REPORT

Tonkin+Taylor

Geotechnical Engineering Assessment of Environmental Effects

Ryman Village, Park Terrace, Christchurch

Prepared for Ryman Healthcare Limited Prepared by Tonkin & Taylor Ltd Date March 2020 Job Number 30315.v1





Exceptional thinking together www.tonkintaylor.co.nz

Document Control

Title: Geotechnical Engineering Assessment of Environmental Effects					
Date	Version	Description	Prepared by:	Reviewed by:	Authorised by:
February 2020	1	Initial issue	Kirsti Murahidy		
March 2020	2	Issue	Kirsti Murahidy	Pierre Malan	
March 2020	3	Final	Kirsti Murahidy	Pierre Malan	Pierre Malan

Distribution:

Ryman Healthcare Limited Tonkin & Taylor Ltd (FILE) 1 electronic copy 1 electronic copy

Table of contents

1	Introduction					
	1.1	Propose	d Village	1		
	1.2	Site des	cription	1		
2	Existi	ng Envirc	onment – Subsurface Conditions	4		
	2.1	Geologia	cal conditions	4		
	2.2	Ground	water	5		
3	Plann	ing Cont	ext	6		
4	Asses	sment M	lethodology	6		
5	Asses	sment of	Effects	7		
	5.1	General		7		
	5.2	Seismic	and liquefaction assessment	7		
	5.3	Subside	nce (settlement) and stability	8		
	5.4	Ground	water	9		
		5.4.1	General	9		
		5.4.2	Groundwater users	9		
		5.4.3	Stream depletion	10		
		5.4.4	Drawdown settlement	10		
		5.4.5	Conclusion	10		
6	Reco	mmendat	tions	10		
7	Concl	usions		10		
8	Appli	cability		11		
Appendix A :		:	Drawings			
Appendix B :		:	Geotechnical Investigations			
Appendix C :		:	Summary of Dewatering Assessment			

1 Introduction

Ryman Healthcare Limited ("Ryman") engaged Tonkin & Taylor Ltd (T+T) to undertake a geotechnical investigation and assessment for a proposed comprehensive care retirement village ("Proposed Village") on two parcels of land at 100 - 104 Park Terrace, 24 Dorset Street and 19 Salisbury Street (Bishopspark site) and 78 - 80 Park Terrace (Peterborough site) in Central Christchurch (collectively "the Site").

This report addresses the potential seismic and liquefaction and subsistence/settlement and stability environmental effects from construction of the Proposed Village.

The geotechnical engineering, groundwater, contaminated land and civil engineering aspects of design are integrated. This report is intended to be read together with the Ground Contamination Report¹ and the Civil Earthworks Report².

In geotechnical terms, we consider the Site to be suitable for the Proposed Village provided the recommendations presented in this report are reflected in the detailed design.

1.1 Proposed Village

A full description of the Proposed Village is included in the Assessment of Environmental Effects. The Bishopspark site will contain the Village Centre, care rooms, assisted living suites, and apartments. The Peterborough site will contain apartment buildings. Basements, extending across the building footprints, are proposed for both the Bishopspark and Peterborough sites. The Proposed Village site layout is shown in Appendix A.

1.2 Site description

The Site is shown in Figure 1.1 below and is described in detail in the Assessment of Environmental Effects. In brief, the Bishopspark site covers an area of approximately 1.2 hectares and generally slopes gently to the west. The Peterborough site is typically flat and covers an area of approximately 5,078 m² (refer Figure 1.1). The Bishopspark site includes Lot 1 DP 46369, Lot 1, DP 46511 and Part Section 23 TN RES Christchurch and the Peterborough site includes Lot 1 DP 77997.

¹ Tonkin & Taylor Ltd (13/03/2020) Report prepared for Ryman Healthcare titled *Ground Contamination Assessment of Environmental Effects – 78 and 100 Park Terrace and 20 Dorset Street,* T+T Ref 30315.

² Beca Limited (March 2020) Report prepared for Ryman Healthcare titled *Proposed Comprehensive Care Retirement Village Park Terrace*, Beca Ref NZI-11471268-61 0.61.



Figure 1.1: Proposed Village Site showing approximate boundaries in red. (Source: Google Earth Pro).

The Bishopspark site is currently occupied by a number of disused single and two storey buildings which are being demolished. The majority of the buildings currently on the Bishopspark site were constructed in the 1980s as the former Bishopspark aged care facility. A small chapel, located in the southern part of the Bishopspark site, was constructed in the 1920s and is currently listed as a heritage building. A number of buildings on the Bishopspark site were damaged during the February 2011 earthquake event and subsequently demolished in 2015.

The Peterborough site is currently covered in gravel and used for parking vehicles. The Terrace on the Park Apartment building that formerly occupied the Peterborough site was removed following the February 2011 earthquake, however approximately 330 precast concrete piles remain in the ground. The approximate location of the former foundation of building and pile locations are shown on Figure 1.2.

The nearest waterway is the Avon River, located approximately 30 to 50 m west of the Site.



Figure 1.2: Approximate location of the precast concrete piles at the Peterborough site.

2 Existing Environment – Subsurface Conditions

2.1 Geological conditions

Published geological information for the Christchurch area^{3,4} shows that the Site is underlain by alluvial sand and silt overbank deposits, underlain by greywacke gravels of the Springston Formation.

Geotechnical investigations were undertaken across the Bishopspark site in November 2018. The investigations comprised ten cone penetration tests (CPTs), two seismic cone penetration tests (SCPTs), six machine-drilled boreholes and four hand augered boreholes and seven Scala penetrometer tests. The locations of these investigations are shown on (refer Appendix A) drawing 30315-Bishopspark-01 in Appendix A and copies of the investigation results are included in Appendix B.

At the Peterborough site, geotechnical investigations were undertaken in December 2013⁵. The investigations comprised seven machine-drilled boreholes and 12 cone penetration tests. The locations of these investigations are shown on drawing 30315-Peterborough-01 in Appendix A and copies of the investigation results are included in Appendix B.

The natural geological conditions at the Site comprise fill and silty topsoil, interbedded sands, silts and peat deposits to approximately 20 m depth below the existing ground surface. These materials overlie a layer of organic silt, generally up to 1.5 m thick, beneath which are dense to very dense sandy gravel deposits (Riccarton Formation).

The generalised subsurface profile inferred from the geotechnical investigations is provided in Table 2.1 and Table 2.2 for the Bishopspark and Peterborough sites respectively and shown graphically on drawings 30315-Bishopspark-02 through 303015-Bishopspark-06 and drawings 30315-Peterborough-02 and 303015-Peterborough-03.

The nature and continuity of subsurface conditions away from investigation locations is inferred, and it must be appreciated that the actual conditions may vary from the assumed model.

Layer No.	Geological Unit	Typical lithology	Depth to top of layer (m)	Layer thickness (m)
0	Fill/Topsoil	Sandy GRAVEL with trace silt and cobbles. Silty TOPSOIL with trace rootlets	0.0	0.3 – 0.5
1	Yaldhurst Member of	Interbedded firm Sandy SILT and loose SAND/Silty SAND	0.5	2.7 – 3.5
2	Springston Formation	Fibrous PEAT and PEAT within very soft SILT matrix	3.2 - 4.0	4.3 – 4.0
3		Loose Silty SAND/firm Sandy SILT	7.5 – 8.0	1.0 - 1.75
За		Medium dense to dense sandy GRAVEL. Isolated 2.5 m thick area at location BH3; thins out towards the west (i.e. location of BH1).	8.5 – 9.75	0.7 – 1.2

Table 2.1:	Generalised geotechnical	profile beneath	the Bishopspark site

³ Brown L.J. & Weeber J.H (1992). Geology of the Christchurch Urban Area. Institute of Geological and Nuclear Sciences Limited, geological map 1.

 ⁴ Brown LJ. et al. (1995). Geology of Christchurch, New Zealand. Environmental and Engineering Geoscience 1 p.427-488.
 ⁵ These investigations, while 7 years old, provide relevant and reliable factual data for the site. We do not consider that the changes to investigation techniques in the intervening time would alter our assessment of the environmental effects at this site.

4	Christchurch	Medium dense to dense SAND	8.5 – 10.95	10.5 - 11.75
5	Formation	Stiff SILT/Sandy SILT	20.25	1.5
6	Riccarton Gravels	Medium dense to very dense Sandy GRAVEL	21.75	>4.0 (confirmed)

Table 2.2: Generalised geotechnical profile beneath the Peterborough site

Layer No.	Geological Unit	Typical lithology	Depth to top of layer (m)	Layer thickness (m)
0	Fill/Topsoil	Sandy GRAVEL with trace silt, cobbles and building waste comprising concrete, plastic, electrical wiring etc.).	0.0	0.3 - 6.0
1	Yaldhurst Member of	Interbedded firm Sandy SILT and loose SAND/Silty SAND	0.3 – 0.5	0-3.0
2	Springston Formation	Fibrous PEAT and PEAT within very soft SILT matrix	2.6 - 5.5	1-3.7
3		Loose Silty SAND/firm Sandy SILT	5.0 - 6.4	2.4 - 3.4
За		Medium dense to dense sandy GRAVEL and gravelly SAND	8 - 9.4	2 – 9.3
3b1		Organic SILT / PEAT within SILT / SAND/ GRAVEL matrix	11.4 - 14.6	0-2.6
4	Christchurch	Medium dense to dense SAND	10.9 – 17.3	2 - 8.4
5	Formation	Stiff SILT / Sandy SILT	18.9 – 20.0	0-1.6
5a		Organic SILT / fibrous PEAT within a firm SILT matrix	20 – 21.3	0.5 - 1.2
6	Riccarton Gravels	Medium dense to very dense Sandy GRAVEL	21 – 21.8	>0.3 to 0.8 (confirmed)

1 – Layer 3b is localised in nature and was encountered in BH04 and BH05 only.

2.2 Groundwater

Groundwater is encountered in the upper layers of silt and sand at depths of approximately 1.5 m below ground level (bgl) at both sites. This shallow groundwater forms a water table (unconfined aquifer) in the shallow geology ie within 10 m of the surface. Deeper groundwater (confined aquifer) exists in the Riccarton gravels at depths greater than 20 m bgl beneath a layer of stiff silt and sandy silt. The Riccarton aquifer has artesian water pressures, meaning the groundwater in this aquifer is pressurised, but is being confined by the overlying layers.

Groundwater flow in the shallow water table aquifer at the sites is assumed to be toward the Avon River. Groundwater movement through the shallow deposits (through flow) will be variable across the sites, with preferential flow through the shallow sand and deeper gravel. Provided that there is no leakage from the Riccarton aquifer, flows into the proposed excavations are expected to be from the shallow water table aquifer via the base of the excavation.

However, the installation of piles (or removal of existing piles) has the potential to create conduits for groundwater at depth to well up into the excavation, particularly if springs exist in these locations. These will be managed during construction and blocked if they occur.

A design depth to groundwater of 1.5 m bgl across the Site is adopted for our geotechnical analysis purposes, including the liquefaction analysis presented in Section 5 to account for variations across

the sites. As this level may temporarily rise under rainfall/storm events, the effects of temporarily elevated groundwater associated with floods or storms must be considered in longer-term static design (including structures).

3 Planning Context

The planning context for the Proposed Village is addressed in the Assessment of Environmental Effects. In a geotechnical context, we understand that the relevant effects to be considered are:

- Natural hazards that may affect the Proposed Village, specifically subsidence, earthquake shaking and liquefaction/lateral spreading;
- The potential for construction works to affect the groundwater regime at the Site and consequently adjacent land; and
- The potential for construction works to affect the stability and settlement of the Site and adjacent land.

In assessing the effects, we have considered the objectives and policies which are set out in the Assessment of Environmental Effects and summarised below:

- Land and Water Regional Plan (LWRP) Objective 3.13, and Policies 4.13 and 4.15: The discharge of construction-phase and operational stormwater to ground will be managed such that the groundwater quality in the Riccarton Aquifer and the surface water quality in the Avon River will not be adversely affected. This will include the use of a treatment system to filter any potential contaminants from hardstand areas;
- *LWRP Policy 4.17*: Stormwater run-off from the Proposed Village will not cause or exacerbate flooding to downstream properties;
- *LWRP Policy 4.19*: Earthworks will be managed to minimise sediment run-off from the site. In particular, the Erosion and Sediment Control Plan will detail the sediment and erosion controls for earthworks at the site in accordance with the relevant sections of the Canterbury Regional Council's Erosion and Sediment Control Toolbox for Canterbury. Tonkin & Taylor have also confirmed that the disturbance of contaminated materials on the site will not contaminate groundwater Policy 4.19;
- *LWRP Policy 4.77*: The establishment of a bore will not result in the contamination of groundwater; and
- District Plan Natural hazards Objective 5.2.1.1 and Policies 5.2.2.2.1 and 5.2.2.3.1: Management of natural hazards relating to flooding and liquefaction risk.

4 Assessment Methodology

In order to assess the geotechnical effects of the Proposed Village, the following methodology was adopted.

A geological and geotechnical model for the Site was developed in stages. An initial model was prepared on a review of aerial photographs, geological maps, our internal geotechnical database, and previous investigations available for the Site. Based on this, and considering the proposed land use, a geotechnical investigation was then carried out. This included boreholes, cone penetrometer tests and groundwater monitoring work. The current subsurface model was then finalised and is summarised in Section 2 of this report.

Following the subsurface model development, the Proposed Village has been considered in the context of the subsurface conditions. In carrying out this work, we liaised with other experts (including Structural Engineers, Mitchell Vranjes) and Ryman to understand the likely foundation and

geotechnical requirements for the Proposed Village. The peat, silt, sand and gravel materials that underlie the Site are suitable for building foundations with appropriate design.

The effects of the Proposed Village have then been assessed based on our experience with similar foundation systems and construction, in the context of the subsurface model and proposed geometry and structural form. The performance of the land during the Canterbury Earthquake Sequence was considered in our geotechnical assessment.

The results of that assessment are set out below.

5 Assessment of Effects

5.1 General

The key geotechnical effects to be considered at both sites comprise liquefaction effects (including lateral spreading and settlement) and consolidation settlements (subsidence). These effects will be mitigated through the use of appropriate retention and foundation design.

The techniques proposed will be designed so that there will be no adverse effects from these activities.

5.2 Seismic and liquefaction assessment

The Site seismic subsoil class has been assessed in accordance with NZS 1170.5⁶ to be Class D (deep or soft soil). This is due to the presence of loose/soft soil (with an equivalent SPT blowcount of less than 6) within the upper soil profile. This assessment is consistent with published geological information⁷ that indicates the depth to bedrock is greater than 100 m beneath the Site.

The seismic performance of the Site (including liquefaction effects) has been evaluated in terms of the seismic shaking hazard assessed for the Site and the requirements of the New Zealand Building Code.

The design earthquake scenarios derived from "NZS 1170 – Structural Design Actions" representing the following design performance requirements have been considered for structures at the Site:

- Serviceability limit state 1 (SLS1) the building should suffer little or no structural damage, and remain accessible and safe to occupy. There may be minor damage to building fabric that is readily repairable; and
- Ultimate limit state (ULS) the building can suffer moderate to significant structural damage, but not collapse.

The design earthquake scenarios are described in terms of an event moment magnitude (M_w) and peak horizontal ground acceleration (PGA_H) and were derived assuming a building design life of 50 years and an Importance Level (IL) of IL2 and IL3, as set out in NZS 1170.

For liquefaction analysis, two SLS1 scenarios (SLS1a and SLS1b) are presented. The SLS1b scenario represents an alternative SLS1 scenario that is also considered when using the Boulanger and Idriss (2014)⁸ liquefaction triggering analysis in the Christchurch area, in accordance with guidance

Tonkin & Taylor Ltd Geotechnical Engineering Assessment of Environmental Effects - Ryman Village, Park Terrace, Christchurch Ryman Healthcare Limited

⁶ Standards New Zealand (2004) – *NZS* 1170.5:2004 – Structural Design Actions Part 5: Earthquake Actions – New Zealand. ⁷ Brown, L. J. and Weeber, J. H. (1992), *Geology of the Christchurch Urban Area*. Institute of Geological & Nuclear Sciences Limited Geological Map 1. Scale 1:25,000.

⁸ Boulanger, R. W. and Idriss, I. M. (2014). *CPT and SPT Based Liquefaction Triggering Procedures*. Center for Geotechnical Modeling, Dept. of Civil and Environmental Engineering, University of California at Davis.

updates released recently by MBIE⁹ (MBIE Guidance). The earthquake scenarios adopted for analysis are presented in Table 5.1 (below).

Table 5.1: Design earthquake scenarios

	Design earthquake scenario				
	SLS1a SLS1b ULS IL2 ULS IL3				
Return period (years)	25	25	500	1,000	
Moment magnitude (M _w)	7.5	6.0	7.5	7.5	
Peak horizontal ground acceleration (PGA _H)	0.13 g	0.19 g	0.35 g	0.44 g	

The results of the liquefaction triggering and settlement analyses show that:

- Minor to moderate land damage is assessed to occur in a SLS1 level event (settlement in the order of 140 to 200 mm). Differential settlement may also occur across individual buildings and this may be in the order of 100 mm over a 6 m distance (unless specifically mitigated in design); and
- Liquefaction-related settlement resulting from ULS level shaking is estimated to be in the order of 200 300 mm. The expected liquefaction-related land damage during such an event could be moderate to severe. Such settlement could occur following 200 to 300 year-equivalent, and greater, return period events. Differential settlements at the ground surface may be in the order of 150 mm over a 6 m distance.

Ground cracks mapped following the Canterbury Earthquake Sequence (CES) indicate that lateral ground movement of up to 50 mm occurred in the vicinity of the Site. The pattern of cracks indicates that this movement is related to spreading towards the Avon River. The liquefaction triggering analyses along with observations from the CES indicate lateral spreading may occur in the order of 10 to 25 mm and 50 to 100 mm in future SLS and ULS seismic events, respectively.

The potential effects of lateral spreading and liquefaction induced settlement can be adequately addressed through foundation design for buildings on the Site. The Proposed Village buildings will be founded on deep foundation systems comprising either CFA piles, or ground improvement (rigid inclusions or CFA columns) extending to the sandy gravel deposits at approximately 13 m depth.

5.3 Subsidence (settlement) and stability

The near surface soils (variable silt and peat deposits) to depths of approximately 8 m below the existing ground level at each Site are prone to both primary and secondary consolidation settlement under applied static loads.

Static consolidation settlements under typical four to seven storey buildings (40 by 80 m in plan dimension) loads on ground that has not been loaded before are assessed to be between 250 and 400 mm over a 50 year time period. Our analyses indicate that around half of this settlement is likely to occur within two years of construction. These settlements are expected to vary across the Site with different subsurface conditions, and possibly across the footprint of larger buildings.

Consolidation of the soft silts and peat deposits may also result in long term secondary "creep" settlements. This has the potential to affect in ground services (such as storm water services), pavement and landscaping features over the design life.

Tonkin & Taylor Ltd Geotechnical Engineering Assessment of Environmental Effects - Ryman Village, Park Terrace, Christchurch Ryman Healthcare Limited

8

⁹ Ministry of Business, Innovation & Employment (2014). Clarifications and updates to the guidance. *Repairing and rebuilding houses affected by the Canterbury earthquakes*, Issue 7, October 2014.

The anticipated settlements will be accommodated in design through engineered solutions such as the use of piling or ground improvement beneath the buildings.

The proposed earthworks will comprise excavation of Site materials (that will then be removed from Site) to allow for the construction of basements. Hard fill will be imported and placed as a bedding layer beneath the foundation basement slabs. The retention system is likely to comprise a modified steel sheet pile (clutch tube) system or other retention system with similar performance. The Proposed Village buildings will be setback from the property boundaries and the construction sequence will be designed to limit lateral and vertical movement at the property boundary.

The Proposed Village is therefore not assessed as being at risk of consequential subsidence or potential instability.

We therefore assess the risk of subsidence affecting adjacent sites due to the construction of the Proposed Village as negligible.

5.4 Groundwater

5.4.1 General

In the permanent case, the building will be waterproofed and will therefore not cause any consequential drawdown of groundwater.

During construction of the basements, excavation of soils up to 4.8 m depth is required with the top of the basement floor slab proposed at RL 13.1m. The natural groundwater levels are relatively shallow at a depth of approximately 1.5 m bgl at both sites. This means that excavation at the Bishopspark and Peterborough sites will encounter groundwater ingress below this level. In order to work in reasonably dry conditions, groundwater will need to be removed via dewatering (pumping) during the basement excavation and basement construction works.

Ingress of groundwater into deep excavations will be restricted by the placement of piles around the excavation which are also essential for stability of the excavation. The current proposed piling preference around the perimeter of the excavations is to install welded steel clutch tubes which will limit any horizontal groundwater seepages entering through the wall system. Clutch tubes provide a continuous barrier to groundwater ingress that will be welded above excavation level. Because of this retention system, groundwater flows at the Bishopspark and Peterborough sites will occur upwards through the base of the excavation, rather than laterally (through the retention system).

5.4.2 Groundwater users

There are a number of groundwater (bore) users in the local area. The depressurisation of the aquifer could therefore have an effect on the water levels in any shallow groundwater bores in the local area. Our dewatering assessment models the potential changes to groundwater levels based on the surrounding external influences. This means that different results can be presented on each side of the Bishopspark and Peterborough sites. Each of the bores nearby is addressed below.

A review of the local bores in the area shows that the closest bore with an active take is shown to be bore M35/2325 located at 447A Montreal Street approximately 230 northeast of (the centre of) Bishopspark site. This bore is owned by Christchurch City Council (CCC) and is reported to be 31.7 m deep with a groundwater take for community supply (likely to be from the Riccarton aquifer). This bore is considerably deeper than the proposed depth for dewatering and we therefore assess that, based on the setback and depth of Bore M35/2325, the proposed excavation will not have consequential effects.

The nearest, most shallow depth bore, reported to have an active take is bore M35/18558, located at Hagley Park approximately 530 m southwest of (the centre of) Park Terrace site. This bore is

reported to be 23 m deep and has a groundwater take for domestic supply. The use of this water is questionable since there are no domestic properties in the area and the bore is located beside a recreational boating pond. A secondary use of groundwater monitoring is noted for this bore. Two other bores located around the periphery of the pond and drilled at the same time as bore M35/18558 also have a secondary use of groundwater monitoring. We assess that, based on the setback of Bore M35/18558, the proposed excavation will not have consequential effects on that bore.

5.4.3 Stream depletion

The Avon River is located at around the same elevation as the proposed basement excavation. Based on our modelling, as the duration of dewatering continues, the proportion of groundwater inflows that comprise water loss from the Avon River increases. However, any dewatering that occurs will discharge directly into the stormwater network, after treatment to address any elevated total suspended solids (TSS). The stormwater network discharges directly into the Avon River. Hence, while the Avon River is potentially affected by the dewatering through loss of flow, any stream depletion effects are mitigated by the effects of the direct discharge (returning the treated discharge to the Avon via the stormwater network).

5.4.4 Drawdown settlement

The thickness of peat around the Site means that this layer could be subject to the effects of consolidation if it is dewatered. The proposed perimeter wall around the excavations limits any horizontal groundwater flow, which then restricts the amount of dewatering in the adjacent in-situ strata. The underlying sand layer (through which water flows into the excavation) has strong recharge from the surrounding area. Combined with the retention system, the potential to cause consolidation (settlement) adjacent to the Bishopspark and Peterborough sites through dewatering is minimal, and we do not assess any consequential settlement risks.

5.4.5 Conclusion

On this basis, we consider that there is no credible risk of the Proposed Village causing consequential adverse effects on the groundwater, either to existing groundwater users, to the Avon, or through settlement of adjacent land. Further details supporting this assessment are provided in Appendix C.

6 Recommendations

The following recommendations address the potential adverse effects for the Bishopspark and Peterborough Sites as outlined in this report:

Foundation design must be undertaken by a suitably qualified and experienced Geotechnical Engineer. The structural foundation design, drawings and specification should be reviewed by an appropriately qualified and experienced Geotechnical Chartered Professional Engineer.

7 Conclusions

Provided the detailed design reflects the recommendations in this report, we assess:

- Natural hazards at the site either meet acceptable thresholds of risk, or the Village detailed design can mitigate the effects to an acceptable level;
- No consequential effect on groundwater is assessed and therefore no subsidence effects on neighbouring properties are predicted; and
- The Site is suitable for the Proposed Village from a geotechnical engineering perspective.

8 Applicability

This report has been prepared for the exclusive use of our client Ryman Healthcare Limited, with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement. We understand and agree that Ryman will submit this report in support of an application for resource consents, and that Christchurch City Council and Environment Canterbury as the consenting authorities will rely on this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Report prepared by:

ксс

Kirsti Murahidy Senior Geotechnical Engineer CPEng, CMEngNZ, IntPE (NZ) Authorised for Tonkin & Taylor Ltd by:

Pierre Malan Project Director CPEng, CMEngNZ, IntPE (NZ)

\\ttgroup.local\corporate\auckland\projects\30315\issueddocuments\akldoc01-#7637774-v3-bishopspark_-_geotechnical_report.docx

Appendix A: Drawings

Warren & Mahoney Drawings

<u>Bishopspark</u>

Drawing name	Revision	Title
• 30315-BISHOPSPARK-01	А	Site Investigation Plan
• 30315-BISHOPSPARK-02	А	Geological Cross Section 1
• 30315-BISHOPSPARK-03	А	Geological Cross Section 2
• 30315-BISHOPSPARK-04	А	Geological Cross Section 3
• 30315-BISHOPSPARK-05	А	Geological Cross Section 4
• 30315-BISHOPSPARK-06	А	Geological Cross Section 5

Peterborough

Reference Drawing		Revision Title	
• 30315-PETERBOROUGH-01	А	Site Investigation Plan	
• 30315-PETERBOROUGH-02	А	Geological Cross Section 1	
• 30315-PETERBOROUGH-03	А	Geological Cross Section 2	



Г

L

SITE INFORMATION

SITE ADDRESS: 100 PARK TERRACE, CHRISTCHURCH SITE AREA: 12290m2

WASTE MANAGMENT STRATEGY

 All village centre waste is transferred to the waste room by the staff. Residents in Apartments can dispose of rubbish in the bin rooms located in each apartment building. All apartments have a nurse call facility for assistance if required. The bins are transferred to the waste room by staff. •

Assisted Living Suites and Care room are fully serviced by staff who will transfer waste to the waste room.

CCC waste management truck route

1. AREA FOOTPRINTS Count Total Area Name **B01 FOOTPRINT** 3952.27 m² **B02 FOOTPRINT** 684.12 m² **B03 FOOTPRINT** 858.69 m² B04 FOOTPRINT 440.06 m² Grand total: 4 5935.14 m²

3. CAR PARK	S
Comments	Count
90 DEGREE	135
ACCESSIBLE	3
ON GRADE VAN	3
PARALLEL	3
Grand total: 144	

4. APARTMENT MIX						
Building	Apartment Type	Count				
BUILDING B01	APT - 1 BED	7				
BUILDING B01	APT - 2 BED	35				
BUILDING B01	APT - 3 BED	2				
BUILDING B01: 44						
BUILDING B02	APT - 1 BED	1				
BUILDING B02	APT - 2 BED	5				
BUILDING B02	APT - 3 BED	13				
BUILDING B02: 19						
BUILDING B03	APT - 1 BED	2				
BUILDING B03	APT - 2 BED	20				
BUILDING B03: 22						
Grand total: 85						

5. CARE UNIT MIX					
Building	Care Unit Type	Count			
BUILDING B01	ALS	54			
BUILDING B01	DEM	6			
BUILDING B01	DEMENTIA	29			
BUILDING B01	HOSPITAL CARE	20			
BUILDING B01 REST HOME CARE 15					
BUILDING B01: 124					



☐ All dimension to be verified on site before producing shop drawings or commencing any work. Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects Ltd.

Revisions

—

A 25/10/19 RESOURCE CONSENT DRAFT B 13/12/19 RESOURCE CONSENT C 09/03/20 FOR INFORMATION

Notes

_



Client _

Ryman Healthcare Ltd

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street PO Box 25086 Christchurch 8011 New Zealand Phone + 64 3 961 5926

Registered Architects and Designers www.warrenandmahoney.com Project Title

PARK TERRACE SITE ONE BISHOPSPARK

Drawing Title

SITE .S01 PROPOSED SITE PLAN - GROUND

Drawing Issue RESOURCE CONSENT Drawing Details

Scale	As indicated @ A1
Date	09/03/20
Job No	8917
Drawn	WM Team
Checked	TDH

Drawing No Revision \bigcirc .S01 .A0-030





Г

L

All dimension to be verified on site before producing shop drawings or commencing any work.
 Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects Ltd.

Revisions

A 25/10/19 RESOURCE CONSENT DRAFT B 13/12/19 RESOURCE CONSENT C 09/03/20 FOR INFORMATION

Notes _



Client _

Ryman Healthcare Ltd

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street PO Box 25086 Christchurch 8011 New Zealand Phone + 64 3 961 5926

—

Registered Architects and Designers www.warrenandmahoney.com Project Title

PARK TERRACE SITE ONE BISHOPSPARK

Drawing Title

SITE .S01 PROPOSED SITE PLAN - BASEMENT

Drawing Issue RESOURCE CONSENT Drawing Details

Scale	1 : 500 @ A1
Date	09/03/20
Job No	8917
Drawn	WM Team
Checked	TDH

Drawing No Revision \bigcirc

.S01 .A0-040

」 I WARREN AND MAHONEY®





All dimension to be verified on site before producing shop drawings or commencing any work.
 Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects Ltd.

Revisions

—

A 22/11/19 COORDINATION SET B 18/12/19 DRAFT RESOURCE CONSENT C 09/03/20 FOR INFORMATION

Notes _

1. AREA FOOTPRINTS			
Name	Count	Total Area	
B07 FOOTPRINT	1	2047.44 m ²	
B08 FOOTPRINT	1	448.15 m ²	
Grand total: 2		2495.59 m ²	
3. CAR PARKS			
Comments Cour		Count	
LEVEL 0			
		07	

90DEG PARKS	67
ACCESSIBLE PARKS	2
DOUBLE BANKED PARKS	8
PARALLEL PARKS	3
LEVEL 1	
PARALLEL PARKS	5
Grand total: 85	

4. APARTMENT MIX		
Name	Count	
APT - 1 BED	4	
APT - 2 BED	53	
APT - 3 BED	23	
Grand total: 80		



Client

—

RYMAN HEALTHCARE

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street PO Box 25086 Christchurch 8011 New Zealand Phone + 64 3 961 5926

Registered Architects and Designers www.warrenandmahoney.com Project Title —

PARK TERRACE SITE TWO PETERBOROUGH

Drawing Title

Drawing Issue RESOURCE CONSENT Drawing Details

_

Scale	1 : 250 @ A1
Date	09/03/20
Job No	8899
Drawn	WM Team
Checked	TDH

Drawing No Revision \bigcirc

.S02 .A0-030

」 I WARREN AND MAHONEY®





Г

L

☐ All dimension to be verified on site before producing shop drawings or commencing any work. Do not scale. The copyright of this drawing remains with Warren and Mahoney Architects Ltd.

Revisions

—

A 22/11/19 COORDINATION SET B 18/12/19 DRAFT RESOURCE CONSENT C 09/03/20 FOR INFORMATION

Notes _



Client — RYMAN HEALTHCARE

Warren and Mahoney Architects New Zealand Ltd

254 Montreal Street PO Box 25086 Christchurch 8011 New Zealand Phone + 64 3 961 5926

—

_

Registered Architects and Designers www.warrenandmahoney.com Project Title

PARK TERRACE SITE TWO PETERBOROUGH

Drawing Title

SITE .S02 PROPOSED SITE PLAN - BASEMENT

Drawing Issue RESOURCE CONSENT Drawing Details

Scale	1 : 250 @ A1
Date	09/03/20
Job No	8899
Drawn	WM Team
Checked	TDH

Drawing No Revision \bigcirc

.S02 .A0-040

」 Ⅲ WARREN AND MAHONEY®



NOT FOR CONSTRUCTION

JC

CAD CHK

DATE

RESOURCE CONSENT

REV DESCRIPTION

А

L:\30315\WorkingMaterial\CAD\DWG\30315-BISHOPSPARK-01.dwg 2020-Mar-13 11:11:07 AM Plotted By: JONALD CASTRO

SITE INVESTIGATION PLAN

SCALE (A3) 1:1000

DWG No. 30315-BISHOPSPARK-01

REV A



JC

CAD CHK

DATE

APPROVE

RESOURCE CONSENT

Α

REV DESCRIPTION

SCALE (A3) 1:500

DWG No. 30315-BISHOPSPARK-02

REV A

TITLE BISHOPSPARK, CHRISTCHURCH GEOLOGICAL CROSS SECTION 1

CLIENT RYMAN HEALTHCARE LTD PROJECT GEOTECHNICAL INVESTIGATION

ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE. LEVEL DATUM: LINZ (MSL) LYTTELTON VERTICAL DATUM 1937 EXISTING GROUND PROFILE BASED ON RL OF INVESTIGATIONS.

NOTE:

ELEVATION



CAD CHK

DATE

APPROVE

Exceptional thinking together www.tonkintaylor.co.nz

REV DESCRIPTION

SCALE (A3) 1:500

REV A

TITLE BISHOPSPARK, CHRISTCHURCH GEOLOGICAL CROSS SECTION 2

CLIENT RYMAN HEALTHCARE LTD PROJECT GEOTECHNICAL INVESTIGATION

ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE. LEVEL DATUM: LINZ (MSL) LYTTELTON VERTICAL DATUM 1937 EXISTING GROUND PROFILE BASED ON RL OF INVESTIGATIONS.

NOTE:



JC

CAD CHK

DATE

APPROVE

RESOURCE CONSENT

REV DESCRIPTION

А

SCALE (A3) 1:500

DWG No. 30315-BISHOPSPARK-04

REV A

GEOLOGICAL CROSS SECTION 3





NOT FOR CONSTRUCTION

APPROVE



JC

CAD CHK

DATE

RESOURCE CONSENT

А

REV DESCRIPTION

SCALE (A3) 1:500

DWG No. 30315-BISHOPSPARK-05

REV A

TITLE BISHOPSPARK, CHRISTCHURCH GEOLOGICAL CROSS SECTION 4

CLIENT RYMAN HEALTHCARE LTD PROJECT GEOTECHNICAL INVESTIGATION











DESIGNED

OP

Mar.20

SCALE (A3) 1:500

DRAWING STATUS

REV A

TITLE BISHOPSPARK, CHRISTCHURCH GEOLOGICAL CROSS SECTION 5

CLIENT RYMAN HEALTHCARE LTD PROJECT GEOTECHNICAL INVESTIGATION

ALL DIMENSION ARE IN METRES UNLESS NOTED OTHERWISE. LEVEL DATUM: LINZ (MSL) LYTTELTON VERTICAL DATUM 1937 EXISTING GROUND PROFILE BASED ON RL OF INVESTIGATIONS.

