REPORT

Tonkin+Taylor

Whenuapai to Redhills Wastewater Servicing Package 2

Ground Contamination Detailed Site Investigation

Prepared for
Watercare Services Limited
Prepared by
Tonkin & Taylor Ltd
Date
May 2023
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May 2023	3	Updates to alignment and to support resource consent application	Sami Myers-Hutchings	Lucy Hine	Robert Hillier

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1 Introduction

Tonkin & Taylor Ltd (T+T) has been commissioned by Watercare Services Ltd (Watercare), to undertake a Detailed Site Investigation (DSI) for ground contamination for the proposed Whenuapai-Redhills Wastewater Servicing Package 2 commonly referred to as Northern Interceptor 2 (NI2).

This report has been prepared in general accordance with the requirements for a DSI referred to in the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human (NESCS) regulations[1] and as outlined in the Ministry for the Environment's (MfE's) Contaminated Land Management Guidelines[2].

The persons undertaking, managing, reviewing and certifying this investigation are suitably qualified and experienced practitioners (SQEP) as defined in the NESCS, as required by the NESCS and defined in the NESCS Users' Guide (April 2012)[3].

This investigation was undertaken in accordance with our proposal of 17 May 2021[4].

1.1 Background

Watercare is proposing to upgrade its Wastewater Servicing Scheme to promote growth in the North-West region of Auckland. The overall servicing project will enable Watercare to efficiently service Whenuapai and Redhills for the next 10 to 15 years by providing capacity in the order of 13,000 dwellings or 39,000 people.

The scheme is being developed in three packages. This DSI covers Package 2. Geotechnical and ground contamination investigations undertaken in 2021 for Package 2 were divided into two Alignment sections corresponding to two distinct Alignment sections of the project.

In May 2022, the proposed Package 2 alignment was modified, and the updated plans now include three Alignment sections:

- **Alignment Section 1 - Massey Connector**: The Massey Connector gravity sewer main (chainage 0 to 1200 m), extending from 8 Spedding Road to Shaft LS8 (State Highway 18 (SH18)). This will be constructed using an Earth Pressure Balance (EPB) Tunnel Boring Machine (TBM). Tunnelling depths range from approximately 8 to 30 m below ground level (bgl).

  A Break Pressure Tank (BPT) will be constructed at 8 Spedding Road. The proposed soil disturbance area for the BPT is approximately 1,500 m^2.

  A Construction Area Hub (CAH) is planned at 32 Mamari Road with an approximate area of 7,500 m^2. The proposed soil disturbance includes stripping and stockpiling topsoil for reuse during site reestablishment at the end of construction.
- **Alignment Section 2 - the Main Tunnel**: The DN2100 gravity sewer main (chainage 0 to 2631 m), extending adjacent to SH18 between Shaft LS8 and Shaft RS17, is to be constructed using an EPB TBM. Tunnelling depths range from approximately 10 to 25 m bgl.
- **Alignment Section 3 - RS17 to Hobsonville pumpstation**: Pipework proposed between Shaft RS17 and the inlet chamber wetwall of the Hobsonville wastewater pumpstation (chainage 0

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011.

[2] Ministry for the Environment, updated 2021, Contaminated land management guidelines No. 1: *Reporting on Contaminated Sites in New Zealand*.

[3] Ministry for the Environment, 2012. Users' Guide - National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health.

[4] Tonkin + Taylor Ltd (17 May 2021), Offer of Service, Northern Interceptor Phase 2, Assessment of Groundwater & Settlement Effects, Contaminated Land DSI and Potholing. Job Ref: 1015506.

to 106.20). The construction methodology for this Alignment section is not yet confirmed, but Watercare has indicated is likely to be installed by trenching. The maximum trench depth is expected to be approximately 4.5 m bgl. Works in this area will also include two new additional manholes (MH 1 and MH 2) on the pumpstation property.

The Alignment Section 3, and the BPT and CAH in Alignment Section 1 were not included in the alignment of the Ground Contamination Preliminary Site Investigation (PSI)[5] and 2021 intrusive investigation[6]. The potential for contamination in these Alignment Sections were assessed in the PSI as adjacent sites and are discussed in this report in the context of the new alignment.

No intrusive investigation works have been completed in BPT and Alignment Section 3 at the time of preparation of this report but are proposed in the coming month. No intrusive investigations are proposed for the CAH as we understand from Watercare that topsoil will remain onsite and be reinstated at the end of project work.

Given the consenting timeframe, the intrusive investigation and analysis of results for Alignment Section 3 and BPT will be reported as standalone pre-works soil investigation or an addendum to this DSI. Earthworks associated with the scheme have the potential to disturb contaminated soils and groundwater resulting from historical and current use of the land along the alignment.

The MfE defines potentially contaminating activities in the Hazardous Activities and Industries List (HAIL). If an activity or industry on the HAIL is, or has occurred at a site, the NESCS applies to proposed soil disturbance and/or land development activities.

T+T completed a PSI for the alignment in March 2021. The purpose of the PSI was to assess whether HAIL activities have occurred or may have occurred along the alignment, and the potential for these activities to have resulted in ground contamination.

T+T completed a ground contamination and soil corrosivity factual report[7] for the intrusive investigations, completed as part of the T+T geotechnical investigations in August 2021. The purpose of the factual report was to report on the laboratory contamination results and assess the need for a DSI. The report concluded a DSI was required to support resource consent application.

This DSI report summarises the site history obtained through the PSI and assesses the contamination investigation data obtained during the 2021 ground investigations and outlines the ground contamination-related implications for the project.

1.1 Objective and scope of work

T+T undertook the site investigation in accordance with the Mott Macdonald project Specifications[8]. In summary the scope of the investigation included:

- Soil sampling from twenty-five (25) machine boreholes.
- Soil sampling from two (2) shallow hand augers (HA).
- Collection of groundwater samples from nine piezometers from near Shafts RS10, LS12, RS14, LS16 and RS17.
- Laboratory analysis of soil and groundwater samples for contaminants of concern.

[5] T+T, March 2021, Whenuapai Redhills Wastewater Servicing Scheme Package 2, Ground Contamination Preliminary Site Investigation, Prepared for Watercare Services Limited, T+T reference: 1015174.0000.v2.
[6] T+T, January 2022. Whenuapai Redhills Wastewater Servicing Scheme Package 2, Ground Contamination Detailed Site Investigation, Prepared for Watercare Services Limited, T+T reference: 1015506.0000 v2.
[7] T+T, January 2021, Whenuapai to Redhills Wastewater Servicing Package 2, Ground contamination and soil corrosivity investigation – factual report, T+T reference: 1015174.v2.
[8] Mott Macdonald, August 2020, Whenuapai to Redhills Wastewater Servicing Package 2, Geotechnical, hydrogeological and contaminated land investigation specification.

This DSI assesses the information in the factual report to inform the contamination implications for the project and to support the resource consenting process. Specifically, the DSI considers the following contamination implications:

- Disposal constraints for surplus soil.
- Health and safety and environmental controls required during construction works.
- Resource consenting implications.

Interpretation and reporting on the corrosive and aggressive ground conditions was not completed as part of this report.

2 Site description

2.1 Site identification

The NI2 alignment is located in Whenuapai and Hobsonville in West Auckland (refer to Figure 2.1). The alignment is made up of three Alignment Sections with a combined length of approximately 3.9 km.

The addresses, legal descriptions, Certificate of Title references, site owners, and current use of land along the alignment are outlined in Alignment Section 2 of the PSI report5 and included in Appendix A. As discussed in Section 1.1, Alignment Section 3 (RS17 to the Hobsonville pumpstation), BPT and CAH were included as adjacent sites in the PSI. The assessment has been revised in the context of the updated alignment.

2.2 Site condition and surrounding land use

The land surrounding both the Massey Connector and main tunnel is predominantly rural land, utilised for agricultural purposes. The main tunnel runs directly south of SH18, the surrounding use is predominantly commercial in nature. A detailed desktop review using Google Street View and aerial photographs was undertaken and summarised in the PSI. Key site features and observation pertaining to land use in the vicinity of the route are illustrated on Figure 2.2 which has been republished from the original PSI report (with updates). Potential sources of ground contamination are further discussed in Section 3.3 below.

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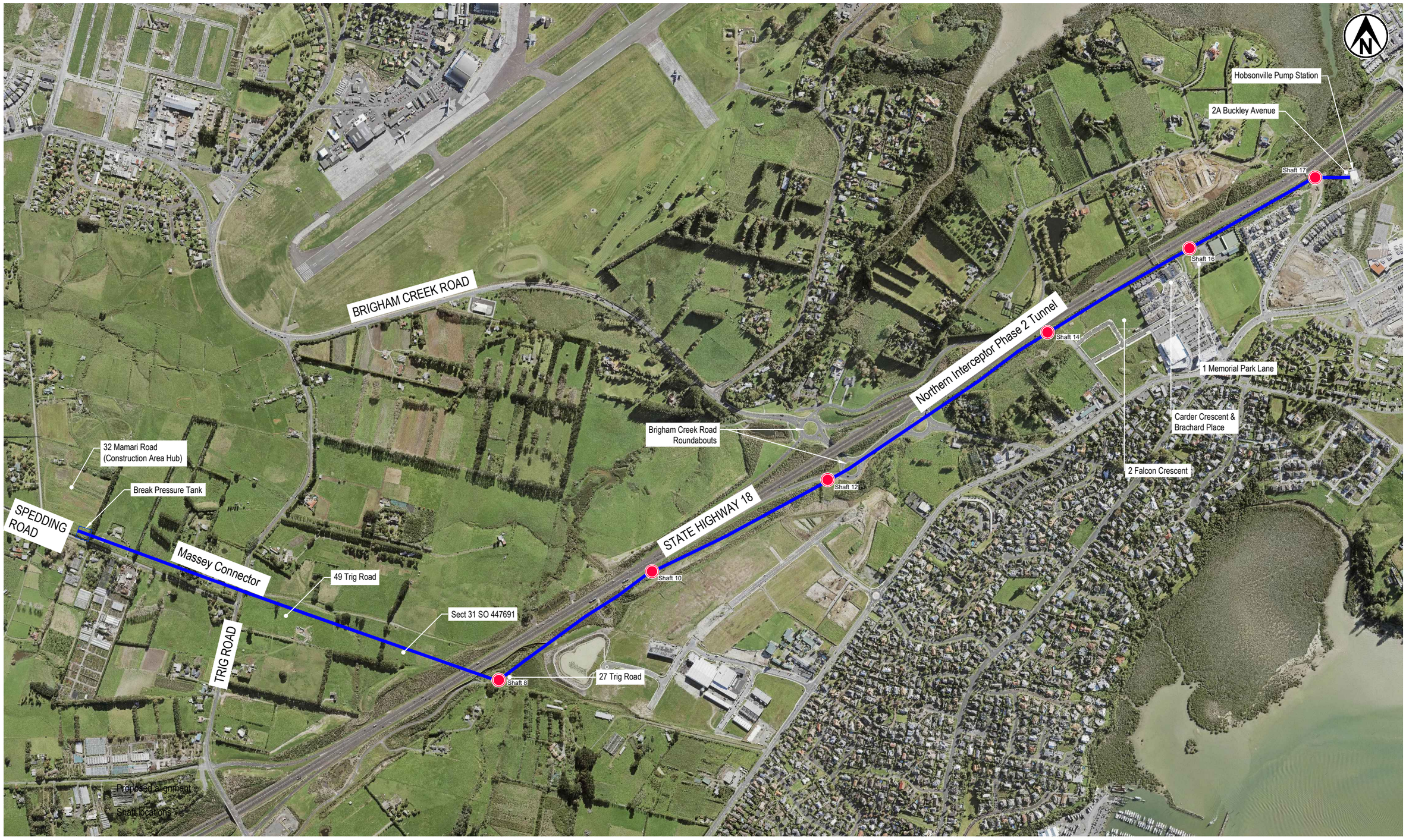

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PROJECT No.	1015506.000	
DESIGNED	RVDK	May.23
DRAWN	RBS	May.23
CHECKED		

BUILDING CONSENT APPROVAL

APPROVED DATE

CLIENT **WATERCARE SERVICES LIMITED**

PROJECT **GROUND CONTAMINATION DETAILED SITE INVESTIGATION**

TITLE WHENUAPAI REDHILLS WASTEWATER SERVICING SCHEME PACKAGE 2
Site Features

UNDER REVISION 1

SCALE (A3) 1:10,000 FIG No. 1015506.000-F2.1 REV 1

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APPROVED	DATE	

CLIENT **WATERCARE SERVICES LIMITED**

PROJECT **GROUND CONTAMINATION DETAILED SITE INVESTIGATION**

TITLE WHENUAPAI REDHILLS WASTEWATER SERVICING SCHEME PACKAGE 2
Potential HAIL Activities

UNDER REVISION 1

SCALE (A3) 1:10,000 FIG No. 1015506.000-F2.2 REV 1

3 Published geology

The published geological map of the area[9] indicates that the site is underlain by mud, gravel, peat, lignite, tephra and pumice from the Puketoka Formation (Tauranga Group) overlying sandstones and mudstones of the East Coast Bays Formation (Waitemata Group). The Waitemata Group materials form the basement rock of the area. The location of the site in the context of the regional geology is presented on Figure 3.1 below.

- Pup: Puketoka Formation of the Tauranga Group alluvial soils (soft to very stiff clays and silts or loose to dense sands with the occasional organic or peat layer), which are expected to be encountered from surface, or near surface under fill.
- Mwe: East Coast Bays Formation of Warkworth Subgroup (Waitemata Group) comprising alternating sandstone and mudstone with variable volcanic content and interbedded volcaniclastic grits.

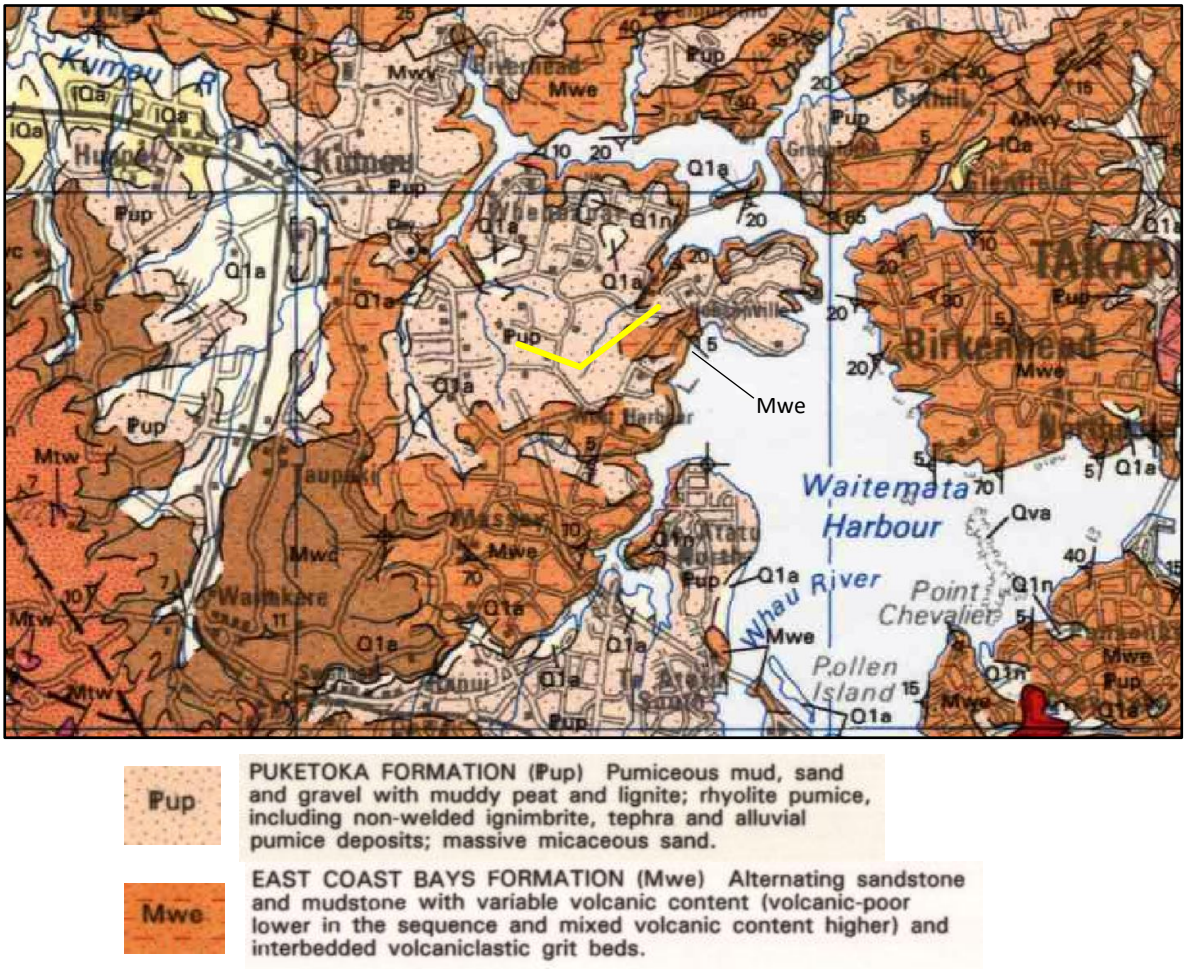

Figure 3.1: Geological setting in relation to the project alignment (yellow) from Edbrook (2001).

[9] Edbrooke, S.W. (compiler) 2001: Geology of the Auckland area. Institute of Geological & Nuclear Sciences 1:250,000 geological map 3. 1 sheet + 74 p. Lower Hutt, New Zealand. Institute of Geological & Nuclear Sciences Limited.

3.1 Hydrogeology and hydrology

Based on the site geology and geotechnical investigations[10], two aquifers have been identified in the area of the proposed alignment:

- A shallow, unconfined aquifer within the Puketoka Formation.
- Underlain by the deeper, confined, regional Waitemata aquifer in the ECBF.

Recharge to the shallow unconfined aquifer is by incident rainfall. This aquifer is predominantly unconfined, however, there might be small, local confined aquifers (perched) present in the Puketoka Formation.

Aquifer permeability testing and groundwater monitoring results of the site area are provided in the Geotechnical factual reports[11]. Based on our initial review of the groundwater level monitoring, the shallow groundwater is assessed to flow generally toward the north/north-east and is a muted reflection of the surface topography.

The shallow groundwater discharges into the Waiarohia Stream and overland flow paths. Both the Waiarohia Stream and the overland flow paths flow in a north/northeast direction, discharging into the Upper Waitemata Harbour.

3.2 Site history

A PSI[5] was undertaken by T+T in March 2021 to determine whether existing and historical activities listed on the MfE's hazardous activities and industries list (HAIL) have been undertaken on the alignment, and to ascertain the potential for contamination.

For completeness, 32 Mamari Road, 8 Spedding Road and the interpretation of Alignment Section 3 desktop information with regards to the new alignment have been included in Version 3 of this DSI.

In summary, aerial imagery indicates land surrounding both the proposed Massey Connector and Main Tunnel was primarily utilised for agricultural and pastoral land in the early 1940s. In 2010/11 the area surrounding the main tunnel alignment underwent construction for SH18. The construction of SH18 was completed in 2015/16. Land surrounding the Massey Connector remains predominantly agricultural land to this day.

The council contamination enquiry identified several discharge consents relating to Hobsonville Pumpstation located at 2A Buckley Avenue. Previous reports[12] indicate that New Zealand Defence Force (NZDF) operated a wastewater treatment plant in this area and disposed of sludge in a small area. Soil remediation of the sludge bed was stated to have been completed in 2010 and backfilled with imported clean material. Validation testing of soil downgradient of the sludge bed is indicated to contain arsenic and zinc above published background concentrations but below levels that pose a risk to human health. Previous reports also indicate that groundwater has been impacted downgradient of the sludge bed. Information on soil and groundwater quality data were not reported in detail, with only the high level summaries noted above.

[10] Rosen, M. and White, P. (eds.), 2001. Groundwaters of New Zealand. New Zealand Hydrological Society Inc.; Wellington.
[11] T+T, December 2021, Whenuapai Redhills Wastewater Servicing Rising Main/ Gravity Main (Massey) Geotechnical Ground Investigation Factual Report, Prepared for Watercare Services Limited, T+T reference: 1015174.v1. and T+T, December 2021, Whenuapai-Redhills Wastewater Servicing Gravity Main (Main Alignment) Collated Geotechnical Ground Investigation Factual Report, Prepared for Watercare Services Limited, T+T reference: 1015174.v1
[12] T+T, 2015. Northern Interceptor- Phase 1. Ground Contamination Assessment. Prepared for Watercare Services Limited. T+T reference: 28773.340v1.

3.3 Potential for contamination

Various potentially contaminating activities have occurred over the past ~80 years within the vicinity of the proposed works as described in Section 3.2. The location of these activities is identified on Figure 2.2.

In summary, there are five identified locations and one potential location where works would intersect a HAIL activity. These are:

- The BPT intercepts horticultural activity at 8 Spedding Road (Alignment Section 1).
- The CAH area intercepts horticultural activity at 32 Mamari Road (Alignment Section 1).
- Potential horticultural activity at 4 Spedding Road (Alignment Section 1).
- Transport yard at 51 Trig Road (Alignment Section 1).
- Hobsonville Pumpstation at 2A Buckley Avenue, Wastewater treatment and use of land for sludge application and waste disposal to land (Alignment Section 3).
- Potential historical horticultural activity near the Brigham Creek Road roundabouts intercepted by Shaft 12 (Alignment Section 2).

A number of other potential HAIL and potentially contaminating activities were identified on land adjacent to and surrounding the proposed alignment. These are:

- Stockyard at 6 Spedding Road (Alignment Section 1).
- Horticultural activities at properties south of Spedding Road and southeast of Shaft 8.
- Sediment treatment ponds east of SH18 between Shaft 8 and Shaft 12 (Alignment Section 2).
- Metal engineering workshop east of SH18 between Shaft 8 and Shaft 12 (Alignment Section 2).
- Bowling Green at 126 Hobonsville Road (Alignment Section 2).
- Historic filling of land to create level surfaces, embankments or for the construction of roads (Alignment Section 1 and 2).

A risk assessment was undertaken to assess the likelihood of these activities to cause contamination on soil/groundwater within the proposed alignment and is summarised below for each.

Soil

The likelihood of soil contamination being encountered within the proposed Alignment Section 1 and Alignment Section 2 is low due to the depth of proposed tunnelling works and limited potential for migration of contaminants to the tunnelling depth. HAIL activities were typically identified distant from where shallow soil disturbance and shaft locations are proposed reducing the potential impact of ground contamination on the proposed works.

Shallow soil disturbance is proposed at 32 Mamari Road and 8 Spedding Road (Alignment Section 1) for the construction of CAH and BPT. Both properties have been identified as HAIL sites due to horticultural activity. Surface soils could be impacted by the application of persistent pesticides.

Alignment Section 3, the alignment from Shaft 17 to the Hobsonville Pumpstation, has the potential to encounter contaminated shallow soil when trenching. At the time of preparing this DSI, the construction methodology for Section 3 has not been confirmed and there is potential for a portion to be trenched.

Groundwater

The likelihood of groundwater contamination within the proposed alignment of Section 1 and Section 2 is low due to the depth of proposed tunnelling works and limited potential for migration of contaminants to the tunnelling depth. HAIL/potential HAIL activities identified were typically not

expected to impact groundwater quality. There is potential for groundwater to have become impacted by former horticultural land identified near Shaft 12, and through the use of potentially contaminated fill imported to create level surfaces or embankments or for road construction.

Shallow groundwater is likely to be encountered during trenching in Alignment Section 3 and dewatering will be required. Based on previous reports, groundwater is impacted in this area.

Summary

The activities, potential contaminants and an assessment of the likelihood, potential magnitude and possible extent of contamination are presented below in Table 3.1. Table 3.1 is an updated version of the original table from the PSI. The table specifies the soil and groundwater investigation locations targeted in the Mott Macdonald Specification to the HAIL activities that were identified in areas of proposed works.

Soil and groundwater investigations were also targeted to assist with characterising cut soil for disposal and for the characterisation of groundwater quality to inform dewatering requirements for groundwater during construction.

Table 3.1: Potential for contamination

Intercepted by or adjacent to the works	Land use/ activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference	Site investigation locations
Intercepted/ adjacent	Horticultural activities	Arsenic, lead, copper, mercury, wide range of organic compounds including acid herbicides, organophosphates and organochlorines, asbestos if used in structures.	The majority of the route does not intersect horticultural land that meets the definition of HAIL A10, with the following exceptions: • Alignment Section 1 proposes to tunnel beneath 4 Spedding Road and potentially contaminated surface soils will not be disturbed. • Shallow earthworks at 8 Spedding Road and 32 Mamari Road will occur with potentially contaminated soils being disturbed. • Shaft 12 is located within an area of land identified to contain potential horticultural activity from 1950 until the construction of SH18. In areas near horticultural land use, surface soils could be impacted by persistent pesticides from spray drift or runoff.	HAIL Activity A10.	BH201 BH203 BH204 BH101 BH102 BH103 BH114 BH115 BH128 No investigation has been completed in CAH and BPT as the 2021 soil and groundwater sampling focused on the alignment of the pipe. Further soil and groundwater investigations are proposed to be undertaken for BPT as a pre-work investigation or an addendum to this DSI. No soil sampling is proposed for CAH as no soil is being taken offsite and the strip and stockpile of topsoil can be managed under the earthwork controls and unexpected discovery protocols in the Contamination Site Management Plan (CSMP).
Intercepted	Wastewater treatment and use of land for the application of sludge at 2A Buckley Avenue.	Depends on type of waste. Biological hazards (Bacteria, viruses), metals, PAHs, semi-volatile organic compounds, and solvents.	Remedial works to address the sludge appear to have been completed at the site. Residual soil contamination appears to remain onsite downgradient of the sludge bed. If significant spills/overtopping of the sludge bed has occurred (during operation of the sludge drying bed), there is potential for soil down gradient of the former sludge bed to be impacted. Validation sampling undertaken post remediation identified arsenic and zinc above published background concentrations. Previous groundwater monitoring data indicates that groundwater quality has been impacted downgradient of the sludge ponds. Moderate to high potential to encounter impacted soil and groundwater when trenching and tunnelling.	HAIL Activities G5 and G6.	Soil and groundwater sampling was not undertaken in 2021. Further soil and groundwater investigations are proposed to be undertaken as a pre-work investigation or an addendum to this DSI.
Potentially intercepted/ adjacent	Historic filling of land to create level surfaces, embankments or for the construction of roads.	Wide ranging depending on the source of fill. Typical contaminants, if sourced from industrial areas, include metals and PAH.	Historical aerials do not show any evidence of substantial historical land disturbance or subsequent filling. Filling associated with construction of SH18 begun in 2010/11 therefore any filling used is likely to be clean quarry sourced materials.	Potentially HAIL Activity I.	The investigation identified fill at several locations between depths of 0.20 between 8.25 m bgl (refer investigation findings later in this report). Both the Massey Connector and the Main Tunnel are to be installed at depths of 20-22 m bgl with shallow soil disturbance only proposed to occur at the six shaft locations[13]. Soil samples have been collected at these eight areas to assess areas of shallow disturbance, with the following sample identifiers: • Shaft LS8, BH108 (Shaft RS10), • BH114 (Shaft LS12), • BH121 (Shaft RS14), • BH128 (Shaft LS16), and • BH133 (Shaft RS17).

[13] Soil disturbance is proposed to occur at all six shaft locations (Shaft 8, Shaft 10, Shaft 12, Shaft 14, Shaft 16 and Shaft 17) from the surface to the depth of the tunnel (22 m bgl).

Intercepted by or adjacent to the works	Land use/ activity	Potential contaminants	Likelihood, magnitude and possible extent of contamination	HAIL reference	Site investigation locations
Intercepted (but soil disturbance at tunnelling depth only)	Stockyard (uncertainty about whether HAIL activity 'dip or spray race' is associated with this yard)	If dip or spray race present: arsenic, organochlorines, and organophosphates, carbamates and synthetic pyrethroids.	The GHD 2020 report identified 6 Spedding Road as a "stockyard" using Google Street view. Our review indicates the property is used for keeping horses. Unlikely to have been stock treatment in this area, potential for contamination therefore limited. If present, contamination likely limited to surface soils around stockyard. Soil testing in this area in 2020 did not detect OCPs.	Potentially HAIL A8 (only if dipping or spray-race activities present, low probability of being a HAIL, however, retained due to uncertainty).	No confirmatory sampling was undertaken as shallow soil disturbance was not proposed to occur in the vicinity of this activity. The proposed tunnelling a depth of approximately 15 m bgl is proposed beneath the site and potentially impacted surface soils will not be encountered.
Intercepted (but soil disturbance at tunnelling depth only)	Transport yard	Total petroleum hydrocarbons (TPH), PAH and heavy metals, other chemicals depending on storage	The aerial review indicates that the property has been used for the storage of transport vehicles from sometime after 2017. If refuelling has occurred onsite there is potential for diesel storage. Other chemicals may have been stored onsite, including batteries. Based on the proposed plans the tunnel will be at 15 m bgl. Soils at this depth are not expected to be impacted unless a very significant spill had occurred onsite. No records of such spills were noted on Council records provided in the GHD 2020 report, so this is considered to be of low risk.	HAIL Activity F8.	No confirmatory sampling was undertaken as shallow soil disturbance was not proposed to occur in the vicinity of this activity. The proposed tunnelling a depth of approximately 17 m bgl is proposed beneath the site and potentially impacted surface soils will not be encountered.
Adjacent	Three sediment treatment ponds adjacent to the proposed route	Metals, petroleum hydrocarbons and PAH from road run off.	The proposed route runs adjacent to the three ponds located on the southern side of SH18. At these locations tunnelling will occur at an approximate depth of 22 m bgl, additional to the nearest shaft is located at least ~90 metres of these ponds. As no shallow soil disturbance is proposed within proximity to these ponds, the impact of any contamination in the ponds to the works is considered to be negligible.	Not a HAIL but potential for accumulation of contaminants.	No confirmatory sampling was undertaken as shallow soil disturbance was not proposed to occur in the vicinity of this activity.
Adjacent	Metal Engineering workshop (Black Steel Engineering)	Heavy metals, cyanide, sulfides, ammonium and ammonia.	Route does not intersect HAIL. Due to the significant distance of the property from the alignment contamination from this activity is considered to be negligible.	Offsite HAIL Activity D5.	No confirmatory sampling was undertaken as shallow soil disturbance was not proposed to occur in the vicinity of this activity (HAIL is 120 m from the alignment).
Adjacent	Waste disposal to land at 174 Brigham Creek Road	Depends on type of waste. Biological hazards (Bacteria, viruses), metals, PAHs, semi-volatile organic compounds, and solvents.	Route does not intersect HAIL but runs adjacent. As tunnelling in the vicinity of this property will occur at a depth of approximately 22 m bgl the contaminants are unlikely to impact soil quality at this depth. The nearest shaft is proposed to be approximately 270 metres of this HAIL.	Offsite Potential HAIL Activity I.	No confirmatory sampling was undertaken as shallow soil disturbance was not proposed to occur in the vicinity of this activity.
Adjacent	Bowling Green at 1 Memorial Lane	Metals (As, Cu, Pb) and organochlorine pesticides (OCPs).	Tunnelling in the vicinity of this property will occur at a depth of approximately 22 m bgl. Therefore, soils are highly unlikely to be impacted by this activity. Shaft 16 is located ~55 m from the bowling green, but within the open recreational area to the west of the green. Limited potential for low levels of contaminants in this area	Offsite HAIL Activity A10.	Shallow soil sampling was undertaken with the following sample identifier: Shaft LS16-BH128 (0.0 and 0.5 m).

4 Field investigations

4.1 Investigation rationale

Contamination sampling and testing was undertaken based on the following rationale:

- Contamination testing was completed on shallow soils with the Spedding Road Reserve adjacent to 8 Spedding Road (sample 'HDD exit') and the six shaft locations (Shaft LS8, RS10, LS12, RS14, LS16 and RS17) along the main tunnel alignment. The purpose of testing was to inform resource consenting implications and disposal. Note: Soil testing at 8 Spedding Road (BPT location) and Alignment Section 3 was not completed at the time of preparation of this report.
- Contamination testing was also completed on natural soils at tunnelling depth primarily to inform appropriate disposal.
- Groundwater sampling was undertaken at boreholes in close proximity to the majority of shaft locations to inform resource consenting implications and to inform the appropriate discharge of dewatering water during construction. Both shallow and deep groundwater was sampled and tested.

The scope for the investigation was in accordance with the Mott MacDonald Specification.

4.2 Soil investigation

A site plan indicating the investigation locations is presented below in Figure 4.1.

In total fourteen (14) shallow soil samples and twenty-nine (29) deep soil samples were collected from 28 location points. Six (6) duplicates (blind replicate) and two (2) split samples were also collected and analysed for quality assurance and quality control (QA/QC) purposes.

The soil sampling procedures are described in detail in Appendix E.

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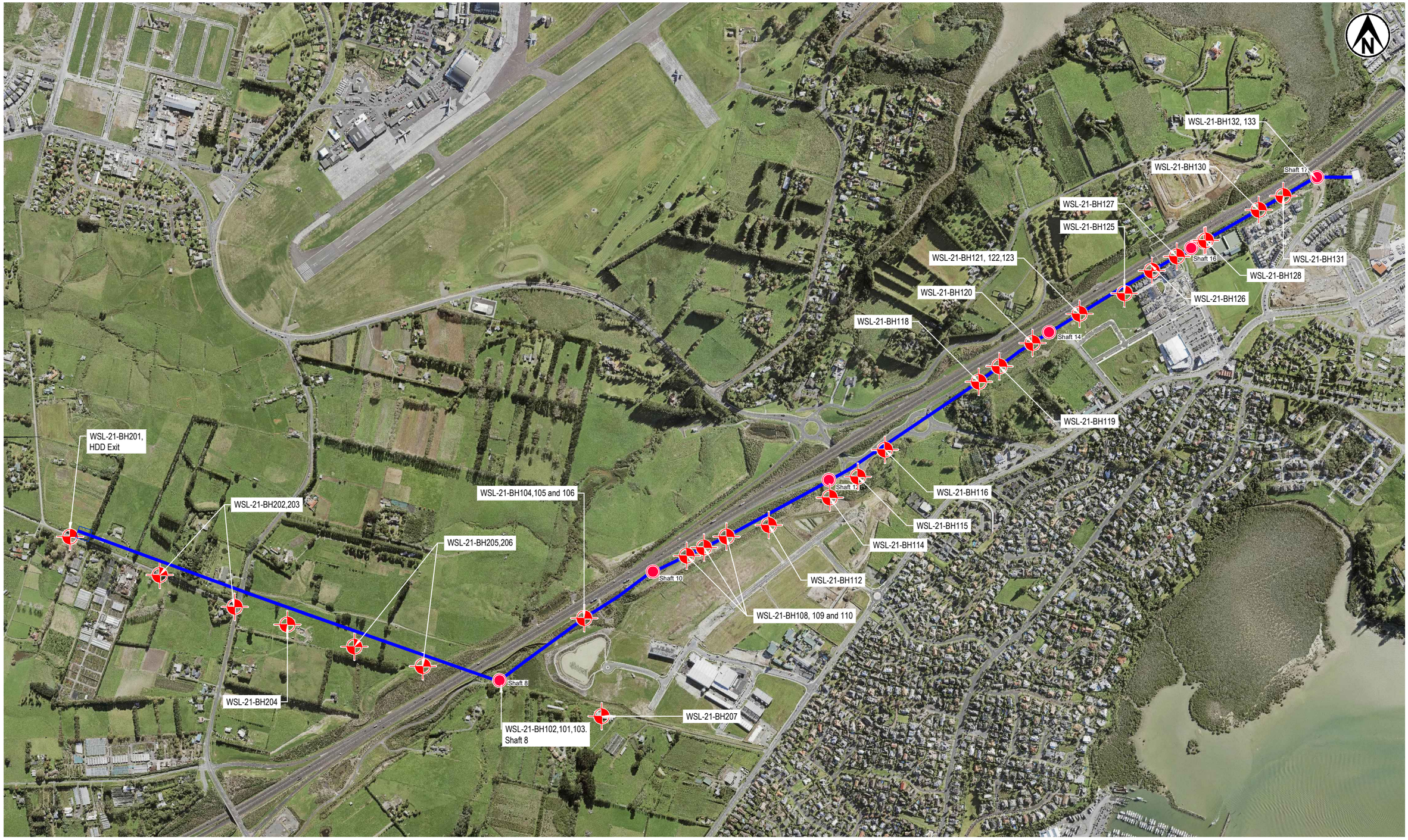

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0 0.1 0.2 0.3 0.4 0.5 (km)

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PROJECT No.	1015506.000	
DESIGNED	RVDK	May.23
DRAWN	RBS	May.23
CHECKED		

BUILDING CONSENT APPROVAL

APPROVED DATE

CLIENT **WATERCARE SERVICES LIMITED**

PROJECT **GROUND CONTAMINATION DETAILED SITE INVESTIGATION**

TITLE WHENUAPAI REDHILLS WASTEWATER SERVICING SCHEME PACKAGE 2
Site Features

UNDER REVISION 1

SCALE (A3) 1:10,000 FIG No. 1015506.000-F4.1 REV 1

4.2.1 Observations

Geotechnical investigations were undertaken in 2021 concurrent with the contamination investigations. Based on a review of the available information, the subsurface profile observed during the intrusive investigation works consisted of localised areas of fill/topsoil overlying variable thicknesses of Tauranga Group materials. These units were underlain by a variably weathered profile of East Coast Bay Formation (ECBF), typically grading from residual soils/weathered rock to slightly weathered/unweathered rock at depth. The geotechnical investigation generally confirmed the expected mapped conditions.

Borehole logs and hand auger logs are provided in Appendix B

Fill materials were encountered in a number of investigation locations as summarised in Table 4.1. No visual or olfactory observations of contamination were present, with the exception of minor brick fragments encountered in BH101 (at the surface and at 0.3 m) and trace wires at depth in BH104 (from 6.6 m and 7.95 m depth).

No other indicators of contamination were observed in soils during the investigation programme.

Fill materials, typically comprising sandy silt/silt were encountered in several of the investigation locations up to depths of 8.25 m bgl as presented in Table 4.1 below. Further description of the soil profiles obtained is contained within the geotechnical investigation reports.

Table 4.1: Soil observation summary[14]

Investigation location	Fill depth	Fill description
'HDD Exit' (HA near BH201)	Topsoil to 0.4 m	Clayey silt
'Shaft 8' (HA near BH102)	Fill to 0.2 m	Silty clay with gravel
BH101	Fill to 0.5 m	Silt. Brick fragments at surface and 0.3 m.
BH104	Fill to 8.25 m	Silt. Geotech cloth and trace wires from 6.60-6.80 m. Trace wires and synthetic fibres from 7.95-8.22 m.
BH106	Fill to 3.0 m	Silt
BH108	Topsoil to 0.05 m	-
BH110	Fill to 3.45 m	Silty clay/ peat
BH112	Fill to 5.5 m	Silt/ Clay
BH114	Topsoil to 0.1 m Fill to 5.45 m	Silt with some sand
BH116	(Hydrovac excavation to 1.5 m – natural material present from 1.5 m)	-
BH118	Topsoil to 0.8 m	Silt
BH120	Fill to 2.25 m	Sandy silt
BH121	Fill to 0.45 m	Sandy silt/ sandy clay
BH125	Topsoil to 0.15 m Fill to 5 m.	Sandy silt
BH126	Topsoil to 0.1 m Fill to 1.5 m	Silty clay/ silt with some clay
BH128	Fill to 1.1 m	Sandy silt
BH130	Topsoil to 0.3 m	Sandy silt
BH131	Fill to 1.7 m	Sandy silt/ clay
BH132	Fill to 0.6 m	Topsoil/ clayey silt
BH133	Fill to 3.95 m	Silt/ clayey silt
BH201	Fill to 1.5 m	Silt/ silty clay
BH202	Fill to 7.5 m	Silty sand/ sandy silt
BH203	Fill to 2.2 m	Sandy silt/ clayey silt
BH204	Topsoil to 0.3 m	Silty sand
BH205	Topsoil to 0.25 m	Sandy silt
BH206	Fill to 1.9 m	Sandy silt/ silt
BH207	Fill to 1.1 m	Sandy silt/ silt

[14] The table provided summarises the investigation locations where contamination sampling was undertaken. For further geological information relating to other investigations along the alignment the relevant geotechnical report(s) should be referred to.

4.2.2 PID field screening

All shallow soils sampled were field screened using a photo ionisation detector (PID). PID readings are recorded on the relevant borehole/hand auger logs and summarised in Table 4.2 below.

Table 4.2: PID field screening results

Location	Depth	PID reading (PPM)
'HDD Exit' adjacent to 8 Spedding Road (HA near BH201)	0.0 - 0.10	0.4
	0.4 - 1.00	0.7
'Shaft 8' (HA near BH102)	0.0 - 0.10	0.6
	0.30 - 1.00	0.6
BH108 (Shaft 10)	0.0	Not collected
	0.5	Not collected
BH114 (Shaft 12)	0.0	Not collected
	0.5	Not collected
BH121 (Shaft 14)	0.0	0.3
	0.5	0.1
BH128 (Shaft 16)	0.0	0.6
	0.5	3.3
BH133 (Shaft 17)	0.0	1.3
	0.5	0.9

4.2.3 Soil sample scheduling

Soil samples were selected for laboratory analysis based on the Mott MacDonald Specification and subsequent agreed revisions. Samples and split samples were couriered to Analytica Laboratories and Hill Laboratories respectively under chain of custody documentation. Samples were scheduled within the generally accepted holding times for analytes[15]. All samples were analysed as per the original scope and any deviations stated below in Table 4.3 and

[15] Ministry for the Environment updated 2021, *Contaminated Land Management Guidelines No 5 Site Investigation Analysis of Soils.*

Table 4.4.

