

Rotokohu Investments Limited c/- Mount Hobson Group Attention: Mark Benjamin By email: MarkB@mhg.co.nz Our Reference: P -002646 22 January 2025

Dear Mark,

50 Westney Road, Mängere – Proposed Land Use Change Geotechnical Desk Study Report

1. Introduction

Initia Limited (Initia) has been engaged by Rotokohu Investments Limited to undertake a geotechnical desktop study for the proposed land use change for the property situated at 50 Westney Road, Māngere.

This Geotechnical Assessment Report (GAR) has been prepared to present the findings of the desktop study and to provide an opinion at to the suitable of the land for future light industrial development.

A previous report¹ was prepared by Initia for minor earthworks and pavement construction associated with a carpark development at the rear (eastern end of the property) in May 2021. This earlier report has been referenced for the purpose of assessing suitability of the land for light industrial development.

2. Background

We understand that the site is currently zoned as residential with a specific SPCA precinct and requires a land use change to light industrial to allow future development. It is understood that future development would comprise industrial buildings up to 20 m high. Moderately to heavily loaded floor slabs (30 to 40 kPa live load) are anticipated for development of this type.

3. Site Description

The site is located at 50 Westney Road, Māngere, and is approximately 4.0 Ha in area. The western half of the site is currently occupied by an SPCA Precinct, comprising several buildings, pavements and grassed areas. The eastern half of the site is occupied by a recently developed hardstanding carpark. Several medium to large trees are present across the site, particularly in the west of the site.

According to Auckland Council GIS Contours, the site is generally level, grading from 14.5 m RL in the south-western corner to 15.0 m RL in the north-eastern corner. It is understood that, as part of the development of the hardstanding carpark, the eastern half of the site was regraded.

The site is bounded by Westney Road to the west, Zayed College to the north, and residential properties to the east. Several light industrial buildings and carparking facilities are present to the south of the site. The Pukaki Inlet is approximately 350 m south-east of the site.

¹ Initia. Proposed Carpark – 50 Westney Road, Mangere. Geotechnical Assessment Report. Initia Ref. P-000747. Dated May 2021

A review of historic aerial photographs indicated that the SPCA precinct on the site was first developed around 1988 and appeared to have been used for agricultural purposes prior. Minor alterations and structures have been added to the precinct since then.



Figure 1: Aerial Photograph of 50 Westney Road

4. Geology

Based on a review of the published geological maps (see Figure 2 below) for the area and historical geotechnical data from the New Zealand Geotechnical Database (NZGD), the site is inferred to be underlain by Puketoka Formation soils (see cream colour unit on Figure 2) These soils typically comprise pumiceous mud, sand and gravel with muddy peat and lignite. Auckland Volcanic Field basaltic tuff is mapped 1.4 km east of the site and it is possible that a veneer of volcanic ash mantles the site.





Figure 2: Published Geological Map of Mangere

5. Geotechnical Investigations

Historic Investigations

Historical investigations are available for the site from the New Zealand Geotechnical Database and from historical Initia projects. The reference investigations are described in detail below.

Drillwell Exploration NZ 1998

Between 11 & 13 October 1998 Drillwell Exploration NZ undertook the boring of a well centrally at 50 Westney Road. The drilling was completed under the supervision of Tonkin + Taylor. The bored well was taken to a depth of 69.88 m. The bored well log has been sourced from the New Zealand Geotechnical Database and is attached in Appendix B and the location is presented on Figure 2646-G01 in Appendix A.

Riley Consultants 2015

Riley Consultants undertook geotechnical investigations at the subject site in January 2015 comprising of 11 No. hand auger boreholes taken to between 3 and 4.5 m bgl. These investigations were completed to assess the suitability of the site for future development.

The Riley hand auger borehole logs are attached in Appendix B and the location is presented on Figure 2646-G01 in Appendix A.

Initia 2021

A geotechnical investigation was carried out by Initia on the 12th and 13th of April 2021 at 50 Westney Road for the hardstanding carpark development. The investigation comprised 9 No. test pits excavated by Wilkinson Civil Ltd using a 13-tonne excavator and 4 No. hand auger boreholes. The investigations were completed under the supervision of an Engineering Geologist from Initia. A summary of the Initia investigations is presented in Table 1 below and locations are shown on Figure 2646-G01 in Appendix A. Logs are attached in Appendix B.



Investigation	Investigation	Coord (NZ	linates TM) ¹	Ground Surface	Termination
ID	Туре	Easting (mE)	Northing (mN)	(m RL) ²	(m BGL)
HA01	Hand Auger	1759536	5905841	15.0	1.8
HA02	Hand Auger	1759580	5905857	14.4	2.0
HA03	Hand Auger	1759589	5905803	14.5	2.0
HA04	Hand Auger	1759544	5905787	14.6	1.8
TP01	Test Pit	1759558	5905878	14.7	2.4
TP02	Test Pit	1759582	5905891	16.6	3.0
TP03	Test Pit	1759606	5905839	14.3	2.3
TP04	Test Pit	1759622	5905830	17.3	3.0
TP05	Test Pit	1759563	5905821	14.7	2.4
TP06	Test Pit	1759512	5905806	15.2	2.7
TP07	Test Pit	1759569	5905762	14.6	2.7
TP08	Test Pit	1759602	5905777	17.3	3.0
TP09	Test Pit	1759536	5905841	15.0	2.1

Table 1: Summary of Historic Investigations

6. Subsurface Model

With reference to the published geological maps and historic investigation results presented above, the site is inferred to be underlain by a veneer of weather volcanic ash (Auckland Volcanic Formation) overlying Takaanini Formation soils (formerly Puketoka Formation). A summary of the inferred ground model is presented on Table 2 below.

It is important to note that the subsurface model has been developed using shallow investigation data and one deep well borehole. Detailed geotechnical investigations, comprising Cone Penetration Tests (CPTs) and/or machine drilled boreholes will be required for future light industrial development.

Table 2: Inferred Site Subsurface Model

Unit	Anticipated Lithology	Depth Below Ground Level (m)	Typical Layer Thickness (m)
Topsoil	Stiff silt	0.0	0.1 - 0.3
Historic Fill	Gravelly silt, mixed topsoil	0.0	0.3 - 1.0
Auckland Volcanic Field: Weathered Volcanic Ash	Very stiff to hard clayey Silt	0.1 - 0.3	0.7 - 1.3
	Stiff to very stiff clayey silt	0.9 - 1.4	0.7 - 1.0
Takaanini Formation Curlow Mombor	Firm to stiff PEAT	1.7 - 2.3	2.5 to 5
(formerly Puketoka Formation)	Silty sand/sandy SILT, loose to medium dense	5 to 7	15.0
	Silty SAND (medium dense to dense)	19	20
Takaanini Formation Otahuhu Member (formerly Kaawa Formation)	Shelly sand, dense to very dense	39.0	>70 m (Not proven)

Groundwater



Historic investigations typically encountered groundwater 2.0 m to 3.0 m below ground current levels, i.e. RL 12 to 13 m. The measured groundwater is expected to be perched with regional groundwater levels likely controlled by the Pukaki Inlet (intertidal), which is approximately 400 m southeast of the site

7. Geotechnical Considerations

The following geotechnical considerations are considered pertinent to the proposed site land use change to future light industrial:

- Site seismicity and subsoil class;
- Liquefaction susceptibility;
- Slope stability;
- Settlement risk and ground improvements; and
- Foundations.