NOTE:



CAD CHK

DATE

Α

REV DESCRIPTION

L:\30315\WorkingMaterial\CAD\DWG\30315-PETERBOROUGH-01.dwg 2020-Mar-13 11:09:08 AM Plotted By: JONALD CASTRO

PROPERTY BOUNDARY
SITE BOUNDARY
TESTPIT LOCATION (2013)
BOREHOLE LOCATION (201
CONE PENETROMETER TES LOCATION (2013)
CONE PENETROMETER TES LOCATION (CGD 2013)
BOREHOLE LOCATION (CGI
CONE PENETROMETER TES LOCATION (CGD 2012)
CONE PENETROMETER TES LOCATION (CGD 2011)

SCALE (A3) 1:500

DWG No. 30315-PETERBOROUGH-01 REV A



JC

CAD CHK

DATE

APPROV

А

REV DESCRIPTION

RESOURCE CONSENT

CLIENT RYMAN HEALTHCARE LTD PROJECT GEOTECHNICAL INVESTIGATION

TITLE PETERBOROUGH, CHRISTCHURCH GEOLOGICAL CROSS SECTION 1

SCALE (A3) 1:500

DWG No. 30315-PETERBOROUGH-02 REV A



JC

CAD CHK

DATE

NOT FOR CONSTRUCTION

APPROV

А

REV DESCRIPTION

RESOURCE CONSENT

°°° ***

20

.....

PROJECT GEOTECHNICAL INVESTIGATION

TITLE PETERBOROUGH, CHRISTCHURCH GEOLOGICAL CROSS SECTION 1

SCALE (A3) 1:500

DWG No. 30315-PETERBOROUGH-02 REV A

L:\30315\WorkingMaterial\CAD\DWG\30315-PETERBOROUGH-02_03.dwg 2020-Mar-13 3:02:38 PM Plotted By: JONALD CASTRO

B1 Bishopspark: T+T 2018 Site-specific geotechnical investigations

B1.1 Overview

Site-specific geotechnical investigations were carried out between 8 November and 21 November 2018 under the supervision of T+T to assess the subsurface conditions beneath the Bishopspark site. The site investigation works comprised the following:

- Six sonic machine-drilled boreholes advanced to depths between 26.1 m bgl and 26.35 m bgl;
- 10 CPTs advanced to depths between 9.45 m bgl and 18.07 m bgl;
- Two seismic cone penetration tests (SCPTs) advanced to depths of 18.81 m bgl and 21.4 m bgl;
- Four hand auger boreholes with adjacent Scala penetrometer tests advanced to depths between 2.05 mbgl and 4.0 mbgl;
- Seven Scala penetrometer tests advanced to depths between 1.45 m bgl and 3.95 m bgl; and
- Surveying to record the locations and levels of the T+T 2018 site-specific geotechnical investigations.

The locations of these locations are shown in Dwg 30315-Bishopspark-01, Appendix A, and the investigation logs are provided within Appendix B

B1.2 Machine-drilled boreholes

Machine-drilled boreholes were carried out by Prodrill Ltd between 8 November and 20 November 2018. All boreholes were drilled using a high frequency (120 Hz) sonic drill rig, and advanced to at depths between 26.1 m bgl and 26.35 m bgl. Standard Penetration Tests (SPTs) were carried out within the boreholes at 1.5 m intervals.

In-situ testing and sampling of the subsurface materials encountered in the boreholes was undertaken using a Standard Penetration Test - SPT (35mm I.D.) split-spoon sampler. The sampler was driven into the soil a distance of 450 mm using a 63 kg hammer dropped from a height of 760 mm. The number of blows required for each 75 mm increment of sampler drive was recorded. The cumulative blow count for the last 300 mm of drive, or fraction thereof, that is presented on the borehole log represents the number of SPT blows required to drive the sampler.

During drilling a T+T geotechnical engineer logged the subsurface materials encountered in general accordance with the New Zealand Geotechnical Society Guidelines¹⁰. Open standpipe piezometers were installed in two boreholes. Table B1.1 presents a summary of the boreholes.

¹⁰ FIELD DESCRIPTION OF SOIL AND ROCK, Guideline for the field classification and description of soil and rock for engineering purposes, NZ Geotechnical Society Inc, December 2005.

Table B1.1: Machine-drilled borehole summary

Borehole ID	Penetration depth (mbgl)	Instrumentation
BH1	26.20	-
BH2	26.30	-
ВНЗ	26.35	-
BH4	26.30	-
BH5	26.35	Open standpipe piezometer
BH6	26.35	Open standpipe piezometer

B1.3 Cone penetration tests

Eight CPTs were undertaken by Geotechnics Ltd (Geotechnics) on 12 and 13 November 2018, and two CPTs were carried out by Ground Investigations Ltd (G-I) on 15 November 2018. The CPTs were terminated at depths between 9.45 m bgl and 18.7 m bgl, where they generally refused on dense sand or gravel material.

Geotechnics used a 16 tonne truck mounted rig and G-I used a Pagani TG63-150 rig to complete the CPTs. The CPTs were undertaken in general accordance with ISO 22467-1: 2012(E). Table B1.2 presents a summary of the CPTs.

CPT ID	Penetration depth (mbgl)	Reason for termination
CPT01	17.63	Test refusal at 17.63 m >20 MPa, truck lifting
CPT02	16.98	Test refusal at 16.89 m >35 MPa, truck lifting
СРТОЗ	10.14	Test refusal at 10.14 m >65 MPa, truck lifing
CPT04	18.07	Test refusal at 18.07 m >30 MPa, truck lifting
CPT05	9.67	Test refusal at 9.67 m >60 MPa, truck lifting
CPT06	9.58	Test refusal at 9.58 m >75 MPa, truck lifting
CPT07	9.45	Test refusal at 9.45 m >35 MPa, anchor failure
CPT08	17.7	Test refusal at 17.7 m >35 MPa, truck lifting
SCPT1	21.4	High cone end resistance
SCPT2	18.8	Limit of reaction force

Table B1.2: Cone penetration test summary

B1.4 Seismic Cone Penetration Tests

Two SCPTs were carried out by G-I on 15 November 2018 with a Pagani TG63-150 rig. The SCPTs were performed adjacent to CPTs (undertaken by G-I) and terminated at depths of 18.8 m bgl and 21.4 m bgl on dense materials. A summary of the SCPTs is provided in Table B1.3.

Table B1.3: Seismic cone penetration summary

SCPT ID	Penetration depth (m)	Reason for termination
SCPT1	21.4	High cone end resistance
SCPT2	18.8	Limit of reaction force

B1.5 Hand auger boreholes and Scala penetrometer tests

Hand auger boreholes and Scala penetrometer tests were carried out by Geotechnics on 12 and 13 November 2018. The hand auger boreholes were terminated at depths between 1.5 m bgl and 4.0 m bgl due to refusal on gravel material. The Scala penetrometer tests were terminated at 3.95 m bgl or refused on dense sand at depths shallower than 3.95 m bgl. These were undertaken adjacent to a number of hand auger boreholes. The Scala penetrometer tests were performed in general accordance with NZS 4402 (1998) Test 6.5.2. The soil was logged in general accordance with the New Zealand Geotechnical Society Guidelines⁴. Table B1.4 presents a summary of the Scala penetrometer tests and hand auger boreholes.

Test ID	Hand auger borehole investigation depth (mbgl)	Scala penetrometer refusal depth (mbgl)
HASC01	1.5	2.05
HASC02	2.4	2.4
HASC03	4.0	3.95
HASC04	4.0	3.95
SC01	-	3.6
SC02	-	3.95
SC03	-	3.95
SC04	-	3.95
SC05	-	3.95
SC06	-	1.45
SC07	-	3.95

Table B1.4: Hand auger borehole and Scala penetrometer test summary

B1.6 Groundwater monitoring

Two open standpipe piezometers were installed in BH5 and BH6 to monitor the groundwater level at the site.

B1.7 Laboratory testing

A geotechnical laboratory testing programme was undertaken by Geotechnics on representative samples of the materials recovered from the machine-drilled boreholes. Details of the testing schedule are summarised in Table B1.5 and the results for fines content and Atterberg Limit are summarised in Table B1.6. Results from the one dimensional consolidation testing will be provided once available. The full laboratory testing results are provided in Appendix D.

Table B1.5: Laborator	y testing schedule
-----------------------	--------------------

Sample source	Sample depth (m)	Laboratory test type					
BH2	4.5	One dimensional consolidation (NZS4402 Test 7.1)					
BH3	0.9	Atterberg Limits (ASTM D4318)					
	3.0	Fines content (GEO190-13)					
	8.05						
	4.5	One dimensional consolidation (NZS4402 Test 7.1)					
	6.0						
BH4	8.5	Atterberg Limits (ASTM D4318)					
		Fines content (GEO190-13)					
	4.5	One dimensional consolidation (NZS4402 Test 7.1)					
	6.0						
BH5	1.5	Atterberg Limits (ASTM D4318)					
	3.0	Fines content (GEO190-13)					
	4.5	One dimensional consolidation (NZS4402 Test 7.1)					
BH6	1.2	Atterberg Limits (ASTM D4318)					
	8.05	Fines content (GEO190-13)					
	4.5	One dimensional consolidation (NZS4402 Test 7.1)					
	6.0						

Table B1.6: Laboratory test results – Atterberg Limits and fines content

Sample source	Sample depth (m)	Laboratory classification	Fines content passing 75µm sieve (%)	Plasticity index
BH3	0.9	Sandy SILT, greyish brown. Wet.	73.8	Non Plastic
	3.0	Sandy SILT, greyish brown. Moist to wet.	63.8	Non Plastic (Liquid Limit 24)
	8.05	Sandy SILT, greyish brown, mottled yellow. Wet.	64.5	Non Plastic
BH4	8.5	SILT with some sand, grey. Moist to wet.	86.7	Non Plastic
BH5	1.5	SILT with minor sand, grey. Moist to wet.	94.8	Non Plastic
	3.0	SILT with some sand, grey. Moist to wet.	86.6	Non Plastic
BH6	1.2	SILT with some sand, grey. Moist to wet. Low plasticity.	84.4	7
	8.05	Sandy SILT, grey. Moist to wet.	62.9	Non Plastic (Liquid Limit 20)

B2 Peterborough: T+T 2013 Site-specific geotechnical investigations

B2.1 Overview

Site-specific geotechnical investigations were carried out between 16 and 19 December 2013 under the supervision of T+T to assess the subsurface conditions beneath the Peterborough site. The site investigation works comprised the following:

- Seven sonic machine-drilled boreholes advanced to depths between 3.0 m bgl and 21.9 m bgl;
- 12 CPTs advanced to depths between 9.5 m bgl and 21.8 m bgl; and
- Eight test pits terminated at depths between 1.5 and 4.3 mbgl.

The locations of these investigations are shown in Drawing 30315-Peterboough-01, Appendix A, and the investigation logs are provided within Appendix B.

B2.2 Machine-drilled boreholes

Machine-drilled boreholes were carried out by Prodrill Ltd between 16 December and 19 December 2013. All boreholes were drilled using a Mobil Sonic MS1000 drill rig, and advanced to at depths between 3.0 m bgl and 21.9 m bgl. Standard Penetration Tests (SPTs) were carried out within the boreholes at 1.5 m intervals.

In-situ testing and sampling of the subsurface materials encountered in the boreholes was undertaken using a Standard Penetration Test - SPT (35mm I.D.) split-spoon sampler. The sampler was driven into the soil a distance of 450 mm using a 63 kg hammer dropped from a height of 760 mm. The number of blows required for each 150 mm increment of sampler drive was recorded. The cumulative blow count for the last 300 mm of drive, or fraction thereof, that is presented on the borehole log represents the number of SPT blows required to drive the sampler.

During drilling a T+T engineering geologist logged the subsurface materials encountered in general accordance with the New Zealand Geotechnical Society Guidelines¹¹. Two single and two nested open standpipe piezometers were installed. Table B2.1 presents a summary of the boreholes.

Borehole ID	Penetration depth (mbgl)	Instrumentation
BH01	21.9	-
ВН02	21.9	-
ВН03	20.3	Nested standpipe piezometer
BH04	20.3	Nested standpipe piezometer
BH05	21.9	-
BH06	21.0	Standpipe piezometer
BH07	3.0	Standpipe piezometer

Table B2.1: Machine-drilled borehole summary

¹¹ FIELD DESCRIPTION OF SOIL AND ROCK, Guideline for the field classification and description of soil and rock for engineering purposes, NZ Geotechnical Society Inc, December 2005.

B2.3 Cone penetration tests

Twelve CPTs were undertaken by Lankelma Ltd (Lankelma) on 16 and 17 December 2013. The CPTs were terminated at depths between 9.4 m bgl and 21.8 m bgl, where they generally refused on dense sand or gravel material.

Lankelma used a 20 tonne truck mounted rig to complete the CPTs. The CPTs were undertaken in general accordance with ISO 22467-1: 2012(E). Table B2.2 presents a summary of the CPTs.

CPT ID	Penetration depth (mbgl)	Reason for termination
CPT01	21.5	Tip load
CPT02A	21.8	Tip load
СРТОЗ	21.0	Tip load
CPT04	20.9	Tip load
CPT05	20.9	Tip load
СРТО6	21.0	Tip load
СРТО7	20.9	Tip load
СРТО8А	10.0	Inclination
СРТО9А	21.0	Tip load
CPT10	21.9	Tip load
CPT11	10.9	Tip load
CPT12	9.5	Tip load

Table B2.2: Cone penetration test summary

B2.4 Groundwater monitoring

Two single standpipe piezometers were installed in BH03 and BH04 and two nested open standpipe piezometers were installed in BH06 and BH07 to monitor the groundwater level at the site.



BOREHOLE LOG

BOREHOLE No.: BH1

Hole Location: Park Terrace Accessway

SHEET: 1 OF 3

CO-ORDINATES: 5180	964.8	89 m	N		,				DRIL		E: Mol	oile So	nic 1000	HOLE STARTED: 08/11/2018
(NZTM2000) 1569	908.7	'7 m	E						DRII	LMET	HOD:	SNC		HOLE FINISHED: 09/11/2018
R.L.:									וופח			TED		
											D. VVF	ATER.	ENGIN	FERING DESCRIPTION
							<u> </u>							
GENERIC NAME,										9N		E	CING	
MATERIAL COMPOSITION.	(%	(%)			TESTS					ATHERI	λ	Pa)	ENGTH FPa) FPa) CT SPA	Description and Additional Observations
	, ross (COVER'						ê	POG	E WE	TH/DENS CATION	SHEAR S	COMP STRI (N	
	ATER	ORE RE	ЕТНОВ	ASING		WPLES	Ű,	EPTH (m	RAPHIC	OISTUR	TRENGT	0.00088		3
10 	182 >	0	M	3		ő		ā		≊õ D-M	b ∂ MD	-01028		ASPHALT, 10mm,
Fill							E		\otimes					Sandy, fine to coarse GRAVEL, with trace silt; greyis
							Ł			M-W	L			brown. Medium dense, dry to moist; sand, fine to
		73	Ŋ				È.		ñ.,**					Silty, fine to coarse SAND, with trace gravel; browni
			S				-	1	_					grey with orange mottling. Loose, moist to wet.
							- 6	1	\mathbf{k}					0.60m: no gravel
							Ē							1.1-1.5m: CORE LOSS.
			L		1/1		E			w				[CONT] Silty, fine to coarse SAND; brownish grey w
		100	SPI		2/2 2/3		ŀ		×					orange mottling. Loose, moist to wet, no dilatancy.
		-	\vdash		N=9		- 5	2	*					1.50m: becomes wet (SPT sample wet).
							F		*					
		100	NC				E		×					
		Ì	0				E		8 8 <u>64</u>	M-W	F			2.6m: trace gravel; coarse, sub-rounded.
							L		<u>1</u>	M	MD			Sandy SILT, with some gravel; grey. Firm, moist to
		_	Ŀ		4/6		- 4	3 ·		IVI	IVID			wet, low plasticity, no dilatancy; sand, fine to coarse gravel, medium to coarse, sub-rounded to sub-
		ŝ	R		6/6		-		$\begin{array}{c} 0 & 0 \\ 0 & 2 \\ 0 & 2 \end{array}$					angular.
-					N=25		F		ð, o					Sandy, fine to coarse GRAVEL, with minor silt; grey
							E		se.					rounded; sand, fine to coarse.
		100	SNC				- 3	4	<u> 46 46</u> <u>46 4</u>		VS			3.75-3.85m: cobble within fibrous peat.
							ŧ		<u> 46 46</u> 46 4					Hibrous PEAT; dark brown. Very soft, moist. Organic smell.
							F		* a <u>tte</u>					SILT and PEAT; brownish grev. Verv soft. moist
		8	ե		0/1 0/1				<u>b</u> e					moderate plasticity; peat, fibrous, mixed in with silt.
		-	0		1/1 N=3		t		<u>8 x x</u> x					
							- 2	5	* *					
Yaldhurst Member							F		* * *		s			5.30 - 5.50m: SILT lense; grey. Soft, moist, moderate
		100	SNC				F		<u>× Mb</u> 28 × ×					<i>5.50m:</i> large fibrous material throughout, eg, 2-10mm of
							E		8 . X					tree roots.
							- 1	6	* **** * * <u>***</u> *					
		5	F		0/0		t .		- <u>1</u> * * * * <u>* *</u>					
		-	0 0		1/1		-		8 × ×					
-					N=2		-		* *					1
							E		* **** * * *					SILT, with trace fibrous peat; grey and brown peat.
		100	SNC				- 0	7	- <u>8</u> × <u>36</u>					
							-				F			Sandy SILT; grey. Firm, moist, low plasticity; sand,
							-		ж. Х					tine.
		8	ե		1/1 1/1									
		Ē	Ō		3/3 N=8		L_1	8	x x x					
							ţ.		×					
			0				F		×××					
		100	SN(E		×		MD			Fine to coarse SAND, with trace silt: grev. Medium
							F		*					dense, moist.
			-		2/3		2	9 -	×					
		100	SPT		2/3 4/5		-		2					
_		Ľ	, "		5/6 N=20		¢.		*					9.55 - 9.75 <i>m:</i> some silt present; grey, non-plastic.
		100	SNC				E		*					
		1	0				ŀ							
COMMENTS:			-											


BOREHOLE No.: BH1

Hole Location: Park Terrace Accessway

SHEET: 2 OF 3





BOREHOLE No.: BH1

Hole Location: Park Terrace Accessway

SHEET: 3 OF 3

PROJECT: 100 Park	Ter	rac	e (0	Geo	tech	nnical)				LOC	ATIO	N: Chi	istchu	ırch		JOB No.: 30315.0000
CO-ORDINATES: 51 (NZTM2000) 15	8096 6990	64.8 08.7	9 m 7 m	NE						DRIL	L TYP	E: Mol	oile So	nic 1000		
R.L.:				-						DRIL	L MET	HOD:	SNC			DRILLED BY: ProDrill
DATUM:										DRIL	L FLUI	D: WA	TER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL														E	NGIN	IEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME															0	
ORIGIN, MATERIAL COMPOSITION.											FRING		ENGTH	SSNE	SPACIN 311)	Description and
	(%) SS		VERY (%			TESTS				g	WEATI	DENSITY	EAR STR (KPa)	OMPRES STRENG (MPa	DEFECT	Additional Observations
	LUID LC	ER	E RECO	ДOH	ßN		PLES	Ê	(m) HT	DHIC LC	BITION	SSIFICA	SHE	°		
	888	WAT	LOO COR	T MET	CAS	1 /1	SAM	BL (DEP	GR.	MOR	STR	222 25 25 25 25 25 25 25 25 25 25 25 25	20 20 2	88888	88
Christchurch			10	R.		2/1		t .		* * × *	w	St				Sandy SILT; grey. Stiff, wet, moderate plasticity; san
Formation						N=12		Ē		* * * * *	м					SILT. with trace sand: grev. Stiff. moist. moderate
			8	N _Z				-		ð, o	w	MD				plasticity; sand, fine.
			~	S				F	21 -							Sandy, fine to coarse GRAVEL, with some silt; grey brown. Medium dense, wet; gravel, sub-angular to
								-14		òċċ						sub-rounded; sand, fine to coarse. 21.20m: becomes silty.
			6	F	1	12/10 7/10		t i								
			Ö	R		8/5 N=30		Ē								
						11-50		F	<u>.</u> -	1. 3xQ -		L-MD				Fine to coarse SAND, with some silt; brownish grey
				0				15 -	22 -							Sandy, fine to coarse GRAVEL, with some silt:
			100	SNC				Ē								brownish grey. Medium dense, wet; gravel, sub-
								F								
			\vdash	<u> </u> .		4/6		Ē			1					Fine to coarse SAND, with trace gravel; grevish bro
			100	SPT		7/5 6/6		16	23							Medium dense, wet, non-dilatant; gravel, fine to medium sub-rounded
Riccarton Gravels						N=24		-								
								E								
			8	NC				F								
			Ì						24	80.0						Sandy fine to coarse GRAVEL brown Medium
																dense, wet; gravel, sub-rounded; sand, fine to coars
			0	F	1	5/4 3/2		t .								24.40m: Low N value due to artesian pressure effects
			10	R R		4/6 N=15		Ē								
-						N-IO			25							
				0				-								
			10	SN				E								
								F								
			0	<u> </u>	1	14/16		E 10	26 -			VD				25.90m: very dense.
			Ę	ι δ	-	18/32 for 75mm	-	-		ò.Yå	-					26 2m: Target depth
						N>=50		Ē		-						
								F		-						
								È an	27 -							
								²⁰	-1	-						
								F								
								E		-						
								F	00	-						
								-21	28 -	-						
								F		-						
								F		-						
								E		-						
								22	29 -	1						
								Ē		-						
								F		-						
								ŧ		-						
COMMENTS:	1:::	1	1		1			Ľ		1	1	1	1::::	1:::::	1	1
ple Depth 26.2m																
ale 1:50																



BOREHOLE No.: BH2

SHEET: 1 OF 3

PROJECT: 100 Park	Teri		e ((<u>эео</u>	leci	inical)				100		N: Chr	istoriu			30D No.: 30313.0000
CO-ORDINATES: 518 (NZTM2000) 156	3093 5996	9.9 6.1	3 m 9 m	NE						DRIL	l type	E: Mot	ile So	nic 1000		HOLE STARTED: 12/11/2018
R.L.:			•	-						DRIL	L MET	HOD:	SNC			DRILLED BY: ProDrill
DATUM:										DRIL	L FLUI	D: WA	TER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL														EN	GINE	EERING DESCRIPTION
GEOLOGICAL UNIT,																
GENERIC NAME, ORIGIN,											SNIS		GTH	₩-	ACING	Description and
MATERIAL COMPOSITION.	(%)		(%) X			TESTS					EATHEI	, LIS	STREN (kPa)	PRESSI RENGTH MPa)	ECT SF (am)	Additional Observations
	SSOLO		COVER				0		Ê	DOL 0	SE W	TH/DEN ICATION	SHEAR	STF	DEF	
	S FLUII	VATER	ORE RI	VETHOD	CASING		SAMPLE	SL (m)	DEPTH (RAPHIC	AOISTUI CONDIT!	STRENG	200 200 200 200 200	200 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	88888	
Fill		-	-		-			-		\times	м	MD			++++``	Asphalt
								-		KXX (Sandy GRAVEL; greyish brown. Medium dense, m
								-		* *		VL				coarse.
			46	SNC				-		/						SAND, minor silt; greyish brown. Medium dense,
									1 -	$1 \vee 1$						Silty SAND: grevish brown, Very loose, moist, low
								-		1						plasticity; sand, fine to medium.
								-	-							CORE LOSS: 0.7 - 1.5m
			00	PT		0/0 0/0		-		* × ×		VS				SILT, trace sand; light brown. Very soft, moist, high plasticity; sand, fine.
			É	Ň		1/1 N=2		- 6	-	× ×	M-\^/					Sondy CII T: groy Vory ooft moint to wate all
								-	2 -	* **	IVI-VV					moderate plasticity, no dilatancy; sand, fine.
				0				-		* * *						
			100	SN				-	-	* * * *						2.50m: orange mottling present
								- 5		* * *						
						1/1		- 5	3 -							
			100	SPT		0/1 1/1		-		к. х						
-						N=3		-		* <u>***</u> *	м	F				SILT and fibrous PEAT; grey with brown mottling.
								-		<u> 46 46</u> - <u>46 46</u>		VS				Firm, moist, moderate plasticity.
			00	2 V				- 4	4 -	<u>36 36</u> 36 3						
			-	S				-	4	××××		St				Sandy SILT; grey. Stiff, moist, low plasticity; sand,
								-		×. *						4.30 - 4.50m: Peat and silt lense
				F	1	BH2-PT1 @ 4.5m		1		<u> 36 36</u> 36 3		VS				Silty fibrous PEAT with some sand; brown. Very so
			100	Ы				- 3		<u> 20 20</u>	1					moist, low plasticity.
Valdhurst Mombor					1			ł	5 -	<u>20 20</u>						
								-		- <u>46 4</u> - <u>46 46</u>						5.35 - 5.65m: Fibrous peat lense
			8	S				-	-	<u> 46 4</u> 46 46						
			-	l o				-		<u></u>						
								- 2	6 -	<u> 46 4</u>						
					1	0/0		E		- <u>an a</u> - <u>an an</u>						
			44	SP		0/0 0/0		-		<u> 46 46</u> 46 46						
-					1	N=0		-	-	<u>36 36</u>						
								- 1		<u> 300 300</u>						6.90 - 6.95m: Silt with trace fibrous peat
			100	SNC					7 -	<u> 400 4</u> 						
								_		* **						SIL I, some peat (fibrous), trace sand; grey and br mottling. Sand, fine.
								-		*^* <u>*</u>						
						0/0 0/0				× × ×						
						1/1 N=2		- 0	8 -	× ×						
			0	<u>ں</u>				-		* * *						8.30m: grades to silt with some sand trace fibrous pea
			10	S N N				F	-	*		L				Silty SAND; grey. Loose, moist; sand, fine to mediu
								E								
								1	0	, ×		MD				SAND, minor to trace silt; grey. Medium dense, mo
			-			2/2		-	9 -	×						
			100	SPT		5/6 7/6		-								
			-	-		N=24		ľ	-	×						
								?		×						9.95 - 10.25m: Sand with some gravel, trace silt lense.
										a la						



BOREHOLE No.: BH2

SHEET: 2 OF 3

FROJECT. 100 F	ark Ter	race	e (G	Geot	echnical)				LOC	ATIO	N: Chr	ristchu	rch		JOB No.: 30315.0000
CO-ORDINATES: (NZTM2000)	518093 156996	89.93 6.19	3 ml 9 ml	N E					DRIL	L TYPE	E: Mol	bile Sor	nic 1000		HOLE STARTED: 12/11/2018
R.L.:									DRIL	L MET	HOD:	SNC			DRILLED BY: ProDrill
DATUM:									DRIL	L FLUI	D: WA	ATER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL													El		
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN										ØN		Ŧ		CING	
MATERIAL COMPOSITION.	(%)		(%) X3		TESTS					EATHERI	SIT≺	STRENG (kPa)	PRESSIVE RENGTH MPa)	ECT SPA (cm)	Description and Additional Observations
	SSO1 GI		RECOVER		0	ES		(L)	IIC LOG	INN W	GTH/DEN FICATION	SHEAR	STF	BE	
	588 FLU	WATER	CORE	METHC	CASINO	SAMPL	RL (m)	DEPTH	GRAPH	MOISTI	STREN	255 200 200 200 200	- 20 - 100 - 20 - 20 - 250	888888	
			0	ç			Ē			м	MD				[CONT] SAND, minor to trace silt; grey. Medium dense, moist; sand, fine to coarse.
			10	Ś			F		*****						
				F	2/3 6/6		Ē								
			81	ß	5/5 N=22		3	11 -	*						
							-		×						
				0			Ę		×						
			10	SN			- 4		*						
5 • •							Ē	12 -	*						12.00m: coarse sand
			00	F	1/2 4/6		-								
			-	S	5/4 N=19		Ē	-	×						
							5		×						
			100	NC			F	13 -							
							Ē		×						13.40 - 13.90m: fine to coarse sand, trace silt; colour gra
					2/3										to brownish grey
			100	SPT	4/5 5/9		6	14 -	*						
					N=23		F		×						
							Ē		×						
5 2			100	SNC			-		*						
Christchurch							F -/	15 -	*****						
<u> </u>			0	F	3/3 1/3		Ē								
			10	Ъ	4/8 N=16			-	×						
							8								
			00	ъ			Ē	16 -	× ×						
			-	S			È		*						
							-	-	×						
			100	SPT	2/4 7/13		9	17 -	*						
					for 70mr N>=50	n 🗖		17	*						
							F		×						
5			100	SNC			Ę								
							-10	18 -	*						
					0/4		-								18.30m: becomes dense. Sand, predominantly fine to
			100	SPT	2/4 8/11 15/13		-		*						medium.
				\vdash	N=47		11		×						
							È.'	19 -	×						
			100	SNC			Ļ		×						
								-	×						
			100	SPT			- 		×						
		•								-	•			·	



BOREHOLE No.: BH2

SHEET: 3 OF 3

PROJECT: 100 Park	Ter	rac	e (Geo	otech	nnical)				LOC	ATIO	N: Chi	istch	urch		JOB No.: 30315.0000
CO-ORDINATES: 51 (NZTM2000) 15	8093	39.9 36 1)3 n 9 n	ηΝ F						DRIL	L TYP	E: Mol	oile Sc	nic 1000		HOLE STARTED: 12/11/2018
RI ·	0330	50.1	1311							DRIL	L MET	HOD:	SNC			HOLE FINISHED: 12/11/2018 DRILLED BY: ProDrill
DATUM:										DRIL	L FLU	ID: WA	TER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL														E	NGIN	NEERING DESCRIPTION
GEOLOGICAL UNIT,																
ORIGIN,											ERING		HLGTH	SNE	SPACING m)	E Description and
	SS (%)		VERY (%			TESTS				0	WEATH	DENSITY TON	AR STRI (kPa)	STRENG (MPa)	DEFECT	Additional Observations
	LUID LO	N.	E RECOV	qo	SN NG		ores	Ê	(m) H	нс го		SIFICAT	SHE	8"		
	888	TAW	COR	METH	CASI	0/4	SAMI	RL (I	DEP1	GRA	MOIS	STRE	8998°9	- º 2 2 2 9	8888	88 87
			100	SP		3/4 5/6		Ē		<u> </u>		MD				[CONT] SAND, minor silt; grey. Medium dense, moi
						N=31		F		Ę.,	w	L-MD				Fine to coarse SAND, with some shells, minor silt;
Christchurch				2				F		* *	M-W	St				grey and white speckling. Loose to medium dense, wet.
Formation			10	S				-13	04	× × ×						Sandy SILT; grey. Stiff, moist to wet, low plasticity;
								F	21	* 3 <u>64</u> 47						21.0-21.3m: trace fibrous peat.
-						7/11		Ē								
			100	SP		7/9 12/11 N=39		Ē		ð. Ö	w	D				SILT, with trace sand; greyish brown. Stiff, wet, low plasticity.
								-14	22 -							Sandy, fine to coarse GRAVEL, with trace silt; brow
			8	Ş				E		ŶŶċ						fine to coarse.
			-	S IS				F		0.ී මා						22.0m: trace cobbles.
								Ē		ģģ						
				F		10/10 9/10		15	22 -	òộ						22.8m: grades to GRAVEL, with some sand.
			9	, R		7/8 N=34		ŀ	25							
								E		ð, o						
								F		p.0						
Piecerton Gravela			78	SNC				-16								
Riccarton Graveis								E	24							
								È.								24.15-24.4m: CORE LOSS.
			17	PT		6/7		Ē		0.7 č						24.40m: becomes medium dense.
			_			9/7 N=29		17			1					
<u></u>								F	25			F				Sandy SILT: light brown. Firm, wet, low plasticity:
			8	N N				E			s	MD				sand, fine to coarse.
			-	- N				-								Silty, sandy, fine to coarse GRAVEL; brown. Mediu dense, saturated; gravel, sub-angular to sub-rounde sand fine to coarse
						16/13		18								25.45m: grades to sandy GRAVEL, with minor silt.
			100	SPT		12/15		1	26	ò						
						for 35mm N>=50		-		<u> </u>						26.3m: Target depth
								Ę		-						
								19		-						
								E	27 -	-						
								F		-						
								Ē		-						
								F	28 -	-						
								E		-						
								F		-						
								Ē		-						
								F -21	29 -	-						
								F		-						
								Ē		-						
								Ļ		-						
								-22		-						
ole Depth																
26.3m																