As per the scope, selected samples were composited and analysed for Toxicity Characteristic Leaching Procedure (TCLP) analysis as indicated below.

No samples from areas of shallow soil disturbance were tested for leachate analysis, as total concentrations of contaminants in soil were recorded below the relevant expected background concentrations for natural soils

Table 4.3: Soil sample testing – shallow soils in areas of proposed disturbance

Investigation location	Depth of sample(s) tested (m)	Analysis suite
'HDD Exit' adjacent to 8 Spedding Road (HA near BH201)	0.0-0.10	Metals (10)[16], PAH[17], TPH[18], OCP[19], ONOP[20] and asbestos.
	0.4-1.00	Metals (10), PAH, TPH and OCP.
'Shaft 8' (HA near BH102)	0.0-0.10	Metals (10), PAH, TPH, OCP, ONOP and asbestos.
	0.30-1.00	Metals (10), PAH, TPH and OCP.
BH108 (Shaft 10)	0.0	Metals (10), PAH, TPH, OCP and asbestos.
	0.5	Metals (10), PAH, TPH.
BH114 (Shaft 12)	0.0	Metals (10), PAH, TPH, OCP, ONOP and asbestos.
	0.5	Metals (10), PAH, TPH and OCP.
BH121 (Shaft 14)	0.0	Metals (10), PAH, TPH, OCP and asbestos.
	0.5	Metals (10), PAH and TPH.
BH128 (Shaft 16)	0.0	Metals (10), PAH, TPH, OCP, ONOP and asbestos.
	0.5	Metals (10), PAH, TPH and OCP.
BH133 (Shaft 17)	0.0	Metals (10), TPH, OCP, asbestos, SVOC[21] and PFAS[22]
	0.5	Metals (10), TPH, Asbestos and SVOC

[16] Metals (10): arsenic, beryllium, boron, cadmium, chromium, copper, lead, mercury, nickel, and zinc.
[17] PAH: Polycyclic aromatic hydrocarbons
[18] TPH: Total petroleum hydrocarbons
[19] OCP: Organochlorine pesticides
[20] ONOP: Organophosphorus pesticides
[21] SVOC: Semi-volatile organic compound
[22] PFAS: Per- and polyfluoroalkyl substances

Table 4.4: Soil sample testing – deep soils at approximate tunnelling depth

Investigation location	Depth of sample(s) tested (m)	Analysis suite	
BH101	10-10.4	Full comprehensive suite[23]	Metals in leachate testing (via TCLP)
	28-28.7	Full comprehensive suite	
BH104	12	Full comprehensive suite	-
	21	Full comprehensive suite	-
BH106	21	Full comprehensive suite	
BH110	20	Full comprehensive suite	-
BH112	24	Full comprehensive suite	-
BH116	13	Full comprehensive suite	-
BH118	22	Full comprehensive suite	-
BH120	20	Full comprehensive suite	-
BH121	10	Full comprehensive suite	Metals in leachate testing (via TCLP)
	25	Full comprehensive suite	
BH125	23	Full comprehensive suite	-
BH126	17	Full comprehensive suite	-
BH130	16	Full comprehensive suite	-
BH131	10	Full comprehensive suite	-
BH132	10	Full comprehensive suite	Metals in leachate testing (via TCLP)
	15	Full comprehensive suite	
BH133	10	Full comprehensive suite	Metals in leachate testing (via TCLP)
BH201	4-4.2	Full comprehensive suite	
BH202	14-14.2	Full comprehensive suite	Metals in leachate testing (via TCLP)
	32-32.2	Full comprehensive suite	
BH203	25-25.2	Full comprehensive suite	-
BH204	26-26.2	Full comprehensive suite	-
	36-36.2	Full comprehensive suite	-
BH205	22-22.2	Full comprehensive suite	-
BH206	16-16.2	Full comprehensive suite	Metals in leachate testing (via TCLP)
	24-24.2	Full comprehensive suite	
BH207	5.4	Full comprehensive suite	-

[23] Metals (arsenic, barium, beryllium, boron, cadmium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, tin, vanadium, and zinc), sulphur, pH, chloride, sulphate, allophane presence, fluoride (calcium chloride extract) and total organic carbon.

4.3 Groundwater investigations

Groundwater samples were collected from piezometers and nested piezometers installed as part of the geotechnical investigations within boreholes near five of the shaft locations across the alignment. A total of nine piezometers were sampled. The locations investigated are indicated on the site plan in Figure 4.1.

A summary of the groundwater piezometers is provided below (note – no piezometers were installed at Shaft LS8).

Table 4.5: Summary of groundwater piezometers

Shaft:	Piezometer identifier:	Top of screen (m bgl)	Bottom of screen (m bgl)
8	No piezometers installed		
10	BH110	21	27
12	BH115 Shallow	5	8
	BH115 Deep	16	19
14	BH122 Shallow	5	9
	BH122 Deep	11	15
16	BH127 Shallow	6.7	9.7
	BH127 Deep	21	24
17	BH132 Shallow	4	7
	BH132 Deep	13	16

The nine piezometers were sampled on the 8 and 9 July and 18 November 2021.

Two (2) duplicates, two (2) trip blanks, three (3) rinsate samples and one (1) field blank were also collected and analysed for QA/QC purposes. Samples were submitted for analysis to Analytica Laboratories.

Samples were scheduled for dissolved metals[24], SVOCs and TPH. Sampling and analysis were conducted in general accordance with the MfE Contaminated Land Management Guidelines No. 5[2]. The groundwater sampling procedures are described in detail in Appendix E.

4.3.1 Observations

Groundwater sampled from the nine piezometers did not have any discernible odour and was described as being visually clear to possessing only minor turbidity. Field parameters prior to sampling and depth to groundwater prior to pumping are summarised in Table 4.6. Complete field parameters and depth to groundwater recorded during the investigation are provided on groundwater sampling field sheets in Appendix D.

[24] Dissolved metals included: arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc.

Table 4.6: Stabilised parameters prior to collecting groundwater samples

Date Sampled	Borehole ID	GW level prior to pumping (m)	Dissolved Oxygen (DO) (mg/L) final	Electrical Conductivity (EC) (µs/cm) (final)	pH (final)	Oxidation reduction potential (mV) (final)
18/11/2021	BH110	8.290	2.40	320.3	6.35	75.8
18/11/2021	BH115 - shallow	3.464	0.26	952	6.08	98.0
18/11/2021	BH115 - deep	3.078	7.80	205.6	6.40	52.7
9/07/21	BH122 - shallow	3.844	2.21	1143	5.00	197.2
8/07/2021	BH122 - deep	5.626	1.78	242.8	7.55	105.9
9/07/2021	BH127 - shallow	5.832	2.67	586	6.01	191.8
8/07/2021	BH127 - deep	7.214	1.59	225.2	10.33	143.7
18/11/2021	BH132 - shallow	3.524	0.69	389.9	5.41	75.0
18/11/2021	BH132 - deep	6.273	1.47	348.6	6.05	3.8

5 Regulatory framework and acceptance criteria

5.1 Regulatory framework

The rules and associated assessment criteria relating to the control of contaminated sites in the Auckland region are specified in the following documents:

- The NESCS Regulations.
- The Auckland Unitary Plan, Operative in Part version dated 15 November 2016 (AUP).

The NESCS Regulations consider issues relating to land use and the protection of human health while the AUP has regard to issues relating to the protection of the general environment, including ecological receptors.

In addition to these regulations/plans the management of asbestos in soils is regulated under the Health and Safety at Work (Asbestos) Regulations 2016 (Asbestos Regulations). In order to help achieve compliance with the Asbestos Regulations, WorkSafe New Zealand has prepared an Approved Code of Practice (ACoP): Management and Removal of Asbestos (September 2016). The ACoP refers readers to the *"New Zealand Guidelines for Assessing and Managing Asbestos in Soil"* (herein referred to as the Asbestos-in-Soil Guidelines) which were published in November 2017 by BRANZ Ltd. The Asbestos-in-Soil guidelines define the level of oversight and controls (including personal protective equipment, decontamination, etc.) that is required to be implemented dependent on the concentration of asbestos fibres/fines or fragments that are present in the soils.

5.2 Assessment criteria

The testing data for soil and groundwater samples collected from the site have been evaluated against criteria selected according to the requirements of the regulatory framework as set out below.

5.2.1 Soils

Soil results have been compared to the following criteria:

- For the protection of human health:
  - The NESCS Soil Contaminant Standards (SCS) for commercial/industrial use, as a proxy for outdoor workers involved in the proposed development.
  - Where NESCS SCS values have not been derived, guidance from the below documents were used, as per MfE's *"Contaminated Land Management Guideline No. 2, Hierarchy and Application in New Zealand of Environmental Guideline Values (Revised 2011)"*:
    - Ministry for the Environment's "Guidelines for Assessing and Managing *Petroleum Hydrocarbon Contaminated Sites in New Zealand (Revised 2011)"*.
    - [Australian] National Environment Protection (Assessment of Site Contamination) Measure 1999, updated 2013.
    - USEPA Regional Screening Levels - http://www.epa.gov/risk/risk-based-screening-table-generic-tables. Residents Soil. Criteria adjusted for 1 in 100,000 risk where required.
    - Canadian Environmental Quality Guidelines (CCME, 2002).
  - For asbestos in soil contamination, the criteria defined in the Asbestos-in-Soil Guidelines have been adopted.
- For discharges to the environment:
  - The Permitted Activity (PA) Soil Acceptance Criteria as defined in Section E30.6.1.4 of the AUP.
  - The published non- volcanic background concentrations for Auckland described in the Auckland Regional Council "*Technical Publication 153 – Background Concentrations of Inorganic Elements in Soils from the Auckland Region"* (and cited in Section E30.6.1.4 of the AUP) are used as a basis for acceptance of soil to cleanfill sites.
- For soil disposal:
  - Background soil concentrations as discussed above for acceptance of soil to cleanfill sites.
  - Managed Fill disposal criteria; published acceptance criteria of a typical managed fill disposal site[25] for an initial assessment of disposal to managed fill.

5.2.2 Groundwater

The groundwater testing data has been evaluated according to the requirements of the regulatory framework of applicable to the proposed works.

[25] Ridge Road Quarry Managed Fill Acceptance Criteria.

The discharge of water onto or into land and/or into water from temporary or permanent discharge of diverted uncontaminated groundwater is a permitted activity so long as the discharge (after reasonable mixing) meets quality guidelines for the protection of 95% of species in freshwater, or the expected background concentrations in groundwater. As such, the following have been used to initially assess whether the discharge of construction dewatering water to stormwater or land would be a permitted activity under AUP Rule E4.6.2: The Australia New Zealand /environment and Conservation Council (ANZECC) values for the protection level of 95% of species in freshwater.

Auckland background groundwater concentrations for Waitemata Bores, published by Auckland Regional Council (2007), in the document titled "State of the Environment Monitoring: Groundwater Data Report 1998-2005". The general permitted activity standards for discharges under AUP rule E4.6.4.1 also requires that the discharge does not result in "any significant adverse effect on aquatic life". The same assessment criteria have also been adopted to assess the works under that rule.

5.3 Quality assurance and quality control

A quality assurance and quality control (QA/QC) program was implemented as part of field procedures to confirm the data collected was fit for purpose and included:

- Sampling equipment decontamination between sampling points.
- Preservation of samples with ice during transport from the field to the laboratory.
- Transportation of samples with accompanying CoC documentation.
- Compliance with sample holding times.

5.3.1 Laboratory quality control

The laboratory testing was undertaken by Analytica Laboratories and Hill Laboratories, who did not notify of breaches of laboratory quality control at the time of the release of analytical results.

5.3.2 Field quality control

In addition to QA/QC undertaken by the laboratories, duplicate and split soil samples and a duplicate groundwater sample were collected in the field during the investigation. Rinsate sampling was also conducted following decontamination of the equipment. Field and trip blanks were submitted for groundwater to assess potential cross contamination during sampling, transport and or storage.

5.3.3 Duplicates and split samples

A quantitative measure of the variability in the results was assessed by calculating the Relative Percentage Difference (RPD) values for contaminants in the primary samples and duplicates and primary samples and split samples. The results of the analyses are summarised, for compounds reported above the laboratory limit of reporting in Appendix E.

$$RPD := \frac{(Co - Cs)}{\left(\frac{Co + Cs}{2}\right)} \cdot x100$$

Where Co = concentration of the original sample

Cs = concentration of the duplicate sample/ split sample

In summary:

- RPDs for soil duplicate samples were generally in an acceptable range of 0 - 50% (exceedances of 50% are highlighted in red in Appendix E Table 1).
- Groundwater duplicate results generally reported low RPDs. The highest RPD reported was 43% for copper, this RPD is likely due to the relatively low concentration of copper detected in the sample (0.00024 g/m^3) and the duplicate sample (0.00037 g/m^3) refer to Appendix E Table 2.

Two soil split samples were sent to Hill Laboratories and analysed for the same suite of analytes as the primary sample utilising similar analytical techniques. The RPD value was calculated for these samples. Concentrations in soil in the split samples generally reported RPDs within a < 50% range indicating that variability in sample laboratory analysis is acceptable. The RPDs for some analytes were higher than 50%, this is considered to reflect the heterogenous nature of the soil and overall low reported concentrations refer to Appendix E Table 3.

5.3.4 Field and trip sample analysis results

Field and trip blank samples from the groundwater sampling were analysed and are reported in Appendix E Table 4. Results were recorded below the laboratory limit of reporting except for 4-methylphenol (in the trip blank for 8/07/2021) and zinc and copper (in the trip blank 18/11/2021). The laboratory was queried regarding these detections and advised the following:

- *The detection of 4-methylphenol is likely a false positive.*
- *The laboratory re-ran the sample where zinc and copper was detected in the trip blank, the analysis returned the same result for zinc, however, copper was not detected above the laboratory limit of reporting.*

Based on the explanation from the laboratory, the reported detections in the blank samples do not affect the interpretation of the primary data.

5.3.5 Rinsate analysis results

Three rinsate samples were collected following decontamination of the sampling equipment during groundwater sampling. The full results are provided in the laboratory transcripts in Appendix F a summary of the results detected above the limit of reporting is presented in Appendix E Table 5.

Concentrations were primarily reported less than the laboratory limit of reporting with minor trace detections for nickel, butyl benzyl phthalate and benzyl alcohol. The laboratory was queried regarding the detections and advised the following:

- *The results reported are close to the reporting limit where uncertainty is expected.*
- *Nickel is very close to the detection limit and therefore a larger degree of uncertainty of measurement is expected. The detection could be caused by uncertainty or spot contamination from the water source, field equipment or laboratory. The laboratory has reviewed their internal quality controls for the analysis and all performed within acceptance criteria.*

Based on the explanation from the laboratory, the reported detections in the rinsate blank samples do not affect the interpretation of the primary data.

6 Investigation results

A summary of the analytical results is provided, in comparison to relevant guidelines, in Appendix E Table 6 (for shallow soils), Appendix E Table 7 (for deep soils), Appendix E Table 8 (for composite

TCLP analysis) and Appendix E Table 9 (for groundwater results). Laboratory transcripts are provided in Appendix F.

6.1 Soil analytical results

6.1.1 Shallow soils

Assessment of the results for shallow soils found:

- All samples submitted for analysis reported concentrations of contaminants below the NESCS SCS for Commercial/ Industrial use.
- All soil samples contained concentrations which comply with the AUP permitted activity soil acceptance criteria.
- None of the fourteen (14) soil samples analysed, contained metal contaminant concentrations above the non-volcanic background levels.
- Asbestos was not detected in the eight samples analysed.
- Concentrations of ONOPs, PFAS and SVOC were below the laboratory limit of reporting (LOR) where tested.
- Concentrations of PAH were below the laboratory limits of reporting in the 14 soil samples tested.
- Concentrations of TPH were detected above the laboratory LORs in eight samples. The highest concentration was 107 mg/kg for C7-C36 in Shaft LS14 BH121 – 0.5 m.

6.1.2 Deep soils

Assessment of the results for deep soils at the proposed tunnelling depth found:

- All samples submitted for analysis reported concentrations below the NESCS SCS for Commercial/ Industrial use.
- All soil samples reported concentrations which comply with the AUP permitted activity criteria.
- Of the twenty-nine (29) soil samples analysed, thirteen (13) samples contained contaminant concentrations above the non-volcanic background levels for barium, nickel, sulfur and total organic carbon.

6.2 Groundwater analytical results

Groundwater analytical results are summarised in the following sections against relevant regulatory criteria.

6.2.1 Comparison to Auckland background groundwater concentrations

The assessment of the groundwater results against background ranges indicates chromium, copper, lead, zinc and to a minor extent nickel exceed background ranges in one or more of BH115 shallow, BH122 (shallow and deep) and BH132 (shallow and deep). The factor of exceedance in each sample, where exceedance was reported, are summarised below in Table 6.1.

Table 6.1: Factor of exceedance of background values

Dissolved metal	BH115 Shallow A	BH122 Shallow A	BH122 Deep A	BH132 Shallow A	BH132 Deep A
Chromium	-	X8	X2	-	X1.8
Copper	X4.7	X11	-	X8.7	-
Lead	-	X2.1	-	X2.75	-
Nickel	-	X1.4	-	-	-
Zinc	X2.4	X6.4	-	X1.2	-

Concentrations of TPH and the majority of SVOCs were below the laboratory limits of detection. SVOCs detected above the laboratory LOR and above expected background concentrations included:

- 4-Methylphenol reported at the laboratory detection limit of 0.001 g/m^3 in sample BH122 Shallow A.
- Butyl benzyl phthalate reported at concentrations up to 0.0012 g/m^3, slightly above a LOR of 0.001 g/m^3. This exceedance is considered insignificant.
- Benzyl alcohol reported at concentrations up to 0.0043 g/m^3, greater than the LOR of 0.003 g/m^3.

These minor detections are not considered significant given the likely source relating to the piezometer installation, low concentrations, and mixing that will occur in the environment.

Only those contaminants that exceed expected background concentrations are considered further in the following assessment against the environmental protection criteria.

6.2.2 ANZECC guidelines for protection of 95 % of freshwater species

The assessment of the groundwater results against ANZECC Guidelines for the protection of 95% of freshwater species indicates:

- The ANZECC 95% trigger value for the protection of freshwater species (and background) was exceeded for chromium, copper, nickel and/or zinc in four of the nine groundwater samples.

The factor of the four samples exceeding the ANZECC 95% of freshwater species (and background) is summarised below in Table 6.2.

Table 6.2: Factor of exceedance of ANZECC 95% Freshwater trigger values, where also exceeding published background concentrations.

Dissolved metal	BH115 Shallow A	BH122 Shallow A	BH122 Deep A	BH132 shallow
Chromium	-	X4.2	X1.1	X1.4*
Copper	X3.4	X7.9	-	X6.2
Nickel	-	X3.8*	-	-
Zinc	X2.4	X6.4	-	X8.3 *

* Note: these results only exceed published background by a marginal amount (refer to Table 6.1).

6.2.3 Groundwater condition summary

In summary:

- Groundwater samples from the deep piezometers (screen depth 11-27 m) returned metal concentrations below either the background or the trigger levels with the exception of a very slight exceedance of chromium in BH122 Deep A.
- Shallow groundwater (screen depth 4 - 9.7 m) quality the criteria with the exception of groundwater from BH122, BH115 and BH132 which contained chromium, copper, nickel and zinc above both background and above the 95% freshwater protection trigger levels.

7 Conceptual site model

A conceptual site model (CSM) as defined by the MfE in the contaminated land management guidelines, sets out known and potential sources of contamination, potential exposure pathways, and potential receptors. A CSM helps to identify whether or not a complete exposure pathway exists. For there to be a contamination risk from the proposed activity there must be a contamination source and a mechanism (pathway) for contamination to affect human health or the environment (receptor). If one of these components does not exist, or can be removed, then the exposure pathway is incomplete. If the exposure pathway is incomplete, then there is little risk to human health or the environment in this location.

A preliminary CSM was developed in the PSI phase of the investigations for the proposed activity considering the available information about the site, and our understanding of the potential effects on human health and the environment.

The CSM has been updated to include the results of this DSI investigation and changes to the alignment. The CSM is presented below in Table 7.1. The CSM for BPT and Alignment Section 3 (Shaft 17 to Hobsonville Pumpstation) will need to be confirmed once soil and groundwater test results are available.

The soil investigation results to date indicate the identified contaminating activities have not impacted soil to a degree which presents a risk to human health or the environment as concentrations of sampled soil are below the relevant NESCS and AUP. Soil testing has focused on the areas where soil disturbance is proposed – at shaft entry points and at the tunnelling depths. The only potentially complete pathways relate to shallow groundwater and the proposed discharge of dewatered groundwater. Groundwater contamination concentrations of copper, nickel and/or zinc in shallow groundwater at Shafts LS12 (BH115 shallow), RS14 (BH122 shallow) and RS17 (BH132 shallow) were recorded above background concentrations and the ANZECC Guidelines for the Protection of 95% of Freshwater species. There is uncertainty around the source of groundwater contamination in these locations. Groundwater from the other shallow piezometer (Shaft 16 BH127 Shallow) returned concentrations of analytes below background and the trigger values. It is possible

that groundwater contamination originates from the application of wastewater to land (elevated contaminants at BH132), fill placed during the earthworks for SH18 motorway, or road run off as the contaminants detected above background in groundwater are typical contaminants of either road runoff or fill material in Auckland. Elevated concentrations in soil in comparison to expected background soil concentrations were not recorded in the shallow soil samples tested in these areas however testing was limited to the small areas of proposed shallow soil disturbance at the shaft locations and HDD exit point. If dewatering is to occur from the shallow groundwater, the resulting discharge with reasonable mixing should meet the ANZECC 95% freshwater trigger values in the receiving environment.

Groundwater sampling from the deeper piezometers returned concentrations below background concentrations and the ANZECC Guidelines for the Protection of 95% of Freshwater species. If dewatering is to occur from the tunnel depth, the resulting discharge should meet the ANZECC 95% freshwater trigger values in the receiving environment.

Table 7.1: Conceptual site model

Contamination Source	Pathway	Receptor	Risk assessment
Stockyard (presence of dip or livestock spray race uncertain); transport yard, sediment treatment ponds and Black Steel Engineering.	Shallow soil disturbance is not proposed to occur in the vicinity of these activities, therefore, there is no risk to human health or the environment in this location.	-	Incomplete: Shallow soil disturbance is not proposed to occur near these locations.
Horticultural land use (orchards, including glasshouses, market gardening).	Inhalation of dust Dermal contact Ingestion of soil	Future site users (with regard to reuse of soil) Maintenance/ excavation workers	Incomplete: Soil concentrations of metals, pesticides, and asbestos below human health criteria for commercial/industrial use. Risk assessment for 8 Spedding Road to be completed following additional soil investigations.
	Leaching of contaminants Runoff	Environmental receptors (groundwater, surface water), workers	Incomplete: Soil concentrations of metals, pesticides, and asbestos below the AUP criteria for the protection of the environment. Risk assessment for 8 Spedding Road to be completed following additional soil investigations.
Bowling Green/sports grounds.	Inhalation of dust Dermal contact Ingestion of soil	Future site users (with regard to reuse of soil) Maintenance/ excavation workers	Incomplete: Soil samples collected and analysed from near Shaft 16 (WSL-21-BH128) ~55 m from the bowling green where shallow soil disturbance will occur did not detect metals, OCPs or ONOPs above the commercial/industrial human health criteria use.
	Leaching of contaminants Runoff	Environmental receptors (groundwater, surface water)	Incomplete: Soil concentrations of metals and pesticides below the AUP criteria for the protection of the environment.

Contamination Source	Pathway	Receptor	Risk assessment
Waste disposal to land - NZDF application of sludge and wastewater treatment plant.	Inhalation of dust	Future site users (with regard to reuse of soil) Maintenance/ excavation workers	Risk assessment to be completed following additional soil and groundwater investigations.
	Dermal contact		
	Ingestion of soil		
	Leaching of contaminants	Environmental receptors (groundwater, surface water)	
	Runoff		
Potentially contaminated fill imported to create level surfaces or embankments or for road construction.	Inhalation of dust	Future site users Maintenance/ excavation workers	Incomplete: Soil samples collected from all locations returned results below the human health criteria for commercial/ industrial land use.
	Dermal contact		
	Ingestion of soil		
	Leaching of contaminants/run off from soil source	Environmental receptors (groundwater, surface water)	Incomplete: Soil concentrations of contaminants below the AUP criteria for the protection of the environment. Groundwater contamination potentially from this source is discussed below.
Elevated metals in shallow groundwater at Shaft 12 and 14 and 17.	Migration of contaminants in groundwater	Groundwater and surface water	Unlikely complete: Groundwater concentrations of copper, nickel, and zinc above the ANZECC Guidelines for the Protection of 95% of Freshwater Species and background groundwater concentrations in the samples collected from BH122 shallow, and copper and zinc in samples collected from BH115 shallow and BH132 shallow. However, mixing prior to and at the receiving environment is expected to reduce metal concentrations below acceptable levels.
	Dewatering of excavations	Surface water and land near the dewatering location where it may enter groundwater	Unlikely complete: Groundwater concentrations of copper and or zinc above the ANZECC Guidelines for the protection of 95% of Freshwater Species and background groundwater concentrations in the samples collected from BH122 shallow, BH115 shallow and BH132 shallow. However, mixing prior to and at the receiving environment is expected to reduce metal concentrations below acceptable levels.

8 Development implications

The following section summarises the regulatory implications associated with the contamination conditions identified at the site.

8.1 Regulatory implications

The rules and associated assessment criteria relating to the control of contaminated sites in the Auckland region are specified in the following documents:

1 NESCS Regulations.

2 The AUP – operative in part.

3 Health and Safety at Work (Asbestos) Regulations 2016 (Asbestos Regulations).

8.1.1 NESCS

The NESCS legislation sets out nationally consistent planning controls appropriate to district and city councils for assessing contaminants in soil with regard to human health.

The NESCS applies to specific activities on land where a HAIL activity has or is more likely than not to have occurred. Activities covered under the NESCS include soil disturbance, soil sampling, fuel systems removal, subdivision and land use change.

The NESCS does not apply to land where a HAIL activity has occurred but concentrations of contaminants in soil are below published background concentration [26].

This report identified a number of HAIL sites intercepted by the proposed alignment and associated works. The applicability of the NESCS at each of these HAIL sites is discussed in Table 8.1.

[26] Clause 9 of the NESCS states that the NESCS…" regulations do not apply to a piece of land…. In which a detailed site investigation exists that demonstrates that any contaminants in or on the piece of land are at, or below, background concentrations".

Table 8.1: HAIL sites intercepted by the alignment and associated works

Address and proposed works in area	HAIL	Comments on status under the NESCS	NESCS applies
8 Spedding Road, the location of the proposed BPT	Horticultural land use (HAIL A10)	NESCS applies – no soil testing data available at the time of writing. Further site investigation data required to inform contamination status under the NESCS.	Yes
32 Mamari Road, the location of the CAH	Horticultural land use (HAIL A10)	NESCS applies – no soil testing data available at the time of writing. Further site investigation data required to inform contamination status under the NESCS.	Yes
Hobsonville Pumpstation, 2A Buckley Avenue, intercepted by proposed Alignment Section 3	Wastewater treatment (HAIL G6) and waste disposal to land (HAIL G5)	NESCS applies - further site investigation data required to inform contamination status under the NESCS.	Yes
Land close to the Brigham Creek roundabouts, intercepted by Shaft LS12	Potential historical horticultural land (HAIL A10)	Soil samples analysed from Shaft LS12 (BH114) reported contaminant concentrations of metals, OCP, ONOP and TPH below the relevant background levels. As such, the NESCS does not apply works to Shaft LS12 as soil concentrations are below background concentrations (Clause 9).	No
51 Trig Road	Transport yard (HAIL F8)	Route intercepts yard but soil disturbance is associated with tunnelling at 17 m bgl. Given the depth of soil disturbance it is concluded that the NESCS regulations do not apply to these works.	No
4 Spedding Road	Potential horticultural land use (HAIL A10)	Route intercepts 4 Spedding Road but soil disturbance is associated with tunnelling at 15 m bgl. Given the depth of soil disturbance it is concluded that the NESCS regulations do not apply to these works.	No
Remainder of route	-	No HAIL sites identified along remainder of route that have potential to impact the works.	No

In summary, based on the findings of the assessment the NESCS applies to the following areas:

- The proposed alignment within the WWTP/waste disposal to land in Section 3 of the alignment (Shaft 17 to Hobsonville Pumpstation).
- The proposed BPT at 8 Spedding Road.

8.1.1.1 NESCS Permitted Activity conditions for soil disturbance

An assessment against the relevant permitted activity (PA) standards of the NESCS for soil disturbance is provided in Table 8.2.

Table 8.2: NESCS Permitted Activity assessment for soil disturbance

NESCS – Soil disturbance permitted activity conditions (Regulation 8(3))		Assessment for 2A Buckley Avenue	Assessment for 8 Spedding Road (BPT)	Assessment for 32 Mamari Road (CAH)
a	Implementation of controls to minimise exposure of humans to mobilised contaminants.	**CAN COMPLY**- Controls will be in place to prevent mobilisation of contamination.		
b	The soil must be reinstated to an erosion free state within one month of completing the land disturbance.	**CAN COMPLY** The area of land disturbance will be reinstated to an erosion free state on completion of the works.		
c	The volume of the disturbance of the piece of land must be no more than 25 m^3 per 500 m^2.	**UNKNOWN** Earthwork volumes for soil disturbance where Section 3 intercepts the HAIL sites are under development and the proposed soil disturbance works is unknown at the time of preparing this DSI. The threshold for disturbance is ~227 m^3 based on a HAIL activity area encompassing the entire of 2A Buckley Avenue (4,550 m^2).	**UNKNOWN** Earthwork volumes for soil disturbance for the BPT are under development and the proposed soil disturbance works is unknown at the time of preparing this DSI. The threshold for disturbance is ~75 m^3 based on a HAIL activity area encompassing the entire of 8 Spedding Road (1,500 m^2).	**UNKNOWN** Earthwork volumes for soil disturbance for the CAH are under development and the proposed soil disturbance works is unknown at the time of preparing this DSI. The threshold for disturbance is ~2,000 m^3 based on a HAIL activity area encompassing the entire of 32 Mamari Road (approx. 4,000 m^2).
d	Soil must not be taken away unless it is for laboratory testing or, for all other purposes combined, a maximum of 5 m^3 per 500 m^2 of soil may be taken away per year.	**UNKNOWN** It is unknown at this stage if offsite disposal of soil will be required. If offsite soil disposal occurs, the site-specific threshold for offsite disposal is ~45.5 m^3 based on a HAIL activity area encompassing the entire of 2A Buckley Avenue (4,550 m^2).	**UNKNOWN** It is unknown at this stage if offsite disposal of soil will be required. If offsite soil disposal occurs, the site-specific threshold for offsite disposal is ~15 m^3 based on a HAIL activity area encompassing the entire of 8 Spedding Road (1,500 m^2).	**CAN COMPLY** No offsite disposal of soil is proposed from the CAH, instead topsoil will be stockpiled and reused following works. If offsite soil disposal occurs, the site-specific threshold for offsite disposal is ~400 m^3 based on a HAIL activity area encompassing the entire of 32 Mamari Road (approx. 4,000 m^2).
e	Soil taken away must be disposed of at an appropriately licensed facility.	**CAN COMPLY** In the event soil is removed from site, soil can be disposed to an approved facility.		

NESCS – Soil disturbance permitted activity conditions (Regulation 8(3))		Assessment for 2A Buckley Avenue	Assessment for 8 Spedding Road (BPT)	Assessment for 32 Mamari Road (CAH)
f	The duration of land disturbance must be no longer than two months.	**DOES NOT COMPLY** Watercare expects that soil disturbance works for Section 3 to take more than 2 months	**DOES NOT COMPLY** The duration of the earthworks is yet to be confirmed, however, based on the scale of the works, they are not expected to be completed in two months.	**UNLIKELY TO COMPLY** The duration of the earthworks is yet to be confirmed, however, based on the scale of the works, they are not expected to be completed in two months.
g	The integrity of a structure designed to contain contaminated soil or other contaminated materials must not be compromised.	**NOT APPLICABLE** As there are no structures containing contamination within the area subject to land disturbance.		

Based on our understanding of the proposed soil disturbance activity, and the assessment completed in Table 8.2, the works are not assessed meet the provisions of a PA under the NESCS Regulation 8(3) and will require a resource consent under the NESCS. A resource consent for soil disturbance will be required as a **Discretionary Activity under the NESCS (Regulation 10)** as soil sampling has not been completed.

A Contamination Site Management Plan (CSMP)[27] has been prepared to support resource consent application.

8.1.1.2 NESCS Permitted Activity conditions for change in land use

The land use at 8 Spedding Road is proposed to be changed from production land to commercial land use for the construction and operation of the BPT. A change in land use is only covered as an activity under the NESCS if changing the land use "is reasonably likely to harm human health" (5(6)). While no site investigation data is available, given the HAIL type (A10 horticultural use) and the typical concentrations of contaminants associated with HAIL A10 in our experience, and the change to low sensitivity commercial land use, with potentially contaminated topsoil to be removed, it is considered unlikely the NESCS applies to this change use. Soil testing data, proposed to be completed in this area to inform disposal, can be used to increase certainty of this assessment.

8.1.2 AUP

The AUP was released on 15 November 2016. This version supersedes the Decisions Version, the Independent Hearings Panel Recommended Version and the original proposed version.

8.1.2.1 Chapter E30 Contaminated Land

The contaminated land rules are set out in Chapter E Environmental Risk Section E30 and are not subject to any appeal. The rules are 'treated as operative' under section 86F of the Resource Management Act 1991. Additionally, the provisions in the Auckland Council Regional Plan: Air Land and Water no longer need to be considered.

Rule E30.6.1.4 states that if soil concentrations or the 95% upper confidence limit (UCL) of soil concentrations are below the specified permitted activity criteria detailed in Table E30.6.1.4.1, then a resource consent is not required for the site. If soil contaminant concentrations exceed these relevant guidelines or separate phase is present, then a resource consent for the ongoing discharge of contaminants is required.

All soil samples analysed in areas of proposed soil disturbance as part of this investigation reported concentrations of chemical contaminants which comply with the AUP PA criteria outlined in Table E30.6.1.4.1 and for contaminants and relevant guidelines listed Rule E30.6.1.4(1)(b). On this basis, no resource consent would be required under rule E30.6.1 for disturbance of soil.

This should be reassessed on completion of the site investigation works at Section 3 of the alignment from Shaft 17 to the Hobsonville Pumpstation and BPT. It is possible that resource consent under the AUP Chapter E.30 rules may be required for these works, in particular in the area of the alignment from Shaft 17 to the Hobsonville Pumpstation.

8.1.2.2 Chapter E4 Other discharges of contaminants – discharge of dewatering water

Dewatering of the shaft excavations will be required. The methodology for construction and dewatering is not confirmed at this time, nor is the discharge points for the dewatered water.

[27] T+T, May 2023. Contamination Site Management Plan for the proposed Whenuapai-Redhills section of the Northern Interceptor 2 (NI2).

Chapter E4 of the AUP considers other discharges of contaminants. The following rules for the discharge of dewatering water have been assessed under E4:

- E4.6.1. General standards for all permitted activities, controlled activities and restricted discretionary activities requires that all discharges must not, after reasonable mixing, give rise to any significant adverse effect on aquatic life.
- Rule E4.6.2.3 allows for the discharge of diverted uncontaminated groundwater to water or land as a permitted activity as long as "The discharge must not either by itself or in combination with other contaminants after reasonable mixing exceed the greater of the 95 per cent trigger values for freshwater (groundwater) … or the natural background level".
- Rule E4.4.2.5 allows for the discharge onto or into land and/or into water for the purpose of dewatering trenched or other excavations as a permitted activity as long as the discharge is undertaken in accordance with best management practice to minimise contaminants to the extent possible (i.e., removal of sediment).

The ANZECC 95% trigger value for freshwater at the receiving environment after reasonable mixing has been used to assess the condition of the dewatered groundwater under E4.6.1 and E4.6.2.3 in the shaft locations. A number of metal concentrations detected in shallow groundwater exceed the criteria, but by less than one order of magnitude. The concentrations will be diluted through the dewatering process and within the receiving environment following mixing. If mixing occurs prior to or in the receiving environment, then the activity is deemed to meet the PA standards and a resource consent would not be required for discharge of dewatering water from shallow groundwater to land or water. The shaft locations where, based on available data, will require confirmation of mixing in the environment are shown in Table 8.3.

Groundwater sampled from the deeper wells comply with either the 95% freshwater trigger values and/or background groundwater concentration. Therefore, the permitted activity criteria for Rule E4.6.2.3 and Rule E4.4.1 can be met and a resource consent would not be required for discharge of deeper groundwater as dewatering water onto or into land or into water.

Groundwater quality data is not available for Shaft 8. Dewatering may be required to construct the BPT and for works at the Hobsonville Pumpstation - groundwater quality has not been assessed in these areas.

For all dewatering, sediment removal to required standards would be needed to meet the requirements of Rule 4.4.2.5.

Table 8.3: Summary of available groundwater quality data and Rule E4.6.2.3 for water quality

Shaft location	Shallow groundwater	Deep groundwater
Shaft 8	No data available	No data available
Shaft 10	No data available	Meets criteria. Discharge expected to meet quality criteria.
Shaft 12	Slight exceedances of quality criteria. **Some mixing in environment required to meet PA rule.**	
Shaft 14	Slight exceedances of quality criteria. **Some mixing in environment required to meet PA rule.**	
Shaft 16	Meets criteria. No further consideration of mixing in environment needed.	
Shaft 17	Slight exceedances of quality criteria. **Some mixing in environment required to meet PA rule.**	
BPT	No data available	NA

Trenching at Hobsonville Pumpstation	No data available	NA

In order for the discharges of dewatering water to be a permitted activity under the E4 rules then the contractor will need to ensure that sufficient mixing is achieved in the receiving environment at Shafts 12, 14 and 17. Whether sufficient mixing will occur will depend on a number of factors including the flow afforded in the receiving environment, the quality and discharge rate of the dewatering water and dilution and mixing afforded prior to entering the receiving environment (e.g. in groundwater prior to discharge).

Water quality management of the dewatering effluent will be required prior to discharge including sediment removal and pH management. The water quality and management controls are outlined in the CSMP.

The re-assessment of the E4 rules should be undertaken upon completion of the site investigation works at Section 3 of the alignment from Shaft 17 to the Hobsonville Pumpstation, and in the BPT.

8.1.3 Asbestos Regulations

The management of asbestos in soils is regulated under the Health and Safety at Work (Asbestos) Regulations 2016 (Asbestos Regulations). In order to help achieve compliance with the Asbestos Regulations, WorkSafe New Zealand has prepared an ACoP: Management and Removal of Asbestos (September 2016). The ACoP refers readers to the *"New Zealand Guidelines for Assessing and Managing Asbestos in Soil"* (herein referred to as the Asbestos-in-Soil Guidelines) which were published in November 2017 by BRANZ Ltd.

The Asbestos-in-Soil guidelines define the level of oversight and controls (including personal protective equipment, decontamination, etc.) that is required to be implemented dependent on the concentration of asbestos fibres/fines or fragments that are present in the soils.

Asbestos was not detected in any of the soil samples analysed during this investigation. Therefore, the Asbestos Regulations and Asbestos-in-Soil guidelines do not apply to disturbance of these soils.

Accidental discovery protocols will need to be place during the works for the identification and management of soils that are suspected to contain asbestos. These are included in the CSMP.

8.2 Construction implications

8.2.1 Soil reuse

Based on the current testing both shallow and deep soils are suitable for reuse onsite provided that the soil meets geotechnical requirements.

8.2.2 Offsite disposal of soils

8.2.2.1 Shallow soils

Concentrations of contaminants in shallow soils are generally below the relevant background levels with the exception of marginal exceedances of OCP and TPH above the laboratory LOR. Therefore, if soils are required to be disposed offsite, the majority of soils are likely suitable for disposed as cleanfill. This includes from the HDD exit points and Shaft LS8 and Shaft LS12. Slightly elevated TPH was recorded at Shafts RS10, RS14, LS16 and RS17 (BH133) and as such these soils may need to be disposed to managed fill. Confirmation of acceptance to cleanfill and managed fill should be sought from the fill operators prior to works commencing.

Shallow soils to be excavated from within Section 3 of the alignment and BPT may be impacted by contaminants and disposal as cleanfill may be unsuitable. This will be confirmed following completion of proposed investigation works in this part of the alignment.

While we understand that the intention is that topsoil stripped from the CAH at 32 Mamari Road will be retained and reused onsite, if this changes, and soil is to be disposed offsite, it will require testing prior to disposal to confirm the appropriate receiving facility.

8.2.2.2 Deep soils

Concentrations of contaminants in deep soils at the proposed tunnelling depth are generally below the relevant background levels with the exception of exceedances of barium, nickel, sulphur and total organic carbon. These exceedances are in soils between depths of 10 to 36.2m depth and are considered to be naturally occurring. Therefore, if these deep soils are required to be disposed offsite, such soils may be suitable for disposal as cleanfill. This will need to be confirmed with the receiving facility prior to works commencing.

8.2.3 Earthworks management

Standard soil related earthwork management procedures such as dust, stormwater and erosion and sediment controls during the proposed works would be sufficient to mitigate risks to people and the receiving environment within Section 1 and 2 of the alignment. Controls to be applied in Section 3 of the alignment, BPT and CAH shall be assessed following completion of the proposed investigation in these areas.

8.2.3.1 Dewatering of groundwater

Dewatering of groundwater is required during the works. Based on the results of this investigation, dewatering effluent is suitable for discharge to land and water. Sufficient mixing in the receiving environment will need to be demonstrated for dewatering of shallow groundwater from Shafts 12, 14 and 17. Removal of sediment and potentially pH management of dewatering effluent will be required prior to discharge.

Council may require further water quality testing during dewatering as a condition of consent.

