckland. It was notified for public submission on the 30th of September 2013, with submissions closing 25 February 2014. The PAUP hearings are almost completed with the Panel recommendations and Council's decision expected mid-2016. It is likely that parts of the plan will become operative next year.

The proposed Unitary Plan includes parking requirements that are applicable to all of Auckland. The proposed site is zoned Single House which results in the following parking rates:

Activity	Parking Rate
Retirement village	0.7 per unit / apartment plus 0.2 visitor space per unit / apartment plus 0.3 per bed for rest home beds within a retirement village

Table 12: Proposed Unitary Plan Parking Rates

Applying the proposed Unitary Plan parking rates to the proposed retirement village results in the following number of parks required:

Unit Type	Number of Units	Parking Rate	Required Number of Car Parks
Assisted living suites	78	0.3 per bed	23
Care beds	120		36
Independent Apartments	195	0.7 per unit / apartment	137
		0.2 visitor space per unit / apartment	39
Total	394	-	235

Table 13: Proposed Unitary Plan Parking Requirements

As shown above, the proposed Unitary Plan requires the provision of 235 car parks. As 269 spaces will be provided on-site, the proposal will exceed this requirement by 34 spaces. However, it is important to note that the proposed Unitary Plan is only at the submission phase and the rules / standards relating to parking requirements do not have legal effect.

6.3 RTA Demand

For comparison purposes, the RTA Guide has again been used to estimate actual parking demand. The RTA Guide recommends the following parking requirements for housing for the aged:

Activity	Parking spaces required
Self-contained unit	2 spaces per 3 units (residential) and 1 space per 5 units (visitor)
Hostels/nursing	1 space per 10 beds and 1 space per 2 employees

Table 14: RTA Parking Rate

It is considered that all independent apartments within the proposal are classified as 'self-contained units' and all assisted living suites, care suites and care beds are classified as 'hostels/nursing' activities.

The RTA Guide requirements are summarised in Table 15 below:

Use	Number	RTA specification	Number of parks required
Proposed Retirement Village			
Apartments	195	2/3 units (residential)	130
		1/5 units (visitors)	39
Assisted living suites	78	1 space per 10 beds	8
Care beds	120	1 space per 10 beds	12
Staff	50	1 space per 2 employees	25
Total for Site			214

Table 15: RTA Parking Requirements

As shown above, the RTA Guide recommends providing a minimum of 214 parking spaces to meet the expected parking demand. This requirement is exceeded by 55 spaces with the 269 provided.

6.4 Parking Provision

A total of 269 parking spaces are proposed to be established on-site which exceeds the, proposed Unitary Plan and RTA Guide recommendations and is 41 spaces less than the District Plan requirement. The number of parks provided on site is based on a ratio per unit type that has been successfully implemented at other Ryman villages throughout New Zealand; this being one parking space per apartment, one parking space per five assisted living suites / care beds and one parking spaces per two members of staff. The rate is also as per recently Auckland Council approved Ryman villages in Birkenhead and Greenlane.

The actual allocation of car parks to different users, such as residents, staff and visitors, will be the responsibility of the retirement village management. This will ensure the parking requirements of each user group are appropriately catered for and parking is used efficiently. Accordingly, it is considered that users of the site can be contained on-site and will not be required to park on-street and thus there will be no off-site parking effects.

7. Parking Dimensions

7.1 Basement Parking Dimensions

Each of the five main buildings contains basement car parks. Car parking dimensions and manoeuvrability has been designed in accordance with AS/NZS 2890.1:2004. Each parking space is 2.5m wide and 5.4m deep and therefore requires 5.8m manoeuvring space as recommended in AS/NZS 2890.1:2004, the New Zealand standard for off-street car parking.

A summary of key dimensions for each parking area have been outlined below with comparison against the District Plan requirements and AS/NZS 2890.1:2004 standards.

Building	General dimensions	District Plan requirements	AS/NZS 2890.1:2004
Building B01	2.4/2.5m stall width, 5.4m stall depth and 5.8m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Meets requirements for user class 1A/2: staff and medium/long term parking
Building B02	2.5m stall width, 5.4m stall depth and 6.1m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Exceeds requirements for medium/long term parking
Building B03	2.5m stall width, 5.4m stall depth and 6.1m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Exceeds requirements for medium/long term parking
Building B04	2.5m stall width, 5.4m stall depth and 6.1m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Exceeds requirements for medium/long term parking
Building B05	2.5m stall width, 5.4m stall depth and 7.19m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Exceeds requirements for medium/long term parking

Building B06	2.5m stall width, 5.4m stall depth and a minimum of 6.2m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Exceeds requirements for medium/long term parking
External car parking spaces outside B02/03	2.5m stall width and 5.4m stall depth and 7.15m manoeuvring space	Complies	Meets requirements for casual users
External car parking spaces outside B01	2.5m stall width and 5.4m stall depth and 6.2m manoeuvring space	Does not comply: 2.5m spaces require 4.9m depth and 7.9m manoeuvring space	Exceeds requirements for medium/long term parking
External spaces outside B01 30 degree angle spaces	2.5m stall width, 5.4m stall depth and 4.4m manoeuvring space	Complies	Meets requirements for casual users

Table 16: Assessment of parking dimensions

AS/NZS 2890.1:2004 recommendations differ to the District Plan, which states that 2.5m wide parking spaces require a depth of 4.9m and an aisle width of 7.9m. The equivalent total depth of two parking spaces and an aisle using North Shore dimensions is 17.7m whereas AS/NZS 2890 requires 2.5m wide parking spaces to be 5.4m long with an aisle width of 5.8m, equating to a total depth of 16.6m. This means that the specified total depth provided falls short of the District Plan requirement meets/exceeds the AS/NZS 2890 requirement.

The parking space dimensions are considered acceptable, as all car parks will be used by residents who will be both regular and long-term users. Ryman Healthcare has successfully implemented the specified parking dimensions (in accordance with AS/NZS 2890) at numerous similar Ryman comprehensive care retirement villages throughout the country including in Auckland.

All basement parking spaces that are located alongside a wall or column have at least 0.3m clearance. At least 1m is also provided at the end of blind aisles as specified in AS/NZS 2890.

7.2 Ramps

Each building has parking in the basement level.

The car park area in B04 is accessed via a ramp directly to Westley Street. The grade reaches a maximum of 1 in 8 which is less than maximum requirements outlined in the

District Plan and AS/NZS 2890 and does not require ramp transitions. All other ramps have a gradient of 1 in 8 or less.

7.3 Mobility/Accessibility Spaces

NZS 4121 outlines requirements for the provision of mobility parking spaces. Given there is to be a total of 269 parking spaces on-site, the NZS 4121 requirement is to provide six mobility parking spaces.

All the mobility parks should be designed as per NZS4121.

7.4 Loading and Servicing

The District Plan outlines loading bay requirements in section 12.4.2.4 and the activity that best matches the proposed retirement village activity is '*Offices and Other Non-Goods Handling Activities*'. Table 12.2 states that for sites with over 50,000sqm, three loading spaces are required plus one additional space per every 40,000sqm.

The provision of one loading bay is however considered appropriate and has proved more than sufficient at current Ryman properties as they are largely residential in nature. A loading area is provided adjacent to the kitchen / laundry area of the main building (Building B01) as shown in Appendix A2. This loading area can accommodate the turning of an 8m rigid truck.

Appendix A3 shows the tracking path of an 8m rigid truck using the proposed loading space. Ambulances can also access all three buildings with parking available near all main entrances. The internal road layout is also able to support emergency vehicles such as ambulances and fire engines Appendix A3.

8. Construction Traffic

The construction methodology for the retirement village has not been finalised as it will depend on a range of factors, including any resource consent requirement. As such, it is proposed that provision be made in the resource consent conditions for a Construction Traffic Management Plan to be developed for the works anticipated (as is typically the case for other Ryman villages in New Zealand) and has been accepted by Auckland Council in recent Ryman proposals in Birkenhead and Greenlane). It is considered that this Construction Traffic Management Plan should include:

- (i) Construction dates and hours of operation including any specific non-working hours for traffic congestion/noise etc, aligned with normally accepted construction hours in the Auckland Region.
- (ii) Truck route diagrams both internal to the site and external to the local road network.
- (iii) Temporary traffic management signage/details for both pedestrians and vehicles to appropriately manage the interaction of these road users with heavy construction traffic.
- (iv) Details of site access/egress over the entire construction period. Noting that all egress points to be positioned so that they achieve appropriate site distance as per the RTS6 document.

Based on experience of constructing similar villages and bearing in mind capacity within the existing roading network, with the appropriate Construction Traffic Management Plan in place and the above measures implemented, it is considered that construction activities will be managed to ensure an appropriately low level of traffic effects.

Of note, the construction activities are temporary and with appropriate measures in place are able to be managed and therefore the construction effects are considered less than minor.

9. Conclusion

On the basis of the assessment contained in this report, the following conclusions can be made:

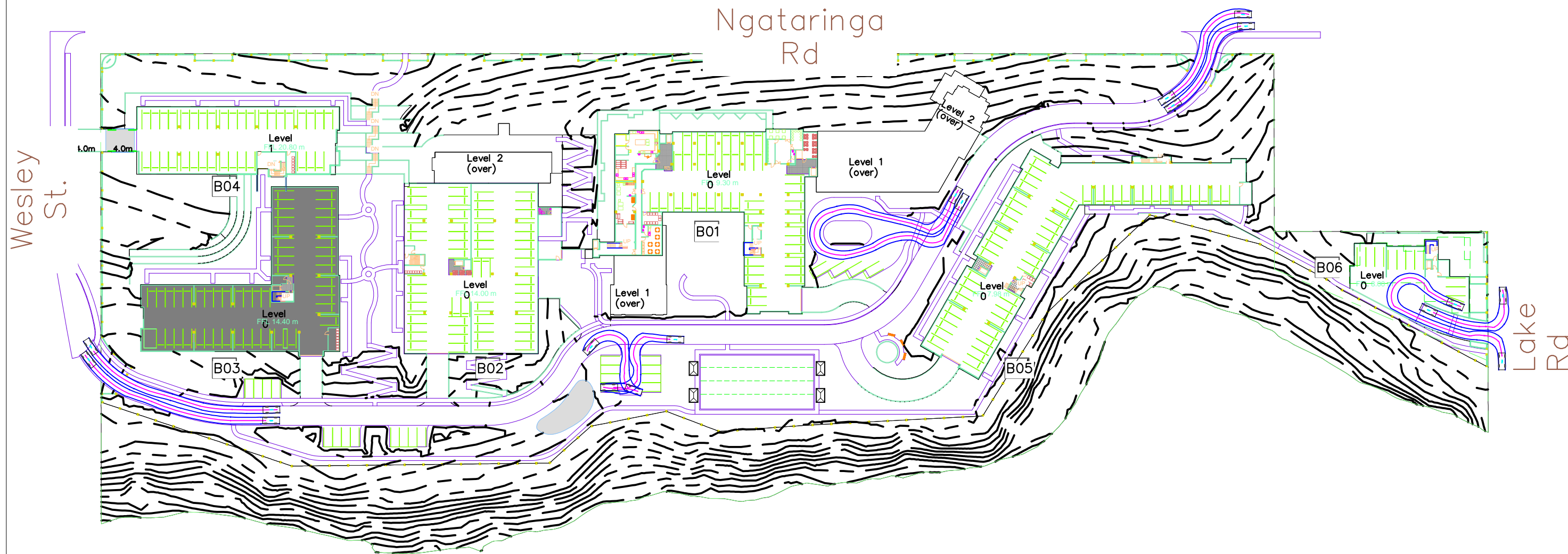
- (i) The level of traffic generated by the retirement village is considered acceptable, is similar to what a typical residential subdivision would generate and will have minimal traffic effects, including in particular effects on the capacity of the surrounding road network.
- (ii) Sufficient parking and loading provisions are provided on-site.
- (iii) Suitable access can be provided to the site using the four accesses.
- (iv) The proposal will not compromise traffic safety in the area.
- (v) It is appropriate to manage the temporary construction traffic through a Construction Management Plan to suitably avoid or mitigate the temporary adverse effects that may arise from construction activities. As such, a Construction Traffic Management Plan should be required as a condition of consent.

The following measures are required as part of the retirement village to avoid adverse effects from the village on the site:

- (i) Construction of a footpath between the main site entrance on the southern side of Ngataranga Road and the end of the footpath at 3 Ngataranga Road.
- (ii) Widening of Wesley Street to 8m width, and
- (iii) Construction of a footpath connecting the site to the existing Ngataranga Road bus stops (assuming these stops are still in service).

Accordingly, it is concluded that there is no traffic engineering or transport planning reason that would preclude the proposed retirement village on the site as intended.

APPENDIX A1 : Light vehicle circulation



Revision notes:		
Rev:	Date:	Notes:

Drawn by: GMN J00045
Client: RYMAN

RYMAN NARROWNECK VEHICLE TRACKING
Drawing Title: LIGHT VEHICLE CIRCULATION

Date: 18 NOVEMBER 2015
Scale @ A3: NTS
Revision: A



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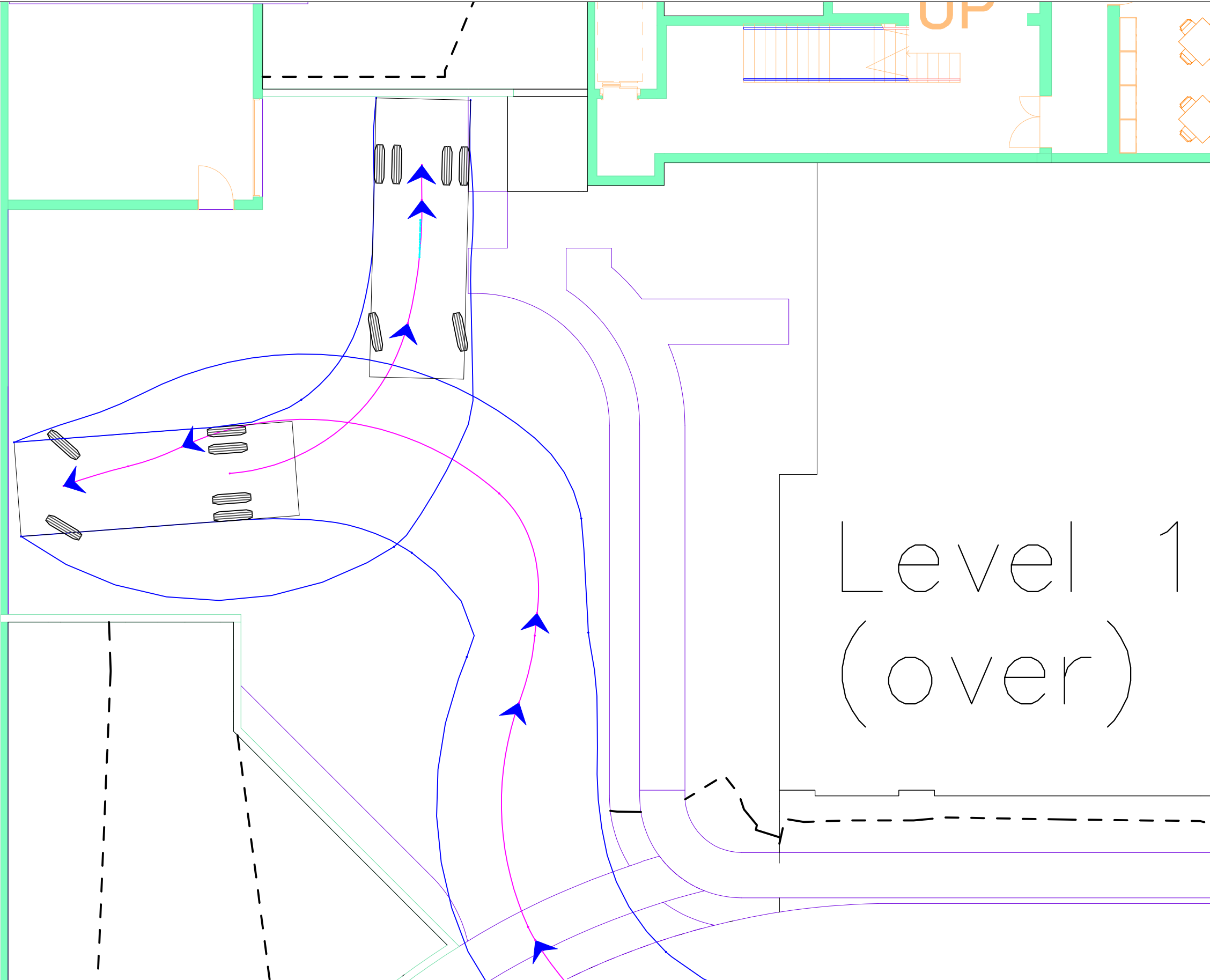
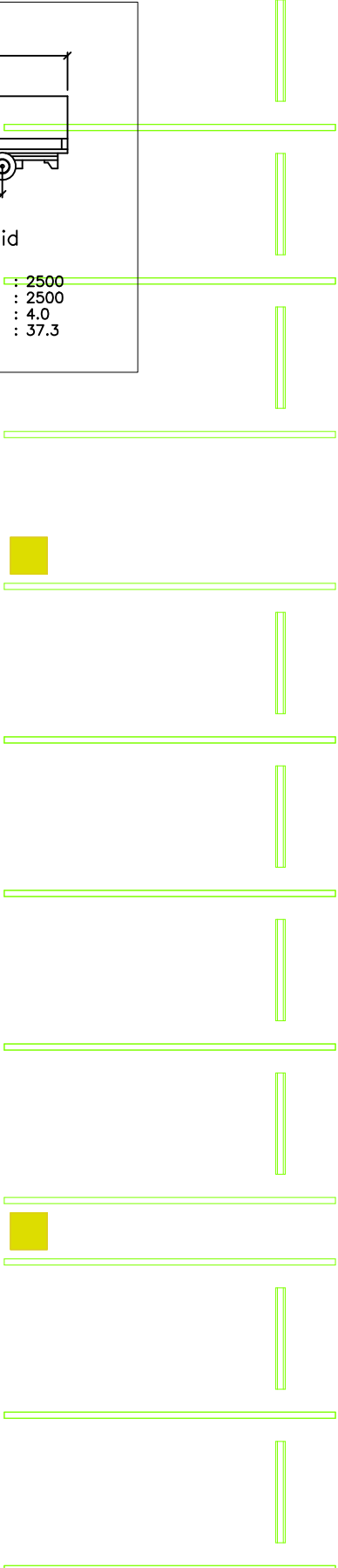
Figure: A1

APPENDIX A2: Loading Bay

7390

North 8m rigid
mm

Width : 2500
Track : 2500
Lock to Lock Time : 4.0
Steering Angle : 37.3



Level 1
(over)

Revision notes:		
Rev:	Date:	Notes:

Drawn by: GMN J00045
Client: RYMAN

RYMAN NARROWNECK VEHICLE TRACKING
Drawing Title: 8M RIGID VEHICLE LOADING

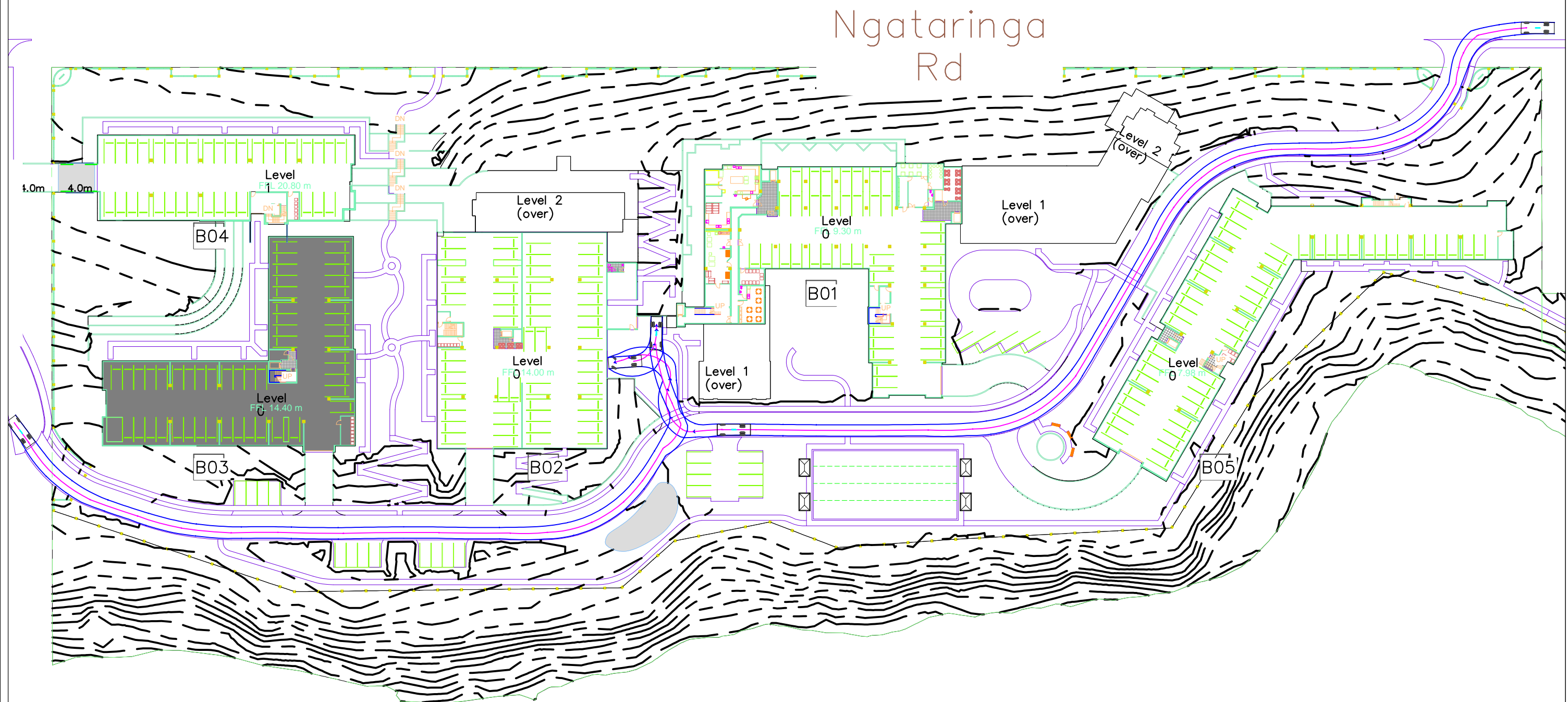
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Scale @ A3: NTS
Revision: A




TRANSPORTATION CONSULTANTS

Figure: A2

APPENDIX A3: Truck circulation



Revision notes:			Drawn by:		Date:			Figure:
Rev:	Date:	Notes:	GMN J00045		18 NOVEMBER 2015			
			Client: RYMAN		Scale @ A3: NTS			
			Drawing Title: 8M RIGID TRUCK CIRCULATION		Revision: A			
			RYMAN NARROWNECK VEHICLE TRACKING				A3	

APPENDIX D

Geotechnical Investigation Report, Tonkin & Taylor (2015)



Geotechnical Investigation Report

Ngataringa Road, Narrow Neck, Auckland

Prepared for
Ryman Healthcare Limited

Prepared by
Tonkin & Taylor Ltd

Date
November 2015

Job Number
29452.0020.v1



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Executive summary

Ryman Healthcare Ltd propose to construct and operate a retirement village on the 4.2 ha site at 7-37 Ngataringa Road, Narrowneck. The layout of the proposed village is shown on Figure 1. This geotechnical assessment is prepared to support the resource consent application for the retirement village and provide guidelines for the detailed design of retirement village buildings.

Geologically, the site is underlain by residually weathered soils overlying East Coast Bays Formation siltstone and sandstone rock. The site is suitable for the proposed retirement village provided the geotechnical conclusions and recommendations in this report are addressed during detailed design.

The risk of slope instability at the site is assessed as low. This conclusion is based on geomorphological site assessments, a review of geological maps and modelling using geological sections based on boreholes and CPT data. Some potential shear surfaces that can be associated with instability were identified in rock beneath the site during the drilling. However, these surfaces do not appear to be connected to form a potential slip surface, and there is no evidence in the site geomorphology or regional slopes that large scale instability is present at the site or in the area. Aerial photographs show that the slopes have not regressed significantly in the past 65 years, and the face is assessed as relatively stable.

Either shallow or deep (piled) foundations are suitable for the site depending on structural requirements, and design parameters are presented. Basements at the site are located above the regional groundwater table, but may intercept some transient, perched groundwater during operation. Any drainage that may be installed for the basements is assessed as having a negligible effect on groundwater at the site boundary.

Specific investigations are required to enable detailed foundation design for buildings at the eastern end of the site. These buildings are likely to require piles to isolate them from any geotechnical hazards that may be present. The overall geotechnical suitability of the site has been assessed on the data available, and these conclusions are assessed as unlikely to be modified by the site specific investigation that will be carried out.

1 Introduction

1.1 General

Ryman Healthcare Ltd (Ryman) have engaged Tonkin & Taylor Ltd (T&T) to carry out a geotechnical investigation for a proposed retirement village at 7-37 Ngataranga Road, Narrowneck, shown in Figure 1. The assessment included the following scope of works:

- 1 Site walkover inspection.
- 2 Geotechnical investigation at selected locations around the site with respect to geomorphologic features and the proposed building locations, which included:
 - machine drilled boreholes
 - cone penetration tests
 - hand augered boreholes
- 3 Assessment of geotechnical risks and potential geotechnical constraints that may affect the development of the site as a retirement village.
- 4 Assessment of the site sub soil class in terms of NZS 1170.5:2004.
- 5 Preliminary assessment of the groundwater regime.
- 6 A desk study contamination report to determine environmental/ecological issues for the proposed retirement village (separate report).
- 7 Preparation of this report.

In geotechnical terms, the site is suitable for the proposed retirement village provided the recommendations in this report are implemented.

1.2 Proposed development

The proposed retirement village development comprises a main building with five independent apartment buildings. The proposed plan is shown in Appendix A. The buildings are typically two to five storeys high, often with a single level of basement. The balance of the site will accommodate roads, landscaping and a bowling green.

1.3 Site description

The site is legally described as Lot 4 & 5 DP 20927. Lot 5 is located at 7-37 Ngataranga Road, Narrowneck, and covers an area of 4.04 ha. Lot 4 is located at 29 Lake Road and covers an area of 0.16 ha. The site boundaries are shown on Drawing 29452-F1 in Appendix A.

A site walkover was undertaken by a senior engineering geologist from T&T on 8 November 2013. Lot 4 is currently grassed with no existing development. Lot 5 currently comprises a single storey residential dwelling, associated amenity buildings and lawn areas. The site is bounded to the north by Ngataranga Road, to the east and west by residential properties, and to the south by Ngataranga Bay. The general topography comprises flat to gently sloping areas separated by moderate to steeply dipping slopes (referred to here as the cliff, although the slopes are relatively shallow). The site has previously been used as a brickworks and by the Navy, and this is discussed in Section 1.4.

1.4 Site history

The site has historically been used for a variety of purposes as summarised in Table 1-1 below.

Table 1-1 – Site history summary

Period (approximate)	Land Use
Pre 1875	Stock grazing
1875 to 1936	R. Duder Brickworks and associated quarrying
1936 to 1942	Derelict Brickworks
1942 to 1953	Demolition of Brickworks
1953 to 1955	Earthworks to prepare building platforms
1955 to Pre 2003	Naval accommodation
2003 to Present	Grassed

A more extensive account of the site's historical uses can be found in a 2015 archaeological report prepared for Ryman by Clough.

2 Geological profile

2.1 General

This section sets out the geological profile at the site. Published geological information is summarised, followed by a discussion of the site investigations and testing, geological conditions and preliminary design parameters are presented.

2.2 Published geological information

The published regional geology¹ of the area shows that the site is underlain by Flysch of the East Coast Bays Formation, refer to Figure 2-1. The flysch is described as greenish grey, alternating muddy sandstone and mudstone, with occasional interbedded lenses of grit. The map shows regional bedding to be dipping 5° to the northwest. A small section of the south eastern extent of the site is shown to be underlain by construction fill, comprising recompacted, clay to gravel sized materials, possibly including demolition debris.

¹ Kermode, L.O. 1992: *Geology of the Auckland urban area. Scale 1:50 000*. Institute of Geological & Nuclear Sciences geological map 2. 1 sheet + 63 p. Institute of Geological & Nuclear Sciences Ltd., Lower Hutt, New Zealand.

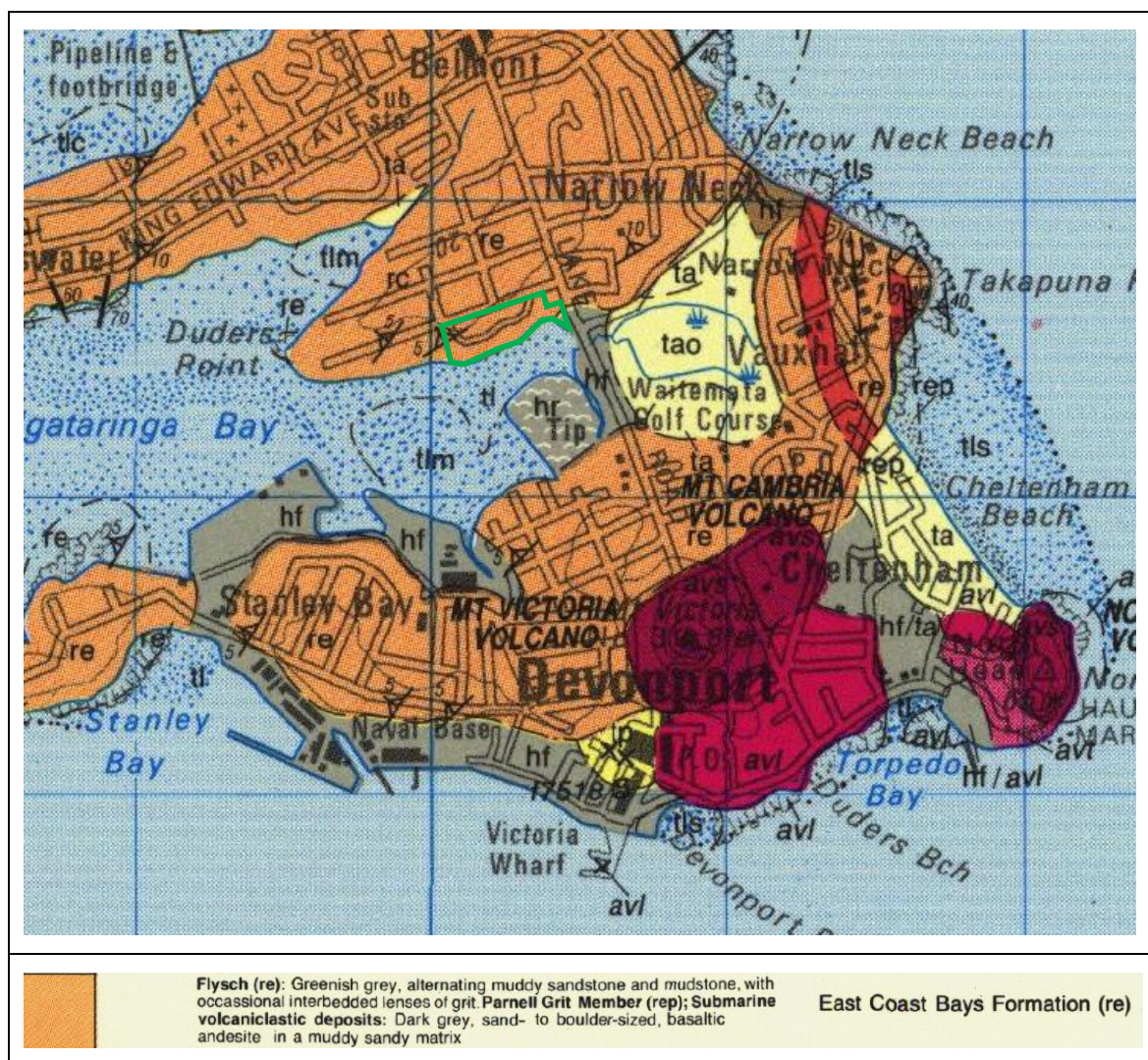


Figure 2-1 – Regional geology of the Auckland area. 7-37 Ngataringa Road shown in green.

2.3 Geological setting

Historic aerial photographs sourced from: the Auckland Council online database, Google Earth, and T&T's own library. The images were reviewed by an engineering geologist from T&T and important site features were noted. Relevant site features observed are presented in Table 2-1 below.

Table 2-1 - Summary of aerial photograph review

Aerial photograph (date and source)	Key points identified
1950 Aerial Photograph (T&T Library, 1916/32)	Four semi-rectangular buildings are observable at the approximate location of the historic Duder Brickworks. The approximate extent of the quarry is visible as un-vegetated land.
1959 Aerial Photograph (Auckland Council)	Ten rectangular buildings can be seen arrayed across the site. They are known, from historical reports, to be naval accommodation blocks, and amenity buildings. Individual buildings are linked by paved pathways. An asphalt access way bisects the site (Wakakura Crescent) running east to west from Ngataringa Road to Wesley Street.

Aerial photograph (date and source)	Key points identified
1950 Aerial Photograph (T&T Library, 1916/32)	Four semi-rectangular buildings are observable at the approximate location of the historic Duder Brickworks. The approximate extent of the quarry is visible as un-vegetated land.
1965 Aerial Photograph (T&T Library, 3232/53)	No observable changes to the site since previous.
1972 Aerial Photograph (T&T Library, 4599/13)	No observable changes to the site since previous.
1980 Aerial Photograph (T&T Library, SN5783M/15)	No observable changes to the site since previous.
1996 Aerial Photograph (Auckland Council)	An additional small shed is observable in the eastern half of the site adjacent to the paved pathway. Two asphalted carpark areas have been constructed adjacent to two of the housing blocks at the western boundary of the site and to the south of a housing block in the middle of the site.
2006 Aerial Photograph (Auckland Council)	The naval accommodation buildings observable in previous images have been removed from site. The site is now predominantly grassed, with asphalted accessways and paths from the naval residences remaining.
2008 Aerial Photograph (Auckland Council)	No observable changes to the site since previous.
2010 Aerial Photograph (Auckland Council)	No observable changes to the site since previous.
2013 Satellite Image (Google Earth)	No observable changes to the site since previous.

The site geomorphology comprises flat to gently sloping terraced areas separated by moderately to steeply dipping slopes. The site generally slopes gently to the south and is bounded by a 1H: 1V vegetated batter slope down to the estuarine tidal flats of Ngataranga Bay. Several areas across the site are identifiable as having unnaturally flat topography. These areas are inferred to be historic building platforms and may demarcate zones of inferred fill material in the upper subsoil profile.

The eastern half of the site has undergone sizeable earthworks associated with quarrying of source material for the Duder Brickworks (1875-1936), considerably altering the topography. The boundary of the quarried area is known to be the 1V:2H batter slope at the north of the site, which curves southward in the western half of the site.

2.4 Site investigations

A combination of 12 static cone penetration tests (CPT), 4 hand augered boreholes (HA), and 7 machine drilled boreholes (BH) were carried out at 7-37 Ngataranga Road between 5 and 13 November 2013. The investigations were carried out for the purposes of; identifying geological stratigraphy and features of interest, and geotechnical classification of the observed stratigraphy.

A thorough site inspection was conducted by a senior engineering geologist on 8 November 2013.

2.4.1 Machine drilled boreholes

Machine drilled boreholes were carried out by Drill Force Ltd between 6 and 13 November 2013. Seven rotary cored machine drilled boreholes (BH01-BH04 & BH06-BH08) were drilled at varied

depths, to R.L. 0 m. A single rotary wash machine drilled borehole (BH07A) was drilled to 6.8 m. All drilling was overseen and logged by a T&T engineering geologist.

Two drilling rigs were employed on the site;

- Tractor mounted rotary coring rig, DF-250T, running a Boart Longyear PQ3 wireline coring system. (Rig No.: 24).
- Excavator mounted rotary coring rig, DF-150E, running a Boart Longyear PQ3 wireline coring system. (Rig No.: 31).

Three push tube samples were collected from BH07A for laboratory testing. Standpipe piezometers were installed in BH01-BH04 & BH06-BH07, to monitor perched groundwater levels.

The location of the machine drilled boreholes is shown on Drawing 29452-F1, and coordinates are presented in Appendix D.

Table 2-2 – Machine Drilled Borehole Summary

Investigation ID	Drilling Method	Hole Depth (m)	Installed Instrumentation
BH01	Rotary Cored (PQ3)	27.0	Standpipe Piezometer
BH02	Rotary Cored (PQ3)	13.5	Standpipe Piezometer
BH03	Rotary Cored (PQ3)	16.0	Standpipe Piezometer
BH04	Rotary Cored (PQ3)	11.0	Standpipe Piezometer
BH06	Rotary Cored (PQ3)	14.0	Standpipe Piezometer
BH07	Rotary Cored (PQ3)	22.6	Standpipe Piezometer
BH07A	Rotary Wash (PQ3)	6.8	-
BH08	Rotary Cored (PQ3)	12.4	-

2.4.2 Hand auger boreholes

Hand auger boreholes were drilled and logged by a geologist from Geotechnics on 11 November 2013. Four hand auger boreholes (HA01-HA04) were drilled to depths between 6.7 m and 7.2 m at point locations across the site, with downhole shear vane testing where appropriate.

The location of the hand auger boreholes is shown on Drawing 29452-F1, copies of the hand auger logs are presented in Appendix B, and coordinates in Appendix D.

Table 2-3 – Hand Auger Borehole Summary

Investigation ID	Hole Depth (m)
HA01	7.2
HA02	6.7
HA03	7.0
HA04	7.2

2.4.3 Cone penetration tests

Cone penetrometer testing (CPT) was undertaken by Perry Geotech Ltd on 5 November 2013, using a Geomil Panther 125. 12 No. CPTs (CPT01-CPT12) were conducted to refusal at point locations

across the site. Refusal depths below ground level varied across the site and are summarised in Table 2-4 below.

The location of the CPTs are shown on Drawing 29452-F1, copies of the CPT returns are presented in Appendix B, and coordinates in Appendix D.

Table 2-4 – CPT Summary

Investigation ID	Refusal Depth (m)	Investigation ID	Refusal Depth (m)
CPT01	9.23	CPT08	0.80
CPT02	14.60	CPT09	1.18
CPT03	7.81	CPT09a	1.19
CPT04	7.35	CPT10	3.40
CPT05	8.05	CPT10a	3.27
CPT06	6.08	CPT11	6.36
CPT07	4.79	CPT12	3.21

2.5 Geological units

2.5.1 General

The subsurface geologic profile of the proposed site is generally in agreement with the published geology of the region. Predominantly underlain by rock of the East Coast Bays Formation (ECBF) mantled by ECBF residual soils, a description of the site lithologies is presented in subsequent sections below, refer to Appendix A for geologic sections.

Fill, inferred to be associated with the construction of naval barracks at the site in 1955, was encountered in areas identified as previous building platforms. The fill forms flat building platforms on the site.

2.5.2 Fill

The fill material encountered at the borehole locations is thought to have been placed during earthworks in the mid 1950's, for the preparation of building platforms. The fill unit is typically 1.0 m to 1.8 m thick with typical undrained shear strength of 80 kPa and is thought to be isolated to areas prepared for building platforms. This fill comprises intermixed silts and sandy silts, and likely derived from ECBF residual soils compacted to a 1950's engineering standard.

We anticipate that uncontrolled fill may be present at other areas of the site; that is, in the areas that were not investigated including the archaeological exclusion zone and the eastern end of the site.

2.5.3 Residual ECBF

The ECBF residual soils comprise stiff to very stiff, greyish white with orange iron stain mottling, silts and medium dense to dense fine silty sands. This unit is generally 4.0 m thick overlying weathered ECBF. The residual soil unit is not found within the bounds of the historic quarry area.

2.5.4 Highly weathered to moderately weathered ECBF rock

The weathered rock of the ECBF can be described as extremely to very weak (equivalent to approximately 1MPa Unconfined Compressive Strength), light to medium greenish grey to grey, interbedded siltstones and fine sandstones. It is common for the sandstones of this layer to be

weaker than the adjacent siltstones due to preferential weathering. The bounds of this layer can be observed as sharp changes in colour and strength at the upper bound or gradational changes in both strength and colour at the upper and lower bound. Due to the processes affecting weathering (i.e. topography, stratigraphic depth, cover, fluctuation in water level) the layer thickness is variable across the site.

2.5.5 Slightly weathered to unweathered ECBF rock

The slightly weathered to unweathered ECBF at the site can be described as very weak to weak (equivalent to approximately 1-5MPa Unconfined Compressive Strength), medium to dark greenish grey to grey, alternating interbedded fine sandstones and siltstones.

Sheared surfaces within the ECBF rock were identified in core from two boreholes at the south western end of the site (at 11.9 and 26.6m depth in BH1 and at 5.0 and 8.1m in BH2). These features typically consist of a zone up to 100mm thick comprising polished surfaces with associated sheared rock mass fabric.

2.6 Groundwater

Standpipe piezometers were installed in BH01-04 & BH06&07 to monitor the perched groundwater regime across the site. The regional groundwater level is inferred to be controlled by tidal levels in Ngataranga Bay fluctuating within the fractured ECBF rock. The piezometers indicate that intermittent localised perched water tables could be present within the upper soil profile of residual soils and completely to highly weathered ECBF rock. Perched groundwater inflows were also encountered in some of the hand augered boreholes which is consistent with measurements taken from the piezometers. Refer to Table 2-5 for measured piezometer levels.

Table 2-5 – Measured piezometer water levels.

Investigation ID	Collar RL (m)	Response Zone (m)	Typical measured Groundwater level, depth below ground level (m)	Typical groundwater level in reduced level (mR.L.)
BH01	25.5	3.0-6.0	Dry	<19.5
BH02	14.2	7.0-8.0	5.1 to 6.7	9.1 to 7.5
BH03	16.1	4.0-6.0	Dry	< 10.1
BH04	11.3	2.0-4.0	Dry	<7.3
BH06	14.2	2.0-4.0	2.5 to Dry	11.7 to <10.2
BH07	20.4	2.4-4.0	2.2 to Dry	18.2 to <16.4

In general, the groundwater measured at the site is more than 3 m deep and located within the weathered ECBF rock.

2.7 Laboratory testing

Laboratory testing was undertaken by Geotechnics on representative samples of materials recovered from the machine boreholes; see Table 2-6. Full details of the laboratory test results are presented in Appendix C.

Table 2-6: Laboratory Testing Schedule

Laboratory test type	Sample taken from	Sample Depth (m)
Multi Staged Undrained (CU) Triaxial Compression (BS 1377: Part 7:1990, clause 5,6 & 7))	BH07A	2.09-2.24
	BH07A	4.26-4.41
One-Dimensional Consolidation (NZS 4402: 1986 Test 7.1)	BH07A	1.45-1.50
Natural Water Content (NZS 4402: 1986, Test 2.1)	BH02	1.0 – 1.1
	BH02	2.0 – 2.1
	BH07A	1.5 – 1.6
	BH07A	2.1-2.2
	BH07A	4.1-4.2
Atterberg Limits (NZS 4402:1986, Test 2.2, 2.3 &2.4)	BH02	1.0 – 1.2
	BH02	2.0 – 2.2
	BH07A	1.5 – 1.6
	BH07A	2.05 – 2.24
	BH07A	4.14 - 4.24
Linear Shrinkage	BH07A	1.5 – 1.6

2.8 Preliminary design soil parameters

The following design soil parameters (Table 2-7) can be adopted for preliminary geotechnical assessment based on the investigation data, laboratory tests and our experience in similar materials.

Table 2-7 – General site profiles engineering properties

Layer No.	Description	Bulk density (kN/m ³)	c' (kPa)	φ' (degrees)	Su (kPa)
1	Topsoil	--	--	--	--
2	Fill	18	5	27	80
3	Residual Soils of ECBF	18	3	30	80
4	HW-MW Rock of ECBF	18	10	32	200
5	UW Rock of ECBF	20	100	40	500

3 Geotechnical considerations

3.1 General

The recommendations and opinions in this report are based on data from 7 machine boreholes, 4 hand auger boreholes and 12 cone penetrometer tests, review of published information and a site walkover. The nature and continuity of subsoil away from the site investigations are inferred but it must be appreciated that actual conditions could vary from the assumed model.

3.2 Site seismic classification

The seismic subsoil class has been assessed in accordance with NZS 1170.5:2004 Section 3.1.3². On the basis of the site investigation results, the site is generally underlain by stiff residual soils up to 5m thick. The site is therefore classified as Class C – shallow soil.

The design peak ground acceleration (PGA) for design of retaining walls and earth slopes with respect to the importance level of the structure is set out in Table 3-1 below. The PGA is derived based on the recommended return periods in Standard AS/NZS 1170.0:2002³ and using the following formula.

$$PGA = C(0) = C_h(0) Z R N(T,D)$$

Where:

- $C_h(0) = 1.33$ for Subsoil Class C
- $Z = 0.13$ for Auckland
- $R_u = 1$ and 0.25 for (1 in 500 year AEP and 1 in 25 year AEP respectively)
- $N(T,D) = 1$ (site is more than 20 km from the nearest major fault line)

The seismic design return period criteria are set out in Table 3.2 in NZS1170.5:2004.

Table 3-1 – Design peak ground acceleration

Design case	ULS Event		SLS1 Event	
	Return period	Design PGA (proportion of g)	Return Period (T)	Design PGA (proportion of g)
Importance level 2 structures	1 in 500 years	0.17g	1 in 25 years	0.04g
Importance level 3 structures	1 in 1000 years	0.22g	1 in 25 years	0.04g

3.3 Liquefaction risk

The material found at the site is typically fine grained residually weathered soils which are considered too fine grained to liquefy. Soils at the site are typically not saturated, with groundwater located in the weathered rock. These observations and the site geomorphological assessment leads to the conclusion that the risk of severe liquefaction or lateral spreading effects affecting the site is very low.

3.4 Foundations

3.4.1 Shallow foundations

Uncontrolled fill and topsoil deposits are unsuitable for shallow foundations, and should be removed below all shallow foundations.

² Standard New Zealand (2004) NZS 1170.5:2004 Structural Design Actions Part 5: Earthquake actions New Zealand

³ Standards New Zealand (2002) AS/NZS 1170.0: 2002 Structural Design Actions

The upper residual soils are typically stiff to very stiff and could be suitable as the founding formation for lightly loaded structures. For preliminary design purposes, shallow foundations founded in the upper soils can be designed with the following bearing capacities:

Strip and pad foundations

Geotechnical ultimate bearing capacity	400kPa
ULS Bearing capacity	200kPa
SLS Bearing capacity	135kPa

Some local undercutting of weaker materials and replacement with compacted hardfill could be required at locations around the site. Settlements under these loadings should be within normally accepted tolerances.

Foundations should extend a minimum of 600mm below finished ground level to mitigate the effects of seasonal shrink/swell deformation at the site. If shallow foundations are considered for larger structures, then the risk of differential settlements should be checked during the detailed design phase.

If foundations are founded on the weathered rock, then a bearing capacity in excess of 1MPa is expected, and settlements will be negligible.

3.4.2 Piles

Piled foundations may be adopted to transfer building loads into the relatively incompressible underlying ECBF rock or to resist uplift loads. It is expected that bored cast in-situ concrete piles could be best suited to the proposed development and preliminary design values are given in Table 3-2 below. The depth to rock (below existing site levels) ranges from 1 to 15m.

Table 3-2 – Bored pile geotechnical ultimate capacities

Bored pile geotechnical ultimate capacity	Weathered ECBF rock	ECBF Rock
End bearing (at least 3D embedment into stratum)	1,500 kPa	6,000kPa
Skin friction, non-grooved piles	100kPa	500kPa
Skin friction, grooved piles	150 kPa	700kPa

Uplift loads could be resisted by either screw piles, bored piles or anchors. For bored pile tension capacity the skin friction values above may be adopted.

3.5 Effect of basements on groundwater

The basements at the site can be designed as drained, partially drained or impermeable. The proposed basement extent and groundwater data is shown on the figures attached in Appendix A. As noted in Section 2.6, groundwater has been consistently recorded in the weathered ECBF rock, and not in the overlying soils, and is consistently more than 3 m below the ground surface during normal operating conditions.

Based on the measured groundwater data, only the lower basement at B01 is assessed to be at risk of intersecting groundwater under normal operating conditions, with the other basements typically located above the groundwater table. The lower basement at B01 is set back at least 20 m from the site boundary.

Using the proposed basement geometry, we have analysed potential groundwater inflows at the site. Assuming an ECBF permeability of 5×10^{-7} m/s (more permeable than normally accepted design values), and adopting a drawdown of 3 m (representing a single basement level fully embedded in groundwater), a groundwater inflow of 2 to 4 m³/day is calculated.

Under heavy rainfall conditions, the groundwater level at the site will rise and additional groundwater inflows could occur both at B01 and the other basements. These additional inflows would comprise seepages during periods of high rainfall that are orders of magnitude lower than stormwater runoff, and are expected to be less than 10 to 20 times the normal operating flows.

For a 3 m drawdown, a dewatering radius of influence of around 20 m is calculated, which indicates that the effect on groundwater at the site boundary is negligible. For context, the potentially affected groundwater tables at the site boundary are:

- a inferred to be located in the weathered ECBF rock,
- b set back more than 20 m from the basements,
- c perched (i.e. located above the regional groundwater table).

As the groundwater drawdown is located in effectively incompressible materials, even if the radius extended outside the site boundary, no measurable settlement or other effects are expected.

3.6 Slope stability

3.6.1 Site stability (global)

The stability of slopes at the site have been assessed by Engineering Geologists using

- a Geomorphological site assessments
- b Review of geological maps
- c Preparation of geological sections based on boreholes and CPT data

The assessment concludes that the risk of significant instability in the rock underlying the site is very low. In particular, despite the extensive historical earth-working of the site, there is no regional evidence for deep seated instability extending into the underlying rock material to be present.

The borehole investigation identified isolated shear surfaces in the core that could, if pervasive, potentially be associated with deep seated instability. Shear surfaces like this are commonly found in this material, and do not necessarily indicate potential instability. Based on the data available to us, we do not believe that the shear surfaces are indicative of a deeper failure, and do not assess these potential shear surfaces as likely to be connected. There is no evidence identified in the site geomorphology suggesting large scale failures are present, and these are not typical of slopes in the area. In addition, the published geological map² indicates that regional bedding dips favourably into the slope at approximately 5° to the northwest, meaning any potential failure surfaces would have to move uphill.

Overall, the risk of significant instability at the site is assessed as very low.

3.6.2 Stability of cliff slopes

3.6.2.1 Regional assessment

A comprehensive regional assessment of coastal erosion hazard was undertaken for Auckland Regional Council in 2006⁴. This assessment included an estimate of the average shoreline retreat at

⁴ Tonkin & Taylor, May 2006. Regional Assessment of Areas Susceptible to Coastal Erosion, Technical Report, Volume I. Published Report for Auckland Regional Council. Report Ref. 19891.100.

the toe of cliffs in the Auckland region. This estimate provides a range of possible cliff retreat within the next 100 years and was based on an assessment of the geology, structure, height and slope angle of cliffs in the Auckland region. The cliffs forming the southern coast of the Narrow Neck Peninsula (which includes cliff slope on the subject site) have been assessed as having a possible long term retreat rate of 1m to 3 m in 100 years. The buildings are located sufficiently far back that the risk of their building footprints being affected by coastal erosion during the design life is very low.

3.6.2.2 Site specific assessment

Assessment of historical aerial photographs for the site dating back to 1950 indicate that the cliff slope has not undergone any observable changes in the intervening period. The slope has retained a thick bush cover, which generally helps to reduce the rate of erosion by strengthening the soil profile with their root systems. The bush cover and presence of archaeological sites has prevented mapping of the cliff face, but based on our experience with similar slopes in the area, it is expected to consist of completely weathered to highly weathered ECBF rock and residual soil.

The sheltered tidal flat at the base of the cliff is assessed as a low energy marine environment and the potential for any significant erosion of the toe of the cliff slope within the design life of the proposed development is assessed to be low.

These observations indicate that the cliff slope on the site is currently relatively stable and is likely to be sitting near the angle of repose for the weathered ECBF slope material (the maximum measured cliff slope angle at the site is 34°).