BOREHOLE No.: BH3

Hole Location: Northern Carport

SHEET: 1 OF 3

PROJECT: 100 Park	Terr	ace	e (G	Geo	tech	nical)				LOC	ATIO	N: Chr	istchu	rch		JOB No.: 30315.0000
(NZTM2000) 156	1008 9926	3.75 5.96	o ml 6 ml	NE						DRILI	L IYPI	=: Mot	oile Sor	ווכ 1000		HOLE STARTED: 10/11/2018 HOLE FINISHED: 10/11/2018
R.L.:										DRILI	L MET	HOD:	SNC			DRILLED BY: ProDrill
DATUM:										DRILI	L FLUI	D: WA	TER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL				_										El		
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	g FLUD LOSS (%)	ATER	ORE RECOVERY (%)	IETHOD	SNG	TESTS	WIPLES	(T (m)	EPTH (m)	RAPHIC LOG	INISTURE WEATHERING	TRENGTH/DENSITY LASSIFICATION	10 25 50 SHEAR STRENGTH 00 (kPa) 00	1 5 20 20 21 20 21 20 20 20 20 20 20 20 20 20 20 20 20 20	20 50 00 00 00 00 00 00 00	Description and Additional Observations
Fill		>	0	2	0		0	-			20	00				ASPHALT, 10mm.
		-	100	SNC	-	BH3-S1 @ 0.9m 1/1		- - - - - - - - - - - - - - - - - - -	1 -							Sandy, fine to coarse GRAVEL; greyish brown. Medium dense, moist; gravel, sub-angular to sub- rounded; sand, fine to coarse. 0.25-0.3m: becomes silty. SILT, with trace sand and rootlets; grey with orange mottling. Stiff, moist, non-plastic; sand, fine. 0.45m: trace fine gravel, becomes moist to wet. Sandy SILT; greyish brown. Firm, moist to wet, low plasticity: sand fine
		-	44	SPT		1/1 1/1 N=4		-	2 -	2 						Silty, fine to medium SAND; greyish brown. Loose, moist to wet.
			76	SNC				- 5								Sandy SILT, with trace fibrous peat; grey. Firm to sti moist, moderate plasticity; sand, fine.
<u>ŏ</u>						BH3-S2 @ ^{3.0m} 1/1			3 -	6						3.00m: grades to low plasticity.
		-	100	SPT	-	0/1 2/2 N=5		- - - 4 -		* 354 * 36 * 36 * 36 * 36						
			100	SNC				-	4 -	<u>10 - 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2</u>						Fibrous PEAT; dark brown. Very soft/loose, moist.
		-	0	Ы		BH3-PT1 @ 4.5m		- 3	5 -	- <u>46 46</u> - <u>46 46</u> - <u>46 46</u> - <u>46 46</u> - <u>46 4</u>						
Yaldhurst Member			100	SNC				- 2	6	्या कर के कि का कि क कि कि क						Fibrous PEAT and SILT; brown. Soft to firm, moist, I plasticity. Peat and silt mixed, homogeneous.
<u>×</u>		-	0	Ы	-	BH3-PT2 @ 6.1m		- - - 1	Ū	- <u>au ab</u> - <u>au ab</u> - <u>au ab</u> - <u>au ab</u>						
			100	SNC				-	7							SILT, with some fibrous peat and trace sand; grey w brown speckling/mottled. Firm to stiff, moist, modera plasticity; sand, fine. Sandy SILT, with trace fibrous organics; grey with brown speckling. Firm moist low plasticity; sand fit
			100	SPT		0/1 3/2 3/2		- 0	8 -	2 8 2 8 8 <u>66</u> 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8						to medium.
			0(ç		N=10 BH3-S3 @ 8.1m		- - - 1	0	х х х х х х						8.05m: no peat; becomes grey.
-			10	SN				- - - -	9 -	×						Silty, fine to medium SAND; grey. Medium dense, moist to wet 8.90m: sand, fine to coarse; some silt.
aver a v xool			99	SPT		6/8 7/6 7/7 N=27		2		× 0 • ×						9.2m: fine to medium gravel present.
			8	Я				Ł		2 . v .						Gravely, line to coarse SAND; brownish grey. Dens wet: gravel fine to coarse, sub-angular to sub-



BOREHOLE No.: BH3

Hole Location: Northern Carport

SHEET: 2 OF 3





BOREHOLE No.: BH3

Hole Location: Northern Carport

SHEET: 3 OF 3

PROJECT: 100 Park	Ter	rac	e (C	Geo	technical)				LOC	ATIO	N: Ch	ristchu	rch		JOB No.: 30315.0000
CO-ORDINATES: 518 (NZTM2000) 156	100	8.7	5 m	N					DRIL	L TYPI	E: Mo	bile Sor	nic 1000		HOLE STARTED: 10/11/2018
RI ·	992	.0.9	0 111						DRIL	L MET	HOD:	SNC			HOLE FINISHED: 10/11/2018 DRILLED BY: ProDrill
DATUM:									DRIL	L FLUI	ID: W	ATER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL													El	NGINE	EERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	(%)		rY (%)		TESTS					EATHERING	siry	STRENGTH (kPa)	PRESSIVE ENGTH MPa)	ECT SPACING (cm)	Description and Additional Observations
	25 FLUID LOSS	WATER	00 CORE RECOVER	рт метнор	DNSYD 2/5	SAMPLES	BL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE	STRENGTH/DEN CLASSIFICATIO	25 SHEAR	5 5 20 50 811 20 811 20 811	DEI 20 20 20 20 20 20 20 20 20 20	[CONT] Fine to coarse SAND, with minor silt; greyis
Christchurch			00	NC	6/6 6/12 N=30		- - 	-							brown. Medium dense, wet. Sandy SILT, with trace organics; grey. Stiff, moist, moderate plasticity; sand, fine to medium; organics, fibrous.
Formation			0	T S	9/12		-	21 -	× × ×						Fine to coarse SAND, with trace silt; light brown. Dense, moist.
			10	SP	13/13 12/12 for 50m N>=50	m		- 22	×× • • • • •	-					21.5m: minor gravel, fine to coarse, sub-angular to sub-rounded. Very dense. Gravelly, fine to coarse SAND; greyish brown. Wet;
			100	SNC			- - - - - - - - - - - - - - - - - - -	-							gravel, fine to coarse, sub-angular to sub-rounded. Sandy, fine to coarse GRAVEL; greyish brown. We gravel, sub-angular to sub-rounded; sand, coarse. 22.40m: grades to some sand.
			33	SPT	6/8 7/6 5/2 N=20			23 -							22.80m: sandy GRAVEL, as above.
Riccarton Gravels			78	SNC			- 	24 -							23.7m: minor silt.
			22	SPT	6/6 5/4 7/10 N=26		- 								
3			85	SNC			- - - - - - - - - - - - - - - - - - -	25 -							
			99	SPT	7/9 8/7 6/10 N=31			26 -							
							19 - - - -	27 -	-						26.35m: Target depth
								-	-						
							- - - 	28 -							
								29 -	-						
								-	-						
COMMENTS:			L	I					1		1	1		1	



BOREHOLE No.: BH4

SHEET: 1 OF 3

	1000	200		Jeou	echnical)				ייפת				nic 1000		
(NZTM2000) 1569	9987	.78 7.44	mE	Ē								500 SNC			HOLE FINISHED: 19/11/2018
R.L.:									DRIL	L МЕТ	HUD:	SNC			DRILLED BY: ProDrill
									DRIL	L FLUI	D: WA	TER	ENO		LOGGED BY: OP CHECKED: KCC
EOLOGICAL													ENG	INE	ERING DESCRIPTION
SECEDITIAL UNIT, SENERIC NAME, DRIGIN.										DNG.		Ŧ			
MATERIAL COMPOSITION.	(%)		(%) X;		TESTS					EATHERI	su y	STRENG KPa)	RESSM ENGTH MPa)	(m)	Description and Additional Observations
	ID LOSS		ECOVER				2	Ē	IC LOG	IRE W	3TH/DEN FICATION	SHEAR	STR STR	3	
	- 25 FLU	WATER	CORE F	METHO	CASING		SAMPL RL (m)	DEPTH	GRAPH	MOISTL	STREN	25 25 260 260 200	250 250 250 250 250 250 250 250 250 250	- 300 - 300 - 300	
Topsoil							-		_≙^TS	D-M	St				TOPSOIL - Sandy SILT with trace rootlets; dark brown, Stiff, dry to moist.
							Ē		<u>46</u> * * *	м	F-St				Sandy SILT; greyish brown. Firm to stiff, moist, low
			8	Ŋ			F		× *						plasticity; sand, fine.
				S			- 7	, 1		w	VL				Silty SAND; greyish brown with orange mottling. V
							-		×						loose, wet; sand, fine to coarse.
					0/0		-		* *	м	F-St				Sandy SILT; greyish brown with orange mottling. F to stiff, moist; silt, low to moderate plasticity; sand.
			100	SPT	1/1		-		× × ×						fine.
		-	_	_	N=3		- e	2	* × - × ×						
									к. * * * *						2.25m Colour abando to grav
			6	SNC			-		× × ×						2.35m. Colour change to grey
							-								
		+	_		1/1		- t	⁵ 3	- x x x						
			88	SPT	1/2 1/2				34 34 34 34		St				Sandy SILT, minor peat (fibrous); grey and dark
		F			N=6		-		<u>n n</u> Divin						brown. Stiff, moist, low plasticity; sand, fine.
							-		$\frac{\Delta D}{\Delta D} \frac{\Delta D}{\Delta D}$		F				PEAT (FIBROUS); dark brown. Firm, moist.
			é	SNC			- 4	4	- <u>an an</u> - <u>an a</u>						
							-		<u>36 36</u> 34 36	-	e				
		F			BH4-PT1 (4.5m	0			<u>n[×] an[×] a</u> an an						SIL I and fibrous PEAT; grey and dark brown mott Soft, moist, moderate plasticity.
			2	F			Æ.	2	<u>0 30° y</u> 34 30						
Yaldhurst Member		F				1		ý 5	<u>u[×] au× a</u> au au						
	· · ·						Ē		- × - ×	w	L				Silty SAND, trace peat (fibrous); grey with brown speckling. Loose, wet; sand, fine to medium, mode
			6	SNC					*						dilatancy.
							- 2	2	- × - ×						
		ŀ		_	BH4-PT2 (6.1m	2 L		6	* <u>***</u> * 2* **	м	S				SILT and fibrous PEAT; grey and dark brown. Soft moist, low plasticity.
			10	Ы					- * * * - <u>8</u> * *						
		F					-		8 <u>866</u> 8 8 8		S-F				SILT, some sand, minor peat (fibrous); grey and c
				0			- 1	7	ж. Х						brown mottling. Firm to soft, moist; sand, fine.
			10(SN			F								
							-		ж. 						
				F	0/0 0/0				* × ×						7.60m: grades to sandy SILT; grey, no plasticity
				<u>s</u>	0/0 N=0		- C	8	×. *						
							Ē		* *						
			100	NC	BH4-S1 @ 8.5m		Ē		× × ×						
				0)			F		* * *		D				SAND trace silt: gray Danse mojet: cand find to
					0/5			1 9							coarse.
			11	SPT	0/2 7/9		-								SAND, some gravel; grey. Dense, moist; sand, fine coarse; gravel, medium, subrounded to subangula
		┝			N=34		-								C C
							Ē.	2							
								٤	ю Ó.						



BOREHOLE No.: BH4

SHEET: 2 OF 3



Hole Depth 26.3m

BoreLog - 13/03/2020 4:36:32 pm - Produced with Core-GS by GeRoc



BOREHOLE No.: BH4

SHEET: 3 OF 3

PROJECT: 100 Park	ler	rac	e (0	Seo	techi	nical)				LOC	ATIO	N: Chr	istchu	Ircn		JOB NO.: 30315.0000
CO-ORDINATES: 513 (NZTM2000) 15	8100 6998)8.7 37.4	8 m 4 m	N E						DRIL	L TYPI	E: Mot	oile So	nic 1000		HOLE STARTED: 19/11/2018 HOLE FINISHED: 19/11/2018
R.L.:										DRIL	L MET	HOD:	SNC			DRILLED BY: ProDrill
DATUM:	-									DRIL	l Flui	D: WA	TER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL														El	IGIN	EERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME,											0		-		л Я	
ORIGIN, MATERIAL COMPOSITION.			(%)								THERING	Ł	RENGTH a)	ESSIVE VGTH a)	T SPACI (am)	Description and Additional Observations
	%) SSO.		OVERY			IESIS				90	WEA	ATION	HEAR ST (KP	COMPRI STREP (MF	DEFEC	
	FLUID L	VTER	RE REC	DOH	SING		MPLES	(E)	(m) HT q	APHIC L	NDITION	RENGTH	<i>5</i>			
	288	Ŵ	00	T ME	3	3/3	SA	RL	DE	- 5	¥8 W	D E	28858	- º % % ē %	88888	[CONT] SAND trace silt: grey Dense wet: sand fir
			7	5		4/5 4/4		-		* × _	м	St				to coarse.
						N=17		-		×××						Sandy SIL1; grey. Stiff, moist, low plasticity; sand, fi
Christchurch			100	SNC				_		* * * * *						
Formation								13	21 -	× ××						
						0.40		-			vv	MD				Silty SAND; grey. Medium dense, wet; sand, fine to coarse.
			100	SPT		3/2 3/3		-		×						
						N=12		-		×					$\begin{array}{c} 1 & 1 & 1 & 1 & 1 \\ 1 & 1 & 1 & 1 & 1 \\ 1 & 1 &$	
								14	22 -		S					Silty GRAVEL, some sand; grey and greyish brown
			100	NC				-								subrounded to subangular; sand, fine to coarse.
								-		è. ċ	w	VD				22.0m: grades to sandy GRAVEL with minor silt.
								-								to coarse, subrounded to subangular; sand, fine to
			33	ЪТ		9/16 17/20		15	23 -	è, è, è						coarse.
				0		13 for 75mm		-								
						N>=50		_		òòò						
			-	ų				-		e°						
Piecerton Crovola			6	Ś				16	24 -	òòò						
Riccarton Graveis								-		$\hat{\rho}_{0}$						24.10m: trace cobbles
				_		7/8		-		è.°ċ		D				24.40m: becomes dense
			77	Ъ		11/13		-		$\dot{\rho}$						
						N-44		17	25 -							
				0				-		\dot{P}						
			100	SNC				-		000						
								-		р. 0.0 ⁻ С						
						19/16		- 	26 -			VD				25.90m: becomes very dense.
			75	SP		18/18 12/2		-								
						N>=50		-		-						26.3m: Target depth
								-		-						
								19	27 -	-						
								-								
								-		-						
								-		-						
								20	28 -	-						
								-		-						
								-		-						
								-		1						
								21	29 -	-						
								-	-	-						
								-		-						
								-		-						
								- 		-						
JOIMINEN IS:																



BOREHOLE No.: BH5

SHEET: 1 OF 3

CO-ORDINATES: 518	093	5.1	1 ml	N		lioui)				DRILI		E: Mol	oile Sor	nic 1000		HOLE STARTED: 13/11/2018
(NZTM2000) 157	001	5.94	4 ml	E						DRILI	_ MET	HOD:	SNC			HOLE FINISHED: 13/11/2018
R.L.: DATUM:										DRILI	- FLUI	D: WA	TER			DRILLED BY: ProDrill LOGGED BY: OP CHECKED: KCC
EOLOGICAL														EN	IGINI	EERING DESCRIPTION
GEOLOGICAL UNIT,																
GENERIC NAME, ORIGIN,											ERING		NGTH	SNE	SPACING	Description and
MATERIAL COMPOSITION.	(%) SS		ÆRY (%)			TESTS					WEATH	ENSITY ION	AR STRE (kPa)	MPRES STRENG (MPa)	DEFECT ((ar	Additional Observations
	I'U LO	ER	E RECOV	ДОН	UN NO		PLES	Ê	(m) H	PHIC LO	DITION	ENGTH/D SSIFICAT	SHE	8"		
	888	WAT	COR	METI	CAS		SAM	BL (DEP	w W	NON	STR	865835 36583	1 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5	88888	Aanhalt
Fill								-		\otimes	IVI					Sandy GRAVEL; greyish brown. Moist; gravel, fine
									-			St				coarse, subangular to subrounded; sand, fine to coarse.
			50	SNC				_		×						Sandy SILT; greyish brown. Stiff, moist, low plastic
								- 7	1 -	$ \vee $						CORE LOSS: 0.75 - 1.5m
								-		$ \wedge $						
						BH5-S1 @ ^{1.5m} 1/2			-							Sandy SILT: brownish grey with orange mottling. S
			77	SPT		1/2 2/1		-		х х к. х						moist, low plasticity; sand, fine.
						N=6		- 6 -	2 -	**************************************		L				Silty SAND; grey with orange mottling. Loose, mois
				0				-		x						2.20m: colour grades to grey
			100	SNG				-	-	×						
								- 5		×						
			0	F		3.0m 1/1 1/1		Ē	3 -	××××		St				Sandy SILT; grey. Stiff, moist, high plasticity; sand fine.
			9	S		1/1 N=4		Ĺ		***** *****						
										×××						
			0	ç				- 4		<u>08 00</u> 2 00 00		S				Silty PEAT (FIBROUS); dark greyish brown. Soft,
			9	S				-	4 -	<u>an an</u> 8 <u>an</u> × a						moist, iow plasticity.
								-		<u>au añ</u> 6 [×] <u>a</u> 6× a						4.30 - 4.40m: Fibrous PEAT lense
			Q	F		BH5-PT1 @ 4.5m		Ē			W					Sandy SILT, trace peat (fibrous); brownish grey w
			10	Ē				- 3		*. * * *						sand, fine to medium.
Yaldhurst Member									5	* *						
			0	υ				-		*. * * *						
			10	SN				-		* * *						
								2	6 -	*. * * *						<i>5.95m:</i> some fibrous peat
			0	F		0/0		¢.		* * * * *						6.20 - 6.35m: Silty fibrous PEAT lense
			10	SP		0/0 0/1 N=1			-	*. * * *						
								}		* * * *						6.65 <i>m</i> : Trace to minor fresh organics (roots, fibrous material)
			0	ç				- 1	7 -	*. * * * * *						
			É	S				-		××××						
								-	-							7.40 - 7.60m: Fine to coarse sand lense with minor silt
			38	Ы		0/1 0/1		-		×××						
				S		0/1 N=2		- 0	8 -	× × ×						
								-		×		L				Silty SAND; grey. Loose, wet; sand, fine to medium
			100	NC				-	-	*						
																SAND, minor silt; grey. Loose, wet; sand, fine to
						04		- ⁻¹	9 -	// 0 //		MD				Gravelly SAND, trace silt; grey. Medium dense, we
			66	SPT		2/4 8/9 9/0		ŀ		•						sand, fine to coarse; gravel, fine to coarse, subang to subrounded.
						N=35		-	-	* 0 * 0						
								2		• •						
	1.1.1									1.2.1.1			1:::::		1111	l



BOREHOLE No.: BH5

SHEET: 2 OF 3



BoreLog - 13/03/2020 4:36:34 pm - Produced with Core-GS by GeRoc Hole Depth 26.35m Scale 1:50



BOREHOLE No.: BH5

SHEET: 3 OF 3

PROJECT: 100 Park	Ter	rrac	e (0	Geo	techn	ical)				LOC	ATIO	N: Chr	istchu	urch		JOB No.: 30315.0000
CO-ORDINATES: 51 (NZTM2000) 15	8093 700 ⁻	35.1 15.9	1 m 14 m	N E						DRIL	L TYP	E: Mol	oile So	nic 1000		HOLE STARTED: 13/11/2018
R.L.:				-						DRIL	L MET	HOD:	SNC			DRILLED BY: ProDrill
DATUM:										DRIL	L FLUI	ID: WA	TER			LOGGED BY: OP CHECKED: KCC
GEOLOGICAL														E	NGIN	EERING DESCRIPTION
GEOLOGICAL UNIT,																
ORIGIN, MATERIAL COMPOSITION											FRING		ENGTH	SINE	SPACIN m)	Description and
	(%) SS		VERY (%			TESTS				g	WEATH	DENSITY	EAR STR (KPa)	OMPRES STRENG (MPa	DEFECT	Additional Observations
	-TUD LC	ER	E RECC	dон	9Ni		PLES	Ē	(m) H	PHIC LC	STURE	SSIFICA	SHI	0		
	888		0 COF	TMET	CAS	4/4	SAV	RL.	DEP	ŝ	WOI	STR	86684 86684	250 250	88888	
			9	Ъ		5/4 N=17		Ē								dense, wet; sand, fine to coarse.
								F								Silty SAND; grey. Very dense to medium dense, we sand, fine to coarse.
			8	У				Ē		*						
Christchurch Formation			-	S				13	21 -		м	F				Sandy SILT, trace peat (fibrous); grey. Firm, moist
								F		к. Х						high plasticity; sand, fine. 21.20 - 21.30m: silty sand lense
			8	Ч		4/7		-		* * *						
<u></u>			-	S		10/14 14/12		t –		• <u>*</u> 3 × • • •	9	VSt				21.6m: colour grades to greyish brown
\/	(N>=50		-14	22 -							Silty sandy GRAVEL; greyish brown. Very dense,
			5	UQ				F	22							saturated; gravel, fine to coarse, subangular to subrounded: sand, fine to coarse.
			8	S				Ē								21.75m: trace silt
								Ę								COPE LOSS: 22.65-22.8m
			6	F		10/11		15	00	ð.°.	w	D				Sandy GRAVEL, trace silt; greyish brown. Dense, v
			99	6		9/8 7/8			23 -	$\hat{\mathbf{o}}_{\mathbf{o}}$						gravel, fine to coarse, subrounded to subangular; sand, fine to coarse.
						N=32		F								
								Ē		°.0 0.0						
			100	SNC						0.00 0.00						
Riccarton Gravels								Ē	24 -	0.0°C						
								-								
			0	SPT		8/9 7/10		E								
						12/10 N=39										
								Ē	25 -							
			85	SNC				E								
								F		$\tilde{\tilde{o}}$						
										\bowtie						CORE LOSS: 25.75-25.9m
			99	PT		5/4 6/8		-	26 -							Sandy GRAVEL, as above.
		_				8/12 N=34		[26.35m: Target depth
								F		-						
								19		-						
								Ē	27 -							
								Ē		-						
								ŧ		-						
								20		-						
								ļ Ī	28 -	-						
								E		-						
								F		-						
										-						
									29 -	-						
								Ē		-						
								F		-						
COMMENTS:				<u> </u>				-22						1:::::		
ole Depth																



BOREHOLE No.: BH6

SHEET: 1 OF 3

CO-ORDINATES: 518	1068	.29	mN	1		,				DRIL		E: Mot	oile Sor	nic 1000		HOLE STARTED: 20/11/2018
(NZTM2000) 1569	9969	.33	mΕ							DRIL	L MET	HOD:	SNC			HOLE FINISHED: 20/11/2018
R.L.: DATUM:										DRIL	L FLUI	D: WA	TER			DRILLED BY: ProDrill LOGGED BY: OP CHECKED: KCC
GEOLOGICAL												0. 11		EN	IGIN	EERING DESCRIPTION
GEOLOGICAL UNIT,																
GENERIC NAME, ORIGIN,											RING		HLDN	H	PACING	Description and
MATERIAL COMPOSITION.	SS (%)		ERY (%)			TESTS				0	WEATH	ENSITY ION	AR STRE (kPa)	MPRESS STRENGT (MPa)	EFECT (Additional Observations
	SOT GIN-	ж.	E RECOV	g	0		Sale	Ê	(m) H	HIC LOG	TURE	SIFICATI	SHE	8°	0	
	882	WATE	CORE	METH	CASI		SAME	BLL (r	DEPT	GRAF	MOIS	STRE	200 20 20 20 20 20 20 20 20 20 20 20 20	20 20 20 20 20 20 20 20 20 20 20 20 20 2	88888	
										\otimes	D	MD				Asphalt Sandy GRAVEL, trace cobbles: brownish grey.
FIII								- 7		\otimes						Medium dense, dry; gravel, fine to coarse, subroun
			8	NC				-		\sim	w	s				Sandy SILT: gravish brown Soft wet low plasticity
				<i>w</i>				_	1 -	× , ×						sandy fine to medium. 0.85 - 1.25m silty sand lense: loose.
					BH	6-S1@		-		× × ×						1.25m: grey with orange mottling
					1.21			- 6		x x x						
			11	ЪТ		0/1 0/1		-								
		-	_			N=4		Ĺ	2 -	× × ×						2.00 - 2.15m: silty sand lense; loose.
								-	_							
			8	NC				- 5		×××	М	St				Sandy SILT; grey. Stiff, moist, high plasticity; sand
				"				-		* *						
								_	3 -	* * * * * *						
			99	ЪТ		1/0 1/1		-	-	ж. ж. 8						
		-	_			N=4		- 4		× ×						
								-		<u>36 36</u> 36 3		s				PEAT (FIBROUS); dark brown. Soft, moist.
			<u>6</u>	NC				-	4 -	<u>an an</u> an an a						
				"				-	-	<u>36 36</u> 36 3						
					вне	6-PT1 @		- 3		<u>au an</u> <u>n[×] an × a</u>						SILT and fibrous PEAT; grey and dark brown. Soft
			8	F	4.5r	n				<u>an an</u> 8 <u>an</u> a						mole, low plastory.
			-	_				E	5 -	<u>an an</u> 6° <u>ao</u> ° a						
								-		<u>an an</u> 1 <u>966</u>						5 2-5 4m: Silty SAND with trace fibrous peat: grey
Yaldhurst Member			8	ų				- 2		<u>04 06</u>						loose.
			₽	ົ				-		<u>an an</u> 6. <u>an</u> . a						5.80 - 6.10m fresh organic material (bark 2-5mm dia
								-	6 -	<u> 78</u> 70 0 70. 7						roots).
			。		BH6 6.1r	6-PT2 @ n		Ē		$\frac{ab}{ab} \frac{ab}{ab} \frac{a}{ab}$						
			9	<u>۲</u>				- 1		<u>00 00.0</u>						
		F	1					1				F				SILT, with trace sand, minor fibrous peat; grey with
			_ ا	<u>ں</u>				-	7 -	<u>к. 61</u> 8						fine.
			2	s				-		1964 Le 28						
			_					- o		<u>к. 64</u> 8						
			8	Б		1/1 2/1		-		× × ×						7.6m: grades to sandy SILT.
			÷	<u>N</u>		1/1 N=5	Ţ	Ē	8 -	ж. х х						
					BH6 8.1r	6-S2 @ n		F		* * * * *						
			00	S				1			w	L-MD				Fine to coarse SAND, with minor silt; grey. Loose t
			-	s				-		3 O .						Oracle fracts area ORANTEL in the little
								_	9 -	ф Д						Sandy, fine to coarse GRAVEL, trace cobbles; grey Dense, wet; gravel, sub-angular to sub-rounded; sa
			8	ЪТ		4/8 9/7		-		0.0 8 8						fine to coarse.
			-	ŝ		8/8 N=32		2		°℃ċ å ^Q c						
								-		ပ.၀ စီးပြီး နိုင်ငံ						9.95m grades to fine to medium gravel
	:::		- 1					ſ		190° ó					iiiii	sisten grades to more to moduli grave.



BOREHOLE No.: BH6

SHEET: 2 OF 3

CO-ORDINATES: 518	31068	.29	mN		,				DRIL	L TYPE	E: Mol	oile So	nic 1000		HOLE STARTED: 20/11/2018
(NZTM2000) 156 R.L.:	59969	.33	mE						DRIL	L MET	HOD:	SNC			HOLE FINISHED: 20/11/2018 DRILLED BY: ProDrill
DATUM:									DRIL	L FLUI	D: WA	TER			LOGGED BY: OP CHECKED: KCC
SEOLOGICAL													E	NGIN	EERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME,												- -		DN I	
ORIGIN, MATERIAL COMPOSITION.	~		(%)		TECTO					THERING	È	a)	ESSIVE NGTH ^{Da)}	CT SPAC (cm)	Description and Additional Observations
	-0SS (%		OVERY		TESTS				8	MEA	ATION	HEAR ST (KP	STREI (MF	DEFEC	
	FLUID I	ATER	DRE REC	SING		WPLES	Ê	(m) HT 4	APHIC I	DISTURE	RENGT	00022			
Yaldhurst Member	288	\$	W N	3		Ś	- 2	8	ి. సంగాంగ	¥8 W	D	-0028		88800	[CONT] Sandy, fine to coarse GRAVEL, trace cobb
							F				MD				grey. Dense, wet; gravel, sub-angular to sub-round
							3	-							Fine to coarse SAND; grey. Medium dense, wet.
					0/0 0/0		-		× × ×		s				10.3-10.4m: some fine to coarse gravel, sub-angul sub-rounded.
			~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~		0/0 N=0		¢.	11 -	ж. ж. 8						SILT, with minor sand; grey. Soft, wet, moderate
							E		* x * x		St				plasticity; sand, fine to coarse.
							4	-	××××						Sandy SILT; grey. Stiff, wet, low plasticity, no
			SN(				Ē		* * *						dilatancy; sand, fine to coarse.
							E	12 -			MD				Fine to coarse SAND; grey. Medium dense, wet.
		┝	_	+	2/1		ŀ	-	$\geq$						12.05-12.2m: CORE LOSS.
			SPT 100		2/3		Ē,								Fine to coarse SAND; grey. Medium dense, wet.
		-	_	-	N=15		- ~								
							F	10							
							Ē	13 -							
			-   º				F								
							6								
			8 1		5/3 5/4		-								
			~ 0		6/6 N=21		¢.	14 -							
							Ē								
			<u>ہ</u> ا				7	-							
			SN   0				ŧ								
Christchurch							E	15 -							
Formation					2/3		¢.								
			SP   3		4/5 8/8		8	-							
					N=25		ŀ		· ·						
							F	16 -							
			SNC 100				E								
							9	-							
		-	_	-	2/4		F								16.70m: becomes dense.
			SP1 00		6/6 9/10		E	17 -							
		┝	+	+	N=31		-								
							E 10								
			NC a				- 10								
			°				Ē	10 -							
							F	10							
		F	<u> </u>		4/7		¢								18.2-18.3m: CORE LOSS.
			6   g		12/13 for 35mm		F -11								[CONT] The to coarse SAND, grey. Dense, wet.
				1	N>=50		-								18.90 - 19.10m: minor crushed shells.
							Ē	19 -							
			SNC 10C				E								
							12	-							
		┝	+	+			Ē								
	1 I			1 1			1		1.1.1.1			1	1::::	1.1.1.1	



BOREHOLE No.: BH6

SHEET: 3 OF 3

PROJECT: 100 Park	Ter	rac	e ((	Geo	tech	nnical)				LOC		N: Chr	istchu	rch	00		JOB No.: 30315.0000
(NZTM2000) 15	8106 6996	58.2 59.3	9 m 3 m	E									nie Sol	IIC 10	υU		HOLE STAKTED: 20/11/2018 HOLE FINISHED: 20/11/2018
R.L.:																	
											LFLUI	D: WA	IER		FN	IGINF	
GEOLOGICAL UNIT,	-																
GENERIC NAME, ORIGIN,											RING		HLGTH	ВЧ		PACING	Description and
MATERIAL COMPOSITION.	(%) Si		ERY (%)			TESTS					WEATHE	ENSITY ON	kR STREI (KPa)	MPRESS	(MHa)	EFECT S (arr	Additional Observations
	ruib Los	H	E RECOV	ę	5N N		oLES	Ê	(m) H	HIC LOC	TURE	SIFICAT	SHE	8‴			
	288	WAT	COR	T MET	CASI	4/3	SAM	RL	DEP.	SR.	WOR	STRE	866833 866833	2 9 9 <del>-</del>	- 100	88888	
			10	Ъ		4/3 3/5		Ę		8 <u>66</u>	vv	St					[CONT] Fine to coarse SAND; grey. Dense, wet. Sandy SILT, with trace fibrous peat: grey with light
						N=15			-	65 . 2 . 5 . 19 8 5 . 19							brown speckling. Stiff, wet, moderate plasticity; sat
Christopurch			8	NC				Ē		2 8 2		MD					Situ fine to modium SAND with trace freeh organ
Formation								-	21 -	2							material (bark, roots); grey. Medium dense, wet.
						0.10				26 - 3 <u>64</u> -							
			90	SPT		0/3 4/5 5/3		- 	-	2 							
			_			N=17		-		8 2014							
								Ē	22 -	ò		D-VD					Sandy, fine to coarse GRAVEL, with some silt; gre brown. Medium to very dense, wet; sand, fine to
			100	SNC				F									coarse.
								15	-								22.5m: no silt.
			_			9/11				* 0 Ŭ 0. ô Č							
			99	SPT		10/13 15/12		F	23 -	ð. ð							
						for 65mm <b>N&gt;=50</b>				°0.0 0.0							
								16	-	ð. Ö							
			86	SNC				Ę									
Riccarton Gravels								F	24 -								
						14/17		-									
			99	SPT		17/16		17 -		èèè							
						for 75mm N>=50		F	05	0.00							
								F	20	$\dot{\circ}$							
			6	SNC				-	-								
								-		ð°ċ							
						7/9		Ē	26 -	0.0° .0≗.0							
			99	R,		11/14 14/11				òòò							
						N2=30		- 19	-								26.35m: Target depth
								F									
								Ē	27 -								
								ŧ									
								-20	-	-							
								È									
								F	28 -								
								F									
								-21	-								
								È	20								
								F	29 -	-							
								22									
								F		-							

Page 11 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Central - CPT01.xlsm100 - 104 Park Terrace, Christchurch Central - CPT01.xlsm200 - 104 Park Terrace, Central - CPT01.xlsm200 - 104 Park Terrace, Central - CPT01.

Page 12 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Central - CPT02.xlsm100 - 104 Park Terrace, Christchurch Central - CPT02.xlsm200 - 104 Park Terrace, CHr

Page 13 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Central - CPT03.xlsm100 - 104 Park Terrace, Christchurch Central - CPT03.xlsm20 - 104 Park Terrace, Central - CPT03.xlsm20 - 104 Park Te

Page 14 of 31



Geotechnics]:/geotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Stadium - CPT04.xlsm100 - 104 Park Terrace, Christchurch Stadium - 104 Park Terrace, Christchurch Stadium - 104 Park Terrace, Christchurch Stadium - 104 Park Terra

Page 15 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Central - CPT05.xlsm100 - 104 Park Terrace, Christchurch Central - CPT05.xlsm200 - 104 Park Terrace, CHr

Page 16 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Central - CPT06.xlsm100 - 104 Park Terrace, Christchurch Central - CPT06.xlsm200 - 104 Park Terrace, CHr

Page 17 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Christchurch Central - CPT07.xlsm100 - 104 Park Terrace, Central - CPT07.xlsm100 - 104 Park Terrace, Central - CPT07.