9 Summary and conclusions

Tonkin & Taylor Ltd was commissioned by Watercare Services Limited to undertake a Ground Contamination Detailed Site Investigation of the proposed Whenuapai to Redhills Wastewater Servicing Package 2 (known as the Northern Interceptor Package 2 or NI2). The investigation was undertaken to interpret the results of the sampling undertaken and to inform the contamination implications for the project and to support the resource consenting process. The main findings of the assessment are:

- The site history and desktop review undertaken as part of the PSI identified several potentially contaminating activities (HAIL activities) which intersect and are on land adjacent to the site, including:
  - Intersected: Horticultural activity at 8 Spedding Road, 4 Spedding Road, 32 Mamari Road and land close to Brigham Creek roundabouts, Wastewater treatment and use of land for sludge application and waste disposal to land at 2A Buckley Avenue, transport yard at 51 Trig Road and potentially intercepted areas of horticultural activities near the Brigham Creek Road roundabouts.

  - Adjacent: Stockyard, horticultural land use, sediment treatment ponds, engineering workshop, waste disposal to land and a bowling green. The potential for contaminated fill to have been imported during road construction was also identified.
- The investigation was undertaken concurrently with the geotechnical investigation for the project, and the scope of investigation works defined in the Mott Macdonald project specification. The investigation covers Section 1 and 2 of the alignment only.
  - Contamination testing was targeted to areas where shallow soil disturbance is proposed including the Massey Connector and the six shaft locations along the main tunnel alignment. The purpose of testing was to inform resource consenting implications and disposal.
  - Soil testing was also targeted for natural soils at the tunnelling depth to inform appropriate disposal.
  - Groundwater sampling was undertaken at boreholes in close proximity to the majority of shaft locations to inform resource consenting implications and to inform appropriate discharge of dewatering water during construction.
  - No soil or groundwater investigation has been completed to date in the BPT, CAH nor in the area of works from Shaft 17 to the Hobsonville Pumpstation.
- Intrusive investigations undertaken as part of the DSI indicate:
  - Low concentrations of contaminants were recorded in soils when compared to published background concentrations.
  - The ANZECC 95% trigger value for the protection of Freshwater Species and/or background groundwater concentrations was exceeded in shallow groundwater at three shaft locations (Shafts LS12 (BH115 shallow), RS14 (BH122 shallow) and RS17 (BH132 shallow).
  - Samples of deeper groundwater (screened at 11-27 m) recorded contaminant concentrations below background concentrations and the 95% trigger values for the protection of freshwater species.
- In summary, contaminated soil and groundwater implications for the project comprise:
  - A resource consent for soil disturbance as a discretionary activity under the NESCS is required for the Section 3 of the alignment from Shaft 17 to the Hobsonville Pumpstation, the BPT and CAH.
  - The contaminant concentrations in soil in the areas of proposed soil disturbance associated with the Massey Connector and Main Tunnel comply with the AUP permitted activity criteria and resource consent is not required under Rule E30.6.1. Soil quality testing for soils disturbed during trenching from Shaft 17 to the Hobsonville Pumpstation, at the BPT and at the CAH will be required to inform the assessment under the AUP E30 rules in those areas.
  - The concentrations of contaminants in dewatering effluent from groundwater (shallow and deep) has been assessed as likely to be below ANZECC 95% freshwater trigger values following reasonable mixing. Based on the slight elevations of some contaminants in shallow groundwater at Shafts 12, 14 and 17, the discharge of dewatering water from shallow depths in these locations will need to be into a final receiving environment that affords sufficient mixing. On this basis, a discharge consent is not required under E4 dewatering water quality rules for the Main Tunnel and Massey Connector works. This assessment will need to be completed for the as yet un-investigated parts of the site (Shaft 17 to Hobsonville Pumpstation, BPT and CAH).
  - Council may require further water quality testing during dewatering as a condition of consent.

  - Based on the testing completed to date shallow and deep soils are suitable for reuse onsite provided that the soil meets geotechnical requirements.
  - Testing indicates that if soil is required to be disposed offsite, the majority of shallow soils are suitable for disposal as clean fill. Elevated TPH in some locations may mean that near surface soils from Shafts RS10, RS14, LS16 and RS17 may need to be disposed to managed fill. Deeper soils are considered suitable for disposal to cleanfill. Confirmation should be sought from the receiving facilities prior to works commencing.
  - A Contamination Site Management Plan has been prepared to mitigate risks to people and the receiving environment and to support resource consent application.

- For the works from Shaft 17 to the Hobsonville Pumpstation and in the BPT, further soil and groundwater investigation is proposed to understand the handling and management of soil and groundwater during the works.

10 Applicability

This report has been prepared for the exclusive use of Watercare Services 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.

Recommendations and opinions contained in this report are based on our visual inspection and laboratory testing of material sampled from discrete locations. The nature and continuity of the contamination away from the test and sample locations is inferred but it must be appreciated that actual conditions may vary from the assumed model.

We understand and agree that our client will submit this report as part of an application for resource consent and that Auckland Council as the consenting authority will use this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

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Rebecca van der Krogt/Sami Myers-Hutchings

Contaminated Land Consultant

Authorised for Tonkin & Taylor Ltd by:

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Robert Hillier

Project Director

Report certified by a suitably qualified and experienced practitioner as prescribed under the NESCS Users Guide (April 2012):

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Lucy Hine

Contaminated Land Specialist

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Appendix A Site Identification

Table A.1: Site identification

	Approximate Chainage (m)	Street address	Legal description	Site owner	Current use	Site condition and surrounding land use
Section 1: Massey Connection	0	32 Mamari Road	SECT 2 SO 582220	Annie Nguyen, Christine Kelibita, Issabelle Ulm, Michelle Pham, Yannick Nguyen	Rural – horticulture	This property is on the northern side of Spedding Road and is the location of the proposed CAH. Market gardening appears to be visible at 32 Mamari Road.
	0-20	8 Spedding Road	SECT 1 SO 582220	Watercare Services Limited	Rural	This property is on the northern side of Spedding Road and is the location of the proposed BPT. The property appears to be vacant.
	20-150	6 Spedding Road	LOT 18 DP 62344	Hang Chuen Fong, Meixian Tan	Rural residential	The gravity alignment appears to be tunnelled beneath the property. The property has a rural residential dwelling and shed with horses grazing in the paddocks.
	150-310	4 Spedding Road	LOT 17 DP 62344	Auckland Council	Rural, appears to be vaccant	The gravity alignment appears to be tunnelled beneath the property The property appears to be vacant and vegetated with some trees. A shed is located on the northern portion of the property and north of the proposed alignment.
	310-450	92 Trig Road	LOT 16 DP 62344	Auckland Council	Rural residential	The gravity alignment appears to be tunnelled beneath the property The property has a rural residential dwelling, shed and swimming pool.
	450-470	Roadway (Trig Road)	SEC 4, 6 and 21 SO 447691	The Crown	Roadway – Trig Road	The gravity alignment appears to be tunnelled beneath Trig Road.
	470-870	49 Trig Road	LOT 6 DP 62344	Chen Lin-Chu, Yang Chao-Chang		The gravity alignment appears to be tunnelled beneath the property. This property is located east of Trig Road. The alignment appears to pass through an area used to store a few shipping containers and sheds near the centre of the property. Potential construction materials are also visible to the south along the fence line.

	Approximate Chainage (m)	Street address	Legal description	Site owner	Current use	Site condition and surrounding land use
						The topography of the property is gently undulating with surface water expected to flow towards the south east of the property.
	870-1020	51 Trig Road	SEC 31 SO 447691	Feng Miao	Transport yard/rural residential	The gravity alignment tunnels beneath the centre of the property. The alignment passes beneath the apparent storage of transport vehicles including buses.
	1020-1200	State Highway 18	SEC 4, 6 and 21 SO 447691	The Crown	Roadway – SH18, and surrounding land, including drain to south	The gravity alignment passes under SH18.
Section 2: Main Tunnel	0	27 Trig Road Whenuapai	SEC 28 SO 447691	Watercare Services Limited	Rural – appears vacant. Alignment crosses Waiarohia Stream.	This property is south east of SH18 and is the location that the main tunnel begins from at Shaft 8.
	100-1200	State Highway 18	Sec 1 SO 447691		SH18 road verge and planting	The properties along the southern side of SH18 appear to be predominantly rural residential. Commercial properties within 200 metres of the alignment include the following: SPCA Hobsonville, Hilton Brown Swimming, Black Steel Engineering, and Metalcraft Roofing. A Gull Service Station is present at 112 Hobsonville Road but it is located approximately 250 m south of the alignment.
	1350	Brigham Creek Road on and offramp	Sec 59, 55, 46, 35, 28, 30, 23 SO 444423		SH18 Brigham Creek Road on and offramps (roundabout) and surrounding verge and planting	Surrounding land use along the alignment from Brigham Creek Road roundabouts to Hobsonville Pumpstation comprises primarily rural residential along the northern side of SH18. The southern side of SH18 is primarily residential with some commercial also present. Commercial properties within 200 metres of the alignment include the following: New World Hobsonville, Car charging station, The Urban Jungle Gardening

	Approximate Chainage (m)	Street address	Legal description	Site owner	Current use	Site condition and surrounding land use
						Centre, Pacific Carwash Systems, Fruitworld supermarket, Countdown Hobsonville, Hobsonville War Memorial Park and Hobsonville Point Primary School.
	1500	State Highway 18	Sec 18 SO444423		SH18 road verge and planting	This land parcel is occupied by SH18 with vegetation along the northern and southern sides. Land use further south and north of SH18 is predominantly rural residential.
	1600-1780	-	Sec 64 SO 444423, Sec 13 SO 444423	Her Majesty the Queen	Vacant land, evidence of vehicle tracking	The alignment travels through the north western edge of this property. Vehicle tracking is visible in the current aerial photograph.
	1850-2050	2 Falcon Crescent Hobsonville	LOT 5 DP 505331	Far East (G9) Limited	Empty land, cropping. Alignment crosses near a small soil stockpile and drain	The property is a large vacant section in the shape of an "L". It appears as though this land will likely be developed in the future for residential purposes.
	2050-2230	13-33 Carder Crescent, and 13 -44 Brachard Close	Lots 47-56 and 39 and 40 DP 487569	Several owners	High density residential	Townhouse properties are present along Carder Crescent, and Brachard Close they appear to be of modern construction (post 2015).
	2230-2375	1 Memorial Park Lane	PT ALLOT 523 SO 40181 WAIPAREIRA		Hobsonville War Memorial Park Domain – Recreation Reserve; and Hobsonville Bowling Club, including carpark	The Hobsonville Bowling Club is located directly south of SH18. The proposed alignment appears to cross through this property. The property contains two large bowling greens, club room buildings and associated carparking. Directly south of the Hobsonville Bowling Club is the Hobsonville War Memorial Park. The park appears to contain a small playground, cricket patch and public toilets building.

	Approximate Chainage (m)	Street address	Legal description	Site owner	Current use	Site condition and surrounding land use
	2620	State Highway 18	Sec 8 SO 445478		SH18 verge and planting	The main tunnel alignment ends directly west of 2 Buckley Avenue.
Section 3: Hobsonville Pumpstation	2620-2900	2 Buckley Avenue	LOT 50 DP 523085	Watercare Services Limited	Site compound for Watercare Northern Interceptor Project	2 Buckley Avenue is currently used as a site compound for the Watercare Northern Interceptor Project, several container buildings and offices are present at the site. The site has a gravel seal.
	2620-2900	2A Buckley Avenue Hobsonville	SEC 1 SO 419259	Watercare Services Limited	Hobsonville Pumpstation	2A Buckley Avenue is occupied by the Hobsonville Pumpstation. A large building in the shape of a church is present near the middle of the site with a smaller building present to the west of the main building.

Appendix B Logs

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH201

SHEET: 1 OF 4

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925824.00 mN 1743970.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 36.30m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 23/03/2021
FINISH DATE: 24/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* SILT, minor organics and minor clay; black. Very soft, dry, low to medium plasticity. Organics, roots greater than 2mm diameter						36	0	TS TS									
	0.40m: Silty CLAY; orange mottled grey. Very soft to soft, moist, high plasticity.			HA	100			0.5										
Tauranga Group	*1.50m:* Sandy SILT; grey. Stiff to very stiff, moist, low to medium plasticity. Sand, fine.			SPTS	67	119/45 kPa 1/2 1/3 2/3 **N=9**	35	1.0 1.5										
				HQ3	100		34	2.0 2.5										Box 1, 0.00-2.70m
	2.70m: Silty SAND; light orange. Loose to medium dense, moist, low plasticity. Sand, fine grading to medium.			SPTS	84	89/45 kPa 1/2 2/3 3/3 **N=11**	33	3.0										
	3.60m: SAND, some silt; light grey. Very loose, moist to wet. Sand, fine to medium.			HQ3	100			3.5 4.0							24/03/2021			
East Coast Bays Formation	*4.30m:* SAND, some silt; grey. Loose to medium dense, wet. Sand, fine to coarse, rounded to sub-rounded. [Completely weathered ECBF].			SPTS	100	1/2 2/2 2/3 **N=9**	32	4.5										Box 2, 2.70-4.95m

COMMENTS: VWP Installed at approx 8.5 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15.21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 6/07/2021 10:48:08 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH201

SHEET: 2 OF 4

PROJECT: Package 2 Whenuapai/Redhill

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925824.00 mN, 1743970.90 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 36.30m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: AIDM

CHECKED: FLRU

START DATE: 23/03/2021

FINISH DATE: 24/03/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.00m:* SAND, some silt; grey. Loose to medium dense, wet. Sand, fine to coarse, rounded to sub-rounded. [Completely weathered ECBF].			SPTS	100	1/2 3/2 4/4 **N=13**	31	5.5										
				HQ3	100		30	6.0										
	6.80m: SW-MW, grey, SANDSTONE. Extremely weak locally Very weak, poorly cemented to moderately cemented, [Recovered as moist to dry, dense, fine to medium grained SILTY SAND]. INTERBEDDED WITH: SW-MW, SILTSTONE. Extremely weak locally Very weak, poorly cemented to moderately cemented.			HQ3	100		29	6.5										
				SPTS	100	2/2 4/5 5/7 **N=21**		7.0										
				HQ3	250		28	7.5										
				HQ3	100			8.0										
				SPTS	100	3/4 4/5 6/7 **N=22**	27	8.5										
								9.0										
								9.5										

COMMENTS: VWP Installed at approx 8.5 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15.21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 6/07/2021 10:48:11 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH201

SHEET: 3 OF 4

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925824.00 mN 1743970.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 36.30m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 23/03/2021
FINISH DATE: 24/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* SW-MW, grey, SANDSTONE. Extremely weak locally Very weak, poorly cemented to moderately cemented. INTERBEDDED WITH: SW-MW, SILTSTONE. Extremely weak locally Very weak, poorly cemented to moderately cemented.	UW SW MW HW CW	ES VS S MS M UW EW	HQ3	86		26	10.0										
	10.35m: CORE LOSS - Suspect washed out.							10.5										
	10.50m: UW, grey, SANDSTONE. Extremely weak, poorly cemented to moderately cemented, fine to medium grained. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak, poorly cemented to moderately cemented.			SPTS	100	2/3 6/6 6/6 **N=24**						100					
				HQ3	100		25	11.0				100						Box 4, 8.24-11.35m
				HQ3	100			11.5				100						
				SPTS	100	1/2 2/4 55/4 **N>=50**	24	12.0				100						
				HQ3	100			12.5				100						
	12.80m: UW, grey, SANDSTONE. Very weak, moderately cemented to well cemented, fine to medium grained, dry. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak to very weak, poorly cemented to moderately cemented.			HQ3	100		23	13.0				97	*13.00-13.17m:* DD (x4)					
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	79	7/29 50 for 65mm **N>=50** Solid		13.5					*13.50-13.59m:* DD (x2), Spacing 50 mm *13.59-13.60m:* J, 30-40°, PL, SM					
	13.95m: UW, grey, SANDSTONE. Very weak locally Extremely weak, poorly cemented to moderately cemented, fine to medium grained. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak, poorly cemented to moderately cemented.			HQ3	63		22	14.0				63	*13.60-14.58m:* DD (x12), Spacing between 20 - 100mm					
				HQ3	100			14.5				100	*14.60-14.63m:* DD					Box 5, 11.35-14.60m

COMMENTS: VWP Installed at approx 8.5 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15.21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 6/07/2021 10:48:11 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH201

SHEET: 4 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925824.00 mN, 1743970.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 36.30m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 23/03/2021
FINISH DATE: 24/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW CDG)	Rock Strength (FS VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
	15.00m: NO RECOVERY - Solid SPTC, no overcore recovered.			SPTC	0	12/28												
	15.21m: END OF BOREHOLE					50 for 55mm **N>=50** Solid	21 20 19 18 17	15.5 16.0 16.5 17.0 17.5 18.0 18.5 19.0 19.5										

COMMENTS: VWP Installed at approx 8.5 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15.21m

Scale 1:25

Rev.: A

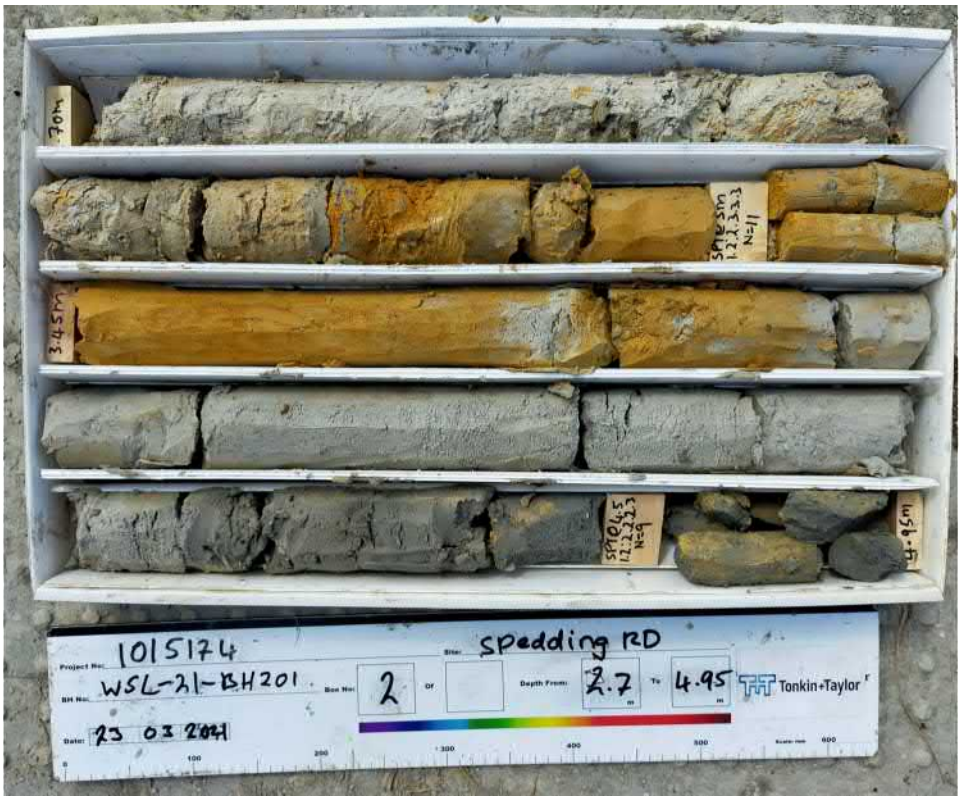
General Log - DESX005 - Fix RQD - 6/07/2021 10:48:11 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH201**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925824.00 mN 1743970.90 mE	DRILL TYPE:	HOLE STARTED: 23/03/2021
R.L.:	36.30m	DRILL METHOD: RC	HOLE FINISHED: 24/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU

0.00-2.70m



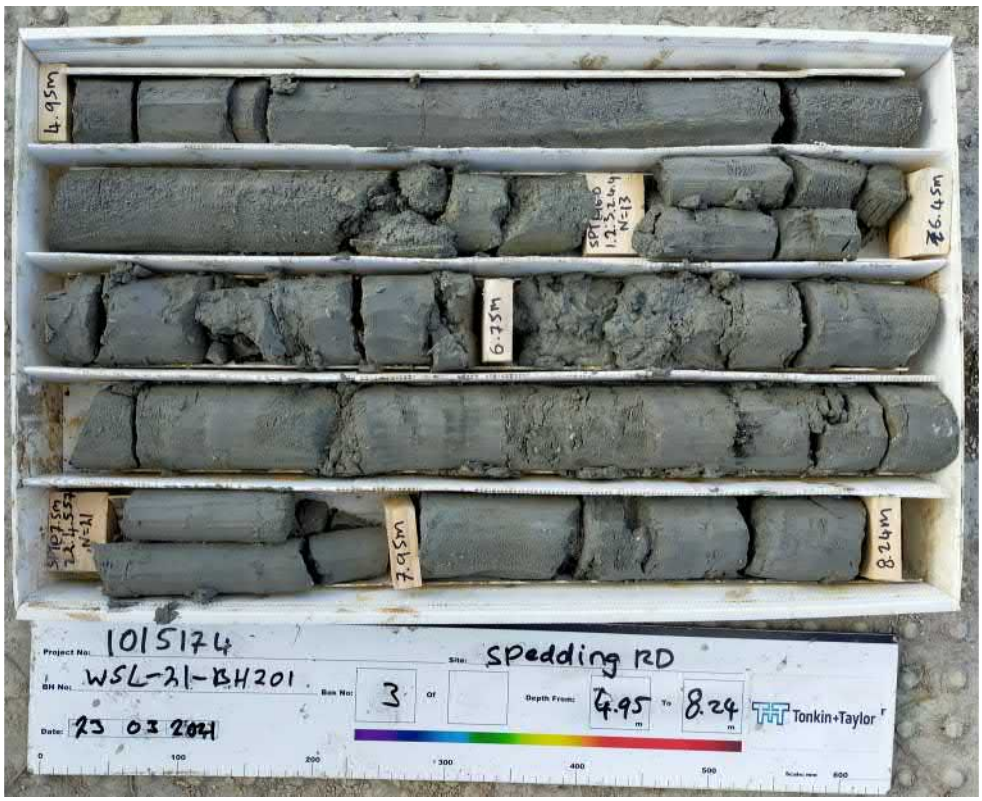
2.70-4.95m

General Log - DESX005 - Fix RQD - 6/07/2021 10:48:11 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH201**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925824.00 mN 1743970.90 mE	DRILL TYPE:	HOLE STARTED: 23/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 24/03/2021
R.L.:	36.30m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: AIDM CHECKED: FLRU



4.95-8.24m

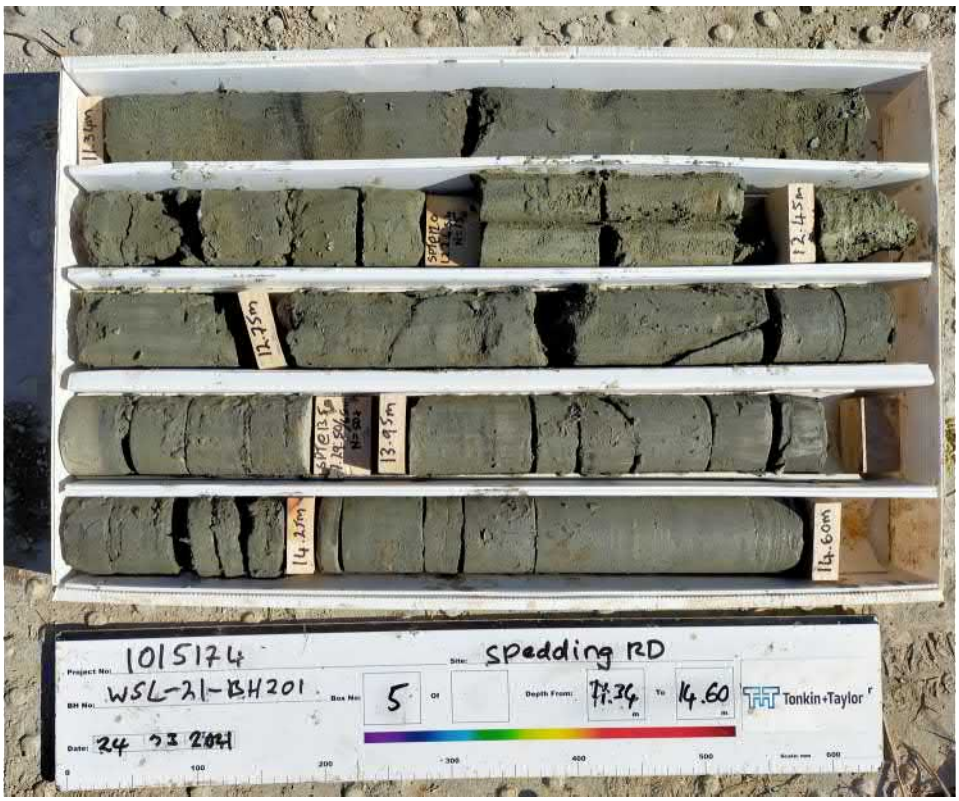
8.24-11.35m

General Log - DESX005 - Fix RQD - 6/07/2021 10:48:11 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH201**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925824.00 mN 1743970.90 mE	DRILL TYPE:	HOLE STARTED: 23/03/2021
R.L.:	36.30m	DRILL METHOD: RC	HOLE FINISHED: 24/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU



11.35-14.60m

14.60-15.21m

General Log - DESX005 - Fix RQD - 6/07/2021 10:48:11 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 1 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925731.77 mN 1744180.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Silty SAND; brown. Medium dense, dry. Sand, fine to medium. (PLACED TOPSOIL (FILL)).								TS									
	0.30m: Silty SAND; greyish brown. Medium dense, dry. Sand, fine to medium. (NON-ENGINEERED FILL).			HA	100	UTP UTP	42	0.5										
	0.90m: CORE LOSS - Suspect washed out.			HQ3	50	UTP		1.0										
	1.20m: Silty SAND; light greyish brown spotted white. Medium dense, dry. Sand, fine to medium. (NON-ENGINEERED FILL).																	
	1.40m: Silty SAND, some organics; light greyish brown streaked brown. Medium dense, moist. Organics, rootlets; sand, fine to medium. (NON-ENGINEERED FILL).																	
	1.62 - 1.75m: Light greyish brown streaked orange.			SPT	71	UTP 2/3 4/5 5/3 **N=17**	41	1.5							17/03/2021			
	1.75m: Sandy SILT, some organics; light greyish brown streaked orange. Very stiff, moist, low plasticity. Organics, rootlets; sand, fine to medium. (NON-ENGINEERED FILL).																	
	1.82m: CORE LOSS - Suspect soft cohesive material dropped out of barrel.							2.0										
	1.95m: CORE LOSS - Suspect washed out.																	
	2.30m: Sandy SILT, some organics; light greyish brown streaked orange. Very stiff, moist, low plasticity. Organics, rootlets; sand, fine to medium. (NON-ENGINEERED FILL).			HQ3	67		40	2.5										
	2.40m: Sandy SILT, some organics, minor clay; light brown spotted black. Stiff, moist, medium plasticity. Organics, rootlets; sand, fine. (NON-ENGINEERED FILL).																	
	2.65m: Organic sandy SILT; dark brown spotted black. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed). (NON-ENGINEERED FILL).							3.0										
	3.00m: NO RECOVERY. - Push Tube Sample.			PT	54	Push Tube @ 3.00m												
	3.50m: Organic sandy SILT, minor clay; greyish brown spotted black. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed). (NON-ENGINEERED FILL).			HQ3	109		39	3.5										
	4.35 - 4.60m: Blocky.							4.0										
	4.60m: PUSH TUBE.					22/3 kPa	38	4.5										Box 1, 0.00-4.10m

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:27 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 2 OF 11

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925731.77 mN 1744180.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*5.10m:* Organic sandy SILT, minor clay; brownish grey spotted black. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed). (NON-ENGINEERED FILL). *5.45 - 5.60m:* Spotted brown.			PT	100													
	5.60m: Sandy SILT, some organic; brownish grey spotted black. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed). (NON-ENGINEERED FILL).			HQ3	100		37	5.5										
				SPT	122	21/2 kPa 0/0 1/1 2/2 **N=6**		6.0							19/03/2021			
	6.75m: Sandy SILT, some clay; greenish grey spotted dark greenish grey, Blocky. Very stiff, moist, medium plasticity. Sand, fine. (NON-ENGINEERED FILL).			HQ3	100		36	6.5										
								7.0										Box 2, 4.10-7.30m
East Coast Bays Formation	*7.50m:* Silty SAND; grey. Medium dense, moist. Sand, fine to medium. [Completely weathered ECBF].			SPT	104	UTP 2/3 3/4 5/5 **N=17**	35	7.5										
	7.95m: HW, grey, SANDSTONE. Extremely weak, fine to medium grained, wet, [Recovered as: Silty SAND; grey. Dense, wet, low to medium plasticity. Sand, fine grading to medium].			HQ3	100		34	8.0 8.5										
	8.80m: MW, grey, SANDSTONE. Extremely weak, poorly cemented to moderately cemented, fine to medium grained.			SPT	112	5/8 11/17 19/3 for 20mm **N>=50**	33	9.0 9.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 3 OF 11

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925731.77 mN 1744180.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* UW, grey, SANDSTONE. Very weak locally Extremely weak, poorly cemented to moderately cemented, fine to medium grained.			HQ3	96								*10.25-10.55m:* DD (x4),					
				SPTC	100	8/17 28/22 for 55mm **N>=50** Solid	32	10.5										
	11.00m: UW, grey, SANDSTONE. Very weak locally Extremely weak, moderately cemented to well cemented, fine to medium grained. INTERBEDDED WITH: UW, grey, SILTSTONE. 100 to 150mm thick, 5° inclined.			HQ3	97		31	11.0					*11.10-11.45m:* DD (x5) *11.45-11.54m:* J, 40-50°, PL, SM *11.60-11.83m:* DD (x4)		18/03/2021			
				SPTC	100	10/40 for 75mm **N>=50** Solid		12.0										
				HQ3	102		30	12.5					*12.06-12.76m:* DD (x9)					
				HQ3	70		29	13.5					*13.54m:* DD *13.65m:* DD *13.90m:* DD *14.10m:* DD *14.17m:* DD *14.20m:* DD *14.28m:* DD *14.34m:* DD					Box 4, 10.15-13.50m
							28	14.5					*14.75m:* DD					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 4 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925731.77 mN, 1744180.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.30m:* UW, grey, SANDSTONE. Extremely weak to very weak, moderately cemented to well cemented, fine to medium grained. INTERBEDDED WITH: UW, grey, SILTSTONE. 100 to 150mm thick, 5° inclined.	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	80		27	15.5			2000 600 200 60 20		*14.98m:* DD *15.10m:* DD *15.15m:* DD *15.20m:* DD *15.30m:* DD *15.40m:* DD *15.50m:* DD *15.59m:* DD *15.65m:* DD *15.70m:* DD *15.80m:* DD *15.90m:* DD	25 50 75				
	16.20m: CORE LOSS.							16.0										
	16.50m: UW, grey, SANDSTONE. Very weak, moderately cemented to well cemented, medium to coarse grained, Widely spaced (300-400mm) thin siltstone bands present.			HQ3	87		26	16.5					*16.60-16.70m:* J, 70°, PL-UN, SM *16.83m:* DD					Box 5, 13.50-16.70m
							25	17.0										
								17.5										
							24	18.0					*18.28m:* DD *18.30m:* DD *18.34m:* DD *18.36m:* DD *18.43m:* DD *18.56m:* DD					
				HQ3	95			18.5										
								19.0					*19.34m:* DD					
	19.41m: CORE LOSS.						23	19.5										Box 6, 16.70-19.70m
	19.50m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak to very weak. 50 to 100mm thick, 5° inclined.												*19.52m:* DD *19.55m:* DD *19.57m:* DD *19.62m:* DD *19.70m:* DD *19.80m:* DD *19.85m:* DD *19.92m:* DD					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 5 OF 11

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925731.77 mN, 1744180.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak to very weak. 50 to 100mm thick, 5° inclined.	UW SW MW HW CW	EW VS S MS M UW EW	HQ3	93		22	20.5			2000 600 200 60 20		*20.04m:* DD *20.08m:* DD *20.14m:* DD *20.36m:* DD *20.40m:* DD *20.42m:* DD *20.44m:* DD *20.48m:* DD *20.50m:* DD *20.52m:* DD *20.55m:* DD *20.59m:* DD *20.61m:* DD *20.71m:* DD *20.84m:* DD *21.05m:* DD *21.11m:* DD *21.14m:* DD *21.22m:* DD *21.30m:* DD *21.40m:* DD *21.47m:* DD *21.57m:* DD *21.72m:* DD *21.80m:* DD *21.86m:* J, 40°, PL, SM *21.95m:* DD *22.01m:* DD *22.03m:* DD *22.06m:* DD *22.10m:* DD *22.12m:* DD *22.20m:* DD *22.24m:* DD *22.54m:* DD *22.60m:* DD *22.64m:* DD *22.69m:* DD *22.92m:* DD *22.95m:* DD *23.00-21.03m:* J, 30°, PL, SM *23.45m:* J, 80°, UN, R *23.99m:* J, 40°, PL, SM *24.08m:* DD *24.13m:* DD *24.20m:* DD *24.40m:* DD *24.55m:* DD *24.60m:* DD *24.80m:* DD	25 50 75				Box 7, 19.70-22.80m
				HQ3	93		21	21.0										
				HQ3	100			21.5										
				HQ3	100		20	22.0										
				HQ3	73			22.5										
	23.00m: SW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, coarse grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak to very weak. 50 to 100mm thick, 5° inclined.							23.0										
	23.60m: CORE LOSS.						19	23.5										
	24.00m: SW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, coarse grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak. 50 to 100mm thick, 5° inclined.			HQ3	93			24.0										
							18	24.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 6 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925731.77 mN, 1744180.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW LOCALLY SW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, coarse grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak. 50 to 100mm thick, 5° inclined.	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	100		17	25.5					*24.98m:* DD *25.00m:* DD *25.15m:* DD *25.18m:* DD *25.25m:* DD *25.40m:* DD *25.53m:* DD	25 50 75				Box 8, 22.80-26.10m
				HQ3	100			26.0					*25.85m:* DD					
	26.10m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak. 50 to 100mm thick, 5° inclined.												*26.10m:* DD *26.17m:* DD *26.29m:* DD *26.35m:* DD *26.38m:* DD *26.40m:* DD *26.42m:* DD *26.45m:* DD *26.50m:* DD *26.53m:* DD *26.64m:* DD					
				HQ3	96		16	26.5										
								27.0					*27.14m:* DD					
	28.32m: CORE LOSS.			HQ3	88		15	27.5					*27.38m:* DD *27.40m:* DD *27.48m:* DD *27.61m:* DD *27.71m:* DD *27.78-27.82m:* J, 70-80°, PL, SM *27.93m:* DD					
								28.0										
	28.50m: UW, grey, SANDSTONE. Very weak, medium to coarse grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.						14	28.5					*28.72m:* DD					Box 9, 26.10-29.00m
								29.0					*29.13m:* DD *29.23m:* DD *29.25m:* DD *29.35m:* DD *29.40m:* DD					
				HQ3	95		13	29.5					*29.50m:* DD *29.54m:* DD *29.58m:* DD *29.62m:* DD *29.80m:* DD					
	29.91m: CORE LOSS.																	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 7 OF 11

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925731.77 mN 1744180.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* UW, grey, SANDSTONE. Very weak, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	100		12	30.5					*30.32m:* DD *30.37m:* DD *30.42m:* DD *30.44m:* DD *30.52m:* DD *30.65m:* DD	25 50 75				
				HQ3	77			31.0					*30.84m:* DD *30.97m:* DD *31.04m:* DD *31.15m:* DD *31.20m:* DD *31.25m:* DD *31.28m:* J, 70-80°, PL, SM					
	31.33m: CORE LOSS.																	
	31.50m: UW, grey, SANDSTONE. Very weak, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.			HQ3	96		11	31.5					*31.66m:* DD *31.70m:* DD *31.75m:* DD *31.78m:* DD *31.81m:* DD *31.89m:* DD *31.94m:* DD					Box 10, 29.00-32.07m
				HQ3	96			32.0					*32.13m:* DD					
				HQ3	100		10	32.5					*32.75m:* DD *32.84m:* DD					
				HQ3	100			33.0					*33.06m:* DD *33.15m:* J, 20°, PL, SM					
				HQ3	100		9	33.5					*33.50m:* DD *33.56-33.70m:* J, 80-50°, ST, R *33.80m:* DD					
								34.0					*34.08m:* DD *34.10m:* DD *34.15m:* DD *34.20m:* DD *34.27m:* DD *34.30m:* DD					
							8	34.5					*34.48m:* DD *34.55m:* DD *34.63m:* DD					
	34.67m: CORE LOSS.																	
	34.75m: UW, grey, SANDSTONE. Very weak, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm												*34.78m:* DD *34.81m:* DD *34.82m:* DD					Box 11, 32.07-34.96m

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 8 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925731.77 mN 1744180.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*35.00m:* UW, grey, SANDSTONE. Very weak, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	91			35.5					*34.94m:* DD *35.04m:* DD *35.20m:* DD	25 50 75				
				HQ3	93		7						*35.60m:* DD *35.64m:* DD *35.68m:* DD *35.80m:* DD *35.90m:* DD					
				HQ3	93			36.0					*36.12m:* DD *36.26m:* DD *36.31m:* DD *36.36m:* DD *36.39m:* DD					
				HQ3	75		6	36.5					*36.52m:* DD *36.92m:* DD *37.02m:* DD *37.12m:* DD *37.16m:* DD *37.19m:* DD *37.20m:* DD *37.22m:* DD *37.25m:* DD *37.27m:* DD					
	37.31m: CORE LOSS.							37.0										
	37.75m: UW, grey, SANDSTONE. Very weak, medium to coarse grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.			HQ3	100		5	37.5					*37.37m:* DD *37.40m:* DD *37.44m:* DD *37.48m:* DD *37.53m:* DD *37.68m:* DD *37.77m:* DD *37.85m:* DD *38.03m:* DD					
				HQ3	100		4	38.5					*39.01m:* DD *39.03m:* DD *39.16m:* DD *39.21m:* DD *39.34m:* DD *39.44m:* DD					
				HQ3	100		3	39.0 39.5					*39.72m:* DD *39.91m:* DD					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 9 OF 11

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925731.77 mN 1744180.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*40.00m:* UW, grey, SANDSTONE. Very weak, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.	UW SW MW HW CW	EW VW W MS VS ES	HQ3	100		2	40.5			2000 600 200 60 20		*40.03m:* DD *40.09m:* DD *40.29m:* DD *40.48m:* DD *40.52m:* DD	25 50 75				Box 13, 38.02-40.75m
				HQ3	100		1	41.0					*40.88m:* DD *41.26m:* DD *41.30m:* DD *41.35m:* DD					
				HQ3	100		0	41.5					*41.60m:* DD *41.72m:* DD *41.76m:* DD *41.80m:* DD *41.84m:* DD *41.89m:* DD *41.90m:* DD *41.93m:* DD *42.00m:* DD *42.06m:* DD *42.27m:* DD					
				HQ3	100		-1	42.0					*42.56m:* DD *42.75m:* DD *42.79m:* DD *42.91m:* DD					
				HQ3	100		-2	42.5					*43.38m:* DD *43.46m:* DD *43.62m:* DD *43.85m:* DD					Box 14, 40.75-43.46m
				HQ3	100			43.0					*44.24m:* DD *44.30m:* DD *44.37m:* DD *44.38m:* DD *44.40m:* DD *44.42m:* DD *44.45m:* DD *44.60m:* DD *44.64m:* DD *44.80m:* DD *44.88m:* DD					
								43.5										
								44.0										
								44.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 10 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925731.77 mN, 1744180.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: FLRU
START DATE: 16/03/2021
FINISH DATE: 19/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*45.00m:* UW, grey, SANDSTONE. Very weak, fine to medium grained, Minor black carbonaceous fragments. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak. 50 to 100mm thick, 5° inclined.	UW SW MW HW CW	EW VS S MS M HW CW	HQ3	100		-3	45.5					*45.31m:* DD *45.35m:* DD *45.37m:* DD *45.42m:* DD *45.43m:* DD *45.50m:* DD	25 50 75				Box 15, 43.46-46.25m
				HQ3	100			46.0					*45.75m:* DD *45.80m:* DD *45.90m:* DD *46.15m:* DD *46.25m:* DD *46.26m:* DD					
				HQ3	100		-4	46.5					*46.77m:* DD *46.84m:* DD *46.96m:* DD					
				HQ3	100		-5	47.0					*47.09m:* DD *47.13m:* DD *47.15m:* DD *47.20m:* DD *47.32m:* DD *47.70m:* DD *47.85m:* DD *47.97m:* DD					
				HQ3	100			47.5					*48.10m:* DD *48.34m:* DD *48.38m:* DD *48.41m:* DD *48.62m:* DD *48.88m:* DD *48.92m:* DD *48.95m:* DD					Box 16, 46.25-49.00m
				HQ3	100		-6	48.0					*49.19m:* DD *49.22m:* DD *49.25m:* DD *49.30m:* DD					
				HQ3	100		-7	48.5					*49.81m:* DD *49.91m:* DD					Box 17, 49.00-50.00m
								49.0										
								49.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH202

SHEET: 11 OF 11

PROJECT: Package 2 Whenuapai/Redhill

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925731.77 mN, 1744180.58 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 42.56m

R.L. COLLAR:

DATUM: NZVD2016

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: AIDM

CHECKED: FLRU

START DATE: 16/03/2021

FINISH DATE: 19/03/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
	50m: END OF BOREHOLE											*49.94m:* DD *49.96m:* DD *49.98m:* DD					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 50m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