3.7 Retention systems

For the design of retention systems, the soil design parameters presented in Table 2-7 can be adopted. Conventional retention systems are likely to be suitable at the site, and these can comprise piled, MSE or gravity walls depending on the geometry and construction sequencing.

3.8 Earthworks

Cut and fill earthworks will be required to level the site, with localised excavation carried out to form building basements. Compacted fill was encountered in boreholes at the site; depending on the use, this fill may have to be excavated or recompacted. We anticipate that uncontrolled fill from past earthworks will be present at the site, especially in the former brickworks area.

Any perched water encountered during excavation should be intercepted with underfill drains to ensure water does not lead to saturation of the fill and foundation soils. Where new fill is to be placed against sloping surfaces steeper than 3H: 1V, the sloping surface should be excavated or 'benched' such that horizontal benches at no greater than 0.5 m high intervals are formed. Underdrainage should be installed at the back of the benched slopes to drain any water seepages that may occur.

3.9 Pavements

For pavements founded in natural ground a subgrade CBR of 3% can be adopted for preliminary pavement design. During construction, further testing should be undertaken to identify any soft or weak areas for undercutting and replacement with hardfill.

4 Limitations

The eastern area of the site was not drilled to avoid archaeological restrictions, particularly around the location of the brickworks. Accordingly, the conclusions and recommendations presented in this

report are based on the readily available geotechnical data. A second phase of site investigations will be required to complete the foundation detailed design for buildings east of the main block. However, we consider our investigations sufficient to draw conclusions to support this resource consent application.

5 Conclusions

Ryman propose to construct and operate a retirement village comprising 5 apartment buildings at the site at 7-37 Ngataranga Road, Narrowneck. A geotechnical assessment has been carried out and to support this application, and the results are included here. The site is suitable for the proposed village provided the geotechnical conclusions and recommendations in this report are addressed.

Geologically, the site is underlain by residually weathered soils overlying East Coast Bays Formation siltstone and sandstone rock. These materials form a suitable founding layer for the proposed buildings. The risk of slope instability or liquefaction occurring at the site is assessed as low, based on the investigation carried out.

Basements at the site are typically located above groundwater under normal operating conditions, with the exception of the lower basement at B01. Groundwater inflows at B01 will have a negligible effect on groundwater at the site boundary under normal operating conditions.

Specific geotechnical investigations are required to enable detailed foundation design for buildings at the eastern end of the site. These buildings are likely to require piles to isolate them from any geotechnical hazards that may be present.

6 Applicability

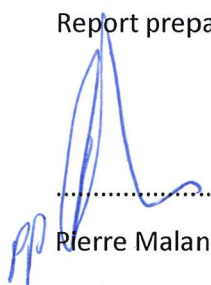
This report has been prepared for the benefit of Ryman Healthcare Ltd with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

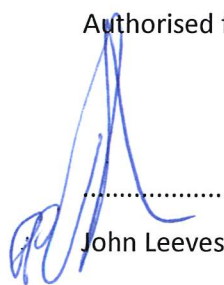
Report prepared by:

Authorised for Tonkin & Taylor Ltd by:



Pierre Malan

Senior Geotechnical Engineer



John Leves

Project Director

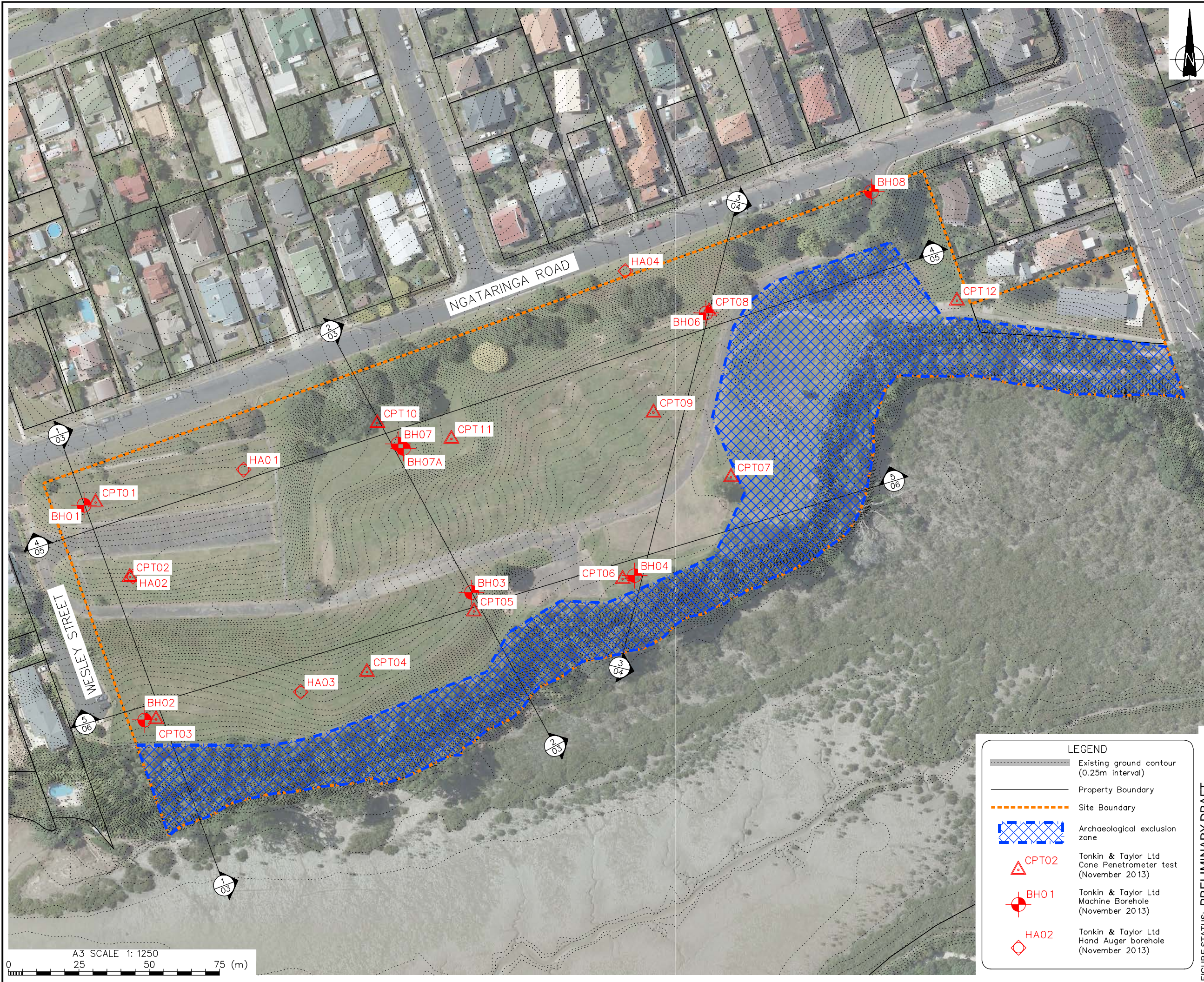
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Appendix A: Figures

- Site Investigation Plan
- Proposed Building Plan
- Geological Cross Sections 1, 2, 3, 4, 5

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- NOTES :
1. All dimensions are in millimetres unless noted otherwise.
 2. Contours and Cadastral GIS information supplied by Auckland City Council.
 3. Coordinate Datum: NZGD2000, Mt Eden Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE
 4. Height datum is Auckland Vertical Datum 1946 (MSL).

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7-37
NGATARINGA ROAD

NARROWNECK

Investigation Plan

FIGURE STATUS: PRELIMINARY DRAFT

SCALES (AT A3 SIZE)
AS SHOWN

PROJECT No.
29452

FIG. No.
Figure 1

REV.
0

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- NOTES :
1. All dimensions are in millimetres unless noted otherwise.
 2. Contours and Cadastral GIS information supplied by Auckland City Council.
 3. Coordinate Datum: NZGD2000, Mt Eden Circuit Coordinates. Origin: Lat 36 52 47S Long 174 45 51E 800,000mN 400,000mE
 4. Building layout/elevations shown are approximate only and based on drawings supplied by Ryman Ltd received by Tonkin & Taylor Ltd on 16 October 2015.

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Proposed
Subdivision Plan

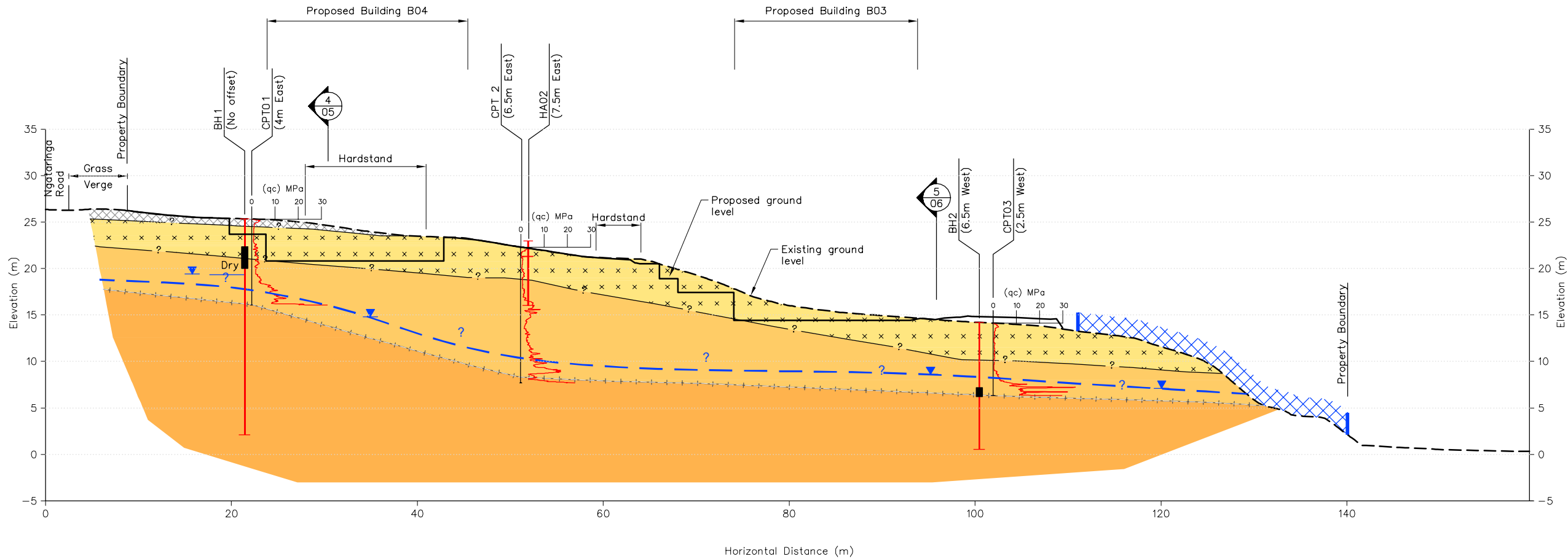
SCALES (AT A3 SIZE) AS SHOWN	PROJECT No. 29452	REV. 0
FIG. No. Figure 2		

FIGURE STATUS: PRELIMINARY DRAFT

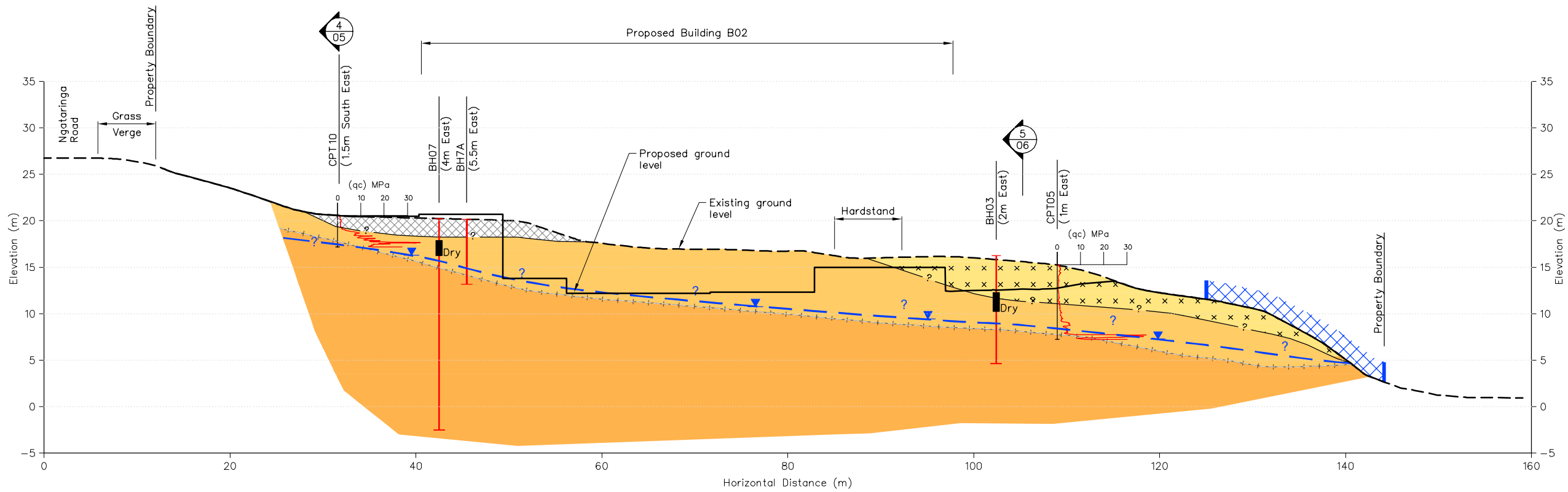
LEGEND

- Property Boundary
- Site Boundary
- Archaeological exclusion zone
- CPT02 Tonkin & Taylor Ltd Cone Penetrometer test (November 2013)
- BH01 Tonkin & Taylor Ltd Machine Borehole (November 2013)
- HA02 Tonkin & Taylor Ltd Hand Auger borehole (November 2013)

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SECTION 1 1
SCALE 1:500 01 02



SECTION 2 2
SCALE 1:500 01 02

A3 SCALE 1:500
0 5 10 15 20 25 (m)

- NOTES:
1. All dimensions are in millimetres unless noted otherwise.
 2. Contours and Cadastral GIS information supplied by Auckland City Council.
 3. Height datum is Auckland Vertical Datum 1946 (MSL).
 4. All test locations are approximate only.
 5. Geological boundaries are inferred, based on geotechnical investigations undertaken at point locations. Actual conditions may vary from the assumed model.
 5. Building layout shown is approximate only and based on preliminary concept drawing by Ryman Ltd. received by Tonkin & Taylor Ltd on 22 November 2013.

LEGEND:		
	Fill	
	Residual soil (ECBF)	
	Highly weathered to moderately weathered rock (ECBF)	
	Slightly weathered to unweathered rock (ECBF)	
	Archaeological exclusion zone	
	Geological contact - inferred	
	Gradational change in weathering	
	Inferred groundwater line	
	Borehole Test Location with screen	

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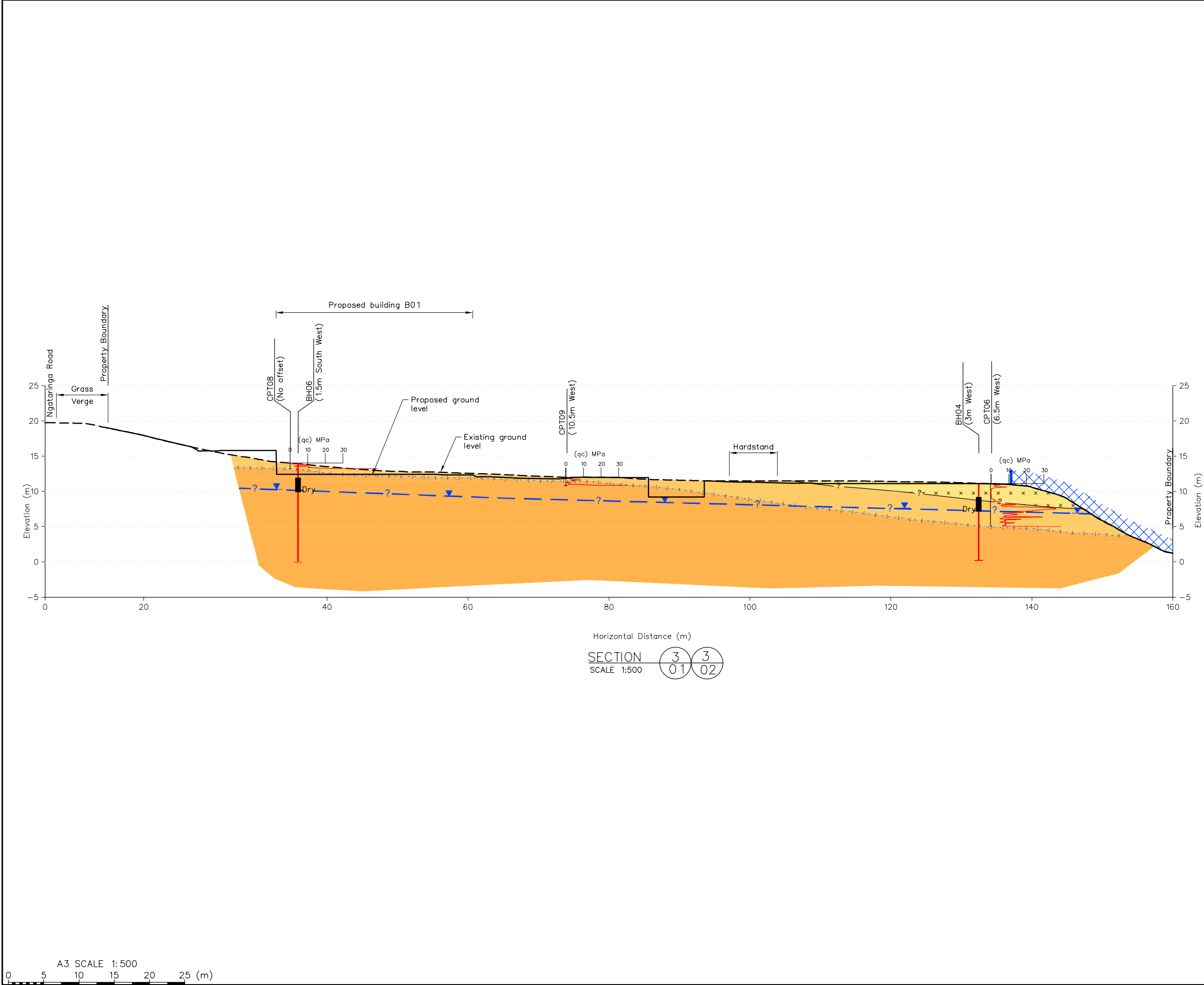
7-37
NGATARINGA ROAD

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Geological
Cross Section 1 and 2
(Sheet 1 of 4)

SCALES (AT A3 SIZE) AS SHOWN		
PROJECT No. 29452		
FIG. No.		REV.
Figure 3		0

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- NOTES :
1. All dimensions are in millimetres unless noted otherwise.
 2. Contours and Cadastral GIS information supplied by Auckland City Council.
 3. Height datum is Auckland Vertical Datum 1946 (MSL).
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 5. Building layout shown is approximate only and based on preliminary concept drawing by Ryman Ltd. received by Tonkin & Taylor Ltd on 22 November 2013.

LEGEND:

- Fill
- Residual soil (ECBF)
- Highly weathered to moderately weathered rock (ECBF)
- Slightly weathered to unweathered rock (ECBF)
- Archaeological exclusion zone
- Geological contact – inferred
- Gradational change in weathering
- Inferred groundwater line
- Borehole Test Location with screen

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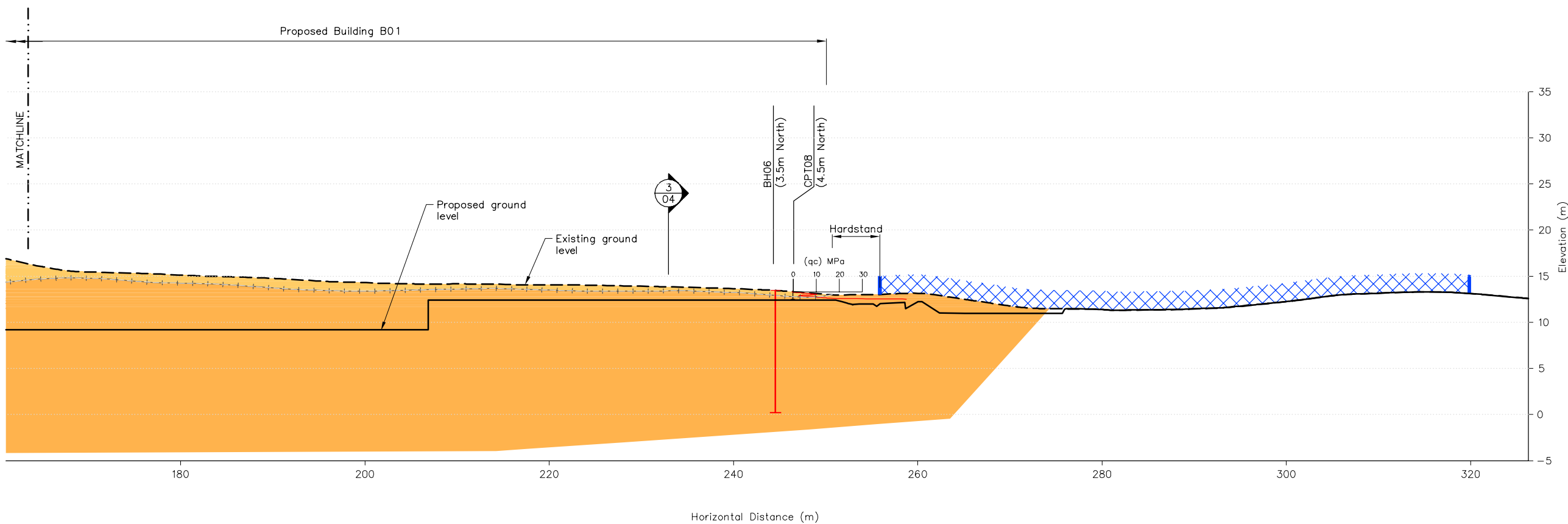
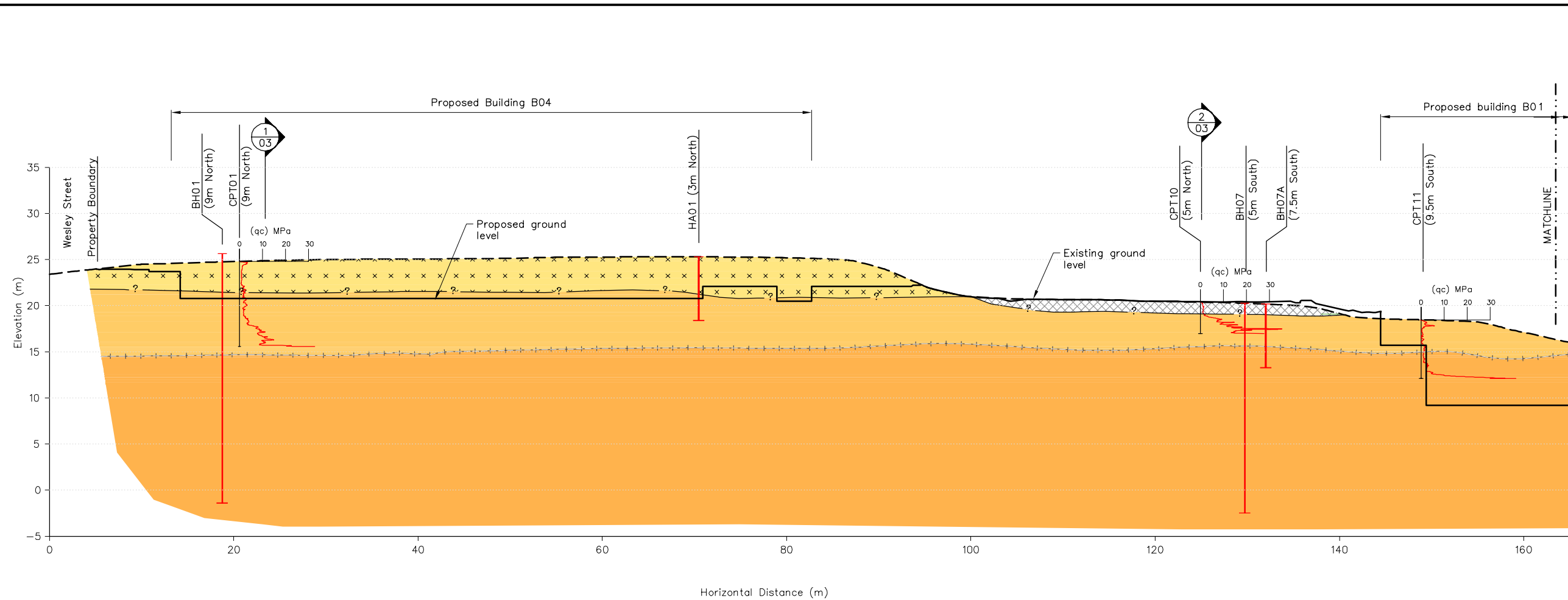
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7-37
NGATARINGA ROAD

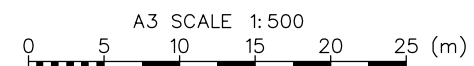
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Geological
Cross Section 3
(Sheet 2 of 4)

SCALES (AT A3 SIZE) AS SHOWN	
PROJECT No. 29452	
FIG. No. Figure 4	REV. 0

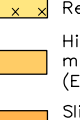











SECTION
SCALE 1:500



- NOTES :
1. All dimensions are in millimetres unless noted otherwise.
2. Contours and Cadastral GIS information supplied by Auckland City Council.
3. Height datum is Auckland Vertical Datum 1946 (MSL).
4. All test locations are approximate only.
5. Geological boundaries are inferred, based on geotechnical investigations undertaken at point locations. Actual conditions may vary from the assumed model.
5. Building layout shown is approximate only and based on preliminary concept drawing by Ryman Ltd. received by Tonkin & Taylor Ltd on 22 November 2013.

LEGEND:

- 
-  Fill
 -  Residual soil (ECBF)
 -  Highly weathered to moderately weathered rock (ECBF)
 -  Slightly weathered to unweathered rock (ECBF)
 -  Archaeological exclusion zone
 -  Geological contact – inferred
 -  Gradational change in weathering
 -  Inferred groundwater line
 -  Borehole Test Location with screen
- Dry

DRAWN	JATG	Nov. 15
DRAFTING CHECKED		
APPROVED		
CADFILE \\29452.0020-F03_F06.dwg		



RYMAN
HEALTHCARE LTD

7-37
NGATARINGA ROAD

NARROWNECK

Geological
Cross Section 4
(Sheet 3 of 4)

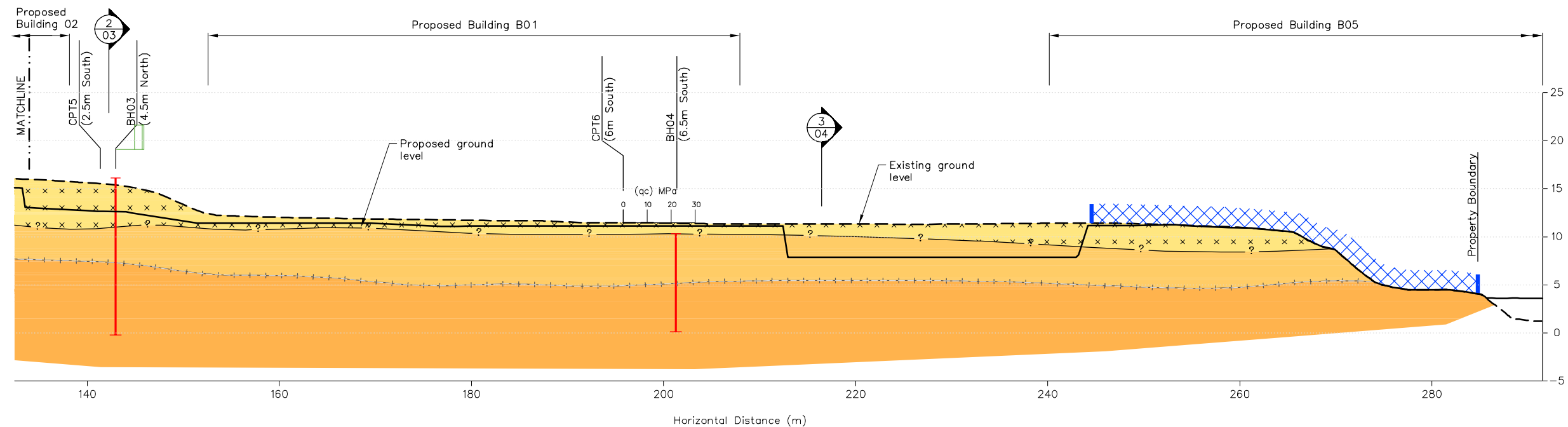
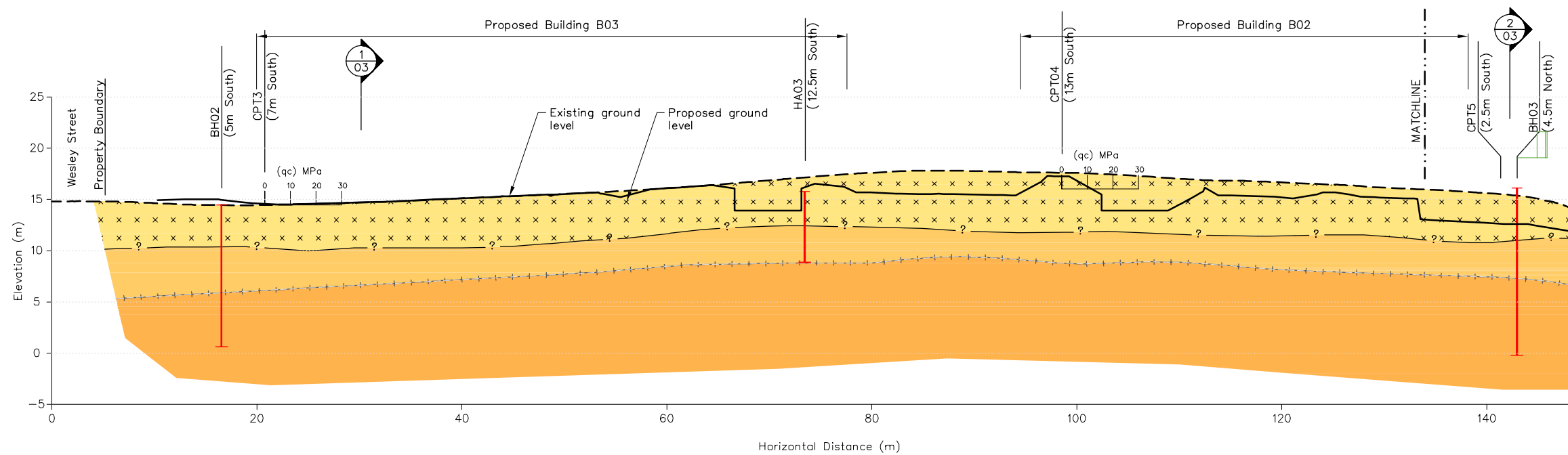
SCALES (AT A3 SIZE)
AS SHOWN

PROJECT No.
29452

FIG. No.
Figure 5

EV.	
0	

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SECTION 5
SCALE 1:500

5
01

5
02

A3 SCALE 1:500
0 5 10 15 20 25 (m)

- NOTES:
1. All dimensions are in millimetres unless noted otherwise.
 2. Contours and Cadastral GIS information supplied by Auckland City Council.
 3. Height datum is Auckland Vertical Datum 1946 (MSL).
 4. All test locations are approximate only.
 5. Geological boundaries are inferred, based on geotechnical investigations undertaken at point locations. Actual conditions may vary from the assumed model.
 6. Building layout shown is approximate only and based on preliminary concept drawing by Ryman Ltd. received by Tonkin & Taylor Ltd on 22 November 2013.

LEGEND:

- Fill
- Residual soil (ECBF)
- Highly weathered to moderately weathered rock (ECBF)
- Slightly weathered to unweathered rock (ECBF)
- Archaeological exclusion zone
- Geological contact - inferred
- Gradational change in weathering

DRAWN JATG Nov. 15
DRAFTING CHECKED
APPROVED
CADFILE \\29452.0020-F03_F06.dwg

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland
www.tonkin.co.nz

**RYMAN
HEALTHCARE LTD**

7-37
NGATARINGA ROAD

NARROWNECK

Geological
Cross Section 5
(Sheet 4 of 4)

SCALES (AT A3 SIZE)
AS SHOWN
PROJECT No.
29452
FIG. No.
Figure 6
REV.
0

Appendix B: Investigation logs

- Machine Drilled Borehole Logs
- Hand Auger Logs
- CPT Logs



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH01

SHEET 1 OF 6

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataranga Rd, Narrowneck

CO-ORDINATES: 5923893.37 mN
1759629.8 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 25.50m

R.L. COLLAR: 25.50m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE				Rock Weathering <div>UW SW MW LW CW</div>	Rock Strength <div>ES SS MS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill																		
Topsoil	SILT, brown black. Firm, moist, non-plastic. Organics, rootlets.									25.5											
Residual Soil [ECBF]	Broken concrete blocks.									25.0											
	SILT, grey white, with pinkish red clayey streaks. Stiff, moist, low to moderate plasticity. Fe stain mottle, decomposing rootlets.						HA	100		25.0											
										24.5											
										24.0											
										24.0											
										23.5											
										23.0											
										23.0											
										22.5											
	SILT, orange. Hard, moist, moderately plastic. Core loss									22.5											
SILT, grey white, with pinkish red clayey streaks. Stiff, moist, low to moderate plasticity. Fe stain mottle, decomposing rootlets.						PQ3	67		22.0												
Cemented orange SILT. Fe bands.									21.5												
SILT, orange brown. Stiff to firm. Cemented?									21.5												
SILT, light grey. Very stiff, moist, moderate plasticity. (Highly weathered, light grey, SILTSTONE, extremely weak.)									21.0												
Core loss						PQ3	100		4.5												
Highly weathered, light grey, fine, SANDSTONE, extremely weak.						PQ3	80		0.0												
Moderately weathered, light grey, SILTSTONE, extremely to very weak. Shallow dipping turbidite									0.0												

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH01

SHEET 2 OF 6

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923893.37 mN
1759629.8 mE

R.L. GROUND: 25.50m

R.L. COLLAR: 25.50m

DIRECTION: 0.00°

DATUM: 0

ANGLE FROM HORIZ.: -90.00°

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>UW SW MW CW VW</div>	Rock Strength <div>ES SS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	21.0 RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				25 50 75 Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Highly to Moderately Weathered ECBF	beds (<5°).							20.5										2	
	Moderately weathered, light grey, fine, SANDSTONE, extremely weak.				PQ3	80		20.5				100							
	Moderately weathered, light greenish grey, SILTSTONE, extremely weak.				PQ3	100		19.6				100							
	Moderately weathered, light grey, fine, SANDSTONE, extremely weak.																		
	Moderately weathered, light greenish grey, SILTSTONE, extremely weak.				PQ3	100		19.6				100							
Slightly Weathered ECBF	Moderately to slightly weathered, greenish grey, MUDSTONE, very weak. Shallow dipping carbonaceous beds.							19.6											
	Slightly weathered, grey, SILTSTONE, very weak. Shallow dipping carbonaceous beds.							18.5											
	Slightly weathered, grey, very fine, SANDSTONE, extremely weak.				PQ3	100		18.0				100							
	Slightly weathered, grey, fine, SANDSTONE, very weak.				PQ3	100		17.8											
	Thinly bedded SILTSTONES & MUDSTONES.							17.0											
	Slightly weathered, grey, fine to medium, SANDSTONE, very weak.				PQ3	100		9.5				100							
	Slightly weathered, grey, SILTSTONE, very weak.																		
	Slightly weathered, grey, fine to medium, SANDSTONE, very weak.																		

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH01

SHEET 3 OF 6

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923893.37 mN
1759629.8 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 25.50m

R.L. COLLAR: 25.50m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering UW SW MW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Slightly Weathered ECBF	Slightly weathered, light white grey, SILTSTONE, <u>very weak</u> .				PQ3	100		15.5		X X									

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH01

SHEET 4 OF 6

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923893.37 mN
1759629.8 mE

R.L. GROUND: 25.50m

R.L. COLLAR: 25.50m

DIRECTION: 0.00°

DATUM: 0

ANGLE FROM HORIZ.: -90.00°

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering UW SW MW CW EW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	ROCK DEFECTS						Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation						Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill							
Unweathered ECBF	Unweathered, greenish grey, SILTSTONE, weak.				PQ3	100	10.5											
	Unweathered, grey, very fine, massive SANDSTONE, weak.						10.5											
	Unweathered, greenish grey, SILTSTONE, weak.																	
	Unweathered, grey, fine, massive SANDSTONE, weak.						9.5											
	Unweathered, greenish grey, SILTSTONE, weak.																	
	Unweathered, grey, fine, massive SANDSTONE, weak.						9.5											
	Unweathered, greenish grey, SILTSTONE, weak.																	
	Unweathered, grey, fine to coarse, massive SANDSTONE, weak.						8.5											
	Unweathered, grey, fine, massive SANDSTONE, weak.																	
	Unweathered, greenish grey, SILTSTONE, weak.						8.5											
	grades to SILTSTONE with carbonaceous spars.																	
	Unweathered, grey, fine, massive SANDSTONE, weak.							7.5										
Interbedded (10-20mm beds) SILTSTONES & MUDSTONES, grey, weak.																		
Unweathered, grey, very fine, massive SANDSTONE, weak.							7.5											
Interbedded (10-20mm beds) SILTSTONES & MUDSTONES, grey, weak.							6.5											
Unweathered, grey, fine, massive SANDSTONE, weak.							19.5											

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH01

SHEET 5 OF 6

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923893.37 mN
1759629.8 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 25.50m

R.L. COLLAR: 25.50m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering LW SW MW CW EW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	SILTSTONE Unweathered, grey, fine to medium, massive SANDSTONE, weak.				PQ3	100		5.5											
	SILTSTONE Unweathered, grey, fine to medium, massive SANDSTONE, weak.				PQ3	100		5.0	0.5				100						
	SILTSTONE Unweathered, dark grey, very fine to fine, massive SANDSTONE, weak.							4.2	1.0					-21.0m; B<5°, PL, SM					
	Interbedded (10-20mm beds) SILTSTONEs & MUDSTONEs, grey, weak.																		
	Unweathered, grey, fine, massive SANDSTONE, weak.				PQ3	100		4.0	1.5				100	-21.5m; B<5°, PL, SM					
	Interbedded (10-20mm beds) SILTSTONEs & MUDSTONEs, grey, weak.																		
	Unweathered, grey, fine, massive SANDSTONE, weak.							3.0	2.5										
								2.3	3.0				100						
	Interbedded (10-20mm beds) SILTSTONEs & MUDSTONEs, grey, weak.				PQ3	100		2.0	3.5										
	Unweathered, grey, fine to medium, massive SANDSTONE, weak.				PQ3	100		1.3	4.0				100						
	SILTSTONE			PQ3	100			24.5					100						

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH01

SHEET 6 OF 6

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923893.37 mN
1759629.8 mE

R.L. GROUND: 25.50m

R.L. COLLAR: 25.50m

DIRECTION: 0.00°

DATUM: 0

ANGLE FROM HORIZ.: -90.00°

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%)	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %	Description					
Unweathered ECBF	Unweathered, dark grey, very fine to fine, massive SANDSTONE, weak.			PQ3	100		0.5					100						11
	SILTSTONE			PQ3	100		-0.25.5						-26.2m; B<3°, PL, SM					
	Unweathered, grey, fine, massive SANDSTONE, weak.						-1.06.5						-26.55m; SZ10°, PL, SL, MN, CG, light grey & cemented					12
End of Hole = 27.0m	Unweathered, dark greenish grey, SILTSTONE, weak. Carbonaceous beds						-1.27.0											
							-2.07.5											
							-2.28.0											
							-3.08.5											
							-3.29.0											
							29.5											
							30.0											

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH02

SHEET 1 OF 3

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 6/11/13

FINISH DATE: 6/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923817.05 mN
1759651.35 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 14.23m

R.L. COLLAR: 14.23m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS WS VS EW	Sampling Method Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Topsail	SILT; trace of sand; grey brown. Firm, moist, low plasticity; sand, fine; organics, rootlets						14.0										
Residual Soil [ECBF]	SILT; orange mottled grey white. Firm, moist, low to moderate plasticity, some decomposing rootlets (Disturbed sample)			HA	100		0.5										
	(undisturbed) Fe stain						1.5										
	grades SILT, with minor fine sand			PQ3	100		2.0										
	grades SILT						2.5										
	grades light grey, stiff, moderate plasticity, Fe stain banding, decomposing rootlets			PQ3	100		3.0										
	grades SILT, with minor fine sand			PQ3	100		3.5										
	grades SILT						4.0										
	Organic SILT; brown. Firm, moist, non-plastic [Paleosol]						4.5										
	SILT; medium grey. Stiff, moist, moderate plasticity, Fe stain bands						5.0										
	Sandy SILT; medium grey. Firm, moist, low plasticity; sand, very fine, poorly graded, sub-rounded. Fe staining			PQ3	100		5.5										
	no Fe staining			PQ3	100		6.0										

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH02

SHEET 2 OF 3

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 6/11/13

FINISH DATE: 6/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923817.05 mN
1759651.35 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 14.23m

R.L. COLLAR: 14.23m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering UW SW MW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation									Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill								
Highly to Moderately Weathered ECBF	Sandy SILT; medium grey. Firm, moist, low plasticity; sand, very fine, poorly graded, sub-rounded			PQ3	100								-5m: shear zone, 2mm clay gouge					
	SILTSTONE						-9.0											
	SILT; grey. Very stiff to hard, moist, low to moderate plasticity																	
	Sandy SILT; grey. Hard, moist, low to moderate plasticity; sand, very fine [3 x 3mm organic bands @5.6m]			PQ3	100		5.5											
Unweathered ECBF	Highly weathered, grey SILTSTONE. Very weak, sub-horizontal structure (bedding?) or similar Completely weathered, grey fine SANDSTONE. Extremely weak grades slightly weathered, weak, closely spaced joints						6.0											
							8.0											
							6.5						-6.4m: J,65°,PL,SM,T,CN					
	Unweathered, grey SILTSTONE. Very weak, moderately thinly bedded with moderately thin interbeds of very weak, grey very fine SANDSTONE. Moderately widely spaced joints siltstone grades weak			PQ3	100		7.5					100						
	siltstone grades moderately thickly bedded						7.0											
							7.0											
	siltstone grades very weak [disturbed sample (over cored and dropped)]						7.5											
				PQ3	100		6.5					0						
	sheared fabric?						8.0											
	sandstone grades thickly bedded, weak to moderately strong, sub-horizontal bedding/cleavage? closely spaced joints			PQ3	100		6.0							-8.1m: S (angle unknown, disturbed from drilling)				
Unweathered ECBF							8.5											
				PQ3	100		5.5					100	-8.6m: J,60°,UN,R,VN,Fest, stiff					
							9.0											
							5.0											
				PQ3	100		9.5					0	-9.5m: B,30°,PL					
	sandstone grades very weak						4.5						-9.65m: J,80°,UN,SM,T,CN -9.8m: J,90°,UN,SM,VN,Fest/CV, white					

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH02

SHEET 3 OF 3

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 6/11/13

FINISH DATE: 6/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923817.05 mN
1759651.35 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 14.23m

R.L. COLLAR: 14.23m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>UW SW MW CW</div>	Rock Strength <div>ES SS MS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm) <div>50 100 150</div>	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Unweathered, grey fine SANDSTONE. Very weak, thickly bedded with moderately thick interbeds of weak to moderately strong, grey SILTSTONE. Closely spaced joints, sub-horizontal bedding				PQ3	100		4.0					0						
	grades widely spaced joints						10.5												
					PQ3	100		3.0				100	-10.7m: J,60°,UN,SM,VN,Fest, well cemented -10.8m: B,5°,PL						
							11.0												
							11.5												
							2.5												
	sandstone grades medium to coarse SANDSTONE, moderately strong, moderately thickly bedded						12.0												
							2.0												
	sandstone grades fine SANDSTONE				PQ3	100		1.5					100	-12.7m: B,15°,UN					
							12.5												
	thin carbonaceous layers						13.0												
							1.0												
							13.5												
							0.5												
							14.0												
							0.0												
							14.5												
							-0.5												
							15.0												
							15.5												
END OF BOREHOLE AT 13.5m (Target depth reached)																			

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH03

SHEET 1 OF 4

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923862.38 mN
1759767.57 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 16.06m

R.L. COLLAR: 16.06m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%)	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %	Description					
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW HW CW	ES SS MS WS VS EW										Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	25 50 75				
Topsoil	SILT, black brown. Firm, moist, non-plastic. Organics, fresh rootlets						16.0											
Residual Soils [EAST COAST BAYS FM]	SILT, greyish white. Stiff, moist, low to moderate plasticity. Decomposing rootlets, Fe stain mottle throughout (20%)						15.5											
	Sandy SILT, greyish white. Stiff, moist, low plasticity. Sand; very fine to fine, poorly graded, subrounded. Decomposing rootlets.						14.5											
							13.5											
Highly Weathered ECBF	Highly weathered, light grey, SILTSTONE, extremely weak. Fe stain mottle.						13.0											
	Highly weathered, light grey, very fine to fine, massive, SANDSTONE, extremely weak. Fe stain on defects.						12.5											
Moderately to Slightly Weathered ECBF	grades to; Moderately weathered, grey, fine SANDSTONE, extremely weak.						12.0						-4.05m; J55°, UN, SM, VN, FeSt B<5°, PL, Carbonaceous					
	Slightly weathered, grey, SILTSTONE, extremely weak.						11.5						-4.7m; J85°, PL, R, VN, CV, Soft & grey brown					

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH03

SHEET 2 OF 4

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923862.38 mN
1759767.57 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 16.06m

R.L. COLLAR: 16.06m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering UW SW MW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Moderately to Slightly Weathered ECBF	Slightly weathered, grey, fine to medium, SANDSTONE, extremely weak.				PQ3	100		11.0											
	grades to; Slightly weathered, grey, fine, SANDSTONE, extremely to very weak.							5.5				100							
	Slightly weathered, grey, SILTSTONE, extremely weak.							6.0					-5.9m; J88°, PL, R, VN, CC, green alteration						
	Slightly weathered, grey, fine, SANDSTONE, extremely to very weak.							10.0					-6.1m; J60°, PL, R, VN, CC, green alteration						
Unweathered ECBF	Slightly weathered, greenish grey, SILTSTONE, extremely weak.				PQ3	100		9.5				100							
	Unweathered, greenish grey, very fine to fine, massive, SANDSTONE, very weak.							7.0					-6.95m; J50°, PL, SM, T, CN						
	Unweathered, greenish grey, SILTSTONE, very weak.							8.5					-7.75m; J55°, PL, R, VN, CV, brownish white & firm						
	Unweathered, greenish grey, very fine to fine, massive, SANDSTONE, very weak.							8.0					-7.85m; B<5°, PL, Carbonaceous						
	Unweathered, greenish grey, SILTSTONE, very weak.							8.0					-8.15m; J50°, PL, SM, T, CN						
	Unweathered, grey, fine, massive, SANDSTONE, very weak.				PQ3	100		7.5				100							
	Irregular SILTSTONE clasts in fine to medium SANDSTONE matrix, sheared fabric, weak.							7.5					-8.5m; SZ45°, PL, SM, MN, CG, parent + brownish white & firm						
	Unweathered, grey, very fine to fine, massive, SANDSTONE, weak.							9.0					-8.95m; J60°, PL, SM, T, CN						
	Unweathered, greenish grey, laminated fabric, SILTSTONE, weak. Thin carbonaceous beds				PQ3	100		6.5				100							

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH03

SHEET 3 OF 4

DRILLED BY: Billy

LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923862.38 mN
1759767.57 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 16.06m

R.L. COLLAR: 16.06m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering UW SW HW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	ROCK DEFECTS			Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
											Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	grades into; grey, very fine, SANDSTONE, weak.			PQ3	100		6.0					100	-10.1m; B<5°, PL, SM, Carbonaceous					
	Unweathered, grey, SILTSTONE, weak.						10.5						-10.3m; Drilling induced defects (200mm)					
	Unweathered, grey, fine, SANDSTONE, weak.						5.5											
	Unweathered, greenish grey, SILTSTONE, weak.												-10.7m; B3°, PL, SM					
	Unweathered, grey, fine, SANDSTONE, weak. 5mm lignite bed			PQ3	100		11.0					100						
	Unweathered, greenish grey, SILTSTONE, weak.						4.5											
	Unweathered, grey, fine, SANDSTONE, weak.						12.0											
	Unweathered, greenish grey, fine, SANDSTONE, weak.						4.0											
	Unweathered, dark grey, laminated fabric, SILTSTONE, weak.			PQ3	100		12.5					100	-12.55m; B5°, PL, SM, Carbonaceous					
	grades into; very fine SANDSTONE						13.0											
	grades into; fine to medium SANDSTONE						3.0											
	Unweathered, dark grey, SILTSTONE, weak.						13.5						-13.6m; J45°, PL, SM, T, CN					

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH03

SHEET 4 OF 4

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 7/11/13

FINISH DATE: 8/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataranga Rd, Narrowneck

CO-ORDINATES: 5923862.38 mN
1759767.57 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 16.06m

R.L. COLLAR: 16.06m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>UW SW MW VW CW</div>	Rock Strength <div>ES SS MS VS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm) <div>50 100 150 200</div>	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Unweathered, dark grey, laminated fabric, SILTSTONE, weak.				PQ3	100		1.0	x x x x x				-15.0m; Drilling induced fractures						
	Unweathered, dark grey, fine to medium, SANDSTONE, weak.							15.5	x x x x x				100	-15.25m; J90°, PL, SM, VN, CC (extends 1m) -15.35m; B5°, PL, SM, Carbonaceous -15.7m; J60°, PL, R, VN, CV, brown & stiff -15.8m; J90°, PL, R, VN, CV, brown & stiff					
								16.0										7	
						100		16.5				100							
								17.0											
								17.5											
								18.0											
								18.5											
								19.0											
								19.5											

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH04

SHEET 1 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 11/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923868.38 mN
1759825.47 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 11.31m

R.L. COLLAR: 11.31m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>LW SW MW CW</div>	Rock Strength <div>ES SS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Topsoil	SILT, scoriaceous gravel ~35mm, rootlets/organics; black brown. Firm, moist, low plasticity. Orange brick fragments at bottom of layer.																		
Highly to Moderately Weathered ECBF	SILT, rootlets; white grey with Fe stain. Stiff, moist, low plasticity.							11.0											
	Sandy SILT, rootlets; grey white. Stiff, moist, low plasticity; sand, fine, poorly graded.				PQ3	100		0.5											
	SILT, as above, low to moderate plasticity, rootlets.							10.5											
	Sandy SILT, as above.							1.0											
	SILT; light grey. Stiff, moist, low plasticity/SILTSTONE, grey, extremely weak, rootlets.							10.0											
	Stronger bed. 25mm SANDSTONE.				PQ3	100		1.5											
	Slightly weathered SILTSTONE, very weak.							9.5											
	Grey, fine SANDSTONE, extremely weak.							2.0											
	Grey SILTSTONE, very weak.							9.0											
	Grey SANDSTONE, very weak.							2.5											
Slightly Weathered ECBF	Grey, very fine to fine SANDSTONE, very weak.							8.5											
	SILTSTONE, very weak, carbonaceous beds.				PQ3	100		3.0											
	Grey, very fine SANDSTONE, very weak.							8.0											
	Grey SILTSTONE, very weak.							3.5											
	Grey, fine SANDSTONE, very weak.				PQ3	100		7.5											
	Green grey SILTSTONE, very weak.							4.0											
											-2.3m: Shear zone? <5°, planar, clay -2.35m: Joint 7°, planar, smooth, very narrow, Fe stained. Bedding <5°, planar.								
											Bedding <5°, planar.								
											-3.7m: Joint 85°, planar, rough, very narrow, clay veneer, white brown hard clay.								
											-4.4m: Joint 85°, planar, smooth, very narrow, clay veneer, as above.								