Page 18 of 31



Geotechnics LTd/GeotechnicsGroup/Projects/1008830/WorkingMaterial/CPT/Processing/100 - 104 Park Terrace, Central Christchurch - CPT08.xlsm100 - 104 Park Terrace, Central Christchurch - CPT08.xlsm20 - 104 Park Terrace, Central Christchurch - 10



#### **CONE PENETRATION TEST (CPT) LOG**



GROUND

INVESTIGATION



#### **CONE PENETRATION TEST (CPT) LOG**



GROUND



29						
Client: Tonkin + Taylor		Operator: Brendon Lemm	NZTM2000 N,E (m): 5181014.39, 1569923.61	Elevation (m): Unknown	Client Job Ref:	
Project: 100 Park Terrace		Cone Ref: MKJ311	WGS84, (deg): 43.523204, 172.627829	Date of Test: 15/11/2018	0.07	
Location: Central Christchurch		Cone Type: 10 cm ² Compression	Location Method: Handheld GPS	Depth (m): 21.40	CPI Number	SCPT-01
Engineer: Omm Prahankhet		Area Ratio: 0.8	Surveyor: N/A	Pre-Drill (m): N/A	Humber.	
Contractor: Ground Investigation Ltd.	www.g-i.co.nz	Filter Type: u2	Termination Reason: High cone end resistance	•	G.I. Job Ref:	18-711
Remarks:		•				

-



#### **CONE PENETRATION TEST (CPT) LOG**



GROUND



# CONE PENETRATION TEST (CPT) LOG

	Tonkin+	Taylor				CO	NE P	PENET	'RA'	TIOI	ΝΤΙ	EST	CF	PT)	LOG					
E)			Cone I Sleev	Resistance e Friction,	, q _t f _s					Po u ₂	ore Pres ₂ (dual s	sure, cale)		Fricti Incli	on Ratio, R nation, x,y	ned -evel	(L)	SBT Ic	Soil Behavio Desc	ur Type (SBT) ription
Depth	.100 4	-200 8 -300 12	64 kbs 64 kbs	a 50 50 a	-600 24	700 28	. 800 32	-900 36		- 0 0 - 500 50	<b>kPa</b>	1500 150	2000 200	-4 2	-8 4 4 degrees -16 8 -16 8	Assur Water I	Depth	8 0	CPT classifications can accurate predictions of size, but provide a g	not be expected to provide soil type based on grain uide to behaviour type.
		<b>3</b>								$\left\{ \right\}$	र			\$					Dense sand to gravely Sands: clean sands to	/ sand silty sands
																			Sands: clean sands to Sands: clean sands to	silty sands
	Client: Tonki	n + Taylor			Ope	rator: Bre	endon Ler	mm	1	NZTM20	000 N,E	<b>(m):</b> 5	180974.8	36, 1569	9998.33	Ele [®]	vation (r	m): Unknown	Client Job Ref:	
Pr Loc Eng	roject: 100 P :ation: Centra iineer: Omm	ark Terrace al Christchurch Prahankhet			Cone Cone Area F	e Ref: MM Type: 10 Ratio: 0.8	(J311 cm² Com }	pression		WG Locati	ss84, (d ion Met Surve	teg): 4 hod: ⊦ evor: N	3.523563 andheld /A	3, 172.6 GPS	28752	Pr	ate of Te Depth (r œ-Drill (r	est: 15/11/2018 m): 18.81 m): N/A	CPT Number:	SCPT-02
Contr	actor: Grour	d Investigation Ltd	I. www.	g-i.co.nz	Filter	<b>Type:</b> u2	•		Те	erminati	on Rea	son: L	imit of re	action f	orce		(1		G.I. Job Ref:	18-711
Ren	narks:				1														1	

















Ē					Shear	Wave V	/eolo	city, V₅											She	ar Modu	ılus, G	<b>B</b> 0							B	Bulk De	ensity,	ρ		Ē
pth,						m/	s													MPa	l									kg	/m³			pth,
De		- 50	- 100	- 150	- 200	- 250		- 300	- 350	- 400		- 450			- 50	- 100		- 150	- 200	- 250		- 300	- 350	- 400	-450		1500		-1600	-1700	-1800		-2100	Del
	-																																	
21				-																														21 -
22																																		22
23																																		23
24																																		24
																																		E
25																																		25 -
26																																		26
27																																		27 -
28																																		28
29																																		29 -
	-																																	·
	lient [.]	Tonkir	n + Tavlo	n l								Kev.					N71	M2000	NF (	<b>n):</b> 518	1014 '	39 14	569923 6	61	Flov	ation	(m). I	Inkno	wn					<u> </u>
Pr	oject:	100 P	ark Terra	ace						Me	easu	red Lo	wer E	Bound				WGS	34, (de	<b>g):</b> 172.	62782	29, 43	3.523204	4	Dat	e of T	est: 1	15/11/2	2018	N	Test umbe	er:	SC	PT-01
Loc	ation:	Centra	al Christo	church						— Me	easu	red Av	erage	e Valu	e		Lo	ocation	Meth	od: Han	dheld	GPS	3			epth	(m): 2	21.40						
Engi	ineer:	Omm	Prahank	het						Me	easu	red Up	oper E	Bound				Sour	се Ту	pe:					C	)ffset	(m): (	0.30		Clie	nt Job	Ref:		
Contra	actor:	Groun	d Invest	igation l	_td.	ww	w.g-i	i.co.nz		ρ f	from	G ₀ Ca	lculat	tion		Т	ermi	nation	Reas	on: High	n cone	end	resistan	се						G.I	Job Re	ef:	1	8-711















# HAND AUGER LOG

SHEET: 1 OF 1

HOLE Id: HASC01

CO-PROVETE: 17.2.07296       USEL INVE: Hord AugoNical PRELIMETHOD. HA-DOP       RL: 30.01 DRUME INVECTORY COLSPAN="2">INVECTORY COLSPAN="2"       INVECTORY COLSPAN="2"	PROJECT: G CH	l Park	k Te	erra	ace	Markout, CPT, HA/SC	LC	CAT	ION	: Park	Terr1	00-10	4 Par	k Terr	ace, City C JOB No.: 1008830.0000
Num     43.63/06     DRLL MEHIO: NA-DO2     HOLE FINISHE: 1911/108       DATUM     NZXZ010     LOGGED N*: SWT     COTECNICS       DATUM     NZXZ010     LOGGED N*: SWT     COTECNICS       SECLOCICAL     EXAMPLE     EXAMPLE     DELLINETING DESCRIPTION       Milestanding     Image: Sector Control     Example     Delling Network       Milestanding     Image: Sector Control     Example     Delling Network       Milestanding     Image: Sector Control     Image: Sector Control     Delling Network       Milestanding     Image: Sector Control     Image: Sector Control     Delling Network       Milestanding     Image: Sector Control     Image: Sector Control     Delling Network       Milestanding     Image: Sector Control     Image: Sector Control     Delling Network       Milestanding     Image: Sector Control     Image: Sector Control     Delling Network       Milestanding     Image: Sector Control     Image: Sector Control     Image: Sector Control       Milestanding     Image: Sector Control     Image: Sector Control     Image: Sector Control       Milestanding     Image: Sector Control     Image: Sector Control     Image: Sector Control       Milestanding     Image: Sector Control     Image: Sector Control     Image: Sector Control       Milestanding     Image: Sector C	CO-ORDINATES:	172	.627	756	6		DF	ILL T	YPE:	Hand	Auger/S	cala		НО	LE STARTED: 12/11/2018
L.L.       Diskult	WG584	-43.	.523	1/56	Ď		DF		1ETH	OD: H	IA+DC	Ρ		HO	LE FINISHED: 12/11/2018
EEOLOGICAL         ENGINEERING DESCRIPTION           Addated and the second and the	R.L.: DATUM:	8.00 NZV	Jm /D2	016	6									LO	GGED BY: SWT CHECKED: HEWI
Tarana de la conserva	GEOLOGICAL		_											EN	GINEERING DESCRIPTION
Market	GEOLOGICAL UNIT,														
Example to be approximated on the second of the secon	GENERIC NAME, ORIGIN,			_								ERING		NGTH	Description and
Image: Second	MATERIAL COMPOSITION.			VERY (%)		SCALA PENETROMETER (Blows/50mm)	TESTS				0	WEATH	DENSITY TON	AR STRE (kPa)	Additional Observations
Image: Section of the section of th			ER	E RECO	дон			PLES	Ê	(m) HT	PHIC LO		SSIFICAT	SHE	
Image: Second			IAN	COF	MET	1 2 3 4 5 6 7 8 9 1 1 1 1 1 1 1 1 1 1 as : : : : : : : : : :		SAV	RL (	DEP	8 <u>44</u> 8	10W	STR	82889 89289	Organic SILT minor sand trace gravel: dark
EXMENTS: No standing groundwater encountered on competion.						1			F	-	18 ° × × <u>34</u>				brown. Very soft, moist, non-plastic; silt, non- dilatat: Organic amorphous; gravel fine
Image: Second						1			-		8 × × × <u>×10</u>				subrounded to subangular; trace rootlets. 0.1m: trace brick fragments; gravel, fine to medium,
Conversion of the standard provided in the sta						1			ŀ		××				brown. 0.3-0.9m: no recovery (core loss).
The standing groundwater encountered on completion.									ŀ		/				
Crively SAND, some brick fragmen Core most, well grades, sand, fine grave, angulato to conclude. 10 m trace sharead. 10 m trace sha									F	0.5-					
Cravely SAND, some brick fragment Gravely SAND, some brick fragment provel, major to remote a 1.2-1.3m. no recovery (core lose), 1.3m. trace concrete. 1.3m. trace concrete. 1.3m						8			-		ĬŇ				
Souther St. No standing groundwater encountered on completion.						05			ŀ		$ /\rangle$				
Convertige SAMD, some brick fragment gravel, angular to rounded. 10:: trace charoosi. 12:13:: in or ecourey (core loss). 13:: trace charoosi. 14:13:: trace charoosi. 15:: trace charoosi. 15:: trace charoosi. 15:: trace charoosi. 15:: trace charoosi. 15:: trace charoosi. 16:: trace charoosi. 17:: trace charoosi. 19:: trace charoosi. 19:: trace charoosi. 10:: tr									t		$  \rangle$				
Comments: No standing groundwater encountered on completion.									ŀ		* *				Gravelly SAND, some brick fragments; brown.
Image: Second						05				1.0-	•				gravel, angular to rounded.
Image: Second						1			Ī						1.0m: trace charcoal.
The second secon						2			-	-	X				1.2-1.3m: no recovery (core loss).
OWLENTS: No standing groundwater encountered on completion.						1			-		~ ~				1.3m: trace concrete.
Demonstrating groundwater encountered on completion.						2 1				4 5 -	•_••				
ZMEENTS: No standing groundwater encountered on completion.										1.J -					End of hole at 1.50mbgl - refusal.
DOMENTS: No standing groundwater encountered on completion.															
OMENTS: No standing groundwater encountered on completion.						1 3				-					
COMENTS: No standing groundwater encountered on completion.						6			-						
OMENTS: No standing groundwater encountered on completion.									L	2.0-					
COMENTS: No standing groundwater encountered on completion.									-						
COMENTS: No standing groundwater encountered on completion.									-						
VOMENTS: No standing groundwater encountered on completion.									ŀ						
COMMENTS: No standing groundwater encountered on completion.									ł						
20MENTS: No standing groundwater encountered on completion.									ŀ	2.5-					
ZOMMENTS: No standing groundwater encountered on completion.									ł						
ZOMMENTS: No standing groundwater encountered on completion.									ŀ						
COMMENTS: No standing groundwater encountered on completion.									ŀ						
COMMENTS: No standing groundwater encountered on completion.									ŀ						
COMMENTS: No standing groundwater encountered on completion.									- 0	3.0-					
COMMENTS: No standing groundwater encountered on completion.									ŀ						
COMMENTS: No standing groundwater encountered on completion.									t	-					
COMMENTS: No standing groundwater encountered on completion.									ŀ						
COMMENTS: No standing groundwater encountered on completion.									Ī						
COMMENTS: No standing groundwater encountered on completion.									[	3.5-					
COMMENTS: No standing groundwater encountered on completion.									[						
COMMENTS: No standing groundwater encountered on completion.										-					
COMMENTS: No standing groundwater encountered on completion.										-					
COMMENTS: No standing groundwater encountered on completion.										4.0-					
UWIVIEN IS: No standing groundwater encountered on completion.									4						
15m	COMMENTS: No sta	anding	gro	unc	dwat	ter encountered on completion.									
	1.5m														


# HAND AUGER LOG

SHEET: 1 OF 1

PROJECT: G CH	Park	Terra	ace Mark	out, CPT, HA/SC	LO	CAT	ION:	Park	Terr1	00-10	4 Par	k Terr	race, City ( JOB No.: 1008830.0000
CO-ORDINATES: WGS84	172.6 -43.52	2741 2345	5		DRI		PE:	Hand J	Auger/S	cala P		HC HC	DLE FINISHED: 12/11/2018
R.L.: DATUM [.]	8.00m	1 12016	3							-			
GEOLOGICAL		2010										EN	GINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION	MATER	CORE RECOVERY (%)	оонтэм 1 7	SCALA PENETROMETER (BlowwJS0mm) 2 3 4 5 6 7 8 9	TESTS	SMIPLES	KL (m)	DEPTH (m)	GRAPHIC LOG	MOISTURE WEATHERING	STRENGTH/DENSITY CLASSIFICATION	10 25 50 100 100 100 100 100 100	Description and Additional Observations
			1 1 2 2 1 1				-	-	* <u>*10</u> 1* * * 8 * <u>* 00</u> 8 * * 8 *	М	S		Organic SILT, some sand, trace gravel; dark brown. Soft, moist, non-plastic; organic, amorphous; sand, fine to coarse; gravel, fine to medium, subrounded; trace rootlets.
								0.5-					SILT, trace sand; dark brown. Soft, moist, low plasticity; sand, fine to coarse.
	12/11/2018	7		3			-	- - - - - - - - - - - - - - - - - - -			L	-	Silty SAND; greyish brown. Loose, moist, poorly graded; sand, fine. 1.75m: medium dense.
				3 3 3 4 4 4 14>14>			- 0 - -	2.0-		w	D		2.2m: wet, dense. 2.35m: very dense. SAND, trace wood and silt; grey. Very dense, wet, needly arended agend fire to medium.
							4	2.5- 3.0- 3.5- 3.5- 4.0-					End of hole at 2.40mbgl - refusal.
COMMENTS: Groun	dwater ı	neas	sured at 1.6	60mbgl on completion.			1		I	I	L	1	1
2.4m													<b>D</b>

HOLE Id: HASC02



# HAND AUGER LOG

SHEET: 1 OF 1

PROJECT: G CH	Park T	erra	ace Markout, CPT, HA/SC	LO	САТ	ION:	Park	Terr1	00-10	4 Par	k Terra	ace, City C JOB No.: 1008830.0000
CO-ORDINATES: WGS84	172.62	2768	17 0	DRII	L TY	PE: I	Hand	Auger/S	cala		HO	LE STARTED: 12/11/2018
RI ·	-43.52	3070	0	DRI	LL M	ETH	DD: H	IA+DCI	Ρ		HO	LE FINISHED: 12/11/2018
DATUM:	NZVD2	2016	6								LOC	GGED BY: SWT CHECKED: HEWI
GEOLOGICAL											ENC	GINEERING DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MATERIAL COMPOSITION.	MATER	ORE RECOVERY (%)	SCALA PENETROMETER (Blows50mm) 보 1 2 3 4 5 6 7 8 9	TESTS	SAMPLES	st. (m)	DEPTH (m)	SRAPHIC LOG	ADISTURE WEATHERING	STRENGTH/DENSITY SLASSIFICATION	10 25 50 SHEAR STRENGTH 100 (4Pa) 200	Description and Additional Observations
	~	0				-	-	و مراجع الح الجامع الحام الجامع الحام ا	D	S		Organic SILT, some sand; dark brown. Soft, dry, non-plastic; trace rootlets. 0.1m: trace gravel, trace brick fragments; gravel, fine, rounded. 0.25m: gravel and brick absent.
						-		* * * * * * * *	М			SILT, trace sand; grey. Soft, moist, low plasticity trace rootlets.
						-	0.5-	× × × × × ×				0.5m: rootlets absent.
						-	-	· × · × · × × × × × × × × × × × × × × ×				0.7m: minor sand.
						- ~	1.0-	* * * * * * * * *				
	12/11/2018					-	-	**************************************		VL	-	Silty SAND; grey. Very loose, moist, poorly graded; sand, fine.
						-	1.5- -					SAND, some silt; grey. Very loose, moist, poorly graded; sand, fine.
						- - - - - -	- - - - - 2.0- - - -			MD	-	1.9m: minor silt, greenish grey, medium dense.
						-			W			2.4m: wet.
			3 2 4 3 4 3 5 5 5 5			2	- - - - - - - - - - - - - - - - - - -	* * * * * * * * * * * * * * * * *		F		SILT, trace organics and sand; grey. Firm, moist, low plasticity; organics, amorphous; trac rootlets.
			6 6 6 5 5 7			-	-	* * * * * * * * * * * * * *				3.2m: minor sand.
			<b>7</b> <b>5</b> <b>6</b>			-		* * *				3.4m: some sand.
			7           6           6           5           5           6           6			-	3.3 - - - - -	* **				3.6-4.0m: no recovery (core loss).
			6			4	4.0	$\left  \right\rangle$				
							-	1				End of hole at 4.00mbgl - target depth.

HOLE Id: HASC03



# HAND AUGER LOG

SHEET: 1 OF 1

HOLE Id: HASC04

WGS84 -4; R.L.: 8.( DATUM: NZ SEOLOGICAL GEOLOGICAL GEOLOGICAL GEOLOGICAL GEOLOGICAL	3.52 00m ZVD:	2016 cone recovery (%)	WETHOD	SCALA PENETROMETER (BlowS50mm) 1 2 3 4 5 6 7 8 9 1 1 4 4 5 6 7 8 9 1 1 1 4 5 6 7 8 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TESTS	LL M	ETHC	DD: H	A+DCF	EATHERING	SITY		LE STARTED: 12/11/2018 LE FINISHED: 12/11/2018 LLED BY: GEOTECHNICS GED BY: SWT CHECKED: HEWI JINEERING DESCRIPTION
DATUM: NZ SEOLOGICAL GEOLOGICAL UNT, GEOROFICHAR, ORERN, MATERIAL CONFOSITION	MATER WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Bowd50mm) 1 2 3 4 5 6 7 8 9 1 1 1 1 1 1 1 1 1 1 1 1	TESTS	SAMPLES	ŵ			EATHERING	SITY		GGED BY: SWT CHECKED: HEWI
GEOLOGICAL GEOLOGICALINIT, GERRICHARG, GORRIN, MATERIAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blow300mm) 1 2 3 4 5 6 7 8 9 1 1 4 4 5 6 7 8 9 1 1 1 4 5 6 7 8 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	TESTS	SMIPLES	ω			EATHERING	SITY	ENC	Description and
GERODICAL UNIT, GEREND LAME. ORIGN. IMTERAL COMPOSITION.	WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows50mm)	TESTS	SAMPLES	æ			EATHERING	ХШХ	RENGTH	Description and
							RL (I	DEPTH (m)	GRAPHIC LOG	MOISTURE	STRENGTH/DENS CLASSIFICATION	10 25 50 100 (KPa 100 (KPa	Additional Observations
			0							M	S		Organic SILT, some sand; brown. Soft, dry, non-plastic; organic, amorphous; sand, fine to medium; trace rootlets.         0.1m: moist.         0.2m: trace gravel, rootlets absent; gravel, fine, roundd.         0.35 - 0.4m: trace rootlets.         SILT, minor sand; brownish grey. Soft, moist, non-plastic; sand, fine.         SAND, trace silt; grey. Very loose, moist, poorly graded; sand, fine.
							-	- - - - - - - - - - - - - - - - - - -		W	L S		1.25m: minor silt, loose. Sandy SILT; grey. Soft, wet, low plasticity; sand, fine.
				1       2       3       3       2       3       4       6       5			- - -	2.0-					SILT, minor sand; grey. Soft, wet, low plasticity; sand, fine. 2.0m: trace sand.
							-	2.5-		М	D		SAND, some silt; greenish grey. Dense, moist, poorly graded; sand, fine.
							-	-		w	MD		2.7m: wet, medium dense.
							- - -	3.0-			F		SILT, trace sand; dark grey. Firm, wet, low plasticity; sand, fine.
				7 6 7 5 5 6 6 6 5 5 5 5 5 5 5 5 5 5 5 5 5			-	- 3.5 - - - - -					3.4m: minor sand, grey. 3.7m: trace sand.
				6 5 5 5			-	4.0	* * * * * * * * *				
COMMENTS: No standin	ng gr	oun	lwate	er measured (hole collapse).			4						End of hole at 4.00mbgl - target depth.

	0		45A Parkh Wigram Christchui New Zeala	ouse Roa rch 8042 and	d										Pag Lab F	e 1 of 2	1 .N			
GEC	DTECHN	ICS	p. +64 3 3	61 0300											16	57/18				
					NZS 440	02: 1998 T	est 6.5.2	Dynami	c Cone Penet	romete	er - Sca	ala								
Project Na	me		G CH Park	Terrace I	nvestigatio	ons			Project ID		1008	830.00	000							
Customer	Project II	)	30315						Equipment ID		CHO	58								
Site Locati	on		100-104 P	ark Terra	ce, City Ce	ntre, Christ	church		Material Sour	ce	NA									
Material D	escriptio	n	NA						Test Series		park	tce/13	1818/ł	nasc+	cpt					
Depth fron	n ground s	surface to c	commencen	nent of pe	netration (	m)		0	Test Number		SC01									
													Es	timat	ed Fi	eld C	BR			
Easting	(NZMG)			Northin	ıg		Level		0	3.5	5 8	13	18	2	3 2	28 3	3 3	89 4	,5 5	50
	247994	40		574259	<del>9</del> 0		8.0m	l	0.1											_
Vertical	Death	Number	Vertical	Dauth	Number	Vertical	Dauth	Number	0.2											
distance driven	Depth (mm)	of blows	distance driven	(mm)	of blows	distance driven	Depth (mm)	of blows	0.3											-
(mm)	. ,		(mm)	. ,		(mm)			0.4											-
50	50	0.5	1750	1750	2	3450	3450	10	0.5											
100	100	0.5	1800	1800	2	3500	3500	8	0.6											
150	150	1	1850	1850	2	3550	3550	9	0.7											
200	200	1	1900	1900	2	3600	3600	10	0.8											
250	250	1	1950	1950	1	3650	3650		0.9											
300	300	1	2000	2000	2	3700	3700		11											
350	350	1	2050	2050	3	3750	3750		1.2											
400	400	1	2100	2100	2	3800	3800		1.3											
450	450	0.33	2150	2150	3	3850	3850		1.4	ļ						-				_
500	500	0.33	2200	2200	4	3900	3900		1.5											
550	550	0.33	2250	2250	6	3950	3950		1.6	ļļ							-			-
600	600	0.25	2300	2300	5	4000	4000		1.7	C										
650	650	0.25	2350	2350	4	4050	4050		<u>ال</u> 1.8											-
700	700	0.25	2400	2400	4	4100	4100		1.9											
750	750	0.25	2450	2450	4	4150	4150		2											
800	800	0.2	2500	2500	3	4200	4200		2.1											-
850	850	0.2	2550	2550	4	4250	4250		2.2							J				
900	900	0.2	2600	2600	4	4300	4300		2.3											
950	950	0.2	2650	2650	5	4350	4350		2.4										-	
1000	1000	0.2	2700	2700	7	4400	4400		2.5											
1050	1050	0.5	2750	2750	7	4450	4450		2.6										1	-
1100	1100	0.5	2800	2800	5	4500	4500		2.7											-
1150	1150	1	2850	2850	5	4550	4550		2.8											
1200	1200	1	2900	2900	4	4600	4600		2.9											
1250	1250	1	2950	2950	3	4650	4650		31			Ļ						-		
1300	1300	1	3000	3000	3	4700	4700		3.2							1				
1350	1350	2	3050	3050	3	4750	4750		3.3											-
1400	1400	1	3100	3100	5	4800	4800		3.4										—	4
1450	1450	1	3150	3150	5	4850	4850		3.5											
1500	1500	1	3200	3200	6	4900	4900		3.6											1
1550	1550	2	3250	3250	6	4950	4950		3.7								-			
1600	1600	1	3300	3300	15	5000	5000		3.8		 				 5	6	 7	 8	4	-  10
1650	1650	2	3350	3350	16	5050	5050			U 1	2	3 Num	4 ber of	: blows	s per 5	5 50mm	1	U	J	10
1700	1700	1	3400	3400	8	5100	5100								· ·					
								Test Rem	arks											
Please not	e Estima	ted Field C	BR cannot	be calcula	ated over 1	LÜ blows.					_									
Tested By		MASC				Date		12/11/20	18											
Data Entry	ву	SWT				Date		13/11/20	18											
Checked b	y Solar	HEWI				Date		20/11/20	18										-	

Checked by HEWI Da GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)

	0		45A Parkh Wigram Christchui New Zeala	nouse Roa rch 8042 and	d						Page 1 of 1 Lab Ref/URN 167/18										
GEC	DTECHNI	CS	p. +64 3 3	61 0300	NI76 444			Dumomi	Cono Donati			-			1	67/18					
Droiget Na			C CLI Dark	Tarragal	NZS 440	JZ: 1998 I	est 6.5.2	Dynamic	Cone Penet	romete	er - So	ala	000								
Project Na	ime Dus is st II	、	G CH Park	Terrace	nvestigatio	ons			Project ID		100	8830.0	000								
Customer	Project IL	)	30315						Equipment ID		CHO	68									
Site Locati	on		100-104 P	ark Terra	ce, City Ce	ntre, Christ	church		Material Sour	ce	NA										
Material D	Descriptio	n	NA						Test Series		park	tce/13	81818/	'hasc+	cpt						
Depth fron	n ground s	surface to c	ommencen	nent of pe	netration (	m)		0	Test Number		SCO	2									
													Es	stimat	ted F	ield C	BR				
Eas	ting (NZN	/IG)		Noi	rthing			Level	0	3.5	58	1	31	82	3	28	33	39 4	45	50	
	2479959			5742623			8.0m		0.1	-											
Vertical	Death	Number	Vertical	Dauth	Number	Vertical	Death	Number	0.2						-	-					
distance driven	(mm)	of blows	distance driven	(mm)	of blows	distance driven	(mm)	of blows	0.3									-			
(mm)			(mm)			(mm)			0.4												
50	50	1	1750	1750	3	3450	3450	5	0.6									-			
100	100	3	1800	1800	3	3500	3500	5	0.7	╞──┛											
150	150	4	1850	1850	4	3550	3550	5	0.8									-			
200	200	2	1900	1900	3	3600	3600	5	0.9	╞╴┖╌┪								-			
250	250	1	1950	1950	3	3650	3650	6	1.1												
300	300	1	2000	2000	2	3700	3700	5	1.2												
350	350	2	2050	2050	2	3750	3750	6	1.3									-			
400	400	1	2100	2100	2	3800	3800	7	1.4							-		-			
450	450	3	2150	2150	2	3850	3850	8	1.5												
500	500	2	2200	2200	1	3900	3900	8	1.0									_			
550	550	3	2250	2250	2	3950	3950	/	1.8												
600	600	2	2300	2300	2	4000	4000		Ê ^{1.9}												
700	700	2	2350	2350	4	4050	4050		2 btp							-		-			
700	700	1	2400	2400	4	4100	4100														
800	800	0.5	2430	2450	5	4200	4200		2.3	-								-			
850	850	0.5	2550	2550	3	4250	4250		2.4									-			
900	900	0.5	2600	2600	6	4300	4300		2.5							-					
950	950	0.5	2650	2650	6	4350	4350		2.6												
1000	1000	1	2700	2700	6	4400	4400		2.7							1					
1050	1050	1	2750	2750	5	4450	4450		2.9								-	j			
1100	1100	1	2800	2800	6	4500	4500		3									-			
1150	1150	2	2850	2850	6	4550	4550		3.1							-		-	-		
1200	1200	2	2900	2900	8	4600	4600		3.2												
1250	1250	1	2950	2950	6	4650	4650		3.4	-											
1300	1300	2	3000	3000	5	4700	4700		3.5	-											
1350	1350	3	3050	3050	5	4750	4750		3.6							1					
1400	1400	2	3100	3100	4	4800	4800		3.7												
1450	1450	3	3150	3150	5	4850	4850		3.9	-						-					
1500	1500	2	3200	3200	5	4900	4900		4							-	•	-			
1550	1550	2	3250	3250	4	4950	4950		4.1												
1600	1600	3	3300	3300	4	5000	5000		4.2	++ 0 1		2 3	3 4	1	+ 5	6	+ 7	8	+ 9		
1650	1650	2	3350	3350	5	5050	5050					Nur	nber o	fblow	s per t	50mm					
1700	1700	3	3400	3400	5	5100	5100	Tort Port													
								rest Kem	arks												
Tested By		MASC				Date		12/11/20	18												
Data Entry	/ By	SWT				Date		13/11/20	18												
Checked b	, IV	HEWI				Date		20/11/20	18												

GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)

	0		45A Parkh Wigram Christchui New Zeala	iouse Roa rch 8042 and	d									Pag Lab I	e 1 of 1 Ref/UR	1 {N			
GEC	JIECHNI	cs	p. +64 3 3	61 0300										10	57/18				
Droiget No			C CLI Dark	Tarragal	NZS 440	D2: 1998 T	est 6.5.2	2 Dynami	c Cone Penet	romete	r - Sca								
Project Na	Project IF	<b>`</b>	G CH Park	Terrace	nvestigatio	ons			Project ID		10088	30.0000							
Site Locati	ion	,	100 104 P	ork Torro	co. City Co	ntro Christ	church		Equipment ID			5							
Site Locati			100-104 P		ce, city cei	nue, chiist	lenuren			Le	INA		- 4						
Material L	Descriptio	n	NA						Test Series		parkto	ce/13181	.8/hasc-	+cpt					
Depth from	n ground s	surface to c	commencen	nent of pe	netration (	m)		0	Test Number		SC03								
													Estima	ted Fi	ield C	BR			
	Easting (I	NZMG)		Northi	ng		Level		0	3.5	8	13	18	23 2	28 3	3 3	39 4	.5	50
	2479966			5742694			8.0m		0.1	┼┲┛┈┾									
Vertical	Denth	Number	Vertical	Denth	Number	Vertical	Denth	Number	0.2	┼└┷									
driven	(mm)	of blows	driven	(mm)	of blows	driven	(mm)	of blows	0.3						_				
(mm)	50	0.5	(mm)	1750	2	(mm)	2450	6	0.5	╷╺┓									
100	100	0.5	1/50	1/50	2	3450	3450	6	0.6	†F									
100	150	0.5	1800	1800	2	3550	3550	6	0.7	╘╴┍┛									
200	200	0.33	1900	1900	3	3600	3600	5	0.0	╷╺┕┪									
250	250	0.33	1950	1950	4	3650	3650	7	1										
300	300	2	2000	2000	4	3700	3700	6	1.1										
350	350	1	2050	2050	3	3750	3750	6	1.2									-	
400	400	0.5	2100	2100	3	3800	3800	7	1.3										
450	450	0.5	2150	2150	3	3850	3850	6	1.5										
500	500	1	2200	2200	3	3900	3900	7	1.6										
550	550	2	2250	2250	4	3950	3950	8	1.7										
600	600	1	2300	2300	5	4000	4000		- 1.9										
650	650	1	2350	2350	3	4050	4050		는 - 유 2										
700	700	1	2400	2400	4	4100	4100		a 2.1										
750	750	1	2450	2450	4	4150	4150		2.2										
800	800	0.5	2500	2500	3	4200	4200		2.4				_						
900	000	0.5	2550	2550	5	4250	4250		2.5					┪					
950	950	1	2650	2650	3	4350	4350		2.6					1	4				
1000	1000	1	2700	2700	5	4400	4400		2.7										
1050	1050	1	2750	2750	5	4450	4450		2.9						<b>1</b>				
1100	1100	1	2800	2800	5	4500	4500		3										
1150	1150	1	2850	2850	5	4550	4550		3.1						1				
1200	1200	1	2900	2900	6	4600	4600		3.3						-	-	<b>.</b>		
1250	1250	1	2950	2950	7	4650	4650		3.4	+						<b>I</b>			
1300	1300	1	3000	3000	5	4700	4700		3.5						J				
1350	1350	1	3050	3050	6	4750	4750		3.6 3.7							1			
1400	1400	1	3100	3100	6	4800	4800		3.8							<b>)</b>			
1450	1450	1	3150	3150	5	4850	4850		3.9						-	<b>1</b>	1		
1500	1500	1	3200	3200	6	4900	4900		4										
1550	1550	2	3250	3250	0	4950 5000	4950 5000		4.1							-			
1650	1650	1	3300	3300	7	5050	5050		۲.2	0 1	2	3	4	5	6	7	8	9	10
1700	1700	2	3400	3400	7	5100	5100					Numbe	r of blov	/s per 5	i0mm				
		_						Test Rem	arks										
Tested Bu		MASC				Dato		12/11/20	18										
Data Entr	/ Bv	SWT				Date		13/11/20	18										
Checked b	, <del>- ,</del> nv	HEWI				Date		20/11/20	18										

Checked by FEWI Da GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)

	0	•	45A Parkh Wigram Christchui New Zeala	iouse Roa rch 8042 and	d						Page 1 of 1 Lab Ref/URN 167/18										
GEC	DTECHNI	CS	p. +64 3 3	61 0300											1	67/18					
					NZS 440	02: 1998 T	est 6.5.2	2 Dynami	c Cone Penet	romete	er - Sc	ala									
Project Na	ime		G CH Park	Terrace I	nvestigatio	ons			Project ID		1008	3830.0	000								
Customer	Project II	)	30315						Equipment ID		CH0	68									
Site Locati	on		100-104 P	ark Terra	ce, City Ce	ntre, Christ	church		Material Sour	ce	NA										
Material D	escriptio	n	NA						Test Series		park	tce/13	81818/	/hasc+	cpt						
Depth fron	n ground s	surface to c	ommencen	nent of pe	netration (	m)		0	Test Number		SC04	ļ									
													E	otimo	tod E	iold C	'DD				
										3 1	5 8	1	⊂: २ 1	suma 8 2			, DR	39 /	15	50	
East	2479970	1G)		Nor	thing		8.0m	evel	0									1	T	7	
Vertical	2475570		Vertical	5742005		Vertical	0.011		0.1											_	
distance	Depth	Number	distance	Depth	Number	distance	Depth	Number	0.3												
driven (mm)	(mm)	of blows	driven (mm)	(mm)	of blows	driven (mm)	(mm)	of blows	0.4												
50	50	0.5	1750	1750	2	3450	3450	3	0.5												
100	100	0.5	1800	1800	2	3500	3500	5	0.6												
150	150	1	1850	1850	3	3550	3550	5	0.8												
200	200	1	1900	1900	3	3600	3600	5	0.9							-					
250	250	1	1950	1950	3	3650	3650	5	1							-					
300	300	1	2000	2000	3	3700	3700	5	1.1											-	
350	350	1	2050	2050	3	3750	3750	5	1.2												
400	400	2	2100	2100	4	3800	3800	5	1.4												
450	450	0.5	2150	2150	4	3850	3850	6	1.5												
500	500	0.5	2200	2200	5	3900	3900	5	1.6												
550	550	0.5	2250	2250	5	3950	3950	9	1.7											-	
600	600	0.5	2300	2300	4	4000	4000		- 19												
650	650	0.5	2350	2350	3	4050	4050														
700	700	0.5	2400	2400	5	4100	4100		2.1												
750	750	1	2450	2450	5	4150	4150		2.2						]						
800	800	0.5	2500	2500	3	4200	4200		2.3						1					-	
850	850	0.5	2550	2550	4	4250	4250		2.4												
900	900	0.5	2600	2600	2	4300	4300		2.6												
950	950	0.5	2650	2650	3	4350	4350		2.7												
1000	1000	1	2700	2700	4	4400	4400		2.8												
1050	1050	1	2750	2750	3	4450	4450		2.9												
1100	1100	2	2800	2800	5	4500	4500		3.1							<b></b>		1			
1150	1150	2	2850	2850	5	4550	4550		3.2										4	-	
1200	1200	1	2900	2900	5	4600	4600		3.3									<b>_</b>			
1250	1250	1	2950	2950	4	4650	4650		3.4							-		-			
1300	1300	2	3000	3000	5	4700	4700		3.5												
1350	1400	2	3050	3050	0	4750	4/50		3.7												
1400	1400	1	3100	3100	8	4800	4800		3.8												
1450	1450	1	2200	2200	9	4650	4650		3.9										1		
1550	1550	1	3250	3250	8	4900	4900		4											-	
1600	1600	2	3300	3300	8	5000	5000		4.1							I				_	
1650	1650	1	3350	3350	6	5050	5050			0 1	2	: 3	3 4	4	5	6	7	8	9	10	
1700	1700	2	3400	3400	6	5100	5100					Nur	nber o	of blow	s per t	50mm					
1,00	1,00	_	0.000	0.00	Ū	5100	5100	Test Rem	arks												
Tested By		MASC				Date		12/11/20	18												
Data Entry	/ Ву	SWT				Date		13/11/20	18												
Checked b	NV	HEWI				Date		20/11/20	18												

GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)

	0		45A Parkh Wigram Christchui New Zeala	iouse Roa rch 8042 and	d										Pag Lab I	e 1 of Ref/U	1 RN			
GEC	DTECHN	ICS	p. +64 3 3	61 0300	NI76 444	D2. 1008 T	ос <b>н С Г 1</b>	Dumouri	- Cana Danata			-1-			10	67/18				
Droject Na			C CH Dark	Torracal	NZS 440	JZ: 1998 I	est 6.5.2	Dynami	Cone Penetr	romete	er - SC		000							
Customor		<u> </u>	20215	Terracer	investigatio	JIIS			Froject ID			5830.0 co	000							
Site Locati	ion	,	100 104 0	ork Torro		ntro Christ	church		Equipment ID			00								
			100-104 P		ce, city ce	intre, cririst	.church		Waterial Source	le	NA									
Material D	Descriptio	n	NA						Test Series		park	tce/13	81818/	hasc+	cpt					
Depth fron	n ground s	surface to o	commencer	nent of pe	netration (	m)		0	Test Number		SC05	5								
													E٩	stima	ted Fi	ield C	CBR			
Easti	ng (NZMO	G)		Nort	hing		Lev	vel	. 0 .	3.5	58	1	31	82	23 2	28	33	39	45	50
	2479987			5742600			8.0m		0.1											
Vertical			Vertical			Vertical			0.2							-				
distance driven	Depth (mm)	Number of blows	distance driven	Depth (mm)	Number of blows	distance driven	Depth (mm)	Number of blows	0.3											
(mm)	()		(mm)	()		(mm)	()		0.4											
50	50	1	1750	1750	3	3450	3450	6	0.6											
100	100	1	1800	1800	2	3500	3500	7	0.7											
150	150	1	1850	1850	1	3550	3550	6	0.8											
200	200	1	1900	1900	1	3600	3600	5	0.9										-	
250	250	4	1950	1950	1	3650	3650	7	1.1											
300	300	3	2000	2000	2	3700	3700	6	1.2	C										
350	350	4	2050	2050	3	3750	3750	6	1.3											
400	400	4	2100	2100	2	3800	3800	6	1.4											
450	450	2	2150	2150	2	3850	3850	5	1.5		ļ									
500	500	2	2200	2200	3	3900	3900	6	1.0										_	
550	550	3	2250	2250	3	3950	3950	5	1.8											
600	600	2	2300	2300	3	4000	4000		Ê ^{1.9}							-				
700	700	2	2350	2550	4	4050	4050		the state											
750	750	2	2400	2400	4	4100	4100													
800	800	2	2500	2500	2	4200	4200		2.3											
850	850	1	2550	2550	3	4250	4250		2.4											
900	900	1	2600	2600	3	4300	4300		2.5											
950	950	1	2650	2650	4	4350	4350		2.6											
1000	1000	1	2700	2700	4	4400	4400		2.8											
1050	1050	2	2750	2750	3	4450	4450		2.9											
1100	1100	2	2800	2800	4	4500	4500		3 -											
1150	1150	2	2850	2850	5	4550	4550		3.1							1				
1200	1200	1	2900	2900	3	4600	4600		3.3							-				
1250	1250	3	2950	2950	2	4650	4650		3.4											
1300	1300	3	3000	3000	3	4700	4700		3.5							-	_			
1350	1350	3	3050	3050	5	4750	4750		3.6 · 2 7											
1400	1400	3	3100	3100	5	4800	4800		3.8											
1450	1450	2	3150	3150	3	4850	4850		3.9							<b>1</b>				
1500	1500	3	3200	3200	6	4900	4900		4 ·	-										
1550	1550	2	3250	3250	6	4950	4950		4.1											
1650	1650	3	3300	3300	5	5000	5000		4.2	0 1	2	: 3	3 4	ļ	5	6	7	8	9	10
1700	1700	2	3330	3550	7	5100	5100					Nur	nber o	f blow	s per 5	50mm				
1700	1700	5	5400	3400	,	3100	3100	Test Rem	arks											
Tested By		MASC				Date		12/11/20	18											
Data Entry	у Ву	SWT				Date		13/11/20	18											
Checked b	v	HEWI				Date		20/11/20	18											

GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)

GEO		cs	45A Parkh Wigram Christchur New Zeala p. +64 3 3	iouse Roa rch 8042 and 61 0300	d									Pa Lab	ge 1 of Ref/UI .67/18	1 RN			
			1		NZS 440	)2: 1998 T	est 6.5.2	Dynamic	Cone Penetro	omete	r - Sca	la							
Project Na	me		G CH Park	Terrace I	nvestigatio	ns			Project ID		10089	30 000	0						
Customor	Project IC	<b>`</b>	20215	Terracer	investigatio	,115			Equipment ID		CHOC		.0						
customer	Project IL	)	50515		<u> </u>				Equipment ID		СНОВ	5							
Site Locati	on		100-104 P	ark Terra	ce, City Ce	ntre, Christ	church		Material Source	9	NA								
Material D	escriptio	n	NA						Test Series		parkt	ce/131	818/has	c+cpt					
Depth fron	n ground s	urface to c	ommencen	nent of pe	netration (	m)		0	Test Number		SC06								
													Estim	nated F	Field C	BR			
Easti	ng (NZMO	5)		Nort	hing		Lev	vel	0 -	3.5	8	13	18	23	28	33 3	39 4	5 5	50
	2479979			5742578			8.0m		Ũ										
Vertical			Vertical			Vertical													
distance	Depth	Number	distance	Depth	Number	distance	Depth	Number	0.1 -										1
driven (mm)	(mm)	of blows	driven (mm)	(mm)	of blows	driven (mm)	(mm)	of blows											
50	50	1	1750	1750		3450	3450		0.2 -										
100	100	2	1900	1800		3430	3430				L								
100	100	2	1000	1000		3500	3500		0.2										
150	150	0.5	1850	1850		3550	3550		0.3								1		]
200	200	0.5	1900	1900		3600	3600												1
250	250	2	1950	1950		3650	3650		0.4 -							-			4
300	300	5	2000	2000		3700	3700												
350	350	8	2050	2050		3750	3750		0.5 -							_			-
400	400	10	2100	2100		3800	3800												
450	450	7	2150	2150		3850	3850		0.0										
500	500	7	2200	2200		3900	3900		0.0 -										
550	550	7	2250	2250		3950	3950				Ē								
600	600	5	2300	2300		4000	4000		0.7 -		<b>L</b>	_							-
650	650	4	2350	2350		4050	4050		E .										
700	700	2	2400	2400		4100	4100		- 8.0 ebt										-
750	750	3	2450	2450		4150	4150		Δ										
800	800	3	2500	2500		4200	4200		0.0										
850	850	2	2550	2550		4250	4250		0.9 -										7
900	900	1	2600	2600		4300	4300												
950	950	3	2650	2650		4350	4350		1 -										-
1000	1000	3	2700	2700		4400	4400				L								
1050	1050	2	2750	2750		4450	4450		1.1 -										-
1100	1100	3	2800	2800		4500	4500				Ļ								
1150	1150	2	2850	2850		4550	4550		1.2 -										_
1200	1200	3	2900	2900		4600	4600						L						
1250	1250	4	2950	2950		4650	4650		10										
1300	1300	5	3000	3000		4700	4700		1.3 -							1			1
1350	1350	7	3050	3050		4750	4750									1			
1400	1400	6	3100	3100		4800	4800		1.4 -							1			1
1450	1450	30	3150	3150		4850	4850												
1500	1500		3200	3200		4900	4900		1.5 -										-
1550	1550		3250	3250		4950	4950												
1600	1600		2200	2200		5000	5000		16 -										
1650	1650		3300	3300		5000	5050		0	1	2	3	4	5	6	7	8 9	9	10
1700	1700		3350	3350		5050	5050					Numb	per of blo	ows per	50mm				
1/00	1/00		3400	5400		2100	2100	Test Rom	arks										
								i est keifi	41 163										
Please not	e Estimat	ed Field C	BR cannot	be calcula	ated over 1	0 blows.													
Tested By		MASC				Date		12/11/20	18										
Data Entr	/ Bv/	SW/T				Dato		13/11/20	18										
	Бу					Date		20/11/20	19										
спескей b	y					Dale		20/11/20	10										

Checked by HEWI Da GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)

Page 1 of 1 Version 3.3 - 14 February 2018

	0		45A Parkh Wigram Christchui New Zeala	iouse Roa rch 8042 and	d										Pag Lab F	e 1 of Ref/UF	1 RN			
GEC	DTECHNI	CS	p. +64 3 3	61 0300	N76 44	<b>1000 T</b>	lact 6 E 2	Dunami	Cono Donote	omoto		-1-			16	57/18				
Droject Na				Torracal	NZ5 44	JZ: 1996 I	est 0.5.2	Dynami	Droiget ID	omete	1000		000							
Project Na	Draigat I	<b>`</b>	G CH Park	Terrace I	nvestigatio	JUIS			Project ID		1008	830.0	000							
Customer	Project IL	)	30315		<u> </u>				Equipment ID		CHU	8								
Site Locati	ion		100-104 P	ark Terra	ce, City Ce	ntre, Christ	cnurch		Material Source	ce	NA									
Material D	Descriptio	n	NA						Test Series		park	tce/13	81818,	/hasc+	-cpt					
Depth fron	n ground s	urface to c	ommencen	nent of pe	netration (	m)		0.2	Test Number		SC07									
													E	stima	ted Fi	eld C	BR			
Eas	ting (NZN	IG)		Nor	thing		L	evel	0 -	3.5	5 8	13	3 1	8 2	23 2	28	33	39 4	45	50
	2479992			5742549			8.0m		0.1											
Vertical			Vertical			Vertical			0.2						-	-				
distance driven	(mm)	of blows	distance	(mm)	of blows	distance	(mm)	of blows	0.3										+	=
(mm)			(mm)			(mm)			0.4											
50	250	2	1750	1950	4	3450	3650	8	0.6											
100	300	2	1800	2000	4	3500	3700	7	0.7											
150	350	3	1850	2050	5	3550	3750	6	0.8											
200	400	2	1900	2100	2	3600	3800	7	0.9						-			-		
250	450	1	1950	2150	3	3650	3850	7	11.											
300	500	1	2000	2200	2	3700	3900	7	1.2											
350	550	1	2050	2250	3	3750	3950	5	1.3											
400	600	1	2100	2300	4	3800	4000		1.4	L										
450	650	1	2150	2350	2	3850	4050		1.5									-		
500	700	1	2200	2400	2	3900	4100		1.6	Ľ										
550	750	1	2250	2450	4	3950	4150		1.8	L										
600	800	1	2300	2500	3	4000	4200		<u> </u>											
650	850	1	2350	2550	2	4050	4250		도) 도 2·											
700	900	0.5	2400	2600	4	4100	4300													
750	950	0.5	2450	2650	3	4150	4350		2.2						3					
800	1000	1	2500	2700	4	4200	4400		2.3											
850	1050	1	2550	2750	4	4250	4450		2.5											
900	1100	1	2600	2800	3	4300	4500		2.6											
950	1150	1	2650	2850	5	4350	4550		2.7		- t				-			-		
1000	1200	1	2700	2900	5	4400	4600		2.8											
1050	1250	1	2750	2950	5	4450	4650		2.3											
1100	1300	3	2800	3000	7	4500	4700		3.1											
1200	1/100	2	2050	3030	6	4550	4730		3.2								-			
1250	1450	1	2900	3150	4	4650	4850		3.3											
1300	1500	2	3000	3200	- 6	4700	4900		3.4											
1350	1550	1	3050	3250	8	4750	4950		3.6											
1400	1600	2	3100	3300	8	4800	5000		3.7 -											
1450	1650	2	3150	3350	8	4850	5050		3.8						-	-	-	<b>-</b>		
1500	1700	3	3200	3400	8	4900	5100		3.9											
1550	1750	3	3250	3450	8	4950	5150		4.1											
1600	1800	3	3300	3500	7	5000	5200		4.2						-		_	_		
1650	1850	3	3350	3550	7	5050	5250		1	0 1	2	Nue	} ·	4 of blow	5	6 0mm	7	8	9	10
1700	1900	4	3400	3600	6	5100	5300					inuf	innel C	WOIG IN	s hei t	JUIIII				
								Test Rem	arks											
											_									
Tested By		MASC				Date		12/11/20	18											
Data Entry	/ Ву	SWT				Date		13/11/20	18											
Checked b	у	HEWI				Date		20/11/20	18											

GEOTECHNICS LTD NZS 4402 Test 6.5.2 - Dynamic Cone Penetrometer (Input Output)



### BOREHOLE LOG

BOREHOLE No:BH01 Hole Location:

SHEET 1 OF 3

	Geo	tec	h In	ives	stiga	atior	ו				LOC	ATIO	N: 78	Park T	erra	ce					JOB No: 29759
CO-ORDINATES:	518	081	19.3 72 5	6 m	nN nE	_		_	_	_	DRI	L TY	PE: N	obile	Soni	c N	/IS10	000	)	но	LE STARTED: 16/12/13
RI ·	692	991 m	2.0	, 1 11	10						DRII	L ME	THOE	: Rot	oSo	nic			l	HO PP	LE FINISHED: 16/12/13
DATUM:	0.85 LY1	TH	IT19	937	(15)	/12/2	2013 - PostEC	2)			DRII	LL FLU	JID: V	Vater	(Cas	sing	g onl	y)	l		GGED BY: CRG CHECKED: JKK
GEOLOGICAL					<u>`</u>											E١	IGIN	EE	RI	NG	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 WEATHERING	STRENGTH/DENSITY CLASSIFICATION	25 SHEAR STRENGTH 50 (LPa)	200 (10 4)	COMPRESSIVE 20 STRENGTH	100 (MPa) 250	50 DEFECT SPACING	1000 (mm) 2000	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.
FILL			-	-					F	-	$\otimes$	-	D	MD		Ħ					Sandy, fine to coarse GRAVEL, with minor
				100	RotoSonic					- - - 1			M								silt, light grey, homogeneous. Tightly packed, dry grades to wet, well graded. Gravel, sub-rounded to angular, slightly weathered, greywacke; Sand, fine to coarse, well graded; various building waste throughout (concrete, plastic, electrical wiring etc).
			-	100	SPT		16 19 14		-5	-			W								
			M	100	RotoSonic		N=33			2											2
			e @ 9:15A	100	SPT		12 16 13			3	$\bigotimes$										2
Yaldhurst Member SPRINGSTON FORMATION	of		From coi	100	RotoSonic		N=29		-3		× × × × × ×			VL							Silty SAND, grey. Medium dense, moist, low plasticity. Sand, very fine, poorly graded. Many decomposing tubular rootlets throughout. grades into SILT, with some organics, dark
				00	PT		1 0		-2	-	×										grey brown. Firm, moist, low plasticity.
				_	ic S	-	1 N=1			5	× × × × ×										grades into soft SILT, many rootlets
				100	RotoSor		1		1	6-	× × × × × ×										grades into an organic very fine sandy SILT, organic odour, slow dilatancy
				100	SPT	-	1 3 N=4			-	× ^ × ×										Silty SAND, dark grey. Medium dense, wet, non-plastic, quick dilatancy
				100	RotoSonic					7	× × × ×										grades into fine SAND, with some silt. Quick dilatancy
				100	SPT		0 2 5		1		×			L							SAND, with trace silt, grey. Loose, slow dilatancy
				100	RotoSonic		N=7		- - - - - - -	8- - - - - - -	X 0 0 8 0 0										Gravelly SAND, grey. Loose, wet. Gravel, fine to coarse, sub-rounded to rounded, well graded, greywacke;sand, medium to coarse, sub-rounded to rounded
				100	SPT 1		1 1 2 N=3			9_ - - - - - - - - - - - - -				VL							Wood SAND, with trace silt, yellow grey, homogeneous. Loose, wet. Sand, medium, poorly graded



### BOREHOLE LOG

BOREHOLE No:BH01 Hole Location:

SHEET 2 OF 3

PROJECT: Rymar	n Geot	tecł	n Inv	/esti	gat	ion					LOC	ATIO	N: 78	Park T	erra	ace					JOB No: 29759
CO-ORDINATES:	5180	081	9.36	۲m آ	١						DRII	L TY	PE: N	lobile	Son	ic N	/IS10	00	F	ю	LE STARTED: 16/12/13
	1569	997	2.51	mE	Ξ						DRII	L ME	тно	): Rot	oSc	onic			F	ю	LE FINISHED: 16/12/13
R.L.:	6.83	m	T10	7 (1	1 5 /1	2/201	2 D 4EC							Matar	(0-	-			D	R	ILLED BY: Pro-Drill
GEOLOGICAL	LYI	IH	1193	<b>5</b> 7 (1	15/1	2/201.	3 - Poste	<u>v</u>						valer	(Ca	EN	J ONI	y) IEE			
								Τ					Q		т	T					
GENERIC NAME,												ABOL	ERIN		INGT		SIVE		ACINO		Soil type, minor components, plasticity or
ORIGIN, MINERAL COMPOSITION.				37 (%								NSΥ	VEATH	ksiT Y	STRE	(kPa)	RES	MPa)	T SP/	(mm)	particle size, colour.
		ŝ		SOVE			TESTS			-	g	ATIO		HUDEN	HEAR		STE		EFEC		Substance: Rock type, particle size, colour,
		Б Г С	н		머머	g		ES I	Ê	TH (m	PHIC	SSIFIC	STURE DITIO	ENGT	[∞]						minor components.
		FLUI	WAT	COR	MET	CASI		MAS	R.L.	DEP.	GRA	CLAS	MOIS	STRI CLA8	- 10	,898,	- 20	- 100	- 50 - 250	- 2000	roughness, filling.
Yaldhurst Member	r of		001	100	onic				E	-			W	MD							SAND, with trace silt, yellow grey,
FORMATION					otoS				F	-											poorly graded
				4	×				F	-											-
					-	9	1		4	-											
			Ŀ	- 6	Ń	1	4			11-											
							N-23		E	-	0.0										packed. Gravel, fine to coarse, well graded;
					Sonic				E	-	0.0										sand, medium, poorly graded.
					(oto)				5	-	0 ∠ ×										SAND, with trace silt, yellow grey,
				1	-				E	12-											homogeneous. Medium dense, wet. Sand, 12-
				- E	_	1	5			-	0. o			D	111						Sandy GRAVEL, brown grey. Loosly
			-	3 8	2		22			-	0.0										packed
						N	N=42		6	-	0.0										
					onic				F	13-	0. o										13-
			÷		otoS				E	-	00										
				6	~				F	-	0.0										-
			F			2	2		- - 7	-	00										
			ł		N.		25 4		Ľ,	14-	0,0										14-
			F			N	N=39		E	-	00										
					lic				E	-	0. o										-
				00	020				F.	-	0.0										
				-	Kot				E-8	15-	00										15-
									F	-	0.0										
					_		4		-	-											
			Ę	Ξ 5	ñ	2	20			-	00										
							N=40		9 -	16-	0.0										16-
					onic				E		0.0										10
				2	oto				F	-	00										
				ſ	×				E	-	0.0			MD	1						-
						1	7			-	$\delta_{\sigma}$										with trace lensoidal clay, gey, moderate to
			ļ		2		5 7		-	17-	a D										high plasticity 17-
			F			N	N=32	Π	E	-											
				·	onic				E	-	0-0										
			00,	00	toSc				<b>-</b> -11	-	₩										SAND, with trace silt, vellow brown
				6	K0				Ē	18-											Medium dense, fine 18-
E			╞	-		9	)		<u> -</u>	-	×										
L am					ZFI	1	0		E	-	×										
			F	+	-	6   N	N=16			-	×.			т							SAND with trace silt area Madine damas
FORMATION	1				2				ļ= '2	19-											quick dilatancy, very fine 19-
EMP				. IS	OSOL				E	-											
			[		Kot				F	-	¦× ;										-
Ľ D∕			L						Ė 12	-	]× _										
<u> </u>										20 -	<b>¦</b> ∡							$\left  \right $			-



### BOREHOLE LOG

BOREHOLE No:BH01 Hole Location:

SHEET 3 OF 3

CO-ORDINATES:     5180819.86 mM 1660972.51 mE BORTUM:     DRILL TYPE:     Mobile Sonic MS1000 DRILL METHOD:     HOLE STARTED:     16/12/13 HOLE DY: Pho-Drill DRILLED BY: Pho-Drille	
1968972.51 mE         DRILL METHOD: RotoSonic         HOLE FUND: SectoSonic         HOLE FUND: SectoSonic         DRILLED BY: Pro-Drill           DATUM:         1XTITHT197 (15122013 - PostFQ)         DRILL FLUD: Water (Casing only)         LOGGED BY: CAS         CHECKED: JAG           GEOLOGICAL         Example:         Figure 1197 (15122013 - PostFQ)         DRILL FLUD: Water (Casing only)         LOGGED BY: CAS         CHECKED: JAG           GEOLOGICAL         Figure 1197 (15122013 - PostFQ)         DRILL FLUD: Water (Casing only)         LOGGED BY: CAS         CHECKED: JAG           GEOLOGICAL         Figure 1197 (15122013 - PostFQ)         DRILL FLUD: Water (Casing only)         LOGGED BY: CAS         CHECKED: JAG           GEOLOGICAL         Figure 1197 (15122013 - PostFQ)           GEOLOGICAL         Figure 1197 (15122013 - PostFQ)         Figure 1197 (15122013 - PostFQ)         Figure 1197 (15122013 - PostFQ)         Figure 1197 (1512013 - PostFQ)         Figure 1197 (1512013 - PostFQ)           GEOLOGICAL         Figure 1197 (15122013 - PostFQ)         Figure 1197 (1512013 - PostFQ)         Figure 1197 (151201	
RL:: 6.83 m DRUL FUURDAME DESCRIPTION DRUL FUUD: Water (Casing Option) LOGGED BY: CRG CHECKED : JK GEOLOGICAL GEOLOGICAL LWT; GEOLOGICAL LWT;	
DATUM: INTERINGUE CASING ONLY LOCASING POINT CASING	
OPECUADICAL GENERIC MARE, ORIGINA GENERIC MARE, ORIGINA GENERIC MARE, ORIGINA GENERIC MARE, ORIGINA GENERIC MARE, ORIGINA MARINAL COMPOSITION         TESTS         T	<
Bit Classical UMP, GRINN INNERNAL COMPOSITION         Sold Decident MM (memory) MINERNAL COMPOSITION        Sold Decident MM (memory) MINERNAL COMPOS	
Orders         metrode         metrode <th< td=""><td></td></th<>	
Initial data data data       Initial data <thinitia< td=""><td></td></thinitia<>	
Bit of the constraint of	
Image: Second	
CRRISTCHURCH FORMATION       Image: Second sec	
PORMATION       Port S       2 S       x N=7       x S       x S       x S       SAND brown Dense SULT, with minor organic fragments, grey. SULT, wet, moderate to low pasticity Sult first no coarse GRAVEL, graning to Sandy first occarse GRAVEL, graning toccarse GRAVEL, grani	
Riceaton Gravels $0$ $0$ $N=7$ $-14$ $X$ $X$ $0$ $12$ $12$ $X$ $X$ $X$ $X$ $0$ $12$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $12$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $12$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $12$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $12$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ $0$ <t< td=""><td>-</td></t<>	-
Riccarton Gravels $\boxed{\mathbb{B}}$ <	
Riccarton Gravels       Image: Construction of the plant difference of the plant diff	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	2-1-
Image: Second	/
E     E     10     22       15     22       16     22       17     22       18     23       19     18       19     18       19     19       19     19	-
22- -16 23- -16 23- -17 24- -17 24- -18 25- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 26- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -19 27- -	-
-16 23 -17 24 -18 25 -18 25 -19 26 -19 26	22-
-16 23 -17 24 -17 24 -18 25 -18 25 -19 26	
	-
	23-
	-
	-
	24-
	-
	-
	25-
	-
	-
	26-
	20
	-
	-
	27-
	-
	-
	28-
	-
	-
	-
	29-
	-
	-
	-
$\begin{bmatrix} -23 & 30 \end{bmatrix}$	-
Log Scale 1:50 BORELOG 29759_CRG.GPJ 17-J:	an-201



### BOREHOLE LOG

BOREHOLE No:BH02 Hole Location:

SHEET 1 OF 3

CO-ORDINATE:     5100054.40 mN (See3686.50 m)     DRUL TYPE:     Mobile Source MS1000     HOLE 5TARTED:     10/12 TIV3       R.L:     7.0 m     DRUL METHOD:     Received in the second s	PROJECT: Ryman	Geo	tec	h In	ves	stiga	atior	1				LOC	ATIO	N: 78	Park T	erra	се				JOB No: 29759
Independent of DATUME	CO-ORDINATES:	518	083	36.4	8 m	۱N						DRIL	L TY	PE: N	obile \$	Soni	c M	S100	0	нс	DLE STARTED: 16/12/13
RL:     210 m     DRUM     DRULE DUD:     Mathematication     DRULE DUD:     View (Casing out)     DRULE DUD:     Cost DUD VI     Cost DUD VI       CRCOCCAL     EXAMPLE DUD:     View (Casing out)     Cost DUD VI     Cost DUD VI <td< td=""><td></td><td>156</td><td>998</td><td>88.5</td><td>5 m</td><td>۱E</td><td></td><td></td><td></td><td></td><td></td><td>DRII</td><td></td><td>тног</td><td>. Rot</td><td>250</td><td>nic</td><td></td><td></td><td>HC</td><td>DLE FINISHED: 16/12/13</td></td<>		156	998	88.5	5 m	۱E						DRII		тног	. Rot	250	nic			HC	DLE FINISHED: 16/12/13
DATURE         1Y (THITS) (1512:2011 - Function)         Definition         Definiton         Definition         Definiton	R.L.:	7.10	m																	DF	RILLED BY: Pro-Drill
NUMERATION         NUMERAT		LY	TH	T19	937	(15)	/12/2	2013 - PostEQ	))				_L FL	UID: V	Vater	Cas	Sing	Only)	)		DIGGED BY: CRG CHECKED: JKK
Bit Manual Production Control         Bi	GEOLOGICAL													U		-			T		
Original and the second of the seco	GEOLOGICAL UNIT, GENERIC NAME,				_								ABOL	IERIN		NGTH	Ļ	ΞΞ		CING	Soil type, minor components, plasticity or
NUMBER Member of SPRINGETON DORMATION         No.         Source of the second particle and the second particle andit and the second particle and the second particle and the second	ORIGIN, MINERAL COMPOSITION.				SY (%)								N SYN	<b>EATH</b>	ISITY N	STRE		KENG MPa)		⊤SP/	particle size, colour.
With most Mumber of SPRINGSTION         Image manual participants         Image manual partitipants         Image manual participants			s		OVEF			TESTS				8	ATIO	5	4 DEN ATION	HEAR		STR )			ROCK DESCRIPTION Substance: Rock type, particle size, colour.
Image: constraint of second constraints of the constraint of			SOL OS	R	E REC	₽	Ŋ		LES	Ê	(m) H	HICI	SIFIC	TURE	ENGTH SIFIC	ş				Δ	minor components.
PILL     P     D     D       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01     01     01       01     01     01     01			FLUI	WAT	CORI	METH	CASI		SAMF	R.L.	DEP1	GRAF	CLAS	MOIS	STRE	- 125	1,200	9928	007 -	- 1000	Defects: Type, inclination, thickness, roughness, filling.
Vuldhurst Member of PORMATION         Null	FILL									-7	-	$\boxtimes$		D	D				Π		Sandy, fine to coarse GRAVEL, with minor
Yaldurst Member of PORMATION         Same and bits         Same and bits         Monogeneous and bits         Monogeneous and										F	-	$\bigotimes$									packed, dry grades to wet, well graded.
Vulnust Member of SPRINCSTON FORMATION         0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0					_	onic				F	-	$\bigotimes$									Gravel, sub-rounded to angular, slightly
Violational Member of SPRIMATION         S         S         2         W         MD         <					100	otoSo				E	-	$\mathbb{K}$									well graded; various building waste
Yublinist Member of SPRINGSTON PORMATION         Is 10 10 11 11 10 10 11 10 10 10 10 10 10						R				-6	1-										throughout (concrete, plastic, electrical 1–
Vuldnust Member of PORMATION         10 10 10 10 10 10 10 10 10 10 10 10 10 1										F	-	$\bigotimes$		D-M							
Yaldhurst Member of WEINCGTION PORMATION         IIS IIS IIS IIS IIS IIS IIS IIS IIS IIS				Ŧ				10			-	$\mathbb{N}$									
Yuldiurst Member of SPRINKSTION         N=33 H         N=33 H         N=33 H         N=33 H         N=33 H         N=33 H         N=33 H         N=34 H         N=34 H					100	SPT		18 15		F	-	$\bigotimes$									
Yuldiurst Member of SPRINCSTON         SAND, with arcs sill, prey, homogeneous. N=30         MD           Yuldiurst Member of SPRINCSTON         01         16 17 17 18 19 10         16 17 17 18 10         16 17 17 17 18 10         16 17 17 18 10         16 17 18 10         33 10 10         33 10         34 10         34 10<					_			N=33			2-	$\mathbb{N}$		W							2-
Validhursi Member of SPRINGSTON FORMATION         0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0						nic				Ę	-	$\bigotimes$									
Yildburst Member of SPRINGSTON FORMATION         N=37         Info 17         State 19         State 19         State 19         State 19         State 19         State 19         State 19         State 19         State 11					100	toSo				E	-	$\mathbb{N}$									
Yaldhurst Member of SPRINCSTON FORMATION         16 17 00 00 00 00 00 00 00 00 00 00 00 00 00						Roi				E	-	$\mathbb{X}$									
Yaldhurst Member of FORMATION         OI         If 20 metric metric program         If 20 metric metric metric program         MD         MD         MD         SAND, with trace sill, grey, homogeneous.         44           Yaldhurst Member of FORMATION         01         15 metric metric metric program         16 metric metric metric metric metric metric metric program         MD         MD         SAND, with trace sill, grey, homogeneous.         66           Yaldhurst Member of FORMATION         01         12 metric metric program         16 metric metric metric program         MD         MD         SAND, with trace sill, grey, homogeneous.         67           Yaldhurst Member of FORMATION         01         18 metric metric program         16 metric program         MD         MD         SAND, with trace sill, grey, homogeneous.         67           MD         01         12 metric program         16 metric program         16 metric program         MD         SAND, with trace sill, grey, homogeneous.         68           MD         01         12 metric program         16 metric program         16 metric program <td< td=""><td></td><td></td><td></td><td>M</td><td></td><td></td><td></td><td>16</td><td></td><td></td><td>3-</td><td>$\mathbb{X}$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>3-</td></td<>				M				16			3-	$\mathbb{X}$									3-
Yaldhurst Member of SPRINGSTON FORMATION         20 N=37         20 N=37         20 N=37         4 A         4 A           Valdhurst Member of SPRINGSTON FORMATION         8 I I I I I I I I I I I I I I I I I I I				<b>a</b> 2]	100	PT		17		E ⁴	-	$\mathbb{K}$									
Yaldhurst Member of SPRINGSTON FORMATION       B 00 1 00 1 00 1 00 1 00 1 00 1 00 1 00				core		•1		20 N=37		-	_										
Yaldhurst Member of SPRINCSTON FORMATION       N=34       Same Formation Formation Formation       Same Formation Formation Formation       Same Formation Formation Formation       Same Formation Formation Formation Formation       Same Formation Formation Formation Formation       Same Formation Formation Formation Formation Formation       Same Formation Formation Formation Formation Formation Formation       Same Formation Formation Formation Formation Formation Formation Formation Formation Formation       Same Formation Form				o mo		5				F	-	$\bigotimes$									-
Yaldhurst Member of SPRINOSTON FORMATION       001       13 15 19 19 19 10 10       10 10 10       MD       MD       SAND, with trace silt, grey, homogeneous. Medium dense, wet, poorly graded. Sand, fine to medium. grades into fine SAND         Yaldhurst Member of SPRINOSTON FORMATION       001       12 14       14       64         001       12 14       14       14       16       16         001       14       16       17       7         101       16       16       17       7         101       16       16       17       7         101       16       16       16       16         101       16       16       16       16       16         101       16       17       17       7       17         101       16       17       17       17       17         101       17       17       17       17       17       17         101       16       16       17       17       17       17       17         101       16       17       17       17       17       17       17       17         17       17       17       17       17       17 <td></td> <td></td> <td></td> <td>Fr</td> <td>õ</td> <td>Soni</td> <td></td> <td></td> <td></td> <td>E</td> <td>4-</td> <td>$\bigotimes$</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>4-</td>				Fr	õ	Soni				E	4-	$\bigotimes$									4-
Yaldhurst Member of SPRINGSTON FORMATION       N=34       T2       5         00       Ls       8       1       6         01       Ls       8       1       6         SPRINGSTON FORMATION       00       Ls       8       1         00       Ls       14       14       14         N=26       1       1       1       7         10       Ls       5       1       7         10       Ls       5       1       7         10       Ls       5       1       7         14       1       1       1       7         14       N=26       1       1       1       7         10       14       1       1       1       1       1         10       14       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1					Ξ	<b>Roto</b>				-3		$\bigotimes$									
Yaldhurst Member of FORMATION       8       5         Valdhurst Member of FORMATION       0       14       6         0       14       14       6         0       14       14       7         0       14       14       7         0       14       14       7         0       14       14       7         0       15       6       7         0       15       6       7         0       15       14       14         0       15       14       14         0       15       14       14         0       15       14       14         0       15       14       14         0       15       14       14         0       15       14       14         0       15       14       14         16       14       14       14         16       14       14       14         16       14       14       14         16       14       14       14         16       14       14       14         17 <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>E</td> <td>-</td> <td>$\bigotimes$</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>-</td>										E	-	$\bigotimes$									-
Yaldhurst Member of SPRINGSTON FORMATION       00 1 12 14 N=26       15 19 N=34       16 12 14 N=26       MD       MD       SAND, with trace silt, grey, homogeneous. Medium dense, wet, poorly graded. Sand, fine to medium. grades into fine SAND, with lensoidal silt         00 1 SPRINGSTON FORMATION       01 14 00 15 15 12 14 N=26       5 10 14 14 N=26       MD       MD       SAND, with trace silt, grey, homogeneous. Medium dense, wet, poorly graded. Sand, fine to medium. grades into fine SAND, with lensoidal silt         00 1 SPRING FORMATION       01 15 12 14 N=26       5 12 14 14 N=26       MD       MD       SAND, with trace silt, grey, homogeneous. Medium dense, wet, poorly graded. Sand, fine to medium. grades into fine SAND, with lensoidal silt, and trace organic fragments       SaND, with lensoidal silt, and trace organic fragments         01 12 17 N=29       8 12 17 N=29       -1 10 10 10 10 10 10 10 10 10 10 10 10 10					_	<u> </u>		8		-	-	$\bigotimes$									
Yaldhurst Member of SPRINCSTON FORMATION       N=34       -2       3         0       1       6       6         1       6       6         SRINCSTON FORMATION       0       12       6         0       12       1       6         1       0       12       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         0       12       1       1         13       1       1       1       1         14       1       1       1       1         14       1       1       1       1       1         14       1       1       1       1       1         15       6					100	SP		15 19		F		$\bigotimes$									
Yaldhurst Member of SPRINGSTON FORMATION       8 12 14 N=26       MD       MD       MD       MD       And fine to medium. grades into fine SAND, with trace silt, grey, homogeneous. Medium dense, wet, poorly graded. Sand, fine to medium. grades into fine SAND, with lensoidal silt         0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0 <t< td=""><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>N=34</td><td></td><td>-2</td><td></td><td>$\mathbb{X}$</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>5-</td></t<>								N=34		-2		$\mathbb{X}$									5-
Yaldhurst Member of SPRINGSTON FORMATION       0       4       8       12       4       6         1       0       4       12       1       1       1       1       6         FORMATION       0       4       12       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1						nic				F	-	$\mathbb{K}$									-
Yaldhurst Member of SPRINGSTON FORMATION       N=26       MD					100	toSo				E	-	$\mathbb{X}$									
Yaldhurst Member of SPRINGSTON FORMATION       8       1       6       6       6       6         Yaldhurst Member of SPRINGSTON FORMATION       8       12       1       14       14       14       14       14       14       14       14       14       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16       16						Ro				E	-	$\mathbb{K}$									
Image: SPRINGSTON FORMATION       Image: Spring Sprin	Valdhurst Member	of						8		-1	6-	$\mathbb{N}$			MD						6-
PORMATION       Image: state of the state o	SPRINGSTON	01			100	SPT		12		E	-				MID						Medium dense, wet, poorly graded. Sand,
0       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1	FORMATION							14 N=26		-	-										fine to medium.
00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00       00 <td< td=""><td></td><td></td><td></td><td></td><td></td><td>ic</td><td></td><td></td><td></td><td>E</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>grades into very line SAND</td></td<>						ic				E	-										grades into very line SAND
0       La       5       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -1       -					00	oSon				Eo	7-										7-
0       Ld       5       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s       s					. –	Rota				F	-	×									grades into fine SAND, with lensoidal silt
0       1       5								-		Ē	-	×									
Image: second					00	ΡT		5		-	-										grades into fine to medium SAND, with
N=13       Image: Problem in the second state					Ξ	S		9 N=15		È,	8-										8-
0       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1       1						0		N=15		E-1	-	×									grades into fine SAND, with lensoidal silt,
0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0					0	Sonic				F	-	بب x .×.									
Image: Section of the section of th					10	oto				F	-	×									grades into fine SAND, brown. Medium
8       12         17						<u>~</u>				F	- 9-										grades into fine SAND, grey, with lensoidal
$\begin{array}{ c c c c c } \hline \hline & \hline & 12 \\ \hline & 17 \\ \hline & N=29 \\ \hline & 10 \\ \hline & 10 \\ \hline \end{array} \begin{array}{ c c c c c } \hline & \hline $					0	Г		8		2	-										SAND with minor gravel grav Sand fine
N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=29 N=					10	SP		12 17		E	-				D						Igravel, fine to coarse.
							1	N=29		F	-	×. ,									SAND, with trace silt, grey, homogeneous.
										F	10	×									