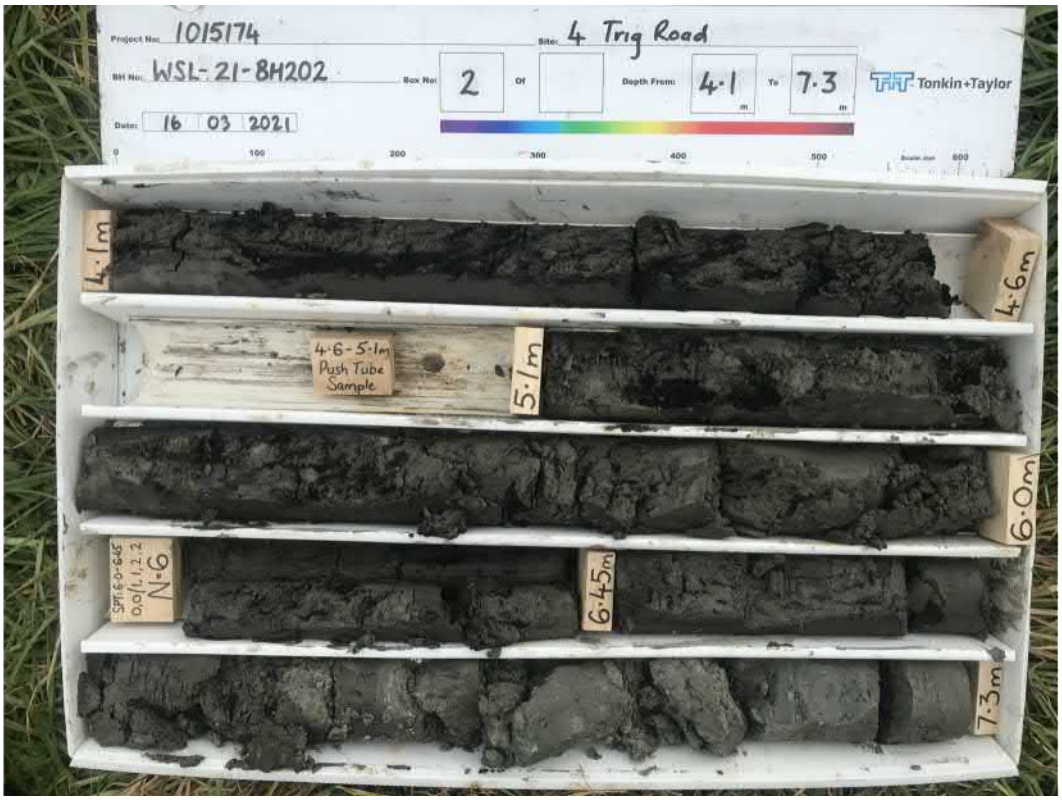
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

SHEET: 1 OF 9

PROJECT: Package 2 Whenuapai/Redhill	LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: 5925731.77 mN (NZTM2000) 1744180.58 mE R.L.: 42.56m DATUM: NZVD2016	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 16/03/2021 HOLE FINISHED: 19/03/2021 DRILLED BY: McMillan Drilling LOGGED BY: AIDM CHECKED: FLRU

0.00-4.10m



4.10-7.30m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU

7.30-10.15m

10.15-13.50m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill	LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: 5925731.77 mN (NZTM2000) 1744180.58 mE R.L.: 42.56m DATUM: NZVD2016	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 16/03/2021 HOLE FINISHED: 19/03/2021 DRILLED BY: McMillan Drilling LOGGED BY: AIDM CHECKED: FLRU

13.50-16.70m

16.70-19.70m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU

19.70-22.80m

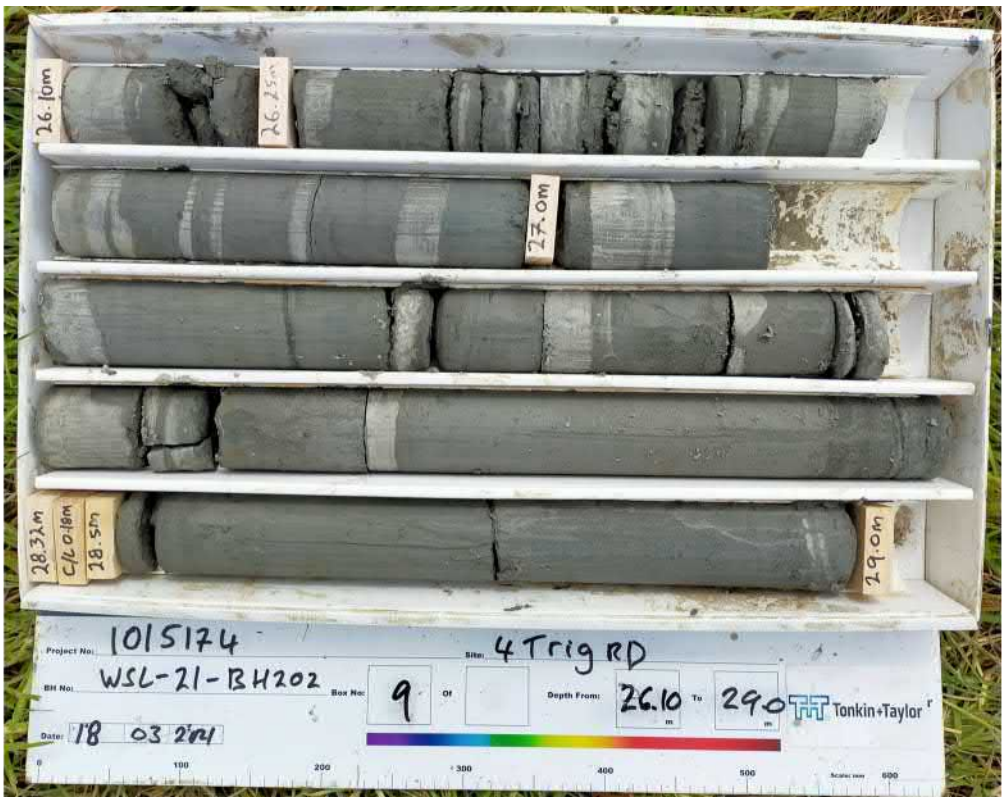
22.80-26.10m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU



26.10-29.00m

29.00-32.07m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU

32.07-34.96m

34.96-38.02m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU

38.02-40.75m

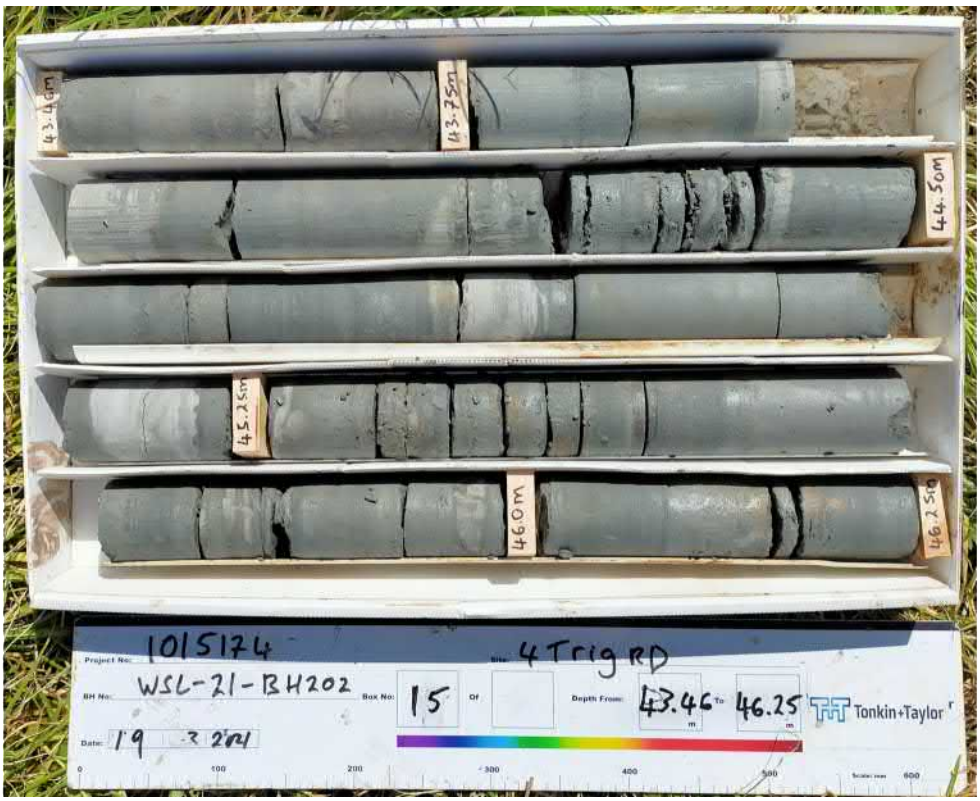
40.75-43.46m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

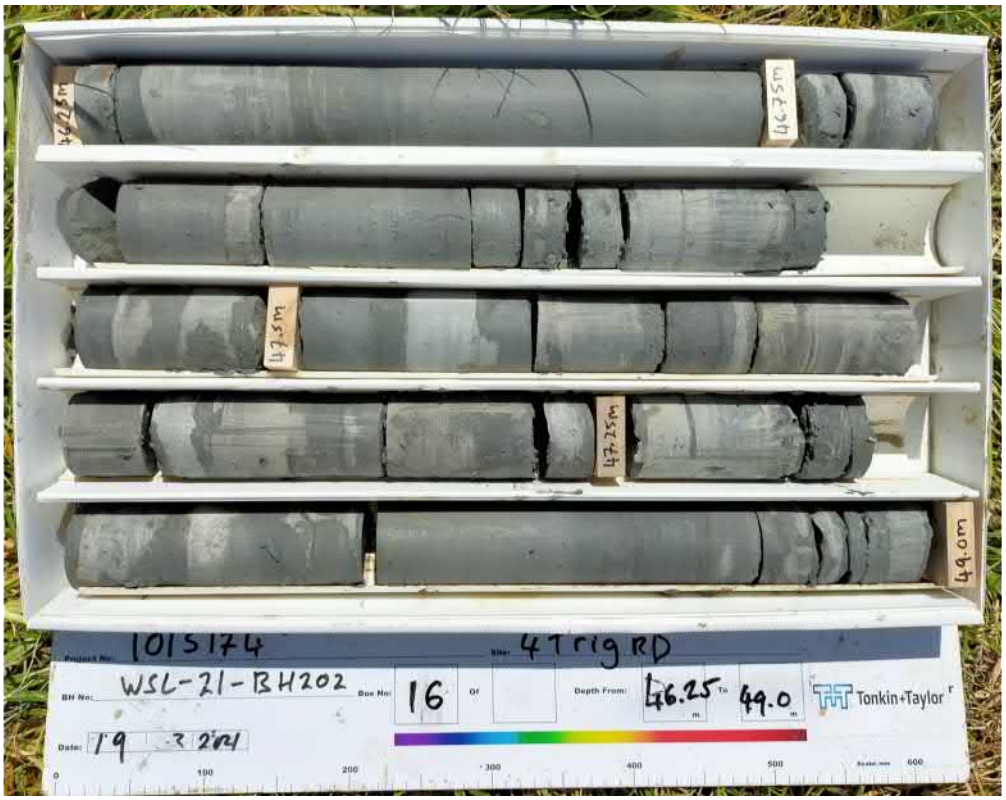
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU



43.46-46.25m



46.25-49.00m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH202**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925731.77 mN 1744180.58 mE	DRILL TYPE:	HOLE STARTED: 16/03/2021
R.L.:	42.56m	DRILL METHOD: RC	HOLE FINISHED: 19/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: FLRU

49.00-50.00m

General Log - DESX005 - Fix RQD - 5/07/2021 6:30:28 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 1 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: 5925577.60 mN 1744458.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics; brown. Firm, moist, low plasticity; sand, fine; organics, rootlets; [TOPSOIL].								TS									
	0.30m: Sandy SILT, some organics; brown, blocky. Firm, moist, low plasticity; silt, high sensitivity; sand, fine; organics, rootlets; [FILL].							0.5					*0.43m:* material becomes non-plastic and wet during breakdown of blocky structure					
	0.43m: Sandy SILT, some organics, minor clay; orange mottled brown. Very stiff, moist, medium plasticity; sand, fine; organics, rootlets; [FILL].			HA	100		48											
	0.80m: Clayey SILT, some organics, minor sand; brown-grey mottled orange. Very stiff, moist, medium plasticity; organics, rootlets; sand, fine; [FILL].							1.0										
	1.10m: Sandy SILT, minor clay, trace organics; brown-grey mottled orange & dark grey speckled black. Very stiff, moist, medium plasticity; sand, fine; decomposed particles; [FILL].							1.5					*1.50m:* Extended nozzle equipped					
				SPTS	100	89/- kPa 1/1 1/2 2/3 **N=8**	47								10/03/2021			
	2.12 - 2.14m: Sand inclusions. fine, sand. Yellow							2.0										
Tauranga Group	*2.20m:* Sandy SILT, some clay, trace organics; brown-grey mottled orange & dark grey speckled black & white. Very stiff, moist, medium plasticity; sand, fine; decomposed particles.			HQTT	90		46	2.5										
	2.90m: 2.9 - 3.0 m: Core Loss							3.0										
	3.00m: SILT, some organics and sand, minor clay; grey and brown, spotted dark brown. Stiff, moist, medium plasticity; decomposed rootlets, sand, fine.			SPTS	100	164/80 kPa 0/1 1/2 2/2 **N=7**												
	3.25m: Sandy SILT, some organics, minor clay; brown-grey, spotted dark brown. Stiff, moist, low plasticity; sand, fine; decomposed rootlets.																	Box 1, 0.00-3.45m
	3.45m: 0.55m Core Loss (washout)			HQTT	48		45	3.5										
	4.00m: SILT, some organics and sand; brown, spotted dark brown. Firm, moist, low plasticity; decomposed rootlets, sand, fine.							4.0							12/03/2021			
	4.20m: Sandy SILT, some organics; light brown, spotted dark brown. Stiff, moist, low plasticity; sand, fine; decomposed rootlets.														11/03/2021			
	4.50m: Push Tube Sample			PT	0	Push tube @ 4.50m	44	4.5										

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:37 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 2 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: (NZTM2000) 5925577.60 mN 1744458.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Sandy SILT, some organics; light brown-grey, spotted dark brown speckled white. Firm, moist, low plasticity; sand, fine; decomposed rootlets.			HQTT	100			5.5										
	5.58 - 5.68m: ORGANICS & Sandy SILT; Organics, wood fragments																	
	5.85 - 6.05m: Minor organics. Decomposed rootlets.																	
	6.05 - 6.20m: Silty SAND, trace organics; light brown-grey spotted dark brown. Loose, moist, poorly graded; sand, fine; decomposed rootlets. *6.20 - 7.30m:* Minor organics. Decomposed rootlets.			SPTS	100	89/1 kPa 0/1 2/1 2/2 **N=7**	43	6.0										
				HQTT	100		42	6.5										
	7.30m: Silty SAND, trace organics; light brown-grey, spotted dark brown speckled white. Loose to medium dense, moist, poorly graded; sand, fine to medium; decomposed rootlets.							7.0										Box 2, 3.45-7.05m
East Coast Bays Formation	*7.45m:* Sandy SILT, some organics; light brown-grey, spotted dark brown speckled white. Firm, moist, low plasticity; sand, fine; decomposed rootlets.			SPTS	100	1/2 3/3 4/4 **N=14**		7.5										
	7.55m: Silty SAND; grey. Medium dense, moist, poorly graded; sand, fine to medium; [RESIDUAL SOIL].						41											
	7.95m: Sandy SILT; grey. Firm, moist, low plasticity; sand, fine; [RESIDUAL SOIL].			HQTT	100			8.0										
	8.12m: Silty SAND; grey. Medium dense, moist, poorly graded; sand, fine to medium; [RESIDUAL SOIL].																	
	8.55m: Sandy SILT; grey. Firm, moist, low plasticity; sand, fine; [RESIDUAL SOIL].						40	8.5										
	9.05m: Silty SAND; grey. Medium dense, moist, poorly graded; sand, fine to medium; RESIDUAL SOIL].			SPTS	96	2/4 4/5 8/9 **N=26**		9.0										
	9.55 - 9.60m: Some silt.						39	9.5										

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 3 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: (NZTM2000) 5925577.60 mN 1744458.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* Silty SAND; grey. Medium dense, moist, poorly graded; sand, fine to medium; [RESIDUAL SOIL]. [CONT].			HQTT	100													Box 3, 7.05-10.40m
	10.40m: Highly weathered, dark grey, MUDSTONE. Extremely Weak. Silty CLAY; dark grey. Hard, moist, high plasticity.			SPTS	76	3/4 6/6 8/9 **N=29**	38	10.5										
	10.55m: Silty SAND, trace organics; grey. Medium dense, moist, poorly graded; sand, fine to medium; organics, carbonaceous; (Completely weathered).							11.0										
	11.42 - 11.44m: SILT, some clay and sand; grey. Very stiff, moist, medium plasticity. *11.46 - 11.48m:* SILT, some clay and sand; grey. Very stiff, moist, medium plasticity. *11.66 - 11.68m:* SILT, some clay and sand; grey. Very stiff, moist, medium plasticity.			HQTT	90		37	11.5										
				SPTS	89	2/4 4/6 8/10 **N=28**		12.0										
				HQTT	100		36	12.5										
	13.15m: Highly weathered, dark grey, MUDSTONE. Extremely Weak. Silty CLAY; dark grey. Hard, moist, high plasticity.							13.0										
	13.20m: SILT, minor clay; dark grey. Stiff, moist, medium plasticity. - INTERBEDDED WITH - SAND, some silt. Medium dense, moist, uniformly graded; sand, fine.			SPTS	100	2/3 4/6 8/10 **N=28**	35	13.5										Box 4, 10.40-13.95m
	13.90m: Moderately weathered, grey-brown, SANDSTONE. Extremely Weak. SAND, minor silt, trace organics; grey-brown. Very dense, moist, uniformly graded; sand, fine to medium; organics, carbonaceous; ..			HQTT	100			14.0				0						
	14.22m: Moderately weathered, grey-brown, SANDSTONE. Extremely Weak, (SAND, some silt; grey-brown. Dense, moist, uniformly graded; Sand, fine (~60%)). - INTERBEDDED WITH - Moderately weathered, brown & grey, SILTSTONE. Extremely Weak, (SILT, some sand, minor clay; brown. Hard, moist, low plasticity (~40%)). *14.62 - 14.68m:* Slightly weathered, dark grey, MUDSTONE. Extremely Weak, gently inclined.						34	14.5					14.50m: B, 5° dip					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH203

SHEET: 4 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: (NZTM2000) 5925577.60 mN 1744458.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* Solid Cone SPT (No recovery)			SPTC	0	5/8 11/13 20/6 for 25mm **N>=50** Solid												
	15.40m: Slightly weathered, dark grey, SILTSTONE. Extremely Weak. Silty CLAY; dark grey. Hard, moist, medium plasticity.			HQTT	100		33	15.5				61	15.45m: BF, 18° dip, PL, SM, VN, CN 15.55m: BF, 20° dip, PL, SM, VN, CN 15.67m: BF, 25° dip, PL, SM, VN, CN 15.77m: DD 15.88m: DD 15.98m: DD					
	15.45m: Unweathered, grey, SANDSTONE. Very Weak, (fine sand). *15.95 - 16.22m:* fine to coarse sand *16.22 - 16.28m:* Unweathered, dark grey, SILTSTONE. Very Weak, gently inclined. *16.28 - 16.35m:* fine to coarse sand *16.35 - 16.42m:* Slightly weathered, grey, SANDSTONE. Extremely Weak.							16.0					16.10 - 16.18m: J, 60° dip, UN, SM, VN, CN 16.14 - 16.19m: J, 58° dip, UN, SM, VN, CN 16.18m: J, 52° dip, PL, RO, VN, CN 16.20 - 16.25m: J, 52° dip, UN, SM, VN, CN 16.34m: J, 30° dip, PL, SM, VN, CN					Box 5, 13.95-17.20m
	16.50m: Solid Cone SPT (No recovery)			SPTC	0	14/36 for 65mm **N>=50** Solid		16.5										
	16.64m: Slightly weathered, grey & brown trace white speckles, coarse, SANDSTONE. Very Weak.			HQTT	99		32	17.0				66	16.35 - 16.50m: J, 60° dip, PL, SM, VN, CN 16.36 - 16.45m: J, 75° dip, PL, SM, VN, CN 16.64 - 16.70m: BZ 16.73m: J, 38° dip, PL, RO, VN, CN 16.88m: J, 12° dip, PL, RO, VN, CN 16.89 - 17.00m: J, 60° dip, PL, RO, VN, CN 17.01m: DD 17.15m: DD 17.20 - 17.28m: J, 76° dip, PL, SM, VN, CN 17.25m: DD					
Albany Conglomerate	*17.45m:* Unweathered, grey, SANDSTONE. Very Weak, (fine to coarse sand).						31	17.5					17.31 - 17.52m: J, 75° dip, UN, SM, VN, CN 17.36m: DD 17.40 - 17.45m: J, 50° dip 17.60m: DD, UN, SM, VN, CN 17.63m: DD 17.65m: DD					
	18.00m: Solid Cone SPT (No recovery)			SPTC	0	11/35 37/13 for 15mm **N>=50** Solid		18.0										
East Coast Bays Formation	*18.24m:* Unweathered, grey spotted dark grey, red & green, SANDSTONE. Very Weak, Conglomeratic sandstone; fine to coarse sand, fine to coarse, sub-rounded silstone gravel-sized clasts. *18.38m:* Unweathered, grey, SANDSTONE. Very Weak, gently inclined, (fine to medium sand, trace carbonaceous material). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined.			HQTT	91		30	18.5				19	18.31 - 18.44m: J, UN, SM, VN, CN 18.44 - 18.62m: BZ 18.67 - 18.85m: J, 72° dip, PL, SM, VN, CN 18.74 - 18.91m: BZ					
								19.0					19.17 - 19.40m: J, 62° dip to 90° dip 19.30 - 19.40m: BZ 19.40m: J, 20° dip, PL, SM, CN 19.50m: DD 19.53 - 19.59m: J, 15° dip, ST, RO,VN, CN 19.54m: J, 10° dip, PL, SM, VN, CN 19.65m: DD 19.69m: DD 19.72m: DD 19.76m: DD,					
	19.90 - 20.06m: Extremely Weak.						29	19.5				10	19.80 - 19.85m: J, 82° dip, ST, RO, VN, CN 19.80m: BF, 12° dip, PL, SM, VN, CN 19.85m: BF, 12° dip, PL, SM, VN, CN					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 5 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac	CO-ORDINATES: 5925577.60 mN (NZTM2000) 1744458.90 mE	R.L. GROUND: 48.80m
JOB No.: 1015174.0000.04	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* Unweathered, grey, SANDSTONE. Very Weak, gently inclined, (fine to medium sand, trace carbonaceous material). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined, [CONT]. *20.20 - 20.50m:* Extremely Weak.			HQTT	100		28	20.5				10	19.93 - 20.06m: BZ 20.06 - 20.20m: J, 78° dip, PL, SM, VN, CN 20.20 - 20.50m: BZ, PL, SM, VN, CN					Box 6, 17.20-20.40m
	20.60m: Core Loss																	
	20.90m: Unweathered, grey, SANDSTONE. Very Weak, gently inclined, (fine to medium sand, trace carbonaceous material). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined.			HQTT	76			21.0				21	20.93 - 20.99m: J, 45° dip, PL, SM, CN 21.00m: B, 25° dip 21.07 - 21.11m: BZ 21.19m: DD 21.27m: DD 21.34m: DD					
	21.50m: Core Loss							21.5										
	21.75m: Unweathered, grey, SANDSTONE. Very Weak, gently inclined, (fine to medium sand, trace carbonaceous material). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined.			HQTT	77		27	22.0				40	21.83m: BF 21.86m: BF 21.91m: DD 22.08m: DD 22.15m: DD 22.25m: DD 22.31m: DD					
	21.92m: Slightly weathered, grey, SANDSTONE. Extremely Weak. SAND, minor silt; grey & brown trace white speckles. Very dense, moist, uniformly graded; sand, fine to coarse.																	
	22.33m: Core Loss							22.5										
	22.50m: Unweathered, grey, SANDSTONE. Very Weak.			HQTT	100		26	23.0				90	23.00m: B, 5° dip 23.03m: DD 23.04m: BF, 21° dip, PL, SM, VN, CN 23.05 - 23.11m: J, 55° dip, PL, SM, VN, CN 23.05m: DD 23.25m: J, 50° dip, PL, SM, VN, CN 23.28m: BF, 18° dip, PL, SM, VN, Calcium carbonate veneer 23.35 - 23.42m: BZ 23.45 - 23.50m: BZ 23.53m: DD 23.58 - 23.60m: BZ 23.65m: DD 23.70 - 23.85m: BZ					
	23.25m: Unweathered, grey, SANDSTONE. Extremely Weak, gently inclined, (SAND, grey. Very dense, moist, uniformly graded). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, (SILT, minor clay; dark grey. Hard, moist, medium plasticity).			HQTT	100		25	23.5				0					Box 7, 20.40-24.00m
	24.00 - 26.75m: Extremely weak to very weak							24.0					24.03m: BF, 12° dip, PL, SM, VN, CN 24.11m: BF, 5° dip, PL, SM, VN, CN					
								24.5				46	24.35m: DD 24.44m: DD 24.52m: DD 24.65m: BF, 10° dip, Pl, SM, VN, CN 24.74 - 24.76m: BZ 24.85 - 24.87m: BZ 24.97m: BF, 15° dip, Pl, SM, VN, CN 24.99m: BF, 10° dip, T					
							24											

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH203

SHEET: 6 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: (NZTM2000) 5925577.60 mN 1744458.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* Unweathered, grey, SANDSTONE. Extremely Weak, gently inclined, (SAND, grey. Very dense, moist, uniformly graded). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, (SILT, minor clay; dark grey. Hard, moist, medium plasticity) [CONT].			HQTT	100							46	25.11m: DD 25.15m: DD 25.23 - 25.43m: BZ					
				HQTT	83		23	25.5				15	25.59m: BF, 12° dip 25.61m: DD 25.71 - 25.73m: BZ 25.76 - 25.77m: BZ 25.82 - 25.83m: BZ 25.87 - 25.88m: BZ					
								26.0					26.02m: DD 26.07m: DD 26.12 - 26.23m: BZ 26.31m: DD					
								26.5					26.45m: DD 26.51m: J, 18° dip, PL, SM, VN, CN 26.60m: DD					
	26.75m: Core Loss (washout in soft rock zones)						22	27.0										
	27.00m: Slightly weathered, grey, fine, SANDSTONE. Extremely Weak, SAND, some silt; grey-brown. Dense, moist, uniformly graded; Sand, fine.			HQTT	77								27.00 - 27.15m: BZ 27.18 - 27.20m: BZ 27.23 - 27.28m: BZ 27.30 - 27.36m: BZ					
	27.40m: Core Loss (washout in soft rock zones)							27.5				6						
	27.85m: Moderately weathered, grey-brown, SANDSTONE. Extremely Weak. SAND, minor silt; grey-brown. Medium dense, moist, uniformly graded; sand, fine to medium.						21	28.0										
	28.40m: Unweathered, grey , fine, SANDSTONE. Very Weak.							28.5					28.50 - 28.69m: J, 70° dip, T					
	28.72m: Moderately weathered, grey-brown, SANDSTONE. Extremely Weak, (SAND, some silt; grey-brown. Dense, moist, uniformly graded; Sand, fine (~40%)). - INTERBEDDED WITH - Moderately weathered, brown & grey, SILTSTONE. Extremely Weak, (SILT, some sand, minor clay; brown. Hard, moist, low plasticity (~60%)).			HQTT	73		20	29.0					28.72 - 28.89m: BZ 28.95 - 28.98m: BZ					
	29.38m: Core Loss (washout in soft rock zones)							29.5				33	29.15 - 29.20m: BZ 29.22m: J, 18° dip, PL, RO, VN, CN 29.28 - 29.32m: BZ, 29.35 - 29.38m: BZ					
	29.78m: Slightly weathered, grey , SANDSTONE. Very Weak.						19						29.91m: J, 20° dip, Pl, SM, VN, CN					

Box 8, 24.00-27.40m

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 7 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: 5925577.60 mN, 1744458.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* Slightly weathered, grey , SANDSTONE. Very Weak, [CONT].			HQTT	100		18	30.5				46	*30.00m:* Half core runs commenced due to core loss in poorquality rock 30.12m: DD 30.18m: DD 30.24 - 30.28m: BZ 30.34m: DD					
	30.60 - 30.69m: SILT; grey. Very stiff, moist, low plasticity.												30.43 - 30.47m: BZ 30.51m: DD 30.54m: DD					
	31.15m: Moderately weathered, grey, SANDSTONE. Extremely Weak, (SAND, some silt; grey-brown. Dense, moist, uniformly graded; Sand, fine (~95%)). - INTERBEDDED WITH - Moderately weathered, dark grey, SILTSTONE. Extremely Weak, (SILT, some sand, minor clay; brown. Hard, moist, low plasticity (~5%)).			HQTT	100			31.0				29	30.82m: BF, 22° dip, PL, SM, VN, CN 30.87m: BF, 8° dip, PL, SM, VN, CN 31.07m: BF, 22° dip, PL, SM, VN, CN 31.17m: DD 31.20 - 31.30m: BZ 31.33m: DD 31.38 - 31.39m: BZ					Box 9, 27.40-31.20m
	31.40m: Unweathered, grey, SANDSTONE. Very Weak, (fine to coarse sand).																	
	31.72m: Slightly weathered, grey, fine, SANDSTONE. Extremely Weak, (SAND, some silt; grey-brown. Dense, moist, uniformly graded; Sand, fine (~95%)). - INTERBEDDED WITH - Slightly weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, (SILT, some sand, minor clay; brown. Hard, moist, low plasticity (~5%)).			HQTT	100		17	31.5				77	31.72m: DD 31.87 - 31.96m: DD					
								32.0					32.07m: BF, 15° dip, PL, SM, VN, CN 32.11m: DD 32.15 - 32.18m: BZ,					
	32.75m: Core Loss (washout in soft rock zones)			HQTT	67		16	32.5				38	32.44m: DD 32.48m: DD 32.53m: DD 32.58 - 32.59m: BZ, 32.67m: DD					
	33.00m: Moderately weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (Clayey SILT; dark grey. Hard, moist, low plasticity (~75%)). Moderately weathered, grey, SANDSTONE. Extremely Weak, bedded, gently inclined, thin, (SAND, some silt; grey. Dense, moist, uniformly graded, poorly cemented; Sand, fine (~25%)).			HQTT	100			33.0				0	33.11 - 33.68m: DD, drilling induced defects due to soft rock 33.69m: J, 18° dip, PL, SM, VN, CN					
	34.02 - 34.05m: Light brown Calcium Carbonate layer; extremely weak			HQTT	100		15	33.5				22	33.80 - 34.50m: DD, drilling induced defects due to soft rock					Box 10, 31.20-34.40m
								34.0										
							14	34.5				25	34.51m: DD 34.54m: DD 34.58m: DD 34.62m: J 34.62 - 34.66m: BZ, 34.66m: J 34.74 - 34.81m: BZ, 34.92 - 34.98m: BZ,					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 8 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: (NZTM2000) 5925577.60 mN 1744458.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*35.05m:* Moderately weathered, grey, SANDSTONE. Extremely Weak, bedded, gently inclined, moderately thin, SAND, some silt; grey. Dense, moist, uniformly graded, poorly cemented; Sand, fine (~70%). - INTERBEDDED WITH - Moderately weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, Clayey SILT; dark grey. Hard, moist, low plasticity (~30%).			HQTT	83		13	35.5				25	35.32 - 35.36m: BZ 35.41m: DD 35.43m: DD 35.53m: DD 35.65 - 35.68m: BZ					
	35.75m: Core Loss (washout in soft rock zones)																	
	36.00m: Unweathered, grey, massive, SANDSTONE. Very Weak, thick.			HQTT	100		12	36.0				93	36.40m: DD 36.56m: DD					
	37.20m: Unweathered, grey spotted green & brown, massive, SANDSTONE. Very Weak, thick, Conglomeratic sandstone; fine to coarse sand, fine to medium, sub-rounded gravel-size siltstone clasts.			HQTT	100			36.5					36.82m: DD					
	37.73 - 37.78m: Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined, laminated.							37.0				100	37.22m: DD 37.27m: DD					
	37.78m: Unweathered, grey, massive, SANDSTONE. Very Weak, thick.						11	37.5					37.74m: DD 37.88m: DD					Box 11, 34.40-37.65m
	37.95m: Slightly weathered, grey, fine, SANDSTONE. Extremely Weak, bedded, gently inclined, moderately thick, (SAND, some silt; grey-brown. Dense, moist, uniformly graded; Sand, fine (~95%)). - INTERBEDDED WITH - Slightly weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (SILT, some sand, minor clay; brown. Hard, moist, low plasticity (~5%)).			HQTT	87			38.0				46	37.98 - 38.06m: DD, drilling induced defects due to soft rock 38.12 - 38.16m: DD, drilling induced defects due to soft rock 38.20 - 38.32m: DD, drilling induced defects due to soft rock 38.21m: DD 38.26 - 38.30m: BZ 38.30 - 38.34m: DD, drilling induced defects due to soft rock 38.40m: DD 38.48m: DD 38.59m: DD 38.71m: DD 38.73m: DD					
	38.80m: Core Loss (washout in soft rock zones)						10	38.5										
	39.00m: Moderately weathered, grey, SANDSTONE. Extremely Weak, bedded, gently inclined, moderately thin, (SAND, some silt; grey. Dense, moist, uniformly graded, poorly cemented; Sand, fine (~70%)). - INTERBEDDED WITH - Moderately weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (Clayey SILT; dark grey. Hard, moist, low plasticity (~30%)).			HQTT	47			39.0				24	39.11m: DD 39.17 - 39.20m: BZ 39.20 - 39.32m: DD					
	39.35m: Core Loss (washout in soft rock zones)						9	39.5										
												0	39.78m: BF, 12° dip, PL, SM, VN, CN 39.86 - 39.89m: BZ 39.95m: DD					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 9 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: (NZTM2000) 5925577.60 mN 1744458.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*40.00m:* Moderately weathered, grey, SANDSTONE. Extremely Weak, bedded, gently inclined, moderately thick, (SAND, some silt, trace organics; grey. Dense, moist, uniformly graded, poorly cemented; Sand, fine, organics, carbonaceous (~70%)). - INTERBEDDED WITH - Moderately weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (Clayey SILT; dark grey. Hard, moist, low plasticity (~30%)) [CONT].			HQTT	100						0	40.00 - 40.03m: BZ 40.07 - 40.13m: BZ 40.18 - 40.20m: BZ					
				HQTT	100		40.5				33	40.29m: DD 40.36m: DD 40.44 - 40.60m: BZ 40.64 - 40.67m: DD, drilling induced defects due to weak bedding planes 40.70 - 40.75m: BZ 40.87m: DD 40.90 - 40.95m: BZ					Box 12, 37.65-41.20m
				HQTT	88		41.0 41.5				37	41.05 - 41.13m: BZ 41.18 - 41.38m: BZ 41.37m: DD 41.42m: DD 41.50 - 41.54m: BZ 41.58m: DD					
	41.83 - 41.93m: Slightly weathered, grey, SANDSTONE. Extremely Weak, Carbonaceous. SAND, some organics, minor silt; grey. Very dense, moist, uniformly graded; sand, fine to medium; organics, carbonaceous.																
	42.05m: Core Loss (washout in soft rock zones)						42.0										
	42.20m: Moderately weathered, grey, SANDSTONE. Extremely Weak, bedded, gently inclined, moderately thick, (SAND, some silt, trace organics; grey. Dense, moist, uniformly graded, poorly cemented; Sand, fine; organics, carbonaceous (~70%)). - INTERBEDDED WITH - Moderately weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (Clayey SILT; dark grey. Hard, moist, low plasticity (~30%)).			HQTT	100		42.5				30	42.26 - 42.29m: BZ 42.42m: DD 42.48 - 42.65m: BZ 42.54m: J, 30° dip, PL, SM, VN, CN 42.71m: DD					
	42.93 - 43.00m: Slightly weathered, grey, SANDSTONE. Extremely Weak, Carbonaceous. SAND, some organics, minor silt; grey. Very dense, moist, uniformly graded; sand, fine to medium; organics, carbonaceous.						43.0					42.98m: DD 43.00 - 43.26m: BZ					
				HQTT	85		43.5 44.0				38	43.36m: DD 43.38m: DD 43.56 - 43.67m: BZ, 3 joints 30 - 65 deg, PL, SN, VN, CN 44.04m: DD 44.20m: DD 44.22 - 44.32m: J, 51° dip, T					Box 13, 41.20-44.15m
							44.5					44.30 - 44.80m: BZ					
	44.80m: Core Loss (washout in soft rock zones)																

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 10 OF 11

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: 5925577.60 mN, 1744458.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*45.00m:* Moderately weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (Clayey SILT; dark grey. Hard, moist, moderate plasticity (~60%)). Moderately weathered, grey, SANDSTONE. Extremely Weak, bedded, gently inclined, thin, (SAND, some silt, trace organics; grey. Dense, moist, uniformly graded, poorly cemented; Sand, fine; organics, carbonaceous (~30%)).			HQTT	100		45.5				38	45.00 - 45.13m: BZ 45.29 - 45.37m: BZ 45.44m: DD 45.47m: DD 45.50 - 45.52m: BZ						
				HQTT	100		46.0				36	45.75m: DD 45.89m: DD 45.94m: DD 46.00m: DD 46.07 - 46.14m: BZ						
				HQTT	100		46.5				0	46.25 - 46.33m: J, 55° dip, , PL, SM, CN 46.30 - 46.34m: BZ 46.35 - 46.50m: J, T, 5 x Annealed fractures 46.59 - 46.72m: BZ 46.78m: DD 46.84 - 46.88m: BZ						
				HQTT	87		47.0				56	46.94m: J, 60° dip, PL, SM ,VN CN 46.95m: J, 50° dip, PL, SM, VN, CN 47.00m: DD 47.05m: DD 47.09m: BF, 12° dip, PL, SM, VN, CN 47.11m: J, 52° dip, PL, SM, VN, CN 47.25 - 47.40m: BZ 47.39m: J 47.47m: DD 47.54m: DD						
	47.90m: Core Loss (washout in soft rock zones)						47.5					47.82 - 47.90m: BZ						
	48.00m: Slightly weathered, grey, fine, SANDSTONE. Extremely Weak, bedded, gently inclined, thin, (SAND, some silt; grey.Very dense, moist, uniformly graded; Sand, fine (~40%)). - INTERBEDDED WITH - Slightly weathered, dark grey, SILTSTONE. Extremely Weak, bedded, gently inclined, thin, (Clayey SILT, dark grey. Hard, moist, low plasticity (~70%)).			HQTT	87		48.0				14	48.06m: DD 48.11 - 48.25m: BZ 48.34 - 48.37m: BZ 48.49m: BF, 12° dip, PL, SM, VN, CN 48.54m: DD 48.57m: DD						
	48.65m: Core Loss (washout in soft rock zones)						48.5					48.63m: DD 48.78m: BF, 10° dip, PL, SM, VN, CN 48.80m: DD						
	48.75m: Unweathered, grey, fine, SANDSTONE. Very Weak, bedded, gently inclined, moderately thin, (fine to medium sand). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined, very thin.			HQTT	100		49.0				28	48.90m: J, 18° dip, T 48.91m: DD 49.02m: DD 49.05m: DD 49.11m: BF, 20° dip, PL, SM, VN, CN 49.16m: DD 49.19m: DD 49.28m: DD 49.29m: DD 49.35 - 49.36m: BZ 49.43m: DD						
							49.5				53	49.54m: BF, 10° dip, PL, SM, VN, CN 49.60m: DD, 49.64m: BF, 12° dip, ST, SM, VN, CN 49.70m: DD 49.71m: BF, 6° dip, PL, SM, VN, CN 49.76m: DD 49.80m: DD 49.81m: BF, 18° dip, PL, SM, VN, CN 49.90m: J, 16° dip, PL, SM, VN, CN						

Box 14, 44.15-47.35m

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH203

SHEET: 11 OF 11

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Whenuapai, Auckland

CO-ORDINATES: 5925577.60 mN, 1744458.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 48.80m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 09/03/2021
FINISH DATE: 15/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation
East Coast Bays Formation	*50.00m:* Unweathered, grey, fine, SANDSTONE. Very Weak, bedded, gently inclined, moderately thin, (fine to medium sand). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined, very thin, [CONT].
	51.85m: Unweathered, grey, fine, SANDSTONE. Very Weak, bedded, gently inclined, moderately thick, (fine to medium sand). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined, moderately thick. *53.20 - 53.55m:* (fine to coarse sand)
	53.55m: Unweathered, grey, fine, SANDSTONE. Very Weak, bedded, gently inclined, moderately thin, (fine to medium sand). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, gently inclined, very thin. *54.85 - 55.00m:* Grey spotted green and red (fine to coarse sand) 55m: END OF BOREHOLE

Rock Weathering: UW SW MW HW CW
Rock Strength: ES VS S MS W VW EW
Sampling Method: HQTT
Core Recovery (%): 100
Testing
RL (m) / Depth (m): 50.5, 51.0, 51.5, 52.0, 52.5, 53.0, 53.5, 54.0, 54.5; -2, -3, -4, -5, -6
Graphic Log

ROCK DEFECTS
Defect Log
Fracture Spacing (mm): 2000, 600, 200, 60, 20
RQD (%): 53, 40, 62, 38

Description & Additional Observations

49.91m: DD
50.03m: BF, 12° dip, PL, SM, VN, CN
50.07m: DD
50.11m: BF, 15° dip, PL, SM, VN, CN
50.16m: BF, 8° dip, PL, SM, VN, CN
50.18m: DD
50.20m: BF, 15° dip, PL, SM, VN, CN
50.24m: DD
50.30 - 50.31m: BZ
50.38m: DD
50.41 - 50.50m: J, 60° dip, PL, SM, VN, CN
50.59m: DD
50.62m: DD
50.66m: DD
50.76m: DD
50.79 - 50.88m: J, 68° dip, PL, SM, VN, CN
50.84m: DD
50.93m: DD
51.00 - 51.83m: DD, drilling induced defects due to weak bedding planes
52.13m: DD
52.15m: DD
52.27m: BF, 10° dip, PL, SM, VN, CN
52.33m: DD
52.50m: BF, 23° dip, PL, RO, CN
52.62m: DD
52.67m: DD
52.71m: DD
52.77m: DD
52.78 - 52.92m: J, 50° dip, PL, SM, VN,CN
52.79m: DD
52.84 - 52.91m: BZ
53.03m: DD
53.04 - 53.08m: J, 10° dip, PL, SM, VN, CN
53.34m: J, 32° dip, PL, RO, VN, CN
53.41m: J, 12° dip, PL, SM, VN, CN
53.56m: DD
53.61 - 53.67m: J, 35° dip, PL, SM, VN, CN
53.83 - 53.98m: J, 72° dip, UN, RO, VN, CN
53.92m: BF, 16° dip, PL, SM, VN, CN
54.00m: J, 52° dip, ST, RO, VN, CN
54.06m: DD
54.08m: DD
54.15m: DD
54.16m: DD
54.25m: DD
54.30 - 54.32m: BZ
54.39 - 54.48m: J, 82° dip, UN, SM, VN, CN
54.48 - 54.58m: BZ
54.63m: DD
54.76m: DD
54.83m: DD

Fluid Loss (%): 25, 50, 75
Water Level
Casing
Installation
Core Box No: Box 15, 47.35-50.40m; Box 16, 50.40-53.40m; Box 17, 53.40-55.00m

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa. Drilling induced fractures and broken zones observed throughout progression of geology. These defects have been included in the fracture spacing.