The advice and recommendations presented in this report are based on a desktop study and previous geotechnical investigation data and local project experience. Future proposed development will require site/project specific geotechnical investigations.

Site Seismicity and subsoil class

Based on our knowledge of the site and the area, the depth to rock is likely to be greater than 70 m bgl. Therefore, our preliminary assessment is that the site is classified **Site Subsoil Class D (Deep Soil)** in accordance with Table 3.2 of NZS 1170.5:2004.

The peak ground accelerations for geotechnical analyses have been derived using the MBIE Geotechnical Earthquake Engineering Guidelines, Module 1, we have assumed the following in deriving the seismic design loading:

- 50 years design life for the proposed building;
- Important level 2 IL2;
- SLS return period 1 in 25 years return period events; and
- ULS return period 1 in 500 years return period events.

The geotechnical peak ground accelerations calculated for the site and the associated effective magnitudes are assumed in Table 3 below.

Table 3: Summary of Design Peak Ground Acceleration

Design Seismic Parameters	Serviceability Limit State	Ultimate Limit State
Peak Ground Acceleration	0.05	0.19 ¹
Effective Earthquake Magnitude	5.9	6.5 ¹

Note 1: The ULS magnitude and PGA are derived lower bounds recommended in MBIE Module 1 – Earthquake engineering practice (November 2021).

Liquefaction Susceptibility

The site is underlain by an upper layer of cohesive soils comprising volcanic ash, and fine-grained units of the Takaanini Formation (formerly Upper Puketoka Formation clayey silt and peat). The upper cohesive soil layers likely extend at least 5.0 m below ground level. The underlying soils comprise interbedded layers of silty SAND and sandy SILT with variable density (loose to dense).

While the upper cohesive soils are non-liquefiable under SLS and ULS seismic events, the sandy SILT and silty SAND units of the Takaanini Formation Curlew Member are potentially liquefiable under ULS



levels of shaking. Based on our experience in the region, potentially liquefiable layers are usually discrete and non-continuous; however, they can be cumulatively between 2 and 5 m in thickness.

Given the presence of a non-liquefiable surface 'crust' which is expected to be at least 5 m thick, the consequential effects of liquefaction within layers of loose/medium dense silty SAND are likely to limited to total and differential settlements (free-field). There is a negligible risk of foundation punching failure, SILT/SAND ejecta and lateral spread under a ULS event.

Overall, it is anticipated that the consequences of liquefaction occurring at depths of 5 m or more below the site will be low and tolerable to light industrial buildings (avoiding geotechnical collapse mechanisms and preserving life-safety, as is required under the building code). We also note that the subsurface conditions beneath surrounding light industrial development (Airport Oaks and Verissimo Drive) have similarly liquefaction susceptible soils at depth and these sites have been successfully developed by design for management of liquefaction related effects (total and differential settlements).

We consider that liquefaction susceptibility is a risk that can be adequately managed by suitable investigation and design and does not preclude the suitability of the site for light industrial development. Detailed investigations and quantitative liquefaction analyses will be required as part of any proposed future development at the site..

Slope Stability

The site is generally level with ground surface levels varying between approximately 14.5 m and 15.0 m RL. The site is also located approximately 350 m from the western most edge of the Pukaki Inlet, where the ground levels reduce from approximately 15.0 m RL to sea level.

Given the 'flat' site levels and significant offset from the coastal fringe, the site slope instability hazard is negligible and does not need to be considered for future development which will be sited at or near to current ground levels.

Settlement risk and ground improvements

Proposed future development at the site is understood to comprise light industrial buildings up to 20 m in height. Such development can include moderately to heavily loaded floor slabs (30 to 40 kPa live load). Therefore, settlement of organic soils (PEAT) which are present at shallow depths (~5m bgl), will likely be the key geotechnical consideration/risk for future development.

As outlined in Section 6, the site is inferred to be underlain by a layer of high strength cohesive AVF clayey silt, and upper Takaanini Formation cohesive soils overlying moderately to highly compressible PEAT. The magnitude of potential settlement will depend on building floor loads, finished floor levels (relative to existing site levels) and the thickness, strength and compressibility of the PEAT and other low strength soil units. This will need to be confirmed by detailed investigation and appropriate design once project proposals are developed.

Where post-construction settlements are estimated to be greater than those which can be tolerated by typical light industrial buildings (portal framed structures with post tensioned floor slabs bearing on grade), some level of ground improvement may be required prior to building construction.

Preloading is likely to be the most cost-effective ground improvement option for management of settlement risk and has been employed on several nearby sites within 500 m of the subject site. Preloading involves placing temporary fill embankments at building platforms prior to constructing the buildings. The preload consolidates the underlying soils prior thus limiting post-construction building settlements to allowable tolerances.

Preloading requirements will depend on building loads, ground conditions and allowable settlement tolerances and will therefore be subject to investigation and analysis during design and consenting phases.



Other settlement mitigation options which could be employed include:

- Load compensated building platforms (undercutting below current site levels, possibly in combination with replacement using lightweight fill)
- Installation of rigid inclusions (e.g. rammed aggregate piers, timber poles, unreinforced concrete columns) at regular centres (1.5 to 2.5 m grids) beneath the building with a load transfer platform above (e.g. geogrid reinforced hardfill raft)
- Fully suspended floor slabs on piles end bearing on dense SAND layers.

In summary, whilst the near surface soils are susceptible to consolidations settlement, there are several proven/effective ground improvement options which can be employed, where necessary, to mitigate adequately mitigate this risk. Such options have been successfully used on nearby sites at Verissimo Drive, with similar ground conditions to the subject site.

Foundation Options

The near surface soils are typically high strength, (>70 kPa undrained shear strength) and therefore likely favourable for support of the proposed light industrial buildings on shallow foundations. Settlement risk will need to be assessed under SLS loading conditions.

Given the nature of likely future buildings, i.e. warehouse structures, shallow foundation pad and strip footings are expected to be suitable. Pad/strip footings will likely need to be tied together with ground beams to limit differential vertical and lateral displacement under seismic and static conditions.

8. Conclusions

The following key conclusions are made in relation to the geotechnical suitability of the site at 50 Westney Road, Māngere for light industrial development, in support of a plan change application.

Subsurface Conditions:

The site is expected to be underlain by a layer of surficial topsoil/ isolated fill, overlying AVF clayey silt and Takaanini Formation soils. The Takaanini Formation 'Curlew Member' soils likely extend to depths of circa 40 m bgl and comprise upper cohesive clayey silt/silty clay, PEAT, and interbedded loose to dense silty SAND/sandy SILT and hard SILT. Dense to very dense shelly SANDs of the Otahuhu Member (formerly known as Kaawa Formation sands) is expected to be present at ~ 39 m bgl.

Seismic Considerations:

- 2. The site is expected to be Site Subsoil Class D, in accordance with NZS 1170.5.
- 3. The risk of liquefaction trigger under a ULS seismic event is moderate in the deeper soils below an upper non-liquefiable crust of approximately 5 m.
- 4. The consequential effects of liquefaction in soils at 5 m below ground level (ULS event) are likely to be low and limited to free-field surface settlement. Such effects can be mitigated by appropriate design.

Slope Stability:

5. Given the flat grade of the site its significant offset from the costal fringe, slope instability is not a risk to future development.

Settlement Risk and Ground Improvements:

6. As the site is underlain by PEAT and other compressible soils, static settlement is expected to be the key geotechnical consideration/constraint to future light industrial development.