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH04

SHEET 2 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 11/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923868.38 mN
1759825.47 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 11.31m

R.L. COLLAR: 11.31m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>UW SW MW CW OW</div>	Rock Strength <div>ES SS MS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm) <div>50 10 5</div>	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Slightly Weathered ECBF	Grey, fine to medium SANDSTONE, very weak, carbonaceous beds.								6.0	<div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div></div><div><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COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH04

SHEET 3 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 11/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923868.38 mN
1759825.47 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 11.31m

R.L. COLLAR: 11.31m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>UW SW MW LW CW</div>	Rock Strength <div>ES SS MS VS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm) <div>50 100 150</div>	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Red grains/clasts																		
	Purple grey bed 10-20mm thick red grains							1.0											
	Green grey SILTSTONE, weak.					100		10.5				100							
	Grey, fine to medium SANDSTONE, weak.							-0.5											
	END OF BOREHOLE AT 11m.							11.0											
	Target depth.							0.0											
								11.5											
								-0.5											
								12.0											
								-1.0											
								12.5											
								-1.5											
								13.0											
								-2.0											
								13.5											
								-2.5											
								14.0											
								-3.0											
								14.5											
								-3.5											
								15.0											

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH06

SHEET 1 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923961.69 mN
1759850.89 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 14.15m

R.L. COLLAR: 14.15m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering LW SW MW CW VW EW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Highly to Moderately Weathered ECBF	SILT, brown grey. Firm, dry, non-plastic. Rootlets, organics.				HA	100		14.0	0.5					Rock chip (7mm) / sand grain sample return. (Breaker bar was needed to assist HA to 0.95m depth).					
	Very disturbed sample; Silty SAND, light grey brown. Dense, moist, homogeneous.																		
	grades into moderately weathered, light grey, SILTSTONE, extremely weak. Fe stain mottle.																		
Slightly Weathered ECBF	grades into moderately to slightly weathered, grey, SILTSTONE, very weak.				PQ	100		13.5	1.0										
	Moderately to slightly weathered, grey, fine to coarse, massive, SANDSTONE, weak.																		
	subrounded clasts of green grey SILTSTONE (2-5mm)																		
	grades into very fine to fine SANDSTONE.																		
Unweathered ECBF	grades into unweathered, grey, massive, fine to coarse, SANDSTONE, weak.				PQ	47		10.0	4.5										
	Unweathered, greenish grey, SILSTONE, weak. Carbonaceous bands.																		
	Unweathered, grey, massive, fine to coarse, SANDSTONE, weak.																		

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH06

SHEET 2 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923961.69 mN
1759850.89 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 14.15m

R.L. COLLAR: 14.15m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	Fracture Spacing (cm)	ROD %	ROCK DEFECTS Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	Water Loss (%)	Water Level	Casing	Installation	Core Box
Unweathered ECBF	Unweathered, greenish grey, SILTSTONE, weak.						9.0						-5.1m; J55°, PL, SL, T, CV, orange & firm					
	Core loss												-5.1m; J88°, UN, SL, T, CV, orange & firm					
				PQ	47		5.5					33						
							8.5											
							6.0											
							8.0											
							6.5											
							7.5											
	Unweathered, grey, fine, massive, SANDSTONE, weak.			PQ	40		7.0					0	-7.05m; J40°, PL, R, VN, CV, white & hard					
	grades into fine to medium/coarse SANDSTONE.						7.0						-7.25m; F90°, PL, SL, VN, CV, white & healed (85mm offset).					
							7.5											
	Unweathered, green grey, laminated fabric, SILTSTONE, weak to moderately strong. Carbonaceous bands.						6.5						-7.6m; B3°, PL, SM					
							8.0											
				PQ	100		6.0					100						
							8.5						-8.4m; B3°, PL, SM					
	Unweathered, grey, fine, massive, SANDSTONE, weak to moderately strong.						5.5						-8.5m; J88°, UN, R, T, FeSt (extends 400mm).					
							9.0						-8.7m; Drilling induced fractures (150mm).					
	Unweathered, greenish grey, SILTSTONE, weak.												-8.8m; B5°, PL, SM					
							9.0											
	Unweathered, grey, fine, SANDSTONE, weak.						5.0						-9.15m; J85°, PL, R, T					
	Unweathered, greenish grey, SILTSTONE, weak.												-9.2m; Drilling induced fractures					
							9.5					100						
	Unweathered, grey, fine, massive, SANDSTONE, weak.			PQ	100		4.5											

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH06

SHEET 3 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataranga Rd, Narrowneck

CO-ORDINATES: 5923961.69 mN
1759850.89 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 14.15m

R.L. COLLAR: 14.15m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering UW SW MW VW CW	Rock Strength ES SS MS WS VS EW	Sampling Method Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation								Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Unweathered, grey, laminated fabric, SILTSTONE, weak. Carbonaceous bands.			PQ	100	4.0	x x										

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07

SHEET 1 OF 5

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923915.13 mN
1759741.41 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 20.39m

R.L. COLLAR: 20.39m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS MS WS VS EW	Sampling Method Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Topsoil	SILT, rootlets, organics; brown grey. Firm, moist, low plasticity.																
Fill	SILT, rootlets, gravels/cobbles; white grey to grey, Fe stain. Stiff, dry to moist, low plasticity; gravels/cobbles, basaltic/scoriaceous. [Fill?] Core seams disturbed/compacted.			PQ3	100		20.0										
R/S	SILT; white, Fe stained. Stiff, moist, moderate plasticity.			PQ3	100		19.5										
Highly to Slightly Weathered ECBF	Moderately weathered, light grey SILTSTONE, extremely weak, Fe stain, rootlets infilling fractures.			PQ3	100		19.0										
	Very weak.						1.5										
	Moderately weathered, light brown grey, fine to very fine SANDSTONE, Fe stain on fractures.						18.5										
	Grey SILTSTONE, very weak.						2.0										
	Carbonaceous beds.						18.0										
	Moderately weathered, light grey, fine SANDSTONE, extremely weak, Fe alteration.			PQ3	100		2.5										
	Slightly weathered, light green grey SILTSTONE, extremely weak.						17.5										
	Slightly weathered, light grey, fine SANDSTONE, extremely weak.			PQ3	100		3.0										
							17.0										
							3.5										
							16.5										
							4.0										
							16.0										
							4.5										
							15.5										
							5.0										

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07

SHEET 2 OF 5

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923915.13 mN
1759741.41 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 20.39m

R.L. COLLAR: 20.39m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW MW CW VW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation									Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill	Defect Log	Fracture Spacing (cm)	ROD %					
Unweathered ECBF	Green grey SILTSTONE.																	
	Grey, fine SANDSTONE, extremely weak.																	
	Green grey SILTSTONE, very weak to weak.																	
	Green grey MUDSTONE, weak.																	
	Green grey, fine to very fine SANDSTONE, weak to moderately strong.																	
	Green grey SILTSTONE, weak.																	
	6.3m: 12mm Parnell Grit lens.																	
	Green grey, fine to medium SANDSTONE, with fine gravel sized clasts of SILTSTONE, weak.																	
	Carbonaceous beds.																	
	Interbedded SILTSTONE and MUDSTONE, grey to green grey, weak.																	
	Grey, fine SANDSTONE, weak, fine to medium with red flecks.																	
	Grey SILTSTONE, weak.																	
	Grey, very fine SANDSTONE.																	
	Fine to medium, red flecks.																	

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07

SHEET 3 OF 5

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923915.13 mN
1759741.41 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 20.39m

R.L. COLLAR: 20.39m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering UW SW MW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Fine to medium and gravel fine clasts of SILTSTONE.				PQ3	100		10.0					100						
	50mm SILTSTONE.							10.5											
					PQ3	100		9.0				50	-11.3m: Joint 45°, planar, rough, tight.						
	Turbidite/submarine avalanche deposit. SILTSTONE clasts (gravel-cobble) in SANDSTONE matrix, weak; sandstone is fine to coarse.							11.5					-11.5m: Joint 55°, planar, rough, very narrow, clay veneer, brown white, stiff.						
	Green grey SILTSTONE, weak.							8.5					-11.55m: Joint 80°, planar, rough, very narrow, clay veneer, brown white, stiff.						
	Grey, very fine to fine SANDSTONE, weak.							12.0					-11.65m: Joint 70°, planar, rough, very narrow, clay veneer, brown white, stiff.						
								12.5					-11.8m: Bedding 50°, planar, variable 10°.						
	Interbedded SILTSTONE and MUDSTONE, weak, 20mm.				PQ3	100		7.5				100	-12.9m: Bedding 5°, planar, smooth, very narrow, clay veneer, yellow, hard.						
	Grey, very fine to fine SANDSTONE, weak.							13.0						-13.4m: Bedding <5°, planar, smooth, tight.					
	50mm SILTSTONE, carbonaceous beds.							13.5						-13.65m: Joint 88°, planar, smooth, tight.					
	Green grey SILTSTONE, weak.							6.5					-13.9m: Bedding 10° but variable.						
	Turbidite/submarine avalanche deposit. SILTSTONE clasts (gravel-cobble) in SANDSTONE matrix, weak; sandstone is fine to coarse.			PQ3	100		6.0					100	-14.7m: Joint 5°, planar, smooth, very narrow, clay veneer, yellow brown, hard.						
								14.0					-14.8m: Bedding <5°, planar, smooth.						
								14.5											
								5.5											

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07

SHEET 4 OF 5

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923915.13 mN
1759741.41 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 20.39m

R.L. COLLAR: 20.39m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%)	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description					
Unweathered ECBF	Grey, fine SANDSTONE, carbonaceous/organic rich. 2x 6mm lignite beds.	Green grey SILTSTONE, weak.			PQ3	100								100	-13.65m: Joint 88°, planar, smooth, tight.				
								5.0							-15.5m: Bedding <5°, planar, smooth.				
	Grey, fine SANDSTONE, weak.							15.5											
	Fine to medium/coarse.				PQ3	100							100						
								4.5											
								16.0											
	Grey MUDSTONE, weak.																		
	Grey, fine to medium SANDSTONE.							4.0							-16.4m: Joint 85°, planar, rough, very narrow, carbonate cemented, yellow brown, hard.				
								16.5											
	Grey SILTSTONE, weak. Parnell Grit lens, 5mm.							3.5							-16.75m: Joint 70°, planar, rough, very narrow, carbonate cemented, yellow brown, hard.				
	Grey, very fine SANDSTONE, weak, grading in to fine to medium, dark grey.							17.0							Joint 85°, planar, rough, very narrow, carbonate cemented, yellow brown, hard.				
	Coarse to fine.														Joint 90°, planar, rough, very narrow, carbonate cemented, yellow brown, hard.				
	Interbedded SILTSTONE and MUDSTONE, grey, weak.				PQ3	100		3.0					100		-17.4m: Joint 85°, planar, rough, very narrow, carbonate cemented, as above.				
								17.5							-17.6m: Joint 85°, planar, smooth, very narrow, Fe stained.				
								2.5							-17.8m: Shear zone? 5°, planar, smooth, moderately narrow, parent and yellow, carbonate cemented.				
	Grey, very fine SANDSTONE, weak.							18.0							-17.9m: Bedding 5°, planar, smooth.				
															-18m: Bedding <5°, planar, smooth.				
								2.0											
	Grey SILTSTONE, weak, carbonaceous beds.							18.5											
	Dark grey, fine to medium SANDSTONE.																		
						PQ3	100		1.5				100		-19m: Bedding 5°, planar, smooth.				
	Fine to coarse.							19.0											
	Green grey SILTSTONE, weak, carbonaceous beds.							1.0											
								19.5											
	Dark grey, fine SANDSTONE, weak.																		
	Interbedded SILTSTONE and MUDSTONE, weak, 30-60mm beds.					PQ3	100		0.5				100		-19.8m: Bedding 5°, planar, smooth.				

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07

SHEET 5 OF 5

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: JKK

START DATE: 11/11/13

FINISH DATE: 12/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923915.13 mN
1759741.41 mE

R.L. GROUND: 20.39m

R.L. COLLAR: 20.39m

DIRECTION: 0.00°

DATUM: 0

ANGLE FROM HORIZ.: -90.00°

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering LW SW MW CW VW EW	Rock Strength ES SS MS WS VS LW VW EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation										Defect Log	Fracture Spacing (cm) 50 10 5	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Green grey SILTSTONE, weak.																		
	20mm carbonaceous bed.				PQ3	100													
	Grey, fine to medium SANDSTONE, weak.																		
	Green grey SILTSTONE, weak. 5mm lignite bed at old end.				PQ3	100													
	Dark grey, fine to medium SANDSTONE, weak.																		
	END OF BOREHOLE AT 22.6m.																		
	Target depth.																		

COMMENTS: Standpipe piezometer installed at hole completion, screen depth 3-6m.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07A

SHEET 1 OF 2

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: DEL

START DATE: 13/11/13

FINISH DATE: 13/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923913.54 mN
1759743.31 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 20.29m

R.L. COLLAR: 20.29m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering UW SW HW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
										Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
TOPSOIL	SILT, with trace sand, black brown. Firm, moist, non-plastic. Sand; fine, subrounded, poorly graded, (aeolian?). Decomposing organics and tubular rootlets throughout.							20.0										
RESIDUAL SOILS [EAST COAST BAYS FM]	SILT, grey white. Stiff, dry to moist, low plasticity. Fe stain mottle, mixture of decomposing and fresh tubular rootlets, trace angular roading aggregate (fill?).				100			0.5										
	Push tube sampler				100			19.0										
	Wash drill, no core recovery				0			18.5										
COMPLETELY/HIGHLY WEATHERED EAST COAST BAYS FM	Push tube sampler				100			2.0										
	Invalid test, weight catcher malfunction. SILT, with trace sand, light grey. Stiff, moist, low plasticity. Fe mottle.				100	$\frac{1}{2}$ $N=3$		18.0										
	Wash drill, no core recovery				0			17.0										
	Push tube sampler				100			4.0										
	Wash drill, no core recovery				0			4.5										
	Invalid test, weight catcher malfunction. Silty fine SAND, light grey. Dense, moist, homogeneous, subrounded, poorly graded. (Highly weathered, light grey, SANDSTONE, extremely				100	$\frac{2}{4}$ $N=10$		15.5										

COMMENTS:



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH07A

SHEET 2 OF 2

DRILLED BY: Sisi

LOGGED BY: CRG

CHECKED: DEL

START DATE: 13/11/13

FINISH DATE: 13/11/13

CONTRACTOR: Drill Force (Sisi)

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5923913.54 mN
1759743.31 mE

DIRECTION: 0.00°

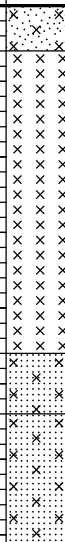
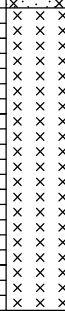

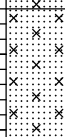














ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 20.29m

R.L. COLLAR: 20.29m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering UW SW MW HW CW	Rock Strength ES SS WS VS VW EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation										Defect Log	Fracture Spacing (cm) 50 10 5	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
EAST COAST BAYS FM	weak).					100	11 19 24 N=43												
	Highly to moderately weathered, light grey,SILTSTONE, extremely to very weak.								15.0										
	Moderately weathered, light grey, fine SANDSTONE, very weak.					100			14.5										
	Moderately weathered, light grey, fine SANDSTONE, very weak.								6.5										
								13.5											
								7.0											
								13.0											
								7.5											
								12.5											
								8.0											
								12.0											
								8.5											
								11.5											
								9.0											
								11.0											
								9.5											
								10.5											
								10.0											

COMMENTS:



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH08

SHEET 1 OF 3

DRILLED BY: Billy
LOGGED BY: CRG

CHECKED: JKK

START DATE: 13/11/13

FINISH DATE: 13/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5924004.86 mN
1759909.69 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 17.34m

R.L. COLLAR: 17.34m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering LW SW HW CW	Rock Strength ES SS WS VS LW VW EW	Sampling Method Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
VACUUM EXCAVATED	Vacuum excavated to clear services.			Vacuum	0												
Residual Soils [EAST COAST BAYS FM]	Clayey SILT, grey white. Stiff, moist, moderate plasticity. Rootlets, Fe stain mottle (~40%).						17.0										
	Silty SAND, grey white. Dense, moist, low plasticity. Sand; very fine, subrounded, poorly graded. Rootlets, Fe stain mottle (15%).						16.5										
	grades into Sand; fine to medium.						1.0										
	Clayey SILT, grey white. Stiff, moist, moderate to high plasticity. Rootlets, Fe stain mottle (45%), relic jointing.						16.0										
Completely Weathered ECBF	grades into very stiff, moderately plastic. Fe stain mottle (5%), relic jointing.						1.5										
	Silty SAND, grey white. Medium dense, moist, non-plastic. Sand; fine to medium, subrounded, poorly graded. Fe stain mottle (15%).						15.5										
	Silty SAND, grey brown. Medium dense, moist, non-plastic. Sand; fine to coarse, subrounded, poorly graded (favouring fine). Fe stain mottle (80%). [becoming less mottled, 4.0m to 4.1m]						2.0										
	SILT, light brown. Hard, moist, low plasticity. (Aquiclude?).						15.0										
Completely Weathered ECBF	Silty SAND, grey. Dense, moist, homogeneous. Sand; fine, subrounded, poorly graded.						2.5										
	Silty SAND, grey. Very dense, moist, homogeneous. Sand; very fine, subrounded, poorly graded.						14.5										
							3.0										
							14.0										
Completely Weathered ECBF							3.5										
							13.5										
							4.0										
							13.0										
Completely Weathered ECBF							4.5										
							12.5										
							5.0										

COMMENTS: Hole backfilled with gap 5-7 gravel.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH08

SHEET 2 OF 3

DRILLED BY: Billy

LOGGED BY: CRG

CHECKED: JKK

START DATE: 13/11/13

FINISH DATE: 13/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataringa Rd, Narrowneck

CO-ORDINATES: 5924004.86 mN
1759909.69 mE

DIRECTION: 0.00°

ANGLE FROM HORIZ.: -90.00°

R.L. GROUND: 17.34m

R.L. COLLAR: 17.34m

DATUM: 0

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering <div>LW SW MW CW</div>	Rock Strength <div>ES SS MS WS VS EW</div>	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) <div>25 50 75</div>	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Completely to Highly Weathered ECBF	Silty SAND, grey. Dense, moist, homogeneous. Sand; fine, subrounded, poorly graded.				PQ	100		12.0	5.5										
	Sandy SILT, light grey. Firm, moist, low plasticity.																		
	Silty SAND, grey. Very dense, moist, homogeneous.																		
Highly to Moderately Weathered ECBF	SILT, light greenish grey. Hard, moist, low plasticity. (Highly weathered, light greenish grey, laminated fabric, SILTSTONE, extremely weak).						6.0	11.5	6.0					-5.95m; B5-7°, PL, SM					
	Moderately to highly weathered, grey, massive, fine, SANDSTONE, extremely to very weak.																		
	Moderately weathered, green grey, SILTSTONE, very weak.																		
Slightly Weathered ECBF	Moderately to highly weathered, grey, massive, fine, SANDSTONE with clasts (5-40mm) of rounded SILTSTONE, extremely to very weak.				PQ	100		10.5	7.0			100							
	becomes fine to medium SANDSTONE, with clasts (5mm) of rounded blue green MUDSTONE.																		
	Slightly weathered, greenish grey, MUDSTONE, very weak.																		
Unweathered ECBF	Slightly weathered, greenish grey, distinctly bedded, SILTSTONE, very weak. Bedding is gentle to moderately inclined, very thin to thin.				PQ	100		9.5	8.0					-8.4m; J50°, UN, R, VN, CV, white & firm, extends 200mm.					
	Slightly weathered, grey, massive, fine, SANDSTONE, very weak to weak.																		
	Angular clasts of greenish grey SILTSTONE in a grey fine to medium SANDSTONE matrix.																		
Unweathered ECBF	Slightly weathered, greenish grey, SILTSTONE, weak. Carbonaceous beds (3mm) at each end.				PQ	100		8.0	9.5					-9.3m; B5°, PL, SM					
	Unweathered, grey, fine, massive, SANDSTONE, weak.																		

COMMENTS: Hole backfilled with gap 5-7 gravel.



TONKIN & TAYLOR LTD

BORE HOLE LOG

BOREHOLE No:

BH08

SHEET 3 OF 3

DRILLED BY: Billy

LOGGED BY: CRG

CHECKED: JKK

START DATE: 13/11/13

FINISH DATE: 13/11/13

CONTRACTOR: Drill Force

PROJECT: Ryman Narrowneck

JOB No: 29452

LOCATION: 7-37 Ngataranga Rd, Narrowneck

CO-ORDINATES: 5924004.86 mN
1759909.69 mE

R.L. GROUND: 17.34m

R.L. COLLAR: 17.34m

DIRECTION: 0.00°



DATUM: 0

ANGLE FROM HORIZ.: -90.00°

SURVEY: Survey

GEOLOGICAL UNIT	DESCRIPTION OF CORE		Rock Weathering UW SW MW CW CW	Rock Strength ES SS MS WS VS EW	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS				Water Loss (%) 25 50 75	Water Level	Casing	Installation	Core Box
	SOIL: Classification, colour, consistency / density, moisture, plasticity	ROCK: Weathering, colour, fabric, name, strength, cementation									Defect Log	Fracture Spacing (cm)	ROD %	Description Type, Orientation, Spacing, Shape, Persistence, Roughness, Aperture, Weathering, Infill					
Unweathered ECBF	Unweathered, greenish grey, laminated fabric, SILTSTONE, weak. Bedding is subhorizontal, very thin.				PQ	100		7.0					100	-10.1m; 20mm carbonaceous bed -10.2m; B<5°, PL, SM -10.35m; 20mm carbonaceous bed					4
	Unweathered, grey, fine to medium, SANDSTONE, moderately strong. Subangular irregular clasts (5-35mm) of SILTSTONE.						10.5												
	Unweathered, greenish grey, laminated fabric, SILTSTONE, moderately strong.						6.5												
	Unweathered, grey, massive, fine, SANDSTONE, weak to moderately strong.				PQ	100		11.0					100						
	Unweathered, dark greenish grey, laminated fabric, SILTSTONE, weak.						11.5							-11.6m; B3°, PL, R					
	Unweathered, dark grey green, fine, SANDSTONE, weak.													-11.7m; B<3°, PL, SM					
	Unweathered, dark greenish grey, laminated fabric, SILTSTONE, weak.						5.5							-11.9m; B7°, PL, R					
	Unweathered, dark grey, massive, fine, SANDSTONE, weak to moderately strong.			PQ	100		12.0						100					5	
	End of Hole = 12.4m.						5.0												
							12.5												
							4.5												
							13.0												
							4.0												
							13.5												
							3.5												
							14.0												
							3.0												
							14.5												
							2.5												
							15.0												

COMMENTS: Hole backfilled with gap 5-7 gravel.

PROJECT: Ryman-pre-2-geo										LOCATION: 7-37 Ngataringa Road, Narrowneck										JOB No: 29452																																																																																																																																																																																																																																																																																																																																																		
CO-ORDINATES: 5923906.03 mN 1759686.5 mE										DRILL TYPE: 50mm hand auger										HOLE STARTED: 11/11/13																																																																																																																																																																																																																																																																																																																																																		
R.L.: 25.48 m										DRILL METHOD: HA										HOLE FINISHED: 11/11/13																																																																																																																																																																																																																																																																																																																																																		
DATUM: Auckland Mean Sea Level Datum 1946										DRILL FLUID: 25.48										LOGGED BY: RBE CHECKED: JKK																																																																																																																																																																																																																																																																																																																																																		
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GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.										FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE / WEATHERING CONDITION	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.																																																																																																																																																																																																																																																																																																																																												
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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:HA02
Hole Location: Refer to site plan

SHEET 1 OF 1

PROJECT: Ryman-pre-2-geo										LOCATION: 7-37 Ngataranga Road, Narrowneck										JOB No: 29452																																																																																																																																																																																																																																																																																																								
CO-ORDINATES: 5923867.96 mN 1759647.15 mE										DRILL TYPE: 50mm hand auger										HOLE STARTED: 11/11/13																																																																																																																																																																																																																																																																																																								
R.L.: 22.82 m										DRILL METHOD: HA										HOLE FINISHED: 11/11/13																																																																																																																																																																																																																																																																																																								
DATUM: Auckland Mean Sea Level Datum 1946										DRILL FLUID: 22.82										DRILLED BY: RBE																																																																																																																																																																																																																																																																																																								
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GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.										FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSIVE STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.																																																																																																																																																																																																																																																																																																	
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TONKIN & TAYLOR LTD

BOREHOLE LOG

BOREHOLE No:HA03
Hole Location: Refer to site plan
SHEET 1 OF 1

PROJECT: Ryman-pre-2-geo										LOCATION: 7-37 Ngataringa Road, Narrowneck										JOB No: 29452																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
CO-ORDINATES: 5923827.02 mN 1759706.86 mE										DRILL TYPE: 50mm hand auger										HOLE STARTED: 11/11/13																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
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GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.										FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	SHEAR STRENGTH (kPa)	COMPRESSION STRENGTH (MPa)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components. Defects: Type, inclination, thickness, roughness, filling.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
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TONKIN & TAYLOR LTD

BOREHOLE LOG

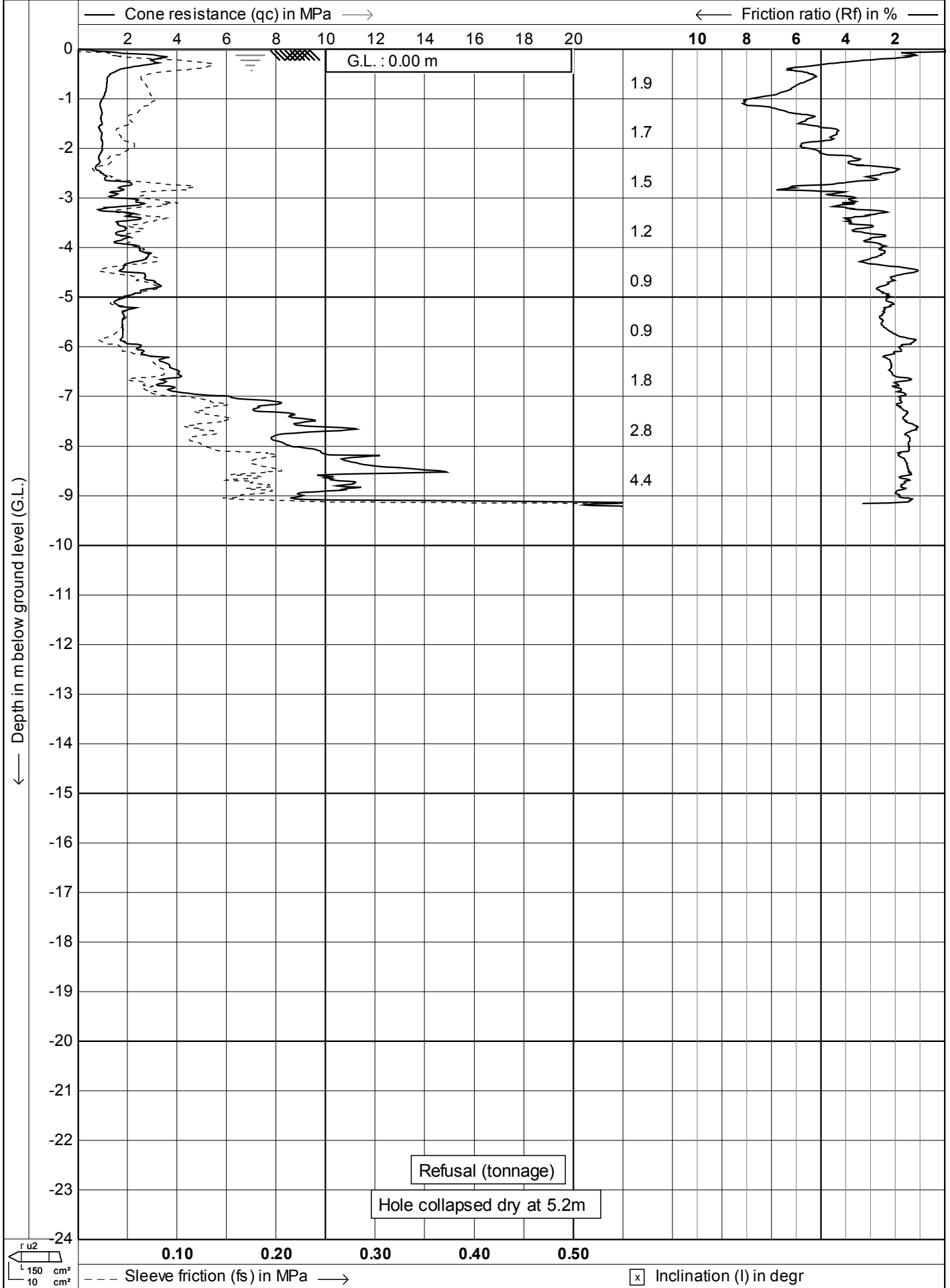
BOREHOLE No:HA04
Hole Location: Refer to site plan
SHEET 1 OF 1

PROJECT: Ryman-pre-2-geo										LOCATION: 7-37 Ngataranga Road, Narrowneck										JOB No: 29452																			
CO-ORDINATES: 5923976.64 mN 1759822.15 mE										DRILL TYPE: 50mm hand auger										HOLE STARTED: 11/11/13																			
R.L.: 21.50 m										DRILL METHOD: HA										HOLE FINISHED: 11/11/13																			
DATUM: Auckland Mean Sea Level Datum 1946										DRILL FLUID: 21.5										LOGGED BY: RBE										CHECKED: JKK									
GEOLOGICAL																				ENGINEERING DESCRIPTION																			
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.										FLUID LOSS	WATER	CORE RECOVERY (%)	METHOD	CASING	TESTS	SAMPLES	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MOISTURE CONDITION	WEATHERING	STRENGTH/DENSITY CLASSIFICATION	10 25 50 100 200 400 800 1600 3200 6400 12800 25600 51200 102400 204800 409600 819200 1638400 3276800 6553600 13107200 26214400 52428800 104857600 209715200 419430400 838860800 1677721600 3355443200 6710886400 13421772800 26843545600 53687091200 107374182400 214748364800 429496729600 858993459200 1717986918400 3435973836800 6871947673600 13743895347200 27487790694400 54975581388800 109951162777600 219902325555200 439804651110400 879609302220800 1759218604441600 3518437208883200 7036874417766400 14073748835532800 28147497671065600 56294995342131200 112589990684262400 225179981368524800 450359962737049600 900719925474099200 1801439850948198400 3602879701896396800 7205759403792793600 14411518807585587200 28823037615171174400 57646075230342348800 115292150460684697600 230584300921369395200 461168601842738790400 922337203685477580800 1844674407370955161600 3689348814741910323200 7378697629483820646400 14757395258967641292800 29514790517935282585600 59029581035870565171200 118059162071741130342400 236118324143482260684800 472236648286964521369600 944473296573929042739200 1888946593147858085478400 3777893186295716170956800 7555786372591432341913600 15111572745182864683827200 30223145490365729367654400 60446290980731458735308800 120892581961462917470617600 241785163922925834941235200 483570327845851669882470400 967140655691703339764940800 1934281311383406679529881600 3868562622766813359059763200 7737125245533626718119526400 15474250491067253436239052800 30948500982134506872478105600 61897001964269013744956211200 123794003928538027489912422400 247588007857076054979824844800 495176015714152109959649689600 990352031428304219919299379200 1980704062856608439838598758400 3961408125713216879677197516800 7922816251426433759354395033600 15845632502852867518708790067200 31691265005705735037417580134400 63382530011411470074835160268800 126765060022822940149670320537600 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T-T DATATEMPLATE.GDT.cgr

Log Scale 1:37.5

BORELOG 616190.GPJ 27-Nov-2013



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

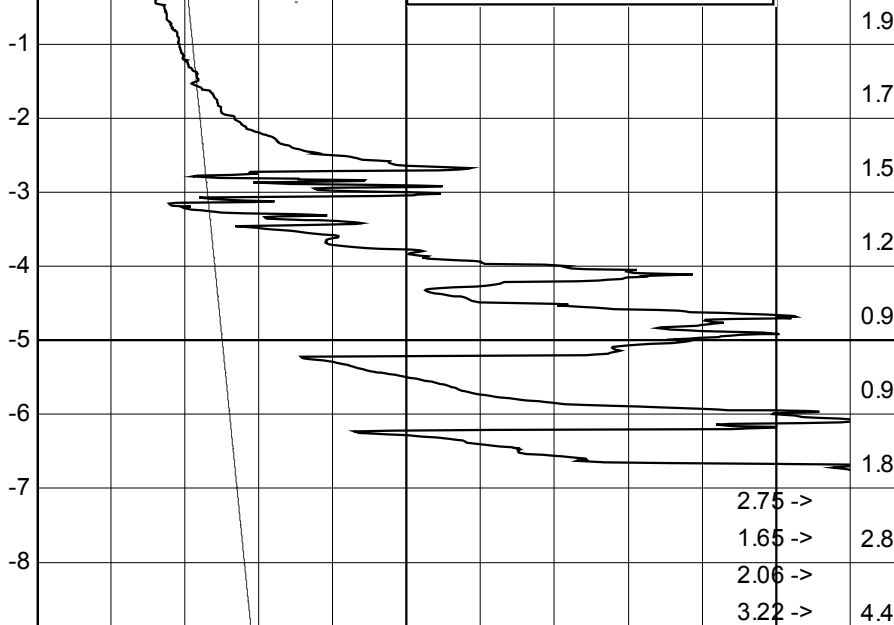
CPT no. : **01** 1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u_2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m



Refusal (tonnage)

Hole collapsed dry at 5.2m

0.00 0.20 0.40 0.60 0.80 1.00 1.20

--- Equilibrium pore pressure (u_0) in MPa →

☒ Inclination (I) in degr



Test according A.S.T.M. Standard D 5778-12

Project : Site Investigation

Location: Ngataringa Rd - Devonport - Auckland

Position: 0, 0 RD

Date : 5-11-2013

Cone no. : C10CFIP.C13184

Project no. : 05TT17

CPT no. : 01

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (tonnage)

Hole collapsed dry at 5.2m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

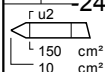
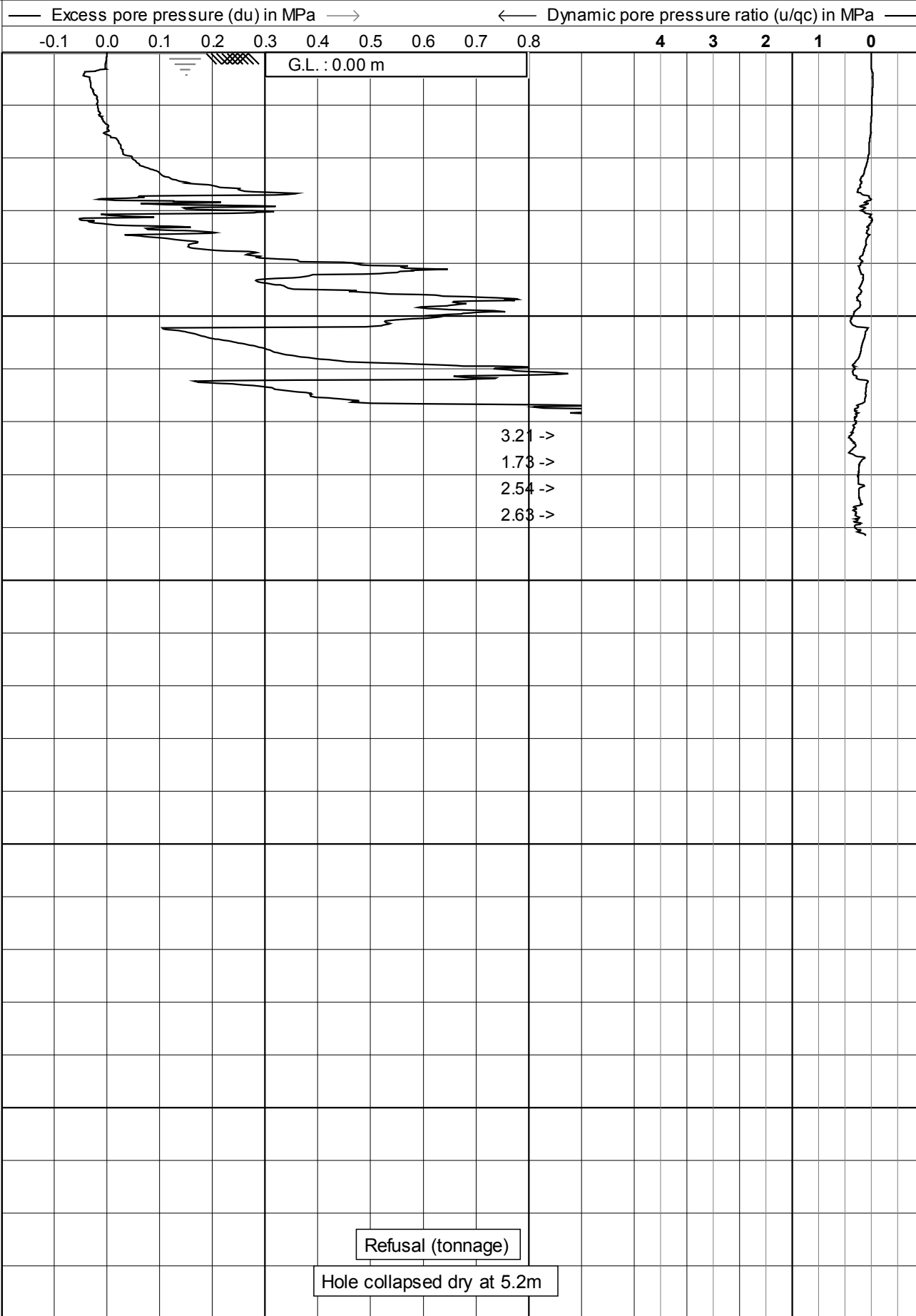
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

3/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

4/14

← Depth in m below ground level (G.L.)

— Effective cone resistance (q_e) in MPa —→

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (tonnage)

Hole collapsed dry at 5.2m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

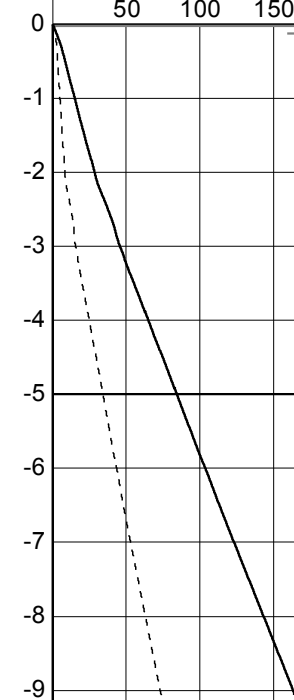
5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (σ_v, z) in kPa →

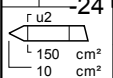
50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m



Refusal (tonnage)

Hole collapsed dry at 5.2m



100

200

300

400

500

600

700

--- Effective vertical stress (σ_v, z') in kPa →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

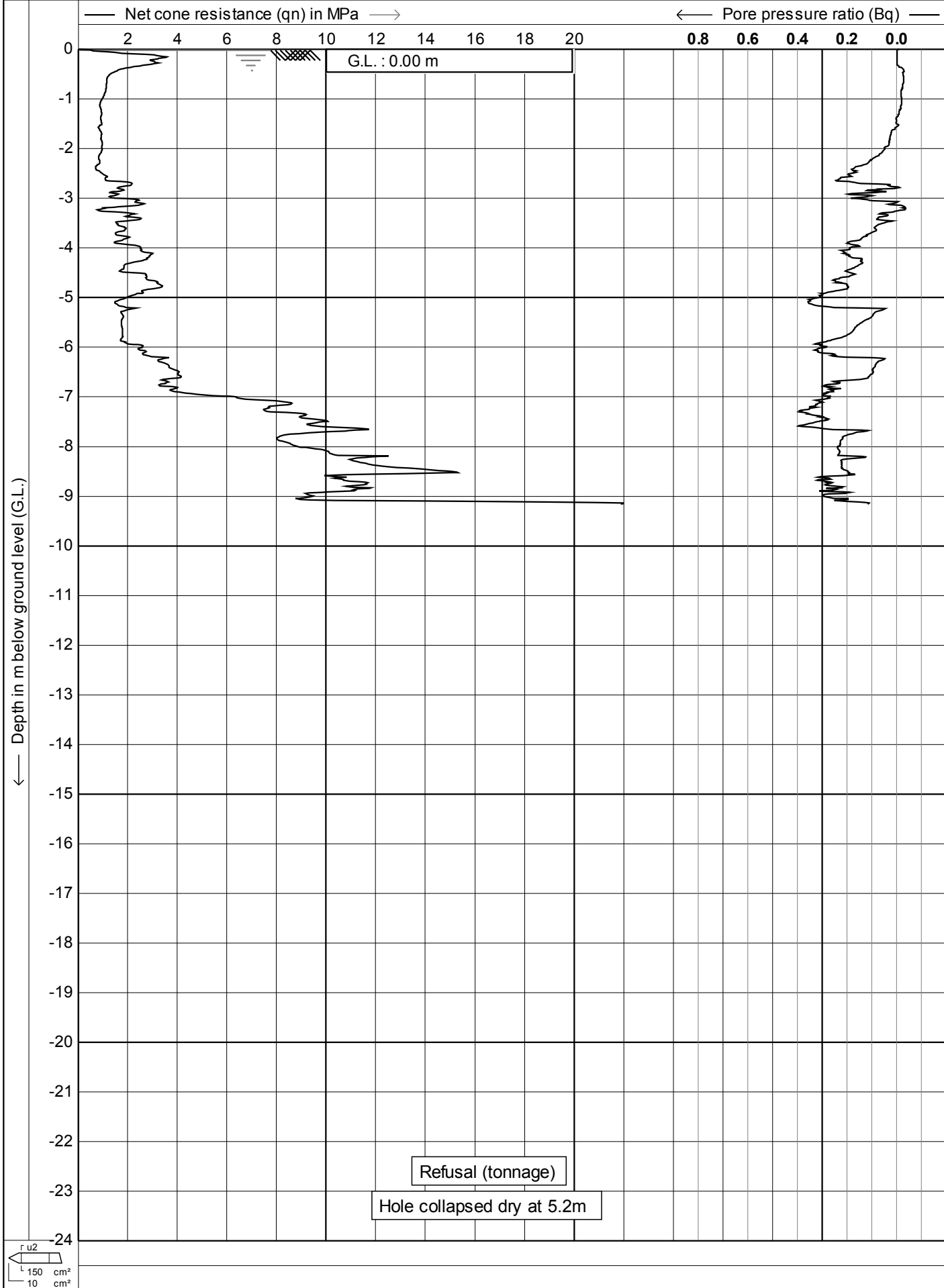
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

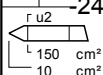
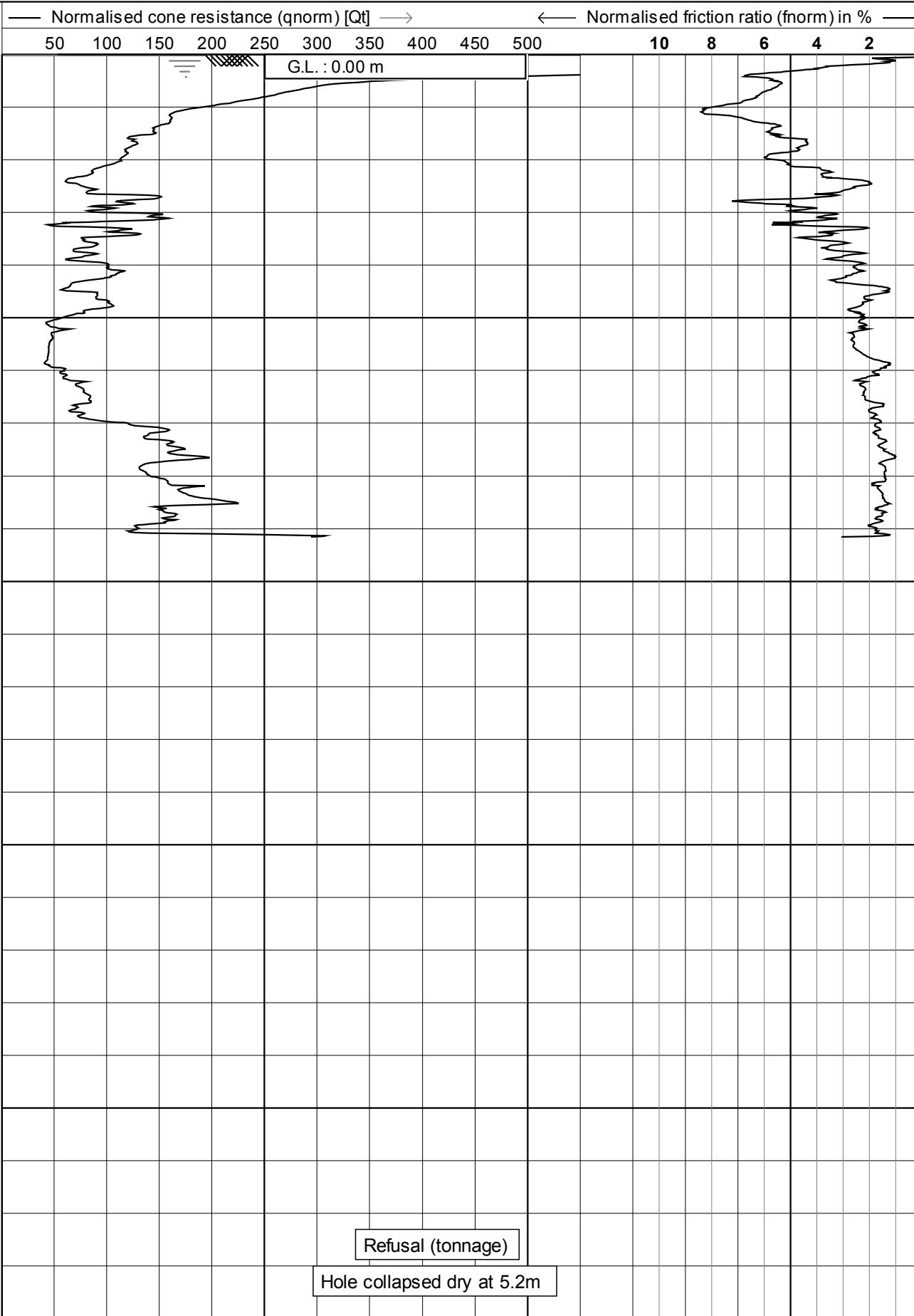
Project no. : **05TT17**

CPT no. : **01**

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← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

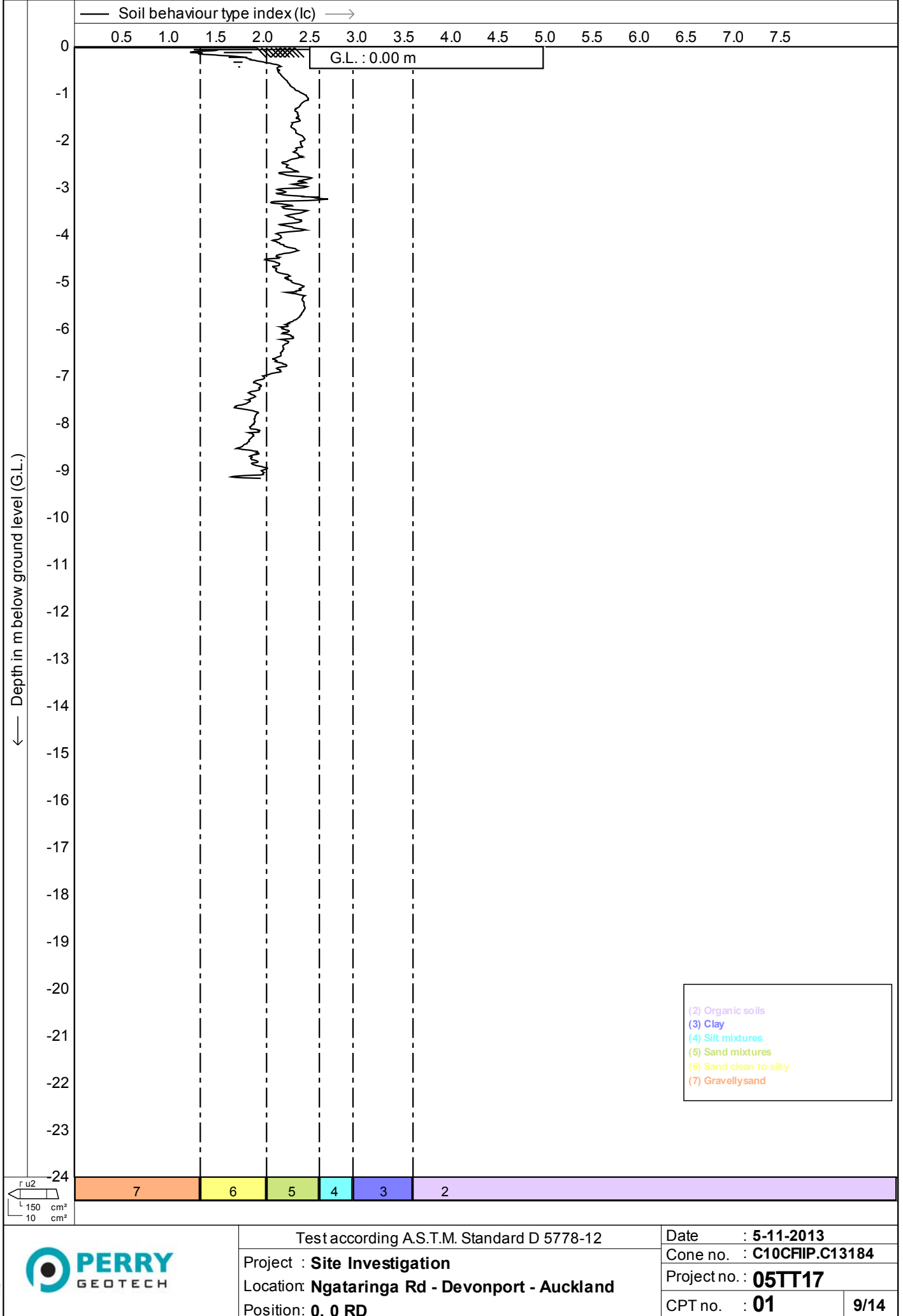
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

8/14



← Depth in m below ground level (G.L.)

— Undrained shear strength (Su) in kPa —→

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500

G.L. : 0.00 m

Refusal (tonnage)

Hole collapsed dry at 5.2m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

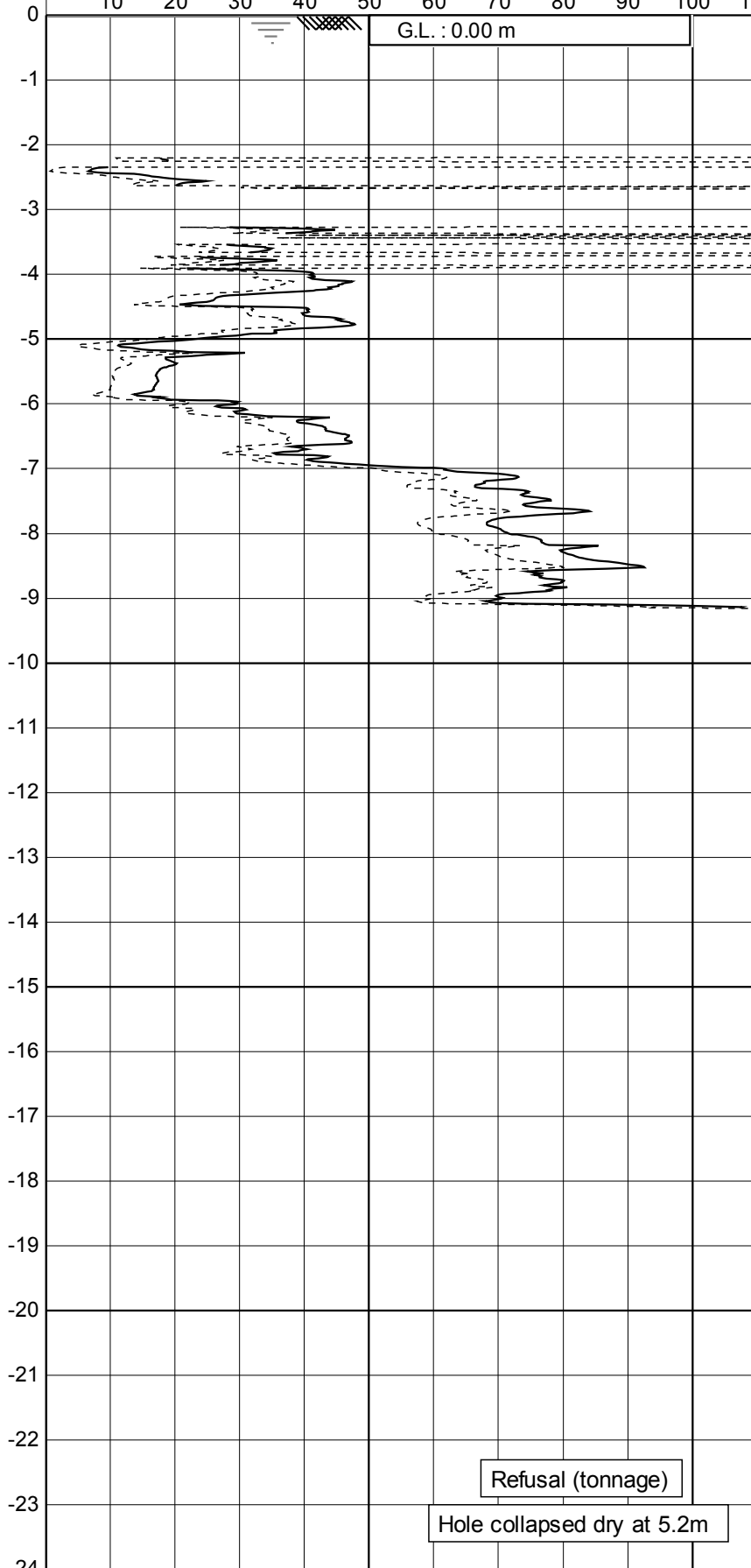
10/14

← Depth in m below ground level (G.L.)