Hole Depth 55m

Scale 1:25

Rev.: A

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
R.L.:	48.80m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

0.00-3.45m

3.45-7.05m

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
R.L.:	48.80m	DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

7.05-10.40m

10.40-13.95m

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
R.L.:	48.80m	DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

13.95-17.20m

17.20-20.40m

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
R.L.:	48.80m	DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

20.40-24.00m

24.00-27.40m

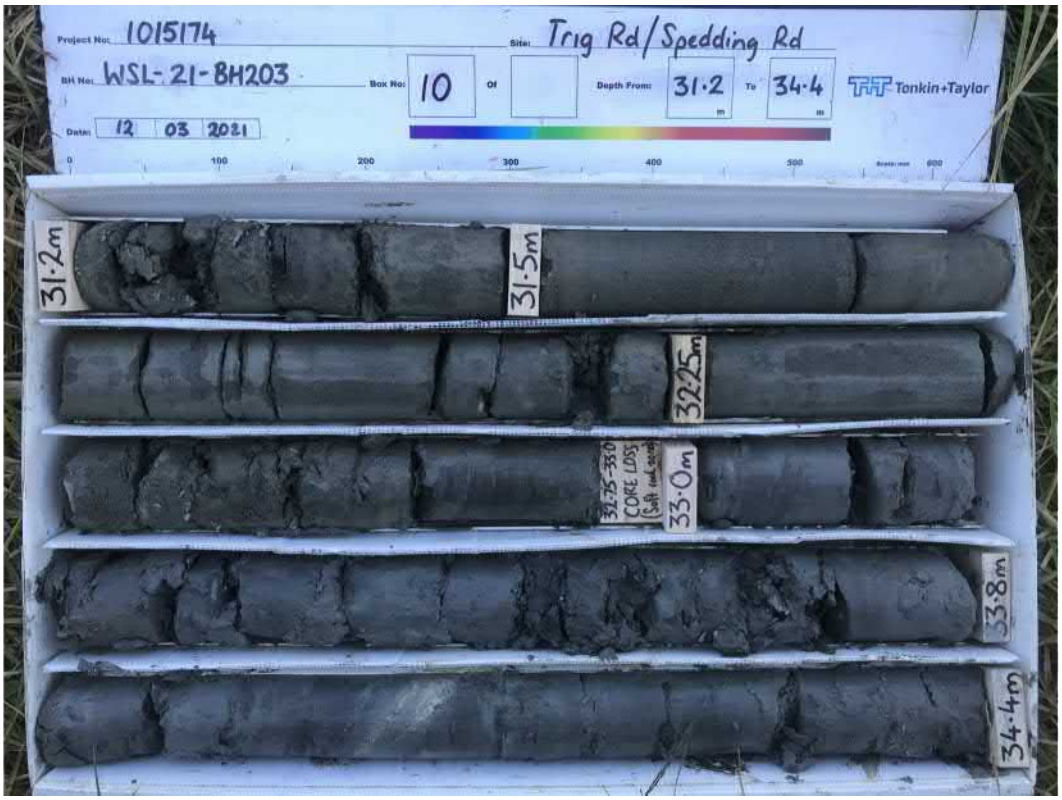
General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
R.L.:	48.80m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

27.40-31.20m



31.20-34.40m

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
R.L.:	48.80m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

34.40-37.65m

37.65-41.20m

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

SHEET: 7 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
R.L.:	48.80m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

41.20-44.15m

44.15-47.35m

General Log _ - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W	LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: 5925577.60 mN (NZTM2000) 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
R.L.: 48.80m	DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
DATUM: NZVD2016		DRILLED BY: McMillan Drilling
		LOGGED BY: ROM CHECKED: TRMC

47.35-50.40m

50.40-53.40m

General Log - 6/07/2021 7:48:38 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH203**

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925577.60 mN 1744458.90 mE	DRILL TYPE:	HOLE STARTED: 09/03/2021
R.L.:	48.80m	DRILL METHOD: RC	HOLE FINISHED: 15/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

53.40-55.00m

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 1 OF 12

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*0.00m:* Silty SAND, some organics; dark brown. Loosely packed, moist, poorly graded; Sand, fine; Organics,rootlets.			HA	100		45	0	TS				*0.00m:* No apparent water loss observed during drilling					
	0.30m: Silty sandy CLAY, trace organics; mottled grey & orange-brown with trace orange and black specs. Hard, moist, high plasticity; sand, fine; organics, rootlets and carbonaceous.			HQTT	100	UTP		0.5										
	1.20m: Grey mottled orange						44	1.0										
	1.45m: Silty CLAY, trace organics; grey. Very stiff, moist, high plasticity; organics, rootlets.			SPTS	67	155/45 kPa 0/0 1/2 2/2 **N=7**		1.5										
	1.95m: SILT, some clay, minor sand, trace organics; light brown mottled orange, red & grey-brown. Stiff, moist, medium plasticity; organics, rootlets.			HQTT	100		43	2.0										
	2.15 - 2.80m: some sand																	
	2.45m: minor clay; silt, low plasticity							2.5										
	2.80m: Sandy SILT, minor clay, trace organics; light brown mottled orange, red & grey-brown. Stiff, moist, low plasticity; sand, fine.			SPTS	93	84/52 kPa 0/1 1/1 1/2 **N=5**	42	3.0							▼ 23/02/2021			
	3.40 - 3.45m: SILT, some clay, minor sand, trace organics; light brown mottled orange. Stiff, moist, low plasticity; sand, fine; organics, rootlets.																	
	3.45m: Sandy SILT, trace organics; light brown, mottled orange, red & grey-brown. Stiff, moist, low plasticity; sand, fine; organics, rootlets.			HQTT	100			3.5										
	4.10m: Silty SAND, trace organics; grey mottled orange. Stiff, moist, low plasticity; sand, fine; organics, rootlets.						41	4.0										
East Coast Bays Formation	*4.40m:* Silty SAND; grey mottled orange. Loose, moist, poorly graded; sand, fine; (Residual Soil).			SPTS	104	57/27 kPa 0/1 2/2 2/2 **N=8**		4.5										Box 1, 0.00-3.00m

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log _ - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 2 OF 12

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: (NZTM2000) 5925572.95 mN 1744601.80 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.00m:* CORE LOSS (Washout)																	
	5.05m: Sandy SILT, trace organics; mottled grey & orange. Stiff, moist, low plasticity; organics, carbonaceous.																	
	5.45m: Completeley weathered SANDSTONE, extremely weak recovered as SAND, some silt; grey.Medium dense, moist, poorly graded; Sand, fine, thinly to moderately thinly bedded(60%). (Completely weathered Sandstone/Siltstone.) - INTERBEDDED WITH - Completely weathered SILTSTONE, extremely weak recovered as Silty CLAY; dark grey. Very stiff, moist, high plasticity, thinly bedded (40%).			SPTS	98	141/40 kPa 0/2 2/3 4/4 **N=13**	40	5.5										
				HQTT	100		39	6.0										
				SPTS	107	UTP Shear test failed - too sandy 2/2 3/3 4/4 **N=14**	38	6.5										
	7.95m: CORE LOSS (Washout)							7.5										
	8.25m: Completeley weathered SANDSTONE, extremely weak recovered as SAND, some silt, trace carbonaceous; grey. Loose to medium dense, moist, poorly graded; Sand, fine, thinly to moderately thickly bedded (95%) - INTERBEDDED WITH - Completely weathered SILTSTONE, extremely weak recovered as Silty CLAY; dark grey. Very stiff, moist, high plasticity, thinly bedded (5%)			HQTT	71		37	8.0										
	8.90m: SAND, trace organics; grey with trace black speckles. Very dense, moist, poorly graded; sand, fine; organics, carbonaceous; Completeley weathered SANDSTONE, extremely weak.			SPTS	118	UTP 3/4 5/6 6/8 **N=25**	36	8.5							24/02/2021			
	9.45m: CORE LOSS (Washout)							9.0										
	9.55m: Highly weathered, grey, SANDSTONE. Extremely Weak. SAND, trace organics; grey with trace black speckles. Very dense, moist, poorly graded; sand, fine to medium; organics, carbonaceous. *9.75 - 9.78m:* dark grey							9.5										

Box 2, 3.00-6.45m

Box 3, 6.45-9.95m

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 3 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: (NZTM2000) 5925572.95 mN 1744601.80 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* Highly weathered, grey, SANDSTONE. Extremely Weak. SAND, trace organics; grey with trace black speckles. Very dense, moist, poorly graded; sand, fine to medium; organics, carbonaceous; [CONT].			HQTT	90		35											
				SBPSS	100	5/9 13/18 27 for 75mm **N>=50**		10.5										
								11.0										
				HQTT	100		34											
								11.5										
				SPTC	0	7/21 33/21 for 50mm **N>=50** Solid		12.0										
	12.27m: CORE LOSS						33											
	12.37m: Moderately weathered, grey, SANDSTONE. Extremely Weak. SAND, trace organics; grey with trace black speckles. Very dense, moist, poorly graded; sand, fine to medium; organics, carbonaceous.				77			12.5										
								13.0										
							32											
				SPTC	0	11/19 15/13 15/16 **N>=50** Solid		13.5										
	13.95m: Unweathered, grey, coarse, SANDSTONE. Very Weak.							14.0					14.02m: J, PL, SM, VN, CN 14.24m: J, 35° - 42° PL, SM, VN, CN					
	14.40 - 14.53m: Unweathered, grey, coarse, SANDSTONE. Extremely Weak. SAND, minor silt; grey. Very dense, moist, poorly graded; sand, medium to coarse.				100		31					61	14.33 - 14.53m: BZ 14.50m: B, 25°					
	14.53m: Unweathered, grey, coarse, SANDSTONE. Very Weak, bedded, moderately inclined, (Fine to medium SAND, trace organics. Very dense, moist, poorly graded). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very Weak, bedded, moderately inclined, laminated, (Silty CLAY. Hard, moist, high							14.5										

25/02/2021

Allowing grouting undertaken af

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 4 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation				SPTC	0	7/19 26/31 for 75mm **N>=50** Solid	30											
	15.30m: CORE LOSS																	
	15.45m: [CONT] Unweathered, grey, coarse, SANDSTONE. Extremely Weak to very weak, bedded, moderately inclined, (SAND, trace organics; grey. Very dense, moist, poorly graded; sand, fine to medium). - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Extremely Weak to very weak, bedded, moderately inclined, laminated, (Silty CLAY, dark grey. Hard, moist, high plasticity).			HQTT	92		29	15.5 16.0				91	15.79 - 15.83m: DD 16.18 - 16.50m: BZ					
	16.20 - 16.40m: Extremely weak.							16.5					16.50 - 16.90m: DD					Box 5, 13.95-17.10m
	17.65 - 17.75m: Recovered as: SAND; grey. Very dense, moist, poorly graded; Sand, fine to medium			HQTT	97		28	17.0 17.5					17.15m: DD 17.28m: DD 17.35m: DD 17.49m: DD 17.51m: DD 17.59m: DD 17.60m: J, 70° PL, SM, VN, CN 17.64m: J, 0° ST, RO, VN, CN 17.65 - 17.75m: DD 17.66m: J, 0° - 20° PL, SM, VN, CN 17.75m: J, 45° PL, SM, VN, CN					
				HQTT	108		27	18.0 18.5				60	17.85m: J, 25° CN 18.17m: J, 32° PL, SM, VN, CN 18.31 - 18.46m: J, 70° - 90° T Light brown veneer 18.42m: J, 35° T, light brown veneer 18.55m: J, 32° T, light brown veneer 18.70m: J, 10° T light brown veneer					
							26	19.0 19.5				0	19.40m: J, 30° PL, RO, CN 19.65m: J, 5° T 19.90m: J, 13° PL, SM, VN, CN 19.94 - 20.00m: BZ					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 5 OF 12

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT: East Coast Bays Formation

DESCRIPTION OF CORE

SOIL: Classification, colour, consistency / density, moisture, plasticity

ROCK: Weathering, colour, fabric, name, strength, cementation

21.00m: CORE LOSS

21.25m: [CONT] Unweathered, grey, coarse, SANDSTONE. Very weak, bedded, moderately inclined, (SAND, trace organics; grey. Very dense, moist, poorly graded; sand, fine to medium).
- INTERBEDDED WITH -
Unweathered, dark grey, SILTSTONE. Very weak, bedded, moderately inclined, laminated, (Silty CLAY, dark grey. Hard, moist, high plasticity).

21.64 - 22.05m: Unweathered, grey, coarse, SANDSTONE. Extremely Weak.
SAND; grey. Very dense, moist, poorly graded; sand, medium to coarse.

22.90m: Moderately thinly to moderately thickly interbedded

23.50 - 23.95m: Recovered as: Sandy GRAVEL, trace carbonaceous; grey & dark grey. Very dense, moist, well graded; Gravel, medium to coarse, angular sandstone; Sand, fine to coarse.

24.75 - 25.53m: Recovered as: Sandy GRAVEL, trace carbonaceous; grey & dark grey. Very dense, moist, well graded; Gravel, medium to coarse, angular sandstone; Sand, fine to coarse.

Rock Weathering: UW SW MW HW CW DW
Rock Strength: ES VS S MS W VW EW
Sampling Method: HQTT
Core Recovery (%): 100 | 83 | 73 | 113
Testing
RL (m) / Depth (m): 25 (20.5) 24 (21.5) 23 (22.5) 22 (23.5) 21 (24.5)
Graphic Log

ROCK DEFECTS

Defect Log
Fracture Spacing (mm): 2000 600 200 60 20
RQD (%): 0 | 46 | 30 | 0 | 16

Description & Additional Observations

19.94m: J, 26° PL, SM, VN, CN
20.32 - 20.75m: BZ
21.05m: BF, 52° PL, SM, VN, CN
21.35m: BF, 48° PL, SM, VN, CN
21.53 - 21.63m: BZ
21.95m: J, 45° T
23.11m: J, 25° PL, SM, VN, CN
23.30m: BF, 22° PL, SM, VN, CN
23.33m: BF, 52° PL, SM, VN, CN
23.47m: J, 5° PL, SM, VN, CN
23.50 - 24.32m: BZ
23.56m: J, 55° PL, SM, VN, CN
24.12m: J, 50° PL, SM, VN, CN
24.21 - 24.32m: BZ
24.30 - 24.40m: J, 70° UN, SM, VN, CN
24.42 - 24.52m: BZ
24.75 - 25.30m: BZ

Fluid Loss (%): 25 50 75
Water Level
Casing
Installation: Box 7, 20.10-23.65m
Core Box No

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 6 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac	CO-ORDINATES: 5925572.95 mN (NZTM2000) 1744601.80 mE	R.L. GROUND: 45.50m
JOB No.: 1015174.0000.04		R.L. COLLAR:
LOCATION: Trig Road - SH18	DIRECTION:	DATUM: NZVD2016
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.25 - 28.50m:* Laminated to thinly interbedded. Very weak			HQTT	103		20	25.5				16						
	25.70m: Turbity flow fabric			HQTT	113		19	26.0				86	25.89m: J, 22° PL, RO, VN, CN					Box 8, 23.65-26.30m
				HQTT	113			26.5				62	26.40m: J, 60° PL, SM, VN, CN 26.46m: J, 18° PL, SM, VN, CN 26.56m: J, 60° PL, RO, VN, CN 26.64m: J, 45 - 50° PL, SM, VN, CN 26.69m: J, 50° PL, SM, VN, CN 26.73m: J, 40° PL, RO, VN, CN					
				HQTT	104		18	27.0				16	27.20 - 27.38m: J, drilling induced discing 27.25m: J, 20° PL, RO, VN, light brown veneer 27.38m: J, 38° PL, SM, VN, CN 27.45m: J, 40° PL, SM, VN, CN 27.53m: J, 25° PL, SM, VN, CN 27.56m: J, 25° PL, RO, VN, CN 27.75m: J, 65° PL, SM, VN, CN					
	28.20m: minor organics, carbonaceous.			HQTT	100		17	28.0				97	28.15m: J, 0 - 20° T 28.29m: J, 32° PL, RO, VN, CN					
	28.50m: CORE LOSS							28.5					28.50m: J, 28° PL, SM, VN, CN					
	28.60m: Unweathered, grey, coarse, SANDSTONE. Very weak - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very weak			HQTT	90		16	29.0				33	28.60 - 28.80m: BZ 28.99m: J, 28° PL, SM, VN, CN 29.10 - 29.24m: BZ 29.13m: J, 58° PL, SM, VN, CN 29.34 - 29.42m: BZ 29.36m: J, 60° PL, SM, VN, CN 29.46m: J, 60° PL, SM, VN, CN 29.52 - 29.72m: J, 60 - 90° UN, SM, VN, CN 29.69 - 29.75m: J, 45 - 58° PL, SM, VN, CN					Box 9, 26.30-29.10m
								29.5										

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 7 OF 12

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* [CONT] Unweathered, grey, coarse, SANDSTONE. Very weak - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Very weak	UW SW MW HW CW DW	FS VS S MS W VW EW	HQTT	95		15 / 30.5				18	30.00m: J, 25° PL, SM, VN, CN 30.07m: J, 4° PL, SM, VN, CN 30.20m: J, 40° PL, SM, VN, CN 30.20 - 30.33m: BZ 30.38m: J, 12° PL, SM, VN, CN 30.38 - 30.45m: BZ 30.45m: J, 35° PL, SM, VN, CN 30.50 - 30.59m: BZ 30.56m: J, 42° PL, SM, VN, CN 30.65 - 30.73m: BZ 30.73m: J, 23° PL, SM, VN, CN 30.78 - 30.95m: BZ	25 50 75				
							14 / 31.0					31.29m: B 31.38m: J, 50° UN, SM, VN, CN 31.45m: J, 32° PL, SM, VN, CN 31.50 - 31.55m: BZ 31.61m: J, 30° T 31.71 - 31.80m: J, 19° PL, SL, CN 31.75 - 31.85m: J, 20° UN, RO, VN, CN 31.80 - 31.88m: BZ					
				HQTT	100		13 / 32.0				0	31.95 - 32.08m: J, 30 - 90° UN, RO, VN, CN 32.06m: BZ 32.07m: J, 42° PL, RO, VN, CN 32.15m: J, 50° UN, RO, VN, CN 32.24 - 32.28m: BZ 32.36m: J, 28° T 32.50 - 32.65m: BZ 32.65 - 33.00m: J, 78 - 90° ST, RO, VN, CN					Box 10, 29.10-32.10m
				HQTT	100		12 / 33.0				32	33.25 - 33.30m: J, 0 - 5° UN, RO, VN 33.50 - 33.80m: J, 0 - 5° UN, RO, VN 33.80 - 33.85m: J, 60° UN, RO, VN 33.90m: DD 33.90 - 34.25m: J, 0 - 5° UN, RO, VN					
	34.50m: Unweathered, grey, coarse, SANDSTONE. Weak, bedded, moderately inclined. - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Weak, bedded, moderately inclined, laminated.						11 / 34.0				51	34.35 - 34.45m: BZ, Crush zone 34.48m: J, 15° dip, UN-R, VN 34.50m: DD 34.53m: J, 15° dip, UN-R, VN 34.73m: J, 0-10° dip, UN-R, VN, S=3-4 cm					Box 11, 32.10-35.00m

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 8 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*35.00m:* [CONT] Unweathered, grey, coarse SANDSTONE. Weak, bedded, moderately inclined. - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Weak, bedded, moderately inclined, laminated.	UW SW MW HW CW DW	ES VS S MS W VW EW	HQTT	100		35.5			2000 600 200 60 20	51	35.03m: J, 45° dip, PL-R, VN 35.13 - 35.17m: J, 20° dip, x2, UN-R, VN 35.33m: J, 20° dip, UN-R, VN 35.43m: J, 15° dip, UN-R, VN 35.55m: J, 15° dip, UN-R, VN 35.65m: J, 15° dip, UN-R, VN	25 50 75				Box 12, 35.00-37.80m
							36.0					35.90m: DD 36.00m: DD 36.00 - 36.18m: J, 90° dip, PL-SM, VN					
				HQTT	100		36.5				17	36.18 - 36.48m: BZ, Broken zone 36.48 - 36.55m: J, 0° dip, PL-R, VN 36.70m: J, 0° dip, x2, PL-SM, VN, S=5cm 36.80 - 36.98m: J, 0° dip, x8, UN-R, VN, S=3-4cm						
							37.0					37.13 - 37.20m: J, 0° dip, x2, UN-R, VN, S=4cm 37.20 - 37.25m: BZ, Crush zone 37.31 - 37.35m: J, 0° dip, x2, UN-R, VN, S=2cm 37.40 - 37.50m: BZ, Crush zone 37.50m: J, 70° dip, UN-R, VN 37.65m: J, 30° dip, UN-R, VN 37.70 - 37.80m: DD 37.87m: J, 45° dip, UN-R, VN						
				HQTT	100		37.5										
							38.0				6	37.95 - 38.45m: J, 0-10° dip, UN-R, VN, spacing 3-7cm					
							38.5					38.52m: J, 0° dip, PL-R, VN 38.62m: J, 0° dip, PL-R, VN 38.69m: BZ, Crush/broken zone 38.82m: J, 0° dip, x2, UN-R, VN, spacing=2cm						
							39.0					39.00m: DD 39.20m: J, 0° dip, UN-R, VN 39.34m: BZ, Crush/broken zone					
				HQTT	100		39.5				30	39.42m: J, 5° dip, PL-R, VN 39.47m: J, 0° dip, PL-R, VN 39.53m: DD 39.90m: BZ, Crush/broken zone					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 9 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*40.00m:* Unweathered, grey, coarse, SANDSTONE. Weak, bedded, moderately inclined. - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Weak, bedded, moderately inclined, laminated.	UW SW MW HW CW DW	XS VS S MS W VW EW	HQTT	100		40.5				100	40.00m: DD 40.10m: J, 50° dip, PL-R, VN	25 50 75				Box 13, 37.80-40.50m
				HQTT	100		41.0				62	40.67m: J, 15° dip, UN-R, VN 41.00m: DD 41.16m: J, 5° dip, UN-R, VN 41.56m: DD 41.75m: J, 25° dip, UN-R, VN 41.80m: J, 5° dip, UN-R, VN 41.88m: J, 0° dip, UN-R, VN					
				HQTT	100		42.0				16	42.00m: J, 45° dip, UN-R, VN 42.10m: J, 20° dip, UN-R, VN 42.13m: J, 20° dip, UN-R, VN 42.21m: J, 0° dip, UN-R, VN 42.25m: J, 0° dip, UN-R, VN 42.32m: J, 0° dip, UN-R, VN 42.47 - 42.67m: J, 0-30° dip, x6, PL-R, VN 42.75m: DD 42.85 - 43.00m: BZ, Broken zone 43.00m: J, 45° dip, UN-R, VN					Box 14, 40.50-43.20m
				HQTT	100		43.5				70	43.12 - 43.20m: BZ, Broken zone 43.20m: J, 30° dip, UN-R, VN 43.28m: J, 35° dip, UN-R, VN 43.50m: J, 25° dip, UN-R, VN 43.65m: J, 55° dip, PL-R, VN 43.90m: DD 44.10m: J, 45° dip, PL-R, VN 44.20 - 44.28m: BZ, Broken zone 44.28m: J, 25° dip, UN-R, VN 44.58m: J, 35° dip, UN-R, VN 44.74m: J, 5° dip, UN-R, VN 44.94m: J, 40° dip, UN-R, VN					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log _ - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 10 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*45.00m:* Unweathered, grey, coarse, SANDSTONE. Weak, bedded, moderately inclined. - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Weak, bedded, moderately inclined, laminated.	UW SW MW HW CW DW	FS VS S MS W VW EW	HQTT	87		0 / 45.5			2000 600 200 60 20	42	45.00m: DD 45.08m: J, 5° dip, UN-R, VN 45.11m: J, 0° dip, UN-R, VN 45.20m: J, 30° dip, UN-R, VN 45.60m: J, 65° dip, UN-R, VN 45.75 - 46.00m: J, 25-30° dip, x4, UN-R, VN	25 50 75				Box 15, 43.20-46.00m
				HQTT	100		-1 / 46.0				32	46.18m: J, 20° dip, PL-R, VN 46.22 - 46.50m: BZ, Broken zone 46.60m: J, 15° dip, x2, PL-R, VN 46.70m: DD 46.85m: J, 15° dip, x2, PL-R, VN 46.93 - 46.99m: BZ, Broken zone 47.24m: J, 40° dip, UN-R, VN 47.43 - 47.55m: BZ, Broken zone 47.60m: J, 40° dip, UN-R, VN 47.72m: BZ, Broken zone					
				HQTT	100		-2 / 47.5 -3 / 48.0 -4 / 48.5 -5 / 49.0				63	48.12m: J, 7° dip, UN-R, VN 48.19 - 48.23m: J, 0° dip, x2, PL-SM, VN 48.29 - 48.39m: J, 90° dip, UN-R, VN 48.46 - 48.50m: BZ, Broken zone 48.75 - 48.80m: BZ, Broken zone 48.90 - 48.94m: BZ, Broken zone 49.05m: J, 0° dip, UN-R, VN 49.20m: J, 0° dip, UN-R, VN					Box 16, 46.00-48.90m
				HQTT	100		-6 / 49.5				50	49.80m: DD					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 11 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*50.00m:* Unweathered, grey, coarse, SANDSTONE. Weak, bedded, moderately inclined. - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Weak, bedded, moderately inclined, laminated. *50.20 - 50.35m:* some organics. Grey with dark brown inclusions; organics, carbonaceous	UW SW MW HW CW DW	ES VS S MS W VW EW	HQTT	100		-5 / 50.5				52	50.00m: DD 50.10 - 50.54m: J, 0-10° dip, x7, UN-R, VN 50.79m: J, 0° dip, PL-SM, VN					
				HQTT	100		-6 / 51.0				100	50.97m: J, 0° dip, PL-R, VN 51.10m: DD					Box 17, 48.90-51.40m
				HQTT	100		-7 / 51.5				60	51.30m: DD 51.40m: DD 52.00 - 52.10m: BZ, Broken zone 52.10 - 52.25m: J, 75° dip, UN-SM, VN					
				HQTT	100		-8 / 52.5				74	52.30m: DD 52.33 - 52.37m: J, 0° dip, x2, UN-R, VN 52.44m: DD 52.46m: J, 5° dip, UN-R, VN 52.63m: J, 0° dip, PL-SM, VN 52.79m: J, 0° dip, PL-SM, VN					
				HQTT	100		-9 / 53.5				52	53.00m: DD 53.10 - 53.15m: BZ, Broken zone 53.27 - 53.56m: J, 0° dip, x9, UN-R, VN 53.70m: J, 0° dip, PL-SM, VN 53.85m: J, 0° dip, x2, PL-R, VN					Box 18, 51.40-54.00m
							54.0					54.00m: DD 54.14 - 54.29m: BZ, Broken zone, 65 mm offset					
							54.5				94	54.50m: J, 0° dip, PL-R, VN 54.66m: J, 3° dip, PL-R, VN 54.86m: J, 0° dip, UN-R, VN					

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH204

SHEET: 12 OF 12

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925572.95 mN, 1744601.80 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 45.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 22/02/2021
FINISH DATE: 25/02/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*55.00m:* [CONT] Unweathered, grey, coarse, SANDSTONE. Weak, bedded, moderately inclined. - INTERBEDDED WITH - Unweathered, dark grey, SILTSTONE. Weak, bedded, moderately inclined, laminated.	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	100		-10			2000 600 200 60 20	94	55.00m: DD	25 50 75				Box 19, 54.00-55.40m
	55.4m: END OF BOREHOLE						-11 -12 -13 -14 / 55.5 56.0 56.5 57.0 57.5 58.0 58.5 59.0 59.5										

COMMENTS: Shear vane readings have been undertaken in soils exposed at the end of the core barrel following the completion of a core run. All shear vane readings have been corrected to kPa.

Hole Depth 55.4m

Scale 1:25

Rev.: A

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
R.L.:	45.50m	DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-3.00m

3.00-6.45m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

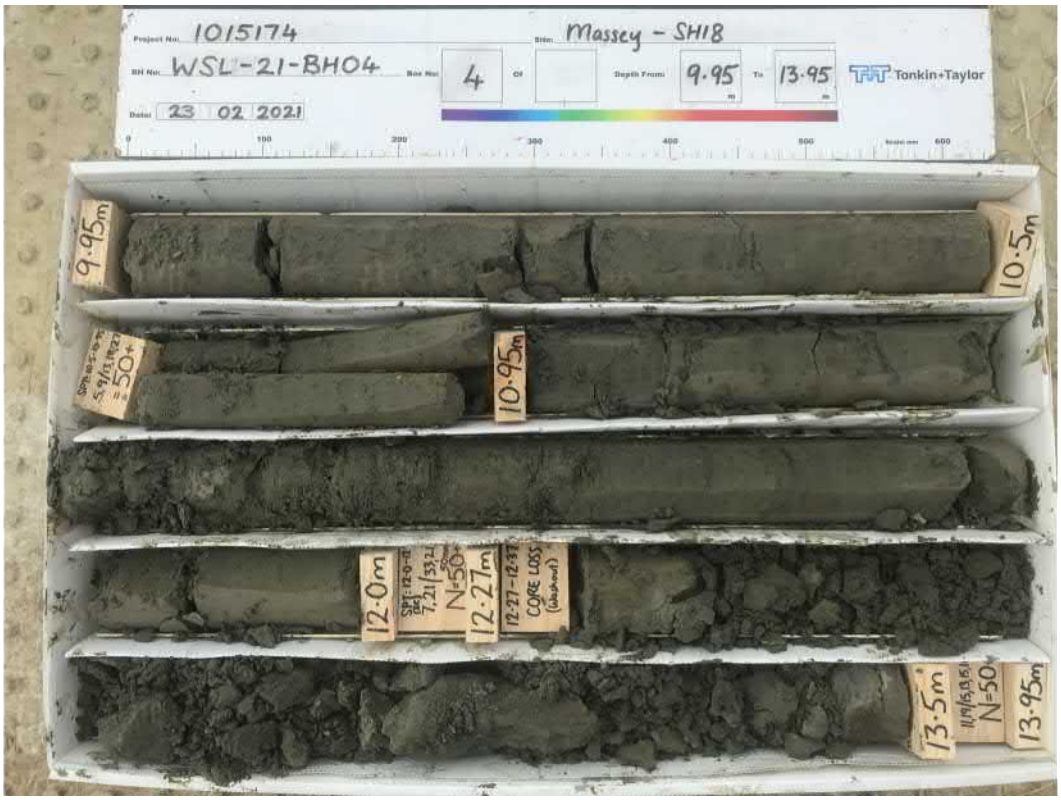
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W	LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000) 5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
R.L.: 45.50m	DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
DATUM: NZVD2016		DRILLED BY: McMillan Drilling
		LOGGED BY: ROM CHECKED: TRMC

6.45-9.95m



9.95-13.95m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
		DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
R.L.:	45.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

13.95-17.10m

17.10-20.10m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

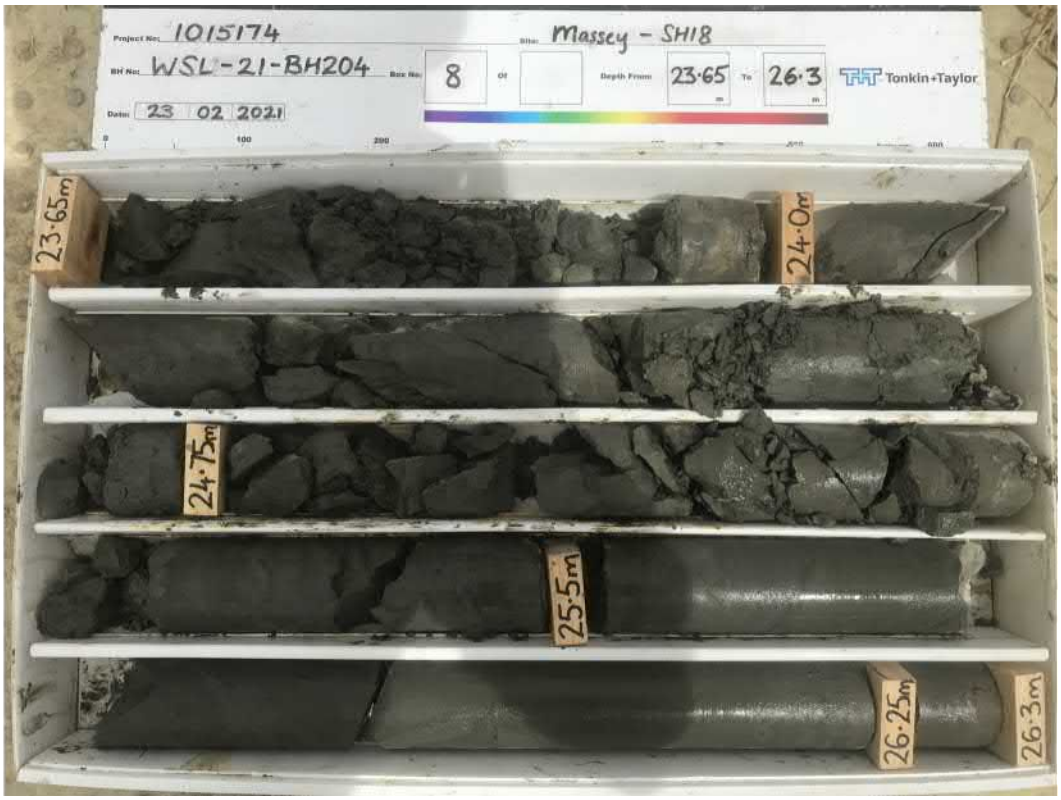
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
R.L.:	45.50m	DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

20.10-23.65m



23.65-26.30m

General Log -- 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
		DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
R.L.:	45.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

26.30-29.10m

29.10-32.10m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
R.L.:	45.50m	DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

32.10-35.00m

35.00-37.80m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
		DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
R.L.:	45.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

37.80-40.50m

40.50-43.20m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
		DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
R.L.:	45.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

43.20-46.00m

46.00-48.90m

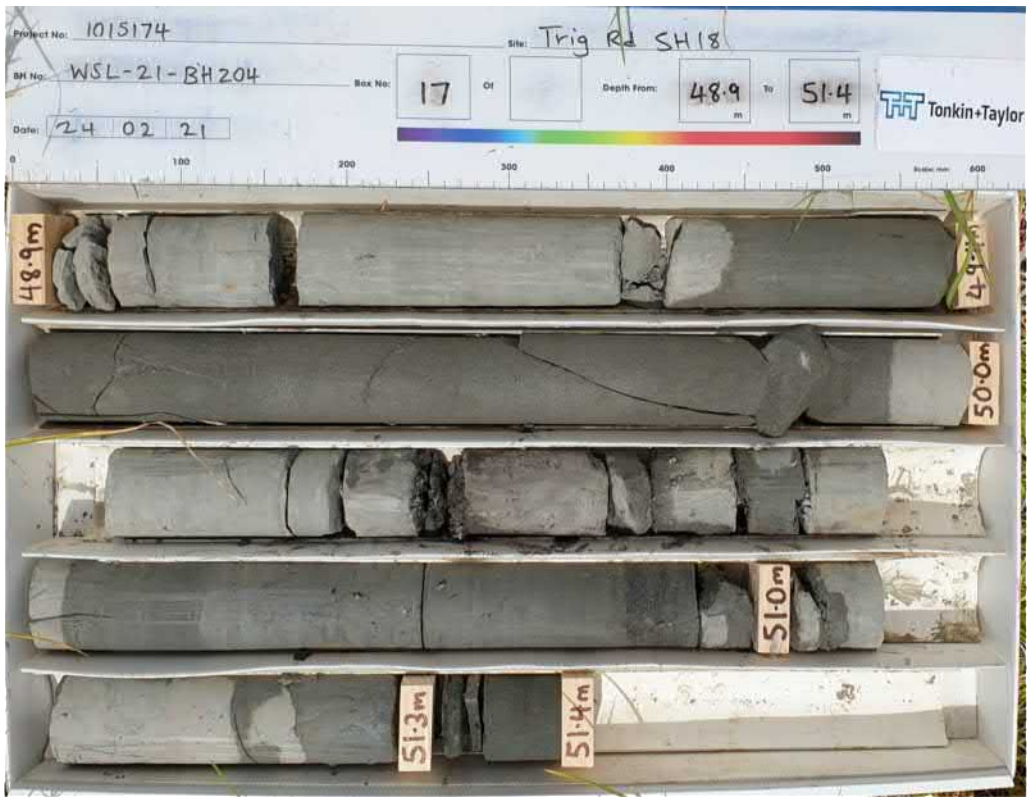
General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

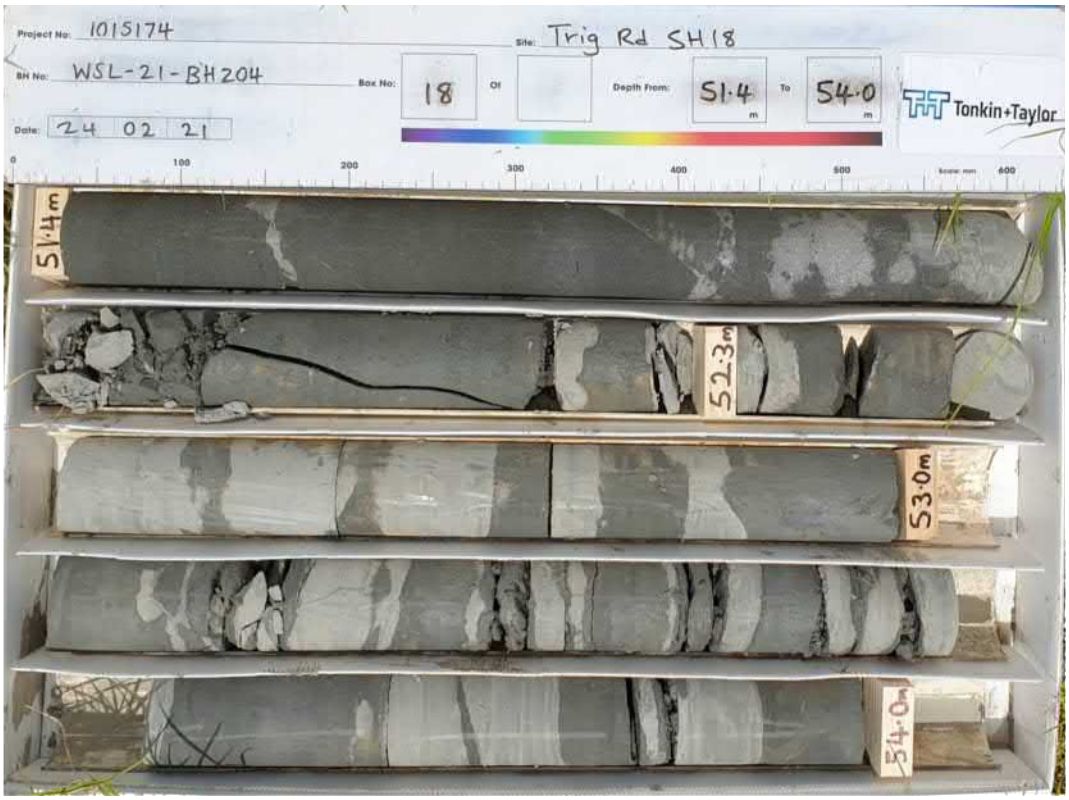
BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925572.95 mN 1744601.80 mE	DRILL TYPE:	HOLE STARTED: 22/02/2021
R.L.:	45.50m	DRILL METHOD: RC	HOLE FINISHED: 25/02/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC



48.90-51.40m



51.40-54.00m

General Log - 6/07/2021 9:14:31 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH204**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W	LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: 5925572.95 mN (NZTM2000) 1744601.80 mE R.L.: 45.50m DATUM: NZVD2016	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 22/02/2021 HOLE FINISHED: 25/02/2021 DRILLED BY: McMillan Drilling LOGGED BY: ROM CHECKED: TRMC