However, this risk can be suitably managed with appropriately designed ground improvement, where required.

7. Preloading is expected to be the most cost-effective ground improvement option and has been successfully utilised on other nearby light industrial sites on Verissimo Drive.

Foundations

8. Given the presence of a relatively high strength soil mantle at the site, shallow foundations are expected to be suitable for future light industrial structure, provided settlement considerations are appropriately addressed.

Investigations and Design

9. Any future proposed development at the site should be subject to detailed geotechnical investigation, design and construction monitoring.

9. Summary

Based on the findings of this geotechnical desk top study, we conclude that the site at 50 Westney Road is generally suitable for light industrial development. There are geotechnical issues – principally the presence of compressible soils - which will need to be resolved by suitable geotechnical investigation and design; however, this should not preclude the use of the land for future light industrial buildings. In addition, we note that surrounding land to the south and south west has similar ground conditions to those inferred at this site and has been successfully developed into large footprint warehousing and other storage facilities.

10. Applicability

This desk study has been prepared for Rotokohu Investments Limited, with respect to the brief provided to us. The advice and recommendations presented in this report should not be applied to any other project or used in any other context without prior written approval from Initia Limited.

Report prepared by,

Freddie Thomlinson Geotechnical Engineer

Report approved by,

Nick Speight Senior Geotechnical Engineer



Appendix A: Figures





Appendix B: Historic Investigation Logs



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astr. trongeneraties dys. 3der. gaacs is way still astr. trongeneraties dys. 3der. gaacs is way still bitter, loop leading: dys. 10 astr. trongeneraties dys. 10 astr. trongeneratie	UNIT	MATERIAL DE (See Classification & Symi	ESCRIPTION bology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm)		SHEAR STRENGTH (kPa) Vane: 2689 2 0 0 Values	WATER
Bayey SLT, chronge breaven. D/m grades to vrig / sketichy, molet. 0,0	Topso	SILT; brown. Stiff; non-plastic; dry.	/		0.2	TS ** ** ****** *******				
Usey Sill. T; orange brown with grey and white metiles. 12 14 10 100 Clayer Sill. T; orange brown with grey and white metiles. 12 10 100 100 Clayer Sill. T; orange brown with grey. 12 10 100 100 100 Clayer Sill. T; orange brown with grey. 12 10 100 100 100 Clayer Sill. T; orange brown with grey. 12 10 100 100 100 Clayer Sill. T; orange brown with grey. 12 10 100 100 100 Clayer Sill. T; orange brown with grey. 12 10 100 100 100 Clayer Sill. T; orange brown with grey. 12 10 100 100 100 Clayer Sill. T; orange brown with grey. 10 100 100 100 100 100 22 24 10 100 <td>Auckland Volcanic Field</td> <td>Clayey SILT; orange brown. Hard; low plasticity; dry.</td> <td>0.6m: grades to very stiff m: grades to high plasticity, moist</td> <td></td> <td></td> <td></td> <td></td> <td>22 224</td> <td>150 43 157 64</td> <td>water Not Encountered</td>	Auckland Volcanic Field	Clayey SILT; orange brown. Hard; low plasticity; dry.	0.6m: grades to very stiff m: grades to high plasticity, moist					22 224	150 43 157 64	water Not Encountered
Claysy stit. Taking regre. -13	Puketoka Formation	Clayey SILT; orange brown with Very stiff; high plasticity; moist.	grey and white mottles.		1.2 1.4 1.6			2723 2724	143 74 100 64	Ground
REMARKS Target depth reached Image: Notestigation type		Clayey SILT; dark grey. Very stiff; high plasticity; moist. EOH: 1.80m			- 1.8 2.0 2.2 2.2			222	100 60	
					T	arget depth	WATER ▼ Standing Water Level ← Out flow ► In flow		STIGATION TYPE Hand Auger Test Pit	_

		H	AN	D Al	JGER	LOG			HOLE N	Ю.: НД02		
		CLIENT: Rotokohu Investmen	ts Ltd		SITE LOCA	TION: 50 We	estney Road, Mangere		Project I	Ref.:	7	
GE	N I T I A	CO-ORDINATES: 1759579.6mE, 5 Co-ordinate system: NZTM Location method: GPSH	90585	7.0mN	ELEVATIO Datum: AU Level meth	N: 14.4m CKHT1946 od: CONTO	UR		START DA START DA END DATE LOGGED E CHECKED	TE: 13/0 : 13/04/2 : 13 QS BY: MDI	/ 4/2021 2021 H	
UNIT	MATERIAL DE (See Classification & Sym	MATERIAL DESCRIPTION (See Classification & Symbology sheet for details)			LEGEND	SCALA 2 4 6	PENETROMETER (Blows / 0mm) 8 10 12 14 16 18	VANE SHEAR STRENGTI (kPa) 14 16 18 응 응 응 응 Value				
Top soil	SILT; brown. ∖ Stiff; non-plastic; dry.	/			TS × × × × × ×							
l Volcanic Field	Clayey SILT; orange brown with Hard; low plasticity; dry.	grey mottles.		0.4		1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1				200+ _ 200+	p	
Aucklanc	0.7	0.9m: grades to high plasticity, moist		0.8	× × × × × × × × × × × × × × × × × × ×					132	ncountere	
nation	Clayey SILT; grey with orange b Very stiff; high plasticity; moist.	rown and white mottles.		1.0 1.2	× × × × × × × × × × × × × × × × × × ×				•	72 112 43	roundwater Not E	
Puketoka Forr		1.5m: grades to stiff	-	1.4 — — 1.6 — — 1.8 —						72 29 109	U	
	PEAT (AMORPHOUS); greyish Stiff; moist.	black.		2.0	**** ***** *****					72 86 46		
	EOH: 2.00m	/		2.2						40		
				2.4								
				2.6								
				3.2								
				3.4 								
				3.6 								
				 4.0								
				4.2								
				4 <u>.</u> 4								
				4.6								
				Т.	arget depth i	eached	REMARKS					
						W	ATER	INVES	TIGATION	ТҮРЕ		
				- 98-A		▼ Standing	Water Level	Н	land Auger		-	
1			ALL PROPERTY	12.42		Out flow ► In flow		T	est Pit			
L Chec	ked By: MDH									Pa	ge 1 of 1	

		Н	٩N	D AI	UGER	LOG	HOLE NO.: HA03
		CLIENT: Rotokohu Investmen	ts Ltd		SITE LOC	ATION: 50 Westney Road, Mangere	Project Ref.:
GEC	N I T I A	CO-ORDINATES: 1759589.4mE, 5 Co-ordinate system: NZTM Location method: GPSH	90580	3.2mN	ELEVATIO Datum: Al Level met	DN: 14.5m JCKHT1946 hod: CONTOUR	START DATE: 13/04/2021 END DATE: 13/04/2021 LOGGED BY: QS CHECKED BY: MDH
UNIT	MATERIAL DE (See Classification & Symi	ESCRIPTION bology sheet for details)	SAMPLES	DEPTH (m)	LEGEND	SCALA PENETROMETER (Blows / 0mm) 2 4 6 8 10 12 14 16 18 译	IE SHEAR STRENGTH (kPa) Vane: 2689 은 은 은 없 Values
Topso il	SILT; brown. Stiff: non-plastic: drv.				TS 		
: Field	Clayey SILT; orange brown. Very stiff; high plasticity; moist.	/		0.2		22	179 43 183 183
Auckland Volcani	1.0m: grades t	o orange brown with grey mottles		0.8		 	174 Log
oka Formation	Clayey SILT; grey with orange b Very stiff; high plasticity; moist.	rown mottles.				22	114 54 157
Puket	EOH: 2.00m					22	43 100 43
Check	ted By: MDH				Target depth	REMARKS reached WATER IN\ ▼ Standing Water Level ← Out flow ▷ In flow	/ESTIGATION TYPE] Hand Auger] Test Pit Page 1 of 1