— Relative density (consolidated) in % →

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

G.L. : 0.00 m



γ u2
150 cm²
10 cm²

--- Relative density (over-consolidated) in % →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

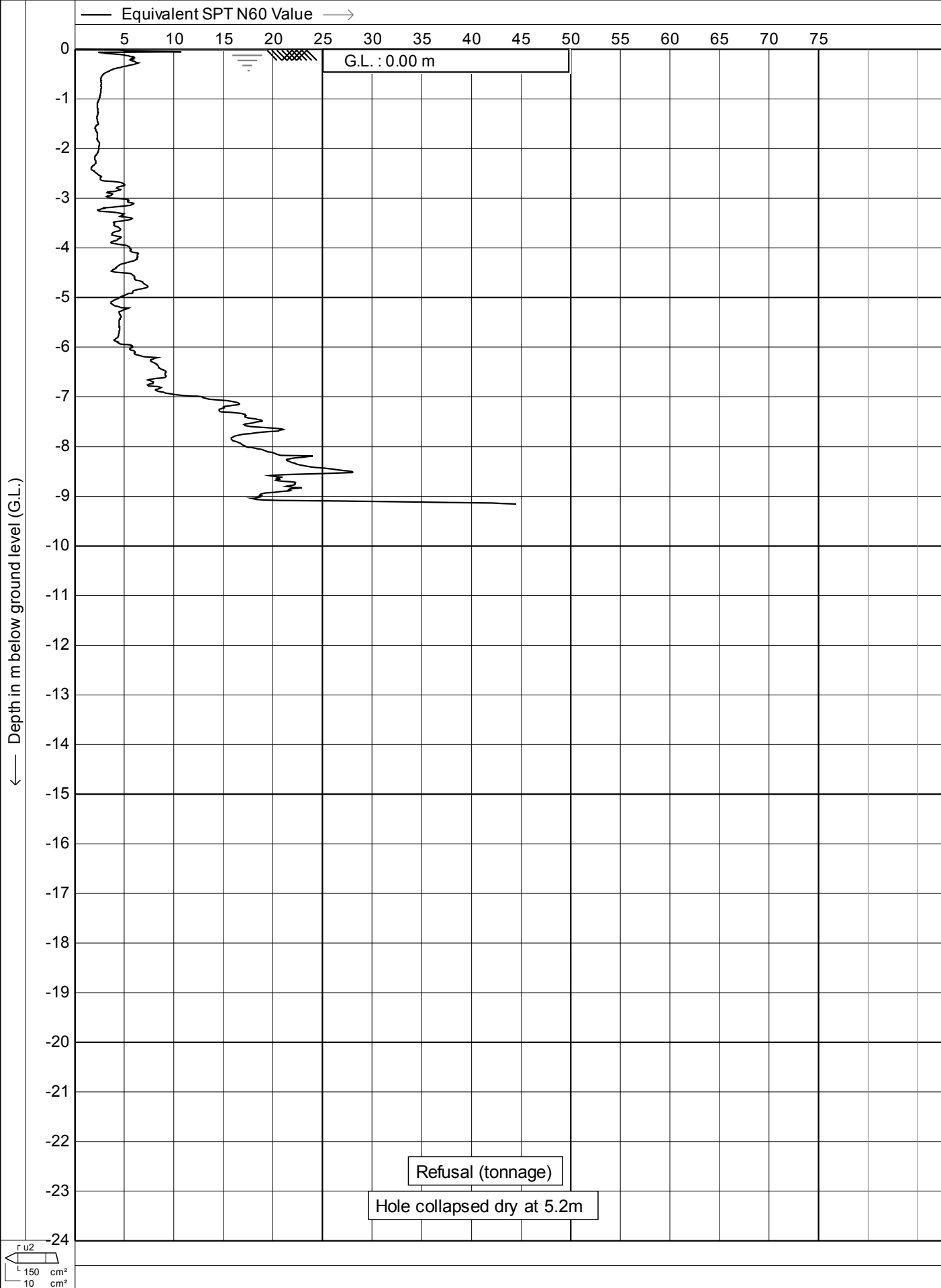
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

11/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

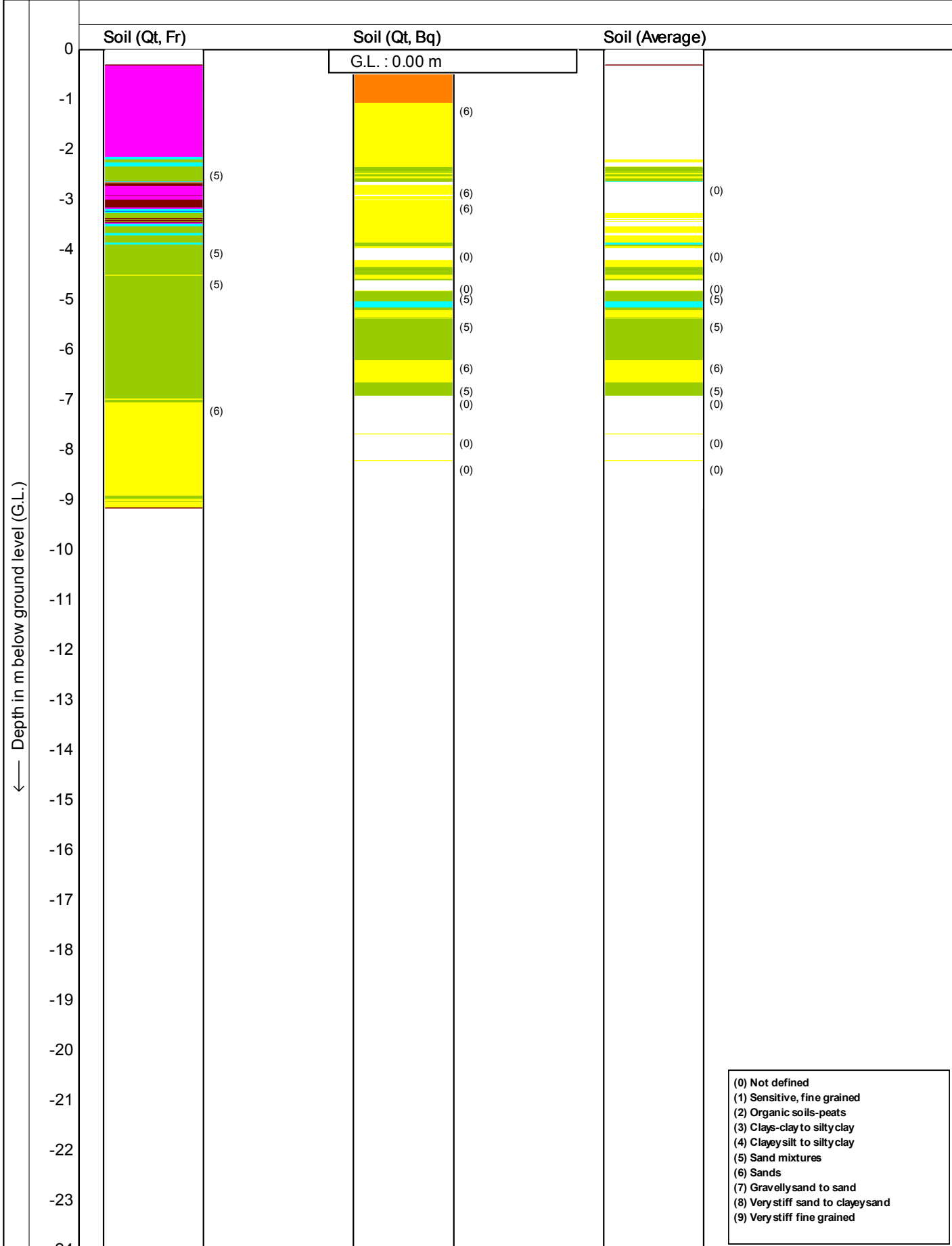
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

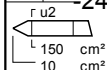
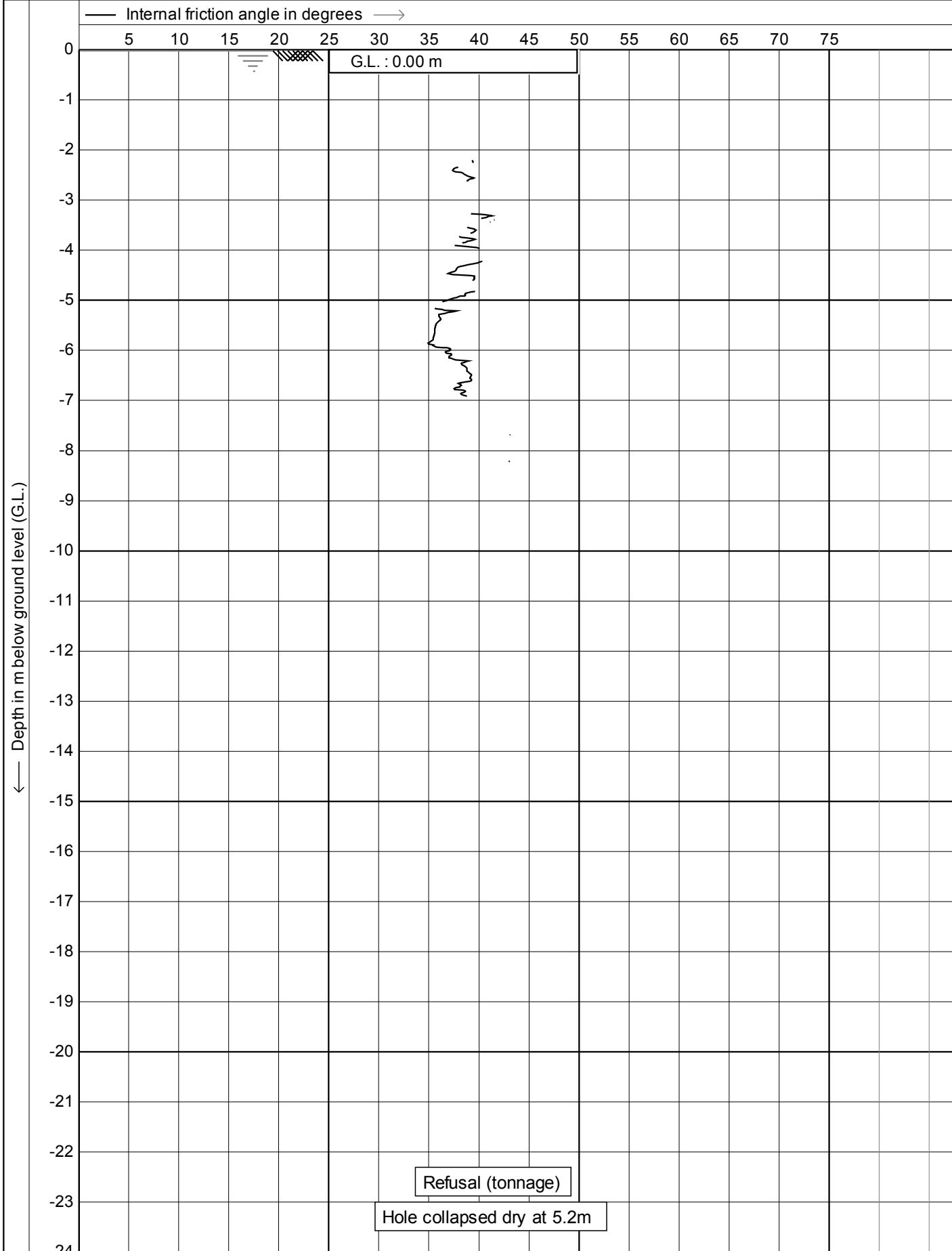
CPT no. : **01**

12/14



Soil behaviour type classification after Robertson 1990		Test according A.S.T.M. Standard D 5778-12		Date : 5-11-2013	
Project : Site Investigation		Location: Ngataringa Rd - Devonport - Auckland		Cone no. : C10CFIIP.C13184	
Position: 0, 0 RD		Project no. : 05TT17		CPT no. : 01	
				13/14	





Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

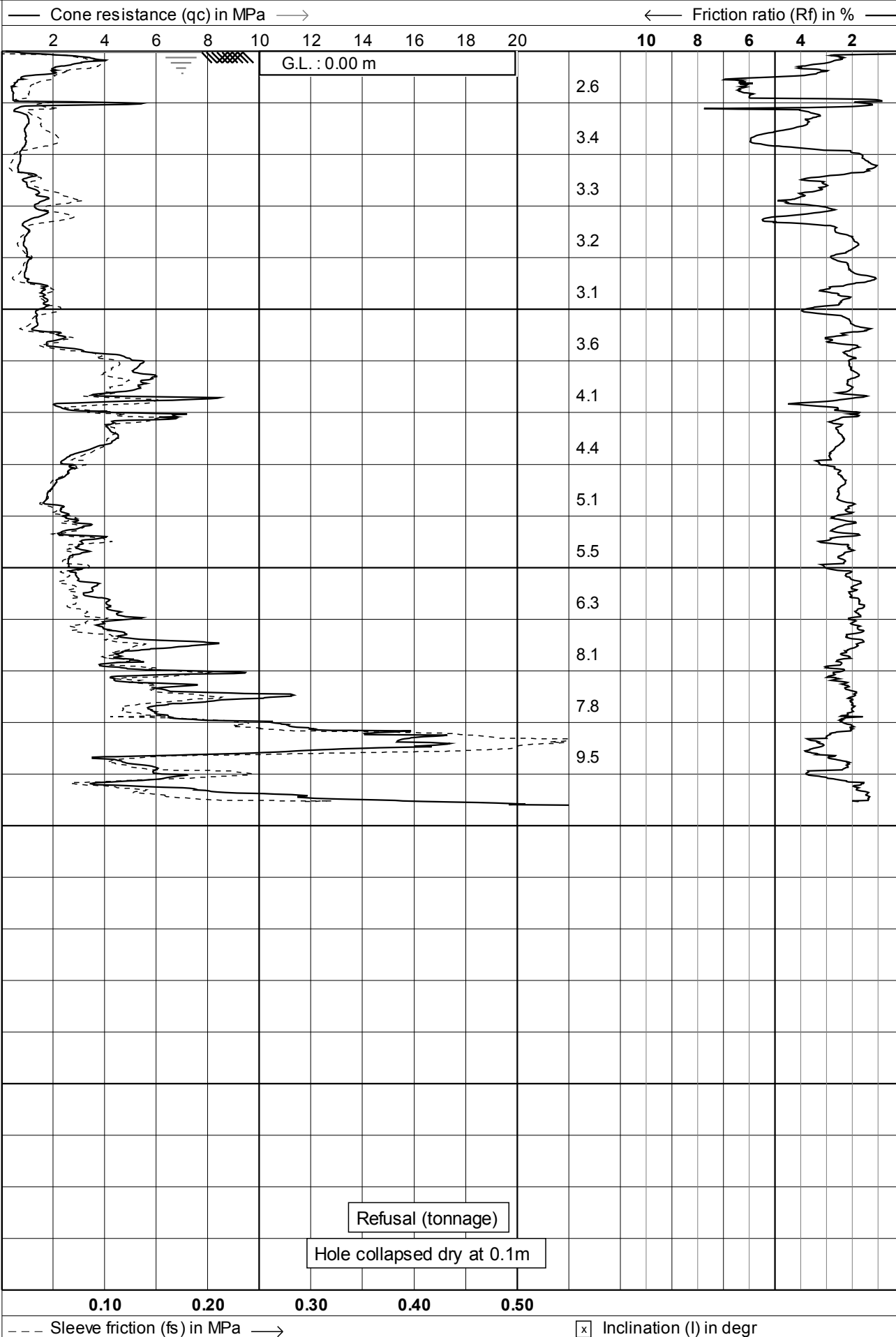
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **01**

14/14

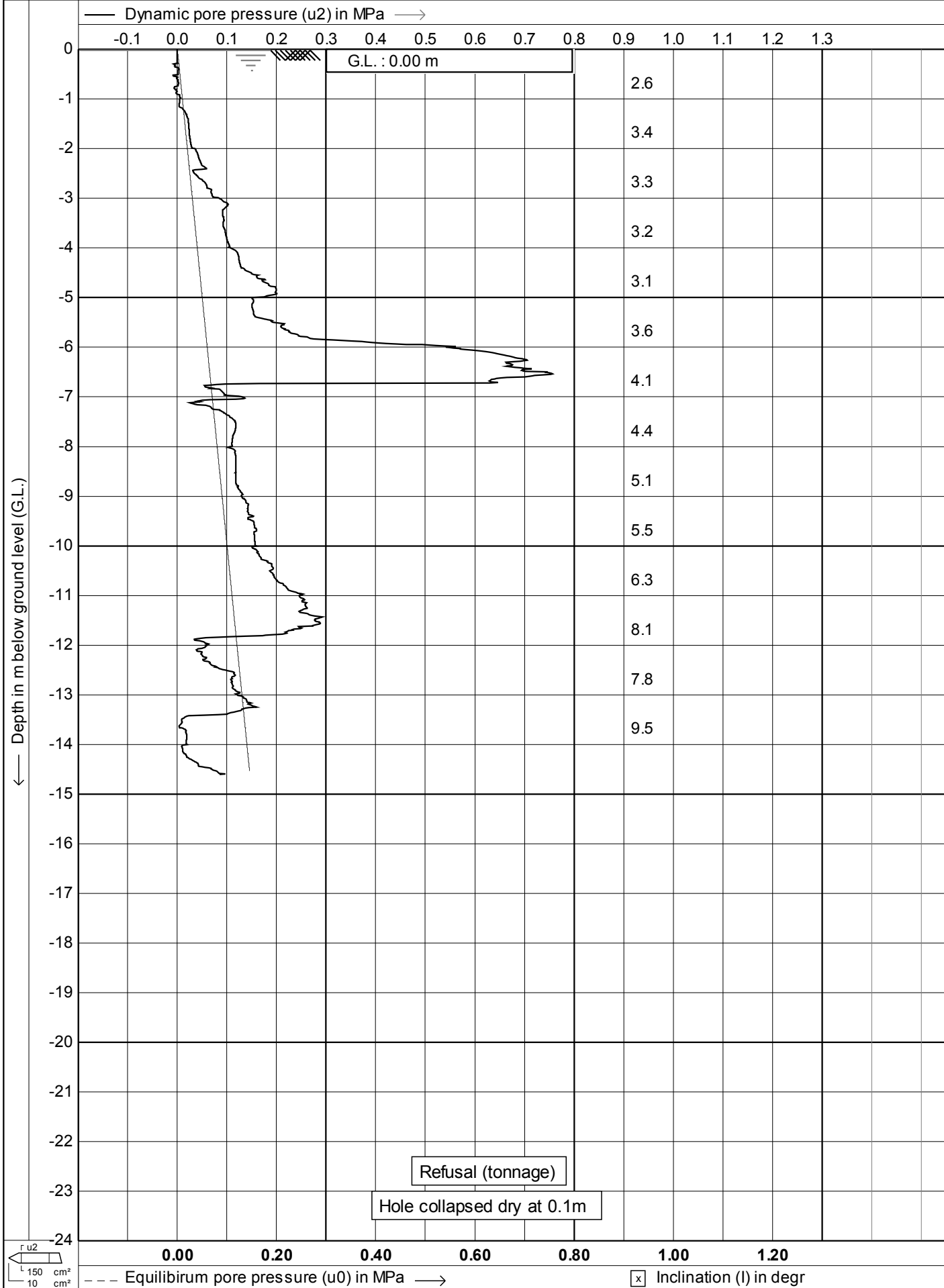
Depth in m below ground level (G.L.)



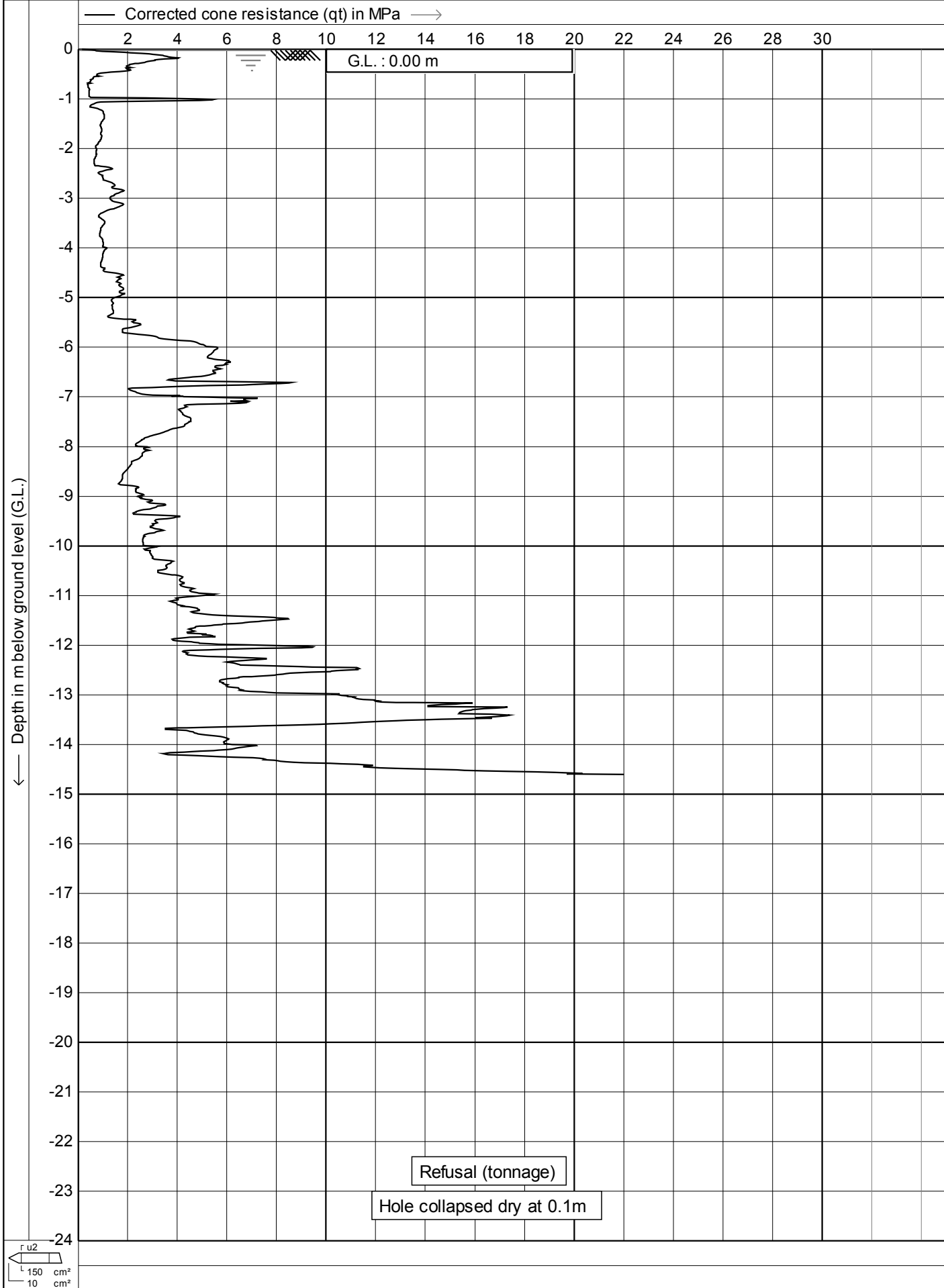
Test according A.S.T.M. Standard D 5778-12
Project : **Site Investigation**
Location: **Ngataringa Rd - Devonport - Auckland**
Position: **0, 0 RD**

Date : **5-11-2013**
Cone no. : **C10CFIP.C13184**
Project no. : **05TT17**
CPT no. : **02**

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	Test according A.S.T.M. Standard D 5778-12		Date : 5-11-2013	
	Project : Site Investigation		Cone no. : C10CFIP.C13184	
	Location: Ngataringa Rd - Devonport - Auckland		Project no. : 05TT17	
	Position: 0, 0 RD		CPT no. : 02	2/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

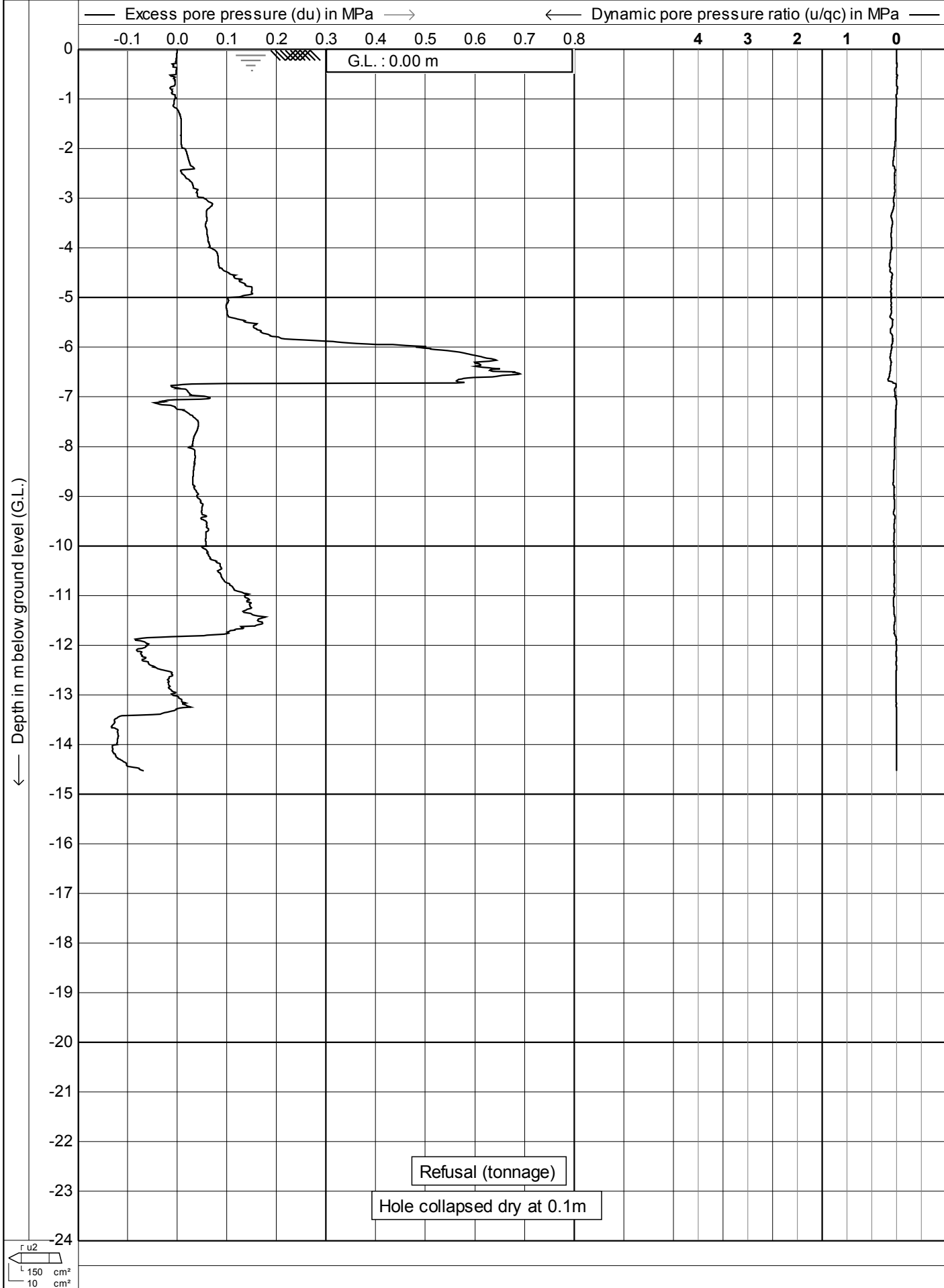
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

3/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

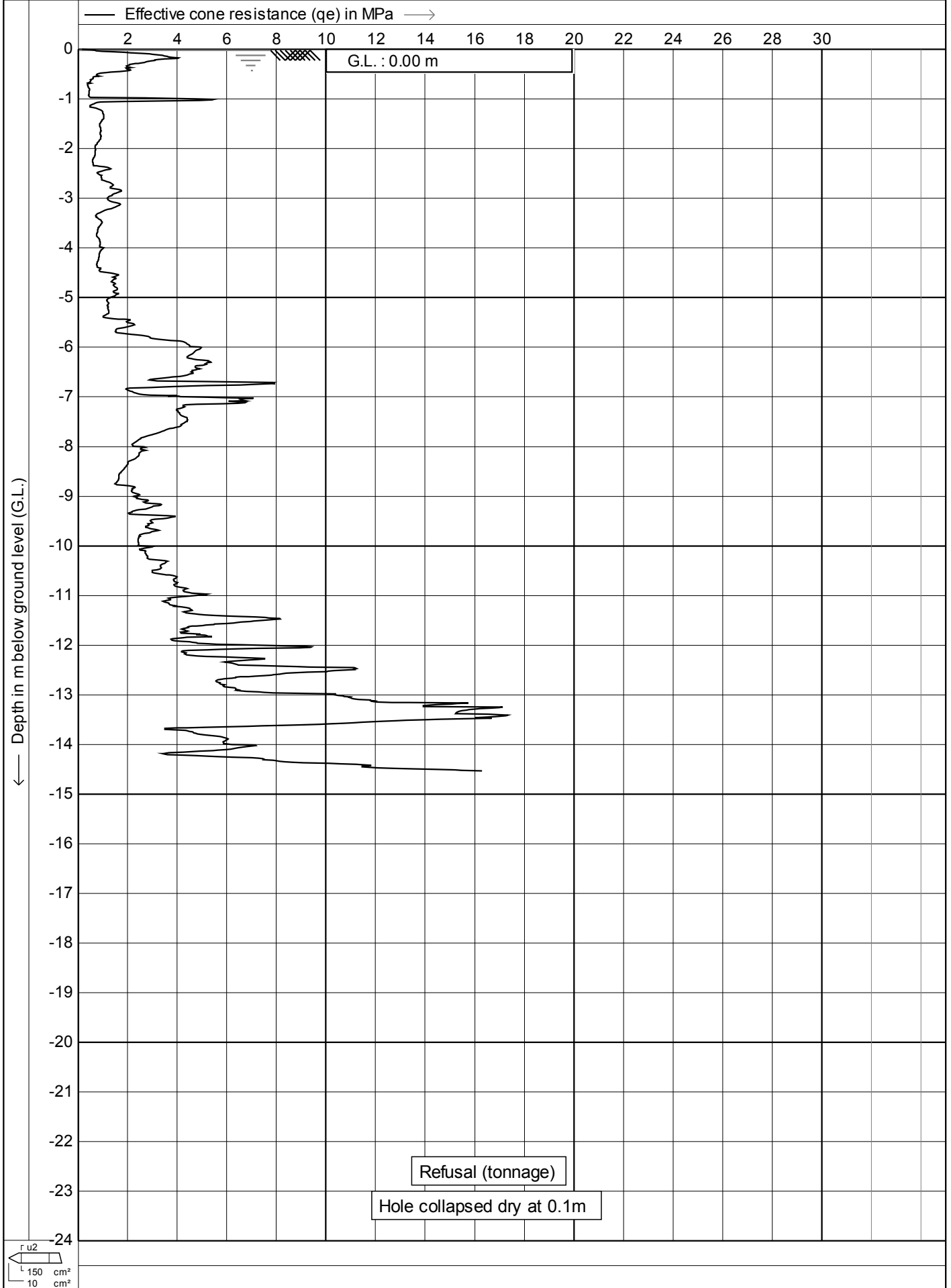
Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

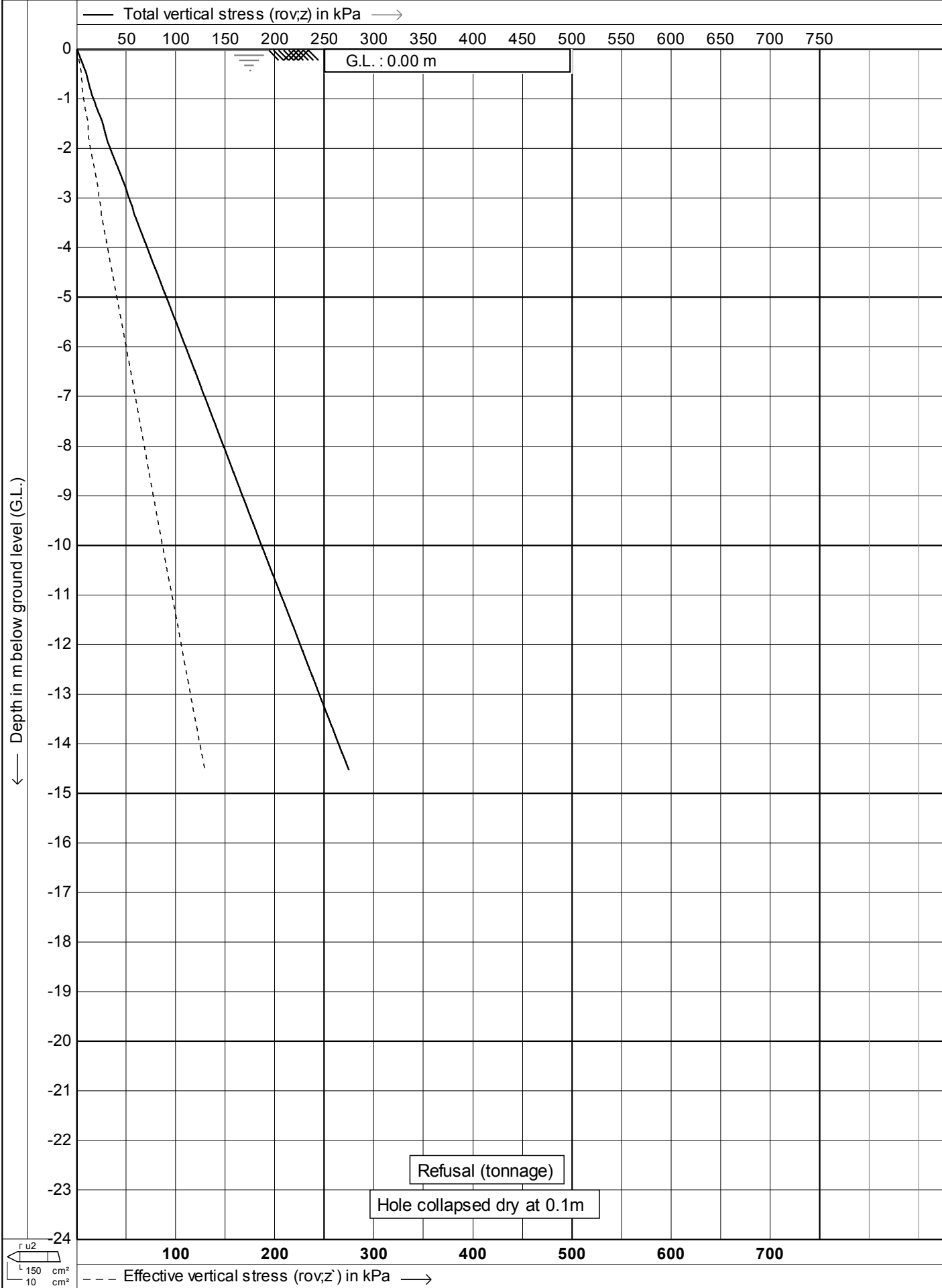
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

5/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

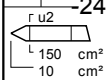
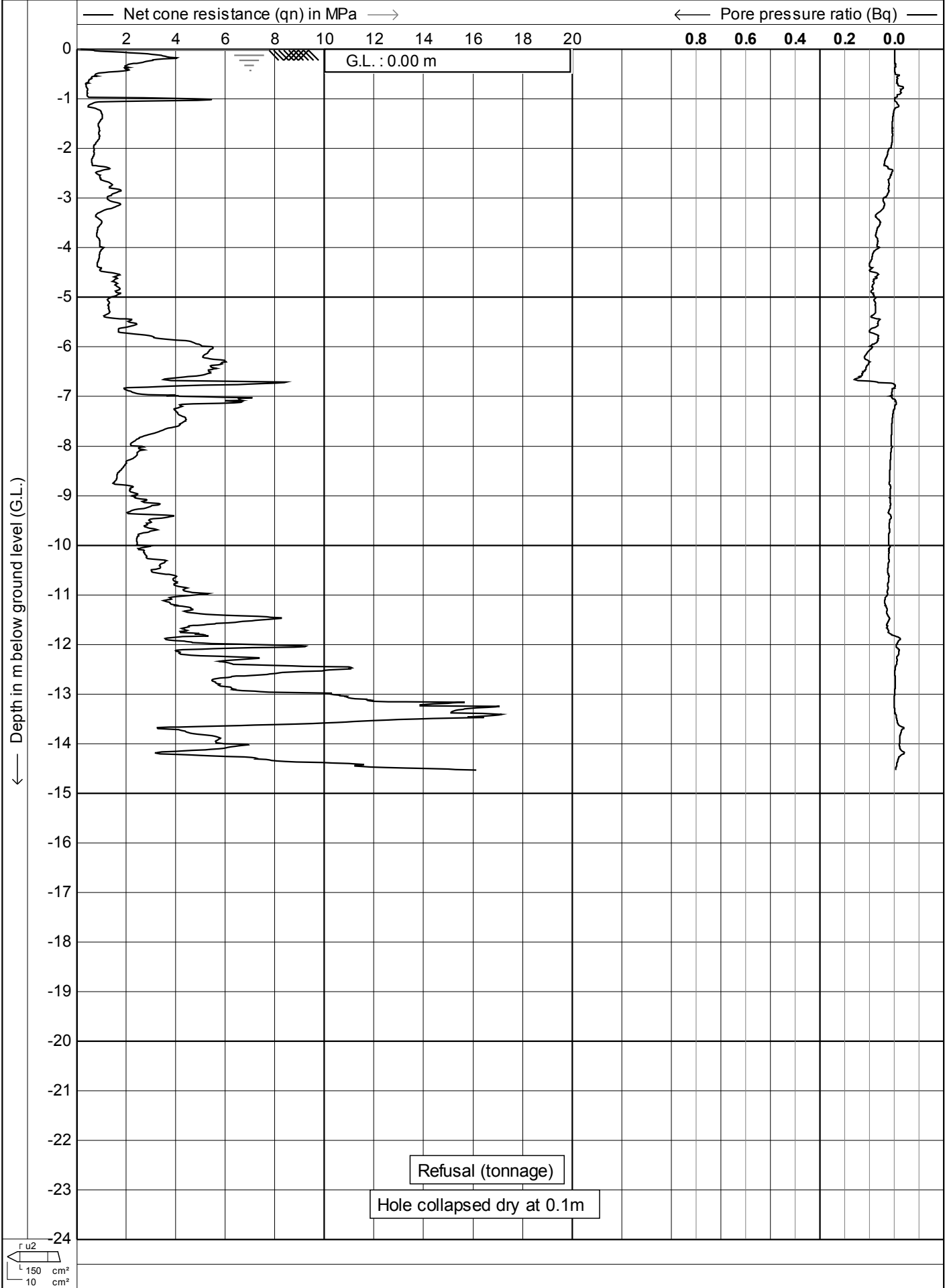
Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

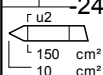
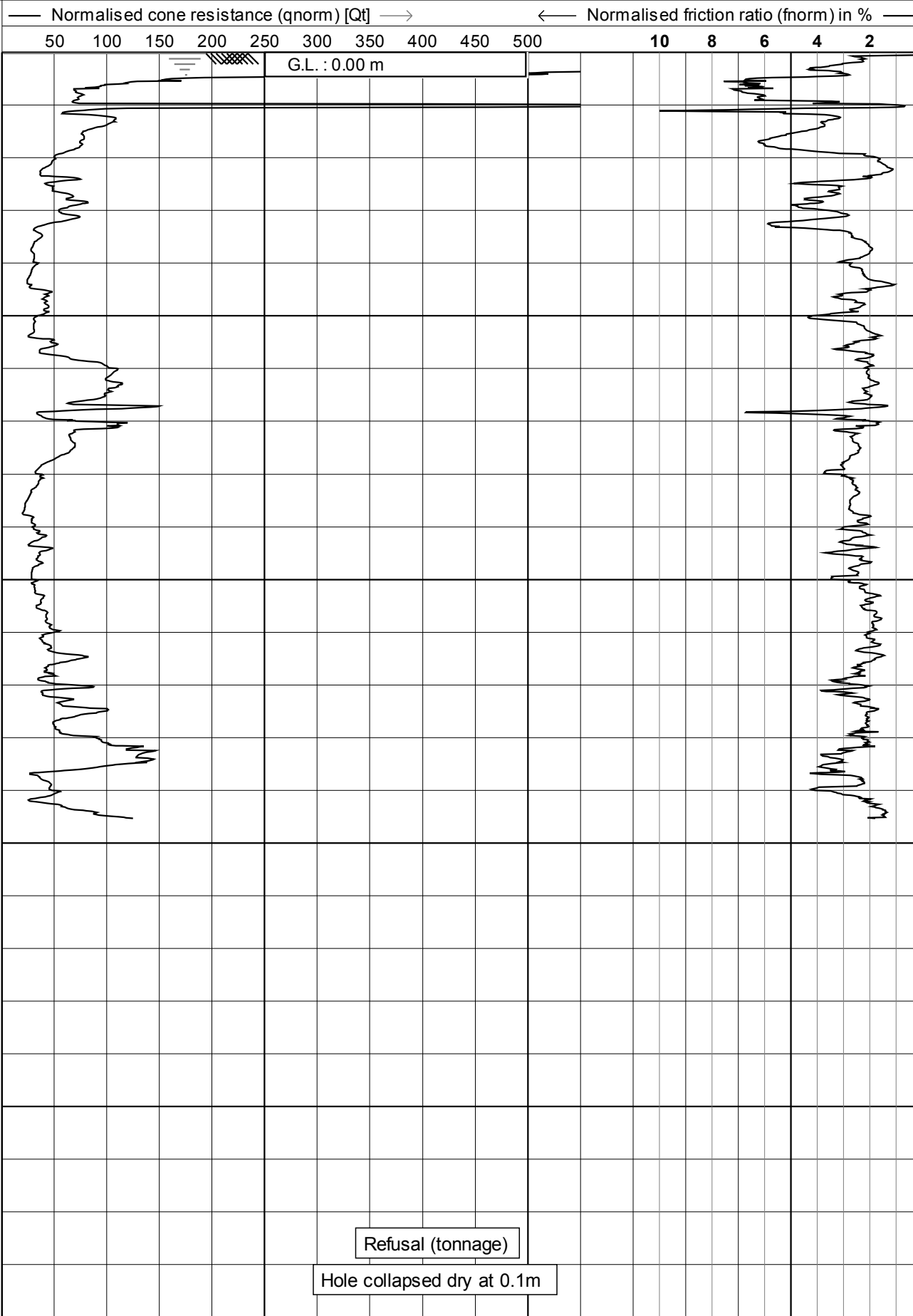
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

7/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

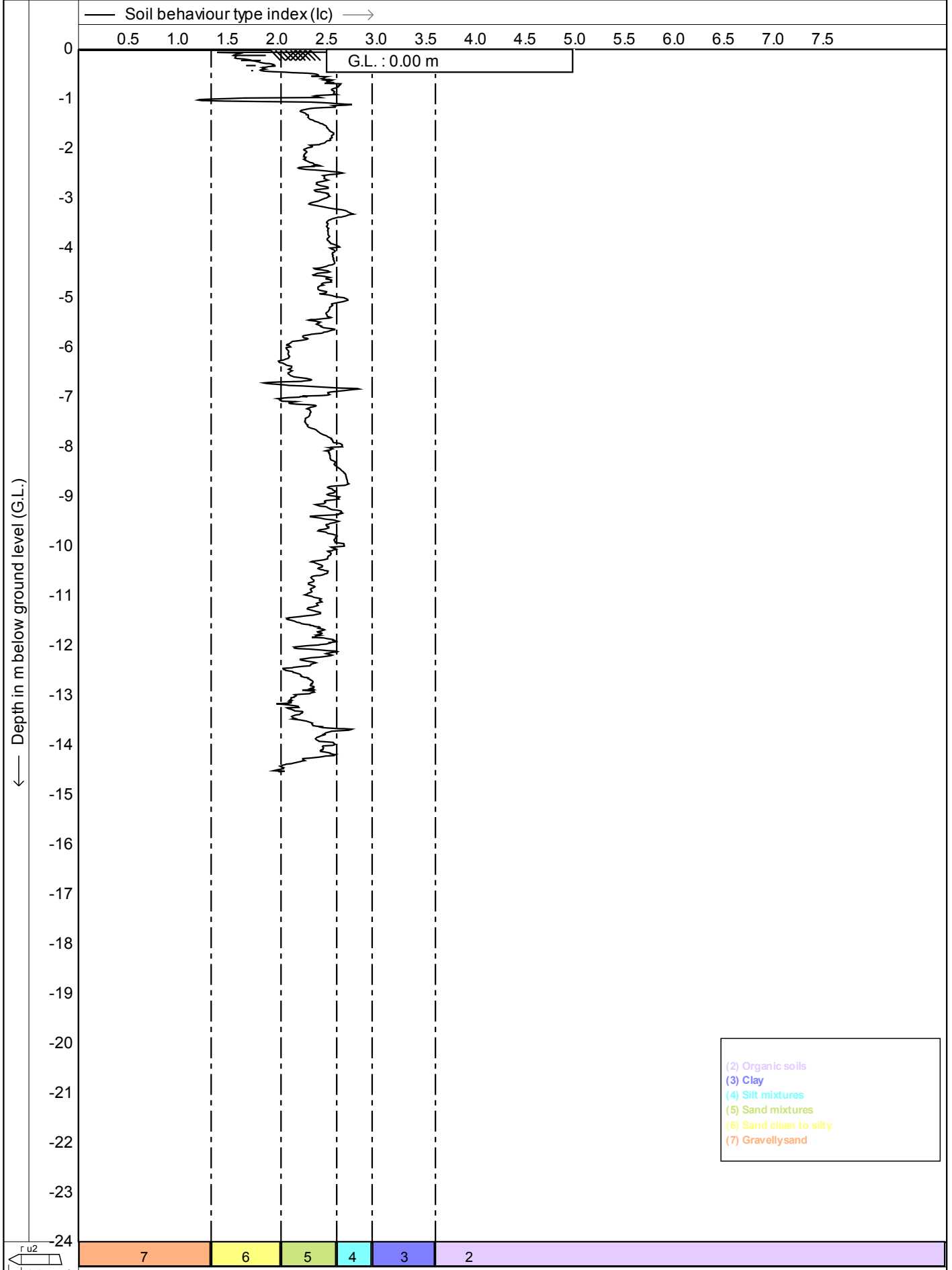
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

8/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

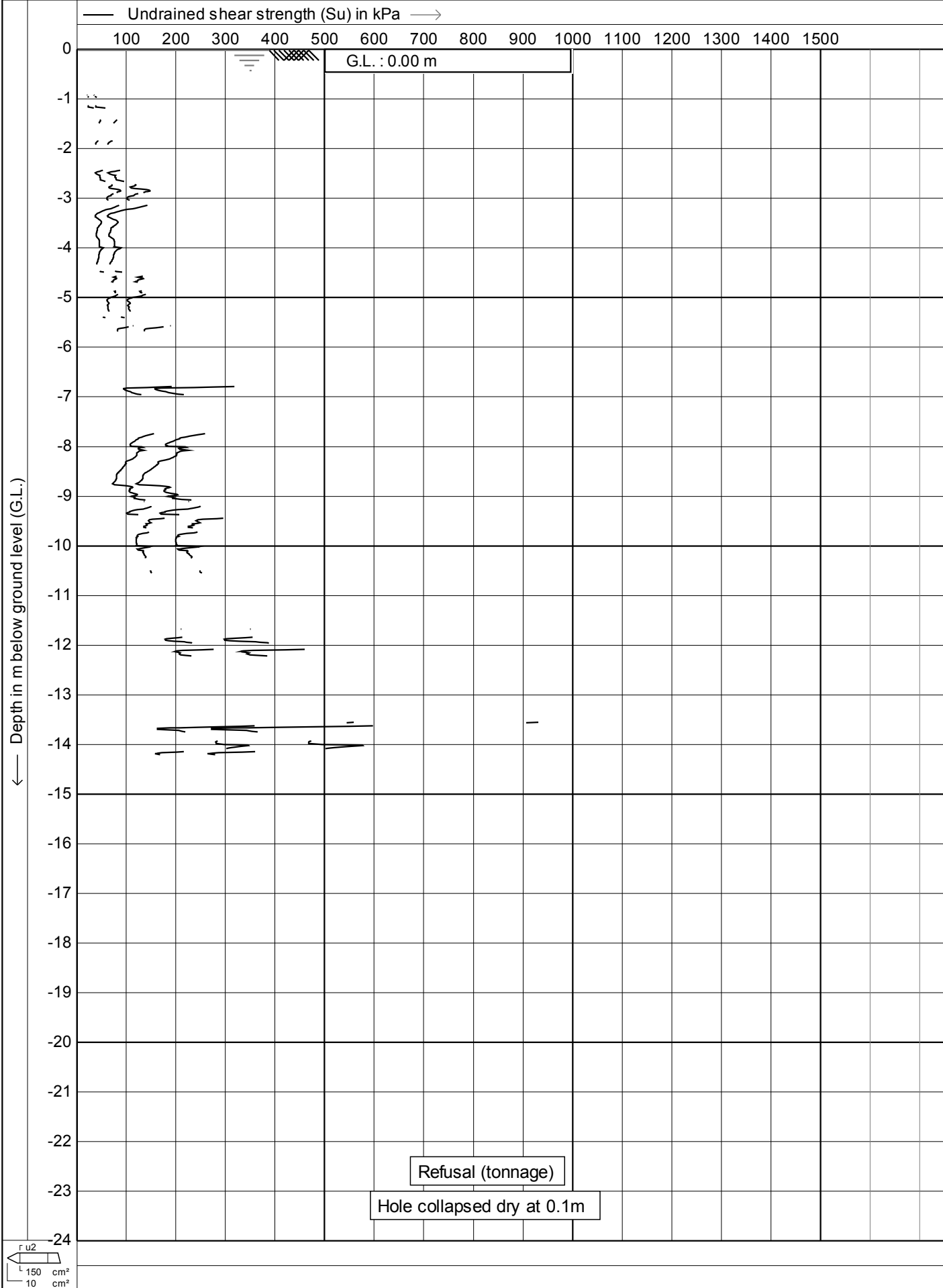
Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **02** 9/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