54.00-55.40m

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH205

SHEET: 1 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: (NZTM2000) 5925506.30 mN 1744809.45 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Top	*0.00m:* Sandy SILT, minor organics, trace clay; dark brown. Firm, moist, low plasticity; sand, fine; Organics, rootlets; [TOPSOIL].								TS				*0.00 - 6.50m:* Drilled dry					
Tauranga Group	*0.25m:* Sandy SILT, trace organics and clay; brown, trace black speckles. Stiff, moist, low plasticity; sand, fine; Organics, rootlets & carbonaceous. *0.45 - 0.65m:* brown mottled orange						38	0.5										
	0.65m: Sandy SILT, minor clay, trace limonite staining; light brown mottled orange spotted red-orange. Very stiff, moist, medium plasticity; sand, fine.			HQ3	107													
	0.90m: Sandy SILT, minor clay, trace organics; light brown-grey mottled orange. Very stiff, moist, medium plasticity; Organics, rootlets & carbonaceous.							1.0										
	1.20m: Sandy SILT, minor clay; light grey & light brown mottled orange, spotted red-orange. Hard, moist, medium plasticity; sand, fine. *1.45m:* trace clay; light brown mottled brown & orange, speckled white (pumiceous)			SPTS	89	>200 kPa 1/3 3/4 3/4 **N=14**	37	1.5					*1.45 - 9.30m:* No apparent high sensitivity recognized during tactile assessment of pumiceous tauranga group soils *1.50m:* Extended nozzle equipped					
	1.90m: minor clay, very stiff							2.0										
	2.30m: trace black speckles *2.40m:* Stiff			HQ3	93		36	2.5										
				SPTS	113	74/25 kPa 0/1 1/1 2/2 **N=6**		3.0										Box 1, 0.00-3.00m
	3.45m: Core Loss (compression) *3.55 - 3.70m:* Firm (potentially drilling induced)						35	3.5					*3.45 - 3.60m:* Apparent core loss due to core compression					
	3.60m: Sandy SILT, minor clay; light brown mottled orange, spotted red-orange, speckled black. Stiff, moist, medium plasticity; sand, fine. *3.83 - 3.88m:* Firm (potentially drilling induced)			HQ3	86			4.0										
	4.40m: Trace clay			SPTS	111	57/33 kPa 0/1 0/1 2/1 **N=4**	34	4.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:22 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 2 OF 9

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925506.30 mN, 1744809.45 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW DW)	Rock Strength (ES VS S MS M W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000 600 200 60 20)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* [Cont.] Core Loss (compression)												*4.95 - 5.15m:* Apparent core loss due to core compression					
	5.15m: Sandy SILT, minor clay; light brown mottled orange, speckled black. Stiff, moist, medium plasticity; sand, fine. *5.50m:* Minor clay						33	5.5										
	6.00m: Push Tube sample			PT	0	54/20 kPa Push Tube @ 6.00m		6.0										
	6.50m: Core Loss (washout)						32	6.5					*6.50m:* Water use commenced during drilling					Box 2, 3.00-6.50m
	6.75m: Sandy SILT, minor clay, trace organics; light brown speckled black. Stiff, moist, medium plasticity; sand, fine to medium; organics, rootlets (decomposed).			HQ3	75			7.0										
	7.75 - 7.95m: Trace clay			SPTS	122	54/27 kPa 0/1 1/1 1/1 **N=4**	31	7.5							02/03/2021			
	8.05m: Light brown mottled orange speckled black			HQ3	100			8.0					*7.95m:* Driller instructed to drill half core runs due to core loss					
				HQ3	100		30	8.5										
East Coast Bays Formation	*9.30m:* Sandy SILT, trace clay; light brown mottled orange speckled grey & black, blocky. Firm to stiff, moist, low plasticity; sand, fine to coarse; (Residual Soil ECBF).			SPTS	102	45/19 kPa 1/0 1/2 1/2 **N=5**		9.0							03/03/2021			Box 3, 6.50-9.45m
	9.75m: Grades: grey mottled orange speckled grey & black			HQ3	117		29	9.5										
	9.90m: Sandy SILT, trace clay; light brown mottled orange																	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 3 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac	CO-ORDINATES: 5925506.30 mN (NZTM2000) 1744809.45 mE	R.L. GROUND: 38.50m
JOB No.: 1015174.0000.04	DIRECTION:	R.L. COLLAR:
LOCATION: Trig Road - SH18	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* Sandy SILT, trace clay and gravel; grey. Firm to stiff, moist, low plasticity; sand, fine to coarse; gravel, fine, rounded, Siltstone; (Residual Soil ECBF).			HQ3	200													
	10.50m: Silty SAND; grey. Loose, moist, poorly graded; sand, fine; (Residual Soil ECBF).			SPTS	100	54/16 kPa 1/2 2/2 2/3 **N=9**	28	10.5										
	10.95m: Completely weathered, grey, SANDSTONE & SILTSTONE. Extremely Weak recovered as Sandy SILT, trace clay and gravel; grey. Firm to stiff; sand, fine to coarse; gravel, fine, rounded, siltstone.			HQ3	117			11.0										
				HQ3	100		27	11.5										Box 4, 9.45-11.80m
	12.30m: Completely weathered grey SANDSTONE, extremely weak recovered as Silty SAND, trace gravel; grey. Loose, moist, poorly graded; sand, fine to coarse; gravel, fine, rounded, siltstone.			SPTS	100	UTP 1/1 1/2 3/3 **N=9**		12.0										
	12.50m: Completely weathered grey SANDSTONE, extremely weak recovered as SAND, trace gravel; grey. Loose, moist, poorly graded; sand, fine to coarse; gravel, fine, rounded, siltstone.						26	12.5										
	12.65m: Highly to completely weathered grey SANDSTONE, extremely weak recovered as Silty SAND, trace gravel; grey. Loose to moderately dense, moist, poorly graded; sand, fine to coarse; gravel, fine, rounded, siltstone.			HQ3	100			13.0										
	13.55m: Highly weathered grey SANDSTONE & SILTSTONE, extremely weak recovered as Sandy SILT, trace gravel; grey. Firm, moist, poorly graded; sand, fine to coarse; gravel, fine, rounded, siltstone.			SPTS	100	UTP 1/1 2/1 3/2 **N=8**	25	13.5										
	14.10 - 14.15m: SILT, some clay; grey. Stiff, moist, medium plasticity.							14.0										
	14.15m: Highly weathered grey SANDSTONE, extremely weak, recovered as Silty SAND; grey. Loose, moist, poorly graded, low plasticity; sand, fine to coarse.			HQ3	93		24	14.5										Box 5, 11.80-15.00m

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 4 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925506.30 mN, 1744809.45 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.05m:* Highly weathered grey SANDSTONE & SILTSTONE, extremely weak, recovered as Sandy SILT; grey. Firm, moist, low plasticity; sand, fine to medium.			SPTS	129	1/1 2/1 3/2 **N=8**	23	15.5										
	15.45m: Core Loss (Washout)																	
	15.55m: Highly weathered grey SANDSTONE & SILTSTONE, extremely weak, recovered as Sandy SILT; grey. Firm, moist, low plasticity; sand, fine to medium.																	
	15.70m: Moderately to highly weathered grey SANDSTONE, extremely weak, recovered as Silty SAND; grey. Firm, moist, poorly graded; sand, fine.			HQ3	90			16.0										
	16.10 - 16.17m: Carbonaceous laminations												16.40m: DD					
				SPTS	116	1/2 2/3 3/4 **N=12**	22	16.5										
	17.10m: Sand, fine to coarse							17.0										
	17.55 - 17.58m: SILT, some clay; grey. Stiff, moist, medium plasticity. *17.58m:* Sand, fine			HQ3	100		21	17.5										
				SPTS	133	1/2 3/2 3/3 **N=11**		18.0										
	18.50m: Moderately weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, some silt; grey. Medium dense, moist, poorly graded; sand, fine.			HQ3	100		20	18.5										
								19.0										
				SPTS	107	2/3 3/5 6/7 **N=21**	19	19.5										
																	Box 6, 15.00-18.00m	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 5 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac	CO-ORDINATES: 5925506.30 mN (NZTM2000) 1744809.45 mE	R.L. GROUND: 38.50m
JOB No.: 1015174.0000.04	DIRECTION:	R.L. COLLAR:
LOCATION: Trig Road - SH18	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.55m:* Sand, fine to coarse *20.75 - 20.76m:* Silty CLAY; grey. Very stiff, moist, high plasticity. *20.76 - 20.81m:* Clayey sandy SILT; green-grey. Very stiff, moist, high plasticity; sand, fine to coarse.			SPTS	107	2/4 5/6 8/10 **N=29**	18	20.5										Box 7, 18.00-21.00m
	21.50m: Moderately weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, some silt, trace gravel; grey trace spotted green. Dense, moist, poorly graded; sand, fine to coarse; gravel, fine.							21.0										
	21.65m: Slightly weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, minor silt; grey. Dense, moist; sand, fine.			HQ3	100		17	21.5				65						
	22.50m: Solid Cone SPT (No recovery)			SPTC	0	5/9 10/11 11/13 **N=45** Solid	16	22.0										
	22.95m: Slightly weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, minor silt; grey. Dense, moist; sand, fine.			HQ3	90		15	22.5				31						
	23.40m: Moderately weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, some silt; grey. Dense, moist, poorly graded; sand, fine to coarse.							23.0										
	23.57m: Core Loss (washout)							23.5										
	23.67m: Unweathered, grey, SANDSTONE. Extremely Weak. SAND, minor silt; grey. Very dense, moist, poorly graded; sand, fine to medium.							24.0										
	24.00m: Solid Cone SPT (No recovery)			SPTC	0	9/15 16/17 17 for 75mm **N>=50** Solid	14	24.5				93	24.55m: J, 45° dip, PL, SM, VN, CV 24.90m: J, 48° dip, x2, PL, SM, VN, CV, conjugate					Box 8, 21.00-24.90m
	24.38m: Unweathered, grey, SANDSTONE. Very Weak. SAND, minor silt; grey. Very dense, moist, poorly graded; sand, fine to medium.																	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 6 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: (NZTM2000) 5925506.30 mN 1744809.45 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation				HQ3	94							93						
	25.50m: Solid Cone SPT (No recovery)			SPTC	0	8/13 17/18 15 for 60mm **N>=50** Solid	13	25.5										
	25.86m: Core Loss (Washout)							26.0										
	26.07m: Unweathered, grey, coarse, SANDSTONE. Very Weak.			HQ3	82		12	26.5				81						
	26.72m: Unweathered, grey, massive, SANDSTONE. Very Weak, Sand, fine to medium.												26.70m: DD					
	27.00m: Solid Cone SPT (No recovery)			SPTC	0	9/24 35/15 for 35mm **N>=50** Solid		27.0										
	27.26m: Unweathered, grey, massive, SANDSTONE. Very Weak, Sandstone, fine to medium.			HQ3	100		11	27.5				100	27.85 - 27.99m: J, 72° dip, PL, SM, VN, CN					
								28.0										
				HQ3	100		10	28.5				100	29.05 - 29.12m: J, 45° dip, PL, R, VN, CN					
								29.0										
							9	29.5					29.60 - 29.70m: J, 60° dip, UN, SM, VN, CN					
																	Box 9, 24.90-28.45m	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 7 OF 9

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925506.30 mN, 1744809.45 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* [CONT] Unweathered, grey, massive, SANDSTONE. Very Weak, Sandstone, fine to medium.			HQ3	100		8	30.5				98	30.83m: J, 27° dip, PL, SM, VN, CN, x2 conjugate					
	31.22 - 31.24m: Sandstone, extremely weak (SAND, grey. Very dense, moist, poorly graded; Sand, fine to coarse) *31.32 - 31.34m:* Sandstone, extremely weak (SAND, grey. Very dense, moist, poorly graded; Sand, fine to coarse)							31.0					*31.22 - 31.24m:* Rock crumbles under firm thumb pressure *31.32 - 31.34m:* Rock crumbles under firm thumb pressure					Box 10, 28.45-31.45m
				HQ3	100		7	31.5				100						
								32.0										
							6	32.5										
				HQ3	100			33.0				100	33.68m: J, 25° dip, PL, SM, VN, light brown veneer 33.81m: DD 33.82m: DD 33.99m: DD 34.02m: DD 34.11m: DD					Box 11, 31.45-34.40m
							5	33.5										
								34.0										
	34.50m: Unweathered, grey, massive, SANDSTONE. Very weak to weak; Sandstone, fine to coarse.						4	34.5				88	34.63m: J, 29° dip, T 34.69m: J, 25° dip, PL, R, VN, light brown veneer 34.83m: J, 18° dip, T 34.84m: DD					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 8 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925506.30 mN (NZTM2000) 1744809.45 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*35.00m:* [CONT] Unweathered, grey, massive, SANDSTONE. Very weak to weak; Sandstone, fine to coarse. *35.20 - 36.80m:* Sandstone, conglomeratic	UW SW MW HW CW	EW VW W MS VS ES	HQ3	97		3	35.5			2000 600 200 60 20	88	35.11 - 35.56m: J, 90-72°, UN, R, VN, CN 35.16m: DD 35.22m: DD 35.31m: DD 35.41 - 35.47m: DD	25 50 75				
				HQ3	100		2	36.0 36.5				79	36.40m: DD 36.46m: DD 36.55m: DD 36.66m: DD					
	36.80m: Unweathered, grey, massive, SANDSTONE. Extremely Weak. SAND; grey. Very dense, moist, poorly graded; sand, fine to medium.						1	37.0 37.5					36.82m: DD 36.87m: DD 36.94 - 37.11m: BZ, Broken zone 37.22 - 37.31m: BZ, Broken zone 37.36m: DD 37.41m: DD 37.45m: J, 25° dip, T, light brown veneer 37.49m: DD					Box 12, 34.40-37.25m
				HQ3	93		0	38.0 38.5				93	37.82m: BF, 15° dip, ST, SM, CN 38.21m: DD 38.54m: DD 38.73m: DD					
							-1	39.0 39.5				106	39.42m: J, 11° dip, PL, SM, VN, CN					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH205

SHEET: 9 OF 9

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: (NZTM2000) 5925506.30 mN 1744809.45 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 38.50m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray / Craig
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 01/03/2021
FINISH DATE: 03/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*40.05m:* Unweathered, grey, massive, SANDSTONE. Very weak to weak; Sandstone, conglomeratic.			HQ3	107		-2	40.5				106	40.14m: J, 36° dip, PL, SM, VN, CN 40.40m: DD					
	41.52 - 41.59m: Sandstone, extremely weak (SAND minor gravel, grey. Very dense, moist, poorly graded; Sand, fine to coarse; gravel, fine, subrounded siltstone) *41.60 - 42.25m:* Sandstone, fine to coarse			HQ3	103		-3	41.0 41.5				76	41.28 - 41.30m: BZ, 2x Joints 30° dip, ST, SM 41.38 - 41.46m: J, 60° dip, PL, SM, VN, light brown infill 41.45m: J, 22° dip, T 41.49m: J, x2, conjugate 41.51m: DD 41.52 - 41.59m: BZ, Broken zone 41.59 - 41.63m: J, 38° dip, T, light brown infill 41.71m: J, 18° dip, T, light brown veneer					
	42.25 - 42.50m: Sandstone, conglomeratic *42.50 - 45.00m:* Sandstone, fine to coarse			HQ3	87		-4	42.0 42.5				52	41.79m: J, 5° dip, PL, SM, VN 41.86m: J, 45° dip, UN, SM, VN, CN 41.89m: J, 35° dip, UN, SM, VN, CN 42.03m: J, 55° dip, T 42.06m: J, 5-22° dip, PL, SM, VN, CN 42.13m: J, 45° dip, PL, SM, VN, CN 42.17m: BZ, Broken zone 42.26m: J, 28° dip, T, light brown infill (2mm) 42.36m: J, 20° dip, T, light brown infill (2mm) 42.40m: J, 58° dip, PL, R, VN, CN 42.47m: J, 40° dip, PL, SM, VN, CN					Box 14, 40.15-42.95m
				HQ3	100		-5	43.0 43.5				100	43.65m: J, 45° dip, T, light brown veneer 44.13 - 42.22m: J, 70° dip, UN, SM, VN, CN 44.36m: J, 50° dip, PL, SM, VN, CN *44.65 - 44.95m:* Annealled microfractures ECS with 10mm offsets					Box 15, 42.95-45.00m
	45m: END OF BOREHOLE						-6	44.0 44.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 45m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
R.L.:	38.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

0.00-3.00m

3.00-6.50m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
R.L.:	38.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

6.50-9.45m

9.45-11.80m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

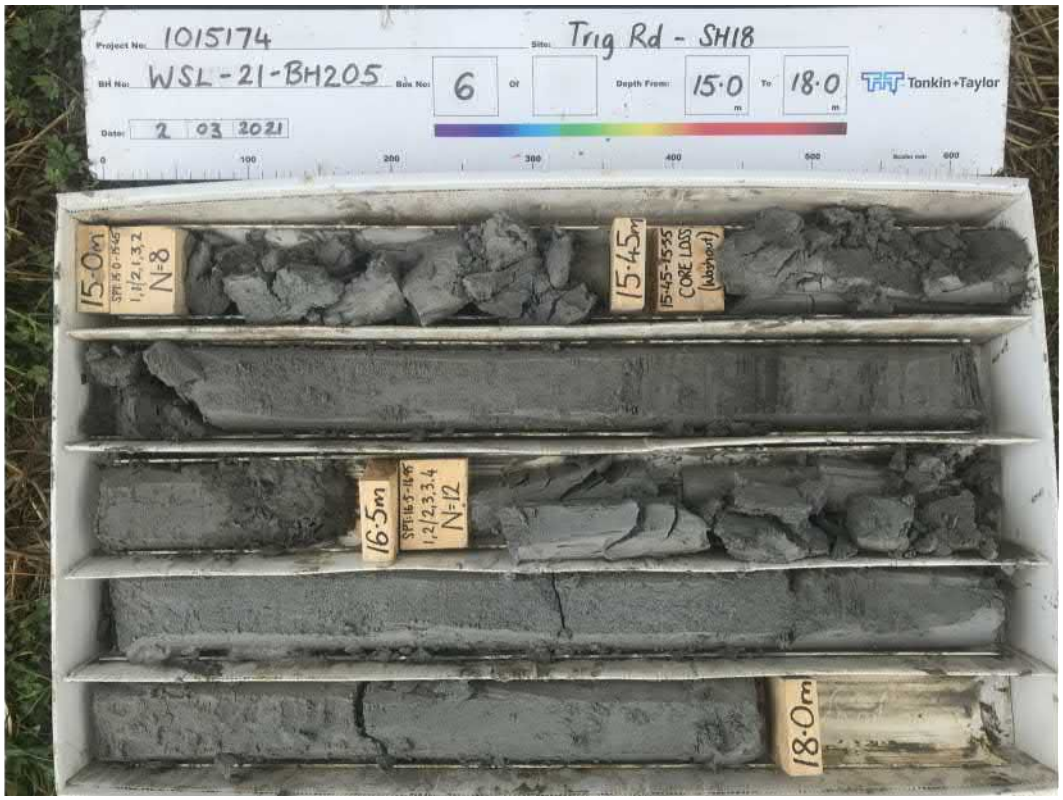
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
R.L.:	38.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

11.80-15.00m



15.00-18.00m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
R.L.:	38.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

18.00-21.00m

21.00-24.90m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
R.L.:	38.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

24.90-28.45m

28.45-31.45m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
R.L.:	38.50m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: TRMC

31.45-34.40m

34.40-37.25m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W	LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: 5925506.30 mN (NZTM2000) 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
R.L.: 38.50m	DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
DATUM: NZVD2016		DRILLED BY: McMillan Drilling
		LOGGED BY: ROM CHECKED: TRMC

37.25-40.15m

40.15-42.95m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH205**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925506.30 mN 1744809.45 mE	DRILL TYPE:	HOLE STARTED: 01/03/2021
R.L.:	38.50m	DRILL METHOD: RC	HOLE FINISHED: 03/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

42.95-45.00m

General Log - 6/07/2021 10:02:23 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH206

SHEET: 1 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Contrac	CO-ORDINATES: 5925453.20 mN (NZTM2000) 1744981.30 mE	R.L. GROUND: 32.10m
JOB No.: 1015174.0000.04	DIRECTION:	R.L. COLLAR:
LOCATION: Trig Road - SH18	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics; brown. Very stiff, moist, low plasticity; sand, fine; organics, rootlets; [TOPSOIL].			HAND AUGER	100		32	0	TS									
	0.10m: SILT, some clay, minor sand, trace organics; brown mottled orange. Very stiff, moist, medium plasticity; sand, fine; organics, rootlets; [FILL].							0.5										
	0.55m: SILT, some clay, minor sand, trace organics; light grey mottled orange and dark grey. Very stiff, moist, medium plasticity; sand, fine; organics, rootlets; [FILL].			HQ3	100	150/66 kPa	31	1.0								144mm HWT		
				SPTS	71	1/1 2/2 2/3 **N=9**		1.5										
Tauranga Group	*1.90m:* Sandy SILT, minor clay; light grey and light brown mottled orange, spotted red-orange. Hard, moist, medium plasticity; sand, fine.			HQ3	62		30	2.0										
	2.60m: CORE LOSS (Washout)							2.5										
	3.00m: SILT, trace sand; brown mottled dark brown. Firm, moist, low plasticity; sand, fine.			SPTS	100	89/36 kPa	29	3.0										
	3.85 - 4.50m: Minor sand; brown mottled dark brown spotted green and orange. Sand (inclusions), fine to medium.			HQ3	100	0/0 1/0 1/1 **N=3**	28	3.5 4.0										Box 1, 0.00-3.60m
	4.50m: 4.5 - 5.0 m: Push Tube Sample.			PT	0	48/6 kPa Push Tube @ 4.50m		4.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:44 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH206

SHEET: 2 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925453.20 mN, 1744981.30 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 32.10m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic SILT, some sand; brown mottled dark brown. Firm, moist, low plasticity; organics, decomposed wood; sand, fine.			HQ3	10		27	5.5							05/03/2021			
	5.80m: Organic sandy SILT; brown mottled dark brown spotted green. Firm, moist, low plasticity; organics, decomposed wood, sand, fine.																	
	6.00m: Organic SILT, some sand; brown mottled dark brown. Firm, moist, low plasticity; organics, decomposed wood; sand, fine.			SPTS	80	45/15 kPa 0/0 0/1 1/1 **N=3**	26	6.0										
	6.37m: Organic sandy SILT; brown mottled dark brown. Firm, moist, low plasticity; organics, decomposed wood, sand, fine.							6.5										
	6.92m: Silty SAND, some organics; brown mottled dark brown. Loose, moist, poorly graded; sand, fine to medium; organics, decomposed.			HQ3	100		25	7.0										Box 2, 3.60-7.05m
	7.55m: Sandy SILT, some organics; light brown spotted dark brown. Stiff, moist, poorly graded; sand, fine; organics, decomposed.			SPTS	84	UTP 1/0 0/1 2/1 **N=4**		7.5							08/03/2021			
	7.95m: CORE LOSS (Washout)						24	8.0										
	8.25m: Sandy SILT, some organics; light brown spotted dark brown. Stiff, moist, poorly graded; sand, fine; organics, decomposed.			HQ3	71			8.5										
	9.45m: CORE LOSS (Washout)			SPTS	100	57/3 kPa 0/0 1/1 1/2 **N=5**	23	9.0										
	9.55m: Sandy SILT, some organics; light brown spotted dark brown. Stiff, moist, poorly graded; sand, fine; organics, decomposed.							9.5										
	9.75m: Silty SAND, minor organics; brown mottled dark brown. Loose, moist, poorly graded; sand, fine to medium; organics, decomposed.																	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH206

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925453.20 mN, 1744981.30 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 32.10m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Silty SAND, minor organics; brown mottled dark brown. Loose, moist, poorly graded; sand, fine to medium; organics, decomposed.			HQ3	71		22	10.0										
	10.25m: Sandy SILT, some organics; light brown spotted dark brown. Stiff, moist, poorly graded; sand, fine; organics, decomposed.																	
East Coast Bays Formation	*10.45m:* Completely weathered, grey, massive, SANDSTONE. Extremely weak, recovered as SAND, some silt; grey. Loose, moist, poorly graded; sand, fine to medium.			SPTS	100	75/21 kPa 1/1 2/2 3/3 **N=10**	21	10.5										
	11.15 - 11.90m: Sand, fine to coarse			HQ3	71			11.0										
	11.90m: Highly weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, some silt; grey. Medium dense, moist, poorly graded; sand, fine to medium.			SPTS	100	UTP 2/2 4/4 5/5 **N=18**	20	11.5										
	12.70m: Moderately weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, some silt; grey. Medium dense, moist, poorly graded; sand, fine to medium.			HQ3	100		19	12.0										
				SPTS	100	2/5 6/8 10/12 **N=36**		12.5										
	14.35m: Slightly weathered, grey, massive, SANDSTONE. Extremely Weak. SAND, minor silt; grey. Very dense, moist, poorly graded; sand, fine to medium.			HQ3	100		18	13.0				61	13.95 - 14.40m: BZ					
								13.5										
								14.0										
								14.5										

Box 3, 7.05-10.50m

Box 4, 10.50-14.25m

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH206

SHEET: 4 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925453.20 mN, 1744981.30 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 32.10m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* CORE LOSS (Solid Cone SPT)			SPTC	0	7/16 21/22 10 for 20mm **N>=50** Solid	17											
	15.32m: Unweathered, grey, massive, SANDSTONE. Very Weak, (fine to medium grained).			HQ3	100		16	15.5				100	15.45m: BF, 13° dip, PL, SM, VN, CN 15.93m: BF, 15° dip, PL, SM, VN, CN					
	16.50m: CORE LOSS (Solid Cone SPT)			SPTC	0	13/38 for 60mm **N>=50** Solid		16.5										
	16.64m: Unweathered, grey, massive, SANDSTONE. Very Weak, (fine to coarse grained). *17.55 - 17.66m:* Unweathered, grey, SANDSTONE. Weak, (fine to coarse sand). *17.66 - 17.69m:* Unweathered, grey, SANDSTONE. Extremely Weak, (fine to coarse sand).			HQ3	93		15	17.0 17.5				93	17.55m: DD					Box 5, 14.25-17.55m
	18.00m: CORE LOSS (Solid Cone SPT)			SPTC	0	12/41 for 65mm **N>=50** Solid	14	18.0										
	18.14m: Unweathered, grey, massive, SANDSTONE. Very Weak, (fine to medium grained). *18.85 - 19.70m:* (fine to coarse sand)			HQ3	100		13	18.5 19.0				100	18.86m: DD 18.96m: DD					
	19.70 - 20.55m: (fine to coarse sand; fine, rounded siltstone gravel-sized clasts)							19.5				98	19.85m: DD					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH206

SHEET: 5 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925453.20 mN, 1744981.30 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 32.10m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)
East Coast Bays Formation	*20.55 - 21.30m:* (fine to coarse sand)
Albany Conglomerate	*21.30m:* Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (fine to coarse grained; with some fine, rounded gravel sized clasts of siltstone).
	21.75m: Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (fine to coarse grained; with some fine, rounded gravel sized clasts of siltstone).
	22.27 - 22.32m: Cobble-sized Siltstone clast. Very weak
	22.85m: Unweathered, grey, massive, SANDSTONE. Weak, (fine to coarse grained).
	23.00m: Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (fine to coarse grained; with some fine, rounded gravel sized clasts of siltstone).

Sampling Method	Core Recovery (%)	RL (m)	Depth (m)	RQD (%)	Description & Additional Observations
HQ3	99	12	20.5	98	20.36m: DD
			21.0		20.92m: DD
HQ3	100	11	21.5	100	
		10	22.0		
			22.5		22.50m: J, 29° dip, PL, RO, CN
HQ3	99	9	23.0	98	23.21m: DD
			23.5		
		8	24.0		
			24.5	100	

Box 6, 17.55-20.70m

Box 7, 20.70-23.65m

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH206

SHEET: 6 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: (NZTM2000) 5925453.20 mN 1744981.30 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 32.10m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Albany Conglomerate	*25.05m:* Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; with some fine, subangular gravel sized clasts of siltstone).			HQ3	100		7 / 25.5				100						
	25.40 - 25.45m: Cobble-sized Siltstone clast. Very weak																
	25.50m: Unweathered, grey spotted green & brown, SANDSTONE. Weak, (Conglomeratic Sandstone, fine to coarse grained; with some fine, rounded gravel sized clasts of siltstone).			HQ3	100		6 / 26.0				94	25.64 - 25.77m: BZ					
	25.65m: Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; with some fine to coarse, subrounded gravel sized clasts of siltstone).											25.88m: DD					
	26.22m: Unweathered, dark grey, SILTSTONE. Very Weak, (Cobble sized clasts).											26.35m: DD					
	26.58m: Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; with some fine to coarse, subrounded gravel sized clasts of siltstone).						5 / 27.0					26.59m: BF, 5° dip, UN, RO, VN, CN					Box 8, 23.65-26.60m
	26.90m: Unweathered, grey, massive, SANDSTONE. Very Weak, (fine to coarse grained).											26.79m: DD 26.84m: DD 26.87m: DD					
	27.15m: Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; fine to medium angular to sub-angular gravel sized clasts of siltstone).			HQ3	100		4 / 27.5				96						
	27.30m: Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (Conglomeratic Sandstone, fine to coarse grained; fine to medium angular to sub-angular gravel sized clasts of siltstone).											27.54 - 27.72m: DD, Discing of core - likely caused by soft rock 27.70m: DD 27.76m: DD 27.82m: DD 27.87m: DD 27.97m: DD 28.02m: DD					
	27.50m: Unweathered, grey, massive, SANDSTONE. Very Weak, (fine to medium grained).											28.16m: DD 28.20m: DD 28.25m: DD 28.30m: DD 28.40m: DD 28.42m: DD					
	27.95 - 28.45m: sandstone, fine to coarse sand																
	28.68 - 28.70m: Carbonaceous materials within sandstone			HQ3	100		3 / 29.0				100	28.52 - 29.60m: J, 85° dip, (80° - 90°) T 29.05 - 29.26m: J, 85° dip, PL, RO, VN, CN					Box 9, 26.60-29.85m
	29.85 - 30.70m: sandstone, fine to coarse sand						29.5										

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH206

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Contrac
JOB No.: 1015174.0000.04
LOCATION: Trig Road - SH18

CO-ORDINATES: 5925453.20 mN (NZTM2000) 1744981.30 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 32.10m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Murray
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 04/03/2021
FINISH DATE: 08/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Albany Conglomerate	*30.70m:* Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (Conglomeratic Sandstone, fine to coarse grained; fine to medium angular to sub-angular gravel sized clasts of siltstone).			HQ3	90		30.5				90						
	30.90m: Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; fine to coarse subrounded gravel sized clasts of siltstone).			HQ3	100		31.0 31.5				95	31.17m: DD 31.21m: DD 31.30m: DD					
	32.15m: Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (Conglomeratic Sandstone, fine to coarse grained; fine to coarse subrounded gravel sized clasts of siltstone).						32.0 32.5										Box 10, 29.65-32.70m
	32.65m: Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; fine, rounded gravel sized clasts of siltstone).			HQ3	100		33.0				100						
	33.35m: Unweathered, grey, massive, SANDSTONE. Weak, (fine to coarse grained).						33.5										
	33.72m: Unweathered, grey spotted green & brown, massive, SANDSTONE. Weak, (Conglomeratic Sandstone, fine to coarse grained; fine to medium, sub-angular gravel sized clasts of siltstone).			HQ3	100		34.0				100	33.72 - 33.76m: DD 33.86 - 33.90m: DD					
	34.50m: Unweathered, grey spotted green & brown, massive, CONGLOMERATE. Weak, (fine to coarse grained; fine to coarse, sub-angular gravel sized clasts of siltstone).						34.5					34.53m: DD					Box 11, 32.70-35.00m
	35m: END OF BOREHOLE																

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel. All shear vane readings have been corrected to kPa.

Hole Depth 35m

Scale 1:25

Rev.: A

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH206**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925453.20 mN 1744981.30 mE	DRILL TYPE:	HOLE STARTED: 04/03/2021
R.L.:	32.10m	DRILL METHOD: RC	HOLE FINISHED: 08/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

0.00-3.60m

3.60-7.05m

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH206**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925453.20 mN 1744981.30 mE	DRILL TYPE:	HOLE STARTED: 04/03/2021
R.L.:	32.10m	DRILL METHOD: RC	HOLE FINISHED: 08/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

7.05-10.50m

10.50-14.25m

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

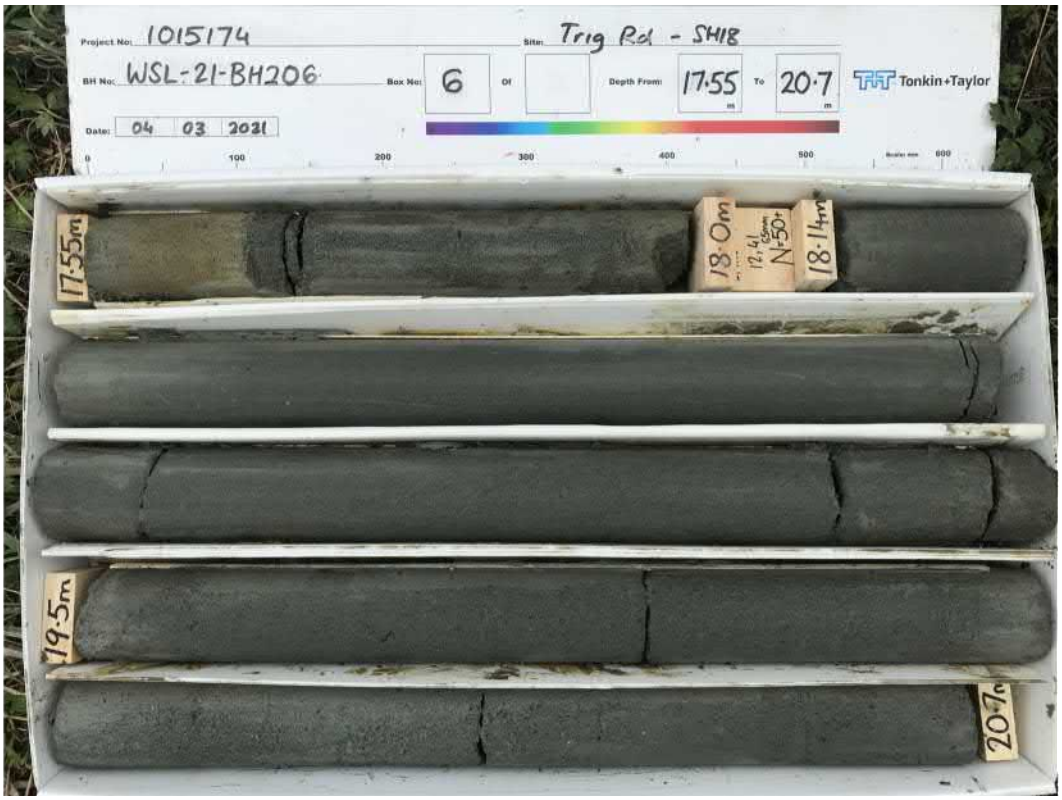
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH206**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925453.20 mN 1744981.30 mE	DRILL TYPE:	HOLE STARTED: 04/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 08/03/2021
R.L.:	32.10m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: FLRU

14.25-17.55m



17.55-20.70m

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

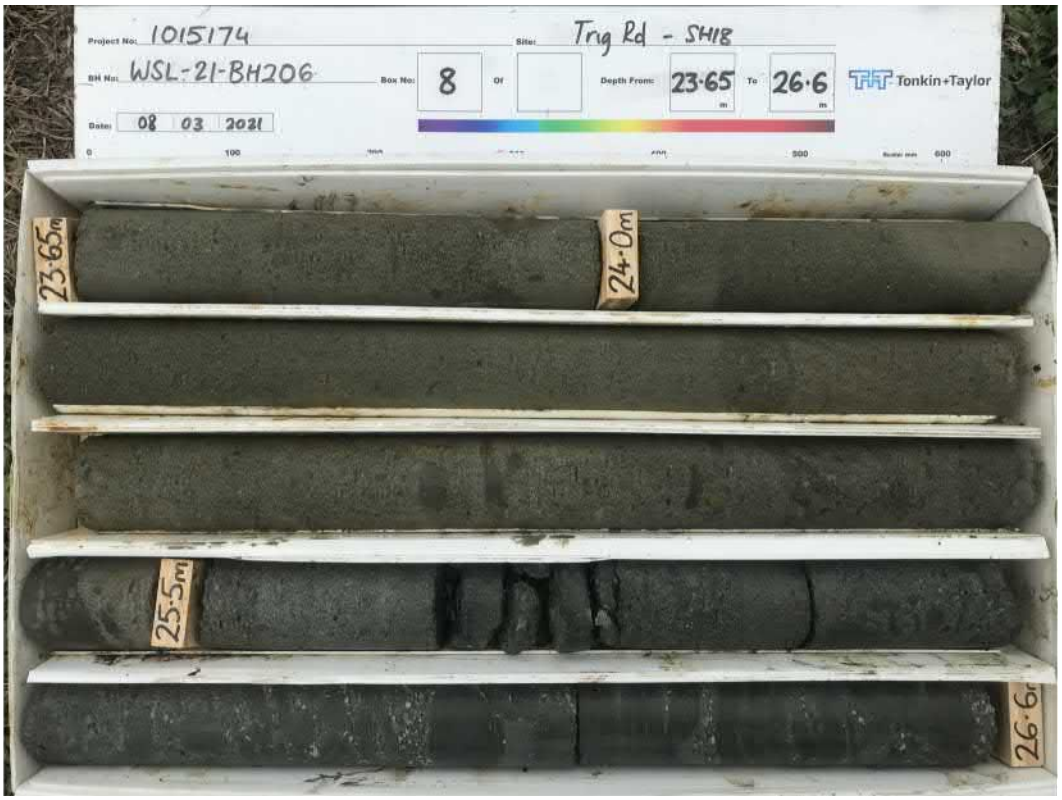
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH206**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925453.20 mN 1744981.30 mE	DRILL TYPE:	HOLE STARTED: 04/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 08/03/2021
R.L.:	32.10m		DRILLED BY: McMillan Drilling
DATUM:	NZVD2016		LOGGED BY: ROM CHECKED: FLRU

20.70-23.65m



23.65-26.60m

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH206**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W		LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: (NZTM2000)	5925453.20 mN 1744981.30 mE	DRILL TYPE:	HOLE STARTED: 04/03/2021
R.L.:	32.10m	DRILL METHOD: RC	HOLE FINISHED: 08/03/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

26.60-29.65m

29.65-32.70m

General Log - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH206**

Hole Location: Trig Road - SH18

PROJECT: Package 2 Whenuapai / Redhill [Contractor: On-Site W	LOCATION: Whenuapai, Auckland	JOB No.: 1015174.0000.04
CO-ORDINATES: 5925453.20 mN (NZTM2000) 1744981.30 mE	DRILL TYPE:	HOLE STARTED: 04/03/2021
R.L.: 32.10m	DRILL METHOD: RC	HOLE FINISHED: 08/03/2021
DATUM: NZVD2016		DRILLED BY: McMillan Drilling
		LOGGED BY: ROM CHECKED: FLRU

32.70-35.00m

General Log _ - 6/07/2021 10:37:45 AM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH207

SHEET: 1 OF 3

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925343.74 mN 1745294.24 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.60m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 15/04/2021
FINISH DATE: 16/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics; brown. Firm, dry, low plasticity. Sand, fine. Organics, rootlets (fresh). [FILL].																	
Fill	*0.35m:* SILT, some sand, minor clay, trace organics; dark brown. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh). [FILL].																	
Fill	*0.50m:* Clayey sandy SILT; grey streaked orange. Stiff, moist, medium plasticity. Sand, fine. [FILL]. *0.60 - 1.10m:* Brownish grey mottled orange.			HA	1017			0.5	TS									
Tauranga Group	*1.10m:* Clayey sandy SILT; grey streaked orange. Stiff, moist, medium plasticity. Sand, fine.			HQ3	100		27	1.0							16/04/2021			
Tauranga Group	*1.50m:* Clayey SILT, some organics and some sand; grey mottled brownish orange. Stiff, moist, medium plasticity. Organics (decomposed); sand, fine. Limonite staining.			SPTS	84	98/19 kPa 1/1 1/2 2/1 **N=6**	26	1.5										
Tauranga Group	*1.90m:* SILT, some organics, minor clay, trace sand; light brown mottled brown. Stiff, moist, medium plasticity. Organics (decomposed); sand, fine. Limonite staining. *1.95m:* CORE LOSS - Suspect washed out.			HQ3	57			2.0										
Tauranga Group	*2.40m:* SILT, minor organics and minor clay, trace sand; light brown mottled brown. Stiff, moist, medium plasticity. Organics (decomposed); sand, fine. Limonite staining. *2.85 - 3.00m:* Brown.						25	2.5										
Tauranga Group	*3.00m:* NOT LOGGED. Push tube sample.			PT	50	Push Tube @ 3.00m		3.0										
Tauranga Group	*3.50m:* CORE LOSS - Suspect washed out.						24	3.5										Box 1, 0.00-3.50m
Tauranga Group	*3.68m:* SILT, some organics, minor clay; brown mottled dark brown. Stiff, moist, medium plasticity. Organics, rootlets (partially decomposed).			HQ3	82	pH / ASS @ 4.30m pH - 7.1		4.0										
Tauranga Group	*4.35m:* Organic SILT, minor clay; dark brown streaked black. Stiff, moist, medium plasticity. Organics, rootlets (partially decomposed).			SPTS	100	60/13 kPa 0/0 0/1 1/2 **N=4**	23	4.5					*4.50 - 4.95m:* SPT @ 4.5m recovered extra material - suspect material from previous core run					

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 7:05:03 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH207