NZGDribyeshereroration NZ LTD 27868	Standard Document SD501.0 Version: 11 May 1998
Dril'iwell Exploration NZ LTD D 9 Rawson Way, Takanini, Auckland	Paily Log Sheet (General) Log No. 29267
1° client <u>PCA</u>	Job Ref No. DE KI www 101 Day Mon
2° client	Permit No. 2512 - 12 - 2426 Date U 1099
Location <u>50 cerestney</u> Rel, Mone Kill street address or locality	Bore Hole No. 1. Bore Size 100
or Grid ref 266 9870 6467550 Rig No.	Tender No. 2. Compressor No.
Purpose of Bore_cerater Consul	Itant Tonkin Bylow.
Work Details	Bore Log
Avrived on sate 11.50.	0-2n Clay
Sorted eite praition	2-Am Eilts
Maved Rig onto site.	d1 - 19.2 m Peat & Tranal layers
Est ap mast a pit.	192-39.09 Fine koona sand
Began to chrill somm probe	3909-42.1m Kaana Sandetone
hole to 69.38	ARI - 5038 - Sandebre with shell
Flushed hole dean	5058-53 Tomice/Shull/Silts
Talled aut rocks	53 - 57.6 Kaana Eballistone
Dackfilled Hole.	57.6-60.6m Shell Deal
Ceased work 5.30	60.6-69.88 - Cemented Soud
Consent Holder SPCA	BC 20924
A Bore Permit No: 30 (512-12-34/76 A 55 2 1	
Bore ID 20924	A DOGA R D Ag 14231
Water Permit No: 14231	
Date Consents D-base Updated. 112/00	
Date Bore Log D-base Updated	
NZGD fb: 81079 It (75% of Test)	

Britwell Exploration NZ LTD	Standard Document SD501.0 Version: 11 May 19
9 Rawson Way, Takanini, Auckland	Daily Log Sheet (General) Log No. 29268
1° client Pc_/>	Job Ref No. Comp Year Div # Day
2° client	
Location 50 cerestrae 200	Bore Hole No. 1. Bore Size
or Grid ref	lo. 5. Tender No. 2. Compressor No.
Purpose of Bore <u>certer</u> Cons	sultant
Work Details	Bore Log
Aninged on site grow	+low Tost
Degan to chill some Hole	Artime, Dame Coh
2 mm 10 to 57.3.	58- 900 8200
Firshall hale dog	
Palled and more created.	19/100 33cm
Tullal STE &	53. 200 8109
Installed Sten of Come	
casing Fleshed Hole.	
Det cop comenting eqcupilient.	<u> </u>
Whited up as board of earney	
great temped groat behind	- Stesh isku.
casing feely growing berge	- Etarting resserve an psi-
t-lushed pump. Cleancold	- Lewing T/OBDEXE 60 pbi
packed tools.	
Ceased cecork Siso	-15% = 670 mpd.
D ID: 81077	
-	

G Driffweil Forporation NZ LTD		Standard Doc	ument SD501.	0 Ve	rsion: 11 May 199
•Driliwell Exploration N 9 Rawson Way, Takanini, Auckland	Z LTD D	aily Log Sheet (Gene	eral) Lo	og No.	29269
1° client <u>SPCA</u>		Job Ref No.	Comp Year	Div #	Day
2° client		Permit No.		Date	
Location 50 coestney S	<u>201.</u>	Bore Hole	No. 1.	Bore	Size
or Grid ref	Rig No.	3. Tender No.	ຊ(Compresso	rNo. Hira
Purpose of Bore <u>water</u>	Consul	tant			Sumame
Work Details		Bore Log Stam	less tote	red Der	Ra 453
Animed on site 30	0				
Topped up great with	h 3	-			7.0.12 55.71m
base of coment.	_				•
Ran issource Bit it real	* +	Header 1-i	5		asing
casing morath.				5	
Flished out Becklill	10. 67.1	1			
Pulled materials		300	3		
- stallool sances					
Do male to The of	the			1 60	
al assa Li Paller	vale a.t				
Tradalland and a to s	States State				
Base to clause to b	<u></u>		-Sun /		
Tatal To cleve poe 12			\uparrow	Thisis	
Levels the Later Biggs				27 6561	<u></u>
Pulled with a literary.			•		
The first our airme		- Demp 3	<u>>~~~</u>		
Tuckack up and a gree	<u>21.</u>		↑ 		
Installed cement tool			┝──┾──	67.	Im
SDUD 81877 5 +					

R	ILEY	Christchurch: 395 Modros Street Chris PO Box 4355, Christchu Tel 03 379 4402 Emol	stchurch 8013 rch 8140 I: rifeychch@rife	iyico.nz	GE	OTECHNICA	
CON	SULTANTS	Auckland: 4 Fred Thomas Drive, T PO Box 100253, North Tel. 09 489 7872 Email	okapuna, Aucki Shore, Auckian I: riley@riley.co.	ond 0622 d 0745 nz	GEOL	JGICAL INFO	DRMATION
	SOIL TYPES	AND SYMBOL	S	1	ROCK TY	PES AND SYMB	OLS
nu.		CLAY			SANDSTONE	BAS	IALT
TOP TOP	SOIL	PEAT		8 5 5 8 4 8 8 8 4 8 7 8	SILTSTONE	TUF	F
SIL	2	GROUNDWATER	LEVEL		MUDSTONE	IGN	IMBRITE
SAM	10,1 IVEL	SCALA PENETR 1,10 LAST 3 NUMBE PER 50mm INC	OMETER R OF BLOWS REMENT		LIMESTONE	Lang CRE	EYWACKE
SOIL	STRENGTH CL/	ASSIFICATION			ROCK S	TRENGTH CLASSI	FICATION
TERM	FINE GRAINED COHES	SIVE SOILS	D SHEAR	TER	2M	FIELD IDENTIFICATION	UNCONFINED UNIAXIAL COMPRESSIVE STRENGTH (MPa)
Very Soft	Exudes between ling	ers when	<12	Extremely	(EW)	indented by thumbhail.	< 1
Soft (S)	Easily indented by fi	ngers. 12	- 25	Very webk	(vw)	Crumbles under firm blows point of geological hamme	with 1 - 5
Firm (F)	indented only by stro pressure.	ong finger 25	- 50	Weak	(W)	Can be peeled with packet Difficult to peel with pocket	t knife. 5 - 20
Stitt (St)	indented by thumb p	pressure. 50 -	100	Moderately	(MS)	Cannol be scraped or pee with packet knife.	ied 20 - 50
Very Stiff (VSt)	Indented by thumbna	il. 100 -	200	Strong	(S)	More than one blow of ge hammer to fracture.	ological 50 - 100
Hard (H)	Difficult to indent by thumbhail.	2	00+	Very strong	(VS)	Many blaws of geological hommer to break.	100 - 250
SPT & SC	CALA PENETRO	METER RESUL	TS	Extremely strong	(ES)	Can only be chipped with geological hommer.	250+
TERM	SPT VALUE No. of BLOWS/300	SCALA PENE Imm No. of BLOW	TROMETER /S/100mm		MC	DISTURE CONDITI	ON
very dense	>50	17	+	Dry (0)	Looks an	d feels dry; powdery and frid	oble.
dense	30 - 50	7 -	17	Moist (M)	Feels coo	i; darkened in calour; na fri	ee water when remoulded
loose	10 - 30 4 - 10	3 -	3	Wet (W)	Feels coo	i; darkened in colour; free	water forms on hands.
very loose	0 - 4	0 -	2	Soturated (S	i) Free wate	er is present on somple.	
	SAMPLE TYPE	S DF	RILLING	METHOD		FIELD TESTS	
	UNDISTURBED	OB	OPEN B	ARREL			
N	1	TT	TRIPLE	TUBE	V	SHEAR VANE (co	prrected to BS.1377)
\bowtie	MACHINE AUGER DISTURBED	WB	WASH 8	ORE		REMOULDED STR	RENGTH
D	HAND AUGER DISTURBED	SH	UNDISTU SHELBY	RBED	C	H CLECG HAMMER	CONC. L.S.
t.	STANDARD	RC	ROCK C	ORE			
•	PENETRATION TES (solid cone)	SPT	STANDAR	D			
L	STANDARD PENETRATION TES	1	PENETRA	NON IEST	IN G Ti	FORMATION BASED ON THE EDTECHNICAL SOCIETY INC HE CLASSIFICATION AND DE	E N2 GUIDELINES FOR SCRIPTION OF