### BOREHOLE LOG

BOREHOLE No:BH02 Hole Location:

SHEET 2 OF 3

PROJECT: Ryman	n Ge	otec	:h Ir	ives	stiga	atior	ı				LOC	ATIO	N: 78	Park T	err	ac	е					JOB No: 29759
CO-ORDINATES:	518	308	36.4	18 m	nN						DRI	LL TY	PE: N	lobile	Sor	nic	MS	5100	00	Н	0	LE STARTED: 16/12/13
DI ·	7.1	0	50.0	11 CC							DRI	LL ME	THOE	: Rot	oS	oni	с			Н		LE FINISHED: 16/12/13
DATUM:	/.1 LY	TTF	IT1	937	(15	/12/2	2013 - PostEC	2)			DRI	LL FL	UID: V	Vater	(Ca	asir	ng	only	()	L	00	GGED BY: CRG CHECKED: JKK
GEOLOGICAL								<u> </u>								E	EN(	SINE	ÉE	RIN	IG	DESCRIPTION
GEOLOGICAL UNIT,												ЭĽ	RING		ЗТΗ		μ	J		ŊŊ		SOIL DESCRIPTION
GENERIC NAME, ORIGIN,				(%)								SYMBO	ATHEF	≿	RENG	a)		NGTH	5	SPACI		Soil type, minor components, plasticity or particle size, colour.
MINERAL COMPOSITION.				VERY			TESTS				U	NOI	WEY	DENSI	AR ST	¥)		ME		ECT (	-	ROCK DESCRIPTION
		OSS		RECO	0	0		ES		(E	IIC LO	FICAT	LION	GTH/E	SHE			) ))		DEF		Substance: Rock type, particle size, colour, minor components.
		I UID I	VATER	ORE	<b>IETHC</b>	SASING		AMPL	S.L.	ЕРТН	RAPH	SLASSI		STREN SLASSI	55	000	8	0.00	250	1000	5000	Defects: Type, inclination, thickness, roughness, filling.
Yaldhurst Member	of	1	>	00	nic			0		-	×	0	W	0,0		Ħ	H		Ï		Ï	grades organic rootlets
SPRINGSTON FORMATION				-	toSo				E	-												
					Ro				F	-	کل بور											
				0	F		10			-	× u.x											
				12	SP		17		E-4	11-	Îx Ť											SAND, with trace silt, yellow brown,+1-
							N=33		F	-												homogeneous. Dense, wet, poorly graded.
				0	onic				E	-												
				12	otoS				F	-	×  `````											
					2				E_5	12-	×. ,											12-
				0	F		7		F.	-	×											:
				12	SP		20		E	-	] } ~ •											SAND, with minor gravel (medium).
							N=34		F	-	×											SAND, with trace silt, yellow brown,
				0	onic				E6	13-	×											Sand, fine. Gradational colour change to
				10	otoS				F	-	,											brown grey.
					R				E	-												
				6	Г		5			-	×,			MD								:
				<u>10</u>	SP		12 16		E7	14-	×											14-
							N=28		= '	-	×											
					nic				E	-	`,											-
				100	toSo				F	-	}											:
					Ro				É.	15-												15-
							2		Ē	-	× ,											
				8	PT		7		-	-	×											-
					0.		10 N=17		E	-	_x											
					. <u>.</u>				È,	16-												slow dilatency 16-
				8	Son				E-9	-												sharp colour change to blue grey
				[	Rotc				F	-	 											
							4		E	-												Sandy GRAVEL, yellow grey
FORMATION	L			00	ΓT		4 8		- -	17-	بن بنا											Clayey SILT, purple grey, moderate to high
				_	S		16 N=24		E-10	-	بن بر											SAND, yellow grey, homogeneous.
					. <u>.</u>				F	-												Medium dense, wet, poorly graded. Sand, fine to medium: wood fragments
				8	Son				E	-												grades into very fine to fine SAND, blue
				[	Rotc				ŧ	18-				D								gray, homogeneous, slow dilatancy.
							10		E-11	-	, O											andas into fino SAND vollous anos
				00	ΡT		10 15		-	-												grades into the SAND, yenow grey.
				-	S		18 N=33			-												
							11-55		È	19-	××			MD								SILT, with trace clay, minor lensoidal sand, blue grey, homogeneous, Firm, wet, poorly 19-
				0	onic				E ⁻¹²	-	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~											graded, quick dilatancy. Trace organics.
				²	<b>coto</b>				F	-	¥Ť.											-
										-	<u></u> ₩^_w						$\left  \right  $					
						-			-	20 -	l× w x											
Log Scale 1:50																						BORELOG 29759_CRG.GPJ 17-Jan-201



### BOREHOLE LOG

BOREHOLE No:BH02 Hole Location:

SHEET 3 OF 3

DO-ORDINATES:         StabB308.8 An MN BERRES         DERLITYPE:         MOLE TARGET Source (MOLE FIRATED: 19/2733 DRILLED 19/2703           R.L.         710 m         DRILL PUP:         MOLE TARGET Source (MOLE FIRATED: 19/2733)           DATUM:         TUTHIT1971(5/12/2013-1watc))         DRILL PUP:         Mole Target Source (MOLE FIRATED: 19/2733)           DATUM:         TUTHIT1971(5/12/2013-1watc))         DRILL PUP:         Mole Target Source (MOLE FIRATED: 19/2733)           OPERATION:         TUTHIT1971(5/12/2013-1watc))         DRILL PUP:         Mole Target Source (MOLE FIRATED: 19/2733)           OPERATION:         TUTHIT1971(5/12/2013-1watc))         TUTHIT1971(5/12/2013-1watc))         DRILL PUP:         Mole Target Ta	PROJECT: Rymar	n Geo	otec	ch In	ives	stiga	atior	ı			LOC	ATIO	N: 78	Park T	erra	ace	е					JOB No: 29759
Instruction         Instruction         DRLL PHOD: RobSon:         MOLE FINISHED: 10/12/3           DATUM:         LYTTHING? (IN122013 - Fould)         DRLL FUND: Water (Casing only)         DOGED BY: CRS         DECEDD: INST.           GEOLOGICAL IN Second on the second on the secon	CO-ORDINATES:	518	308	36.4	18 m	ηN					DRI	LL TY	PE: M	obile S	Sor	nic	MS	610	00	F	ю	LE STARTED: 16/12/13
RL: 2.00 DRIME CONCORCAL BOOK (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE Water (Camp Only LOGGI D LYC CSG CHECKED Job C CSC (15/2013-Row C) DRILL PLUE WAter (Camp Only L) LOGGI D LYC CSG CHECKED JOB C CSC (15/2013-Row C) DRILL PLUE WAter (Camp Only L) LOGGI D LYC CSG CHECKED JOB C CSC (15/2013-Row C) DRILL PLUE WATER (15/2013-Row C) DRILL PLUE WAT		156	5998	88.5	5 m	۱E					DRII	LL ME	THOD	: Roto	oSc	onio	с			H	10	LE FINISHED: 16/12/13
DATUM         DITINITION         DESCRIPTION         DESCRIPTION         DESCRIPTION           CECLOGICAL DIT, GENERAL DAT, GENERAL DAT, GENE	R.L.:	7.1	0 m	1771	0.27	(1.5	10/								0-		-				DR	ILLED BY: Pro-Drill
Construction         Construction<	GEOLOGICAL	LY		1119	937	(15)	/12/2	2013 - PostE0	L)		DRI		JID: V	vater (	Ca	ISIF F	IG ( NC		り = F			
Construction with the construction of the second													U		-						NC.	
CAUCH, Marked, COMPORTION         Early big	GENERIC NAME,											BOL	ERIN		NGTH		H کار	Ξ		CING		Soil DESCRIPTION
Instrument         Instra         Ins	ORIGIN, MINERAL COMPOSITION				(%)							I SYN	ЕАТН	≻TIS -	STRE	kPa)	RFS.	ENGT	ì	SPA	(mm	particle size, colour.
Nome         Nome <th< td=""><td></td><td></td><td></td><td></td><td>OVER</td><td></td><td></td><td>TESTS</td><td></td><td></td><td>g</td><td>VIION</td><td>M</td><td>VDEN:</td><td>EAR (</td><td>-</td><td>AMO 0</td><td>STR</td><td></td><td>FEC</td><td>-</td><td>ROCK DESCRIPTION</td></th<>					OVER			TESTS			g	VIION	M	VDEN:	EAR (	-	AMO 0	STR		FEC	-	ROCK DESCRIPTION
CHREATCH INCOM         Image: Section of the sect			rose	۲ ۲	RECO	a	U		) ES	(E) T	-IIC L	SIFIC/	URE TION	IGTH	SH					В		Substance: Rock type, particle size, colour, minor components.
CRRETCHURCH         L   2   2   2   2   2   1   1   1   1   1			I'UID	VATEI	ORE	IETH(	ASIN		AMPL 8.L. (m	EPTH	RAPI	SILASS	TSION COND	TREN	0.9	000	 3	0.00	20	220	0000	Defects: Type, inclination, thickness, roughness, filling.
FORMATION ¹ / ₁	CHRISTCHURCH	I	ш	>	00	L L	0	1	o ⊯ —-13	-	×	0	W	00		Ĥ	H		Ï		Ĥ	
Recentor Gravels         N=18         Image: Second	FORMATION				Ξ	S		7 11	-	-	×											SAND, with trace silt, blue grey. Medium
Recarton Gravels         Iso and a stress of constraint city bin are graved.         Subject of constraint city bin are graved.								N=18	F	-												dense, wet, poorly graded.
Recarton Gaveds         Ist 14 (s) (s) (s) (s) (s) (s) (s) (s) (s) (s)						onic			ΙE	-	<u>w</u> _u											organic odour, woody (spongy?) texture
Recartos Gaveis         14         15         10         Participanda de la statici, nanz- organic (soud) particulas: Siny hen course (da VPE, course give, rund) rund) pastad au         Participanda de la statici, nanz- organic (soud) particulas: Siny hen course (da VPE, course give, rund) rund) pastad au         Participanda de la statici, nanz- organic (soud) pastad au           North         North         -11         22         -11         22           -10         23         -11         23         -11         22           -10         23         -11         23         -11         23           -11         23         -11         24         -11         24           -11         24         -11         24         -11         24           -11         24         -11         24         -11         24           -11         24         -11         24         -11         24           -11         24         -11         24         24         24           -12         24         -12         24         24         24           -13         24         -12         24         24         24           -14         -12         24         -13         24         24					10	otoS				21-	∷ × *⊶											Organic SILT, with minor clay, blue grey. 21-
Recurton Gravels         it         it<         it         it         it						R			-14		× ×											Firm, wet, moderate plasticity, many oorganic (woody) spars/rootlets
Image: Second Carbon         Image: Second Carbon	Riccarton Gravels							14		-	× Oxo		S	D								Silty fine to coarse GRAVEL, grading to
Image: Second					100	SPT		18		-	& ♦											Sandy fine to coarse GRAVEL, orange grey.
Log Sale 1.90 EXECUTE 22- Log Sale 1.90 EXECUTE 23- Log Sale 1.90 EXECUTE						•		23 N=41			×0 -				╢	Ш		$\left  \right $				FoH @ Target Denth - 21 85 m
Ly Scale 1.9										22-												22- 22-
Leg Stark 1:0 Log Stark 1:0 Lo										-												
Lig Stake 1:0 DOC 2019 _ COC COPI 11/20-201										-												-
Log Sake 150										-												
Leg State 1:0										23-												23-
Log Start 1:0 Lo									E-10	-												
Log Scale 1-0 Deg Sc										-												
Leg Stale 1:50										-												-
Leg Scale 1:50										24-												24-
Leg Scale 1:50									-17													
Leg Stale 1:9 DORELOG 2979_CRG.GPT 17.Jan-201										-												
Leg Stake 1:50									E	-												-
Leg Scale 1:50										-												
Leg Scale 1:0 BORELOG 20759_CRG GEP 17-Jan-201- BORELOG 20759_CRG GEP 17-Jan-201-									-18	25-												25-
Leg Scale 1:0									E	-												
Log Scale 1:50									E	-												
Log Scale 1:50										-												-
Log Scale 1:50									E 10	26-												26-
Log Scale 1:50									-19	-												
Log Scale 1:50										_												
Log Scale 1:50										-												-
Log Scale 1:50									E	27-												27-
Log Scale 1:50										<i>21</i> –												27
Log Scale 1:50										-												-
Log Scale 1:50									ΙĒ	-												
Image: Constraint of the second sec									ΙE	-						$\left  \right $						
Draw Log Scale 1:50									21	28-												28-
Log Scale 1:50	E									-												
Definition of the second secon	Tam								ΙĒ	-						$\left  \right $						-
Log Scale 1:50	<u>-</u>								ΙE	-												
Log Scale 1:50	ATE									29-												29-
Log Scale 1:50	IdW									-												
Log Scale 1:50 BORELOG 29759_CRG.GPJ 17-Jan-2014	ATE								ΙE	-						$\left  \right $						
$\frac{1}{100} \text{ Scale 1:50} \qquad \qquad$	DAT									-												
Log Scale 1:50 BORELOG 29759_CRG.GPJ 17-Jan-2014	T+T									30 -												
	Log Scale 1:50													I			<u> 1</u>				<u> </u>	BORELOG 29759_CRG.GPJ 17-Jan-2014



### BOREHOLE LOG

BOREHOLE No:BH03 Hole Location:

SHEET 1 OF 3

PROJECT: Rymar	ו Geo	otec	:h Ir	ves	stiga	atior	ı				LOC	ATIC	N: 78	Park T	erra	ace				JOB No: 29759
CO-ORDINATES:	518	308	59.3	6 m	۱N						DRII	LL TY	PE: N	obile	Soni	ic N	/IS100	00	нс	DLE STARTED: 17/12/13
	157	7002	26.5	4 m	١E						DRII	I ME	тног	. Rot	020	nic			HC	LE FINISHED: 17/12/13
R.L.:	7.1	8 m									DIVI			. 1100	000	nic			DF	ILLED BY: Pro-Drill
DATUM:	LY	TTH	IT19	937	(15/	/12/2	2013 - PostEQ	2)			DRII	LL FL	UID: V	Vater	(Cas	sing	g only)	)	LO	GGED BY: CRG CHECKED: JKK
GEOLOGICAL								_								EN	IGINE	E	RINC	DESCRIPTION
GEOLOGICAL UNIT,												Ч	RING		GTH		۳_		ING	SOIL DESCRIPTION
ORIGIN,				(%)								MB	AT HE	≿	REN	(g)	ESSIV VGTH		n)	Soil type, minor components, plasticity or particle size, colour.
MINERAL COMPOSITION.				ΈRΥ			TESTS				0	NO	ME	ENSI.	AR ST	Ē	MPRI (MF		Ű.	ROCK DESCRIPTION
		SSC		ECO				<i>v</i> .	,	Ê	CLOC	ICAT	ON N	ICAT	SHE/		00		DEFI	Substance: Rock type, particle size, colour, minor components.
		DI LC	TER	RE RI	THOL	SING		L L L	Ē	) HT	APHI	ASSIF	ISTU NDITI	RENG						Defects: Type, inclination, thickness,
		FLU	WA	Ö	ME	CĂ		AAS.	R.L.	DEI	GR	CLA	Q Q	STF CL/	- 25	,220,		- 250	8998c	roughness, filling.
FILL				100	RotoSonic				7 7 7 7 7 7 7 	- - - - - - - - - - - - - - - - - - -			D	MD						Sandy, fine to coarse GRAVEL, with minor silt, light grey, homogeneous. Tightly packed, dry grades to wet, well graded. Gravel, sub-rounded to angular, slightly weathered, greywacke; Sand, fine to coarse, well graded; various building waste throughout (concrete, plastic, electrical wiring etc).
			Ē	100	SPT		8 8 20		-	-			М							
							N=28		Ē	2-	$\bigotimes$		W							2-
					nic				-5	-	$\bigotimes$									
				100	toSo				E	-	$\mathbb{X}$									-
					Roi				F	-	$\mathbb{X}$									
			M				Q		E	3-										3-
			© 8⊿	00	ЪТ		8 11		-4	-	$\bigotimes$									
			ore (6	1	S		17 N-28		Ē	-	$\mathbb{X}$									-
			m c				N=28		E	-	$\mathbb{X}$									
			Fro		onic				F	-	$\bigotimes$									-
				100	toSc				F.	4-	$\bigotimes$									4-
					Ro				=3	-	$\mathbb{X}$									
									E	-	$\bigotimes$			VL						-
				00	F		1		-	-	$\mathbb{N}$									Core loss
Valdhurst Member	r of			=	S		1 N=1		- - 	5-										Sandy, fine to coarse GRAVEL, with minor
SPRINGSTON FORMATION	1 01			100	RotoSonic						×3 +3 ×1 ×3 ×3 ×3			MD						silt, light grey, homogeneous. Tightly packed, dry grades to wet, well graded. Gravel, sub-rounded to angular, slightly weathered, greywacke; Sand, fine to coarse, well graded; various building waste throughout (concrete, plastic, electrical 6
				100	SPT		2 4		1 1	-										wiring etc). Organic SILT, brown. Firm, wet,
							0 N=10		-	-										non-plastic.
					ic				E	-										Organic SILT, grey. Firm, wet, low
				00	Son				F	7-										plasticity. Rootlets7
				-	Rotc				-0	-										Very fine SAND, blue grey, homogeneous. Medium dense, wet, poorly graded, slow
							3			-										grades into fine SAND
				100	3PT		6		E	-										grades into very fine SAND, blue grey,
					•		8 N=14		-	8-										quick dilatancy.
					<b>ں</b>				1 -	-										grades into fine to medium SAND.
amr				00	Soni				F	-										
<u>ē</u>				Ξ	oto				Ē	-										grades into fine SAND, blue grey.
ATE.					R				F	-										
MP.				_	E-		4			-										grades into fine to medium SAND
ATE				100	SPT		6 7		Ē	-										grades into medium SAND, poorty graded
TAC							N=13		E	-										grades into gravelly fine SAND, blue grey.
I									F	- 10	0.0									Tightly packed, wet, moderately well
H		1	1							10	1:0:0		1						ШΙ	F Braded. Oraver, incurum to codise,



### BOREHOLE LOG

BOREHOLE No:BH03 Hole Location:

SHEET 2 OF 3

	Geot	ech	n Inv	ves	tiga	ition	1				LOC		N: 78	Park T	er	race	) NO 1	1000	, ,		JOB No: 29759
JU-URDINATES:	1570	002 002	9.30 6.54	o m 4 m	ηΕ						URIL				20		viS1	1000	י ו ו	-10 -10	LE STARTED: 17/12/13 LE FINISHED: 17/12/13
R.L.:	7.18	m									DRIL		THOL		05	onic	;			DR	ILLED BY: Pro-Drill
JATUM: GEOLOGICAL	LYT	TH	119	037	(15/	12/2	2013 - PostEC	2)					JID: V	Vater	(C)	asın E	g oi NGI	niy) NEE			GGED BY: CRG CHECKED: JKK
GEOLOGICAL UNIT,													0 N		Ŧ				ŋ		SOIL DESCRIPTION
GENERIC NAME, DRIGIN,				(%)								YMBO	THER	≻	ENG.	e (	SSIVE	a) (	PACIN	(,	Soil type, minor components, plasticity or particle size, colour.
INERAL COMPOSITION.				/ERY (			TESTS				0	ION S	WEA	ENSIT	AR ST	(KP	MPRE	MP (MP	ECTS	шш)	ROCK DESCRIPTION
		oss		RECOV	D			S		Ē	IC LOC	FICAT	NOI	3TH/D FICAT	SHF/		8,	0	DEFI		Substance: Rock type, particle size, colour, minor components.
		FLUID L	WATER	CORE F	METHO	CASING		SAMPLE	R.L. (m)	DEPTH	GRAPHI	CLASSII	MOISTL	STRENC	-10	1990 2998 2998	- 20	- 50 - 100 - 250	- 50	- 1000	Defects: Type, inclination, thickness, roughness, filling.
Yaldhurst Member SPRINGSTON	of			100	Sonic				3	-	0.0										sub-rounded to rounded, slightly weathered,
FORMATION					RotoS				E	-	0.0										grades into sandy fine to coarse GRAVEL, blue grey. Tightly packed, wet, well
			ł	0	Г		3		L-	-	×°°°										graded.Sand, fine to medium. grades into gravelly SILT with minor sand
CHRISTCHURCH				10(	SP'		3 6		-	11-											& clay, trace organics, brown grey. Firm,
10Rum Hore							N=9		<u>–</u> -4	-											coarse, sub-rounded to rounded, slightly
				00	Sonic				F	-											weathered, greywacke.
				16	Roto 2				Ē	-											homogeneous. Medium dense, wet, poorly
					I				E_5	12-											grades into medium SAND
				00	ΡT		8 17			-											grades into fine to medium SAND
				-	S		22 N=39		E	-											
					iic				Ē	12											
				100	oSor				6	-											
					Rot				Ē	-											grades into fine SAND
			+				9			-											
				100	SPT		15 19			14-											
			ł				N=34	T	7	-											grades into very fine SAND
					nic				Ē	-											with slow dilatency
				100	toSo				E	-											without dilatency
					Ro				Ę	15-											
			╞				6		8	-	×										with minor lensoidal silt
				100	SPT		14 20		F	-											very fine SAND, blue grey, homogeneous. Medium dense, wet. poorly graded
			ŀ				N=32		-	-											
				_	nic				Ė۵	16-											
				100	otoSc				È.	-											
					R				E	-											with quick dilatency
			ł	0	T		8		Ē	- - 17											with slow dilatency
				10	SP		13 17														
					0		N=30		Ē	-											grades to fine SAND, blue grey,
				00	Sonic				E	-											graded, non-dilatent.
				-	Roto				E	18-	A										with shell fragments, dark blue grey
							0		-11	-	0 0 0										
				100	ЪΤ		9 12			-	0										
			╞	. 1	5		18 N=30	T	-	-	,										grades into medium SAND, without shell
					nic				╞	19-	×_										grades into SILT with minor clay grey
				1.15	toSo				$\mathbb{F}^{-12}$	-	×										bedded. Firm, wet, moderate to high
					Rc				E	-	*_×										piasieity.
			ŀ							-	×, °				11						with minor shell fragments



### BOREHOLE LOG

BOREHOLE No:BH03 Hole Location:

SHEET 3 OF 3

PROJECT: Rymar	ו Ge	otec	:h Ir	nves	stiga	atior	ı				LOC	ATIC	N: 78	Park T	err	ace	;				JOB No: 29759
CO-ORDINATES:	518	308	59.3	36 n	nN						DRI	LL TY	PE: N	lobile S	Sor	nic I	MS1	00	0	нс	DLE STARTED: 17/12/13
	15	7002	26.5	54 n	nE						DRI	LL ME		): Rote	oSc	onic	2			НС	DLE FINISHED: 17/12/13
R.L.:	7.1	8 m TTI	TT1	0.27	(15	10/	012 D 4EC	2)			וחח			Matar	0	!	~ ~			DF	RILLED BY: Pro-Drill
	LY		111	937	(15	12/2	2013 - PosteQ	<i>t)</i>			DRI			valer	(Ca	F	IG OI NGI	NF	FR		DESCRIPTION
													ũ		т				T,		
GENERIC NAME,												ABOL	ERIN		NGT		SIVE	5			Soil type, minor components, plasticity or
ORIGIN, MINERAL COMPOSITION.				3Y (%								NSY	(EAT)	ysit7	STRE	(kPa)	PRES	MPa)		1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2	particle size, colour.
		s		OVEF			TESTS				90	ATIO	5	4/DEN ATIO	IEAR	Ĭ	SOME	5			Substance: Bock type particle size colour
		SO1 (	۲.	REC	ДQ	g		LES	Ê	ЩЩ Ц	HICL	SIFIC	TURE	NGT	ъ С				6	2	minor components.
		FLUIC	WATE	CORE	METH	CASI		SAMF	R.L. (I	DEPT	GRAF	CLAS	MOIS	STRE	25 25	1 3998	5a-1	2200	20	2200	Defects: Type, inclination, thickness, roughness, filling.
				01	PT		4		- 12	-	. p										grades into fine SAND, with some shell
							6				<u></u>										fragments & trace silt. FoH @ Target Denth - 20 25 m
							N=10		-	-											Lon w Target Deptil - 20.25 m.
								I E	-	-											
									-	21-											21-
										-											
									-	-											
									-	-											
									-	22-											22-
									- 												
									-	_											
									-	-											
									-												
									- - 16	23-											23-
									-	-											
									-	-											-
									-	-											
									-	24											24-
									17	-											
									-	-											-
									-	_											
									-	25-											25-
										-											
									-	-											
									-	-											
									-	26											26-
									- 19	20											20-
									-	-											
									-	-											-
									-												
									-	27-											27-
								I E		-											
									-	-											-
									-	-											
									-	28-											28-
										-											
									-												
									-	-											
									-												
1								E	- 22	29-											29-
										-											
									-	-											
-									-	20 -											
Log Scale 1:50		1	1	1	I				-	30			1								BORELOG 29759_CRG.GPJ 17-Jan-201
-																					



### BOREHOLE LOG

BOREHOLE No:BH04 Hole Location:

SHEET 1 OF 3

PROJECT: Rymar	Geote	ech lr	nves	stiga	ation	۱			LOC	ATIO	N: 78	Park T	erra	ce			JOB No: 29759
CO-ORDINATES:	5180	856.4	45 n	nN					DRI	L TY	PE: N	lobile S	Sonic	MS1	000	НС	DLE STARTED: 17/12/13
	1569	974.2	26 n	nE					DRII	L ME	THOE	): Roto	Sor	iic		HC	DLE FINISHED: 17/12/13
R.L.: Datlim:	7.27 t	m ГНТ1	037	(15	/12/2	2013 - PostEC	))		וופח		י י חוו	Vətor (	Cae	ina or	nhv)	DF	
GEOLOGICAL		1 11 1	937	(15)	12/2	2013 - FOSLEC	2)				UID. V	valei (	Cas	ENGI	nee		G DESCRIPTION
GEOLOGICAL UNIT.											ŊG		Ξ			c	SOIL DESCRIPTION
SENERIC NAME,			6							MBOL	HERII		ENGT	SIVE		ACING	Soil type, minor components, plasticity or
UNERAL COMPOSITION.			RY (%							N SY	VEAT	NSITY	(kPa)	PRES	(MPa)	(mm)	particle size, colour. ROCK DESCRIPTION
	0	20 N	COVE			TESTS		~	LOG	CATIC	u z	HUDE	HEAF	COM	5	DEFEC	Substance: Rock type, particle size, colour,
		ËH LÖ	E RE	ЦОН	ß		(m)	TH (m	PHIC	SSIFIG	STUR	ENGT SSIFIG	S				minor components.
	1		COR	MET	CAS		SAM R.L.	DEP	GRA	CLA	MOI	STR CLA	2229	50-50	- 250	- 50 - 250 - 1000 - 2000	roughness, filling.
No Recovery								-									Core Loss
							<del> </del> <del> </del> <del>7</del>	-	$ \rangle/ $								
				onic			I E	-	X								-
			5	otoS				-	$\left  \right\rangle $								
				Å			1 F	1-	1/								1-
Yaldhurst Member	of	-					-6	-	××		М	L					Sandy SILT, with trace organic fragments,
FORMATION						1		-	×								plasticity.
			100	ΓŢ		3		-									grades into fint to medium SAND, green
		M	-			N=6		2-									grey, Fe stain.
		(a) (a)		ji.			-5	-									
		core	100	oSor			∎F	_									
		om		Rot			I E	-	<u> </u>		W	VL					PEAT (fibrous), brownish black, organic
		F						3-	$\frac{1}{2}$								Organia SILT gray Firm wat low to3
			8	Ы		0	Ē,	-	××								moderate plasticity. Large rootlets.
			-	S		0 N-0	4	-	×								Sandy SILT, brownish grey. Soft, wet, low
						N=0		-	××								graded.
				onic			F	-	X, X,								grades into grey SILT, with minor sand.
			100	toSe			I E	4-									poorly graded; rootlets.
				R			-3	-	iu × × ·u								
						0		-	بسير								PEAT (fibrous), brown, with minor
			8	Ы		0	<b>–</b>	-									SILT with minor sand grey Firm wet low
			-	S		1 N-1		5-	<u>~</u>								plasticity. Sand, very fine, poorly graded; 5–
				0		IN-1	-2	-	in in the second								PEAT (fibrous) brown Firm
			0	Sonic			F	_	X X								SILT, with minor lensoidal sand, grey.
			12	oto			I E	-	× 								Firm, wet, low plasticity. Sand, fine, poorly
				2				6-	××								grades, no rootlets 6-
						1		-	××			Т					
			10 1	SP		3		-	××			L					-
						N=6		-	××								grades into fine SAND, with trace silt &
				nic			F	-									organics, blue grey, homogeneous. Loose,
			100	oSo			I E	7-	×								wet, poorly graded, quick dilatency. 7–
				Rot			-0	-	×								
						E		-	×								with lensoidal silt, medium dense
			00	ΡT		3 7	<b>—</b>	-	· · · · · ·								without lensoidal silt
			_	S		10 N-17		8-	× ,			MD					grades into fine to medium SAND 8-
				0		11-17	-1	-	×								
			0	Sonic			F	-	×								-
			Ĕ	toto			I E	-									
								- 9-	×.								Gravely fine to medium SAND blue area
				Г		10	الله ال	-	<b>,</b> 0								homogenous. Dense, wet, well graded.
			10	SP		18 15	<b>–</b> ⁻²	-	0. d								Sand; sub-rounded; gravel, medium to
			$\vdash$			N=33		-	0. 0.								sub-rounded to rounded.
								10 -	0.0								
		-						10	10				111				POPELOG 20750 CPG CPL 17 Jan 201