SHEET: 2 OF 3

Tonkin+Taylor

PROJECT: Package 2 Whenuapai/Redhill
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925343.74 mN 1745294.24 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.60m
R.L. COLLAR:
DATUM: NZVD2016
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 15/04/2021
FINISH DATE: 16/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW CS)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* CORE LOSS - Suspect washed out.																	
	5.40m: SILT, some organics, minor clay; brown mottled dark brown. Stiff, moist, medium plasticity. Organics, rootlets (partially decomposed).					pH / ASS @ 5.40m pH - 7.0		5.5										
	5.72m: Sandy SILT, some organics, trace clay; brown spotted black. Stiff, moist, low to medium plasticity. Sand, fine. Organics, rootlets (decomposed).																	
	6.00m: SILT, some organics and some sand, minor clay; brown spotted black. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (partially decomposed).			SPT	100	0/0 1/1 2/1 **N=4**	22	6.0										
	6.10 - 6.75m: Greyish green streaked brown.																	
	6.75m: Sandy SILT, minor organics, trace clay; greyish green spotted dark brown, Blocky. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (partially decomposed).			HQ3	100		21	6.5										
	7.45 - 7.50m: Some organics; green mixed brown. Organics, carbonaceous material. *7.50 - 7.55m:* Organic sandy SILT; brown.							7.0										Box 2, 3.50-7.35m
	7.50m: Sandy SILT, minor organics; greyish brown streaked dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (partially decomposed).			SPT	100	40/6 kPa 0/1 2/1 1/1 **N=5**	20	7.5										
	7.87 - 7.88m: WOOD. Partially decomposed.																	
	7.95m: CORE LOSS - Suspect washed out.							8.0										
	8.10m: Organic sandy SILT; dark brown mixed brown. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (partially decomposed).			HQ3	86		19	8.5										
	8.30m: SILT, some sand, minor organics and minor clay; light greyish brown streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (partially decomposed).																	
	8.55m: Organic SILT, minor clay; dark brown streaked black. Stiff, moist, medium plasticity. Organics, rootlets (partially decomposed).																	
	8.70m: Sandy SILT, some organics; brown spotted black. Stiff to very stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed).																	
	8.75m: Sandy SILT, some organics, minor clay; greyish green spotted dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed).			SPT	100	101/45 kPa 0/0 0/0 1/2 **N=3**		9.0										
	9.00 - 9.40m: Sandy SILT, minor organics; greyish green streaked dark brown. Firm, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed).																	
	9.45m: CORE LOSS - Suspect washed out.						18	9.5										
	9.55m: Sandy SILT, some organics, minor clay; greyish green spotted dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed).			HQ3	100													
	9.55 - 9.75m: Sandy SILT, some wood, minor clay; light brown. Firm, low to medium plasticity. Organics, wood fragments (partially decomposed).																	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 5/07/2021 7:05:04 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH207

SHEET: 3 OF 3

PROJECT: Package 2 Whenuapai/Redhill	CO-ORDINATES: (NZTM2000) 5925343.74 mN 1745294.24 mE	R.L. GROUND: 27.60m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: NZVD2016
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 15/04/2021
FINISH DATE: 16/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Sandy SILT, some organics, minor clay; greyish green spotted dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed). [CONT].			HQ3	100													Box 3, 7.35-10.50m
East Coast Bays Formation	*10.38m:* SW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, [Recovered as dense fine to medium grained SAND].			SPT	100	4/6 9/12 17/12 for 50mm **N>=50**	17	10.5										
				HQ3	98		16	11.0 11.5										
				SPTS	100	9/15 26/24 for 55mm **N>=50**		12.0										
	12.28m: UW, grey, SANDSTONE. Extremely weak to very weak, moderately cemented, fine to medium grained.			HQ3	100		15	12.5				95	*12.34m:* DD *12.52m:* DD *12.73m:* BF, 17° *12.94m:* DD *13.19m:* DD *13.32m:* DD					Box 4, 10.50-13.65m
	13.50m: CORE LOSS - Suspect washed out.			SPTC	0	10/40 for 70mm **N>=50** Solid	14	13.5										
	13.65m: UW, grey, SANDSTONE. Extremely weak to very weak, moderately cemented, fine to medium grained.			HQ3	100		13	14.0 14.5				90	*13.82m:* DD *14.20-14.26m:* BZ *14.50m:* DD					Box 5, 13.65-15.00m
	14.26 - 14.32m: UW, grey, SILTSTONE. Very weak, poorly cemented to moderately cemented.																	
	15m: END OF BOREHOLE																	

COMMENTS: Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 15m

Scale 1:25

Rev.: A

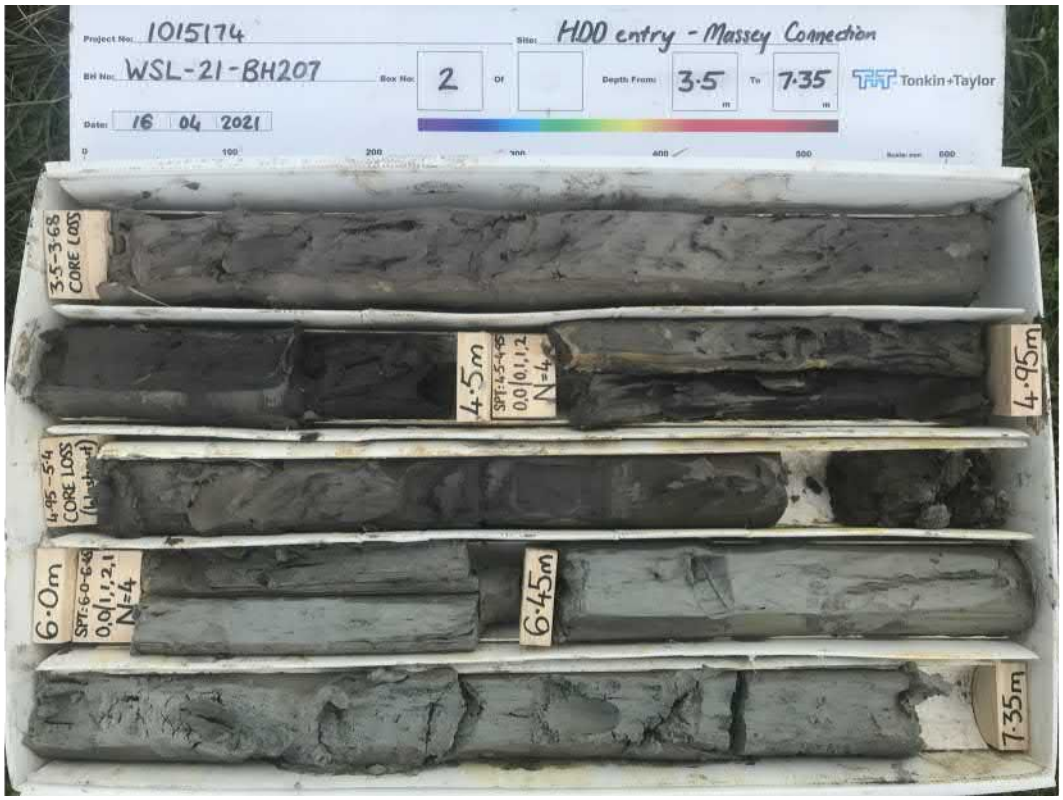
General Log - DESX005 - Fix RQD - 5/07/2021 7:05:04 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH207**

PROJECT: Package 2 Whenuapai/Redhill	LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: 5925343.74 mN (NZTM2000) 1745294.24 mE R.L.: 27.60m DATUM: NZVD2016	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 15/04/2021 HOLE FINISHED: 16/04/2021 DRILLED BY: McMillan Drilling LOGGED BY: ROM CHECKED: FLRU

0.00-3.50m



3.50-7.35m

General Log - DESX005 - Fix RQD - 5/07/2021 7:05:04 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH207**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925343.74 mN 1745294.24 mE	DRILL TYPE:	HOLE STARTED: 15/04/2021
R.L.:	27.60m	DRILL METHOD: RC	HOLE FINISHED: 16/04/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

7.35-10.50m

10.50-13.65m

General Log - DESX005 - Fix RQD - 5/07/2021 7:05:04 PM - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH207**

PROJECT: Package 2 Whenuapai/Redhill		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925343.74 mN 1745294.24 mE	DRILL TYPE:	HOLE STARTED: 15/04/2021
R.L.:	27.60m	DRILL METHOD: RC	HOLE FINISHED: 16/04/2021
DATUM:	NZVD2016		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

13.65-15.00m

General Log - DESX005 - Fix RQD - 5/07/2021 7:05:04 PM - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 1 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925405.54 mN 1745137.85 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: OYCH

CHECKED: FLRU

START DATE: 31/03/2021

FINISH DATE: 08/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* SILT, some sand, minor gravel; white grey. Soft, moist, non-plastic. Sand, fine and coarse; gravel, fine, sub-angular, unweathered, basalt and brick. [FILL].																	
Fill	*0.30m:* SILT, minor clay and minor sand, trace gravel; brown. Firm to stiff, moist, low plasticity. Sand, fine; gravel, fine and coarse, angular, brick fragments. [FILL].					58/33 kPa												
Tauranga Group	*0.50m:* Clayey SILT, trace organics and trace sand; brown. Firm to stiff, moist, medium to high plasticity. Organics, fibrous; sand, fine.			HA	0	80/42 kPa	21	0.5										
Tauranga Group	*0.90m:* Silty CLAY, trace organics and trace sand; yellowish brown. Very stiff, moist, high plasticity. Organics, fibrous; sand, fine.					174/107 kPa		1.0										
Tauranga Group	*1.25m:* SILT, minor clay and minor gravel, trace sand; grey white. Soft, moist, medium plasticity. Sand, fine and coarse; gravel, fine. Possibly recovered from surface material.																	
Tauranga Group	*1.52m:* Sandy SILT; orange grey. Firm to stiff, moist, medium plasticity. Sand, fine and coarse.			SPT	100	1/1 1/2 2/2 **N=8**	20	1.5										
Tauranga Group	*2.05 - 2.26m:* Trace organics (amorphous).							2.0										
Tauranga Group	*2.26m:* CLAY, some silt; brownish orange. Firm to stiff, wet, high plasticity.																	
Tauranga Group	*2.35m:* Sandy SILT, minor amorphous organics. Firm to stiff, moist, medium plasticity. Sand, fine and coarse.			HQ3	86		19	2.5										
Tauranga Group	*2.85m:* CORE LOSS. (Fines washed out.)														08/04/2021			
Tauranga Group	*3.00m:* Push tube sample.			PT	0	53/13 kPa Push tube @ 3.00m MC PSD AL		3.0										
Tauranga Group	*3.50m:* Clayey SILT; grey. Very soft, saturated, high plasticity.							3.5										
Tauranga Group	*3.54m:* Sandy SILT, minor clay, trace organics; grey. Firm to stiff, moist, medium to high plasticity. Organics, amorphous; sand, fine.			SPTS	100	1/1 1/1 2/2 **N=6**	18											
East Coast Bays Formation	*4.07m:* Sandy SILT; grey. Firm, moist, dilatant. Sand, fine. [Residual Soil].			HQ3	100			4.0										
East Coast Bays Formation	*4.26m:* CW, dark grey, SANDSTONE. Extremely weak, fine grained, Recovered as silty SAND, Loose to medium dense, moist, poorly graded. Remoulds to sandy SILT, high plasticity.																	
East Coast Bays Formation	*4.58 - 4.60m:* Carboniferous bed.																	
East Coast Bays Formation	*4.55m:* CW, grey, SILTSTONE. Extremely weak, Recovered as SILT, minor sand. Very stiff to hard, moist, medium to high plasticity; sand, fine.			SPTS	100	3/3 3/6 8/9 **N=26**	17	4.5										
East Coast Bays Formation	*4.62m:* HW, dark grey, SANDSTONE. Extremely weak, fine grained, Poorly cemented, Recovered as silty SAND. Loose to medium dense, moist, poorly grade; sand, fine.																	

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:11 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 2 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925405.54 mN, 1745137.85 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: OYCH
CHECKED: FLRU
START DATE: 31/03/2021
FINISH DATE: 08/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*4.92 - 4.93m:* Carboniferous bed.																	
	5.29 - 5.34m: HW, SILTSTONE. Extremely weak.																	Box 1, 0.00-5.37m
	5.50m: MW, dark grey, SANDSTONE. Extremely weak, fine grained, Recovered as silty SAND; dark grey. Medium dense, moist, poorly graded. Sand, fine, poorly cemented.			SPTS	100	7/15 21/29 for 65mm **N>=50**	16	5.5										
	6.29m: MW, dark grey, SANDSTONE. Extremely weak, fine grained, Recovered as: SAND, some silt. Very dense, moist.							6.0										
	6.35m: SW, dark grey, SANDSTONE. Extremely weak, fine grained, Recovered as: SAND, minor silt. Very dense, moist.			HQ3	100		15	6.5					*6.29-6.42m:* DD *6.54m:* DD					
								7.0				100	*6.84m:* J, 10°, UN, R, VN, CN *7.00m:* J, 7°, UN, R, VN, CN					
	7.50m: NO RECOVERY - Solid cone SPT.			SPTS	0	8/42 for 75mm **N>=50**	14	7.5					*7.43m:* DD					
	7.65m: SW, dark grey, SANDSTONE. Very weak, fine grained.			HQ3	100	BH101_S1 @ 8.05m SW SANDSTONE (ECBF) Sample description from target		8.0				99	*7.80m:* J, 5°, UN, SM, VN, CN *7.85m:* DD *7.95m:* J, 30°, PL, SM, VN, CN *8.05m:* DD					Box 2, 5.37-8.05m
				HQ3	100		13	8.5				100	*8.35m:* DD *8.55m:* DD *8.73-8.87m:* DD					
	9.00m: NO RECOVERY - Solid cone SPT.			SPTS	0	15/35 for 50mm **N>=50**		9.0					*9.00m:* DD					
	9.13m: CORE LOSS. Core milled and washed away.						12	9.5				66	*9.62m:* DD *9.68m:* DD					
	9.43m: SW, dark grey, SANDSTONE. Very weak, fine grained.												*9.82-9.85m:* DD					

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 3 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925405.54 mN 1745137.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: OYCH
CHECKED: FLRU
START DATE: 31/03/2021
FINISH DATE: 08/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.18m:* SW, dark grey, SANDSTONE. Very weak, fine grained.			HQ3	78			10.5				66	*9.98m:* DD *10.18m:* DD					
	11.40 - 11.43m: SW, SILTSTONE.			HQ3	100		11	11.0				55	*10.68m:* DD *10.82m:* DD *10.95m:* DD *11.10m:* DD *11.25m:* DD					Box 3, 8.05-11.10m
	12.00m: UW, dark grey, SANDSTONE. Very weak, fine grained.			HQ3	100		10	11.5					*11.37-11.82m:* DD *11.83-12.00m:* BZ					
				HQ3	100		9	12.5				100	*12.35m:* DD *13.00m:* DD					
				HQ3	100		8	13.5				88	*13.50-13.55m:* DD *14.05m:* J, 40°, PL, SM, VN, CN *14.25m:* DD *14.30m:* J, 35°, PL, R, VN, CN					Box 4, 11.10-13.80m
							7	14.5					*14.60m:* DD					

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 4 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925405.54 mN 1745137.85 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: OYCH
CHECKED: FLRU
START DATE: 31/03/2021
FINISH DATE: 08/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* UW, dark grey, SANDSTONE. Very weak, fine grained, [CONT].	UW SW MW HW CW	EW VW MW SW FS	HQ3	100	BH101 @ 15.00m uw sst f-c vw Sample description from sample	6	15.5				87	*15.64-15.74m:* BZ *15.74-15.90m:* DD *16.06m:* DD					Box 5, 13.80-16.50m
	17.30 - 17.40m: Some limonite inclusions.			HQ3	100		5	16.0 16.5				72	*16.73m:* DD *16.92-17.10m:* J, 75°, PL, R, VN, CN *17.15m:* J, 10°, UN, R, VN, CN *17.23m:* DD *17.31m:* J, 25°, UN, R, VN, CN *17.37m:* BZ					
	18.00m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.			HQ3	99		4 3	17.0 17.5 18.0 18.5				99	*17.60m:* DD *17.80m:* J, 7°, UN, R, VN, CN *18.05m:* DD *18.54m:* J, 86°, PL, SM, VN, CN					Box 6, 16.50-19.50m
	19.85 - 21.00m: Grey. Fine to medium grained.					BH101 @ 19.53m uw sst f-c vw Sample description from sample	2	19.0 19.5				99	*19.00m:* J, 83°, PL, SM, VN, CN *19.52m:* DD *19.85m:* J, 32°, PL, SM, VN, CN					

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 5 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925405.54 mN 1745137.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: OYCH
CHECKED: FLRU
START DATE: 31/03/2021
FINISH DATE: 08/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained, [CONT].			HQ3	99		1	20.5				99	*20.33m:* DD *20.66m:* DD					
								21.0					*21.06m:* J, 15°, PL, SM, VN, CN *21.25m:* DD					
				HQ3	95		0	21.5				91	*21.74m:* J, 30°, PL, SM, VN, CN					
	21.93m: UW, dark grey, bedded, SILTSTONE. Very weak, well cemented.							22.0					*21.92m:* DD *21.93m:* DD					
	22.09m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, medium to coarse grained. *22.09 - 22.15m:* UW, grey spotted white, Conglomeratic SANDSTONE. Very weak, well cemented.												*22.13m:* J, 34°, PL, R, VN, CN *22.17m:* DD					
	22.42m: CORE LOSS - Suspect washed out.							22.5										Box 7, 19.50-22.50m
	22.50m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, medium to coarse grained.						-1											
	22.60m: UW, grey speckled white, Conglomeratic SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.												*22.76m:* BF, 20°, PL, R, VN, CN *22.89m:* BF, 25°, PL, PO, VN, Clay					
	22.82m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to coarse grained. *23.20 - 23.27m:* UW, grey, SILTSTONE. Very weak.							23.0					*23.04m:* DD					
				HQ3	96							96	*23.26m:* J, 22°, PL, SM, VN, CN *23.29m:* DD *23.32m:* DD *23.41m:* DD					
							-2	23.5					*23.55m:* DD, Potential fracture along weak plane					
						BH101 @ 23.68m uw sst f-c vw Sample description from sample												
	23.94m: CORE LOSS - Suspect washed out.							24.0										
	24.00m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. *24.33 - 24.52m:* UW, grey, SILTSTONE. Very weak. INTERBEDDED WITH: SW, grey, bedded, SANDSTONE. Extremely weak, poorly cemented, fine to coarse grained. *24.52 - 25.05m:* Poorly cemented grading to moderately cemented.						-3	24.5				71	*24.13m:* DD *24.14m:* DD *24.60-24.82m:* DD, drilling induced due to weak rock					

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 6 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925405.54 mN, 1745137.85 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: OYCH

CHECKED: FLRU

START DATE: 31/03/2021

FINISH DATE: 08/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	RQD (%)	Description & Additional Observations
East Coast Bays Formation	*25.05 - 25.10m:* UW; grey; SILTSTONE; Very weak. 22 to 30° inclined. *25.10 - 25.13m:* Extremely weak, poorly cemented. *25.13 - 25.18m:* Carbonaceous SANDSTONE. *25.21 - 25.22m:* Extremely weak, poorly cemented.	HQ3	88	71	*24.98m:* DD *25.01m:* DD *25.03m:* DD *25.15m:* DD *25.29m:* DD *25.31m:* DD
	25.32m: CORE LOSS - Suspect washed out.				
	25.50m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.	HQ3	93	93	*25.62m:* DD *25.73-25.80m:* DD *25.84m:* DD *25.93m:* DD *26.00m:* DD
	26.05 - 26.16m: Extremely weak, poorly cemented.				
	26.25 - 26.36m: UW, grey, SILTSTONE. Very weak. 5 to 65mm thick. INTERBEDDED WITH: SW, grey, bedded, SANDSTONE. Extremely weak, poorly cemented, fine to coarse grained. 1 to 5mm thick.				*26.36m:* BF, 26°, PL, SM, VN, CN *26.41m:* DD *26.64m:* DD *26.82m:* DD
	26.90m: CORE LOSS - Suspect washed out.				
	27.00m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.	HQ3	76	74	*27.21m:* DD *27.23m:* DD *27.26m:* BF (x2), 30°, PL, SM, VN, CN *27.42m:* BF, 30°, PL, SM, VN, CN *27.53m:* DD
	27.25m: UW, dark grey, indistinctly bedded, SILTSTONE. Weak, well cemented. 1 to 32mm thick. INTERBEDDED WITH: UW, grey, indistinctly bedded, SANDSTONE. Weak, fine to medium grained. 2 to 65mm thick.				
	27.97m: UW, grey, Silty CONGLOMERATE. Very weak, poorly cemented to moderately cemented, fine to coarse, sub-rounded siltstone gravel-sized clasts.				*27.94m:* BF, 20°, PL, SM, VN, CN *27.97m:* DD *28.02-28.04m:* BZ
	28.14m: CORE LOSS. - high break at base of run.				
	28.50m: UW, dark grey, indistinctly bedded, SILTSTONE. Weak, well cemented. 1 to 30mm thick. INTERBEDDED WITH: UW, grey, indistinctly bedded, SANDSTONE. Weak, fine to medium grained. 1 to 10mm thick.	HQ3	129	129	*28.50 - 29.25m:* 0.22m recovered from previous core run (27.0 - 28.5) *28.71m:* BF, 20°, PL, SM, VN, CN
	28.65m: UW, grey speckled white, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.				*28.92m:* BF, 18°, PL, SM, VN, CN *29.05m:* DD
	29.20 - 29.25m: UW, grey, SILTSTONE. Very weak. 18° inclined. *29.25 - 29.55m:* Fine to medium grained.	HQ3	100	91	*29.25m:* BF, 22°, PL, SM, VN, CN *29.43m:* DD
	29.65 - 29.82m: UW, grey, Sandy SILTSTONE. Very weak. 30° inclined. *29.80 - 29.83m:* UW, grey, SILTSTONE. Extremely weak (very stiff), Recovered as SILT grey. Very stiff, moist, low plasticity.				*29.77m:* DD *29.82m:* BF, 32°, PL, SM, VN, CN *29.85m:* BF, 32°, PL, SM, VN, CN *29.96m:* DD
	30m: END OF BOREHOLE				

Box 8, 22.50-25.50m

Box 9, 25.50-28.65m

Box 10, 28.65-30.00m

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH101

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925405.54 mN, 1745137.85 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: OYCH

CHECKED: FLRU

START DATE: 31/03/2021

FINISH DATE: 08/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No

COMMENTS: Packer testing undertaken between 12.0 - 18.0 m bgl & 24 - 30 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH101**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925405.54 mN 1745137.85 mE	DRILL TYPE:	HOLE STARTED: 31/03/2021
R.L.:	21.60m	DRILL METHOD: RC	HOLE FINISHED: 08/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: OYCH CHECKED: FLRU

0.00-5.37m

5.37-8.05m

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH101**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5925405.54 mN 1745137.85 mE	DRILL TYPE:	HOLE STARTED: 31/03/2021	
R.L.: 21.60m	DRILL METHOD: RC	HOLE FINISHED: 08/04/2021	
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling	
		LOGGED BY: OYCH	CHECKED: FLRU

8.05-11.10m

11.10-13.80m

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH101**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925405.54 mN 1745137.85 mE	DRILL TYPE:	HOLE STARTED: 31/03/2021
R.L.:	21.60m	DRILL METHOD: RC	HOLE FINISHED: 08/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: OYCH CHECKED: FLRU

13.80-16.50m

16.50-19.50m

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH101**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925405.54 mN 1745137.85 mE	DRILL TYPE:	HOLE STARTED: 31/03/2021
R.L.:	21.60m	DRILL METHOD: RC	HOLE FINISHED: 08/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: OYCH CHECKED: FLRU

19.50-22.50m

22.50-25.50m

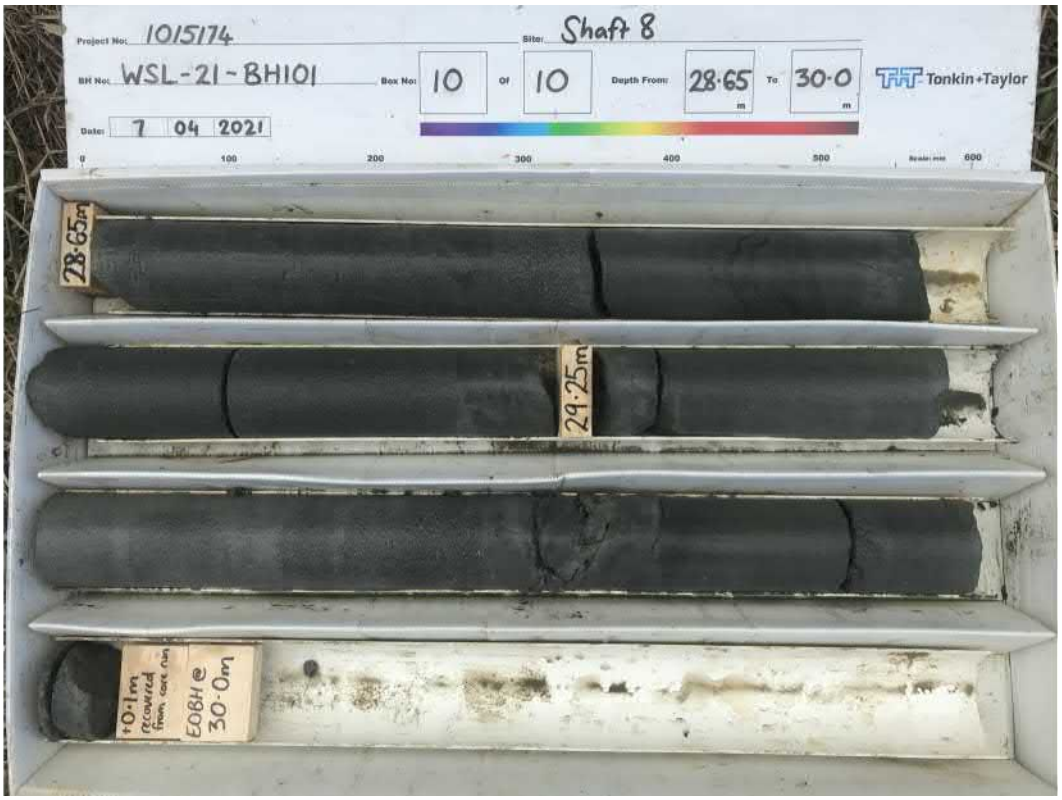
General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH101**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5925405.54 mN 1745137.85 mE	DRILL TYPE:	HOLE STARTED: 31/03/2021	
R.L.: 21.60m	DRILL METHOD: RC	HOLE FINISHED: 08/04/2021	
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling	
		LOGGED BY: OYCH	CHECKED: FLRU

25.50-28.65m



28.65-30.00m

General Log - DESX005 - Fix RQD - 16/12/2021 4:56:12 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH102

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925411.61 mN 1745162.27 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 20.90m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: ROM
START DATE: 25/03/2021
FINISH DATE: 30/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Gravelly SILT, trace rootlets; brown. Firm, dry, non-plastic. Gravel, fine grading to medium, angular, brick fragments and basalt. [FILL].			HA	100	AL PSD MC	20	0.5										
	1.35m: Clayey SILT, trace roots/rootlets; light orange mottled grey. Soft to firm, dry to moist, medium to high plasticity. Trace topsoil bands approx 10-50mm thick (between 1.35-1.40m) [FILL].							1.0										
Tauranga Group	*1.50m:* Sandy SILT, trace gravel; light grey mottled orange. Soft to firm, moist, medium plasticity. Sand, fine; gravel, fine to coarse, sub-rounded to sub-angular, Basalt.			SPTS	78	1/1 1/2 2/1 **N=6**	19	1.5										
				HQ3	100			2.0										
				HQ3	100	30/15 kPa	18	2.5										Box 1, 0.00-2.70m
				SPTS	100	45/15 kPa 1/2 3/2 4/5 **N=14**		3.0							30/03/2021			
East Coast Bays Formation	*3.20m:* SAND, some silt; bluish grey. Medium dense, moist. Sand, fine to medium, Remoulds to Sandy SILT, High plasticity. [Residual - Completely Weathered ECBF].			HQ3	100			3.5					*3.60 - 3.70m:* Black wood fragments					
	3.75m: HW, bluish grey, SANDSTONE. Extremely weak (dense), fine to medium grained, moist to wet, [Recovered as dense, moist to wet, fine to medium grained SAND].			HQ3	100	60/33 kPa Likely infulanced by sand	17	4.0										
				SPTS	100	3/4 6/8 9/10 **N=33**	16	4.5					*4.50 - 4.60m:* Section of SPT disturbed by drilling fluids					

COMMENTS: Hole dry on morning of 26/03/2021. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:17 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH102

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925411.61 mN 1745162.27 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 20.90m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: ROM
START DATE: 25/03/2021
FINISH DATE: 30/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.25m:* MW, bluish grey, SANDSTONE. Extremely weak (dense), fine to medium grained, moist to wet, [Recovered as dense, moist to wet, fine to medium grained SAND].	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	100		15	5.5										Box 2, 2.70-5.33m
				SPTS	100	6/11 15/24 11 for 35mm **N>=50**		6.0										
				HQ3	73			6.5										
	6.75m: UW-SW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained.			HQ3	87		14	7.0					*6.83m:* DD *6.90-7.20m:* DD (x20), Bisciting with breaks between 10-20mm. *7.30m:* DD					
	7.40m: Core Loss.							7.5										
	7.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	12/32 41/9 for 20mm **N>=50** Solid												
	7.75m: UW-SW, grey, SANDSTONE. Extremely weak locally Very weak, fine to medium grained, [Recovered as dense, moist to wet, fine to medium grained SAND].			HQ3	60		13	8.0					*7.85m:* DD *7.96m:* DD *8.19m:* DD					
				HQ3	100			8.5										Box 3, 5.33-8.84m
	9.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	18 32 for 71mm **N>=50** Solid	12	9.0										
	9.15m: UW-SW, grey, SANDSTONE. Extremely weak locally Very weak, fine to medium grained, [Recovered as dense, moist to wet, fine to medium grained SAND].			HQ3	50			9.5					*9.45 - 9.72m:* Recovered mostly as loose sand. This was likely issues regarding incorrect rotation speed. *9.80m:* DD *9.85m:* DD					
							11											

COMMENTS: Hole dry on morning of 26/03/2021. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH102

SHEET: 3 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925411.61 mN 1745162.27 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 20.90m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: ROM
START DATE: 25/03/2021
FINISH DATE: 30/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* UW-SW, grey, SANDSTONE. Extremely weak locally Very weak, fine to medium grained, [Recovered as dense, moist to wet, fine to medium grained SAND].	UW SW MW HW CW	EW VS S MS M W EW	HQ3	100								*9.95m:* DD *10.10m:* DD	25 50 75				
	10.50m: UW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained.			HQ3	100			10.5					*10.47-10.50m:* J, 20-40°, PL, SM *10.53-10.58m:* DD (x4) *10.53-10.93m:* DD (x10), Rang in size from 10-100mm					
				HQ3	53		10	11.0					*11.05-11.15m:* DD (x3) *11.34m:* DD *11.40m:* DD *11.46-11.65m:* DD (x11), size ranges from 5-10mm					
	11.65m: Core Loss.							11.5										
	12.00m: UW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained, [Recovered as dense, dry to moist, fine to medium grained SAND].			HQ3	83	B21-1599 @ 12.05m UW SANDSTONE Goodrich Drillability;	9	12.0					*12.00-12.39m:* DD (x12) *12.40m:* J, 20-20°, ST, R					
	12.65m: Core Loss.							12.5										
	12.75m: UW, grey, SANDSTONE. Very weak locally Extremely weak (dense), fine to medium grained.			HQ3	69		8	13.0					*12.75-12.90m:* DD (x2), Size between 50-150mm *12.90m:* J, 5-10°, ST, R *13.04-13.20m:* DD (x7), Size range between 5-100mm					
	13.27m: Core Loss suspect washout of uncemented sandstone.							13.5										
	13.50m: UW, grey, SANDSTONE. Very weak locally Extremely weak (dense), coarse grained.			HQ3	87		7	14.0					*13.50m:* DD *13.60-13.68m:* DD (x4) *13.80m:* DD					
	14.15m: Core Loss.							14.5										
	14.25m: UW, grey, SANDSTONE. Very weak locally Extremely weak (dense), fine to medium grained, [Recovered as dense, moist to wet, fine to medium grained SAND with some coarse GRAVEL of sandstone].			HQ3	73		6						*14.25-14.34m:* DD (x3), Size ranges between 10-100mm *14.34 - 14.44m:* Recovered as loose sand. *14.57m:* DD *14.70-14.78m:* DD (x3), Range up to 10mm					
	14.80m: CORE LOSS - Suspect washed out.																	

Box 4, 8.53-12.75m

COMMENTS: Hole dry on morning of 26/03/2021. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH102

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925411.61 mN 1745162.27 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 20.90m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: AIDM

CHECKED: ROM

START DATE: 25/03/2021

FINISH DATE: 30/03/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* UW, grey, SANDSTONE. Very weak locally Extremely weak (dense), fine to medium grained.	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	80	B21-1600 @ 15.00m UW SANDSTONE Splitting Tensile Strength (Mpa); Equivalent Quartz and Schimazek wear factor;	15.5	5			2000 600 200 60 20		*15.00-15.60m:* DD (x16), Size ranges from 5-100mm	25 50 75				
	15.60m: CORE LOSS - Suspect washed out.					B21-1601 @ 15.30m UW SANDSTONE Goodrich Drillability;												
	15.75m: UW, grey, SANDSTONE. Very weak locally Extremely weak (dense), fine to medium grained.			HQ3	77		16.0					32	*15.80m:* DD *15.84m:* DD					
	16.27m: CORE LOSS - Suspect washed out.												*16.04-16.12m:* DD (x4), Range from 10-20mm *16.04m:* DD *16.24m:* DD					Box 5, 12.75-16.50m
	16.50m: UW, grey, SANDSTONE. Very weak locally Extremely weak (very dense), moderately cemented, fine to medium grained. *16.54 - 16.56m:* UW; grey; bedded; SILTSTONE; Very weak, well cemented. 20mm thick, 35° inclined.			HQ3	77		16.5	4				77	*16.67m:* DD *16.89m:* DD *16.97m:* DD					
	17.10m: CORE LOSS - Suspect washed out.						17.0											
	17.25m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to coarse grained.			HQ3	100		17.5					100	*17.38m:* DD *17.48m:* DD *17.51m:* DD *17.53m:* DD *17.57m:* BF, 35°, PL, SM, VN, CN					
				HQ3	83	B21-1602 @ 17.88m UW SANDSTONE Splitting Tensile Strength (Mpa); BH102 @ 18.00m uw sst f-c vw Sample description from sample	18.0	3				83	*18.32m:* J, 69°, PL, R, VN, CN					
	18.60m: CORE LOSS - Suspect washed out.						18.5											
	18.75m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to coarse grained.			HQ3	89		19.0	2				89	*18.79m:* DD *19.03m:* DD *19.18m:* DD *19.21m:* DD					
	19.00m: UW; grey spotted light greenish grey; Conglomeratic SANDSTONE; Very weak, well cemented. Fine to coarse grained. *19.22 - 19.35m:* UW. Weak, well cemented.					B21-1603 @ 19.22m UW SANDSTONE Goodrich Drillability;												
	19.37m: CORE LOSS - Suspect washed out.						19.5											
	19.50m: UW; grey; SANDSTONE; Extremely weak to very weak, poorly cemented to moderately cemented. Fine to coarse grained. *19.80 - 19.99m:* UW. Extremely weak (very dense), poorly cemented.							1				21	*19.70m:* DD *19.72m:* J, 20°, PL, SM, VN, CN *19.80m:* J, 20-25°, PL, SM, VN, CN					Box 6, 16.50-19.80m

COMMENTS: Hole dry on morning of 26/03/2021. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH102

SHEET: 5 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925411.61 mN 1745162.27 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 20.90m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: ROM
START DATE: 25/03/2021
FINISH DATE: 30/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.05 - 20.15m:* UW. Extremely weak (very dense), poorly cemented.			HQ3	80		20.5				21	*20.05m:* J, 20°, PL, SM, VN, CN					
	20.15m: CORE LOSS - Suspect washed out.																
	20.25m: UW; grey; SANDSTONE; Extremely weak to very weak, poorly cemented to moderately cemented. Fine to coarse grained.											*20.29m:* J, 50°, PL, SM, VN, CN					
	20.50m: UW; grey spotted light greenish grey; Conglomeratic SANDSTONE; Very weak, well cemented. Fine to coarse grained.			HQ3	100		21.0				76	*20.45-20.53m:* J, 62°, PL, SM, VN, CN *20.64m:* DD *20.86m:* DD *20.95m:* J, 52°, PL, SM, VN, CN					
	21.05m: UW; grey; SANDSTONE; Extremely weak to very weak, poorly cemented to moderately cemented. Fine to coarse grained.						21.5					*21.06m:* DD *21.16m:* J, 30°, PL, SM, VN, CN *21.25m:* J, 42°, PL, SM, VN, CN *21.29m:* DD *21.38m:* DD *21.42m:* J, 6°, PL, SM, VN, CN *21.45m:* DD *21.54-21.60m:* BZ *21.63m:* J, 30°, PL, SM, VN, CN					
	21.60 - 22.25m: UW. Very weak, poorly cemented to moderately cemented.			HQ3	83		22.0				65	*21.71m:* DD *21.87m:* J, 24°, PL, SM, VN, CN *22.19m:* J, 25°, PL, SM, VN, CN					
	22.25m: CORE LOSS - Suspect washed out.						22.5										
	22.50m: UW; grey; SANDSTONE; Extremely weak to very weak, poorly cemented to moderately cemented. Fine to coarse grained.											*22.57m:* DD *22.59m:* DD *22.63m:* J, 45°, PL, R, VN, CN					
	22.60m: UW; grey spotted light greenish grey; Conglomeratic SANDSTONE; Weak, well cemented. Fine to coarse grained.						23.0					*22.93m:* DD					
	22.82 - 23.90m: UW. Very weak, moderately cemented.			HQ3	93						86	*23.10m:* DD *23.18m:* DD *23.24m:* DD *23.47m:* DD *23.67m:* DD *23.78m:* DD					
	23.90m: CORE LOSS - Suspect washed out.						23.5										
	24.00m: UW; grey spotted light greenish grey; Conglomeratic SANDSTONE; Very weak, moderately cemented. Fine to coarse grained.						24.0					*24.07-24.15m:* J, 62°, PL, SM, VN, CN *24.20m:* DD					
	24.35m: UW, grey, SANDSTONE. Extremely weak, uncemented to poorly cemented, fine to medium grained, [Recovered as].						24.5				33	*24.40m:* DD *24.50-24.60m:* J, 62°, PL, SM, VN, CN *24.53m:* DD *24.57-25.10m:* BZ *24.58m:* DD					

Box 7, 19.80-23.05m

COMMENTS: Hole dry on morning of 26/03/2021. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH102

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925411.61 mN 1745162.27 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 20.90m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AIDM
CHECKED: ROM
START DATE: 25/03/2021
FINISH DATE: 30/03/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	RQD (%)	Description & Additional Observations
East Coast Bays Formation	*25.10m:* CORE LOSS - Suspect washed out.	HQ3	73	33	
	25.50m: UW, grey spotted light greenish grey, Conglomeratic SANDSTONE. Extremely weak to very weak, moderately cemented, fine to coarse grained, [Recovered as].	HQ3	100	95	*25.58m:* DD *25.76m:* DD *26.05m:* J, 15°, PL, SM, VN, CN
	26.25m: UW, light grey and grey, SILTSTONE. Very weak, well cemented.				*26.22m:* J, 11°, PL, SM, VN, CN
	26.37m: UW, grey, Carbonaceous SANDSTONE. Very weak, fine to medium grained.				*26.41m:* DD, CN *26.45m:* DD
	26.42m: UW, grey speckled light grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to coarse grained.	HQ3	100	87	*26.65m:* DD *26.71m:* DD *26.83m:* DD *26.98m:* DD *27.00-27.16m:* J, 85°, PL, SM, VN, CN *27.15-27.41m:* J, 72°, PL, SM, VN, CN *27.42m:* DD *27.53m:* DD *27.55m:* DD *27.67m:* DD
	28.08m: CORE LOSS - Suspect washed out.	HQ3	79	35	*28.04m:* DD
	28.50m: UW, grey, SANDSTONE. Extremely weak to very weak, poorly cemented to moderately cemented, fine to coarse grained, [Recovered as].	HQ3	100	21	*28.54m:* DD *28.75-28.90m:* DD (x8)
	28.87m: UW; grey; Carbonaceous SANDSTONE; Extremely weak. Fine to medium grained.				
	28.93m: UW; grey; SANDSTONE; Very weak, poorly cemented to moderately cemented. Fine to medium grained.				*29.05m:* DD
	29.82 - 30.00m: UW. Extremely weak.	HQ3	100	100	*29.25m:* J, 45°, PL, SM, CN *29.39m:* DD *29.52m:* J, 18°, PL, SM, VN, CN *29.61m:* DD *29.72m:* J, 12°, PL, SM, VN, CN *29.82m:* DD
	30m: END OF BOREHOLE				

Box 8, 23.05-26.35m
Box 9, 26.35-29.55m
Box 10, 29.55-30.00m

COMMENTS: Hole dry on morning of 26/03/2021. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