2	RI	ULT	EY NTS	Riley Cons Fold Thomas D atlaesana, ARL 0 el 1642 423 71 az 1645 423 7	ultants kore kore kore kore kore	Limited							Н	AN	DA	U	GE	R LOG
Proje	tct:					Locati	ioni				Hole	position	nc					No.:
Job	No.:	112	ad	Start Dat	e: 13-	01-15	Groun	d Level	l (m)	;	Co-	Ordinate	es ():				1	HA2
Clie	nt: PCA A	ickia	nd	P HILDO DA	10. 10		-	Hole D	epth n	4							She	et: 1 of 1
Elevation (m)	Depth (m)	integrat Unit	(refe	Geologic roseparate formation she	al Desc Geotechn eet for furt	ription ical and G	Sectogical nation)	Legend	nified Symbol	Soil	Shear (kP	Strengt a)	h Scala ((blow	Penetrom rs / 50 mr	eter n)	Soli Moisture	Samples	Tests
		9	TOPSOIL					IU	2	55	100	150 200		9.1	12 19	D		
	0.30		SILT with brown/ore	hace to minor visiting No	r clay, dar	k brownio	range, iraci	0 * *										~ 20
			0 70 m Gr	ades to slight	ly plastic			× *								М		
	-1	8						××			A.	×						\sigma_R [™]
		Formatio	1.30 m Gr brown/gre	ades to minor y, trace to min	r clay, trac nor crange	e fine san e staining	nd: medium Non to slig	htly x x					1.1					~ ^V R
		Uketoka	1.50 m Gr orange an	ades to brown d light yellow	s and med brown mo	Sum brown	in/grey, trac	* × ×										
	-2	1						× ×		. 3								∨ ^V _R
	2.30		Clavey Sil	T: very light	arey Mod	erately cla	estic	к) 								w		V.
	2.60		Pumeciou	fine sandy 5	SILT: very	light brow	in/grey Nor	-1							V			Ho.
	3 3 00		plastic	in Mon-sheet	L'SALARO	Denia		1	1							s		
			FOH @ 3.	oc. Non pasa	c, segney	tiorous.		4										
			con g o															No. 1 0, 0, 1, 0, 0, 1,
	-4												1			L		1, 1, 1, 0, 1, 0, 1, 0, 1,
													S.					1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 2, 1, 1, 2, 1, 1, 2, 1, 1, 2, 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 2, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,
													5					
	-5												3	-	5.0m *			Y
								-										
	6																	
	7																	
Evel	anation	~									0.01							Domotio
expl Rock/ weath compl Relativ firm/m	Mass Wei ared, moo ately wes ve soli Str edium de nall Distu	stherin lorate therein ength nse, therein rbed	ng - unwea ly weathers t, residually - very soft titf/dense, Sample	hered, slight d, highly wei weathered very loose, a very stiff/very	y athered, oftfocse, dense	 Scala Perm Schm Insitu V=Pe to per Water 	a Penetrom leability Tes nidt Hamma Vane She Vane She ak, R¤Res netrate r Strike (1s	eter - bloi at ar Streng idual, UTi t, 2nd)	ws/50 th (kP P=Un	a)	X Slo Raj	wDWATE one w Seep pid Inflow	R (depth 2.8 / (depth)	m) TO:	-		,	(emarks

C	CON	SULT	ANTS	Failingsona, AKL 0622 Fail: 4849 489 7872									HAND	M		JLI	LUG
Proje	ect:			ua +649 489 7873	L	ocatio	n:				Hole	position:					No.:
Job N	Vestne No.: 14	312	oad	Start Date: 1 Finish Date: 1	3-01 3-01	-15 -15	Ground	t Level	l (m);	Co-0	Ordinates	0:				HA3
Clier	nt: PCA A	uck	land				1	Hole D 3.50 r	ept n	h:						Shee	nt: 1 of 1
Elevation (m)	Depth (m)	soological Unit	(cefe tr	Geological Det r to separate Geolec formation sheet for fi	scrip hnical uther	tion and Ge informa	eological ation)	Legend	Inified Symbol	Soil S	Shear (kPi	Strength a)	Scala Penetrometro (blows / 50 mm) 3 6 9 12	Georedwater	Sol Moisture	Samples	Tests
		Ĭ	TOPSÓIL					11							D		
	0.4		SILT with brown/gre	minor clay; dark brov ly. Siighli'y plantic	m/ora	nge and	d light	× ×				×			DM		✓ V≈ 2
	1		0.90 m Gr	rades to slightly plast	с			× × × × × ×			×				м		$\sim \frac{V_{R}}{R^{o}}$
		Formation -	1.30 m Gr staining, M 1.50 m Gr orange an	nades to dark crange. Non to slightly plastic rades to minor clay, li od light grey staining.	with d ght br Slight	lark bro own/gre ly plasti	wn/grwy sy, trace ic	× × × ×		•	*				w		$\sim \frac{V^{\pi}}{R^{\pi}}$
	-2	- Puketoka	Clayey Sil	I.T. light grey, orange	stain	ing Hig	hiy plastic	x x x x x x		a ×				V	1		$\sim \frac{V}{R}$
	2.5	x.	2.40 m Sa	ndy lenaes				× × ×			×						∨ V= 7 R= 1
	-3		PEAT with fibrous with 3 10 m Po	n minor clay; black. N ih occasional wood in ior necovery	on to clusio	slightly i n	plastic; slig	100y		÷	÷.						V= 9 V= 9 *Fib inclu
	-4		EOH @ 3	av m													
	6																
Expla	7 anatio	nst			¥	8	Doort			0,0,0,0	8016	DMATE P		1		P	emarks
Rock M weather comple Relativ firmine Sr La	dass W ered, mi etely we re soil S edium d nail Dis inge Dis	eathe sdera athor trangl ense, surber turber	nng - unwea tely weather ed, residualit h - very soft stiff/dense, d Sample d Sample	thered, slightly ed, highly weathered y weathered /very toose, soft/loos very stifl/very dense		V=Peo Water Water	Venetronic zability Tes dt Hamme Vane Shea ak, R=Res- etrate Strike (1st Rise (1st,	t r Streng dual U1 , 2nd) a	th (k P=U)	Pa)	No X Slo Raj OLE T Collaj	pid Inflow ERMINAT	depth 2.2 m) (depth) ED DUE TO:				