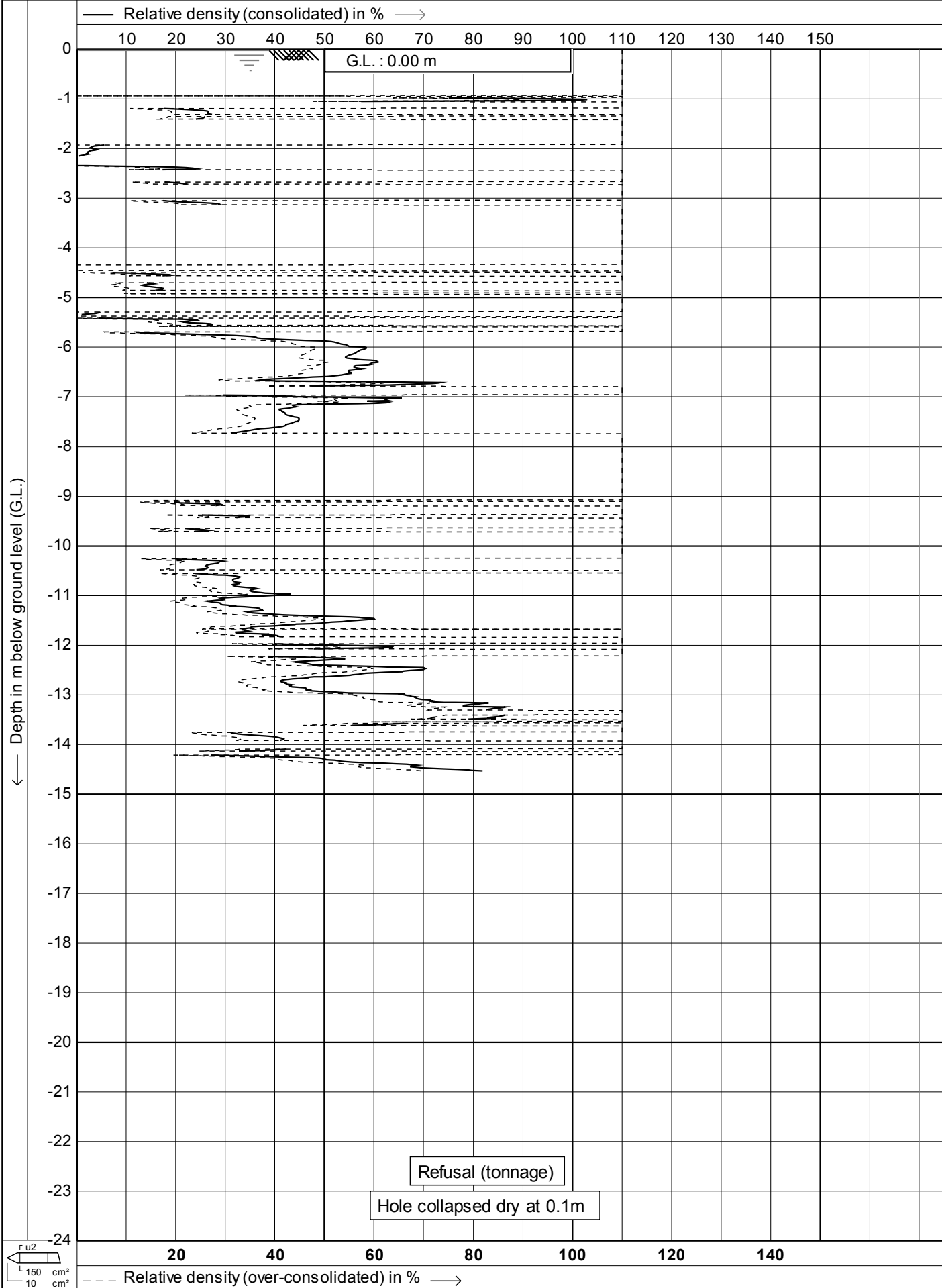
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

10/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

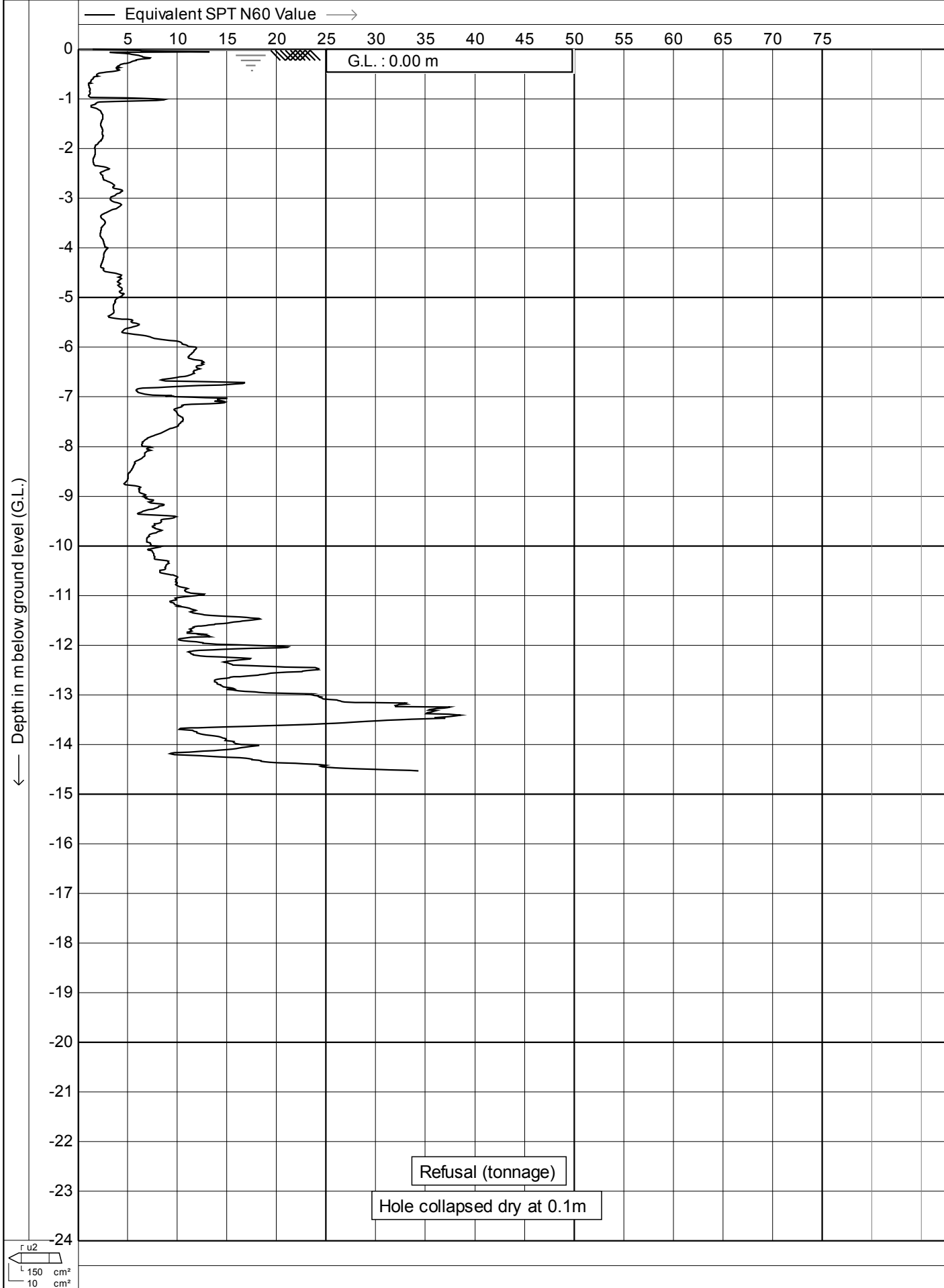
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

11/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

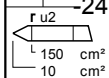
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

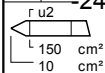
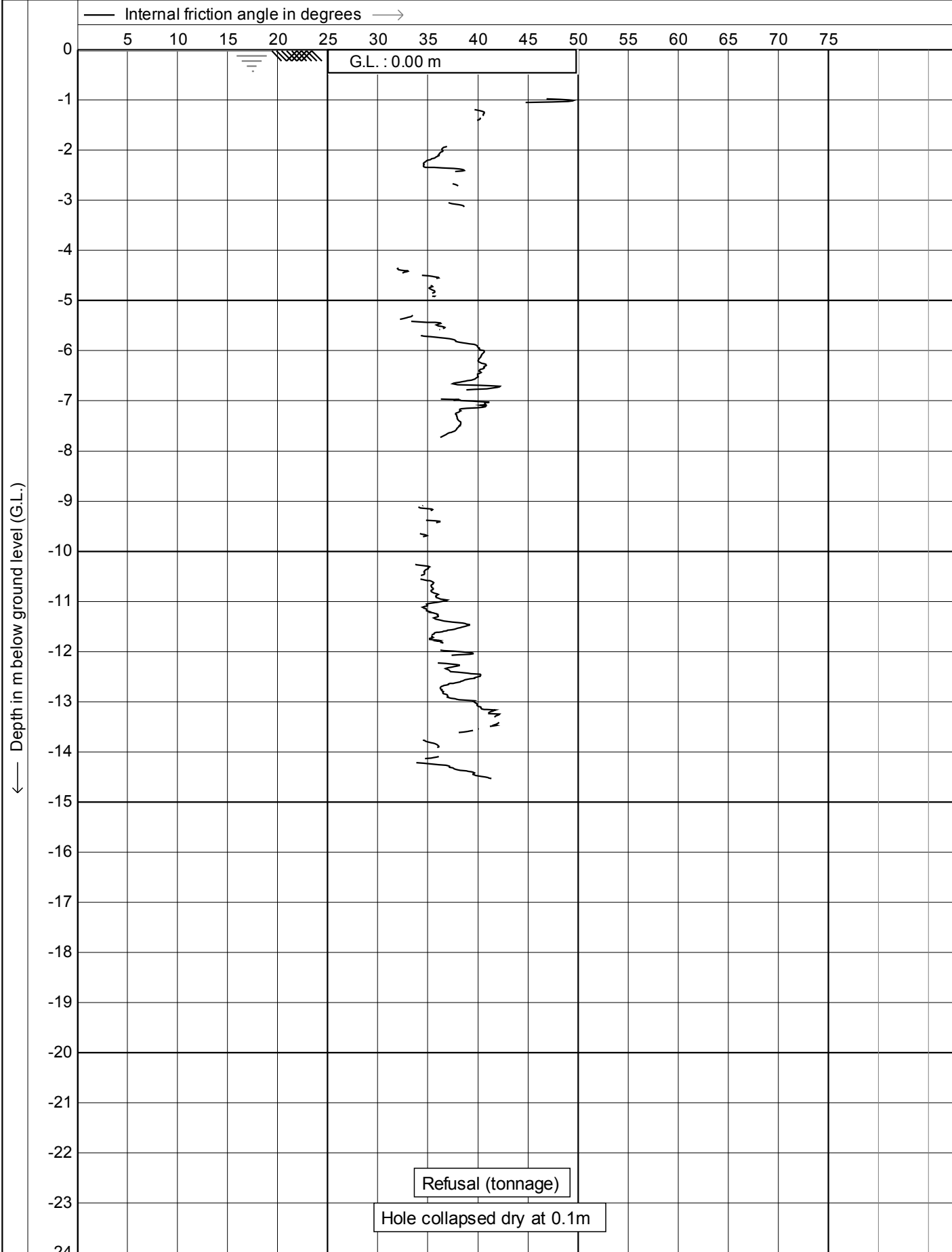
Project no. : **05TT17**

CPT no. : **02**

12/14



Soil behaviour type classification after Robertson 1990



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

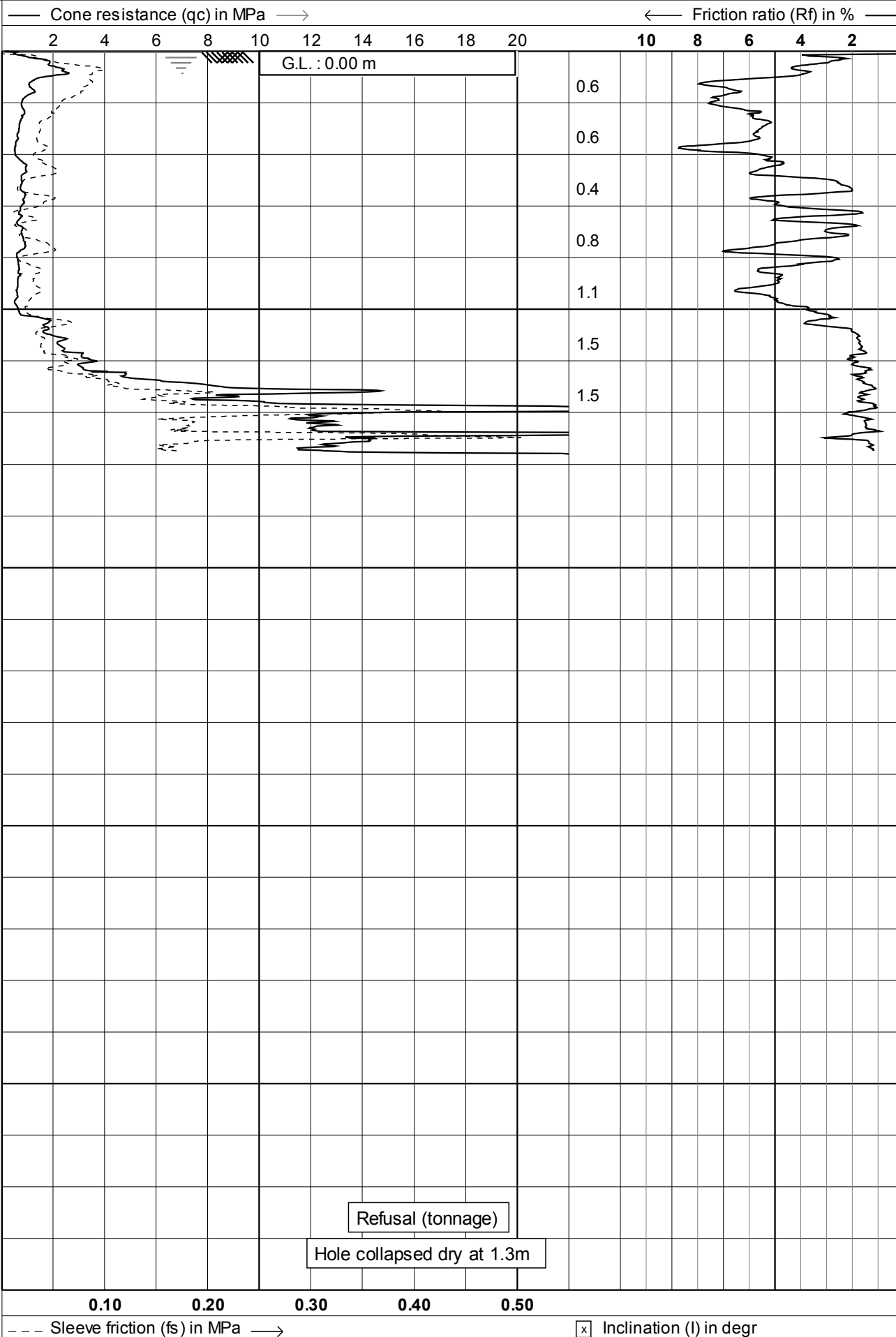
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **02**

14/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

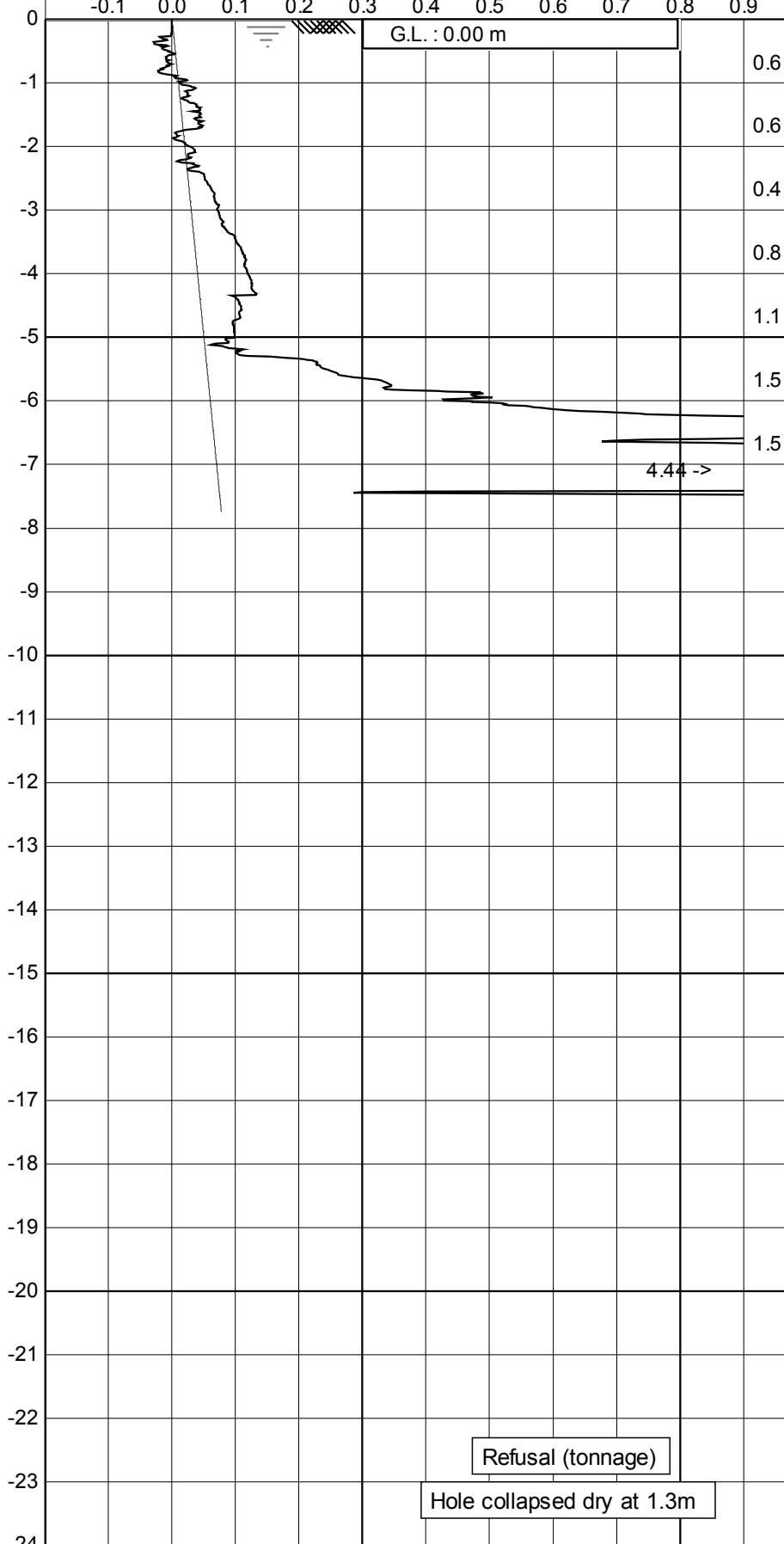
1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m



Refusal (tonnage)

Hole collapsed dry at 1.3m

0.00 0.20 0.40 0.60 0.80 1.00 1.20

--- Equilibrium pore pressure (u0) in MPa →

☒ Inclination (I) in degr



Test according A.S.T.M. Standard D 5778-12

Project : Site Investigation

Location: Ngataringa Rd - Devonport - Auckland

Position: 0, 0 RD

Date : 5-11-2013

Cone no. : C10CFIP.C13184

Project no. : 05TT17

CPT no. : 03

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa →

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (tonnage)

Hole collapsed dry at 1.3m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

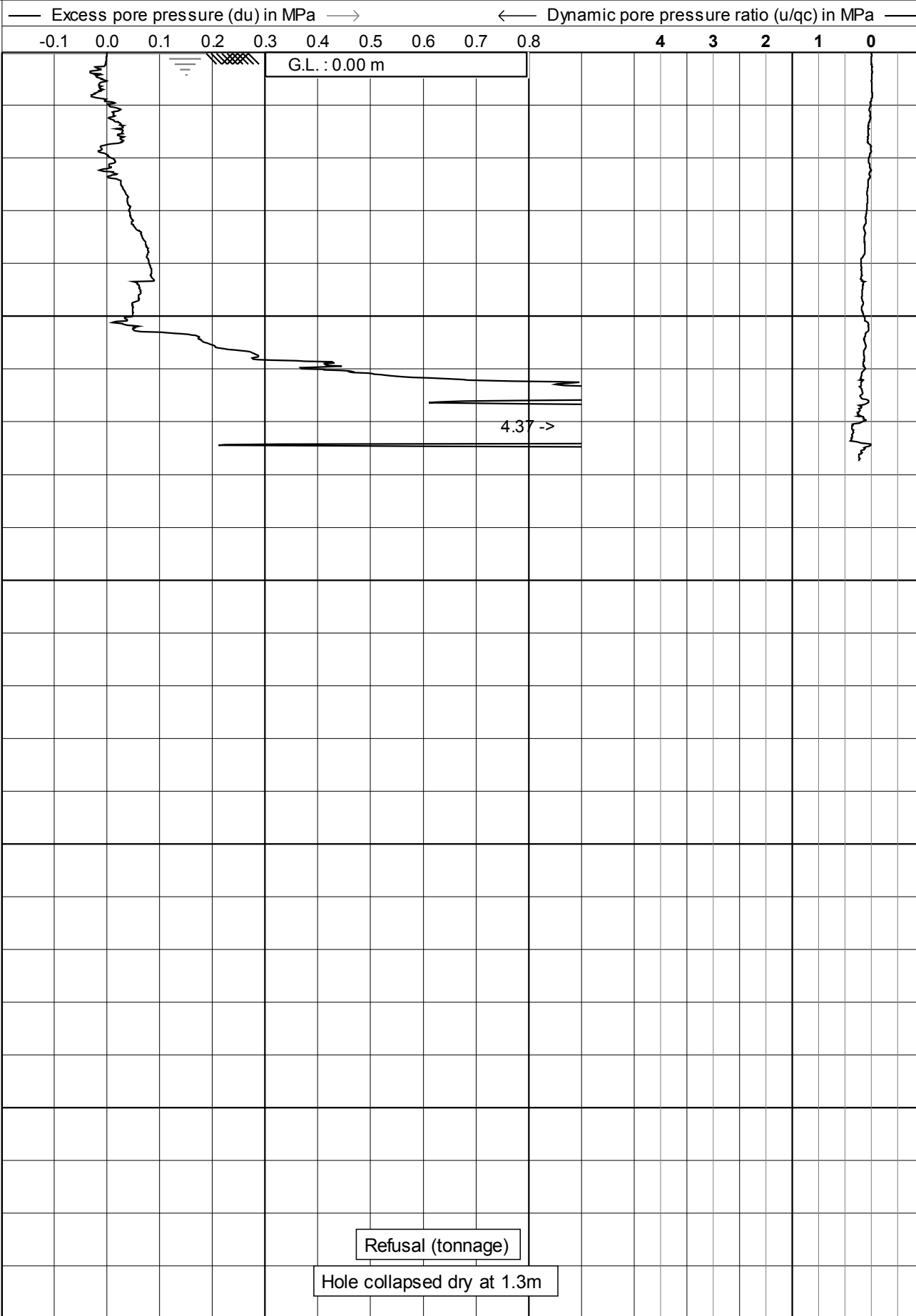
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

3/14

← Depth in m below ground level (G.L.)



150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

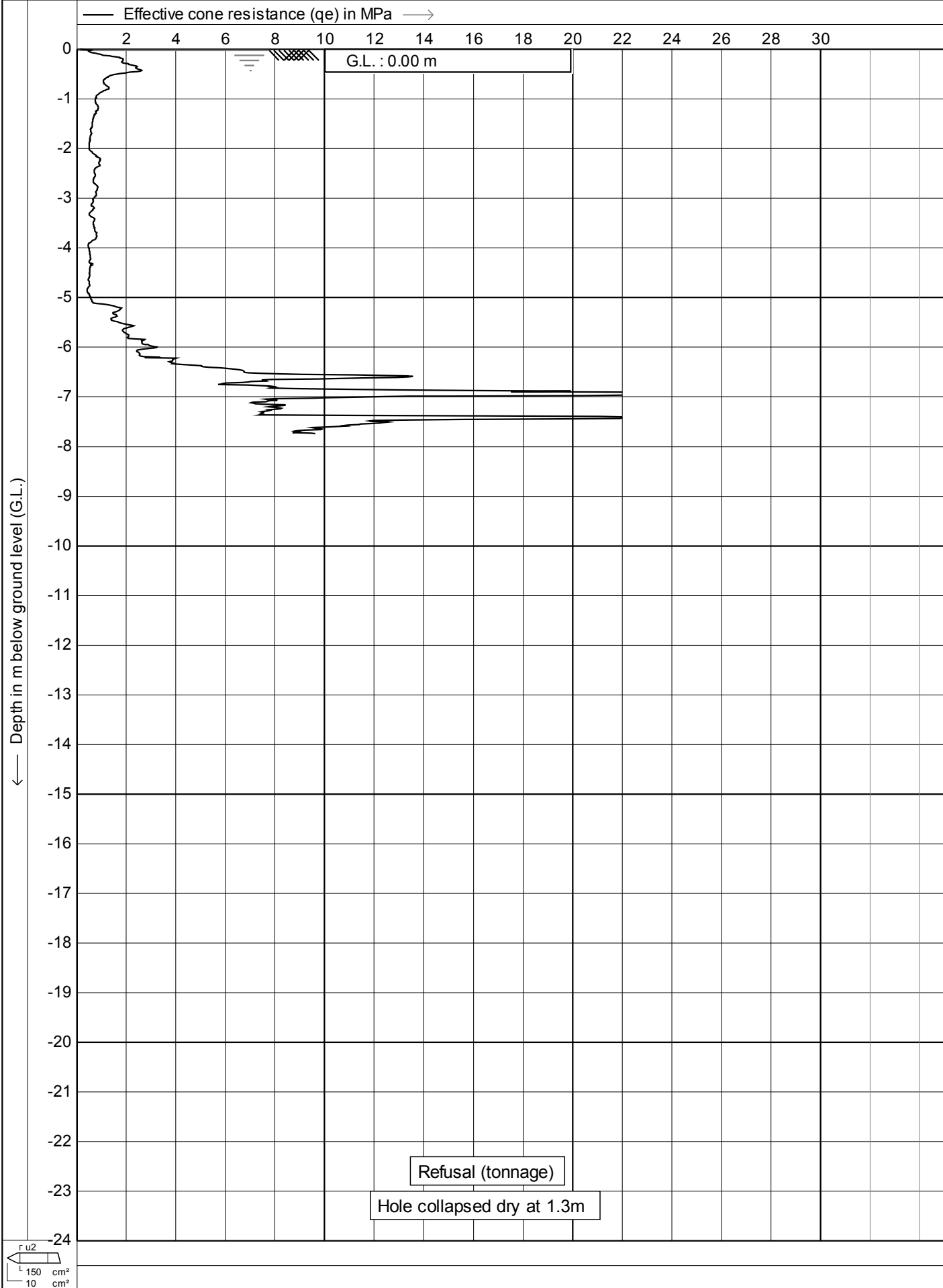
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

4/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (rov,z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 1.3m

150 cm²
10 cm²

100 200 300 400 500 600 700

--- Effective vertical stress (rov,z') in kPa →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

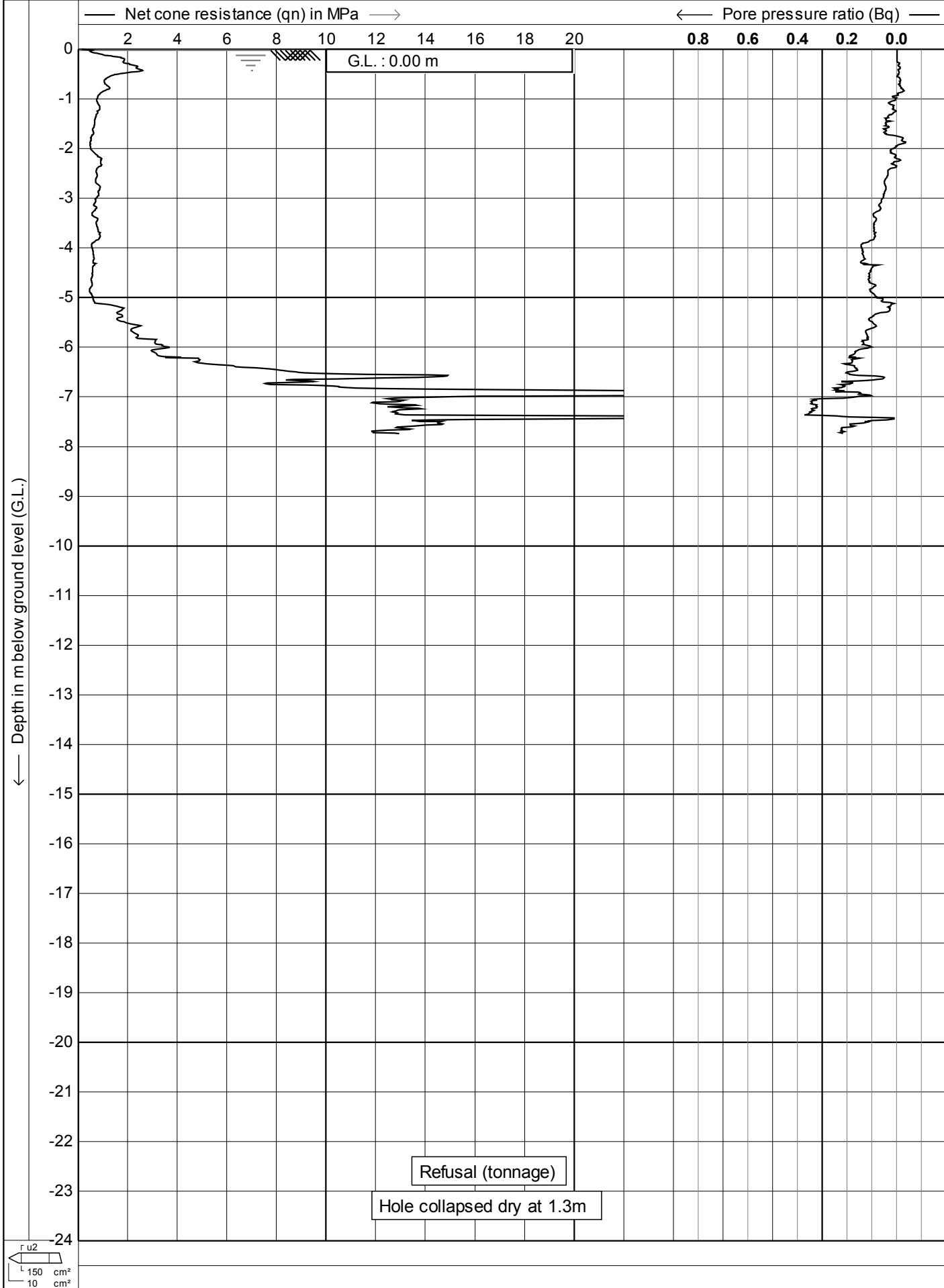
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

6/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

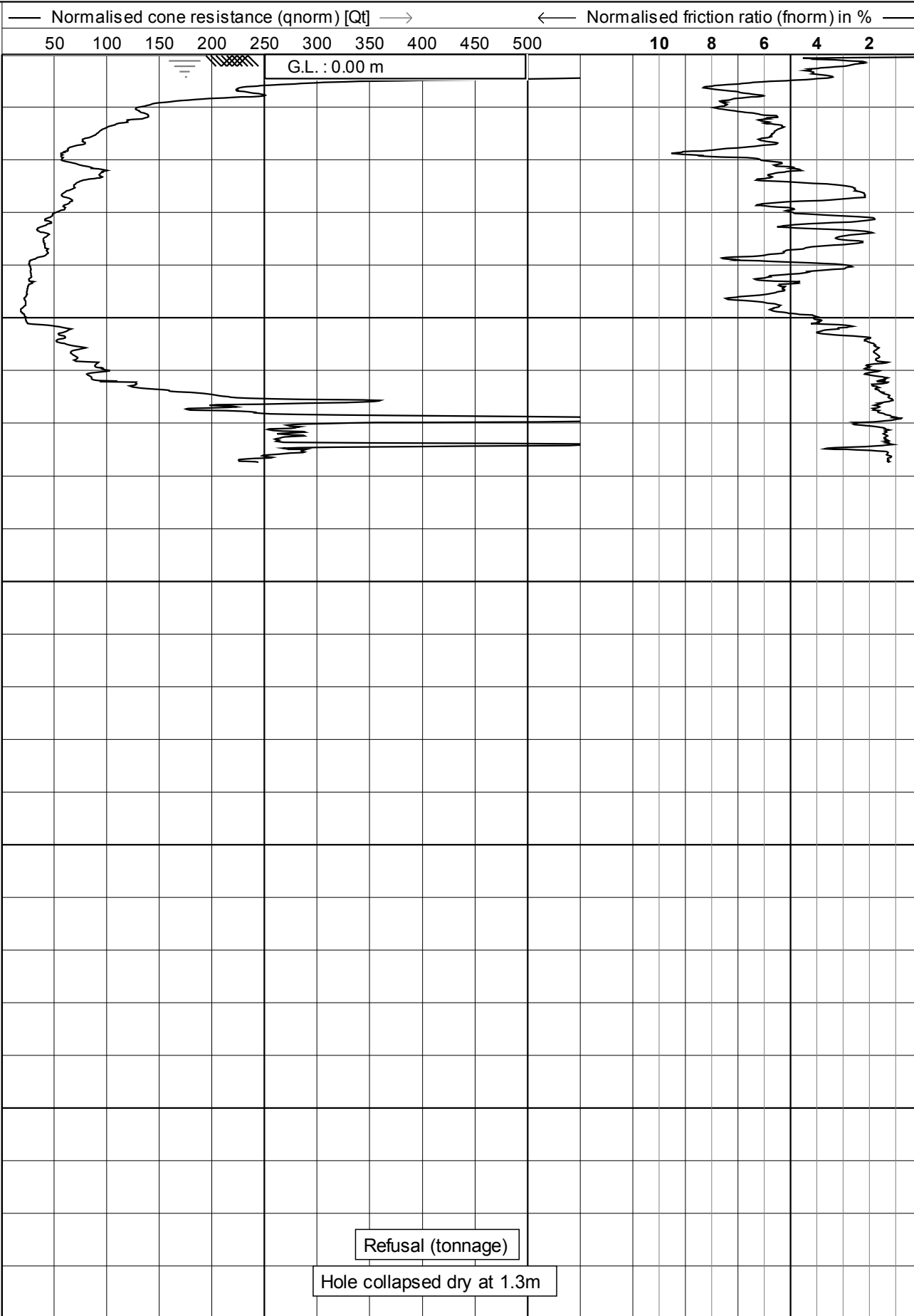
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

7/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

8/14

← Depth in m below ground level (G.L.)

— Soil behaviour type index (Ic) —→

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

(2) Organic soils
(3) Clay
(4) Silt mixtures
(5) Sand mixtures
(6) Sand clean to silty
(7) Gravelly sand

150 cm²
10 cm²

7

6

5

4

3

2



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

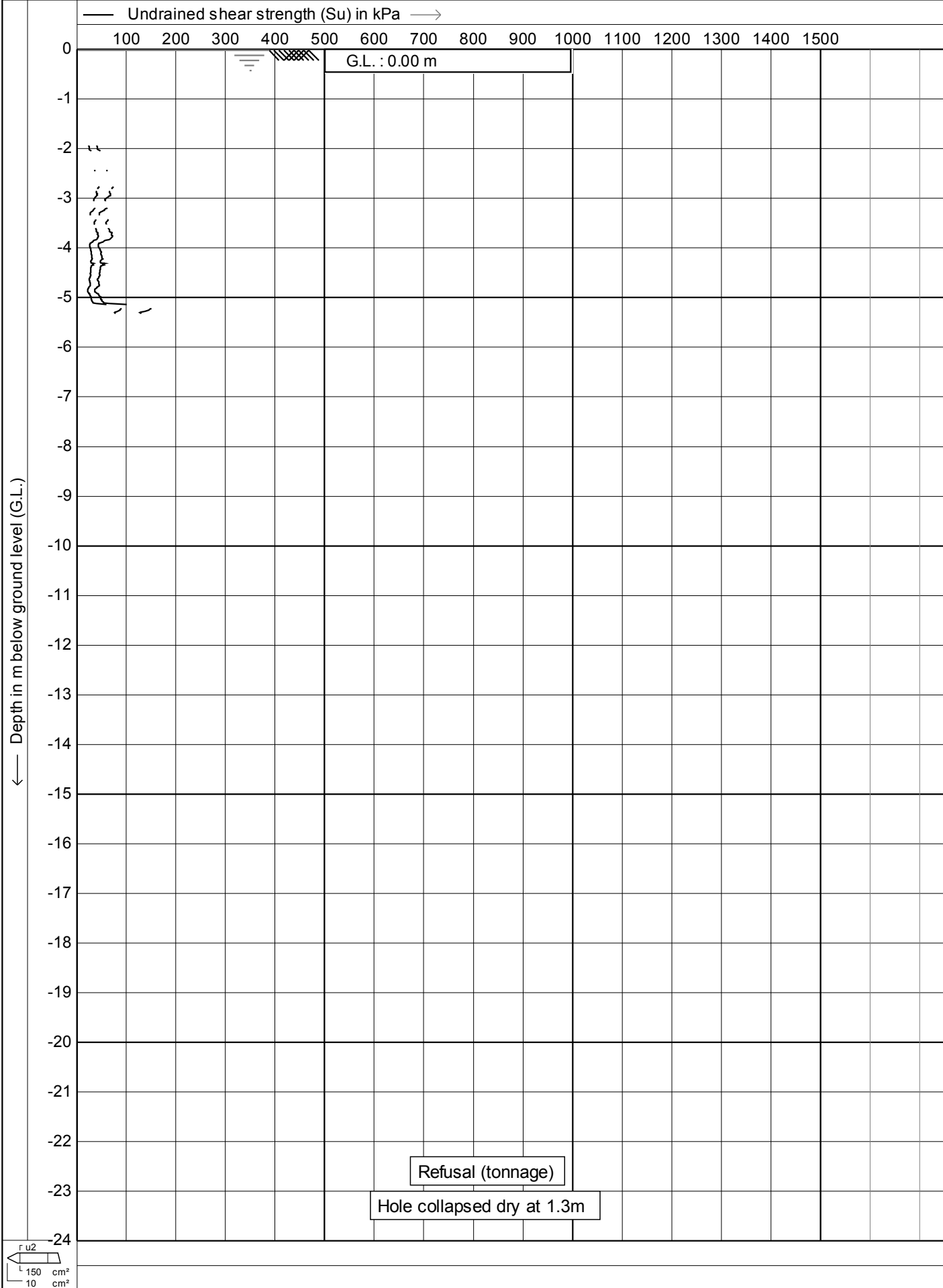
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

9/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

10/14

← Depth in m below ground level (G.L.)

— Relative density (consolidated) in % →

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 1.3m

150 cm²
10 cm²

--- Relative density (over-consolidated) in % →

20

40

60

80

100

120

140



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

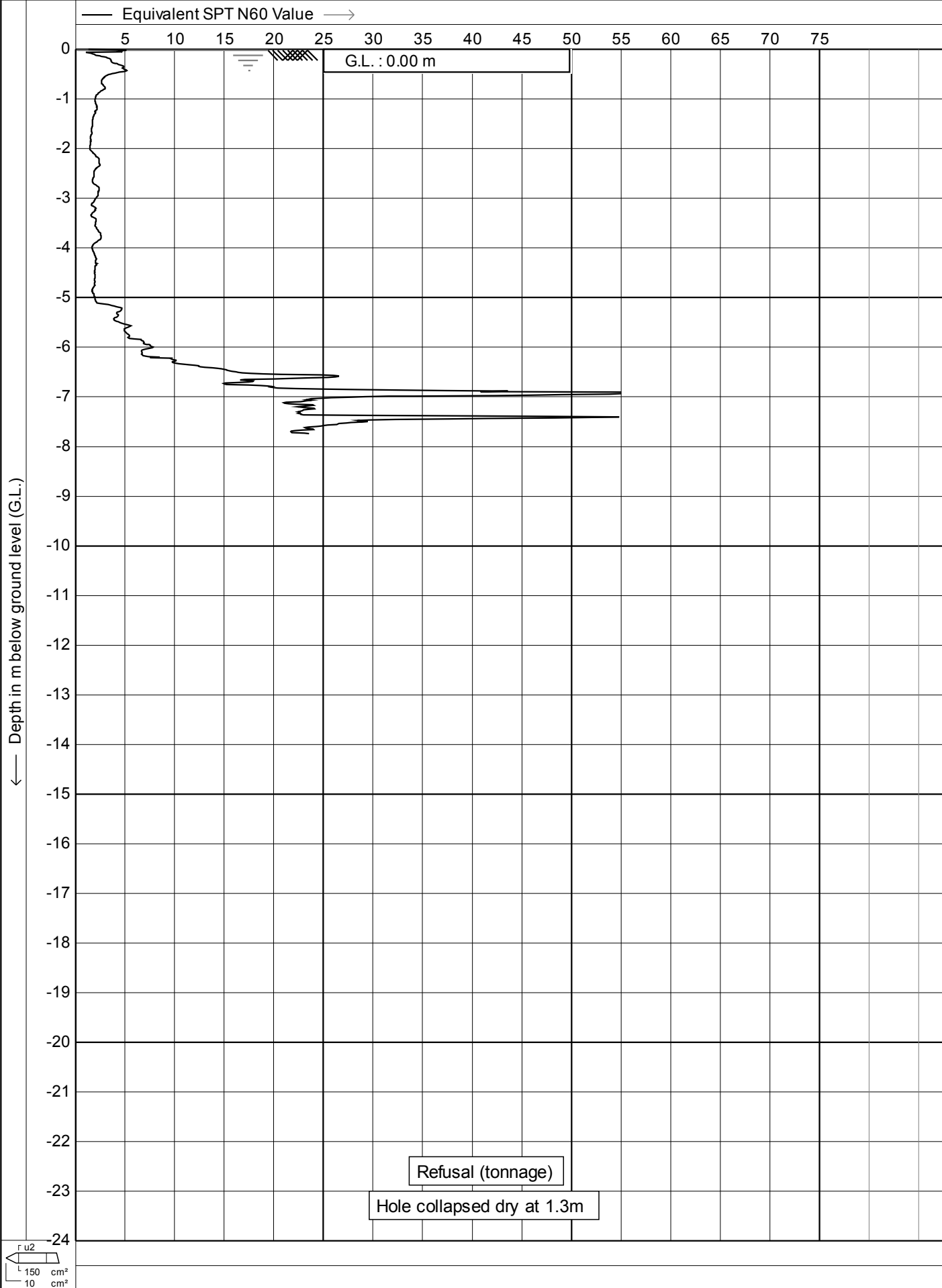
Date : **5-11-2013**

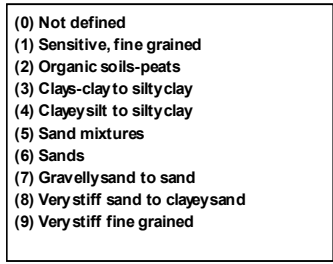
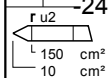
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

11/14





13/14

← Depth in m below ground level (G.L.)

Internal friction angle in degrees →

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

Refusal (tonnage)

Hole collapsed dry at 1.3m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

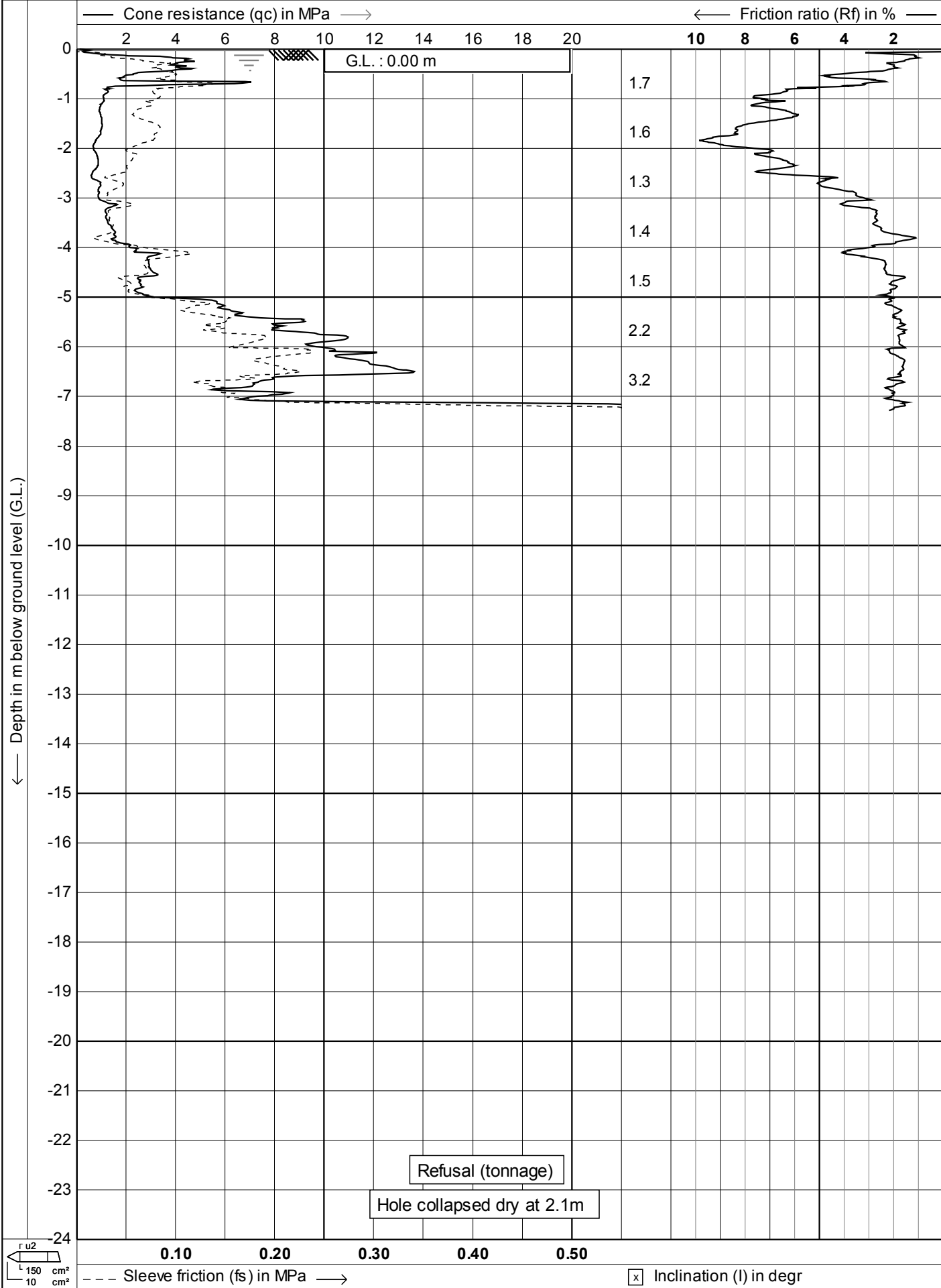
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **03**

14/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m

1.7

1.6

1.3

1.4

1.5

2.2

3.2

Refusal (tonnage)

Hole collapsed dry at 2.1m

0.00 0.20 0.40 0.60 0.80 1.00 1.20
--- Equilibrium pore pressure (u0) in MPa →

☒ Inclination (I) in degr



Test according A.S.T.M. Standard D 5778-12

Project : Site Investigation

Location: Ngataringa Rd - Devonport - Auckland

Position: 0, 0 RD

Date : 5-11-2013

Cone no. : C10CFIP.C13184

Project no. : 05TT17

CPT no. : 04

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa →

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 2.1m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

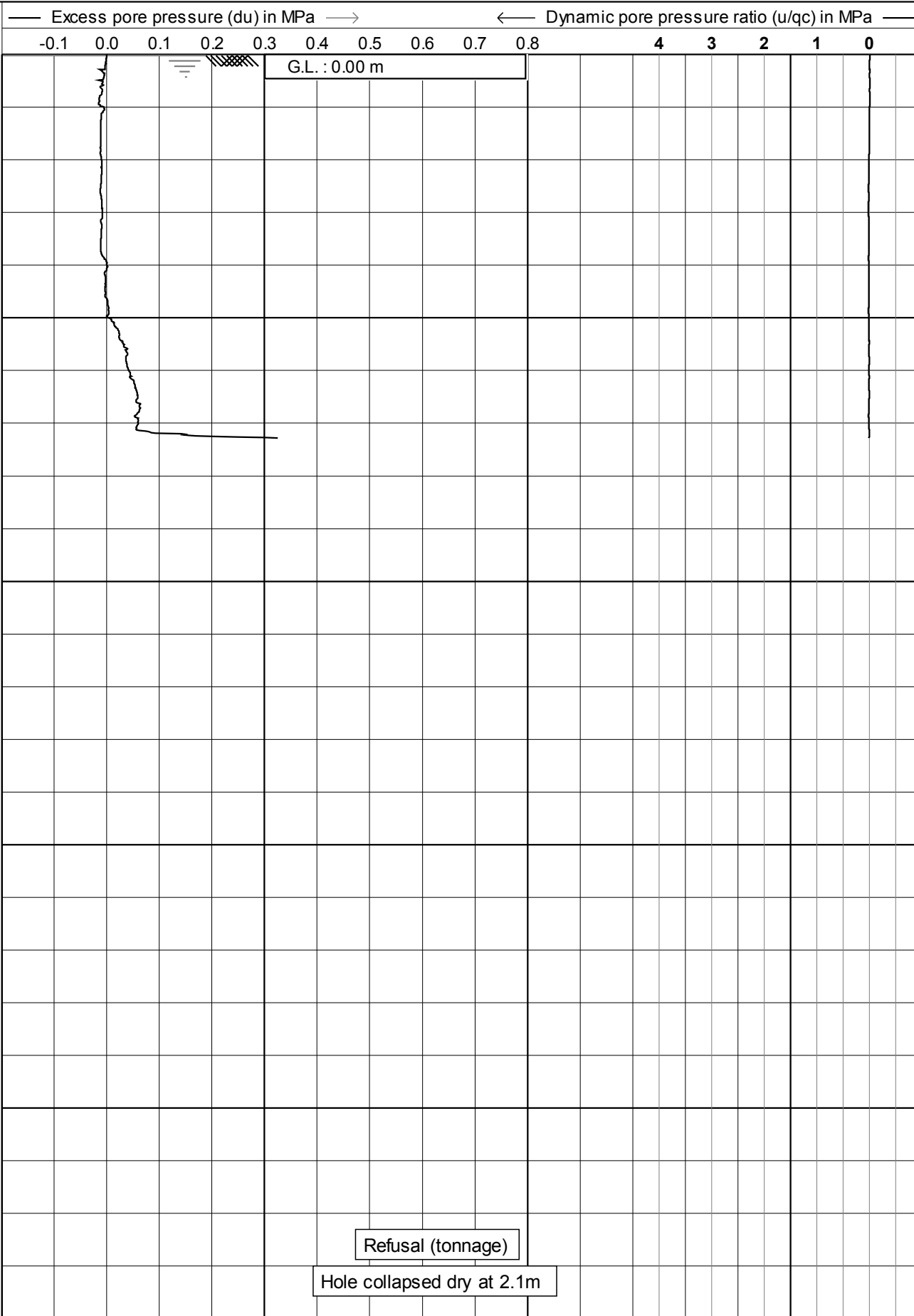
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

3/14

← Depth in m below ground level (G.L.)



150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

4/14

← Depth in m below ground level (G.L.)

— Effective cone resistance (qe) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 2.1m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (rov,z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 2.1m

150 cm²
10 cm²

100

200

300

400

500

600

700

--- Effective vertical stress (rov,z') in kPa →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

6/14

← Depth in m below ground level (G.L.)