### BOREHOLE LOG

BOREHOLE No:BH04 Hole Location:

SHEET 2 OF 3

CO-ORDINATES:	5180 1569	)85 )97	6.4	5 m 6 m	N					DRIL	L TY	PE: N	obile	Sonic	MS100	0 HC	DLE STARTED: 17/12/13
R.L.:	7.27	m	T. 20	5 11	-					DRIL	L ME	THOE	: Rot	oSoni	ic	HC DF	DLE FINISHED: 17/12/13 (ILLED BY: Pro-Drill
DATUM:	LYT	ΤH	T19	37 (	(15/	12/2013 - Po	stEQ)			DRIL	L FL	UID: V	Vater	Casi	ng only)	LO	GGED BY: CRG CHECKED
GEOLOGICAL			_									(1)		E	ENGINE T	ERINO T	DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME,											BOL	ERING		NGTH	E H	CING	SOIL DESCRIPTION Soil type, minor components, plasticity or
ORIGIN, MINERAL COMPOSITION.				3Y (%)							N SYN	VEATH	4SITΥ	STRE (kPa)	PRESS RENGT RENGT (MPa)	T SPA (mm)	particle size, colour.
		s		COVEF		TESTS			0	LOG	CATIO	s z	HIDEN	HEAR (	STF ()	EFEC	Substance: Rock type, particle size, colour
	0		ШШ	RE REC	DOH-	9 NI		E E	TH (m)	VPHIC I	SSIFIC	STURE	SSIFIC	5			minor components. Defects: Type, inclination, thickness,
	i	<u> </u>	MA	COF COF	C MET	CAS	0	SAIV R.L.	DEP	GR ²	CLA	MOI	STR CLA	9889 1111	99282-50 99282-50	5200 5400 5200 5200 520	roughness, filling.
SPRINGSTON	51			100	Soni			E3		л-							blue grey, homogeneous. Tightly pack
FORMATION					Roto			Ē	-								wet, well graded. Gravel, sub-rounded
			+			5		E									sand, fine to medium, poorly graded.
				100	SPT	7		-	11-	× 0,0							wet, poorly graded.
			ŀ			N=18		-4		\$2 \$.							grades into silty medium to coarse
					nic			E									Tightly packed, wet, well graded. Gra
				100	otoSc			F		× 0 × 0							sub-rounded to rounded, slightly weat greywacke; sand, fine.
					Ä			Ē	12-	33							PEAT (spongy), with trace gravel & s
			ł	_	r	6		5		· · · ·							medium, rounded.
				100	SP	8		E									Sandy medium to coarse GRAVEL, w trace silt & wood fragments. Tightly
			Ī			N=16		E	-	<u>1/</u> 							packed, wet, poorly graded.
				_	onic			E	13-	· · · ·							Fine to medium SAND, with trace sile
				10(	otoS			6	-				VL				wood fragments/lensoidal peat, grey.
					~			F		3 3							Wood
CHRISTCHURCH			ł	0	н	0		Ē.	-				MD				Organic SILT, with minor lensoidal saturation of the second secon
FORMATION				10	SP	1		-	14-	0			MD				medium.
						N=2		-7	-	, 							Medium SAND, with trace gravel, blu
					onic			F		· · · · >							grey. Medium dense, wet, poorly grad
				100	otoS			E		×							grades into fine SAND, with trace slit
					2			E	15-	×							without silt
				_	r .	7											
				100	SPI	11 19											grades into fine to medium SAND.
			Ī			N=30		E	-								
				0	onic			E.	16	*							<u>.</u>
				<u>1</u>	otoS			E-9	-								grades into SAND, with some shell fragments, dark blueish grey.
					~			F		×			D				grades into fine SAND, blue grey. De
			ł	0	F	6		Ē	17-	×							grades into fine SAND, with trace silt
				10	SP	20		- 10	1/								
					0	N=41		Ē		×							
				8	Soni			E	-								grades into fine to medium SAND, with some shell fragments, dark blueish grades into fine to medium some shell fragments.
				-	Roto			E	18-								
								E-11	-	0.0							
			ſ	00	ΡT	6 12		Ē		4			MD				without shell fragments
			╞		S	13 N=25											
					.c			Ē	19-								
				15	oSon			12		×							grades into fine SAND, with minor
				-	Rote			Ē	-	××							lensoidal silt, blue grey. Medium dens wet, guick dilatancy.
			-						-	××							grades into SILT, with some fine lense
									20 -	· · · ·							sand & trace organic fragments blue g



### BOREHOLE LOG

BOREHOLE No:BH04 Hole Location:

SHEET 3 OF 3

PROJECT: Ryman	Geo	otec	h Ir	nve	stig	atior	า				LOC	CITA	N: 78	Park 7	erra	ace					JOB No: 29759
CO-ORDINATES:	518 156	8085	56.4	15 r 26 r	nN nF						DRI	LL TY	PE: N	lobile	Son	ic N	/IS1	000	Н	IOL	E STARTED: 17/12/13
RI ·	7 27	7 m	- <b>-</b> .2	-01							DRI	LL ME	THO	D: Rot	oSo	nic			Н	10L VRII	E FINISHED: 17/12/13
DATUM:	LYI	ГТН	IT1	937	(15	/12/2	2013 - PostE	Q)			DRI	LL FL	UID: \	Nater	(Ca	sing	g on	ıly)	L	.0G	GED BY: CRG CHECKEI
GEOLOGICAL					<u>`</u>		-									EN	IGI	NEE	RIN	NG I	DESCRIPTION
GEOLOGICAL UNIT,												5	SING		TH		ш		ŊŊ		SOIL DESCRIPTION
generic Name, Origin,				(%)								SYMBo	ATHEF	≥	RENC	(j)	ESSIV NGTH	a)	SPACI	Ê	Soil type, minor components, plasticity or particle size, colour.
MINERAL COMPOSITION.				/ERY			TESTS				U	NOL	ME	ION	AR ST	Ŧ	MPRI	Ψ,	ECT (	Ē	ROCK DESCRIPTION
		OSS		RECO		(1)		S		Ē	ICLO	FICAT	ION	GTHIE	SHE		80		DEF		Substance: Rock type, particle size, colo minor components.
		-UID L	ATER	OREF	ETHO	ASING		AMPLE	(m) F	EPTH	RAPH	LASSI	OISTL	TREN	0.00			.88	000	88	Defects: Type, inclination, thickness, roughness, filling.
		Ē	3	0	M L	Ű	5	Ś	<u>~</u>		o .x∵	0	ΣŬ	ပလဲ	- 612	- A-		0-0	- 100	~~ 	bedded.
				=	S	-	8		13							+					grades into fine SAND, with minor s
							N=18		E	-											EoH @ Target Depth - 20.25 m.
									F	-											~ ~ .
									E	21-											
									-14	-											
									E	-											
									F	-											
									E	22-											
									-15	-											
									E	_											
									F	-											
									E	23-											
									16	-											
									E	_											
									F	-											
									E	24-											
									-17	-											
									E	_											
									F	-											
									E	25-											
									-18	-											
									F	_											
									E	-											
									F	26-											
									E-19	-											
									F	_											
									E	-											
									F	27-											
									E-20	-											
									F	-											
									E	-											
									Ē	28-											
										-	1										
									Ē	-											
									E	-											
									F	29-											
									E_??												
									<b>⊨</b>	-											
									Ē	-											
			l I	1	1	1			F		1		1	1							



### BOREHOLE LOG

BOREHOLE No:BH05 Hole Location:

SHEET 1 OF 3

PROJECT: Ryman	n Geo	tec	h In	ves	stiga	atior	1				LOC	ATIO	N: 78 I	Park T	erra	ice				JOB No: 29759
CO-ORDINATES:	518 157	082	22.6	3 n 7 n	nN nE						DRIL	L TY	PE: M	lobile	Soni	c N	/IS10	00	Н	DLE STARTED: 19/12/13
R.L.:	7.00	00 ) m	14.0	1 11							DRIL	L ME	THOD	): Rot	oSo	nic			H D	DLE FINISHED: 19/12/13 RILLED BY: Pro-Drill
DATUM:	LYI	TH	IT19	937	(15)	/12/2	2013 - PostEQ	))			DRIL	L FL	JID: V	Vater	(Cas	sing	g only	/)	LC	DGGED BY: CRG CHECKED: JKK
GEOLOGICAL								_								EN	IGIN	EE	RIN	G DESCRIPTION
GEOLOGICAL UNIT, GENERIC NAME, ORIGIN, MINERAL COMPOSITION.		SS		ECOVERY (%)			TESTS	0		(F	010	ICATION SYMBOL		TH/DENSITY ICATION	SHEAR STRENGTH	(NT d)	COMPRESSIVE STRENGTH (MPa)	(1411 47)	DEFECT SPACING (mm)	SOIL DESCRIPTION Soil type, minor components, plasticity or particle size, colour. ROCK DESCRIPTION Substance: Rock type, particle size, colour, minor components
		-LUID LO	VATER	CORE RE	VETHOD	CASING		SAMPLE	3.L. (m)	ОЕРТН (I	GRAPHIC	CLASSIF		STRENG	255 50	<u>68</u>	20020-	250	250 1000	Defects: Type, inclination, thickness, roughness, filling.
FILL		ш.	~	100 00	RotoSonic	0		0				0	D	MD						Sandy, fine to coarse GRAVEL, with minor silt, light grey, homogeneous. Tightly packed, dry grades to wet, well graded. Gravel, sub-rounded to angular, slightly weathered, greywacke; Sand, fine to coarse, well graded; various building waste throughout (concrete, plastic, electrical wiring etc).
			-	100	SPT		13 13 16 N=29				$\bigotimes$		W							2-
			М	100	RotoSonic															
			@ 8A]	00	PT		12 7		4	3										3-
Yaldhurst Member SPRINGSTON FORMATION	r of		From core (		nic S		4 N=11			-	×:			F						Sandy SILT, with some organics, dark grey. Firm, wet, low plasticity. Sand, very fine, poorly graded. Organic odour.
				100	RotoSoi					4	× × × × × ×									grades into fine sandy SILT, with minor organics, dark greenish grey. Low plasticity
				100	SPT	-	0 1 1				× × × ×									grades into very fine sandy SILT, with wood fragments, dark brownish grey, organic odour
							N=2		-2	5										5-
				100	RotoSonic						×××			L						grades into fine grey SAND, with minor silt, homogeneous. Medium dense, slow dilatancy
				100	SPT		0 1			-	×									
					onic		/ N=8			- - - - 7-										SAND, with trace silt, yellow grey, homogeneous. Loose, wet, slow dilatancy. Sand, fine, poorly graded
				10	RotoS					- - - -										
				100	SPT		7 10 14 N=24		- - 1					MD						grades into fine to medium SAND, brown grey, homogeneous. Medium dense, 8– non-dilatent
				100	RotoSonic					- - - - - - - - - - - - - - - - -	0 0 0 0			VD						Sandy GRAVEL, yellowish brown grey.
				100	SPT		23 31 19 For 40mm N>50				00000000									well graded, rounded to sub-rounded; gravel, fine to coarse, well graded, rounded to sub-rounded.



### BOREHOLE LOG

BOREHOLE No:BH05 Hole Location:

SHEET 2 OF 3

CD ORDATES:     51802248 gram       RL:     700 a       RL:     700 a       DATUM:     170111971(10122013-19ast0)       DATUM:     170111971(10122013-19ast0)       DRUL MERCENNO DESCRIPTION       DOUGE INSPECTION       DESCRIPTION	PROJECT: Rymar	n Geo	otec	:h Ir	ives	stiga	atior	ı				LOC	ATIO	N: 78	Park T	erra	ice				JOB No: 29759
Hoursenance	CO-ORDINATES:	518	3082	22.6	63 n	ηŅ						DRII	L TY	PE: N	lobile	Soni	ic N	/IS100	00	HC	DLE STARTED: 19/12/13
HL     DOM     DelLL SLUT     DelLL SLUT     Problem       DATIM     LTTITITUTYT (15/12/013 - Notil.Q)     DELL FLUD: Wate (Cating on) LOGGED VC CK     CHCHCED. (KC       GEOLOGICAL     FORMERRING DESCRIPTION     COCCED VC CK     CHCHCED. (KC       GEOLOGICAL     FORMERRING DESCRIPTION     CHCHCED. (KC     CHCHCED. (KC       Value     GEOLOGICAL     FORMERRING DESCRIPTION     CHCHCED. (KC       GEOLOGICAL     FORMERRING DESCRIPTION     CHCHCED. (KC     CHCHCED. (KC       GEOLOGICAL     FORMERRING DESCRIPTION     CHCHCED. (KC     CHCHCED. (KC   <		157	,00,	14.8	37 n	nE						DRII	_L ME	THOE	): Rote	oSoi	nic			HC	LE FINISHED: 19/12/13
GEOLOGICAL         ENGINEERING DESCRIPTION           microscol unit microscol unit microscol microcol microscol microscol microscol microscol micros	DATUM [.]	7.00 LY	U m TTF	IT1	937	(15	/12/2	2013 - PostE	( <b>0</b> )			DRII	I FI	ע יסו∪	Vater	(Cas	sino	a only	)		
EP:D2020-URT GRIN         Ep:D2020-URT GRIN <thep:d2020-urt GRIN         Ep:D2020-URT GRIN</thep:d2020-urt 	GEOLOGICAL	<u> </u>			,,,,	(10)	12/2	2013 10302						012. 1	Tator	(Out	E١		Ē	RING	DESCRIPTION
OWNER, DNOR.         Display	GEOLOGICAL UNIT,												Ļ	SNG		TH				Q	SOIL DESCRIPTION
MILEON CONCOUNT.         Note	GENERIC NAME, ORIGIN,				(%)								YMBC	THER	≿	RENG	9	ESSIVI JGTH (a)		sPACIN	Soil type, minor components, plasticity or particle size, colour.
Bit of the second sec	MINERAL COMPOSITION.				/ERY			TESTS				U	S NOI	WEA	ION	AR ST (kP	5	MPRE (MP		ECT S (mr	ROCK DESCRIPTION
Image: Section of the sectio			OSS		RECO	0	(1)		u u	2	(E	IC LO	FICAT	ION	GTH/D FICAT	SHE		80		DEF	Substance: Rock type, particle size, colour, minor components.
Valuation Member of PORMATION         P         P         P         P         P           Valuation Member of PORMATION         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P         P			I UID I	VATER	CORE F	AETHO	SASING			S.L. (m)	ОЕРТН	BRAPH	CLASSI		STREN	222 252	 200	2000	250	2200 2000 2000	Defects: Type, inclination, thickness, roughness, filling.
SPRINGSTON         O         D         D         D         Fighty packet, model in solv-conside, in packet, model in solv-conside, in adv-conside, in adv-conside, in adv-conse, in adv-conse, adv	Yaldhurst Member	r of		-	8	nic				, <u> </u>	-	0.0	0	W	0,0		Ť		Ì		Sandy GRAVEL, yellowish brown grey.
Image: construction of the construction of	SPRINGSTON FORMATION					otoSo				E	-	0.0			D						Tightly packed, wet. Sand, fine to coarse, well graded, rounded to sub-rounded;
Bits         Bits         Bits         F         MD         SAND, Jellowish Brown, prev.         11           Sign         Bits         Sign         Sign <td></td> <td></td> <td></td> <td></td> <td></td> <td>R</td> <td></td> <td>_</td> <td></td> <td>Ē</td> <td>-</td> <td>0.0</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>gravel, fine to coarse, well graded, rounded</td>						R		_		Ē	-	0.0									gravel, fine to coarse, well graded, rounded
Image: State is a state in the state is a s					00	Ы		9 18			-	0. .0. o									
Image: Solution of the					-	S		13 N=31		–-4 –	-11				MD						SAND, vellowish brown grey,
01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01         01<						<u>.</u> 2		11 51		F	-										homogeneous. Medium dense, wet. Fine to
Image: Christian of the image in t					00	Son				E	-										
Image: Construction of the second s					[	Rote				È,	12										
Image: State in the s								3		Ē											12-
Image: CHRISTCHURCH PORMATION         Im					100	SPT		9			-										
OP         OP<					-			N=23		-	-				D						Gravelly SAND, yellow brown,
Image: CHRISTCHURCH FORMATION         Im						nic				E6	13-	ρο									homogeneous. Dense, wet. Sand, fine to medium, rounded to sub-rounded, poorly
Image: Construction of the start o					100	toSo				Ē	-	0.00									graded; gravel, fine to medium, rounded to
Image: Second						Ro				E	-										
Image: CHRISTCHURCH         Image: CHRISTCHURCH <thimage: christchurch<="" th="">         Image: CHRISTCHURCH</thimage:>								13			-										
Image: Christic HURCH					100	SPT		24 24		7	14-	0.									14-
Image: Christic HURCH FORMATION     Image: Christic HURCH FORMATION     Image: Christic Hurch Hill Hill Hill Hill Hill Hill Hill Hil								N=48			-										
CHRISTCHURCH PORMATION     00 14 10 10 10 10 11 11 11 11 11 11 11 11 11						jic.				F	-	¢			MD						fine to medium SAND
Image: CHRISTCHURCH PORMATION     Image: CHRISTCHURCH Image: CHRISTCHURCH Image: CHRISTCHURCH Image: CHRISTCHURCH PORMATION     Image: CHRISTCHURCH Image: CHRISTCHURCH Ima					100	toSor				E	-										Gravelly SAND, blue grey
CHRISTCHURCH FORMATION     0     13       0     0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     13       0     14       14     14       10     14       11     10       12     14       13     14       14     14       15     14       16     14       17     18       18     10       19     10       10     13       11     14       11     14       12     14        14     14						Rot				8	15-										Wood 15-
CHRISTCHURCH FORMATION     01 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 01 02 02 01 01 01 01 01 01 01 01 01 01 01 01 01								2		E	-										
CHRISTCHURCH FORMATION       00       10       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       18       -11       -11       18 <t< td=""><td></td><td></td><td></td><td></td><td>100</td><td>SPT</td><td></td><td>3</td><td></td><td></td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></t<>					100	SPT		3			-										
Op       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0					_	•1		5 N=8		-	-										SAND, blue grey, homogeneous. Fine7
CHRISTCHURCH FORMATION       00       13         01       13         01       13         01       14         10       14         11       14         11       14         11       14         11       14         11       14         11       14         12       14         13       14         14       14         15       11         16       12         17       13         18       14         19       10         10       13         11       14         11       14         11       14         11       14         11       14         11       14         12       14         13       14         14       14         15       14         16       14         17       14         18       14         19       14         10       14         11       14         <						jic.				E-9	16-	X									<u>SAND, blue grey. Medium</u> 16
Origination					100	0S01				F	-	× Q									Sandy GRAVEL, blue grey
CHRISTCHURCH       0       10       10       10       10       17         N=22       0       0       11       10       17       17         N=22       0       0       11       10       17       17         N=22       0       0       11       10       17       17         SILT, GRAVEL, yellow grey, Tightly       packed, wet, sub rounded       17       17         N=22       0       0       11       10       17         N=22       0       0       13       0       18         Interbedded lenses wet Sand, fine to medium       0       0       18         Interbedded lenses of blue & yellow brown       18       11       18         Interbedded lenses of blue & yellow brown       18       11       11       11         N=25       -12       19       ×       19       5       10       10         Interbedded lense, wet, poorly       13       11       11       12       19       10       10       10       10       10         Interbedded lense, wet, sub rounded       19       10       11       10       10       10       10       10       10 <t< td=""><td></td><td></td><td></td><td></td><td></td><td>Rot</td><td></td><td></td><td></td><td>E</td><td>-</td><td>0</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>Silty GRAVEL, yellow grey. Tightly</td></t<>						Rot				E	-	0									Silty GRAVEL, yellow grey. Tightly
CHRISTCHURCH FORMATION     00     Last 11 11 N=22     11 11 N=22     11 11 N=22     11 11 N=22     11 11 N=22     13 14 11 N=25       CHRISTCHURCH FORMATION     00     Last 13 14 11 N=25     13 14 11 N=25     13 14 11 N=25     13 14 11 N=25     13 14 11 N=25     F       CHRISTCHURCH FORMATION     01     Last 14 11 N=25     13 14 11 N=25     F     F     III N=25     III N=25       CHRISTCHURCH FORMATION     01     Last 14 11 N=25     13 14 11 N=25     F     IIII N=25     IIII N=25     IIII N=25       Log Scale 1:50     00     02     02     20     X     F     IIIII N=25     IIIII N=25								10		-	-	[®] ∂ _X o									lipacked, wet, sub rounded
CHRISTCHURCH FORMATION       0       13 14 11         0       14 12         0       13 14 11         0       14 12         10       14 12         11       15         12       19         14       19         15       11         16       10         17       10<					100	SPT		11		-10	17-										dense, wet 17-
CHRISTCHURCH FORMATION       0       13         0       13         0       14         11       14         11       14         11       14         11       14         11       14         12       19         13       11         14       11         15       12         16       12         17       18         18       11         19       12         11       14         11       14         12       19         14       11         12       19         14       11         15       14         16       14         17       18         18       11         19       12         10       13         11       14         12       19         13       19         14       11         15       19         16       19         17       18         18       19					-			N=22		E	-										Silty GRAVEL, yellow grey. Tightly
CHRISTCHURCH FORMATION       0       0       0       13       -11       18       12       18         11       13       14       14       14       15       16       17       18         11       11       12       14       11       18       11       11       11       11       11       11       11       11       11       11       11       12       12       19       12       14       12       14       12       14       12       14       12       14       12       14       14       14       15       16       16       16       16       16       17       18       11       16       17       18       11       16       18       18       16       16       18       16       16       17       18       11       16       16       16       16       17       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       19       18       19       18       19       18       19       18       18       18       <						nic				F	-	بب بن بن									SAND, yellow grey, homogeneous.
CHRISTCHURCH FORMATION       2       -11       18       1/2       Image: Comparing SLT, dark brown. Firm, odour       18         OB       13       13       14       14       14       15       16       17       18         Image: Comparing SLT, dark brown. Firm, odour       18       14       14       14       14       16       17       18         Image: Comparing SLT, brown       13       14       11       14       16       16       17       18       18       18       18       18       18       18       16       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18       18					100	toSo				Ē	-	ц, , ц									Organic SAND, blue
FORMATION       13       13       14         14       14       14       14         N=25       11       N=25       12       19       ×       F       III       SAND, with some organic fragments       197         15       16       17       18       14       19       ×       F       III       N=25       SAND, with some organic fragments       197         16       17       19       ×       F       III       N=25       SILT, with minor lensoidal fine sand, blue       197         17       18       20       ×       F       III       N=25       SILT, with minor lensoidal fine sand, blue       197         18       20       ×       20       ×       F       IIII       N=10	CHRISTCHURCH	ł				Ro					18-										Organic SILT, dark brown. Firm, odour 18
Image: Construction of the second state of the second s	FORMATION				-	r		13			-	بب بب									SAND, with some organic fragments
N=25 N=25 N=25 F SILT, with minor lensoidal fine sand, blue grey. Firm, wet Log Scale 1:50 N=25 SILT, with minor lensoidal fine sand, blue grey. Firm, wet SILT, with minor lensoidal fine sand, blue grey. Firm, wet minor silt, blue grey. Slow dilatancy BORELOG 29759_CRG.GPJ 17-Jan-2014	DT an				100	TqS		14 11		-	-	بب بب									Fibrous PEAT, brown
Image: Constraint of the second definition of the seco	D. E.							N=25		E	-	ن بنا									blue grey. Medium dense, wet, poorly
Image: Seale 1:50     Image: Seale 1						onic				E ⁻¹²	19-	××			F				$\ $		SILT, with minor lensoidal fine sand blue
Log Scale 1:50	VIEW				100	otoSc				Ē	-	××									grey. Firm, wet
+ Log Scale 1:50	DATZ					R				Ē	-	×									grades into very fint to fine SAND, with
Log Scale 1:50 BORELOG 29759_CRG.GPJ 17-Jan-2014	 				-				H		20 -	×									minor silt, blue grey. Slow dilatancy
	Log Scale 1:50											<u>- x 1</u>							<u> </u>		BORELOG 29759_CRG.GPJ 17-Jan-2014



### BOREHOLE LOG

BOREHOLE No:BH05 Hole Location:

SHEET 3 OF 3

CO-CREMATE:         51802283 mB         DRIL:         TYPE:         Mode South MS:00         HOLE STARTED:         97/33           RL:         7.00 m         DRIL:         TYPE:         Mode South MS:00         PRILED BY: Pro-Dail         PRILED BY: Pro-Dail           DATUM:         TYPE:         Mode South MS:00         PRILED BY: Pro-Dail         PRILED BY: Pro-Dail         PRILED BY: Pro-Dail           GEOLOGICAL         TYPE:         Mode South MS:00         PRILED BY: Pro-Dail         PRILED BY: Pro-Dail         PRILED BY: Pro-Dail           GEOLOGICAL         TYPE:         Mode South MS:00         PRILE TYPE: Mode South MS:00         PRILED BY: Pro-Dail         PRILED BY: Pro-Dail           GEOLOGICAL         TYPE:         Mode South MS:00         PRILE TYPE: Mode South MS:00         PRILE TYPE: Mode South MS:00         PRILETYPE: Mode South MS:00         PRILETYPE: Mode South MS:00           GEOLOGICAL         TYPE: Mode South MS:00         PRILETYPE: Mode South MS:00         PRILETYPE: Mode South MS:00         PRILETYPE: Mode South MS:00         PRILETYPE: Mode South MS:00           GEOLOGICAL         TYPE: Mode South MS:00         PRILETYPE: Mode South MS:00           CIRRETCURRCH         Bit MS:00         PRILETYPE: Mode South	PROJECT: Ryma	PROJECT: Ryman Geotech Investigation											CATIO	N: 78	Park T	err	ace	e				JOB No: 29759							
ISUDIA Print         DRULL METHOD.         Recentor Cases de la construcción de la construne la construcción de la construne la construcción de	CO-ORDINATES	: 51	808	22.6	63 m	nΝ				DRILL TYPE: Mobile Sonic MS1000 HOLE STARTED: 19/12/13												LE STARTED: 19/12/13							
RL:     7.00 ar     DRUE     DRUE PUID:     DRUE PUID: <thdrue puid:<="" th="">     DRUE P</thdrue>		15	700	14.8	37 m	nΕ					DRILL METHOD: RotoSonic HOLE FINISHED: 19/12/13																		
DATADAT     DITITUTY (EXELAD) - YING (DECAD)     DITITUTY (EXELAD) - YING (DECA	R.L.:	7.0	0 m	1711		(15	11.21	012 D4E																					
Decision L resolution (Conversion (Response)         V (S) (S) (S) (S) (S) (S) (S) (S) (S) (S)		LY	111	111	937	(15/	/12/2	2013 - PostE	Q)		DRILL FLUID: Water (Casing only)											ERING DESCRIPTION							
Characterization         Non-24														U		-													
CHCR. Werste Connorman         Entry	GENERIC NAME,												1BOL	IERIN		NGTH			E		CING		Soil DESCRIPTION Soil type, minor components, plasticity or						
Image: Section Converse         Image: Section	ORIGIN, MINERAL COMPOSITION	L			× (%)								N SYN	EATH	× II	STRE	kPa)		ENG	vira)	T SP	(mm	particle size, colour.						
Normal         Norma         Norma         Norma <td></td> <td></td> <td>l o</td> <td></td> <td>OVEF</td> <td></td> <td></td> <td>TESTS</td> <td></td> <td></td> <td></td> <td>g</td> <td>ATIO</td> <td>5</td> <td>4/DEN ATION</td> <td>IEAR</td> <td>Ŭ</td> <td></td> <td>STR</td> <td>-</td> <td>EFEC</td> <td>Ŭ</td> <td>ROCK DESCRIPTION Substance: Rock type particle size colour</td>			l o		OVEF			TESTS				g	ATIO	5	4/DEN ATION	IEAR	Ŭ		STR	-	EFEC	Ŭ	ROCK DESCRIPTION Substance: Rock type particle size colour						
Understand         Underst			LOS	۲.	REC	ДQ	g		ES	Ê	Ш Н	HICL	SIFIC	TURE	NGTH SIFIC	Ŷ					õ		minor components.						
CHRISTCHURCH         E         E         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S         S <t< td=""><td></td><td></td><td>FLUID</td><td>WATE</td><td>CORE</td><td>METH</td><td>CASIN</td><td></td><td>SAMP</td><td>R.L. (r</td><td>DEPT</td><td>GRAP</td><td>CLAS</td><td>MOIS'</td><td>STRE CLAS:</td><td>10 25</td><td>200 100</td><td>907-43 1</td><td>285</td><td>250</td><td>50 250</td><td>2000 2000</td><td>Defects: Type, inclination, thickness, roughness, filling.</td></t<>			FLUID	WATE	CORE	METH	CASIN		SAMP	R.L. (r	DEPT	GRAP	CLAS	MOIS'	STRE CLAS:	10 25	200 100	907-43 1	285	250	50 250	2000 2000	Defects: Type, inclination, thickness, roughness, filling.						
PORMATION       Image: Constraint or grants or grant or grants or	CHRISTCHURC	Н	-	-	8	Ld	-	5	-	-		۶×و		W								Ħ	with shell fragments						
Recurton Gravels         Image: Second Control of Second Control Control of Second Control Contervity ana control Control Control Control Contervity and contr	FORMATION					01		5 4			-	К.	]										SILT, with minor organic rootlets &						
Riccation Gravels         Is						<u>.</u>		N=9		F	-	× ×											odour						
Riccarton Gravels         15 15 123         14 21 25 26 26         12 25 26 26         D         Shift file in course GRAVEL orange grey. Tightly packed, wet.         21 Shift file in course GRAVEL orange grey. Tightly packed, wet.           N=44         -16         22         23         24         54         24           -16         22         -16         22         24         54         24           -16         22         -16         22         24         54         24           -16         22         -16         22         24         24         24           -17         24         -16         22         24         24         24           -17         24         -17         24         24         24         24           -18         25         -18         25         25         26         26           -18         25         -18         24         24         24         24         24           -18         25         -18         26         26         26         26         26           -18         25         -19         26         26         26         26         26         26         26         26					8	Son				F	-		]																
Recarton Gravels         Ist Stress         D         SklyThe to course GRAVEL, grading or SklyThe to course GRAVEL, grading or SklyThe to course GRAVEL, grading or SklyThe to course GRAVEL, orange grey.           Recarton Gravels         Ist Stress         22         SklyThe to course GRAVEL, orange grey.         24           Ist Stress         -15         22         -16         23         23           Ist Stress         -16         23         -16         23         23           Ist Stress         -17         24         -17         24         24           Ist Stress         -18         25         -18         25         25           Ist Stress         -19         26         -19         26         26           Ist Stress         -21         28         25         25         26           Ist Stress         -22         29         26         26         26           Ist Stress         -21         28         28         28         28           Ist Stress         -22         29         29         29         29           Ist Stress         -19         -10         -10         21         28           Ist Stress         -19         -10         -10         -					-	Roto				-14	21-	ĺ _× ×											21-						
Recarton Gravels         15										E	-	× _																	
Image: Solution of the second secon	Riccarton Gravel	s				r		15			_	0 e			D								Silty fine to coarse GRAVEL, grading to						
N=44         -15         2.2         Eall @ Target Depth - 21.85 m.         2.2           -16         2.3         -16         2.3         2.3           -16         2.3         -16         2.4         2.4           -17         2.4         -16         2.5         2.5           -18         2.5         -17         2.4         2.4           -19         2.6         -20         2.7         2.5           -20         2.7         2.6         2.6         2.6           -20         2.7         2.7         2.7         2.7           -20         2.7         2.7         2.7         2.7           -20         2.7         2.7         2.7         2.7           -21         2.8         2.9         2.9         2.9           -21         2.0         -1         2.9         2.9					100	LdS		15 29		-	-	0.0											Tightly packed, wet.						
Log Sale 159			$\vdash$					N=44		- 15		. <i>U</i> . e				╈	+	$\left  \right $				╈	EoH @ Target Depth - 21.85 m.						
										-15																			
Hunton Line and Line										F	-																		
Ling Schiel 159										E	-																		
Ligs stale 1:59										È.	-																		
Ling State 1:9										F ⁻¹⁶	23-	1											23-						
-17 24 -18 25 -18 25 -19 26 -19 26 -20 27 -21 28 -21 28										E	-																		
Line Line Line Line Line Line Line Line										F	-												-						
Hard Hard Hard Hard Hard Hard Hard Hard										F	-																		
Line Loop 200 277 200 277 27 -20 277 27 -21 28 28 -22 29 27 -22 29 27 -22 29 27 -22 29 20 -22 29 20 -23 20 -24 20 -25 20 -26 20 -27 20 -20 27 -20 27 -20 27 -20 27 -20 27 -20 27 -20 27 -20 27 -20 27 -20 27 -21 28 -20 27 -21 28 -20 27 -21 28 -21 29 -21 29 -21 28 -21 29 -21 29 -21 29 -21 28 -21 29 -21 29 -21 29 -21 29 -21 29 -21 29 -21 29 -21 29 -21 28 -21 29 -21 2										-17	24-												24-						
Long Sale 1:50										F	-																		
Lig Sale 1:0										F	-												-						
Ling Scale 1:0										E	-																		
Log Sade 1:9 BORELOG 2979_CRG.GPI 17.Jm-201 BORELOG 2979_CRG.MM-201 BORELOG 2979_CRG.MM-201										-18	25-												25-						
Ling Stake 1:50										E	-																		
Ling Scale 1:50 DOELOG 20759_CRG GPI 17Jan-201 BORELOG 20759_CRG										E	-																		
Ling Scale 1:50										F	-																		
Lug Stale 1:50										E 10	26												26						
Log Scale 1:50										E-19	20-												20-						
Log Scale 1:50										F	-																		
Log Scale 1:50										F	-												-						
Log Scale 1:50										E	-																		
Log Scale 1:50										20	27-												27-						
Log Scale 1:50										F	-																		
Log Scale 1:50										E	-																		
Log Scale 1:50										F	-																		
Image: Scale 1:50											28-	1											28-						
Log Scale 1:50         BORELOG 29759_CRG.GPJ 17-Jan-201										E	-																		
Log Scale 1:50	amm									F	-												-						
BUT HULL         -22         29         29           Log Scale 1:50         BORELOG 29759_CRG.GPJ 17-Jan-201         BORELOG 29759_CRG.GPJ 17-Jan-201	GDT									F	-	1																	
Image: Constraint of the second sec	ATE.									E_??	- 29-												20-						
Image: Constraint of the second sec	MPL.									<b>⊢</b> ⁻	29 - -	1											29-						
Log Scale 1:50         BORELOG 29759_CRG.GPJ 17-Jan-201	ATE									F	-	1																	
E	DAT.									E	-	]																	
Log Scale 1:50 BORELOG 29759_CRG.GPJ 17-Jan-201-										F	30 -	1																	
	Log Scale 1:50		1	1						1	50	1	1	1		11	11						BORELOG 29759_CRG.GPJ 17-Jan-201-						