÷

-		t and G	g/5/4	Pak 1048 4	168 7073				_			1.		alliant				-		No :	
Proje	ect: Nestne	y Ro	bad				Location Mangar	n: ne					tole po	540071				_		110	
Job	No.: 14	312		Start I Finish	Date: Date:	13-01 13-01	-15	Groun	id Lev	el (n	n):	(Co-Ord	linates	():					HA4	
Clie	nt: PCA A	ucki	and	1.0000000					Hole I 3.00	Dep	th:								Shee	1 of 1	
tion (Ê	I Unit		Cruth	alast D	a a cui a	tion		2			all Ch	oor St	renath	Scaia P	netrome	ket 19	isture	ples		
Eleva (m	Depth	Seclegica	(celi	or to separ information	gical De sheet for	chnica further	il and Geo r informati	ological ion)	Leon	o Project		50 1	(kPa)	200	(blows	/ 50 mm	Ground	Soil Mc	Sam	Tes	us
	E.	1	FILL, sit	mixed with	topsoil; o	vange	brown an	d dark b	rown	R								Univ			
	- 0.67	1							K,	×	1			×							V= 19 R= 24
	0.80	-	Buried TO	OPSOIL					11	1				1				м			
	-1		SILT with	trace clay	; orange t	briown	Slightly p	astic	-	к к		8	×					W		~	V= 14 R= 55
			1.00 m G brown wit	rades to m th brown st	sinor clay taining. SI	and tre ighily p	ce sand; (lastic	orange	×		I.										V= 1
		mation							20	K) K)	1		ж.							~	R= 16
		oka Fon	100-0	and an and an	and the state	1.Calif	niastic		×	C C											V= 33
	-2	Puket	1.89 11 53	Necretal tip BC	une cay	called.	Poil 3 (5C		×	×	4	× .					V				R= 1
			2.40 m - 1	2 50 m Grr	ides la mi	inor cla	y and trac	ce	×	к к	1			11						~	V= 35 R= 8
	2.65		pumeciou Slightly to	s sand; wh moderate	hitish grey iy plastic	, trace	orange st	taining	-	1	1			1				s			
_	3 00	,	PEAT with	s minor cla	ry; black.	Non pla	astic; amo	arphous	4.3	4	-3	×								~	V= 39 R= 8
			ECH @ 3	00 m																	
	4										ŀ										
	5																				
	-6																				
	-7.											_									
Expla Rock M	anation Mass We	is: athen	ng - unwea	thered, si	ghdy	Y	Scala Permea	enetrom bility Te	eter - bi	ows/S	90mm	GRO	NONDA	ATER					Re	emarks	_
comple Refer	ered, mo	derate	ry weather d, residual	ed, highly y weather	weathere ed	4. V	Schmidt Insitu Va	t Hamme ane She	er ar Stren	gth (i	Pa)	x	Slow S	eep (de	epth 2.2 m)					
fem/m	edium de	rise. I	sliffidense.	very stiff/v	ery densi	0	V=Peak to penet	, R=Res trato	idual, U	T₽≈U	inable		Rapid I	Inflow (d	depth)						
• Si	nail Dist	bods.	Sample Sample			Y	Water S	irike (1s	t, 2nd) and		HOL	ETER	MINATE	D DUE T	0					

L	GON	SULT	ANTS	Tel. +649-409 7872 Fax: +649-489 7873								HAND	AU	GER	LOG
Pro 50	iect: Westn	ey Ro	bad		Local	tion; dare				Hole positi	ion:				No.:
Job	No.:	1312		Start Date: 1 Finish Date: 1	13-01-15 13-01-15	Groun	nd Leve	el (m):		Co-Ordina	ates ():				HA5
Clie	int. iPCA A	wckl	and				Hole D)epth m						Sheet:	1 of 1
Elevation (m)	Depth (m)	seological Unit	(refe	Geological De into separate Geole information sheet for	Scription chrical and o further inform	Geological mation)	Legend	nified Symbol	Soil S	hear Stren (kPa)	gth Sci (I	sla Penetrometer blows / 50 mm)	Groundwäter Solt Moisture	Samples	Tests
	0.1	Ă	TOPSON				11	1 3	50	100 150 200	0 3	6 9 12	15 D DN		
	-1		SILT; orac	nge brown. Non plaa	tic		ж ж ж ж ж ж ж ж								∨ V×2 ∨ V×2
		ketoka Formation	1.60 m Gr Non plast	ades to trace clay, in	ght grey, cra	inge stainin	x x x x x x x x x x x x x x x x x x x		۵				м		∨ V*2 R=5
	-2	6	2.10 m Gr staining, M	ades to some clay; il Andr dark brown por	ight grey will Kets/lenses	h orange for 100mm				×			w		∨ V= 1 R= 1 V= 8
	33.00	v	plastic		u uay and u	ace serio.	x x x x x		A×	×			Î		∨ Rn 9 ∨ V= 3 R= 1
	-4														
Expla Rock M weather comple Relativ firm/me	7 Anation Mass We ared, mo elety wea e soil Str adium de	S: atherin derate thered ength ese, si coad 5	ig - unweat y weathere i, residually - very soft/ att/dense, s Sample	hered, slightly d, highly weathered weathered very laces, soft/cosy ery stiff/very dense	▼ Scola Perm ▼ Schart ∨ Insitu v=Pe 1 to per ₩ Water	Penistrom eability Te- lidt Hamme Vane She ak, R#Res netrate r Strike (1t	eter - blov st er ar Strengt dual, UTI	ws/50n th (kPa P=Una) ble	OUNDWATI	ER (depth w (depth) .)		Ren	narks