— Net cone resistance (qn) in MPa —→

← Pore pressure ratio (Bq) —→

2 4 6 8 10 12 14 16 18 20

0.8 0.6 0.4 0.2 0.0

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 2.1m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

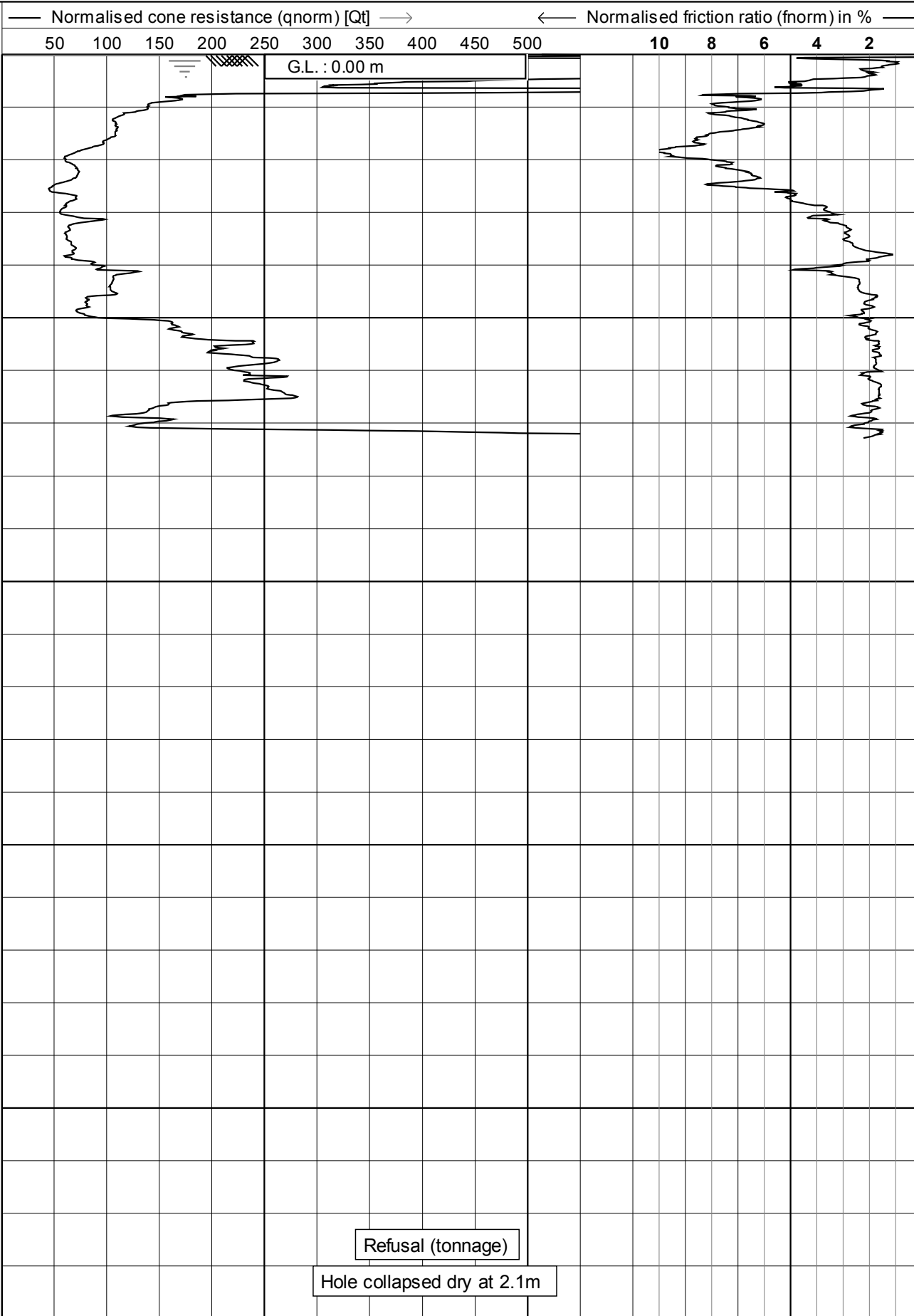
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

7/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

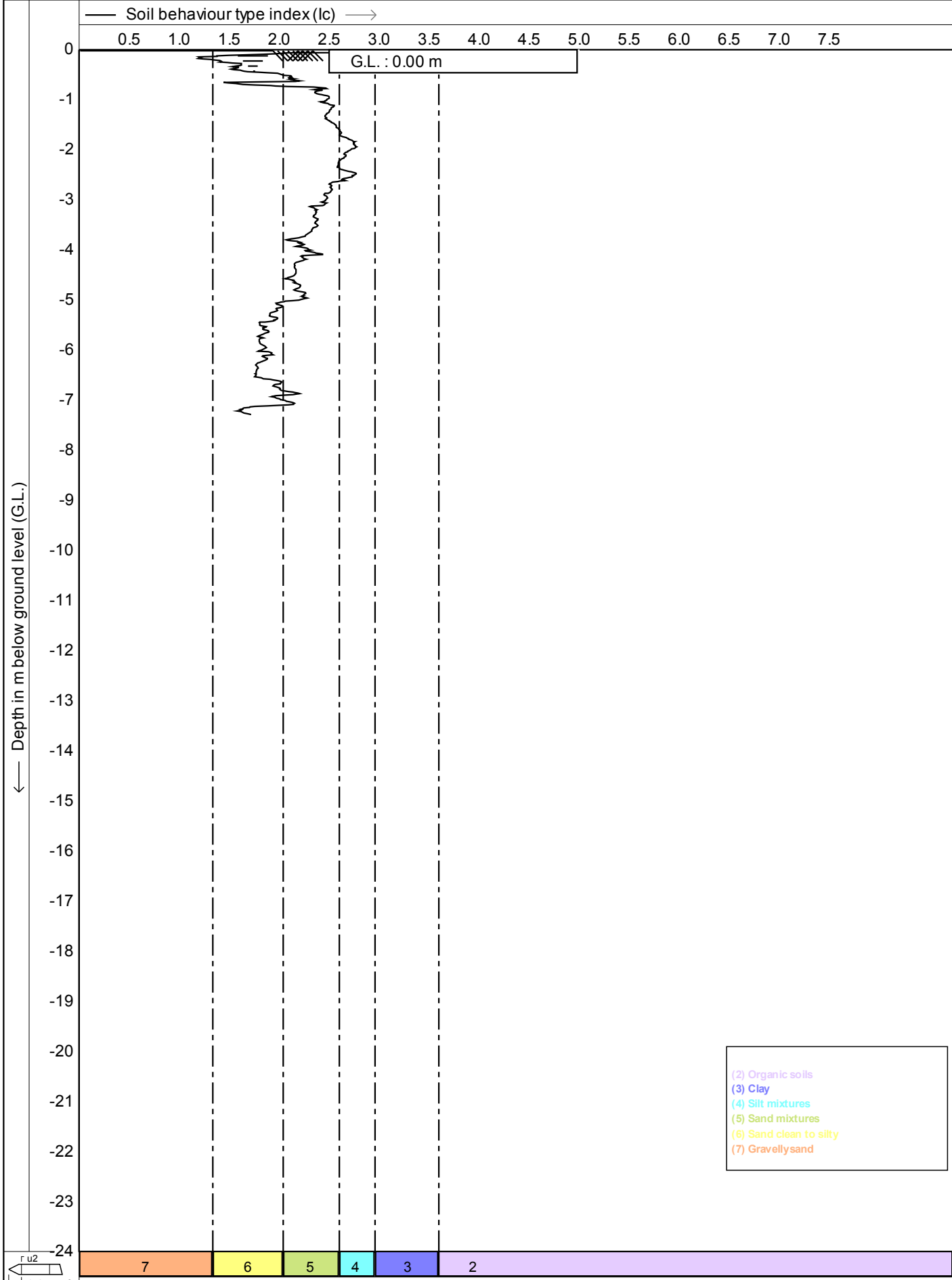
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

8/14



150 cm²
10 cm²

	Test according A.S.T.M. Standard D 5778-12		Date : 5-11-2013	
	Project : Site Investigation		Cone no. : C10CFIP.C13184	
	Location: Ngataringa Rd - Devonport - Auckland		Project no. : 05TT17	
	Position: 0, 0 RD		CPT no. : 04	9/14

← Depth in m below ground level (G.L.)

— Undrained shear strength (Su) in kPa —→

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500

G.L. : 0.00 m

Handwritten marks at depth -3m

Refusal (tonnage)

Hole collapsed dry at 2.1m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

10/14

← Depth in m below ground level (G.L.)

— Relative density (consolidated) in % →

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (tonnage)

Hole collapsed dry at 2.1m

$\frac{\gamma}{150} \frac{u^2}{cm^2}$
 $\frac{\gamma}{10} \frac{u^2}{cm^2}$

20 40 60 80 100 120 140

--- Relative density (over-consolidated) in % →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

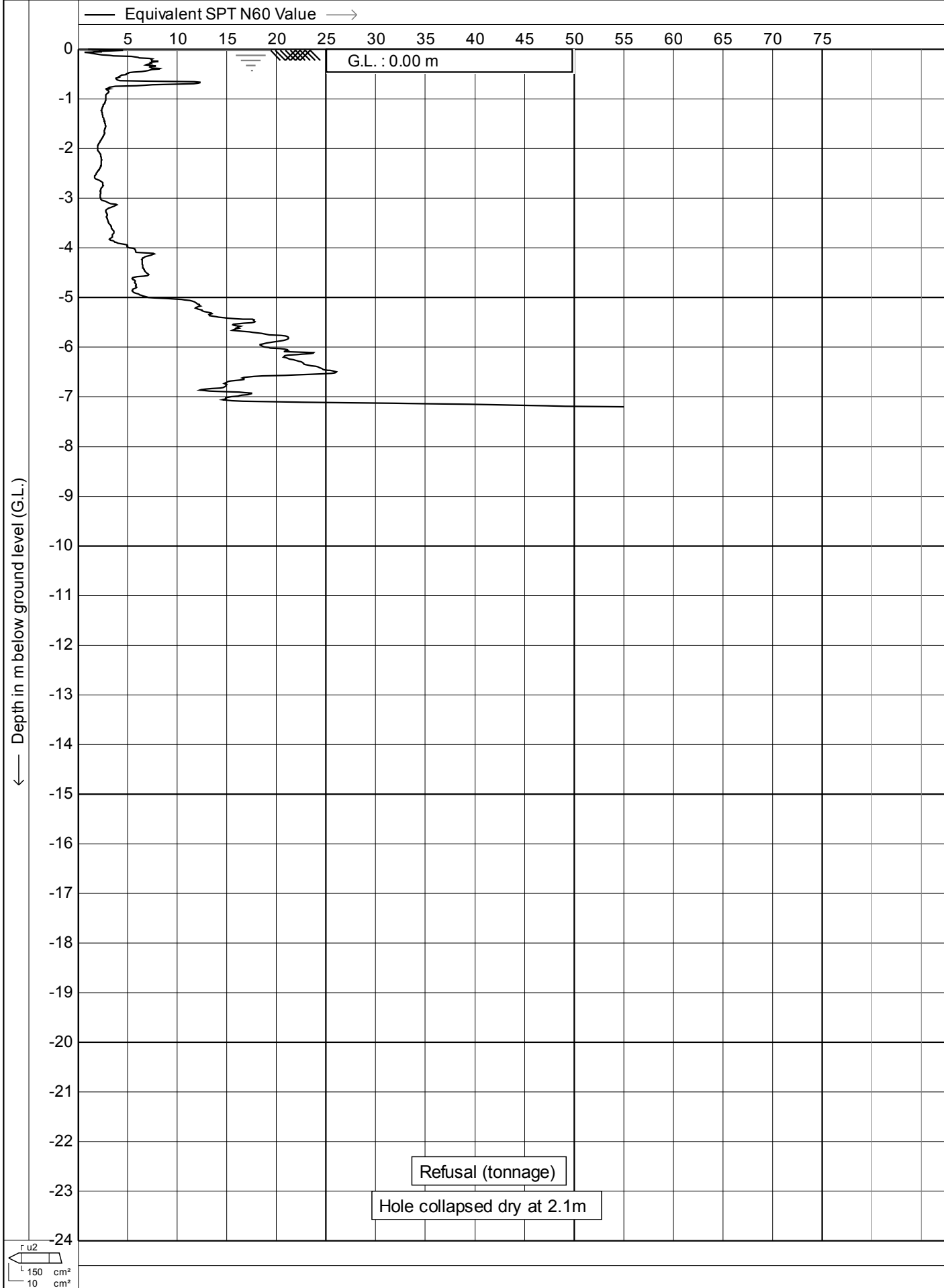
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

11/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

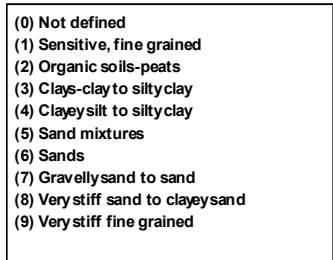
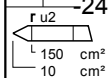
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

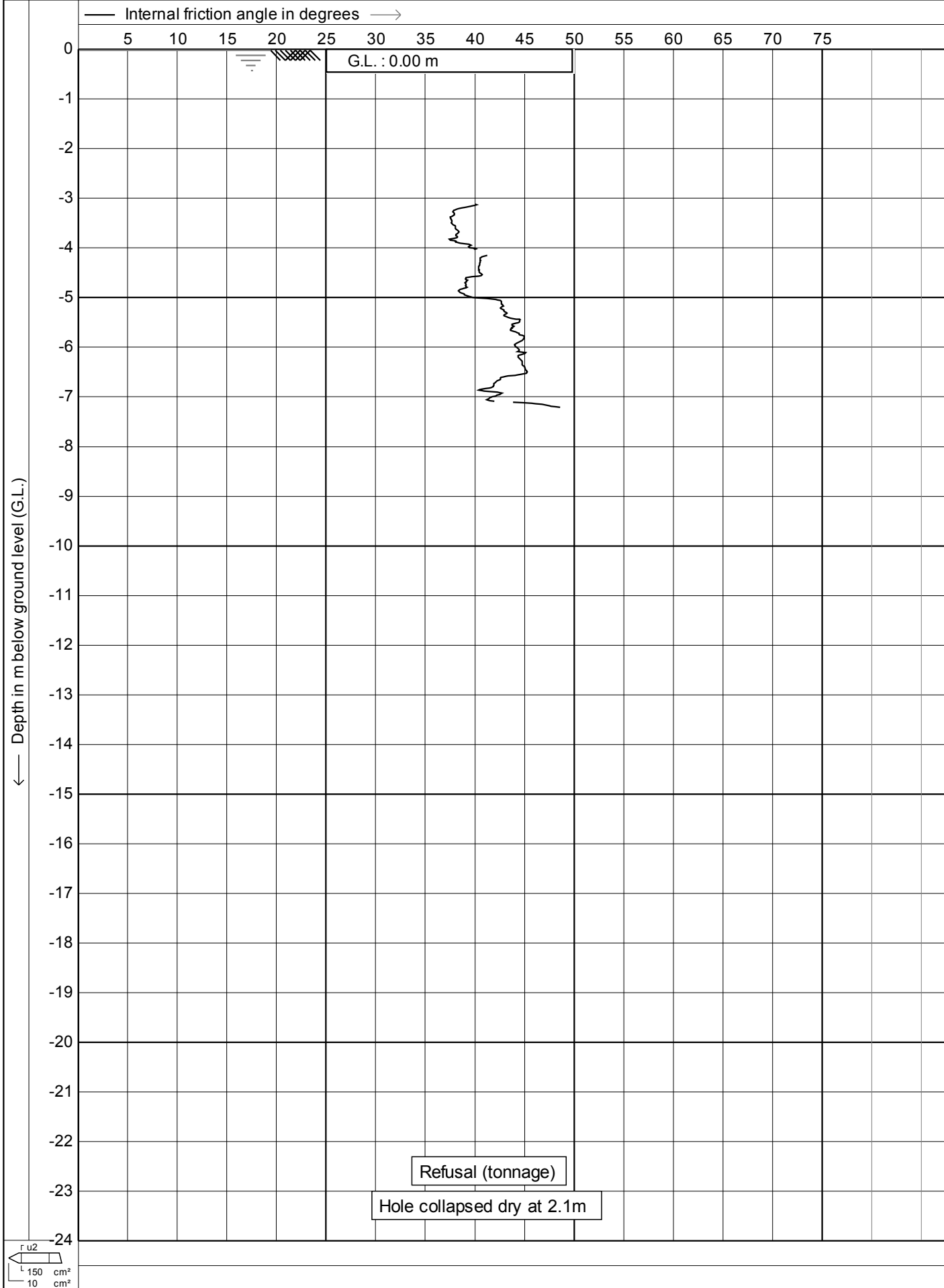
Project no. : **05TT17**

CPT no. : **04**

12/14



Soil behaviour type classification after Robertson 1990



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

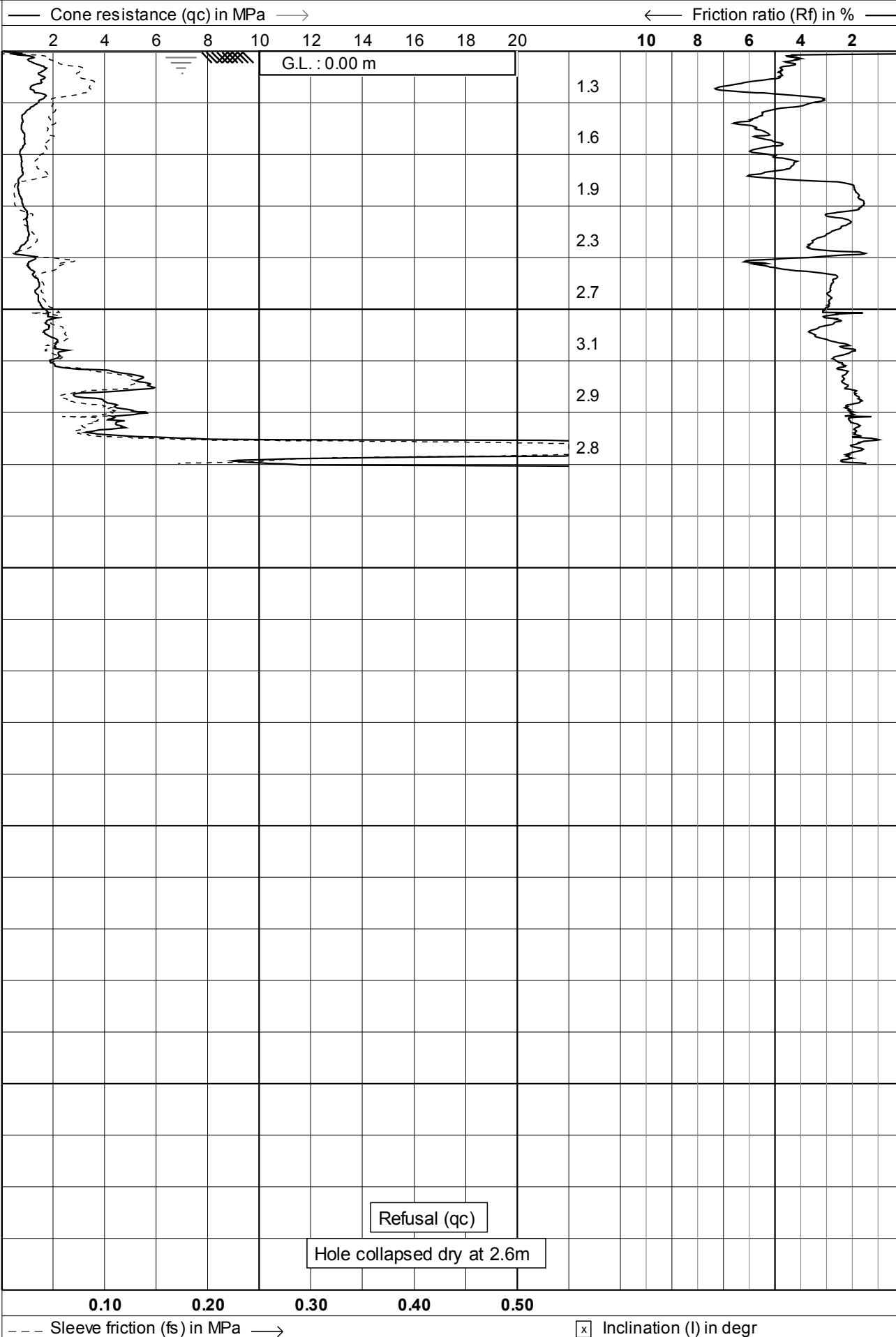
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **04**

14/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

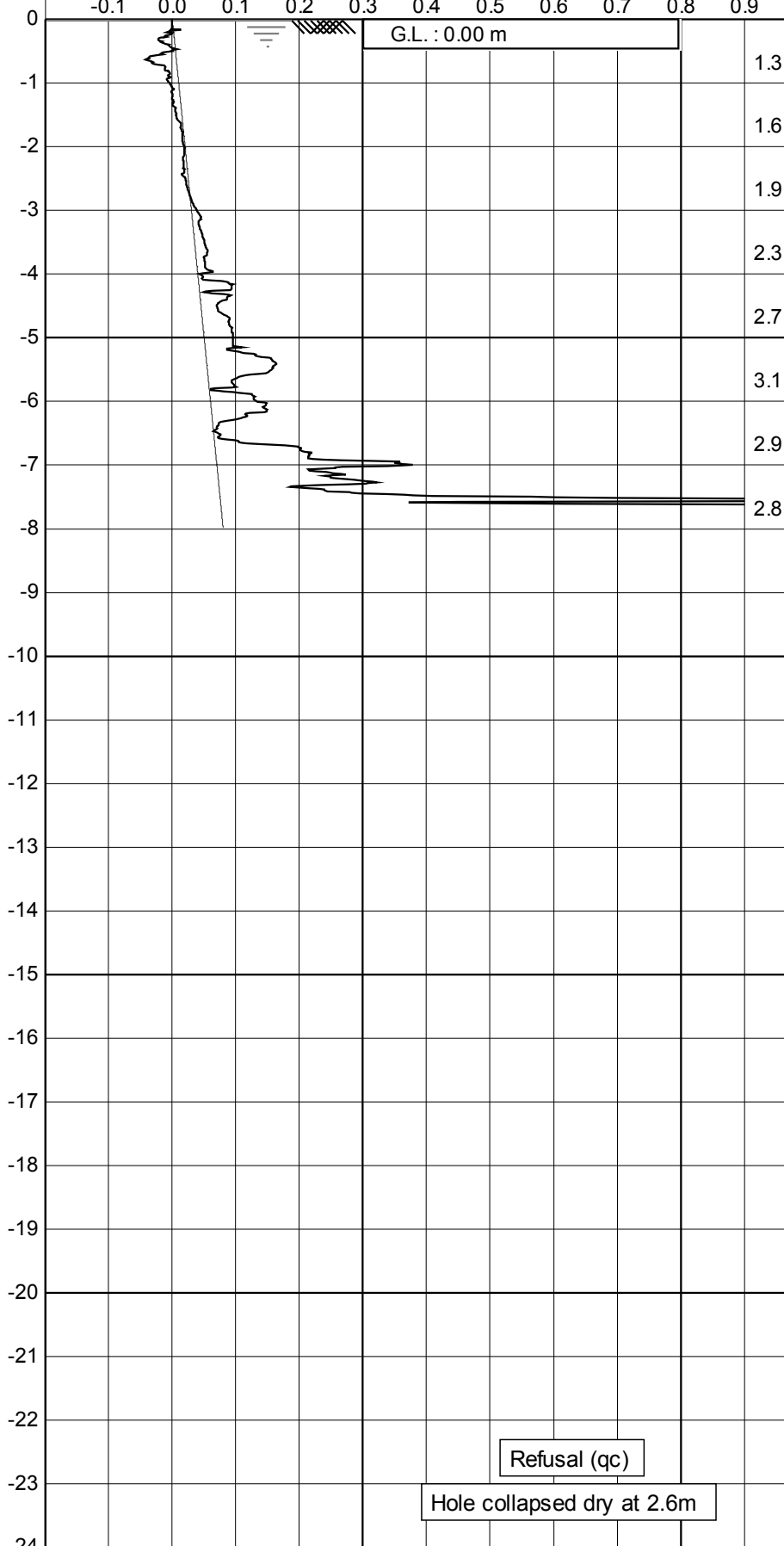
1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m

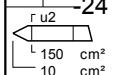


Refusal (qc)

Hole collapsed dry at 2.6m

--- Equilibrium pore pressure (u0) in MPa →

☒ Inclination (I) in degr



0.00

0.20

0.40

0.60

0.80

1.00

1.20



Test according A.S.T.M. Standard D 5778-12
Project : **Site Investigation**
Location: **Ngataringa Rd - Devonport - Auckland**
Position: **0, 0 RD**

Date : **5-11-2013**
Cone no. : **C10CFIP.C13184**
Project no. : **05TT17**
CPT no. : **05**

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 2.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

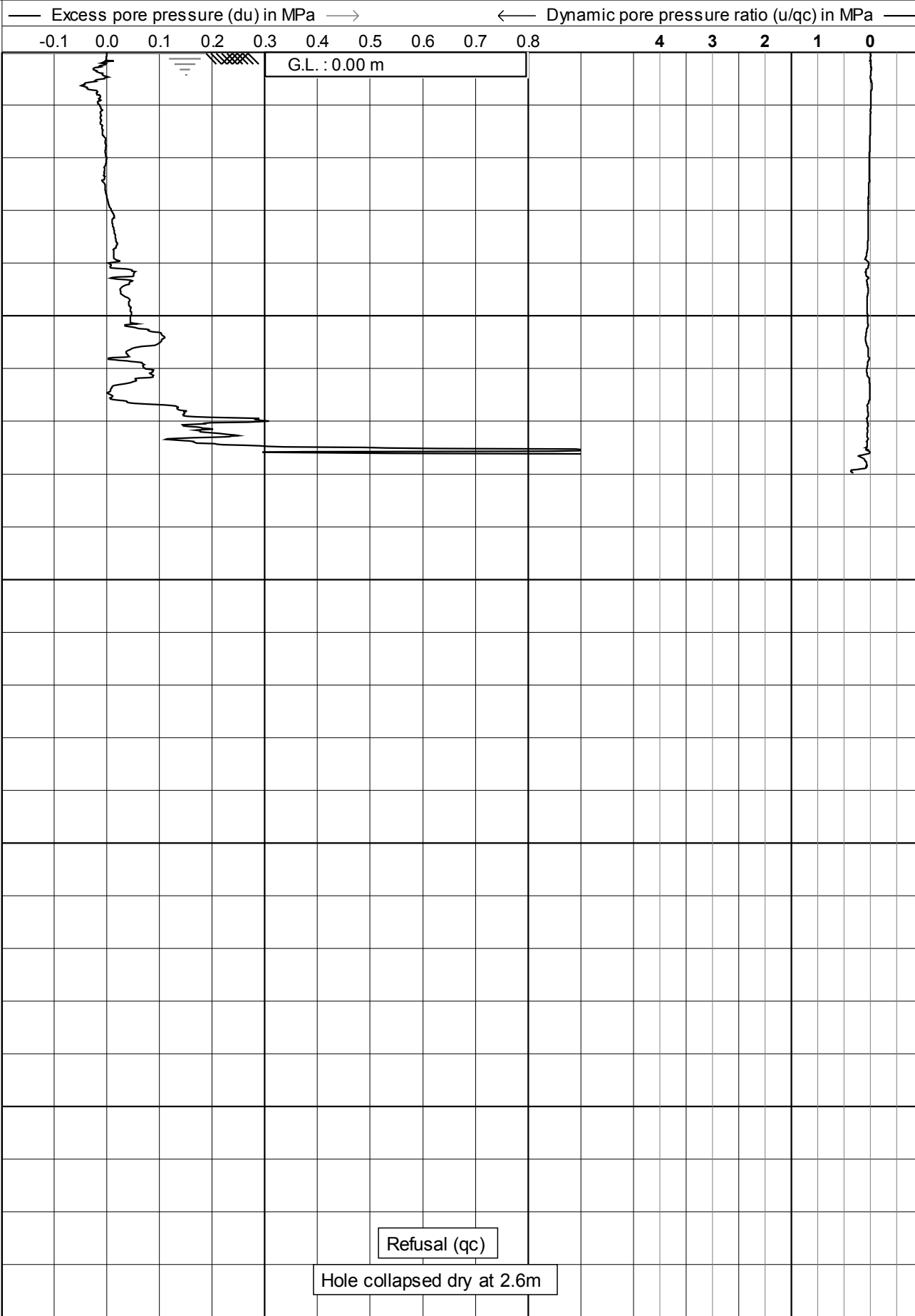
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

3/14

← Depth in m below ground level (G.L.)



γ u2
150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

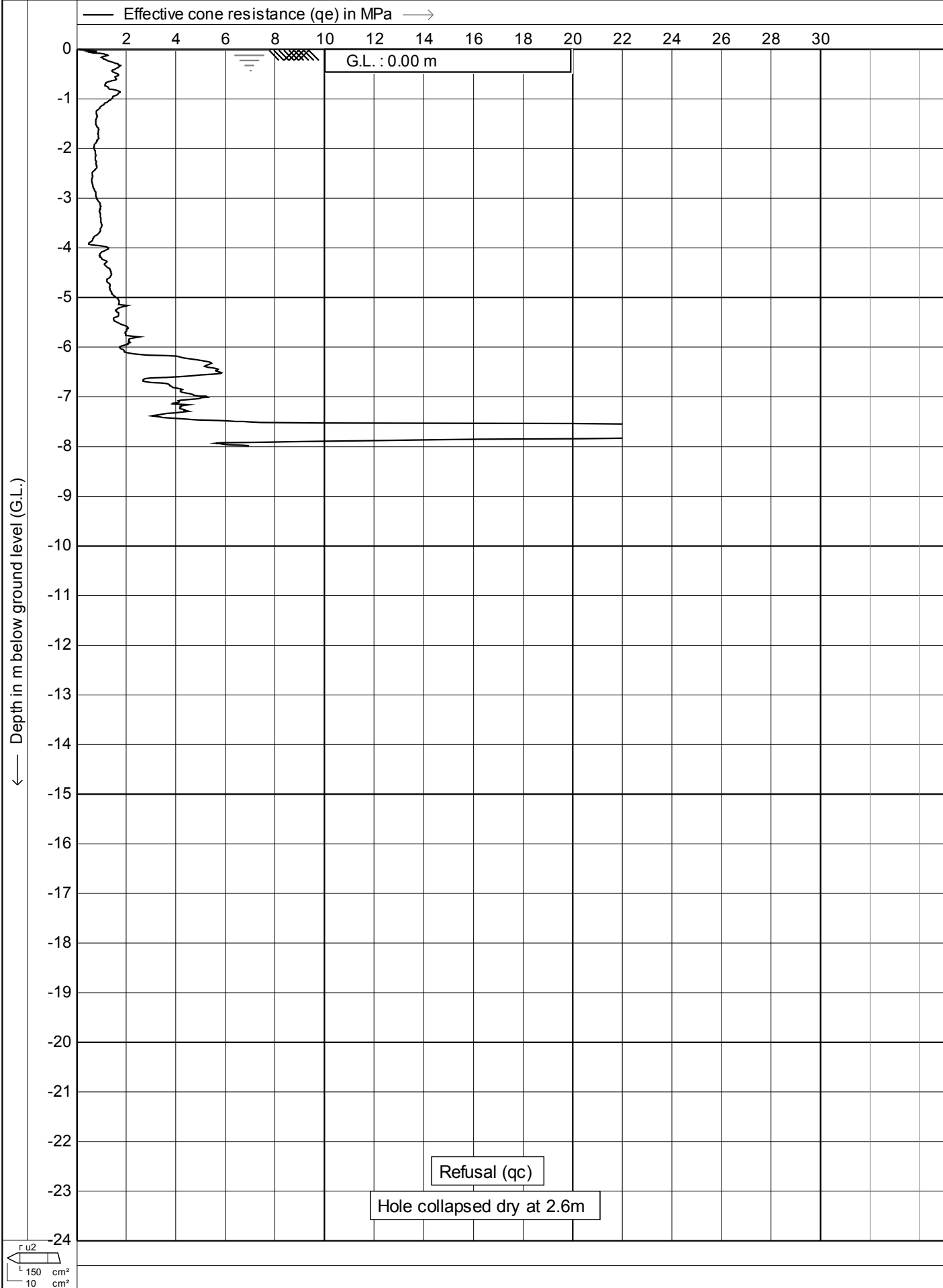
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

4/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

← Depth in m below ground level (G.L.)

— Total vertical stress (σ_v, z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

150 cm²
10 cm²

--- Effective vertical stress (σ_v, z') in kPa →

100

200

300

400

500

600

700

Refusal (qc)

Hole collapsed dry at 2.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

6/14

← Depth in m below ground level (G.L.)

— Net cone resistance (qn) in MPa —→

← Pore pressure ratio (Bq) —→

2 4 6 8 10 12 14 16 18 20

0.8 0.6 0.4 0.2 0.0

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 2.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

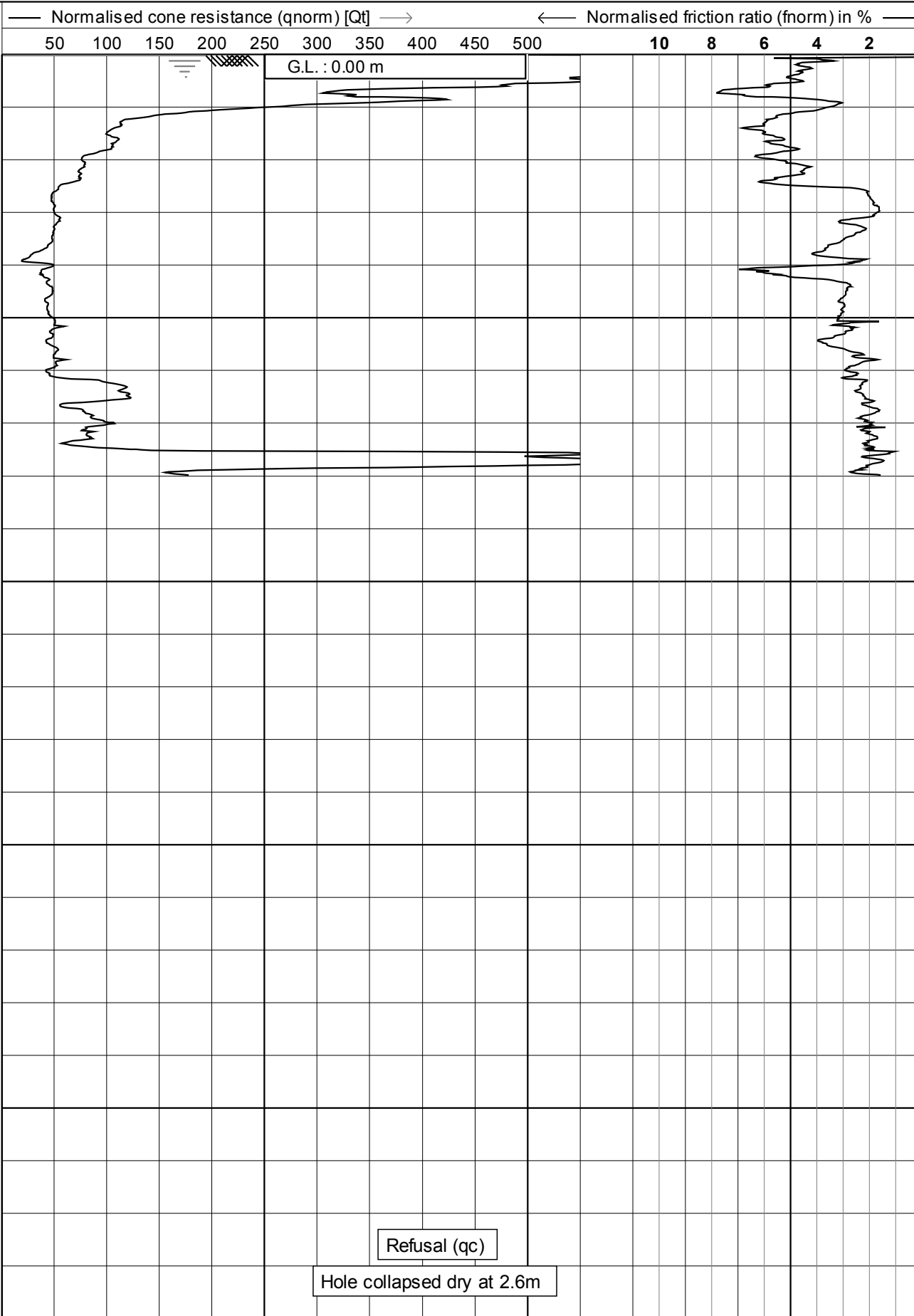
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

7/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

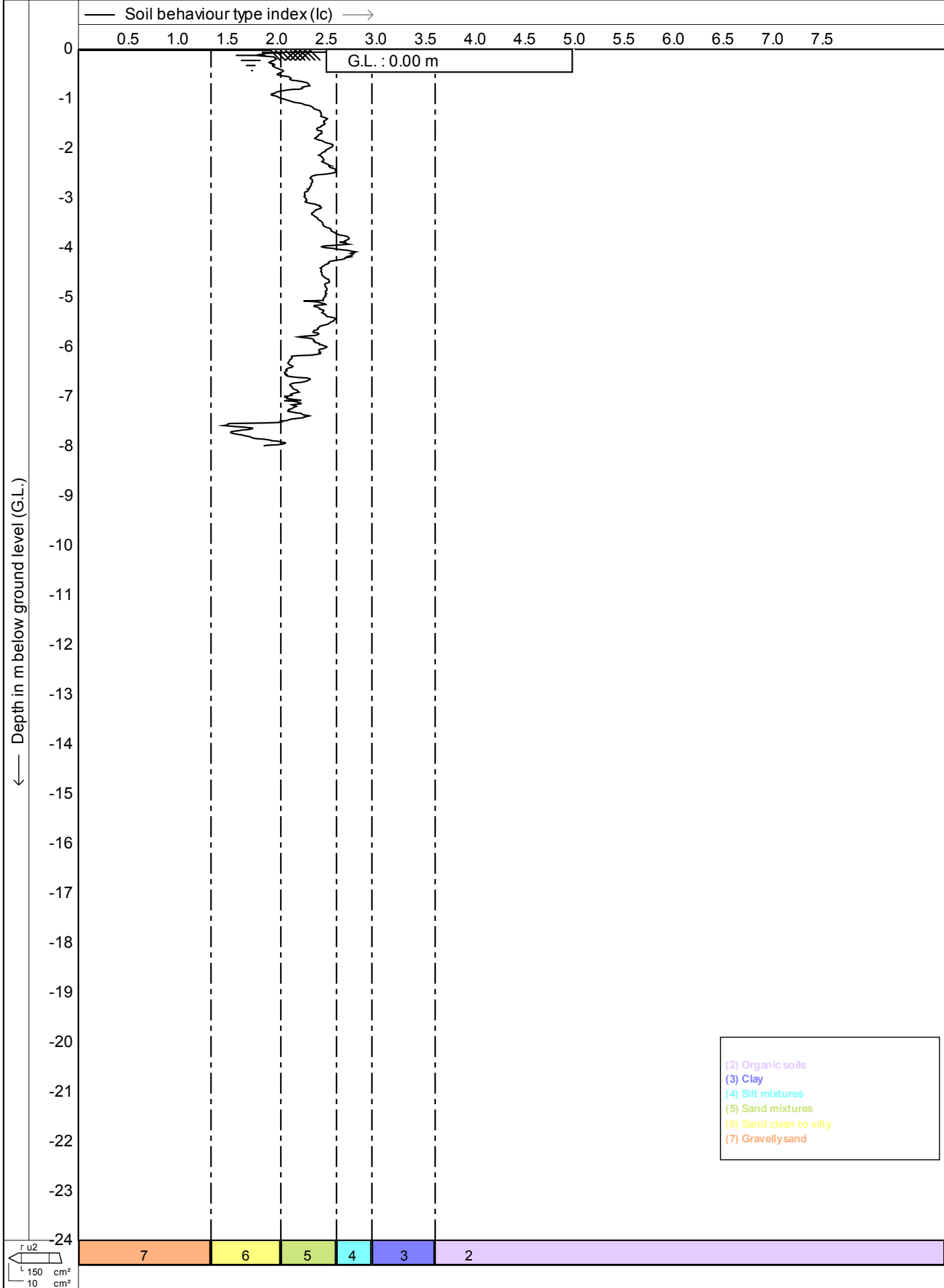
Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **05** 8/14



← Depth in m below ground level (G.L.)

— Undrained shear strength (Su) in kPa —→

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 2.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataranga Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

10/14

← Depth in m below ground level (G.L.)

— Relative density (consolidated) in % —→

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (qc)

Hole collapsed dry at 2.6m

γ_{u2}
150 cm²
10 cm²

--- Relative density (over-consolidated) in % —→

20

40

60

80

100

120

140



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

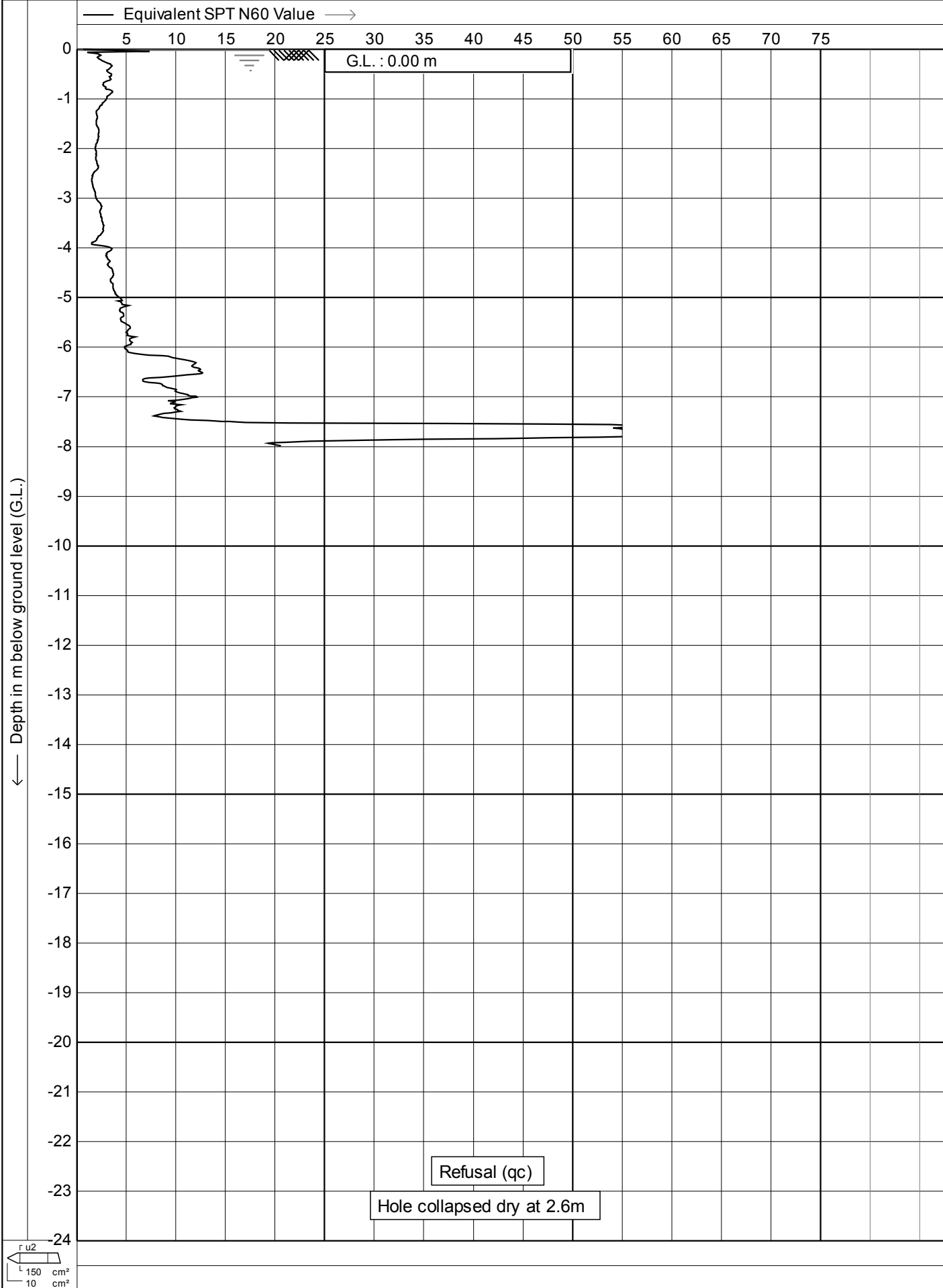
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

11/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

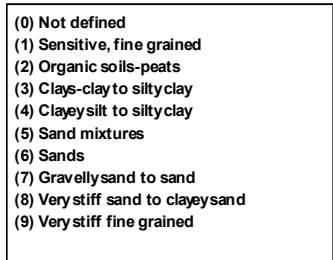
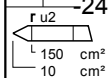
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

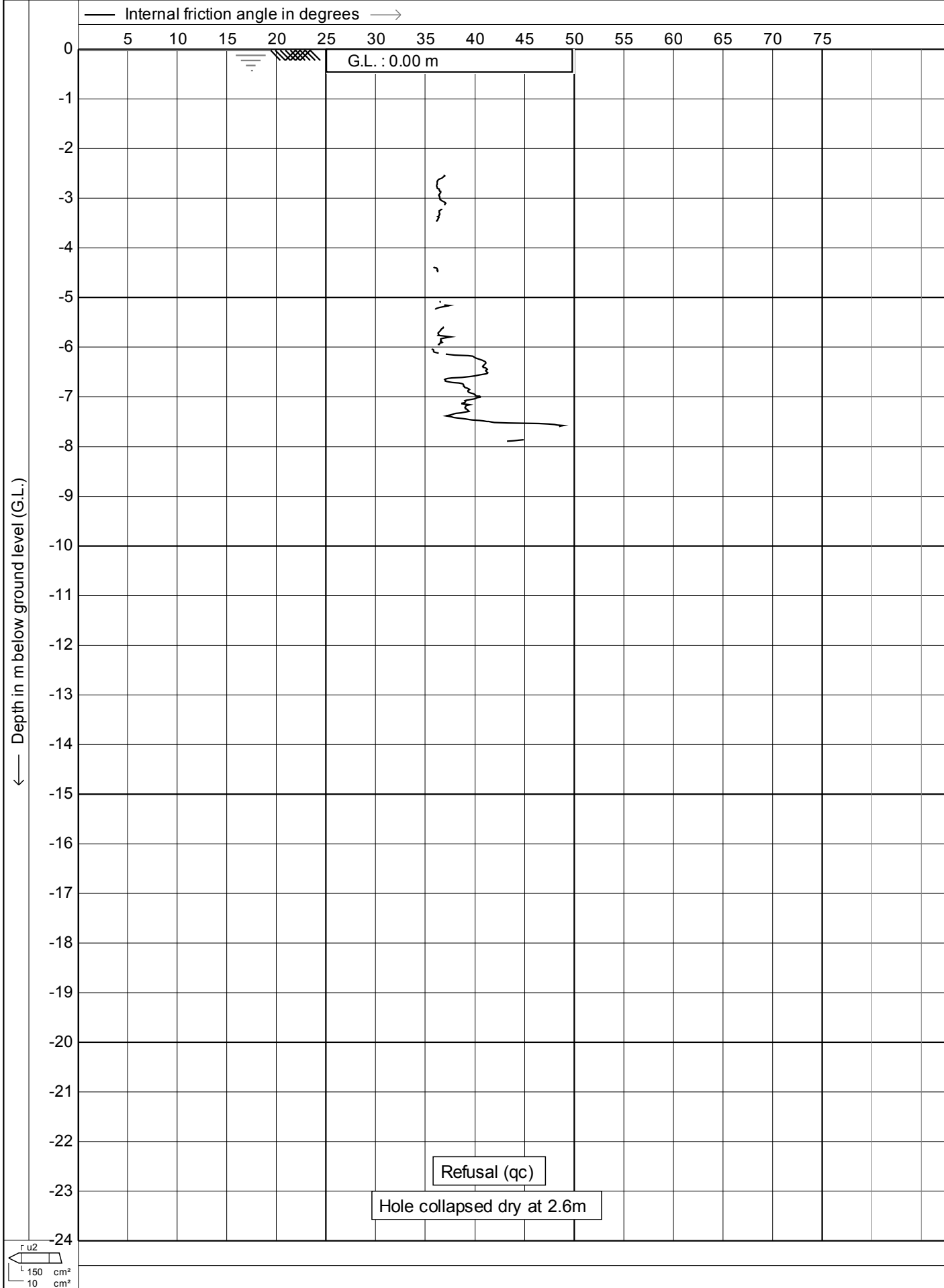
Project no. : **05TT17**

CPT no. : **05**

12/14



Soil behaviour type classification after Robertson 1990



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

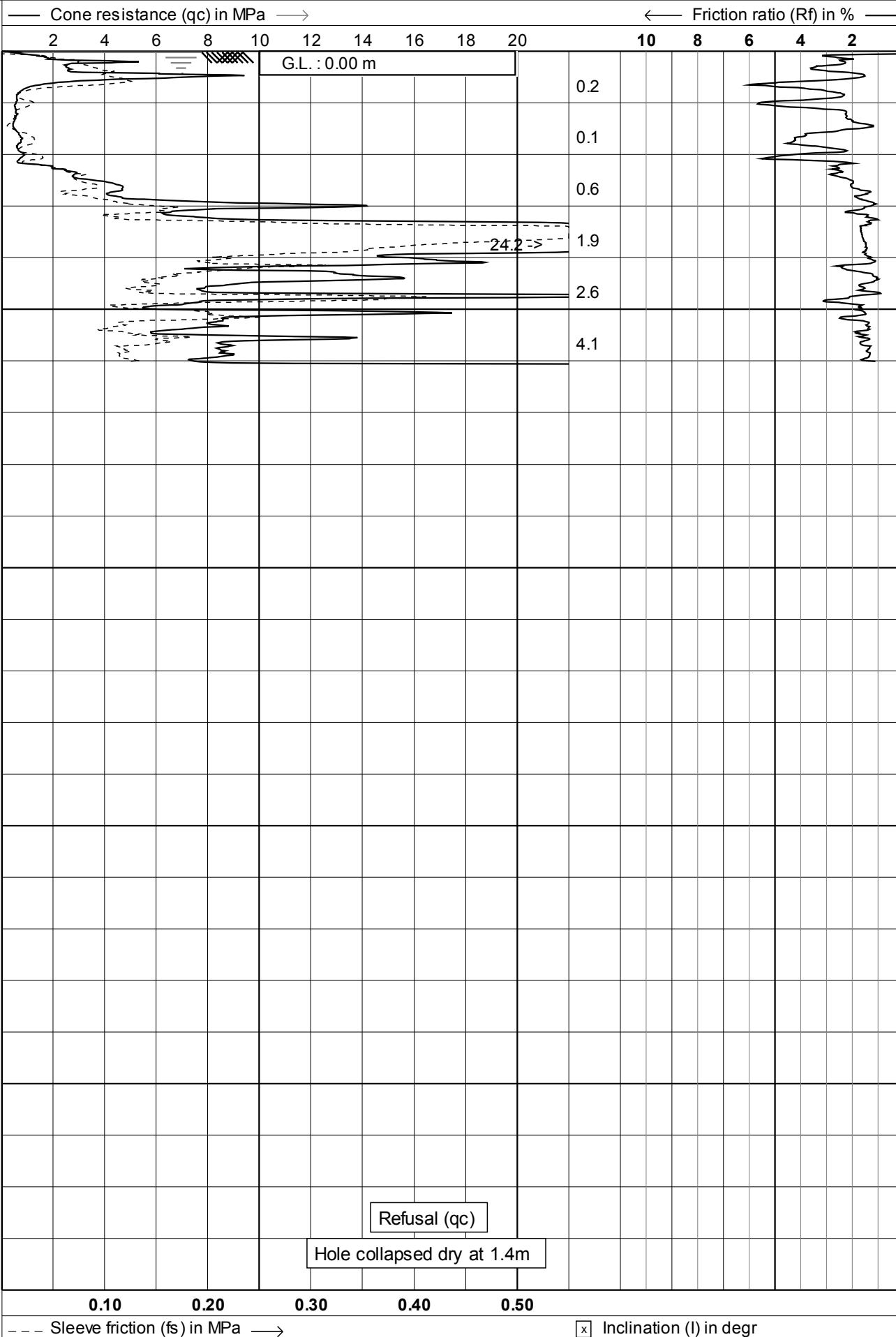
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **05**