### BOREHOLE LOG

BOREHOLE No:BH06 Hole Location:

SHEET 1 OF 3

PROJECT: Rymar		LOCATION: 78 Park Terrace JOB No: 29759																		
CO-ORDINATES:	DRILL TYPE: Mobile Sonic MS1000 HOLE STARTED: 18/12/13												LE STARTED: 18/12/13							
	157	002	21.3	5 m	ιE					LE FINISHED: 18/12/13										
R.L.:	6.97	7 m									DRIL	L ME	THOL	: Roto	Sor	nic			DR	ILLED BY: Pro-Drill
DATUM:	LY	ГТН	IT19	937	(15/	/12/2	2013 - PostEQ	2)			DRIL	L FL	UID: V	Vater (	Cas	sing	g only)		LO	GGED BY: CRG CHECKED: JKK
GEOLOGICAL													-			ΕN	IGINE	EF	RING	DESCRIPTION
GEOLOGICAL UNIT,													NG		ΓH	Τ			ŋ	SOIL DESCRIPTION
GENERIC NAME,				(9								MBO	HER		ENG		SSIVE		ACIN	Soil type, minor components, plasticity or
MINERAL COMPOSITION.				۲Y (%								NSγ	VEAT	ISITY	STRI (kPa)		PRES KENG MPa)		⊥SP (mm)	particle size, colour.
		S		OVEF			TESTS				8	ATIO	1	VDEN ATIOI	EAR		STF ()		E C	Substance: Pock type particle size colour
		ros	æ	REC	ас	υ		S	Ê	E)	HC L	SIFIC	URE TION	NGTH SIFIC	SH		0		ä	minor components.
		OID-	ATE	ORE	ЕТНО	ASIN		MPL	ڪ ا	EPTH	RAPI	LASS	OIST	TREN	0000	88	0088			Defects: Type, inclination, thickness, roughness, filling.
EILI		Ē	3	Õ	Σ	Û		5	⊆ n ∠	ā		ō	ΣÕ	ώÖ MD	= 2026 = + + + +	≈≈- 	->≈≈≈=	1 2	sa≈a +++	Sandy fine to coarse CPAVEL with minor
FILL				100	RotoSonic					- - - - - - - - - - - - - - - - - - -				WID						saild, light grey, homogeneous. Tightly packed, dry grades to wet, well graded. Gravel, sub-rounded to angular, slightly weathered, greywacke; Sand, fine to coarse, well graded; various building waste throughout (concrete, plastic, electrical wiring etc).
			-	100	SPT		6 6 6			-	$\bigotimes$		W							
							N=12		-5	2-	$\bigotimes$									2-
				100	toSonic					-	$\bigotimes$									
					Ro				F	-	$\bigotimes$									
			AM				7		-4	3-	$\mathbb{K}$									3-
			<u>a</u> 9,	00	РТ		7		E	-	$\bigotimes$									-
			ore (	-	S		4 N-11			-	$\mathbb{X}$									-
Yaldhurst Membe SPRINGSTON FORMATION	r of		From co		onic		N=11		-	-	× × × × × ×									SILT, with trace organics, grey. Firm, wet, low plasticity.
				100	toSc				=3	4-	×									Silty very fine SAND, grey, homogeneous.
					Ro				F	-	× ^									Medium dense, wet, poorly graded.
									F	_	×			УЛ						SILT, grey. Firm, wet, low plasticity.
				_	Γ		0		-	-	$\mathbb{Z}_{\sqrt{2}}$			VL						Organic SILT brown Firm wet
				10(	SP		0		E,		× ×									non-plastic. Organic odour, rootlets.
							N=0		ĘŹ	5-	×									
				00	Sonic					-	×× ×									grades into SILT, with minor clay & organic fragments, grey. Firm, wet, low plasticity. Wood and rootlets.
				-	Roto				E,	-				MD						Very fine SAND, with trace silt, grey. Medium dense, wet, poorly graded.
							1		_ 1	6-										with slow dilatancy 6-
				100	SPT		5			-										grades into the SAND, without dilatancy
					•1		7 N=12			-										-
					2				F	-										with minor lensoidal silt
				0	onid				<b>-</b> 0	7-	Î									Fine SAND, grey, homogeneous. Medium 7–
				10	otoS				F	-										dense, wet, poorly graded
					R				E	-	× ,									Fine to medium SAND, with trace silt,
							5		_	-	×									wet, poorly graded.
				100	$\mathbf{PT}$		10			-	x.									
				_	S.		9 N=19		1	8-										8_
GDT amm				100	otoSonic		N=17				000 00 00 00			VD						Sandy fine to coarse GRAVEL, with trace fine red gravel(?), yellow grey, homogeneous. Tightly packed, wet, well graded. Gravel, sub-rounded to rounded,
TE.					Ŗ				E,	-	0 . <i>O</i>									medium.
DLA							15		2	9-	00									without red gravel
TEM				100	3PT		27		F	-	0.0									-
ATA				. ,			23 For 120mm		50	-	0,-1									
L D							101 1201111	Ĩ	F	-	00									
- H									E_	10 -	0									-

Log Scale 1:50



### BOREHOLE LOG

BOREHOLE No:BH06 Hole Location:

SHEET 2 OF 3

CO-ORDINATES: 5180796.17 mN										DRILL	_ TY	PE: N	lobile	Sonic	MS1	HOLE STARTED: 18/12/13							
	1570	021	1.35 r	nΕ						ייוקר	ME		). Rot	nSoni	ic.		HC	LE FINISHED: 18/12/13					
R.L.:	6.97 1	m															DR	ILLED BY: Pro-Drill					
	LYT	ΓΗΊ	F1937	(15	/12/20	013 - PostE0	2)			DRILL	_ FLI	JID: V	Vater	(Casii		ly)							
	-							1				U		-			RINC						
GEOLOGICAL UNIT, GENERIC NAME,											<b>ABOL</b>	TERIN		NGTH	LINE		CING	Soil bescription Soil type, minor components, plasticity or					
ORIGIN, MINERAL COMPOSITION.			2Y (%)								N SYN	/EATH	ISITY	STRE (kPa)	RESS	MPa)	T SP/	particle size, colour.					
		s	OVEF			TESTS				8	ATIO	5	4 DEN	HEAR (	STF	Ŭ	EFEC	Substance: Rock type particle size colou					
			REC	ДQ	ġ		LES	Ê	Ш Щ	HICL	SIFIC	TURE	NGTH	ş			ā	minor components.					
			CORE	METH	CASI		SAMF	R.L. (I	DEPT	GRAF	CLAS	MOIS	STRE	- 10 - 25 - 100	1 20-1-20 1-20-1-20	- 100	- 250	Defects: Type, inclination, thickness, roughness, filling.					
Yaldhurst Member	of		100	onic				F										sandy bed					
FORMATION				otoSo				F		0.0			D					Sandy fine to coarse GRAVEL, yello					
				Å				E										homogeneous. Tightly packed, wet, we graded. Gravel, sub-rounded to round					
			0	Т		15 26		-		20								slightly weathered, greywacke; sand,					
			1	SF		20N=46		-4		0.0								meaium.					
								E															
			0	onic				F		a			MD					Fine to medium SAND, with trace m					
			10	otoS				Ē		0								gravel, yellow grey.					
				2				5	12									homogeneous. Tightly packed, wet, v					
				<u> </u>		4		F										graded. Gravel, sub-rounded to round					
			10	SP		6		F	-									medium.					
						N=13	T	F										Fine to medium SAND, with trace m					
				nic				6	13-	0								Fine SAND, with some wood fragme					
			100	toSo				E										blue.					
				Ro				F		0								gravel, yellow grey. With Fe stain.					
						11		_	-[. - ;ç	0								Fine SAND, with some wood fragme					
			100	SPT		14		7										Wood					
						14 N=28				0.0								Fine to medium SAND, blue grey,					
				5				E	 ċ									homogenous. Medium dense, wet, po graded.					
			8	Soni				F		20								Gravelly medium SAND, blue grey.					
			Ē	Loto				E.		00								fine to coarse, sub-rounded, slightly					
								E-0	15-1*									weathered greywacke.					
				L.		8		-		0								wet, poorly graded.					
			10	SP		18 18		E		0 q								Gravelly medium SAND, blue grey.					
						N=36	T	-	-0	0. d								fine to coarse, sub-rounded, slightly					
								F-9	16-	۰,								weathered greywacke.					
								E										orange grey, homogeneous. Tightly p					
								F										wet, well graded. Gravel, sub-rounde					
				nic				E	-1.	0.0								Isand, fine.					
			100	oSol				-10	17-c									grades into brown grey					
				Rot				F		0								Fine SAND, blue grey. Medium dens					
								E										poorly graded.					
								F										Tightly packed. [no fines, see note]					
								E-11	18-	<								Gravelly SAND, blue grey. [no fines,					
CHRISTCHURCH						-		F		< l								grades into fine SAND. with minor s					
FURMATION			00	L		5 12		┡	];	< ]								grey. Medium dense, wet, poorly gra					
			Ĕ	SI		14 N=26		E										with trace gravel					
						N=26		E-12		<u>,</u>								grades into silty very fine SAND, gre					
									19-13									Medium dense, wet, poorly graded, s					
				0				Ē										with some shell fragments					
				Jonic				E										without shell fragements					
			00	oto				F	20	\$								with trace shell fragments					
a 1 4 60			1-	L M				F	20 1						1111	11		with some shell fragments					



### BOREHOLE LOG

BOREHOLE No:BH06 Hole Location:

SHEET 3 OF 3

PROJECT: Rymar	PROJECT: Ryman Geotech Investigation LOCATION: 78 Park Terrace												JOB No: 29759														
CO-ORDINATES:	CO-ORDINATES: 5180796.17 mN										DRILL TYPE: Mobile Sonic MS1000 HOLE STARTED: 18/12/13																
	157	7002	21.3	85 m	ηΕ				DRILL METHOD: RotoSonic HOLE FINISHED: 18/12/13												OLE FINISHED: 18/12/13						
R.L.:	6.9	7 m															0			DI	RILLED BY: Pro-Drill						
DATUM:	LY	TTF	HT19	937	(15/	/12/2	2013 - PostEQ	2)	DRILL FLUID: Water (Casing only)										)	LOGGED BY: CRG CHECKED: JKK							
GEOLOGICAL									1				(1)			E	INC.	JINE									
GEOLOGICAL UNIT,												ğ	BNIN		GTH		Ľ	-		5NG	SOIL DESCRIPTION						
ORIGIN,				(%)								SYME	ATHE	È	TREN	a)		NGTH Pa)		SPAC m)	Soil type, minor components, plasticity or particle size, colour.						
MINERAL COMPOSITION.				VERY			TESTS				U	NOL	ME	DENSI	AR S ⁻	(kF	MPR	STRE (M		ECT E	ROCK DESCRIPTION						
		OSS		ECO'	0			S		(E	IC LO	FICAT	INE ION	3TH/E FICA1	SHE					DEF	Substance: Rock type, particle size, colour, minor components.						
		n n n	ATER	DREF	ETHO	SING		MPLE	E	PTH	APH	ASSI	DISTL	REN		_ 00	ļ			- 88	B Defects: Type, inclination, thickness,						
CHRISTCHURCH	r	Ē	ŝ	8 8	ME	ç		SA	Ľ.	DE	5	5	ĕ ö	ST CL	22 22	398	°-∘	882	- 25	8:828 							
FORMATION	1								E	_	×	1									SILT, with trace organic fragments & clay,						
									F	-	Ĩ~_~~										grey. Stiff, wet, moderate plasticity. Rootlets & wood.						
									F	-	<u>*</u> _*																
									F.,	-	lý –										grades into very fine SAND, with some silt,						
									E-14		<u>^··</u> ··								Ħ		grey. Medium dense, wet, poorly graded. 21						
									F	-											FoH @ 21 m - Target Depth						
									F	-											End of hole touched Riccarton Gravels.						
									F	-											Shoe malfunction @ 15.8 - drill string						
									15	22-											installed. Casing advance stopped at 18.1 22-						
									F	-											but misalinged head, SPT unavailable. 2nd shoe lost downhole during piezo install						
									F	_																	
									F	_																	
									E 16	-																	
									E-10	23-											23-						
									F	-																	
									F	_																	
									F	_																	
									E-17	24-											24-						
									F	-																	
									F	_	1																
									F	-																	
									E-18	25																	
									-10	25-											25-						
									F	_																	
									F	-																	
									E	_																	
									19	26-											26-						
									F	-																	
									F	_																	
									E	-																	
									20	27-											27-						
									F	2/ _																	
									F	-																	
									E	-																	
									E	-																	
									21	28-											28-						
-									F	-	1																
amn									F	_																	
GDI									E	-	1										:						
ATE									L_22	20-	1																
APL/									È	29 <b>-</b>											29-						
VIEV									F	_	1																
AT/									E	-	1																
									E	-	1																
Log Scale 1:50		1	1				I		L	30 -											BORELOG 29759 CRG.GPJ 17-Jan-201						
~																											



### BOREHOLE LOG

BOREHOLE No:BH07 Hole Location:

SHEET 1 OF 1

PROJECT: Ryman Geotech Investigation								LOCATION: 78 Park Terrace												JOB No: 29759	
CO-ORDINATES:	518	808	16.3	6 n	۱N						DRII	L TY	PE: M	obile	So	nic	MS	100	0	HC	DLE STARTED: 19/12/13
D.L.	10/	000	/ <del>+</del> .0	<i>i</i> 11	10						DRII	L ME	THOD	: Rot	oS	oni	с			HC	DLE FINISHED: 19/12/13
K.L.:	7.00	J m TTT	IT14	727	(15	/12/	2012 De-4DC				ייסס	1 5 1		Votor	( <b>C</b> )					UF	
	LY	111	112	131	(15	12/2	2013 - PostEQ	U					י טוע: ע	valer	ιUi	asif ⊏		лпу) ¦IN⊏	FF		
													Q		<b>-</b>				T		
GENERIC NAME,												BOL	ERIN		NGTH		IVE N	Ŧ		SUCING	Soil type, minor components, plasticity or
ORIGIN, MINERAL COMPOSITION				X (%)								I SYN	EATH	×11	STRE	(Pa)	RESS	dPa)		A mu	particle size, colour.
				OVER			TESTS				g	VIION	×	DEN	EAR	÷	MO MD	STR ()		5	ROCK DESCRIPTION
		LOSS	~	RECO	g	U		E E	-	E)	IC L(	IFICA	URE	IGTH	L HS	5				2	Substance: Rock type, particle size, colour, minor components.
		IUD	VATEI	ORE	IETH(	ASIN		AMPL	<u>-</u>	EPTI	RAPI	SILASS	TSION COND	TREN	0.4	1000	 3	0.000		000	Defects: Type, inclination, thickness, roughness, filling.
FILL		ш	5	0	2	0		ں 	r		xx	0	20	s O					Ĥ		Sandy, fine to coarse GRAVEL, with minor
			1.375 @ 19/12/2013   1.305 @ 13/01/2014						5.5 5.0 5.5	0.5											silt, light grey, homogeneous. Tightly packed, dry grades to wet, well graded. Gravel, sub-rounded to angular, slightly weathered, greywacke; Sand, fine to coarse, well graded; various building waste throughout (concrete, plastic, electrical wiring etc). 1.0 1.0 2.0
									.0	3.0											EoH @ Target Depth - 3.0 m.
										_											
										-											-
								F.	5	25					$\left  \right $			$\left  \right  \right $	$\left  \right  \right $		
								$ E^3$	.5	3.5-					$\left  \right $			$\left  \right  \right $	$\left  \right  \right $		3.5-
								ΙE		-					$\left  \right $			$\left  \right  \right $			
								E		-					$\left  \right $			$\left  \right  \right $			
										_					$\left  \right $			$\left  \right  \right $			:
								==	.0	4.0-					$\left  \right $			$\left  \right  \right $			4.0-
								F		_					$\left  \right  \right $						
								ΙE		_								$\left  \right  \right $			
								ΙE		-					$\left  \right $			$\left  \right  \right $			
									-						$\left  \right $			$\left  \right  \right $			:
								F²	.5	4.5-					$\left  \right $			$\left  \right  \right $			4.5-
								I E		-								$\left  \right  \right $			
										-					$\left  \right $			$\left  \right  \right $	$\left  \right  \right $		
										-					$\ \ $			$\left  \right  \right $			
										5 -											-

CPT Data



**Client: TONKIN & TAYLOR** 





**Client: TONKIN & TAYLOR** 







**Client: TONKIN & TAYLOR** 






Elevation:

Coordinate system:

Operator: Javan Cassidy

Date of test: 17/12/2013 03:14:02



Termination Remark: Tip load

### **Project: 78 PARK TERRACE**

Pore Pressure Ratio, Bq

0

Friction Ratio (%)

4

0.5

6

8 -100

Checked by: Emma Stickland

0

100

-0.5

2

650 0



Penetration

Dissipation Test

600

Inclination (degrees

10

Pause

500

वा

400

Assumed In-situ Pore Pressure u₀ (kPa)

300

Page 2 of 2

Dynamic Pore Water Pressure **u**₂ (kPa)

















Client: TON	KIN & TAYLOR	Project:	Project: 78 PARK TERRACE												
0 (iii) (iii) (iii) (iii) (iii) (iii)	Cone Resistance qt (MPa)           4         6         8         10           0.2         0.4         10         10         10         10         10         100         200         250		20 22 24 26 1 1.2 1.3 500 550 600 650	Pore Pressure Ratio, E -1 -0.5 0 ( Friction Ratio (%) 0 2 4	Bq Ass 1.5 1 Dyr 6 8 -100 0	umed In-situ Pore Press namic Pore Water Press 100 200 3	sure u₀ (kPa) Pei Pai ure u₂ (kPa)      Dis Tei 00 400 500	netration use sispation st 600 0 10 21							
Lange     Sand     0     50       16     17     0     50       17     18     0     50       18     19     0     70       20     20     7     7       22     23     7     7       23     24     25     26       26     27     28     29	Friction Sleeve Resistance f         100       150       200       250         100       150       200       100         100       150       200       250         100       150       200       250         100       150       200       250         100       150       200       250         100       150       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100       100         100       100       100			Friction Ratio (%)											
Cone area (mm2):1500 Cone ID: S15CFIIP.835 Operator: Javan Cassidy		Location: Christchurch Coordinates: , Elevation: Coordinate system:	Remarks:	1	Date of plot: Lankelma 19-12-13 PNZ2258 Checked by: Emma Stickland	Project Ref: TES Page 2	<b>T ID: CPT07</b> 2 of 2	11 1							























# C1 Introduction

T+T has undertaken a dewatering assessment for the Proposed Village development at the Bishopspark and Peterborough sites, Because the proposed basements will be constructed below the water table at both sites, construction of these basements requires mechanical support of the excavation and dewatering to allow work in the dry.

This summary sets out our dewatering assessment for resource consenting purposes.

### C2 Our understanding of the proposed works

The Proposed Village works comprise extensive basements at the two sites which cover approximately 85% of the site area at both the Park Terrace and Bishopspark sites.

To allow construction of these basements, excavation of soils up to 4.8 m depth is required with the basement floor to approximately 3.5 m depth. A summary of the excavation areas are shown in Table C.1. The natural groundwater levels are shallow at a depth of approximately 1.5 m below ground level (bgl) at both sites. This means that excavation at the sites are expected to encounter groundwater ingress below this level. In order to work in reasonably dry conditions, groundwater will need to be removed via dewatering (pumping) during the basement excavation and basement construction works.

Village	Site area	Basement area	Estimated groundwater level	Estimated volume of material below natural groundwater level
Peterborough	5,078 m ²	4,300 m ²	1.5 m bgl	12,500 m ³
Bishopspark	10,929 m ²	9,300 m ²	1.5 m bgl	37,900 m ³

#### Table C.1: Summary of proposed excavations and volumes

Ingress of groundwater into deep excavations will be restricted by the placement of piles around the excavation which are also essential for stability of the excavation. The proposed retention system around the perimeter of the excavations is welded steel clutch tubes which will limit any horizontal groundwater seepages entering through the wall system. Groundwater flows will occur through the base of the excavation.

At the Park Terrace site, concrete piles exist at the site (the old building foundations) and extend to a depth of approximately 9 m bgl. As part of the site enabling works, some of these piles may be removed and depending on the method of removal some groundwater seepages and/or additional inflows may occur into the excavation which will need to be managed during the construction period. The piling may also cause hydraulic connections, and this risk will be managed during construction by blocking flows if they occur.

Given the site locations and the close proximity to the Avon River (as shown in Figure A.1), there will be a relationship between the river, and the aquifer affected by the excavation.



*Figure C.1: Site outline of two sites; Bishopspark and Peterborough, and the close proximity of the Avon River.* 

# C3 Geology and hydrogeology

The shallow site-specific geology (ie within 10 m of the surface) for both the Bishopspark and Peterborough sites comprise alluvial deposits of sand, silt, gravel and peat. There is some variation in the thickness of each layer across the sites, as summarised below. However, these layers are generally laterally extensive and typical of the geology in the wider area beyond the sites.

These shallow alluvial deposits for the Bishopspark site are described as predominantly:

- Interbedded firm, sandy silt and loose sand/silty sand (of the Springston Formation) to a depth of up to 3.5 m;
- Up to 4.3 m thickness of peat within a very soft silt matrix to a depth of up to 8 m; and
- Up to 3 m thickness of loose silty sand, firm sandy silt and medium dense to dense sandy gravel to a depth of up to 10.95 m.

The shallow alluvial deposits for the Park Terrace site are described as predominantly:

- Interbedded firm, sandy silt and loose sand/silty sand (of the Springston Formation) to a depth of up to 3.0 m overlying up to 6 m of fill and/or topsoil;
- Up to 2.6 m thickness of peat within a very soft silt matrix to a depth of up to 5.5 m; and
- Up to 2 m thickness of loose silty sand, firm sandy silt and medium dense to dense sandy gravel to a depth of up to 13.7 m.

Groundwater is encountered in the upper layers of silt and sand at depths of approximately 1.5 m bgl at both sites. This shallow groundwater forms a water table (unconfined aquifer) in the shallow geology ie within 10 m of the surface. Deeper groundwater (confined aquifer) exists in the Riccarton gravels at depths greater than 20 m bgl beneath a layer of stiff silt and sandy silt. The Riccarton aquifer has artesian water pressures, meaning the groundwater in this aquifer is pressurised, but is being confined by the overlying layers.

Groundwater flow in the shallow water table aquifer at the sites is assumed to be toward the Avon River. Groundwater movement through the shallow deposits (through flow) will be variable across the sites, with preferential flow through the shallow sand and deeper gravel. Provided that there is no leakage from the Riccarton aquifer, flows into the proposed excavations are expected to be from the shallow water table aquifer via the base of the excavation.

# C4 Surrounding environment

### C4.1 Avon River

The Avon River is located adjacent to Park Terrace and approximately 30 m west of the sites at the closest point. During normal dry conditions, water level of the Avon River is approximately 4 m below the ground level at the Bishopspark and Peterborough sites and is estimated to be at a similar level to the base of the proposed excavations.

The groundwater in the water table aquifer at the sites is assumed to be hydraulically connected to the Avon River. This means that the Avon River is likely to be receiving some groundwater flow from the shallow groundwater at the sites. It is also possible that the Avon River is supporting groundwater flows in the water table aquifer by leakage through the river bed.

Therefore, the Avon River is a sensitive receptor and could potentially be affected by the proposed dewatering activities at the sites by the lowering of the groundwater levels in the local area and having a stream depletion effect on the river. This effect is mitigated by the discharge of water from the excavation back into the Avon (via the stormwater network), and is discussed in more detail in Section C8.

### C4.2 Groundwater users

There are a number of groundwater (bore) users in the local area. The depressurisation of the aquifer could therefore have an effect on the water levels in any shallow groundwater bores in the local area. Our dewatering assessment models the potential changes to groundwater levels based on the surrounding external influences. This means that different results can be presented on each side of the sites. Each of the bores nearby is addressed below.

A review of the local bores in the area shows that the closest bore with an active take is shown to be bore M35/2325 located at 447A Montreal Street approximately 230 northeast of (the centre of) Bishopspark site. This bore is owned by Christchurch City Council (CCC) and is reported to be 31.7 m deep with a groundwater take for community supply (likely to be from the Riccarton aquifer). This bore is considerably deeper than the proposed depth for dewatering and we therefore assess that, based on the setback and depth of Bore M35/2325, the proposed excavation will not have consequential effects.

The nearest, most shallow depth bore, reported to have an active take is bore M35/18558, located at Hagley Park approximately 530 m southwest of (the centre of) Park Terrace site. This bore is reported to be 23 m deep and has a groundwater take for domestic supply. The use of this water is questionable since there are no domestic properties in the area and the bore is located beside a recreational boating pond. A secondary use of groundwater monitoring is noted for this bore. Two other bores located around the periphery of the pond and drilled at the same time as bore M35/18558 also have a secondary use of groundwater monitoring. We assess that, based on the setback of Bore M35/18558, the proposed excavation will not have consequential effects on that bore.

# C5 Groundwater Modelling

Our assessment is based on understanding the potential inflows of groundwater into the proposed excavation from the surrounding area and from the Avon River. This is to allow us to determine the volume of dewatering at the Bishopspark and Peterborough sites and the possible effect around the village.

We have developed a multi-layer 3D transient groundwater model, using groundwater modelling software known as AnAqSim¹² to assess the anticipated groundwater inflows into the excavations and to assess the potential stream depletion effect of the Avon River. The transient groundwater model means multiple assessments can be made through time and over the course of the dewatering activity. This is because changes occur to the amount of drawdown over time as groundwater table is lowered and maintained at a lower level during the course of the dewatering activity.

To allow the set-up of the model, we have made a number of assumptions where actual data are not immediately available, as described below. This means that the current model is conservative and can be refined once site specific data have been obtained. We have adopted the hydraulic conductivities presented in Table C.2 for the dewatering assessment, and have varied the hydraulic conductivity as part of our sensitivity study. These values are based on site specific investigations, and are generally consistent with parameters adopted around Christchurch.

Depth (m bgl)	Lithology	Adopted hydraulic conductivity (m/s)	Notes
0-3.5	Sand	5 x 10 ⁻⁵	
3.5 – 7.5	Peat	5 x 10 ⁻⁷	Varied from 5 x $10^{-6}$ to 5 x $10^{-8}$ to obtain range of flows
7.5 – 12	Sand	5 x 10 ⁻⁵	
12 – 20	Coarse sand	5 x 10 ⁻⁴	
River Avon	Sandy silt	7 x 10 ⁻⁶	River bed conductance estimated as $7 \times 10^{-6}$ m/s, based on river width = 15 m and a bed thickness = 1 m.

#### Table C.2: Adopted input parameters

### C6 Assumptions

The multi-layer 3D transient groundwater model is based on the following assumptions to make a conservative assessment:

- Entire footprint of both the Bishopspark and Peterborough sites is used to represent the basement excavation extent;
- Ground conditions were adopted from the investigations contained within this report;
- Proposed excavation is supported by sheet piles to 12 m bgl;
- Static groundwater level is 1.5 m bgl and the groundwater flow is horizontal across the sites;
- Aquifer input parameters for permeability (hydraulic conductivity) is based on a secondary source for the aquifer in the Springston Formation¹³;

¹² AnAqSim – **An**alytical **Aq**uifer **Sim**ulator is a highly versatile Analytic Element Method (AEM) groundwater modelling software developed by Charlie Fitts <u>www.fitssgeosolutions.com</u>.

¹³ <u>https://nzgeothermal.org.nz/app/uploads/2016/11/12June2015_1-2_AQUALINC-Rutter.pdf</u>.

- Aquifer input parameters for porosity and storativity are based on published values¹⁴ and using our hydrogeological judgement;
- Values of stream bed conductance (leakage) are based on adopted values using our hydrogeological judgement;
- The duration of the dewatering is estimated to be around 18 months; and
- For this assessment has been based on the geological and hydrogeological conditions for Bishopspark.

# C7 Limitations

The limitations of our groundwater model is the absence of site specific data. Our estimates of the aquifer input parameters (hydraulic conductivity and storativity) are based on reporting by others rather than site specific values. All of these input parameters can vary significantly and the model results are sensitive to these hydraulic input parameters. Therefore, the results provide a range of the anticipated groundwater inflow rates and stream depletion effects on the Avon River, and a conservative approach has been adopted. The parameters will be confirmed by geotechnical testing to obtain site specific data.

### C8 Results

The model assesses how much dewatering is required to maintain a dry excavation, with an initial depth selected to 4.4 m, by the amount of groundwater inflow to the excavation. The results are a function of the input aquifer parameters and Avon River bed permeability values. We have included a range of hydraulic input parameters with sensitivity analysis for our model, which has resulted in the range of groundwater inflow and stream deletion rates.

The results of our groundwater modelling show groundwater inflows into the basement excavation are calculated to be in the order of:

- 12 to 50 Litres/second (L/s) or 43 to 180 m³/hr after two weeks of the dewatering (1,000 4,300 m³/d); and
- 3 to 17 L/s or 11 to 60 m³/hr after approximately 100 days of dewatering  $(250 1,500 \text{ m}^3/\text{d})$ .

Based on these reported results, the pumped volumes will require management and control during the dewatering on the Bishopspark and Peterborough sites. This assessment assumes that both these excavations will be completed concurrently, whereas in reality the work may be sequential. These groundwater inflows are based on flows from the shallow water table aquifer.

Groundwater inflow rates, and thus dewatering volumes are expected to be greatest during the early stages of dewatering to remove water from storage i.e. lowering of the water table within the excavation. As the groundwater levels are lowered, a cone of depression expands out from the dewatering point and the rates of inflow approach steady state of the throughput by the aquifer.

Our groundwater modelling shows that the stream depletion effects will be up to 80% of these groundwater inflow rates, with the range provided below:

- 10 to 40 L/s or 36 to 145 m³/hr after two weeks of the dewatering ( $865 3,500 \text{ m}^3/\text{d}$ ); and
- 2 to 14 L/s or 7 to 50 m³/hr after approximately 100 days of dewatering (170 1,200 m³/d).

The Avon River is located at around the same elevation as the proposed basement excavation. Based on our modelling, as the duration of dewatering continues, the proportion of groundwater

¹⁴ Morris, D.A. and A.I. Johnson, 1967. Summary of hydrologic and physical properties of rock and soil materials as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey, U.S. Geological Survey Water-Supply Paper 1839-D, 42p.

inflows that comprise water loss from the Avon River increases. However, any dewatering that occurs will discharge directly into the stormwater network, after treatment to address any elevated total suspended solids (TSS). The stormwater network discharges directly into the Avon River. Hence, while the Avon River is potentially affected by the dewatering through loss of flow, any stream depletion effects are mitigated by the effects of the direct discharge (returning the treated discharge to the Avon via the stormwater network).

The thickness of peat around the Site means that this layer could be subject to the effects of consolidation if it is dewatered. The proposed perimeter wall around the excavations limits any horizontal groundwater flow, which then restricts the amount of dewatering in the adjacent in-situ strata. The underlying sand layer (through which water flows into the excavation) has strong recharge from the surrounding area. Combined with the retention system, the potential to cause consolidation (settlement) adjacent to the sites through dewatering is minimal, and we do not assess any consequential settlement risks.

	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	т т	-	- T	Τ.	Τ.	т	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	1 I I	1	11	1	1	1	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
				-		±	
	· · ·	1	1	1	1	1	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
						T	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	тт	-	Ŧ	Ŧ	Ŧ	т	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	1 f	1	1	1	1		
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	۰.	т.	+	+	+	
	· +	+	Ŧ	Ŧ	× .	1	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
			1.1				
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
			1.1				
	т т	- T		Τ.	Τ.	T	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	1.1	1	1	1	1	1	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	· · · · ·	1		1			
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	<u>ц</u> , ,		1	+	+	+	
	. +	+	Ŧ	т,	τ.		
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	· *	т	1	1	1	•	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	1 C			1.1	1.0	-	
	+ +	+	+	+	+	+	
	+ +	+	+	+	+	+	
	+ + + +	+ +	+ +	+ +	+ +	+	
	+ + + +	+++++	++++++	+ + +	+ + +	++++	
	+ + + + + +	+ + +	+ + +	+ + +	+ + +	+ +	
	+ + + + + +	+ + +	+ + +	+ + +	+ + +	+ + +	
	+ + + + + + + +	+ + +	+ + + + .	+ + + + .	+ + + + .	+ + +	
	+ + + + + + + + + +	+ + + +	+ + + + +	+ + + +	+ + + +	+ + + +	
	+ + + + + + + + + +	+ + + + +	+ + + + +	+ + + + + +	+ + + + + +	+ + + +	
	+ + + + + + + + + +	+ + + + +	+ + + + +	+ + + + +	+ + + + + +	+ + + + +	
	+ + + + + + + + + + + + + +	+ + + + + +	+ + + + + +	+ + + + + + + +	+ + + + + + +	+ + + + +	
	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + +	+ + + + + + +	+ + + + + + +	+ + + + + + +	+ + + + + + +	
www.topkintaylor.co.pz	+ + + + + + + + + + + + + + + + + + +	+ + + + + + + +	+ + + + + + + + + + +	+ + + + + + +	+ + + + + + + +	+ + + + + + + +	
www.tonkintaylor.co.nz	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + +	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + +	
www.tonkintaylor.co.nz	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + + + + + + + + + + +	+ + + + + + + + +	+ + + + + + + + .	+ + + + + + + + .	+ + + + + + + + + +	
www.tonkintaylor.co.nz	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + + + + + + + + + + +	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + + + +	
www.tonkintaylor.co.nz	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + +	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + + +	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + + + +	
www.tonkintaylor.co.nz	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ $+$ $+$ $+$ $+$ $+$ $+$ $+$ $+$	+ + + + + + + + + + + + +	

+ + +

+ +