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Proje	ect: Vestner	R	bad		Locati Mang	ion: jare				Hole positi	on:					No.:	
Job M	No.: 14	112		Start Date: 13 Finish Date: 13	-01-15	Groun	d Level	(m)	:	Co-Ordina	tes ():					HA6	
Clier	PCA A	icki	and	T Indi Onic To	AT 17.		Hole D 4.20 n	epth n	1						She	et: 1 of 1	
(m)	Depth (m)	sological Unit	(refe	Geological Des r to separate Geotech formation sheet for fu	cription nical and G	Soological tation)	Pregend	nified Symbol	Soil S	ihear Streng (kPa)	gth S	cala Penetrometer (blows / 50 mm)	Groundwater	Soil Moithine	Samples	Tes	ts
	0.20	9	TOPSOIL				111	13	50	190 199 200				DM			
			SILT; cra	nge brown. Non plastic			× × × ×			*						~	V= 152 R= 64
	-1		0.70 m G orange st	ades to trace clay and sining. Non to slightly (sand; brow stastic	wn and grey				×				M		~	V= 79 R= 27
	1.70		1 30 m G	ades to some clay. Mo	idenately to	highly plas	tic × × × × × × ×		4.7					100		~	V= 70 R= 27
	-2	ua Formadon	PEAT; bis amorphos	ick. Non plastic; slight) is ades to trace fibrous in	y spongy: k	ow density,	2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2		۵							~	V= 99 R= 18
		- Puketok					14 - 5 ¹ 1 <u>8 16</u> 14 - 51						V			~	V= 73 R≈ 15
	-3		2.70 m - 1	.80 m Wood fragment			1 <u>3 1</u> 1 <u>9</u> 1 <u>9</u>		à	<						~	V= 76 R= 24 'wood
							9 9 9 10 9 10 9 10 9		۵	×				c		~	V# 91 R# 15
	-4		3.70 m Ini 3.90 m Ve	dudas minor roots/woo ry poor to no recovery	d. Poor rec	covery	19 3 ⁽¹⁾ 319 10 319		د ×							~	V# 64 R# 23
	-5		EOH @ 4	20 m												0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0	
	6										477. 	ö, Im				¥	
	7																
Expla Rock M weathe somple Relative Irrovime	Anation Ass Wei and, moo tely wea tely wea tely wea tely wea tely wea tely wea tely wea	S; liher lerat here ongti tse, tbed	ing - unwea ely weather id, residuali n - very soft stiff/dense, Sample	thered, slightly od, highly weathered, y weathered very loose, softloose, very sliff/very dense	Scala Permi Schm Insitu VePe to per	i Penetromi eability Tes idt Hamme Vane Shea ak, R≈Resi netrate r Strike (1st	ater - blov I r sr Strengt dual, UTF , 2nd)	n (xP P=Un	a) > H	ROUNDWAT None Slow Seep Rapid Inflo	ER (depth w (dep	n 2.5 m) hth) DUE TO:			R	temarks	

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Proje	tot:				Locat	ion:				Hole	position:						No.:
Job	No:	142	ad	Start Date: 13	-01-15	Groun	nd Level	(m):		Co-C	Ordinates	():			-		HA7
Clier	nt: PCA A	ickli	and	Pinish Date. 13	-01-10	-	Hole D 3.00 r	epth: n								Sheet	1 of 1
Elevation (m)	Depth (m)	Seological Unit	(rate	Geological Desi in to separate Geoloch information sheet for fu	cription nical and C ther inform	Jeological hation)	Legend	Unified Symbol	Soil S	hear (kPa	Strength	Scala F (blow	enetrometer s / 50 mm) 9 12	Groundwater	Sol Moisture	Samples	Tests
_	0 20	1	TOPSOIL				111								U.		
			SILT with moderatel 0.50 m Gr	minor clay; brown/grey ly plastic redes to some clay redes to minor clay; lid	y and oranj ht trown/o	ge Slightly	ilo x x x x x x x x x x x x x x x x x x x				*				м		~ V≈;
	-1	ormation	white molt	ties/staining rades to trace dark bro	wn/black a	taining	X X X X X X X X X X X X X X X X X X X		4	1					MW		Ver Rev
	1.60	Puketoka P	PEAT with moderated	n minor to some clay, b	lack. Sligh	tty to	× × × ×							Y	s		Ved Res
			2.30 m Pa	tor recovery			24 14 - 2 14		A								∨ V= 6 R= 1
	3 3 00	•	EOH @ 3	00 m			20 <u>1</u> 314		1 -								$\sim \frac{Ve7}{Re4}$
	-4																
	- 5																
	-0																
	z																
Expla Rock I weath comple Relativ firm/m	anation Mass We pred, mor ately wea re soil Str edium de mall Distu trge Distu	S: ather foration nore engli nore, inted	ing - unwea by weather d. residuall n - very soft stiff/dense, Sample Sample	thered, slightly ed, highly woathered, y waathered /very loose, soft/loose, very stiff/very dense	V Scale Perm Schrr V Schrr V=Pe 10 pe Wate 1 Wate	a Panetron toability Te hidt Hamm I Vane She sak, R=Re netrate r Strike (1) r Rise (1st	neter - blor est ear Strengj sidual, UTI st. 2nd) s	nd	um GJ) X Die C	ROUNI Nor Slov Rap DLE TE	DWATER ne v Seep (d id Inflow (ERMINAT)	epth 2.0 r (depth) EO DUE	π.) TO:			Re	marks

Proje	iot.			- M. (100	1 400 110		Locat	tion:				Ho	le positio	0:					-	No.:
Job I	Vestre No.:	y Ro	ad	Star	1 Date	13	01-15	Gare Grou	nd Leve	(m))	Ge	Ordinati	ee ():						HA8
Clier	14: nt:	312		Finit	sh Dat	o: 13	-01-15		Hole D	opt	K.								She	nt: 1 of 1
C	CAN	1CM	ind					-	3.001	m I R	T			T			T.	1.		T and t
Elevatio (m)	Depth (m	Geological U	(14)	Geo er to seg	logical larate O on shee	eotech eotech i for fu	oription nicel and t ther infor	Geological mation)	Legend	Unlied Sym	Sol	Sheri (k	ir Strengt Pa)	n se 1	ala Por Movro / 6	etrome 50 mm	10	Sol Monte	States	Tee
			SILT with and brow (POISSIB	minor (miorang LE FILC	lay and e, frace 7]	triana n briawn/	ootleta, kg grwy pock	ht brownig etc. Non p	rey = = estin				DC 1					M	1	
	0.70		0.70 m 0	rødes iz	minart	o kome	clay Sing	pily plantic						1						
	-1	alot	BILT with brown/gr plastic	e some c ey. trace	lay and orange	trace n and di	nudetone (ark brown	grit, light staining, fi	hghiliy a a		2	۰,						57		~
		na Fam							1 X		6.73									~~
	- 2	Paint	PEAT wi	n some	ciny; th	MCR. NO	n plastic, i	slightly fibr	948 2 - 2 5 - 2		4	¢					3	s		~
			2.50 m 0	icades to	poor to	no rec	overy		23											v
	3 3 00								114											No.1
														V. daman	**		Nev *			2, 2, 3, 3, 3, 4, 4, 4, 4, 4, 4
Exp Rock weath comp Relati ficaum	7 Mass W lered, mi letety we we soil S wedium d limall Dist arge Dis	ns: auther dora drang erise, urber	ning uniwit laty weaths id, residua h - yeny so abhidensis 1 Sampte 1 Sampte	iathered ired, hig by weigt folvery b i, very bl	, slightly Ny wea hered sociel, so iffryery	r thored, Al/loose dense	▼ fica + Per ▼ fica ↓ Jop ↓ Jop ↓ Wat	ala Penetro maabiity 1 midt Hann tu Vons SP Paak, Ro-Ri enetrale ter Strike (5	meter - bi ner mer sest Stren osidual, U 1st, 2nd st, 2nd	gth (K PP=Q) and	Omm Pa) Nable		UNDWATI None None Septi Infor	ER (depth w (dep ATED (1.9 m th 3 20E T ()				Remarks