14/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

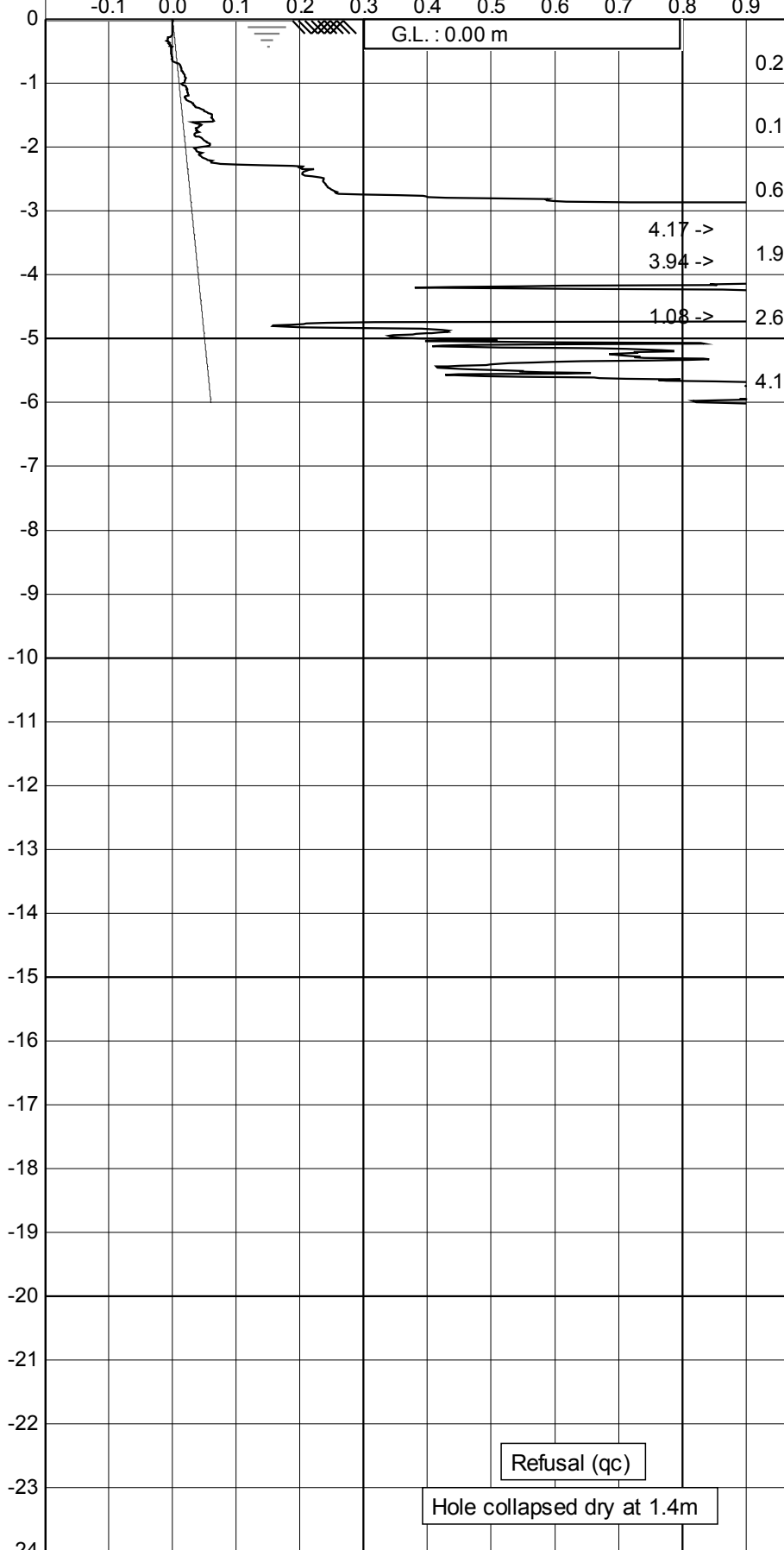
1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m



Refusal (qc)

Hole collapsed dry at 1.4m

γ u2
150 cm²
10 cm²

0.00 0.20 0.40 0.60 0.80 1.00 1.20

--- Equilibrium pore pressure (u0) in MPa →

☒ Inclination (I) in degr



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

25.2 ->

Refusal (qc)

Hole collapsed dry at 1.4m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

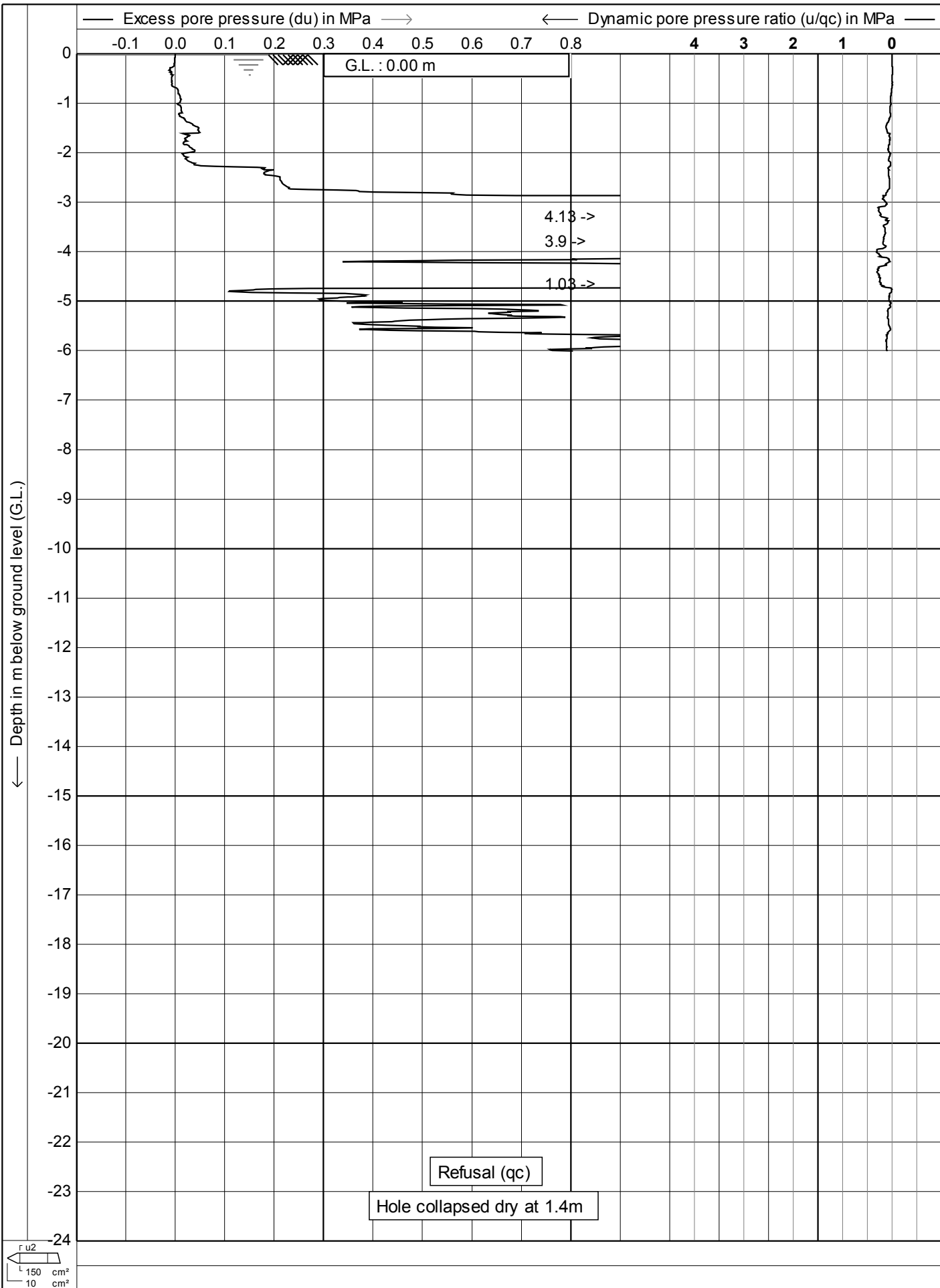
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

3/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

4/14

← Depth in m below ground level (G.L.)

— Effective cone resistance (qc) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 1.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (σ_v, z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (qc)

Hole collapsed dry at 1.4m

100

200

300

400

500

600

700

150 cm²
10 cm²

--- Effective vertical stress ($\sigma'_{v, z}$) in kPa →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

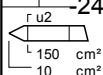
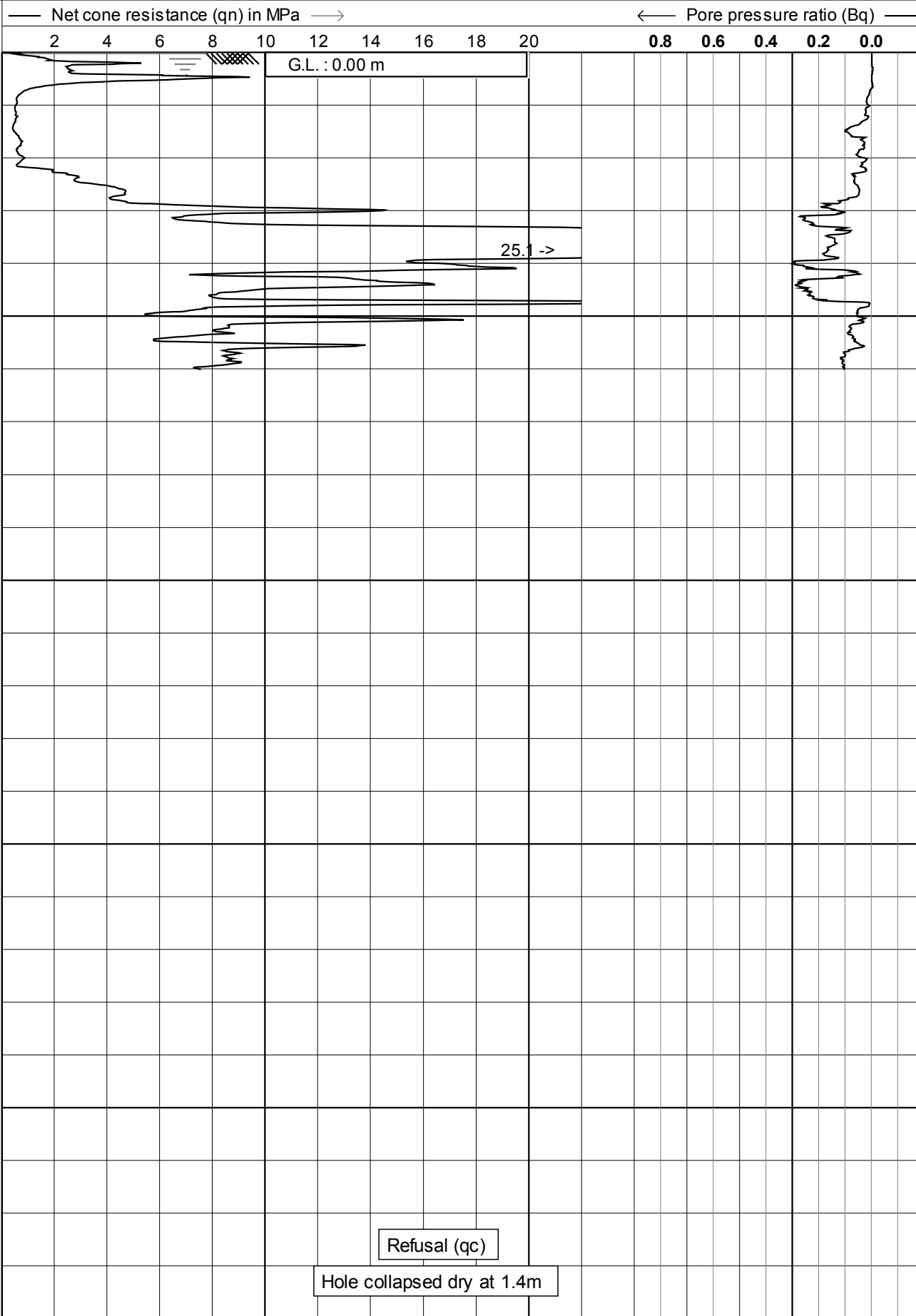
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

6/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

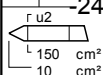
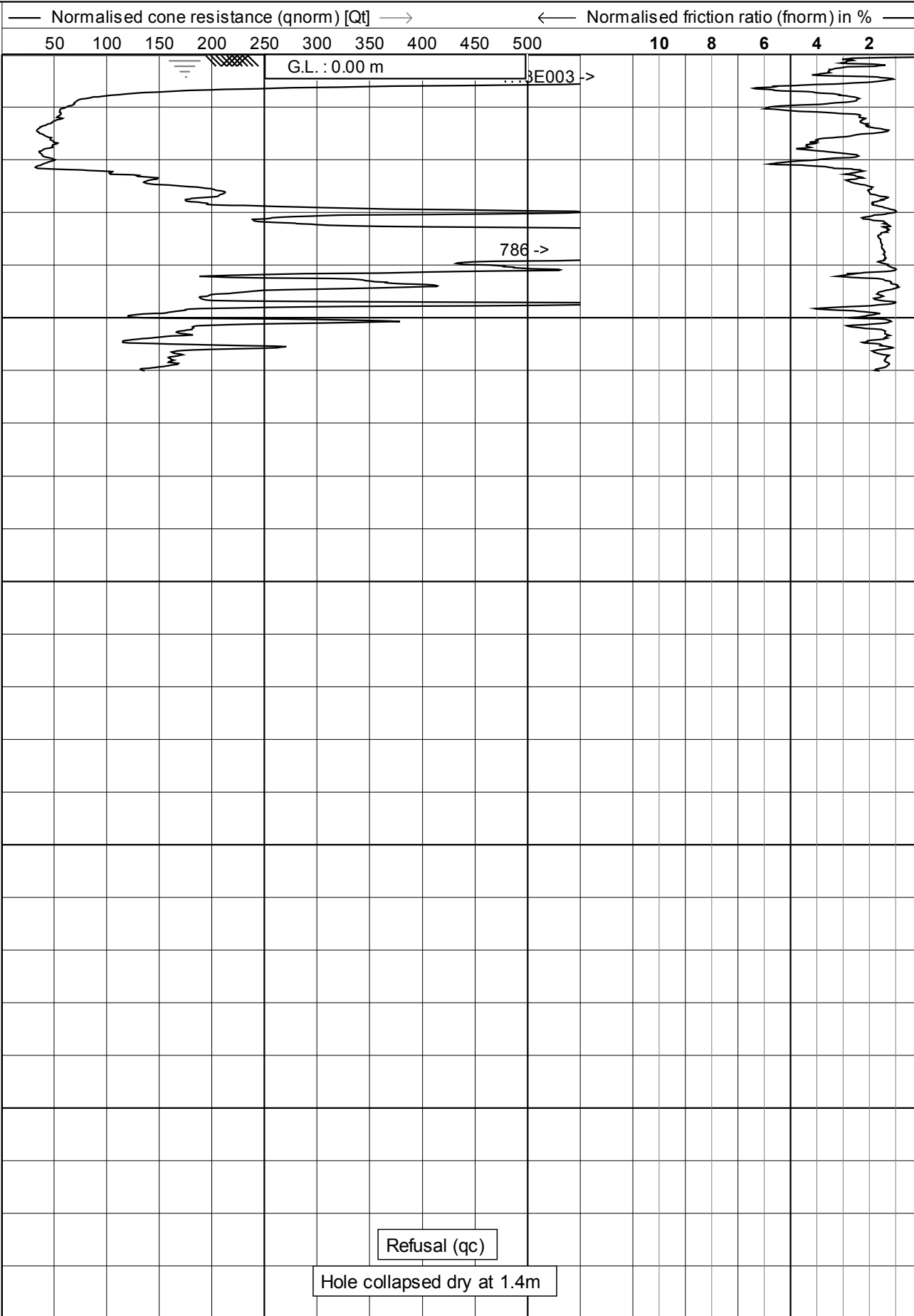
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

7/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

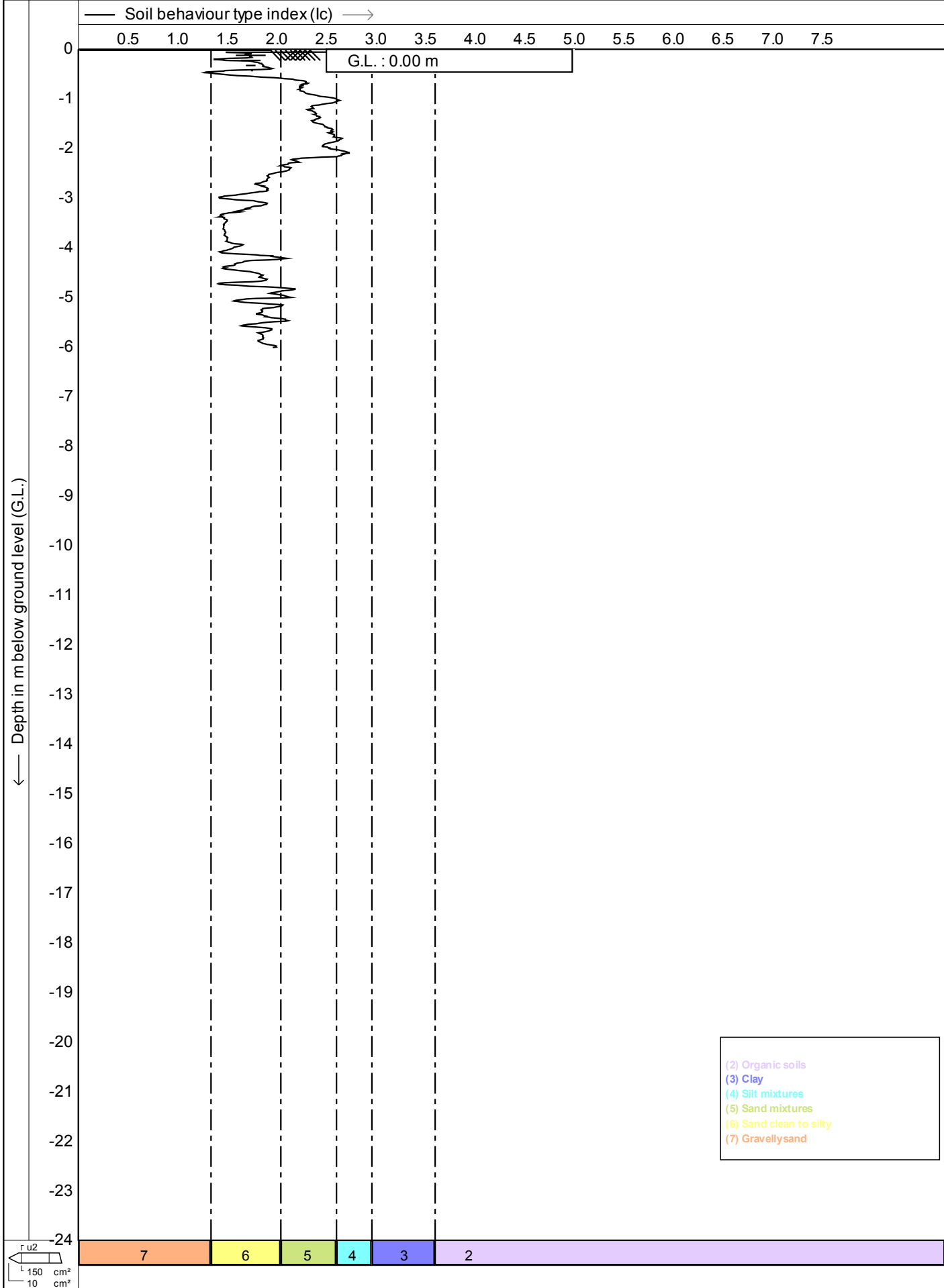
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

8/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

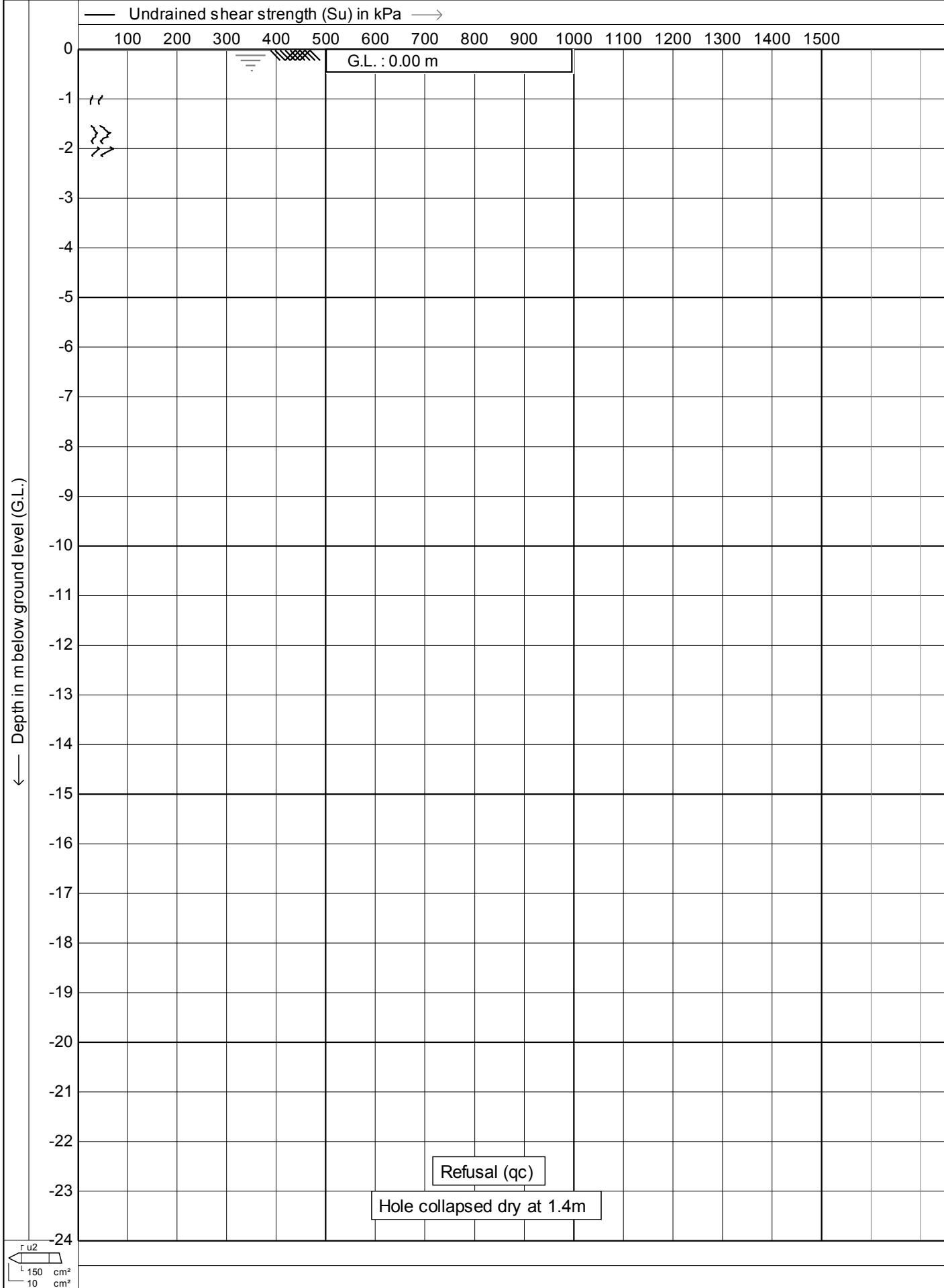
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

9/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

10/14

← Depth in m below ground level (G.L.)

— Relative density (consolidated) in % →

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (qc)

Hole collapsed dry at 1.4m

150 cm²
10 cm²

20 40 60 80 100 120 140

--- Relative density (over-consolidated) in % →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

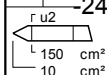
11/14

← Depth in m below ground level (G.L.)

— Equivalent SPT N60 Value —→

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m



Refusal (qc)

Hole collapsed dry at 1.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

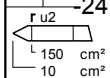
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**


Project no. : **05TT17**

CPT no. : **06**

12/14



- (0) Not defined
- (1) Sensitive, fine grained
- (2) Organic soils-peats
- (3) Clays-clay to silty clay
- (4) Clayeysilt to silty clay
- (5) Sand mixtures
- (6) Sands
- (7) Gravelly sand to sand
- (8) Very stiff sand to clayey sand
- (9) Very stiff fine grained





← Depth in m below ground level (G.L.)

Internal friction angle in degrees →

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 1.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

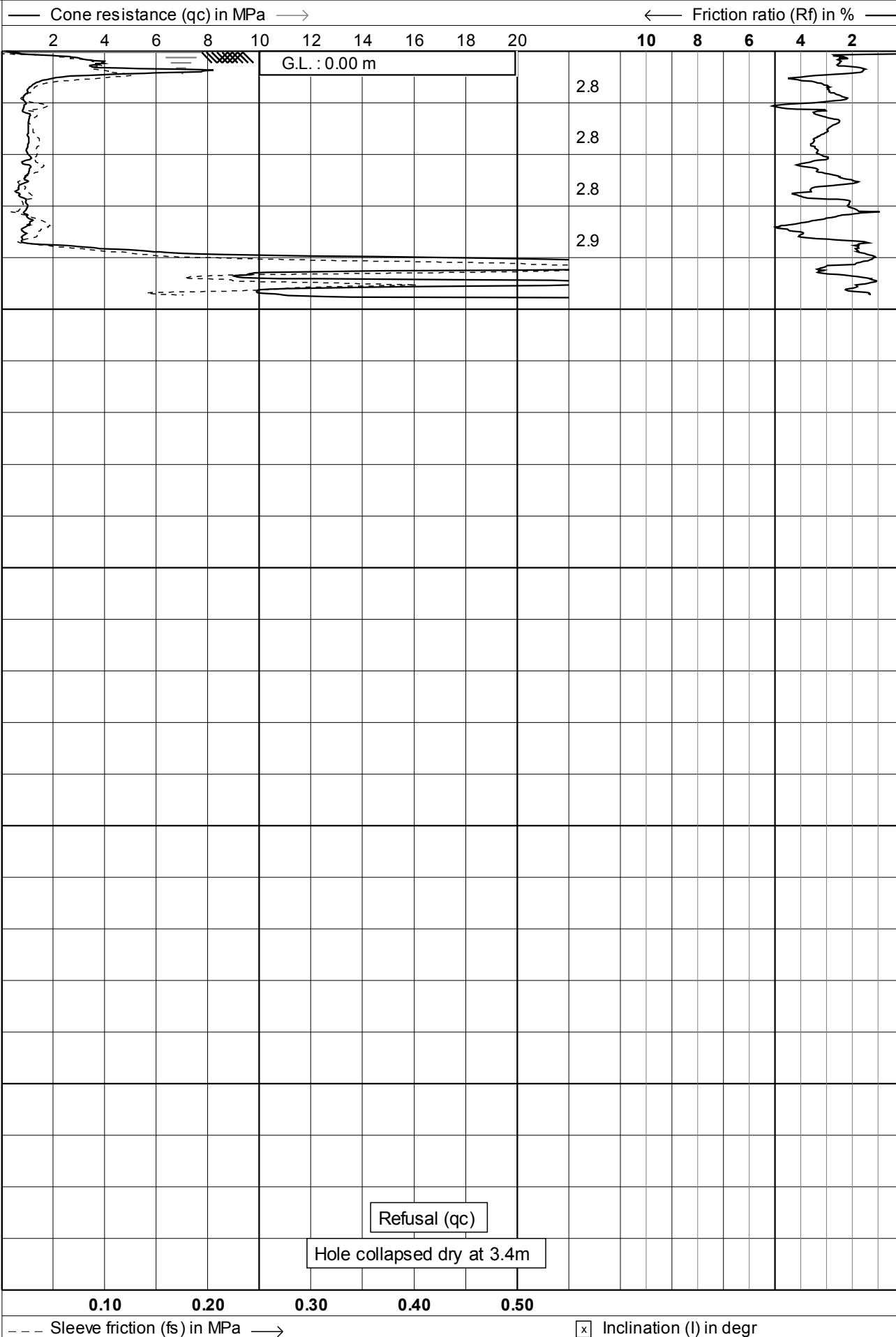
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **06**

14/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u2) in MPa —→

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m

2.8
2.8
2.8
2.9

Refusal (qc)

Hole collapsed dry at 3.4m

0.00 0.20 0.40 0.60 0.80 1.00 1.20
--- Equilibrium pore pressure (u0) in MPa —→

☒ Inclination (I) in degr



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 3.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

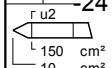
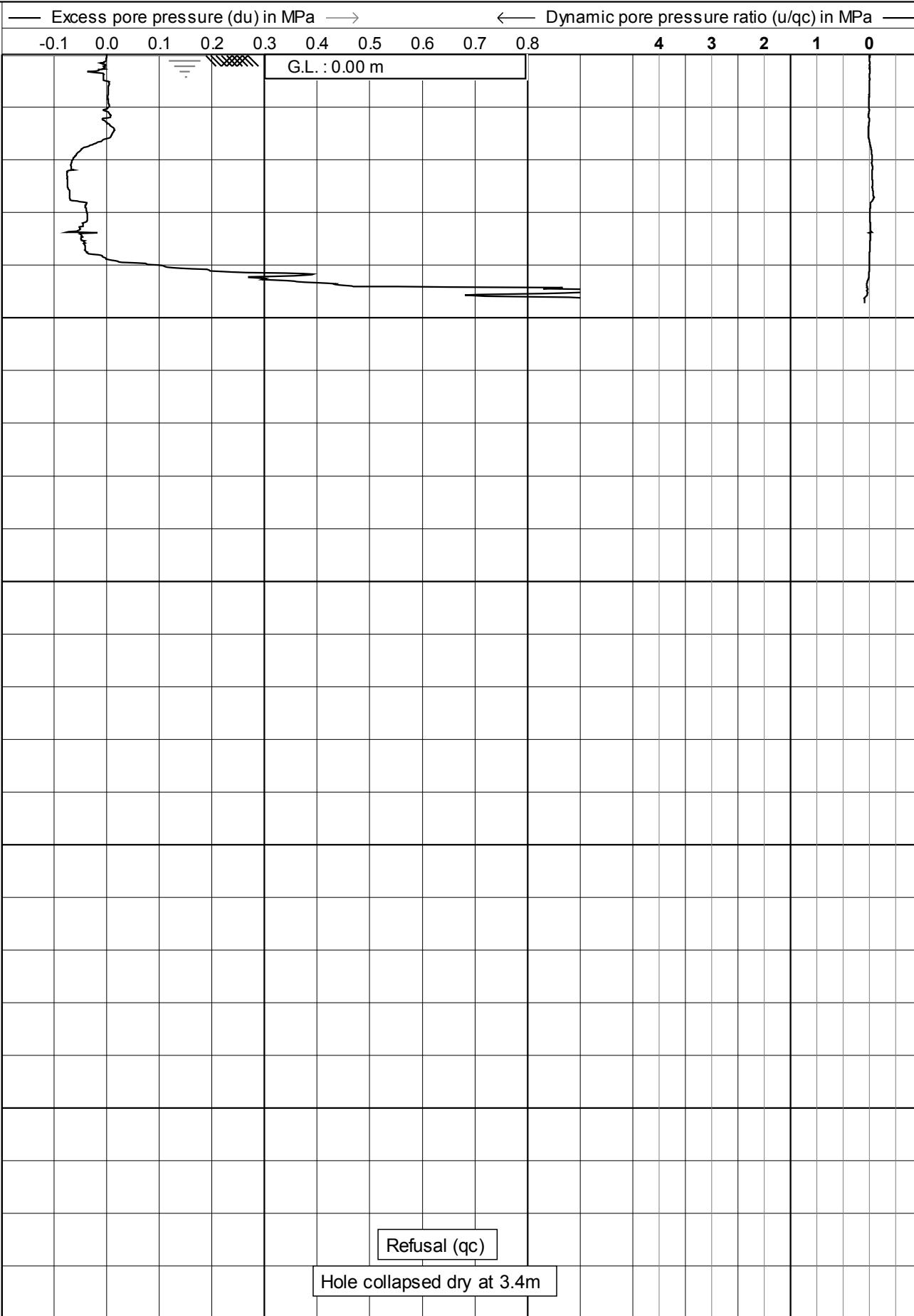
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

3/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

4/14

← Depth in m below ground level (G.L.)

— Effective cone resistance (qc) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 3.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (σ_v, z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (qc)

Hole collapsed dry at 3.4m

100

200

300

400

500

600

700

--- Effective vertical stress ($\sigma'_{v, z}$) in kPa →

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

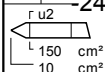
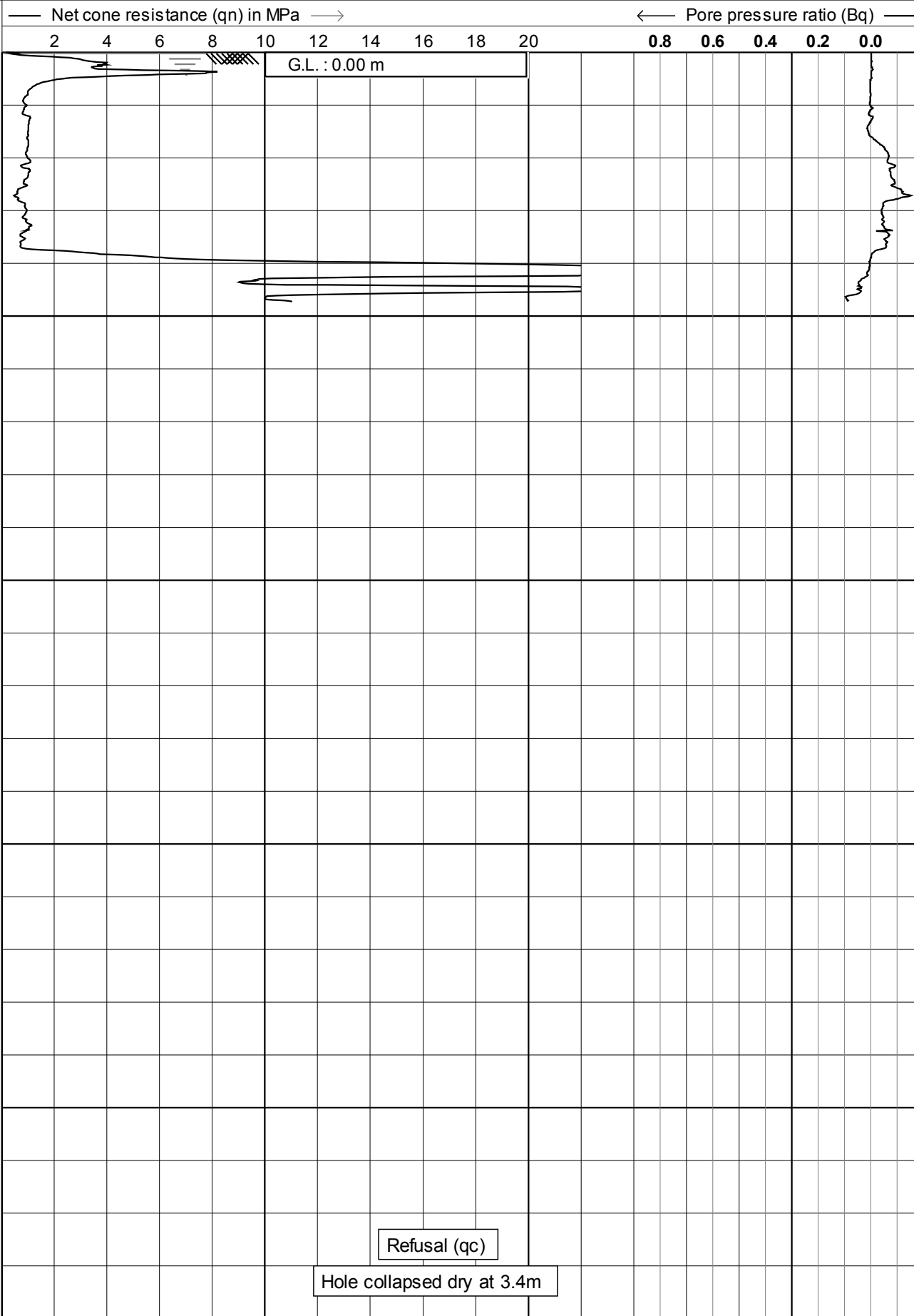
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

6/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

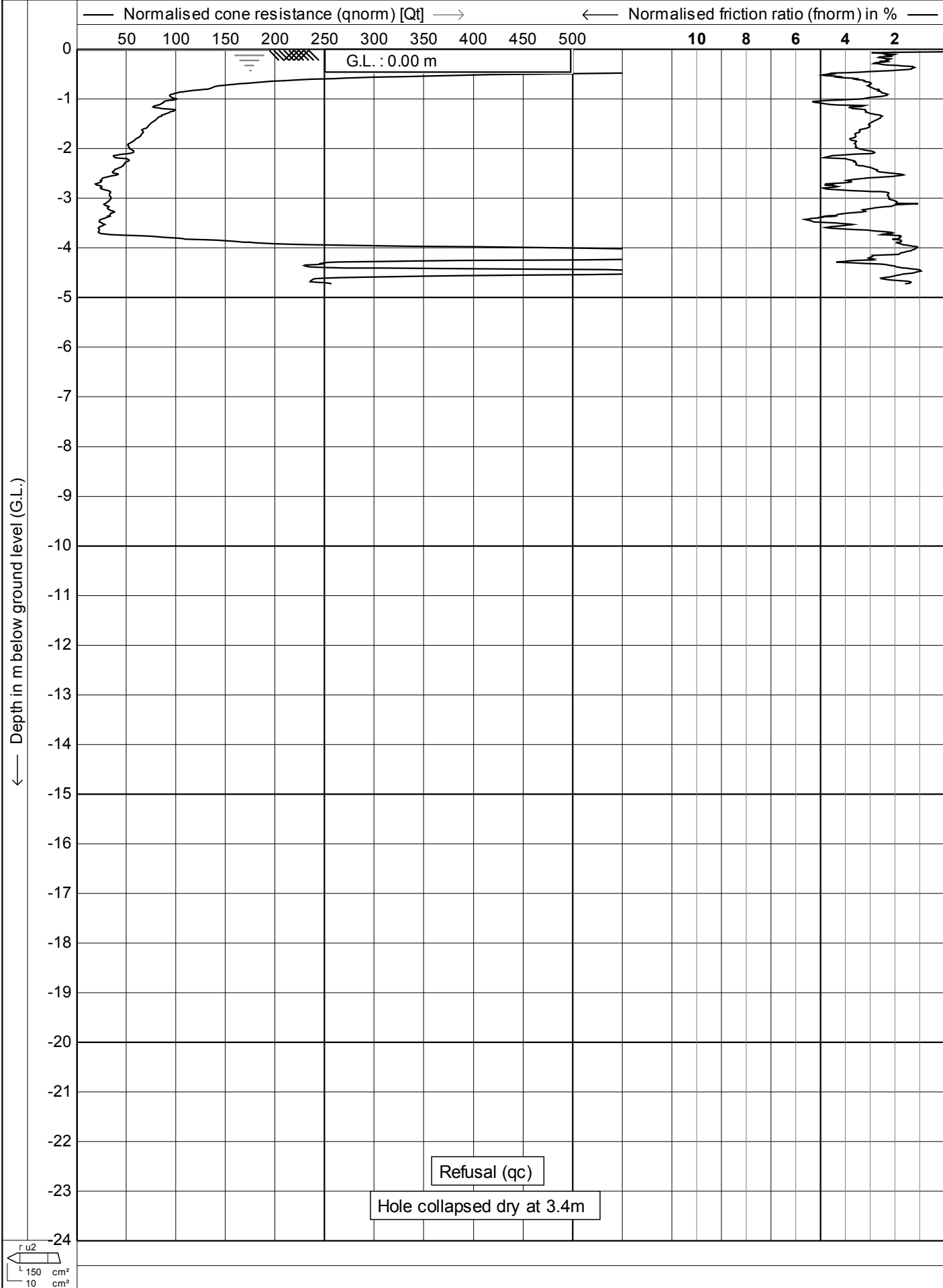
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

7/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **07** 8/14

← Depth in m below ground level (G.L.)

— Soil behaviour type index (Ic) —→

0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5 7.0 7.5

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

(2) Organic soils
(3) Clay
(4) Silt mixtures
(5) Sand mixtures
(6) Sand clean to silty
(7) Gravelly sand

150 cm²
10 cm²

7

6

5

4

3

2



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

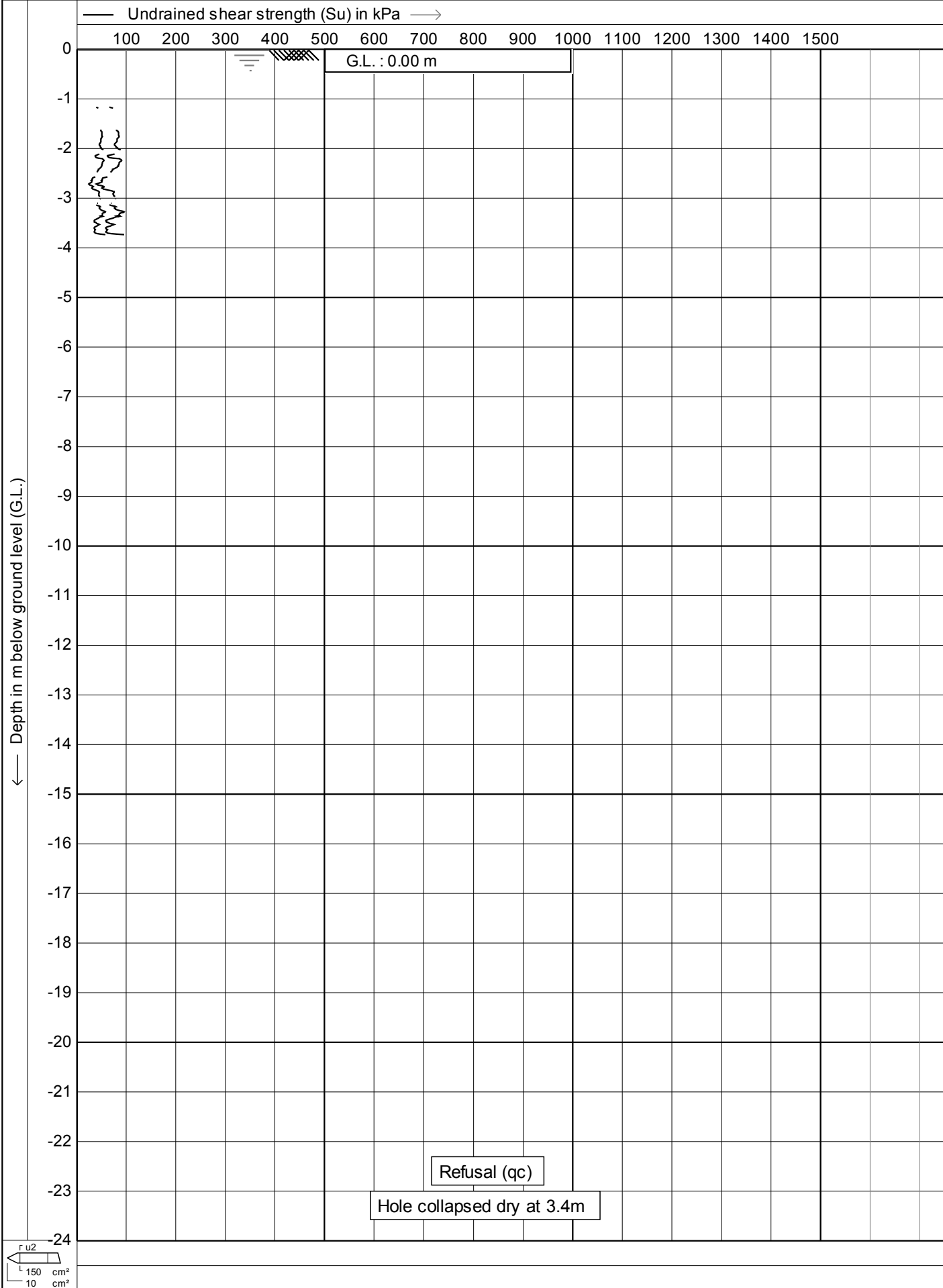
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

9/14



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataranga Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

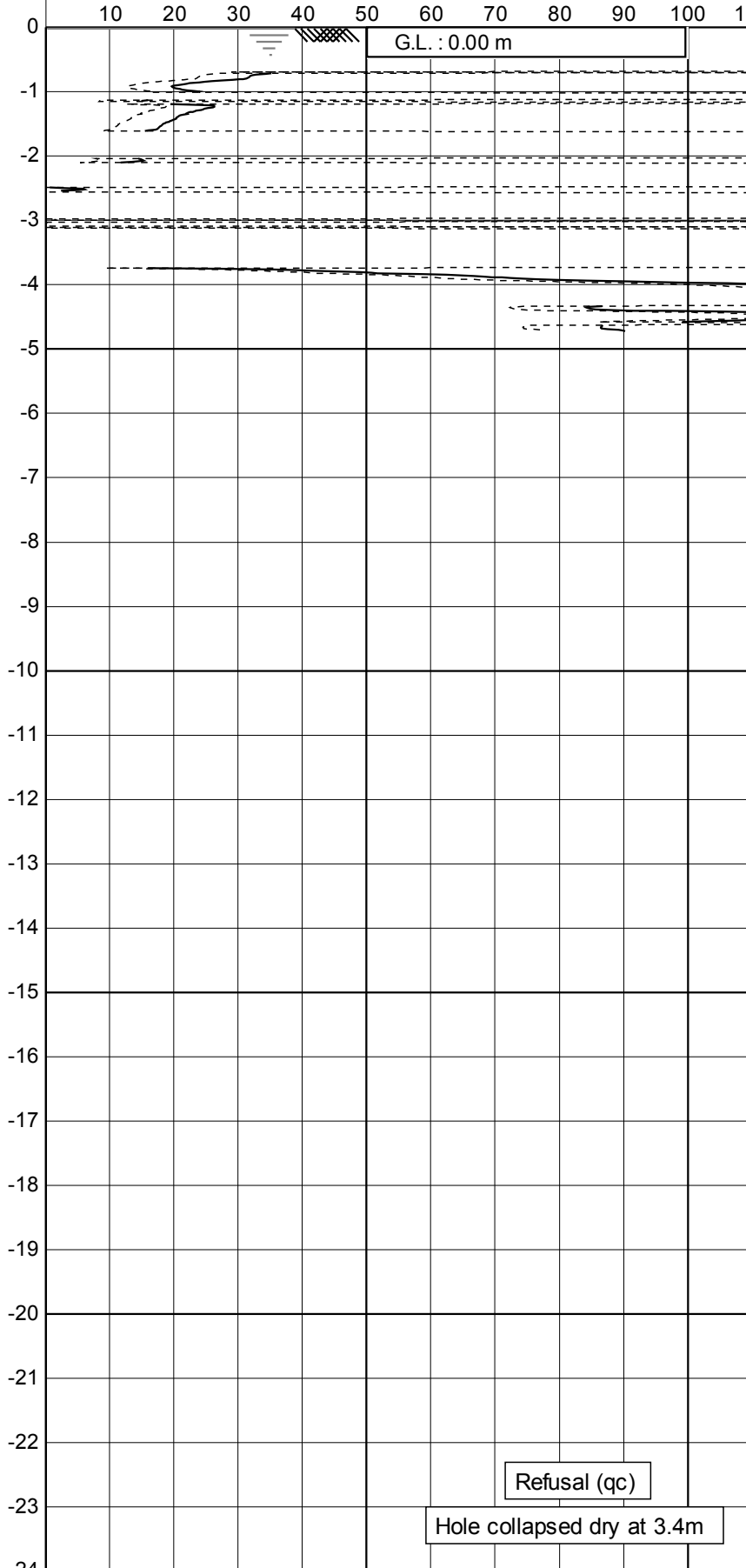
10/14

← Depth in m below ground level (G.L.)

— Relative density (consolidated) in % →

10 20 30 40 50 60 70 80 90 100 110 120 130 140 150

G.L. : 0.00 m



Refusal (qc)

Hole collapsed dry at 3.4m

150 cm²
10 cm²

--- Relative density (over-consolidated) in % →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

11/14

← Depth in m below ground level (G.L.)

— Equivalent SPT N60 Value →

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 3.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

12/14

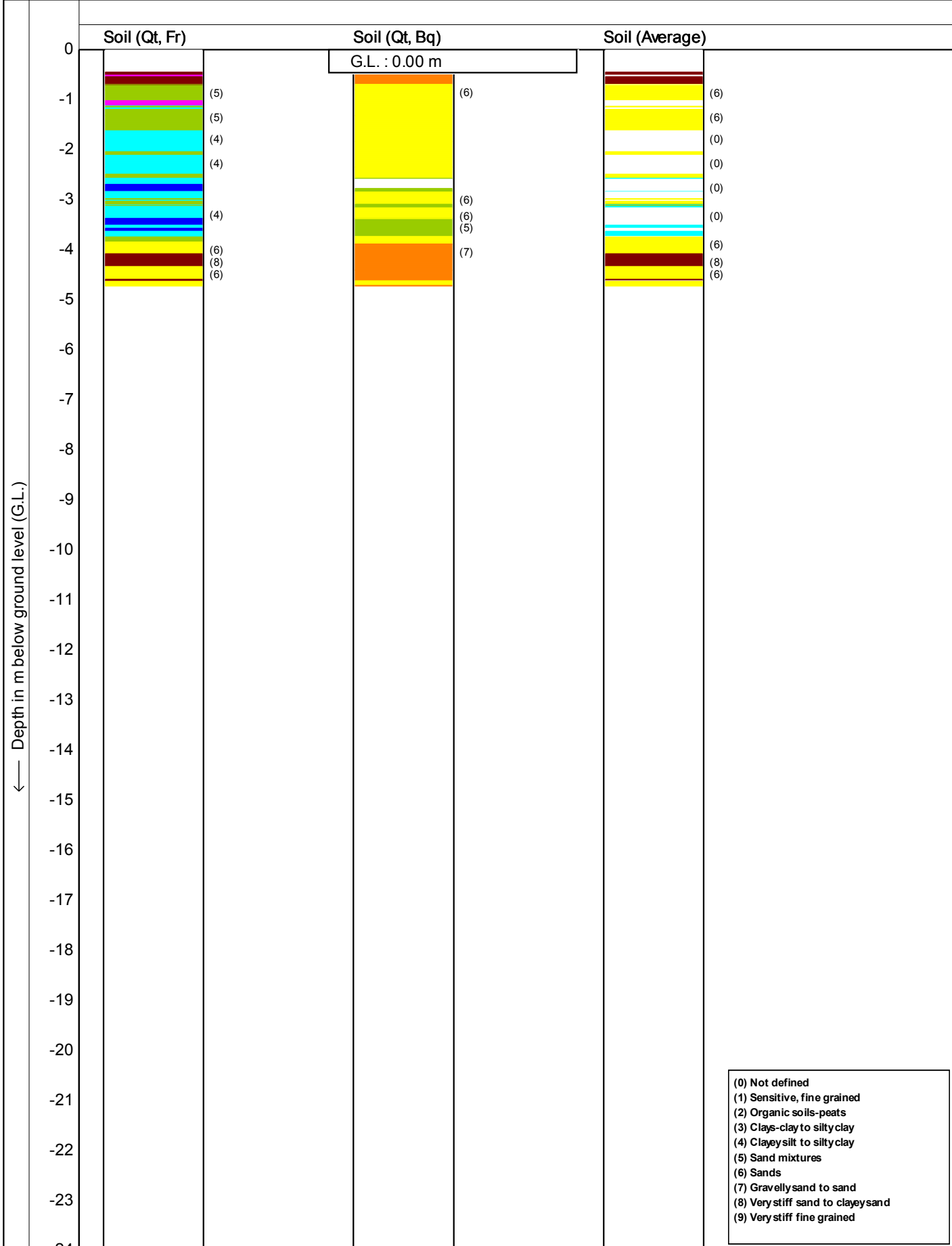


Diagram of a pencil with dimensions: length 150 cm, width 10 cm, and a label "r u2".

13/14

Position: 0, 0 RD



← Depth in m below ground level (G.L.)