-	Code of the second		unopera 1	Pax 1049 480 7873								_			
Proje	vestne	y Re	bad		Loc	ation: ngara			_	Hole position					No.:
Job I	No.: 14	312		Start Date: Finish Date:	13-01-15	5 Grou	nd Level	(m)	š.	Co-Ordinate	5 ():				HA9
Clier	IL: PCA A	uckl	and				Hale D 3.80 r	epth n	;					Sheel	t: 1 of 1
Elevation (m)	Depth (m)	sological Unit	(refe	Geological D er to separate Geol nformation sheet fo	escription echnical and r further info	n d Geological ormation)	Legend	nified Symbol	Soll S	hear Strength (kPa)	Scala Penetrometer (blowa / 50 mm)	Groundwater	Sol Moisture	Samples	Tests
	0.25	9	TOPSOIL	Ú)			11)	5	50	100 150 200	3 6 9 12	15	D		
			SILT with	minor clay; light gr	ey, brown a	ind dark oran	90. × ×								√ V= 20
			0.60 m G staining 3	tic irades to minor to s Slightly plastic	ome clay; liç	ght grey, ora	ngo x x					ŀ	м		V= 1
	-1		1 30 m G	rades to minor to s	ome day, in	ace mudston	e gnit x		A (1) (4) =	×	1.1				R= 4
		mation	very light motiles. N 1 70 m G	brown/grey, mediu Non plastic rades to some clay	m grey stair	sing, trace or	ange × ×		э. (б. 1) 1)						∼ R= 1
	-2	Uketoka Fo	orange m	ollies. Moderately	plastic	121241	н ж ж ж		ÅЖ						∨ ^{V=36} R=10
	2.45	9	2 35 m Si PEAT with	andy lanses	w black Nr	no to sliably	* * * *		A ×						$\sim \frac{V=32}{R=8}$
	-3		plastic; sil	ightly fibrous	91 KANANA 144	on is anging	27 3 277 10 3		a X				W		∨Ve4 R=3
	3 50		3.40 m W 3.50 m No	lood inclusion o recovery. Hole co	liapsing		<u>2.5</u> 6-8								
	-4	¥	EOH @ 3	1.80 m											
	5														
	6														
	7														
Expl Rock weath compl Relati firm/m	anation Mass We ered, mo etely we re soil St edium de mail Dist arge Dist	15; derat ather rengt sose, urbed urbed	ing - unwei ely weather id, residual h - very sof stiff/dense, stiff/dense, stiff/dense stiff/dense stiff/dense	athored, slightly red, hightly weather ily weathered ft/very loose, soft/ic , very stiff/very den	ed. V So red. V So ose. V se 1 W 1 W	cala Penetro ermeability T chmidt Hamn situ Vane Sh "Peak, R=Re penetrate ater Strike (1 ater Rise (1)	meter - blo est ear Streng Isidual, UT Ist, 2nd) (ws/50 th (kP P=Un	a) X	ROUNDWATER None Slow Seep (Rapid Inflow	depth 2.6 m) (depth) TED DUE TO:			Re	marks

-	Ingree	Sel D	ministration 1	Tel: +649.489.7872 Fax: +649.489.7873							LACKING SALTH				
Proje	ct: /estre	V P	ad		Locat	lon:				Hole positio	nt				No.:
Job N	10.:	312		Start Date:	13-01-15	Grou	nd Level	(m):	+	Co-Ordinate	es ():			1	HA10
Clier	It: PCA A	uckl	and	Timan Date.	10-01-10		Hole D 3.00 n	epth; n						Shee	at 1 of 1
Elevation (m)	Depth (m)	sological Unit	(refe	Geological E or to separate Geo	escription technical and (Geological nation)	Legend	nified Symbol	Soil St	near Strengt (kPa)	h Scula Penetromete (blows / 50 mm)	Groundwater	Soli Moisture	Samples	Tests
	0.10	Ŭ,	TOPSOIL	2			111	5	50	100 150 200	3 6 9 12	15	D		
			SILT; one	nge brown. Non pl	aștic		- (* * * *		a)	×	1.1.1.1				$\sim \frac{V}{R}$
	1	uu	1.00 m G	rades to trace clay			× × × ×		4 X				м		$\sim_{\rm R}^{\rm Vi}$
		ketoka Formale	1.70 m G	rades to some cla	r, light brown, (brown stair									∨ ^V R
	2	B	PEAT wit	by to highly plastic h trace clay, black	Non plastic; a	morphous	11 2 12 2	4	Ĵ.			V	w		$\sim \frac{V}{R}$
							13 14 14 14 14 14		~ × ¹						$\sim \frac{V^2}{R^2}$
	3 3.00	*	EOH @ 3	1.00 m			19 S.		2						∨ ^V R ³
	4														
	5														
	-6														
	τ														
Expl Rock weath compl Retail firm/m	anation Mass We ered, mo otely we re soil St edium di mall Dist	hS: ealbe sther trengi ense, urbe	ring - unwe tely weathe ed, residual h - very sof stiff/dense d Sample	athered, slightly red, highly weather lly weathered ft/very loose, soft/i , very stiff/very der	red, V Sca Perrov Sch V=Perrov Sch V=P to prov V=P Waterov V=P	la Penetroi meability T midt Hamn tu Vane Sh leak, R=Re enetrate er Strike (1	meter - blo est ner ear Streng isidual, UT	ws/50mr ih (kPa) P=Unab		ROUNDWATE None Slow Seep Rapid Inflov DLE TERMIN/	(depth 2.2 m) v (depth) NTED DUE TO:			F	lemarks

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-	- Chilling	112		Pag 1600 cdie F871															
Proje 60 V	ek Instia	, Ri	ind.		1	ocation Aangara					1168	a position							No.:
Job f	10.	54.0		Start Date	13-21	16 Gr	und L	evel	(m)		60	Ordenates	0						HA11
Cher	E GA A	rokti	ind	T minit but			Hot	н Di 15 п	ipth 1		_							She	et. 1 of 1
Elevation (III)	Capito (m)	in and an	(768	Geological ter to separata Gr	Descrip	tion and Gestoge Microalion)	-	Lagard	must Symbol	Soil S	itiene (kf	(Strength 'a)	Be#	a Panet towe / 57	ioratar 9 mm)	Canada and	Name of Street	Samples	144
	0.10	9	TOPBOR				-	11	.9	50	100	160, 200	- 1	0 0	-17 -1	4	0		
			BILT WR	states they only	şə telmin İ	lise) piantes	-1	5				,							
			0.60 /0 0	inados to angelity	piesto			1											
	1	1	1.00 m 0 starring	iradaa to record b Modarataty plani	i soma slaj 6	r) Sraca brown		1		ł	X						М		~
	1.60	Format						1		$\epsilon \dot{\epsilon}$						Ľ	211		0
	1	Passed -	PEAT on Shrout	dh traca in minsr	tløy, klieck	Necro presente	shiptiny	29		A.F						Y	5		
			2 x0 m C	iranea to stightly	speragy						e,								
			2.70 m N	in moovery.				<u>84</u>											
	1.15	+	EOH @	8.15.69				t bai				1							Ab 1 0,0,0,0 0,0,0,0 0,0,0,0
																			00000
	d.																		
													3.			Ľ			
	5												22		5.0W				٧
	6																		
	2																		
Expla	anation Mass We	nits; Helther	ong - unw	whered, slightly	Y	Scala Pana	orometer	- 1444	49/50	nm 0	ROU	NOWATER	8			I.		F	Remarks
wnath comple Renath Bendm	ered, mo elery we in soli fü edum d	dena stren ningi unse,	niy weath ad. residua hi issiy ss stiffdama	arad, highly weat ally weathored off/vory loose, sof a, vary soff/vary d	narad, 🚽 Moden Anse	Schmidt Ha Insitu Vane V-Posit, R to penetrate	nimer Shear St Stearbus	i (JTI	n (adř Katijin		X SI PL	ione ow Seep (; epid Inflow	septh 3 (dept?	(0 m)					
1	nar Dei rige Diel	urber	s transpie s tiempre		3	Water Rice	9 (188, 20 (Yet, 2nd	1.10	od	H	Coll	TERMINA	TEO D	UE TO					