Internal friction angle in degrees →

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 3.4m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

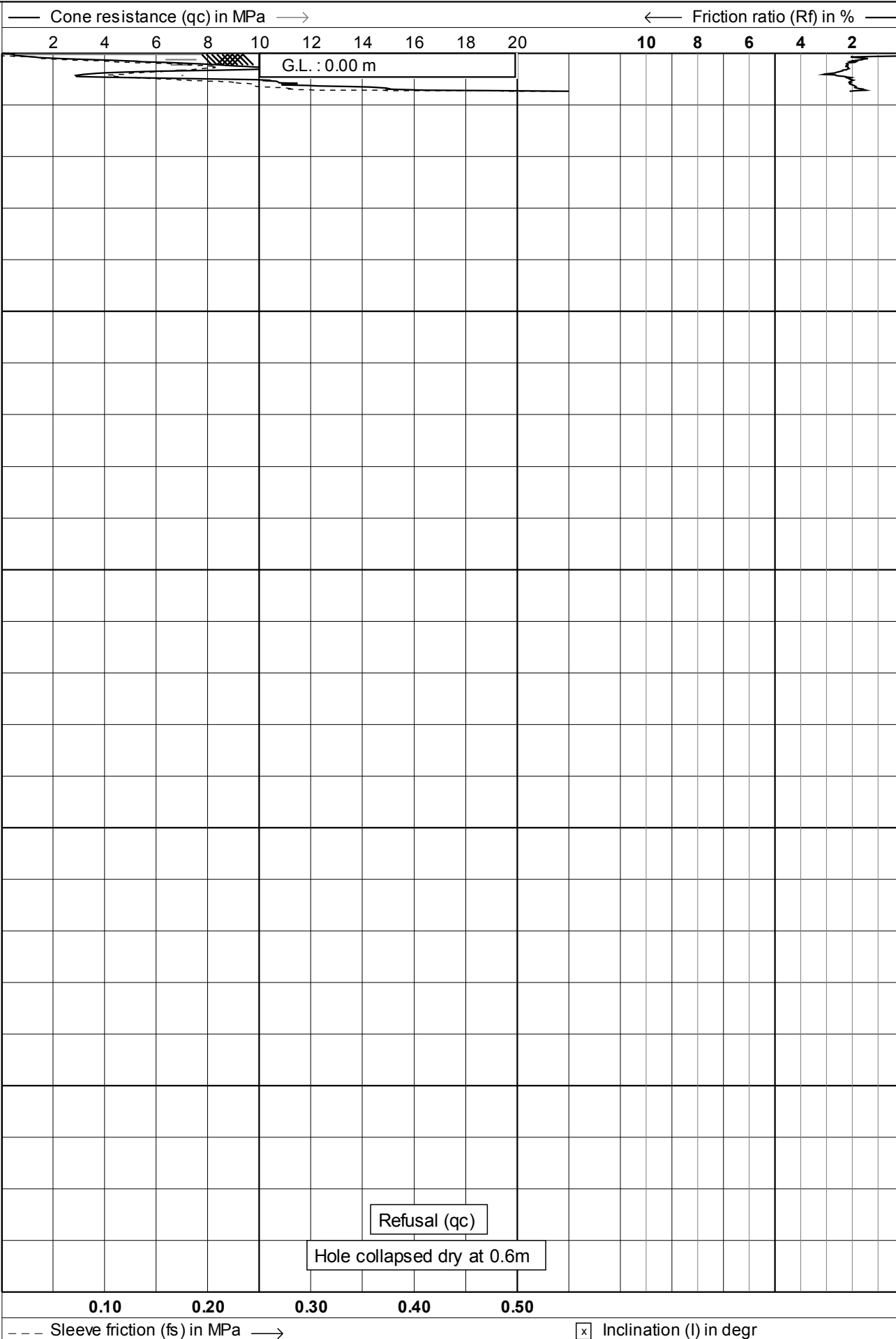
Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **07**

14/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u_2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m

1.42
150 cm²
10 cm²

0.00 0.20 0.40 0.60 0.80 1.00 1.20

--- Equilibrium pore pressure (u_0) in MPa →

☒ Inclination (I) in degr

Refusal (q_c)

Hole collapsed dry at 0.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

2/14

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 0.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

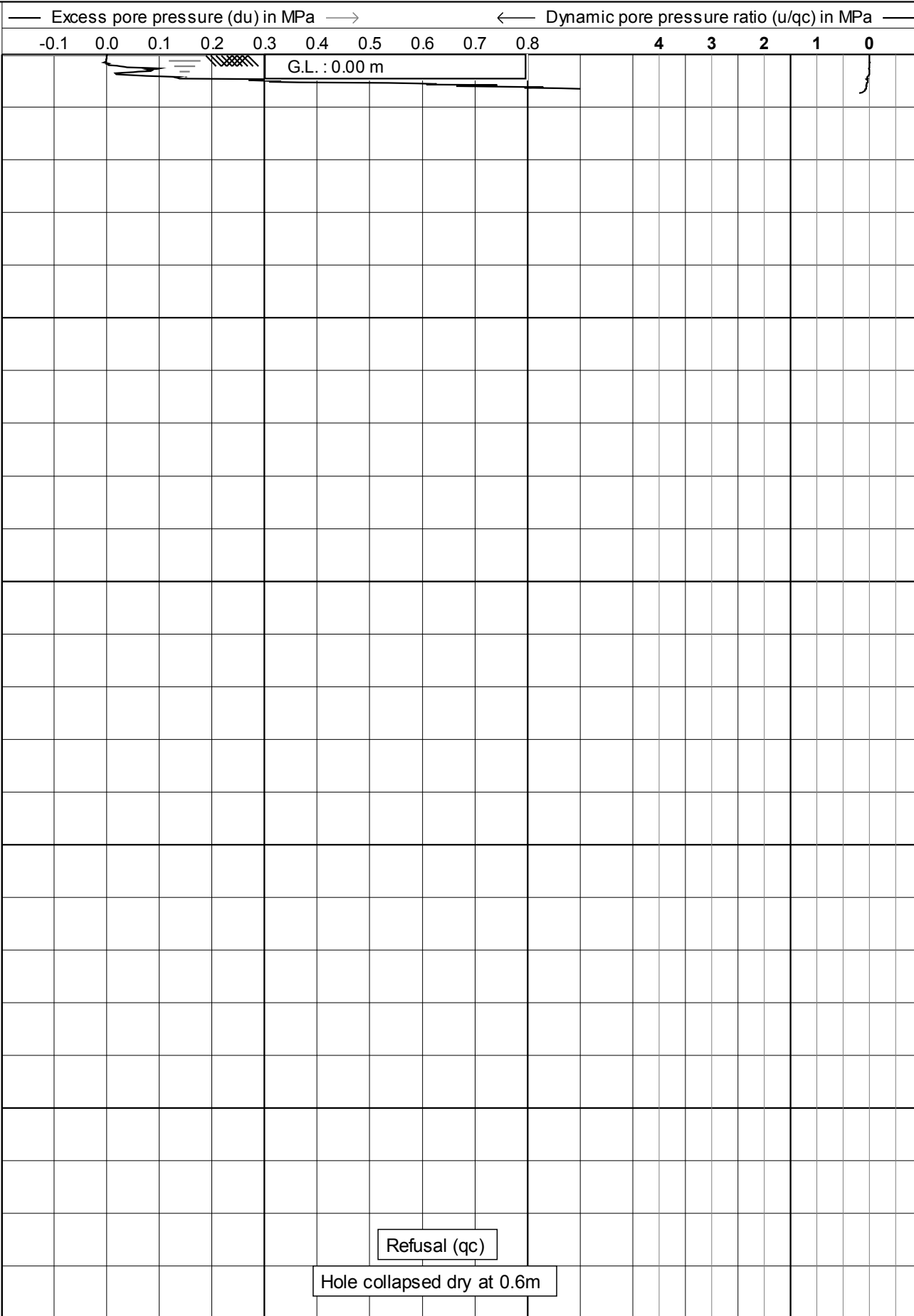
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

3/14

← Depth in m below ground level (G.L.)



150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

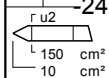
4/14

← Depth in m below ground level (G.L.)

— Effective cone resistance (qc) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m



Refusal (qc)

Hole collapsed dry at 0.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (σ_v, z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
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-12
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-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (qc)

Hole collapsed dry at 0.6m

150 cm²
10 cm²

100

200

300

400

500

600

700

--- Effective vertical stress (σ_v, z') in kPa →



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

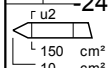
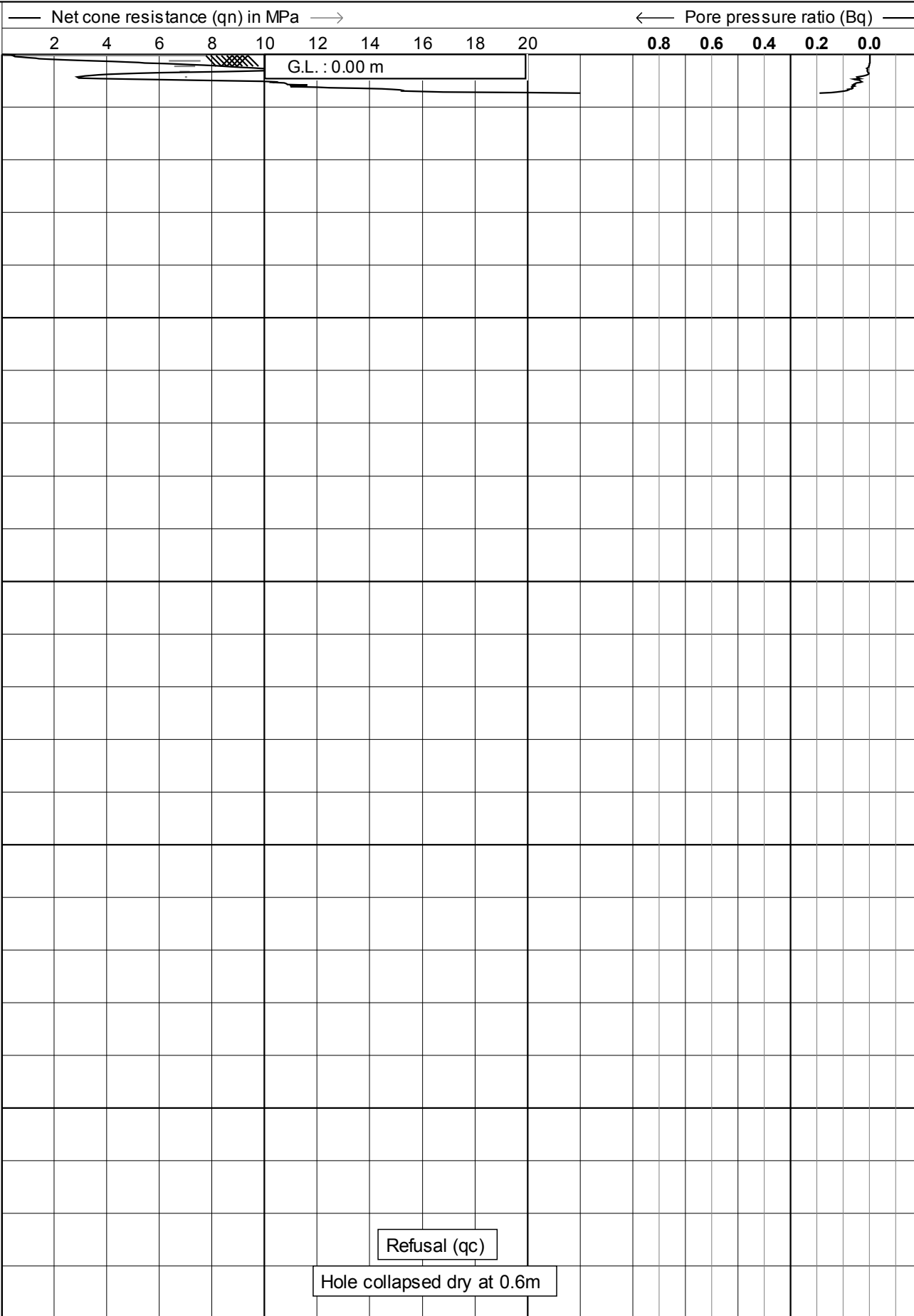
Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

6/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

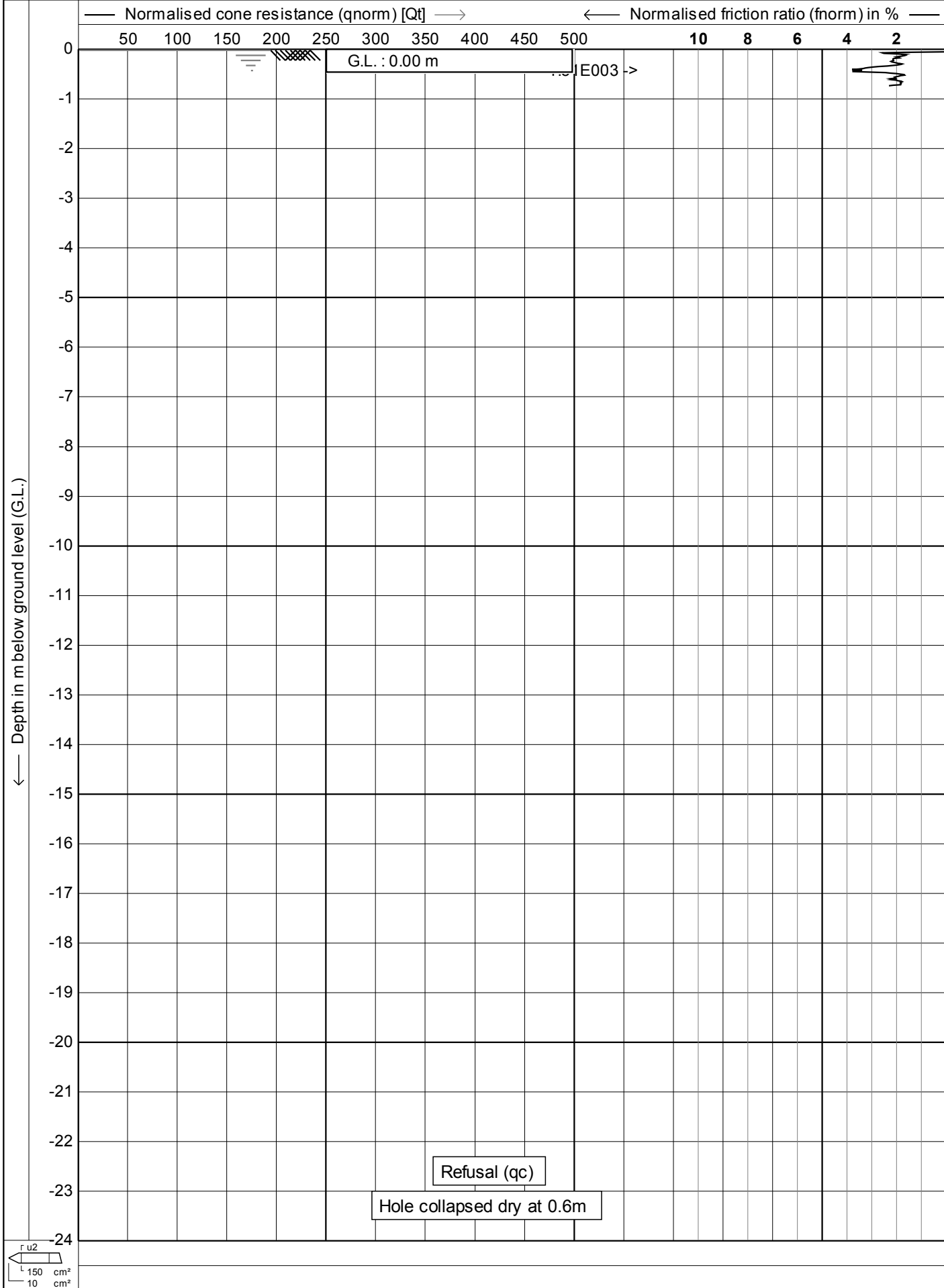
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

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Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

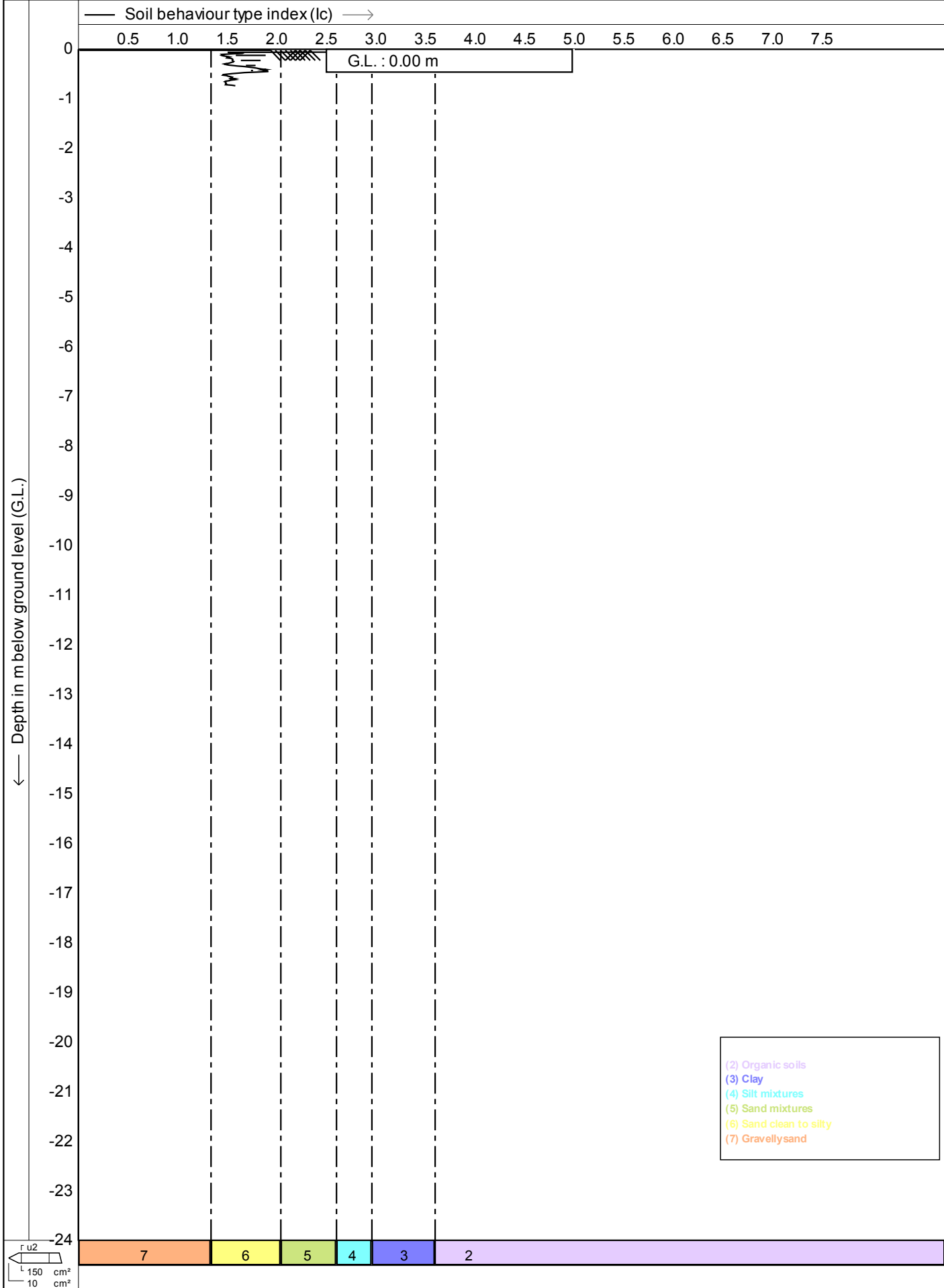
Position: **0, 0 RD**

Date : **5-11-2013**

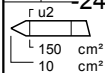
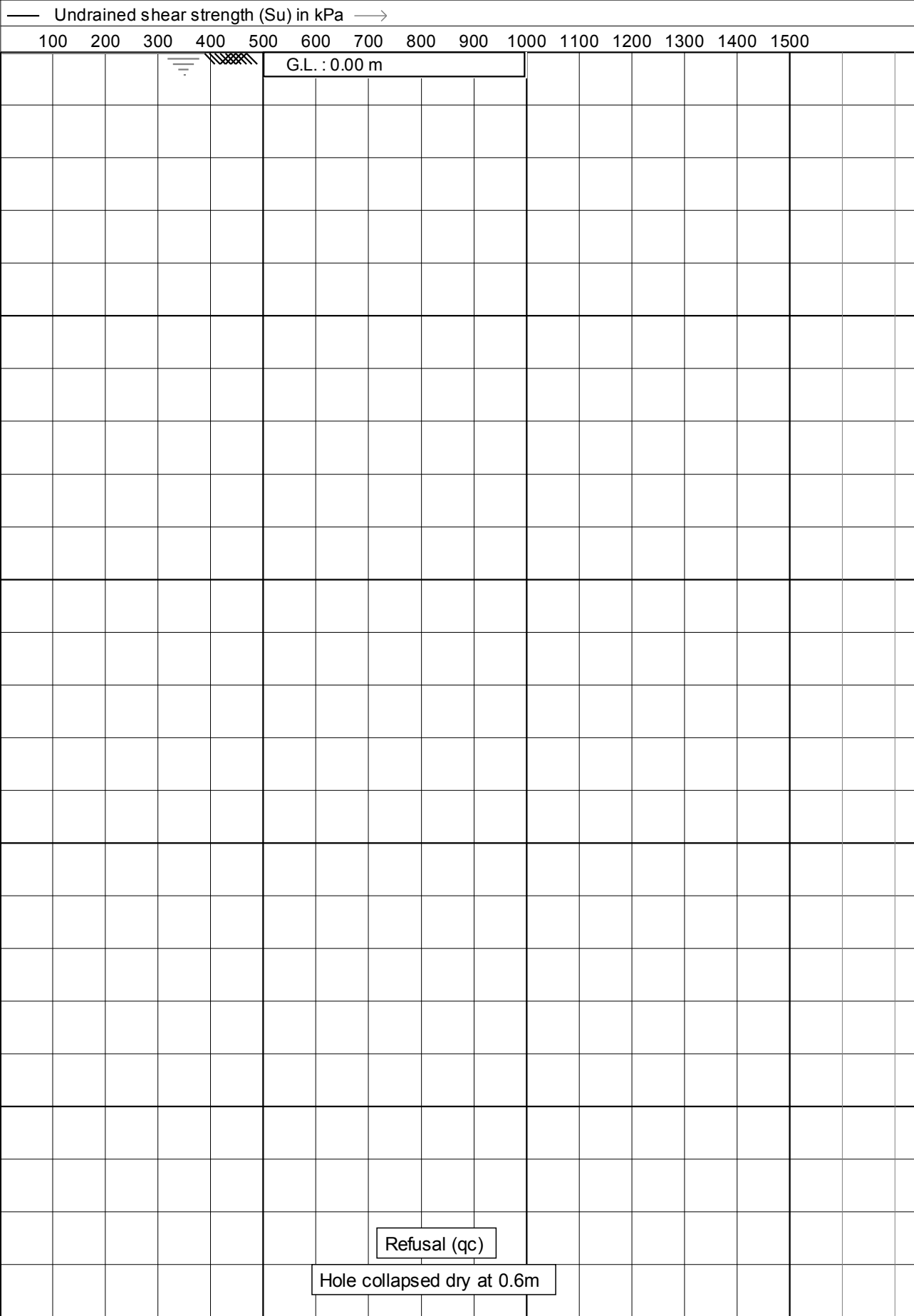
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08** 8/14



← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

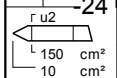
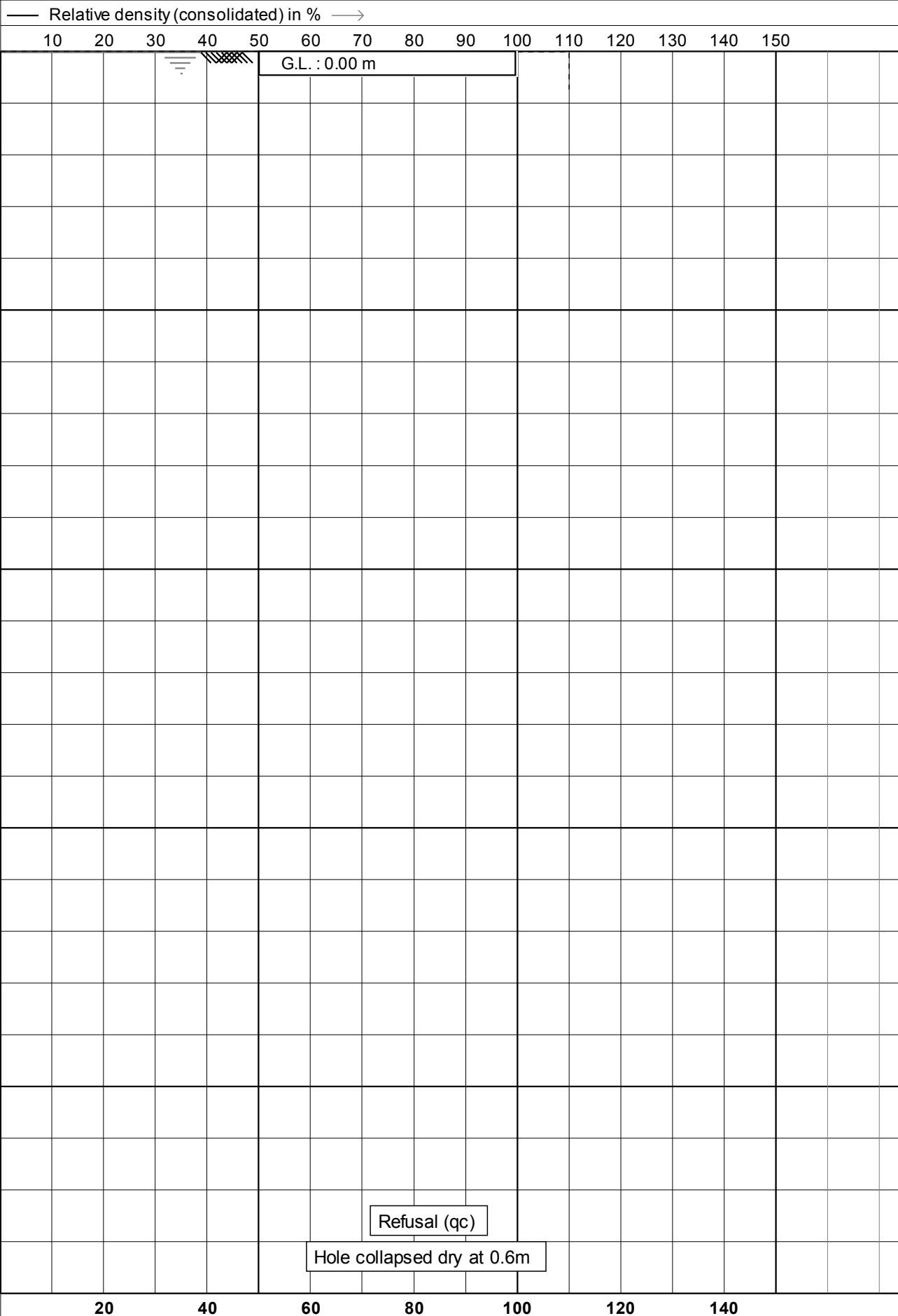
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

10/14

← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

11/14

← Depth in m below ground level (G.L.)

— Equivalent SPT N60 Value →

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 0.6m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

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← Depth in m below ground level (G.L.)

Internal friction angle in degrees →

5 10 15 20 25 30 35 40 45 50 55 60 65 70 75

G.L. : 0.00 m

Refusal (qc)

Hole collapsed dry at 0.6m

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

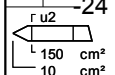
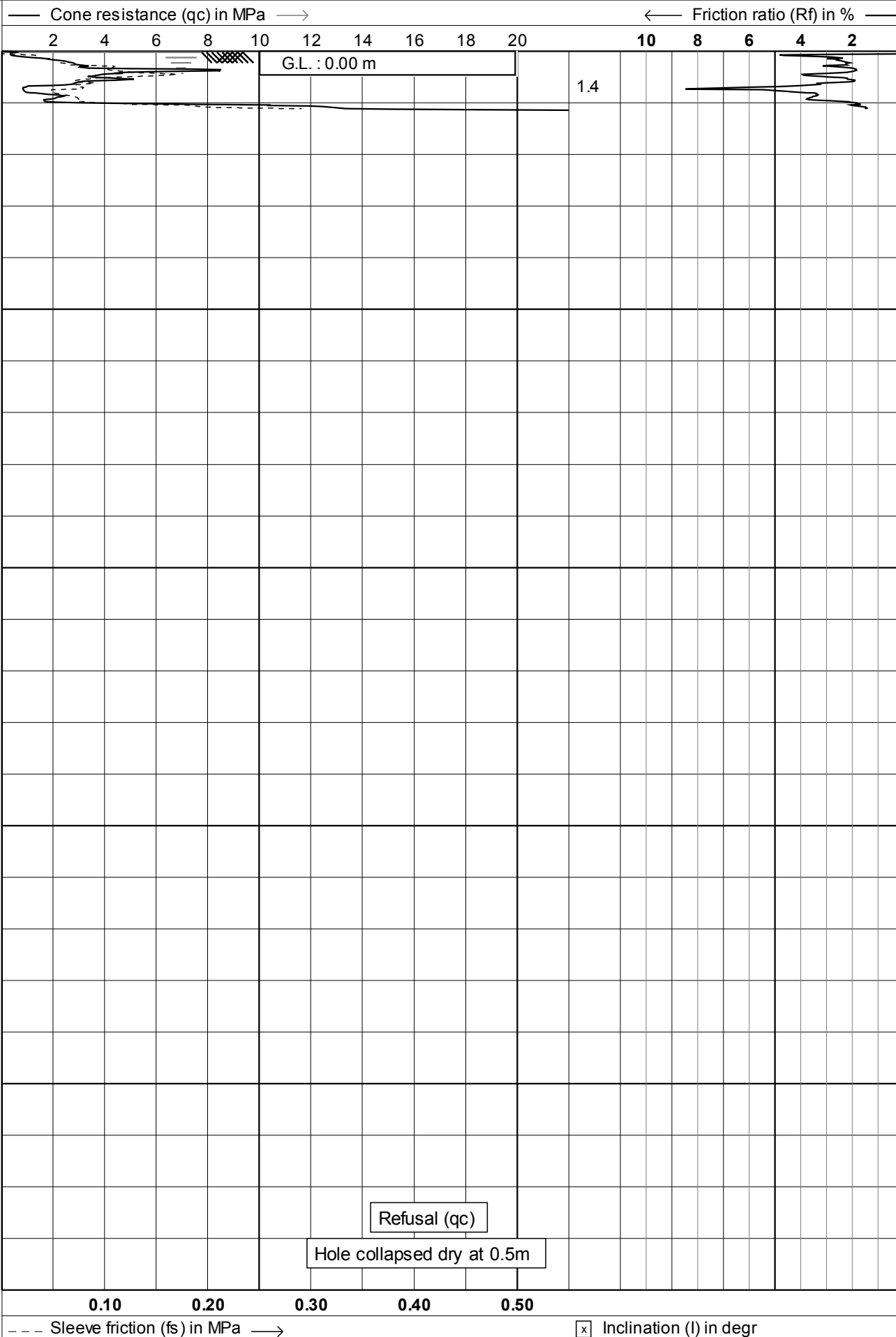
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **08**

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← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12		Date : 5-11-2013
Project : Site Investigation		Cone no. : C10CFIP.C13184
Location: Ngataringa Rd - Devonport - Auckland		Project no. : 05TT17
Position: 0, 0 RD		CPT no. : 09
		1/14

← Depth in m below ground level (G.L.)

— Dynamic pore pressure (u2) in MPa →

-0.1 0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0 1.1 1.2 1.3

G.L. : 0.00 m

1.42
r u2
150 cm²
10 cm²

--- Equilibrium pore pressure (u0) in MPa →

☒ Inclination (I) in degr



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

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Refusal (qc)

Hole collapsed dry at 0.5m

← Depth in m below ground level (G.L.)

— Corrected cone resistance (qt) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m

150 cm²
10 cm²

Refusal (qc)

Hole collapsed dry at 0.5m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

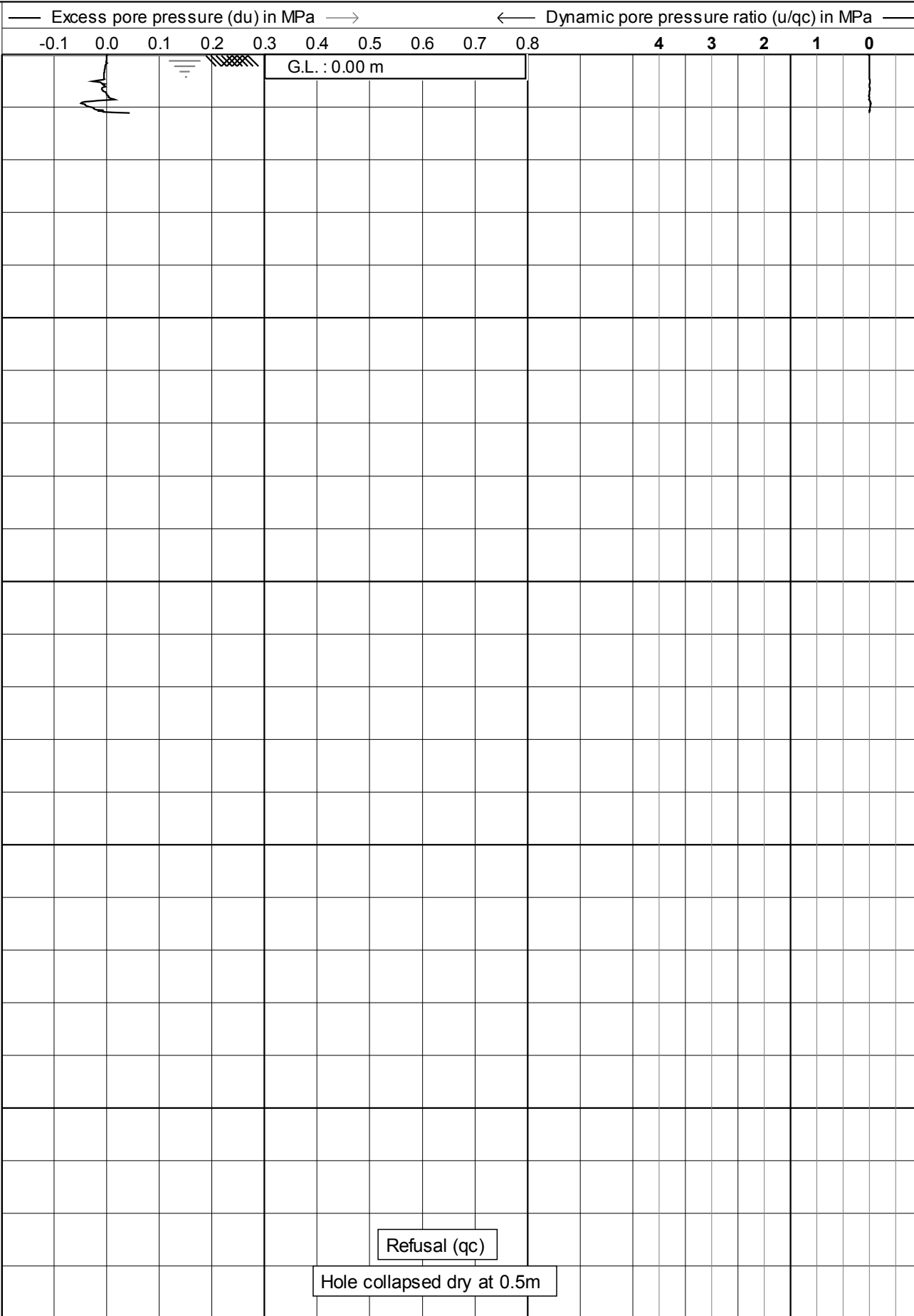
Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

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← Depth in m below ground level (G.L.)



150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

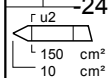
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← Depth in m below ground level (G.L.)

— Effective cone resistance (qc) in MPa —→

2 4 6 8 10 12 14 16 18 20 22 24 26 28 30

G.L. : 0.00 m



Refusal (qc)

Hole collapsed dry at 0.5m



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

5/14

← Depth in m below ground level (G.L.)

— Total vertical stress (rov,z) in kPa →

50 100 150 200 250 300 350 400 450 500 550 600 650 700 750

G.L. : 0.00 m

0
-1
-2
-3
-4
-5
-6
-7
-8
-9
-10
-11
-12
-13
-14
-15
-16
-17
-18
-19
-20
-21
-22
-23
-24

Refusal (qc)

Hole collapsed dry at 0.5m

100

200

300

400

500

600

700

--- Effective vertical stress (rov,z') in kPa →

150 cm²
10 cm²



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

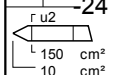
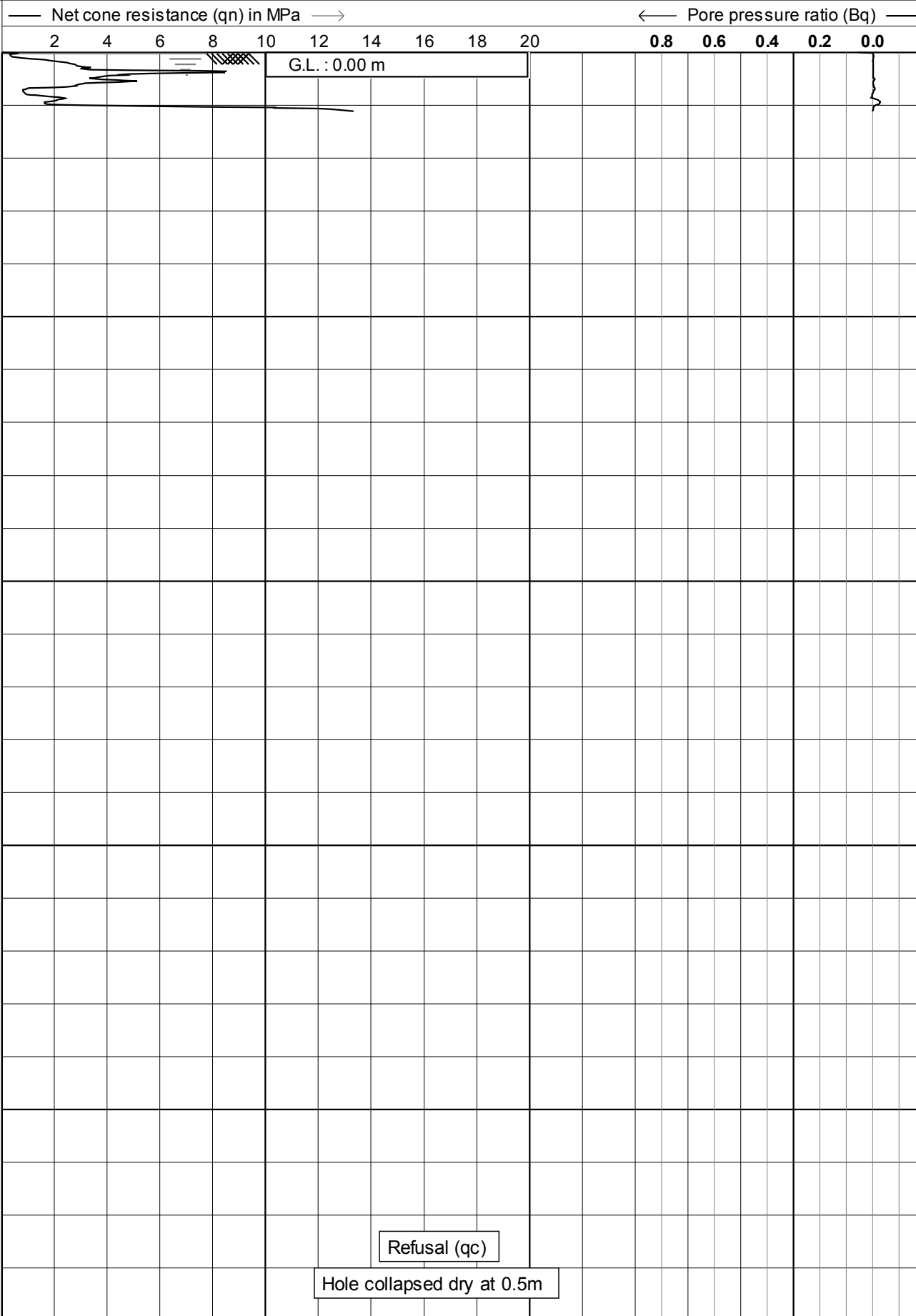
Cone no. : **C10CFIIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

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← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

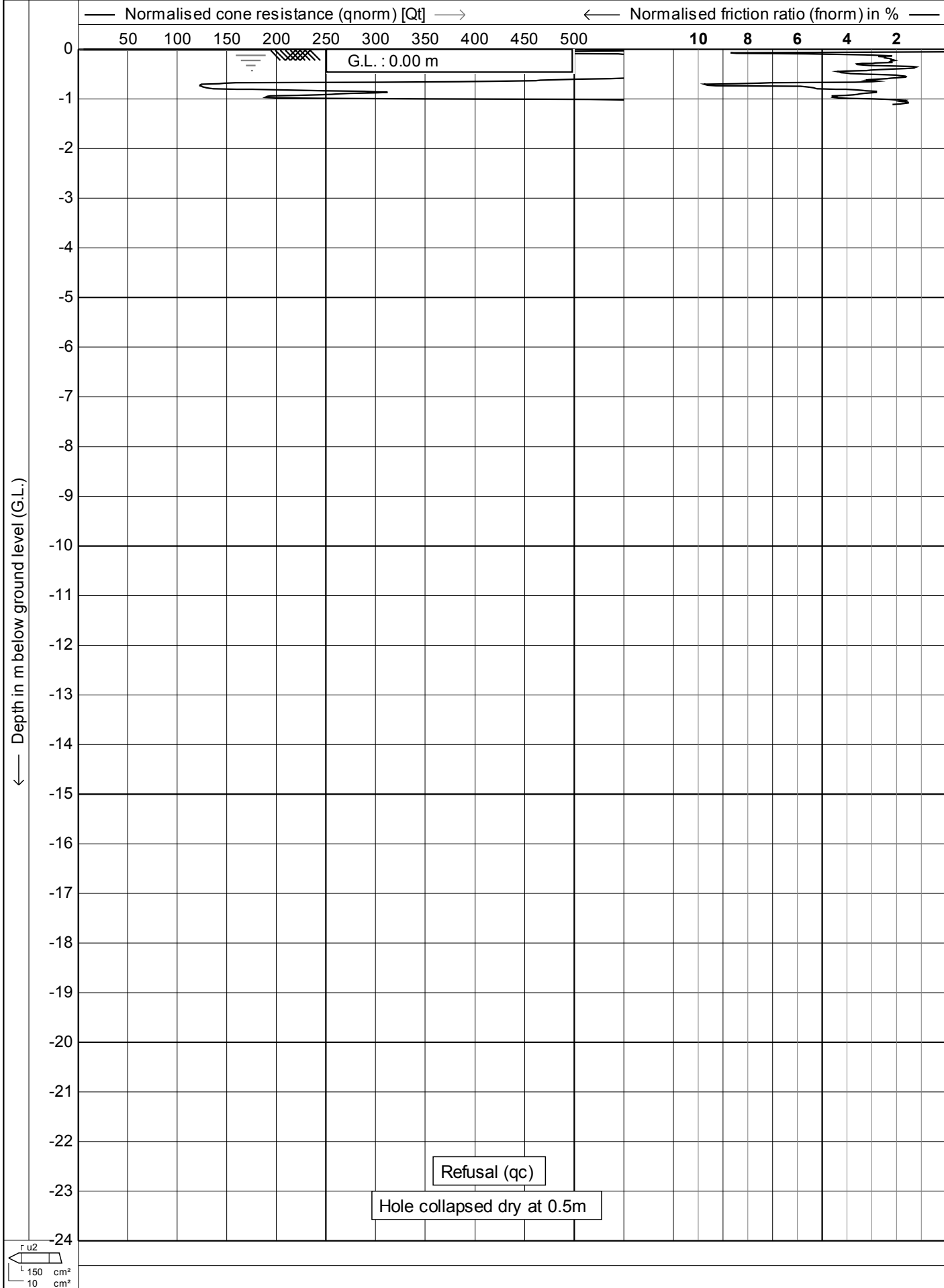
Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

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Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataringa Rd - Devonport - Auckland**

Position: **0, 0 RD**

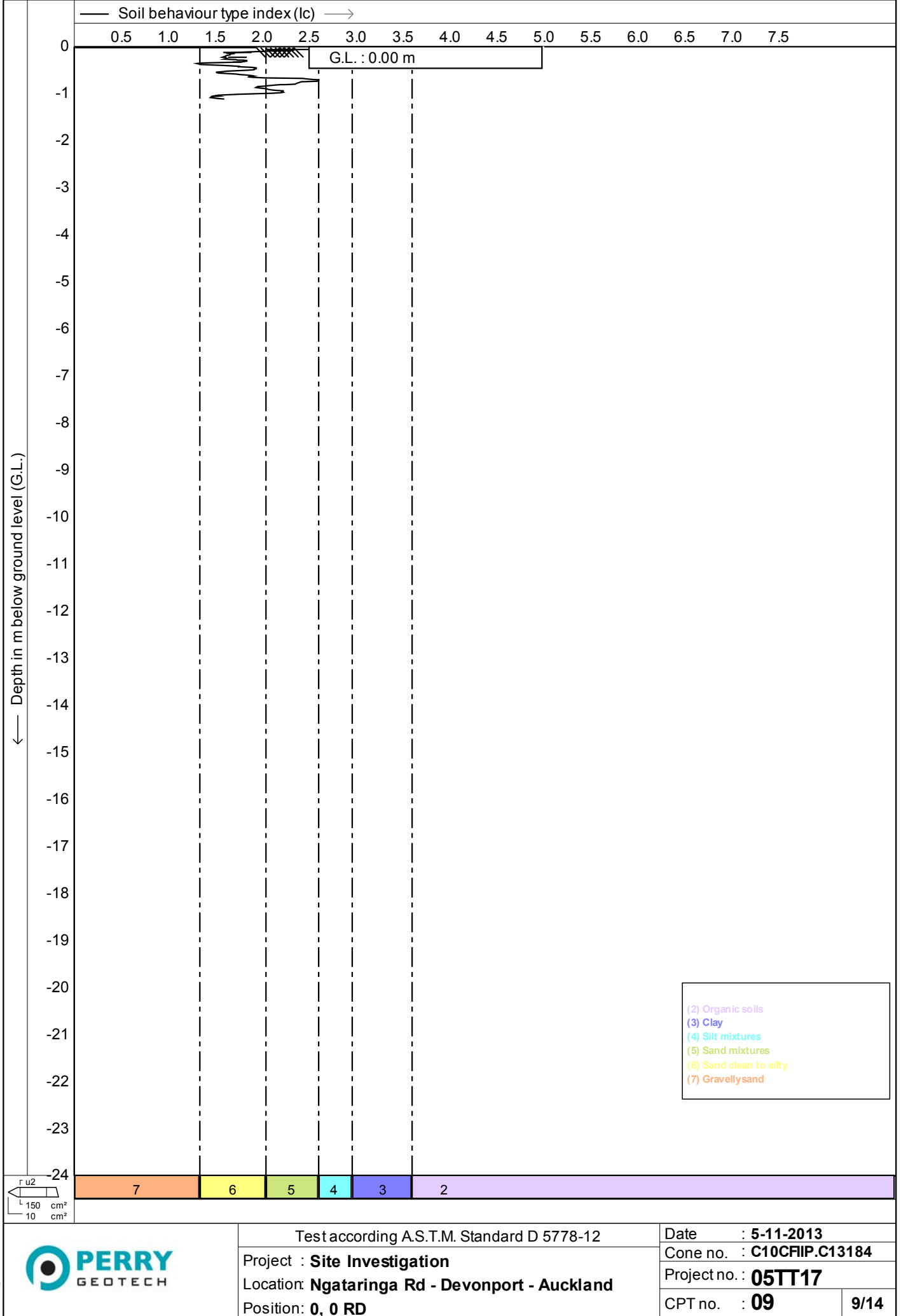
Date : **5-11-2013**

Cone no. : **C10CFIIP.C13184**

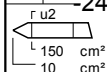
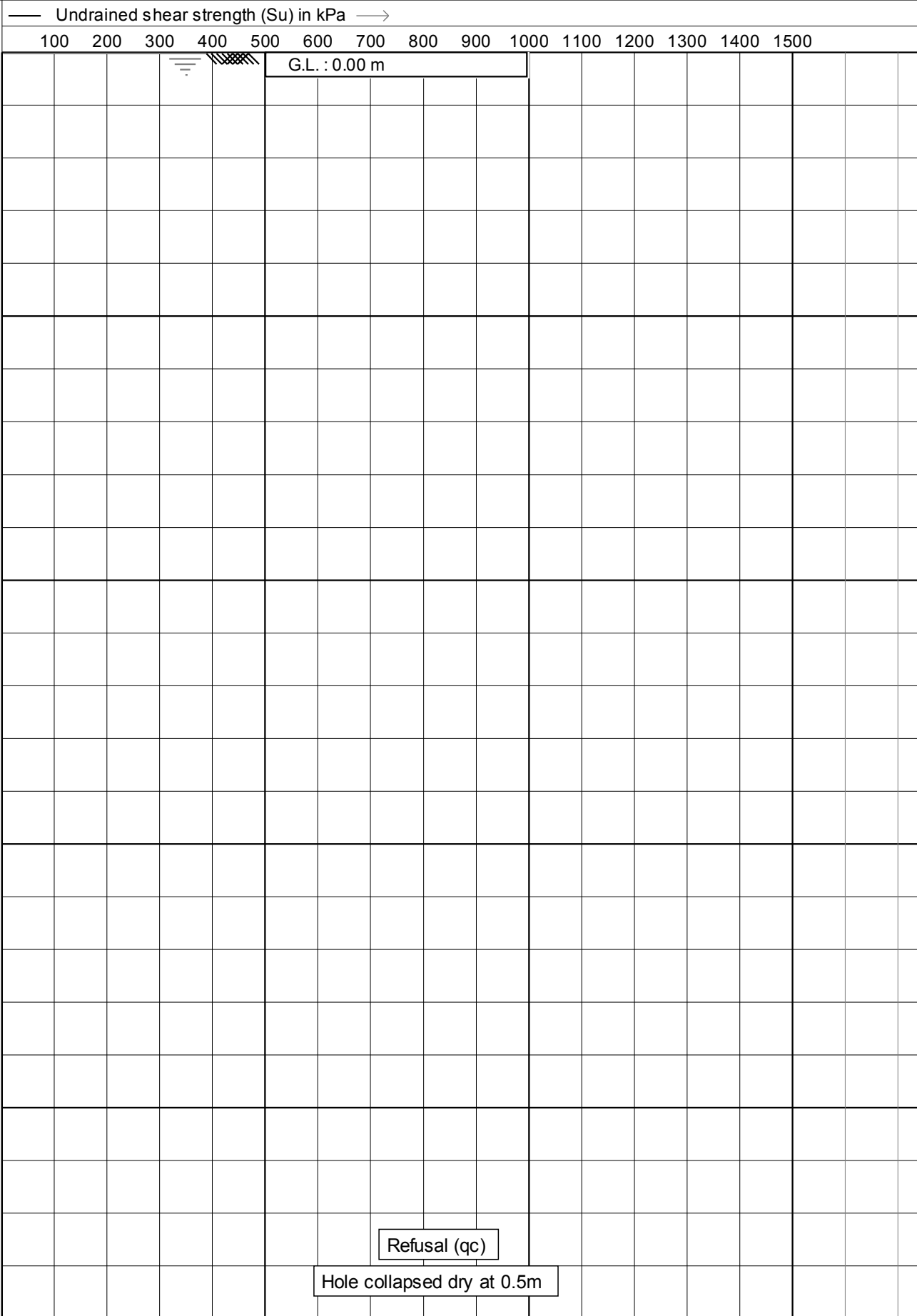
Project no. : **05TT17**

CPT no. : **09**

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← Depth in m below ground level (G.L.)



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Ngataranga Rd - Devonport - Auckland**

Position: **0, 0 RD**

Date : **5-11-2013**

Cone no. : **C10CFIP.C13184**

Project no. : **05TT17**

CPT no. : **09**

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