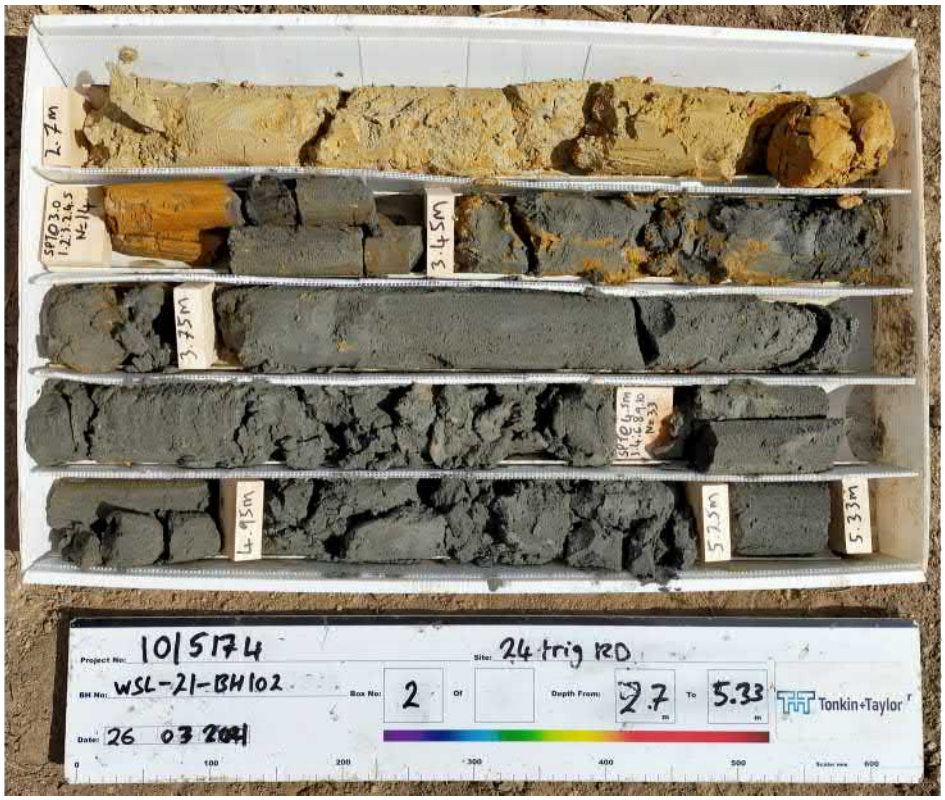
General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH102**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925411.61 mN 1745162.27 mE	DRILL TYPE:	HOLE STARTED: 25/03/2021
R.L.:	20.90m	DRILL METHOD: RC	HOLE FINISHED: 30/03/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: ROM

0.00-2.70m



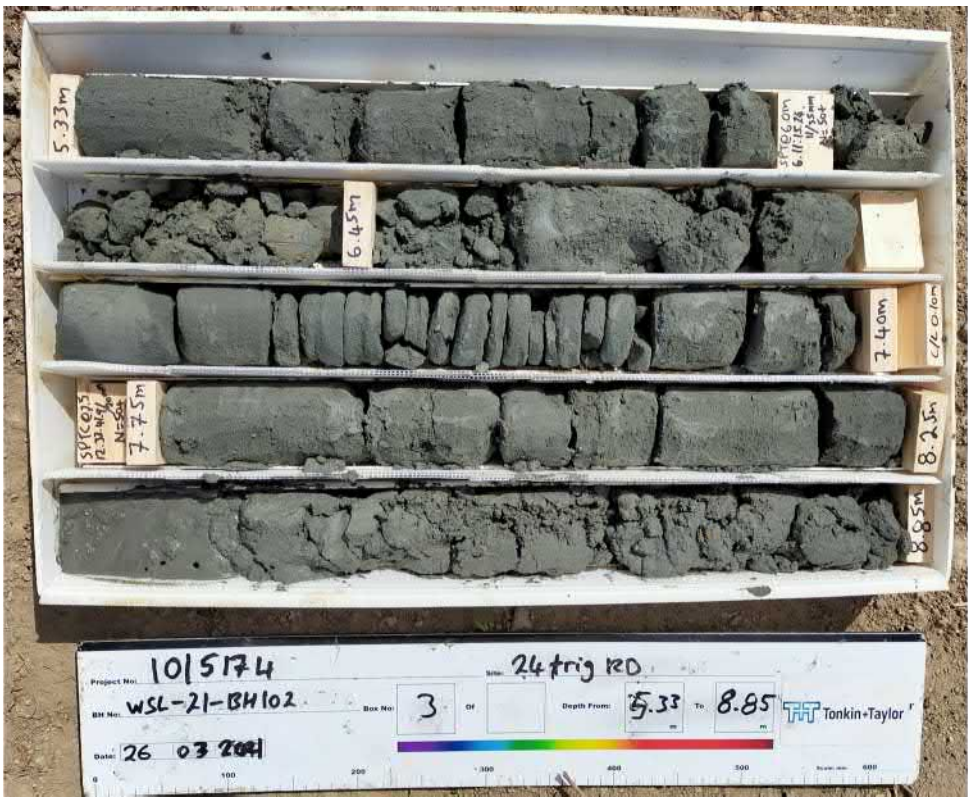
2.70-5.33m

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH102**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925411.61 mN 1745162.27 mE	DRILL TYPE:	HOLE STARTED: 25/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 30/03/2021
R.L.:	20.90m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AIDM CHECKED: ROM



5.33-8.85m

8.53-12.75m

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH102**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925411.61 mN 1745162.27 mE	DRILL TYPE:	HOLE STARTED: 25/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 30/03/2021
R.L.:	20.90m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AIDM CHECKED: ROM

12.75-16.50m

16.50-19.80m

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH102**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925411.61 mN 1745162.27 mE	DRILL TYPE:	HOLE STARTED: 25/03/2021
R.L.:	20.90m	DRILL METHOD: RC	HOLE FINISHED: 30/03/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AIDM CHECKED: ROM

19.80-23.05m

23.05-26.35m

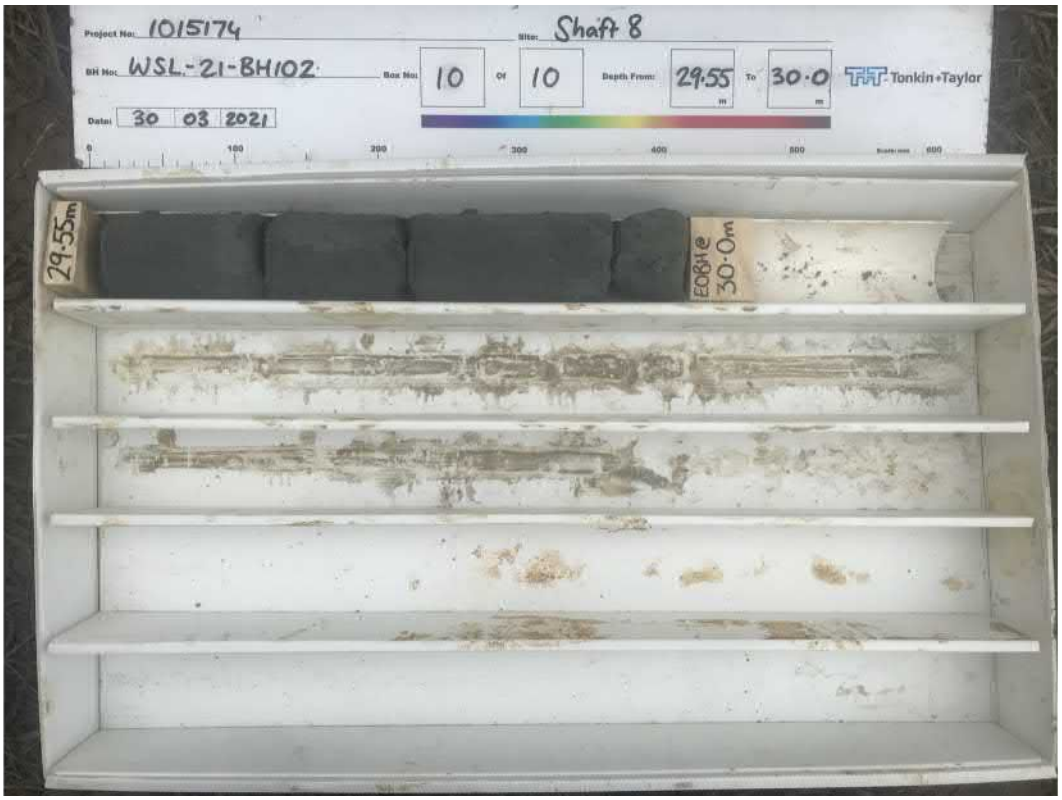
General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH102**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925411.61 mN 1745162.27 mE	DRILL TYPE:	HOLE STARTED: 25/03/2021
		DRILL METHOD: RC	HOLE FINISHED: 30/03/2021
R.L.:	20.90m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AIDM CHECKED: ROM

26.35-29.55m



29.55-30.00m

General Log - DESX005 - Fix RQD - 16/12/2021 4:57:18 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH103

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925401.04 mN, 1745152.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.66m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 09/04/2021
FINISH DATE: 13/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* CORE LOSS: sandy SILT; light brown spotted orange. Firm, moist, low plasticity. Sand, fine. Fill, bitumen. [FILL].			HA	0		21	0.5										
	0.20m: Sandy SILT, minor clay, trace gravel; brownish orange mottled orange. Firm to stiff, moist, medium plasticity. Sand, fine; gravel, fine, sub-angular to angular, sandstone. [FILL].							1.0										
	1.20 - 1.25m: Grey speckled orange.			HQ3	100			1.5								HWT (HD:3.00m)		
	1.35m: Sandy SILT, trace gravel; brownish orange mottled orange. Firm to stiff, moist, medium plasticity. Sand, fine; gravel, fine, sub-angular to angular, sandstone. [FILL].			SPT	33	0/- kPa SV test failed 2/2 2/3 4/3 **N=12**	20											
	1.55 - 1.65m: Some gravel. Gravel, fine to coarse, angular, Aggregate.																	
Tauranga Group	*1.95m:* Sandy SILT; brownish orange mottled orange. Firm to stiff, moist, medium plasticity. Sand, fine.			HQ3	143			2.0										
	2.05 - 2.82m: Light brown mottled orange.							2.5										
	2.82m: Silty SAND; brown. Medium dense, moist. Sand, fine.						19											
	3.00 - 3.38m: Light brown mottled orange.			SPT	84	191/33 kPa 2/4 4/4 5/5 **N=18**		3.0							14/04/2021 12/04/2021 13/04/2021			
	3.38m: CORE LOSS. Suspect material dropped out of SPT.																	
East Coast Bays Formation	*3.45m:* CW, grey, Silty SANDSTONE. Extremely weak, Recovered as Silty SAND; grey. Medium dense, moist. Sand, fine. Remoulds to Sandy Silt High Plasticity.			HQ3	65		18	3.5										
	4.05m: HW, grey, Silty SANDSTONE. Extremely weak (medium dense), fine to medium grained, Recovered as Silty SAND; grey. Medium dense, moist, poorly graded.							4.0										
	4.13m: CORE LOSS - Suspect washed out.																	
	4.50m: HW, grey, SANDSTONE. Extremely weak (medium dense), poorly cemented, fine to medium grained, Recovered as SAND, some silt; grey. Medium dense, moist, poorly graded; fine to medium.			SPT	100	UTP 2/4 5/6 7/10 **N=28**	17	4.5										Box 1, 0.00-3.45m

COMMENTS: Packer testing undertaken between 13.0 - 20.25 m bgl & 9 - 30 m bgl. VWP installed at approximately17.0 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:08 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH103

SHEET: 2 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925401.04 mN (NZTM2000) 1745152.58 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.66m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 09/04/2021
FINISH DATE: 13/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.00m:* HW, grey, SANDSTONE. Extremely weak (medium dense), poorly cemented, fine to medium grained, Recovered as SAND, some silt; grey. Medium dense, moist, poorly graded; fine to medium [CONT].																	
	5.40m: MW, grey, SANDSTONE. Extremely weak (very dense), fine to medium grained, Recovered as SAND, some silt; grey. Medium dense, moist, poorly graded; fine to medium			HQ3	66		16	5.5										
	5.65m: CORE LOSS - Suspect washed out.							6.0										
	6.00m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to coarse grained, Recovered as SAND, some silt; grey. Very dense, moist, poorly graded; fine to coarse.			SPT	100	7/12 18/20 12 for 40mm **N>=50**												
	6.60m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			HQ3	100		15	6.5				100						
	6.83 - 6.85m: UW; dark grey; SILTSTONE; Very weak, well cemented.			HQ3	67			7.0				13	*6.83m:* J, 36°, PL, SL, VN, CN *6.87m:* DD *6.97-7.03m:* J, 90°, PL, R, VN, CN *6.97m:* DD *7.03m:* DD *7.10m:* J, 58°, PL, R, VN, CN *7.18m:* J (x2), 32°, PL, R, CN, 2 conjugate fractures					Box 2, 3.45-7.15m
	7.25m: CORE LOSS - Suspect washed out.							7.5										
	7.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	12/38 for 75mm **N>=50** Solid	14											
	7.65m: UW, grey, SANDSTONE. Weak, moderately cemented, fine to medium grained. *7.65 - 7.70m:* UW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained, moist locally wet, Recovered as coarse GRAVEL of sandstone.			HQ3	100			8.0				100	*7.84m:* BF, 28°, PL, SM, VN, CN *7.85m:* DD *8.11m:* DD *8.18m:* DD					
	9.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	12/38 for 75mm **N>=50** Solid		9.0										
	9.15m: UW, grey, SANDSTONE. Weak, moderately cemented, fine to medium grained.			HQ3	96		13	8.5				96	*8.78-9.00m:* J, 65°, PL, R, VN, CN					
	9.30m: UW, grey, SANDSTONE. Weak, moderately cemented, fine to coarse grained.							9.5				85	*9.15-9.27m:* J, 85-90°, PL, R, VN, CN *9.27m:* DD *9.72m:* DD					
							12											

COMMENTS: Packer testing undertaken between 13.0 - 20.25 m bgl & 9 - 30 m bgl. VWP installed at approximately17.0 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH103

SHEET: 3 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925401.04 mN, 1745152.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.66m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 09/04/2021
FINISH DATE: 13/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* UW, grey, SANDSTONE. Weak, moderately cemented, fine to coarse grained, [CONT].			HQ3	85							85	*10.05m:* DD					
	10.30m: CORE LOSS - Suspect washed out.																	
	10.50m: UW, grey, SANDSTONE. Weak, moderately cemented, fine to coarse grained.			HQ3	94		11	10.5				83	*10.54m:* DD *10.55m:* DD					Box 3, 7.15-10.70m
	10.55m: UW, grey, SANDSTONE. Weak, moderately cemented, fine to medium grained.							11.0					*10.95m:* J, 12°, PL, R, VN, CN *10.99m:* J, 40°, PL, SM, CN *11.00-11.05m:* J, 78°, PL, SM, CN					
	11.30 - 12.00m: UW. Very weak.						10	11.5					*11.15m:* DD *11.23m:* DD *11.23-11.30m:* J, 95°, ST, SM, VN, CN *11.35m:* DD *11.38m:* DD *11.55m:* DD *11.71m:* DD					
	12.15 - 12.50m: UW. Very weak.			HQ3	77			12.0				57	*12.12m:* DD *12.30m:* DD *12.36m:* DD					
	12.50 - 12.53m: SILT; grey. Very stiff, moist, low plasticity. Sensitive.						9	12.5					*12.44-12.50m:* J, 12°, PL, SM, VN, CN *12.55m:* J, 28°, PL, R, VN, CN					
	12.58m: CORE LOSS - Suspect washed out.												*12.68m:* DD					
	12.75m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			HQ3	116			13.0				59	*12.75m:* DD *12.85m:* DD *12.75 - 13.70m:* 0.17 m of core loss recovered from previous core run					
	13.25 - 13.35m: UW. Uncemented, interbedded layers recovered as Silty SAND, grey speckled yellow. Very dense, moist, poorly graded. 5 to 80mm thick.						8	13.5										
	13.35m: UW, grey speckled yellow, SANDSTONE. Extremely weak (very dense), uncemented, fine to medium grained, (Recovered as SAND. Very dense).																	
	13.55m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.																	
	13.70m: UW, grey, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained, (Recovered as SAND, grey. Very dense, moist, poorly graded)..			HQ3	100	BH103_S2 @ 13.90m UW SANDSTONE Sample description from target		14.0				0	*14.11m:* J, 65°, PL, SM, VN, CN					Box 4, 10.70-13.70m
	13.80m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.						7	14.5					*14.33-14.39m:* J, 55°, PL, SM, VN, CN *14.38-14.50m:* J, 72°, PL, SM, VN, CN *14.54m:* J, 50°, PL, SM, VN, CN *14.55-14.70m:* DD, drilling induced due to poor rock cementation					
	13.92m: UW, grey speckled white, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained, (Recovered as SAND, Very dense).																	
	14.05m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained.																	
	14.13m: UW, grey, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained, (Recovered as SAND, grey. Very dense, moist, poorly graded).																	
	14.35m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained.																	
	14.70m: CORE LOSS - Suspect washed out.																	

COMMENTS: Packer testing undertaken between 13.0 - 20.25 m bgl & 9 - 30 m bgl. VWP installed at approximately17.0 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH103

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925401.04 mN, 1745152.58 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.66m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 09/04/2021

FINISH DATE: 13/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.	UW SW MW HW CW DW	ES VS S MS W VW EW	SPTS	100	19/31 for 20mm **N>=50**	6	15.5										
				HQ3	115							98	*15.42m:* DD *15.57m:* DD *15.61-15.73m:* J (x2), 45-72°, UN, SM, VN, CN, 2 conjugate fractures *15.75-15.88m:* DD *15.80m:* DD					
	16.15m: CORE LOSS - Confirmed material left in bottom of hole, washed out on subsequent run.			HQ3	53			16.0				37	*16.05-16.15m:* J, 80-85°, PL, SM, VN, CN *16.50 - 17.25m:* Driller noted that prior to each drill run, the drill tube seats approx 50mm higher than the expected depth, potentially due to downhole collapse or ingress of poorly cemented sands					
	16.50m: UW, grey speckled red, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.			HQ3	87	BH103_S1 @ 16.85m UW SANDSTONE Sample description from target HQ3 @ 16.85m	5	16.5				75	*16.50-16.61m:* J, 62°, PL, SM, VN, CN *16.68-16.81m:* J, 62°, PL, R, VN, CN *16.75m:* DD					Box 5, 13.70-16.85m
	17.15m: CORE LOSS - Suspect washed out.							17.0					*17.03m:* DD *17.11m:* DD					
	17.25m: UW, grey, Conglomeratic SANDSTONE. Weak, moderately cemented, fine to coarse, subrounded gravel-sized sandstone & siltstone clasts.			HQ3	87	B21-1605 @ 17.27m UW SANDSTONE Goodrich Drillability;	4	17.5				28	*17.40-17.45m:* J, 72°, UN, R, VN, CN *17.57-17.73m:* DD, PL, SM, VN, CN, Drilling induced fracturing					
	17.72m: UW, grey, SANDSTONE. Extremely weak to very weak, moderately cemented, fine to medium grained. *17.80 - 17.83m:* UW, grey, Sandy SILTSTONE. Extremely weak (hard).												*17.75m:* BF, 22°, PL, SM, VN, CN *17.79m:* BF, 22°, PL, SM, VN, CN *17.90m:* BF, 28°, PL, SM, VN, CN					
	17.90m: CORE LOSS - Suspect washed out.							18.0										
	18.00m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. *18.15 - 18.20m:* UW, grey, Sandy SILTSTONE. Very weak, moderately cemented to well cemented.			HQ3	87		3	18.5				41	*18.00-18.06m:* DD *18.20m:* DD *18.25m:* DD *18.32m:* DD *18.44m:* BF, 22°, PL, SM, VN, CN *18.56m:* DD					
	18.65m: CORE LOSS - Suspect washed out.																	
	18.75m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. *19.32 - 19.35m:* UW; grey; SILTSTONE; Very weak, moderately cemented to well cemented.			HQ3	80			19.0				64	*18.75-19.03m:* DD, Drilling induced fracturing *19.27m:* DD					
	19.35m: CORE LOSS - Suspect washed out.							19.5										
	19.50m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. *19.50 - 19.52m:* UW; grey; SILTSTONE; Very weak, moderately cemented to well cemented. *19.67 - 19.71m:* UW; grey; SILTSTONE; Very weak, moderately cemented to well cemented. *19.80 - 20.00m:* UW. Fine to coarse grained.						2					100	*19.50m:* DD *19.65m:* DD *19.69m:* BF, 30°, PL, SM, VN, CN *19.75m:* DD					

COMMENTS: Packer testing undertaken between 13.0 - 20.25 m bgl & 9 - 30 m bgl. VWP installed at approximately17.0 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH103

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925401.04 mN, 1745152.58 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.66m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 09/04/2021
FINISH DATE: 13/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, SANDSTONE. Very weak, moderately cemented, fine to coarse grained, [CONT].	UW SW MW HW CW DW	ES VS S MS W VW EW	HQ3	100		20.5				100						
	20.30m: UW, grey, SANDSTONE. Weak, well cemented, fine to coarse grained.			HQ3	100		21.0				93	*20.38m:* DD *20.60m:* DD *20.77-20.83m:* BZ					
	21.10m: UW, grey, SANDSTONE. Extremely weak to very weak, moderately cemented, fine to medium grained. *21.22 - 21.26m:* UW. Extremely weak (very dense). *21.26 - 21.33m:* UW; grey; SILTSTONE; Very weak, moderately cemented to well cemented. *21.33 - 21.36m:* UW. Extremely weak (very dense). *21.40 - 21.46m:* UW. Extremely weak (very dense).			HQ3	69		21.5				29	*21.17m:* DD *21.22-21.25m:* DD, Drilling induced fracturing *21.25m:* BF, 28°, PL, SM, VN, CN *21.33-21.36m:* DD, Drilling induced fracturing *21.40-21.46m:* DD, Drilling induced fracturing					
	21.52m: CORE LOSS - Suspect washed out.																
	21.75m: UW; grey; SANDSTONE; Very weak to weak, moderately cemented. Fine to coarse grained.			HQ3	99		22.0				88	*21.85m:* DD					
	22.23m: UW; grey; distinctly bedded; SANDSTONE; Weak, moderately cemented. Fine to medium grained. 1 to 30mm thick INTERBEDDED WITH: UW; dark grey; distinctly bedded; SILTSTONE; Weak. 1 to 20mm thick.						22.5					*22.20m:* BF, 22°, PL, SM, VN, CN *22.26m:* BF, 28°, PL, R, CN *22.39m:* DD *22.50m:* BF, 28°, PL, R, , CN *22.54m:* DD					
				HQ3	89						80	*22.78m:* BF, 25°, UN, SM, CN					
							23.0					*23.04m:* DD					Box 7, 20.10-23.17m
	23.17m: CORE LOSS - Suspect washed out.																
	23.25m: UW; grey; distinctly bedded; SANDSTONE; Weak, moderately cemented. Fine to coarse grained. 1 to 5mm thick INTERBEDDED WITH: UW; dark grey; distinctly bedded; SILTSTONE; Weak. 1 to 20mm thick.						23.5				8	*23.46m:* DD					
	23.45m: UW, grey, SANDSTONE. Weak, moderately cemented, fine to medium grained.			HQ3	100							*23.66m:* DD *23.81m:* DD *23.86m:* DD					
	24.10m: UW; grey; distinctly bedded; SANDSTONE; Weak, moderately cemented. Fine to coarse grained. 100 to 250mm thick INTERBEDDED WITH: UW; dark grey; distinctly bedded; SILTSTONE; Weak. 10 to 80mm thick.						24.0					*24.04m:* DD					
							24.5				76	*24.17-24.23m:* BZ *24.26-24.37m:* BZ *24.53-24.58m:* J, 35-40°, UN, R, VN, CN *24.59m:* BF, 32°, PL, R, VN, CN *24.61m:* DD *24.67m:* DD *24.84m:* DD *24.92m:* DD					

COMMENTS: Packer testing undertaken between 13.0 - 20.25 m bgl & 9 - 30 m bgl. VWP installed at approximately17.0 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH103

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925401.04 mN, 1745152.58 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.66m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 09/04/2021

FINISH DATE: 13/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.11m:* UW; grey; distinctly bedded; SANDSTONE; Weak, moderately cemented. Fine to medium grained. 1 to 30mm thick INTERBEDDED WITH: UW; dark grey; distinctly bedded; SILTSTONE; Weak. 1 to 20mm thick.	UW SW MW HW CW	ES VS S MS W VW EW	HQ3	100		-4	25.5			2000 600 200 60 20	76	*25.09m:* BF, 25°, PL, SM, VN, CN *25.21m:* DD *25.34m:* BF, 22°, PL, SM, VN, CN *25.43m:* BF, 24°, PL, SM, VN, CN	25 50 75				
	25.92m: UW, grey speckled white, SANDSTONE. Weak, moderately cemented, fine to coarse grained. *26.32 - 26.40m:* UW; grey speckled white; Conglomeratic SANDSTONE; Weak, well cemented. Fine to coarse grained; fine to medium, sub-rounded gravel-sized siltstone clasts.			HQ3	90			26.0				60	*25.58m:* BF, 28°, PL, SM, VN, CN *25.59m:* DD *25.62-25.65m:* BZ *25.62m:* BF, 28°, PL, SM, VN, CN, Clay on joint surface *25.65m:* BF, 28°, PL, SM, VN, CN, Clay on joint surface *25.69m:* BF, 28°, PL, SM, VN, CN *25.73m:* BF, 25°, PL, SM, VN, CN *25.74m:* BF, 25°, PL, SM, VN, CN *25.78m:* DD *25.95m:* DD *25.96m:* DD					Box 8, 23.17-26.10m
	26.48m: UW, dark grey, indistinctly bedded, SILTSTONE. Weak. 1 to 60mm thick. INTERBEDDED WITH: UW, grey, distinctly bedded, SANDSTONE. Weak, moderately cemented, fine to coarse grained. 1 to 10mm thick.						-5	26.5					*26.45m:* BF, 25°, PL, R, VN, CN *26.53-26.57m:* BZ *26.57-26.68m:* J, 72°, PL, SM, VN, CN *26.75m:* DD					
	26.85m: CORE LOSS - Suspect washed out.							27.0										
	27.00m: UW, dark grey, indistinctly bedded, SILTSTONE. Weak. 1 to 60mm thick. INTERBEDDED WITH: UW, grey, distinctly bedded, SANDSTONE. Weak, moderately cemented, fine to coarse grained. 1 to 10mm thick. *27.33 - 27.36m:* UW, grey, SILTSTONE. Extremely weak to very weak, Decomposed. *27.38 - 27.42m:* UW, grey, SILTSTONE. Extremely weak to very weak, Decomposed. *27.45 - 27.60m:* UW; grey speckled white; Conglomeratic SANDSTONE; Weak, well cemented. Fine to coarse grained; fine to medium, sub-rounded gravel-sized siltstone clasts.			HQ3	100		-6	27.5				85	*27.08m:* DD *27.33-27.37m:* BZ *27.33m:* J, 18°, PL, SM, VN, CN *27.37m:* J, 32°, PL, SM, VN, Clay on joint surface *27.42m:* J, 35°, PL, SM, VN, Clay on joint surface *27.42-27.45m:* BZ *27.45m:* DD *27.63m:* J, 45°, UN, R, CN *27.66m:* J, 18°, ST, R, CN					
	28.15m: UW; grey; distinctly bedded; SANDSTONE; Very weak, moderately cemented. Fine to coarse grained. 130 to 160mm thick INTERBEDDED WITH: UW; dark grey; indistinctly bedded; Sandy SILTSTONE; Very weak. 130mm thick.			HQ3	100		-7	28.0				31	*28.04m:* J, 28°, PL, SM, VN, Sandy silt on joint surface *28.14-28.21m:* BZ *28.14m:* J, 40°, PL, SL, VN, Silt on joint surface *28.20m:* J, 45-60°, PL, SL, VN, Silt on joint surface					
	28.50m: UW, grey, SANDSTONE. Very weak to weak, moderately cemented, fine to medium grained.							28.5					*28.27-28.45m:* BZ *28.45m:* J, 40-72°, PL, SM, VN, Sandy silt on joint surface *28.50m:* J, 40-72°, ST, R *28.74m:* DD					Box 9, 26.10-29.10m
				HQ3	100		-8	29.0				100	*29.42m:* DD					Box 10, 29.10-30.00m
	30m: END OF BOREHOLE							29.5										

COMMENTS: Packer testing undertaken between 13.0 - 20.25 m bgl & 9 - 30 m bgl. VWP installed at approximately17.0 m bgl. Drilling induced fractures have not been included in the fracture spacing. Shear vane testing has been undertaken in soils exposed at the end of the core barrel

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH103**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925401.04 mN 1745152.58 mE	DRILL TYPE:	HOLE STARTED: 09/04/2021
R.L.:	21.66m	DRILL METHOD: RC	HOLE FINISHED: 13/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

0.00-3.45m

3.45-7.15m

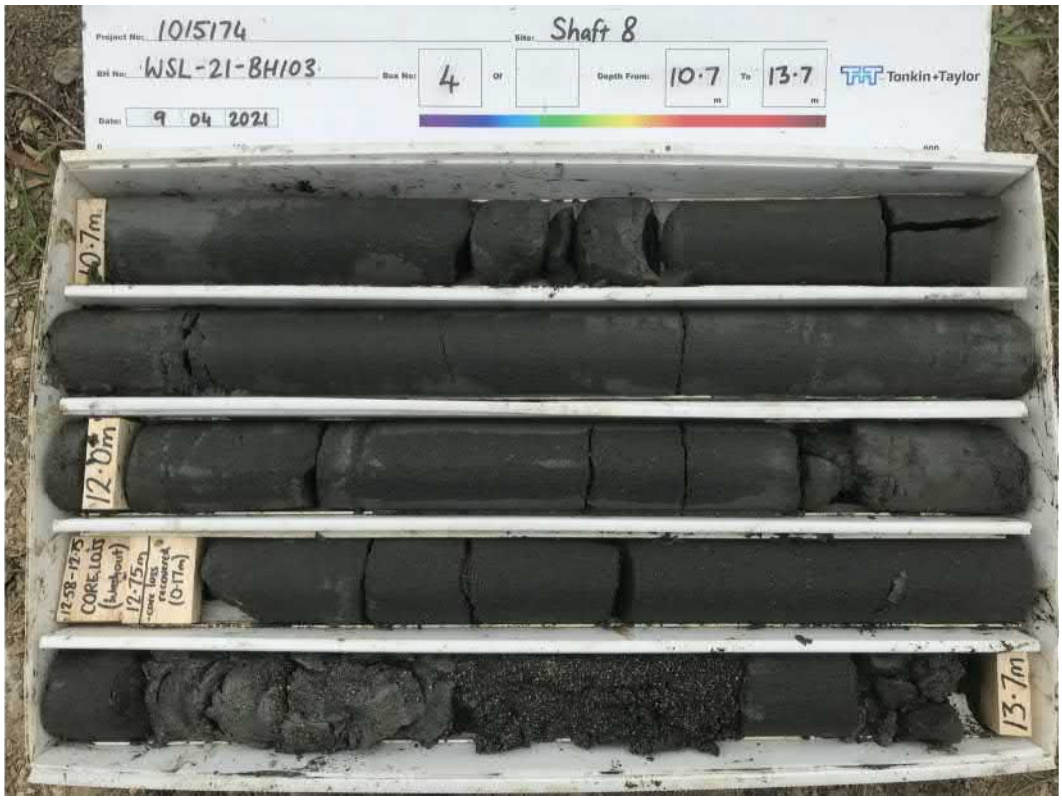
General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH103**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5925401.04 mN 1745152.58 mE	DRILL TYPE:	HOLE STARTED: 09/04/2021	
R.L.: 21.66m	DRILL METHOD: RC	HOLE FINISHED: 13/04/2021	
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling	
		LOGGED BY: ROM	CHECKED: FLRU

7.15-10.70m



10.70-13.70m

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH103**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925401.04 mN 1745152.58 mE	DRILL TYPE:	HOLE STARTED: 09/04/2021
		DRILL METHOD: RC	HOLE FINISHED: 13/04/2021
R.L.:	21.66m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

13.70-16.85m

16.85-20.10m

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH103**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925401.04 mN 1745152.58 mE	DRILL TYPE:	HOLE STARTED: 09/04/2021
		DRILL METHOD: RC	HOLE FINISHED: 13/04/2021
R.L.:	21.66m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

20.10-23.17m

23.17-26.10m

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH103**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925401.04 mN 1745152.58 mE	DRILL TYPE:	HOLE STARTED: 09/04/2021
R.L.:	21.66m	DRILL METHOD: RC	HOLE FINISHED: 13/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

26.10-29.10m

29.10-30.00m

General Log - DESX005 - Fix RQD - 8/12/2021 10:26:09 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH104

SHEET: 1 OF 5

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925502.74 mN 1745273.48 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.36m
R.L. COLLAR: 21.36m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 04/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Hand auger - sample not recovered.			HA	0	MC PSD AL	21	0.5							03/06/2021			
	1.20m: Sandy SILT, some clay; brown mottled orange. Very stiff, moist, medium plasticity. Sand, fine. (FILL).			HQTT	100	UTP	20	1.0										
	1.55m: No recovery - rock obstruction.			SPTS	11	1/0 1/1 0/1 **N=3**		1.5										
	1.95m: SILT, some clay, minor gravel; grey. Stiff, moist, medium to high plasticity. Gravel, coarse, angular. (FILL).			HQTT	57		19	2.0										
	2.15m: Clayey SILT; light brown mottled light grey. Very stiff, moist, medium plasticity. (FILL).																	
	2.30m: SILT, some clay, minor gravel; light brown mottled light grey. Stiff, moist, medium to high plasticity. Gravel, coarse, angular. (FILL).							2.5										
	2.55m: CORE LOSS. Rock obstruction.																	
	3.00m: SILT, minor clay; brown. Stiff, moist, medium to high plasticity. (FILL).			SPTS	22	1/0 1/0 1/1 **N=3**	18	3.0								PQ3		
	3.10m: NO RECOVERY. Rock obstruction.																	
	3.45m: SILT, some clay, minor gravel; light brown mottled light grey. Stiff, moist, medium to high plasticity. Gravel, coarse, angular. (FILL).			HQTT	19			3.5										
	3.65m: CORE LOSS. Geocloth obstruction.																	
	3.64 - 3.65m: Geocloth.																	
	4.50m: Clayey SILT; grey. Firm, moist, medium to high plasticity. (FILL).			SPTS	78	1/1 1/0 1/1 **N=3**	17	4.0							04/06/2021			
	4.50 - 4.60m: Greenish grey.							4.5										
	4.85m: NO RECOVERY. Geocloth obstruction.																	

COMMENTS: Standpipe piezometer installed with screen interval at 8.00 - 13.00 m bgl.

Hole Depth 21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:47 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH104

SHEET: 2 OF 5

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925502.74 mN, 1745273.48 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.36m
R.L. COLLAR: 21.36m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 04/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*5.00m:* SILT, some clay; light brownish grey. Firm, moist, medium plasticity. (FILL). [CONT]. *5.10m:* CORE LOSS. Geocloth obstruction.			HQTT	10		16	5.5										
	6.00m: SILT, some clay; light brownish grey. Firm, wet, medium plasticity. (FILL). *6.10m:* NO RECOVERY. Geocloth obstruction.			SPTS	22	1/2 3/2 2/2 **N=9**	15	6.0										
	6.45m: SILT, minor clay; grey. Stiff, moist, medium to high plasticity. (FILL). High sensitivity. *6.60 - 6.65m:* Geocloth and trace wires. *6.70 - 6.80m:* Trace wires.			HQTT	100			6.5										
	6.80m: SILT, some sand, minor clay; light brown. Stiff, moist, medium to high plasticity. Sand, fine. (FILL). *6.80 - 6.82m:* Wet.							7.0										
	7.20m: SILT, some clay; light brown. Stiff, moist, high plasticity. (FILL). *7.25m:* SILT, some sand, minor clay; light brown. Stiff, moist, medium to high plasticity. Sand, fine. (FILL).						14	7.5										
	7.50m: Sandy SILT, minor clay; light brown. Stiff, moist, medium to high plasticity. Sand, fine to medium. (FILL). Trace carbonaceous material. *7.95 - 8.20m:* Trace wires. *8.20 - 8.22m:* Synthetic fibrous material..			SPTS	56	● 64/3 kPa 1/2 2/1 2/2 **N=7**		8.0										
Tauranga Group	*8.25m:* SILT, some sand, minor clay; light brown. Firm to stiff, moist, medium to high plasticity. Sand, fine. Trace carbonaceous material.			HQTT	100		13	8.5										
	8.65m: Sandy SILT, minor clay; light brown. Firm to stiff, moist, medium to high plasticity. Sand, fine. Trace carbonaceous material.							9.0										
	8.95m: Silty SAND, minor clay; light grey. Dense, moist. Sand, fine to medium.			SPTS	100	● 52/14 kPa 1/1 1/1 1/1 **N=4**												
	9.35m: Sandy SILT, minor clay; light brownish grey. Firm to stiff, moist, medium to high plasticity. Sand, fine. Trace carbonaceous material.						12	9.5										
	9.90m: Silty SAND, minor clay; light brown. Dense, moist. Sand,			HQTT	100													

Box 1, 0.00-7.20m

COMMENTS: Standpipe piezometer installed with screen interval at 8.00 - 13.00 m bgl.

Hole Depth 21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH104

SHEET: 3 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925502.74 mN, 1745273.48 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.36m
R.L. COLLAR: 21.36m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 04/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Tauranga Group	*10.15m:* Sandy SILT, minor clay; light brown. Stiff, moist, medium to high plasticity. Sand, fine. Trace carbonaceous material.	HQTT	100		11	
	10.25m: Silty SAND, some gravel, minor clay; grey. Dense, moist. Sand, fine to medium; gravel, fine, sub-rounded to sub-angular, lenses 10cm thick, Remoulds to Sandy Silt, medium plasticity.			● 51/14 kPa		10.5
	10.25 - 10.90m: Fine to medium grained.	SPTS	100	1/1 1/2 3/3 **N=9**		
East Coast Bays Formation	*11.55m:* CW, grey, SANDSTONE. Extremely weak, uncemented, fine grained, moist, Recovered as:Silty SAND, some clay; brownish grey. Medium dense, moist. Sand, fine. Remoulds to Sandy Silt, High plasticity.	HQTT	100		10	11.0
	12.05m: NO RECOVERY. Geocloth obstruction from above caught in spool.	SPTS	22	1/3 4/4 4/3 **N=15**		11.5
	12.45m: CW, light brown, SILTSTONE. Extremely weak, moist, Recovered as SILT, some clay, minor sand; light brown. Stiff, moist, high plasticity. Sand, fine.			ASS/pH @ 12.00m Field measured pH 7	9	12.0
	12.55m: CW, grey, SANDSTONE. Extremely weak, uncemented, moist, Recovered as Silty SAND, minor clay; grey. Medium dense, moist. Sand, fine. Remoulds to Sandy Silt, high plasticity.			PSD MC AL		12.5
	12.65 - 12.75m: Synthetic fibrous material dragged in from above.	HQTT	100			13.0
	13.05m: CW, light brown, SILTSTONE. Extremely weak, moist, Recovered as Clayey SILT; light brown. Stiff, moist, high plasticity.				8	
	13.10m: HW, brownish grey, SANDSTONE. Extremely weak, poorly cemented, Recovered as SAND, some silt; brownish grey. Medium dense, moist. Sand, fine.	SPTS	100	3/4 5/5 8/8 **N=26**		13.5
	13.95m: Core Loss - Loose sand washed away.					14.0
	14.20m: MW, grey, SANDSTONE. Extremely weak, well cemented, fine to coarse grained, moist, Recovered as SAND, some silt; grey. Very dense, moist. Sand, fine to coarse.	HQTT	76		7	
	14.35m: SW, grey, SILTSTONE. Extremely weak, moist, Recovered as Clayey SILT; grey. Hard, moist, low plasticity.					14.5
	14.40m: UW, grey, SANDSTONE. Extremely weak, moderately cemented, fine grained, moist, Recovered as SAND, some silt; grey. Very dense, moist. Sand, fine.					

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Fluid Loss (%) (25, 50, 75); Water Level; Casing; Installation; Core Box No

Box 2, 7.20-10.35m

Box 3, 10.35-13.50m

COMMENTS: Standpipe piezometer installed with screen interval at 8.00 - 13.00 m bgl.

Hole Depth 21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH104

SHEET: 4 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925502.74 mN 1745273.48 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.36m

R.L. COLLAR: 21.36m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie

LOGGED BY: AMHO

CHECKED: ROM

START DATE: 03/06/2021

FINISH DATE: 04/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.20m:* UW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: Clayey SILT; grey. Hard, moist, low plasticity.			SPTC	100	6/6 9/12 16/13 for 60mm **N>=50** Solid													
	15.30m: UW, grey, SANDSTONE. Extremely weak, moderately cemented, fine grained, moist. RECOVERED AS: SAND, some silt; grey. Very dense, moist. Sand, fine.																	
	15.55m: UW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: Clayey SILT; grey. Hard, moist, low plasticity.																	
	15.60m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.			HQTT	99	ASS/pH @ 16.00m Field measured pH 7		15.5										
	15.60 - 15.65m: UW. Fine grained.					BH104 @ 16.10m clayey SILT and SANDSTONE Sample description from sample		16.0										
	16.50m: NO RECOVERY. Solid cone SPT.			SPTC	0	24/25 for 25mm **N>=50** Solid		16.5										
	16.60m: CORE LOSS, Washout.																	Box 4, 13.50-16.60m
	16.65m: UW, grey, SANDSTONE. Very weak, fine and coarse grained, moist.			HQTT	96	UW SANDSTONE Splitting Tensile Strength (Mpa): B21-1607 @ 16.70m UW SANDSTONE Goodrich Drillability; BH104 @ 16.90m clayey SILT and SANDSTONE Sample description from sample		17.0				89	*16.71m:* J, 5°, UN, R, VN, CN *16.90-16.93m:* J, 20°, UN, R, VN, CN *16.97m:* J, 5°, UN, R, VN, CN *17.24m:* J, 5°, UN, R, VN, CN *17.43m:* DD *17.48m:* DD *17.51m:* J, 2°, UN, R, VN, CN *17.85m:* DD *17.94m:* J, 0°, UN, R, VN, CN					
	18.00m: NO RECOVERY. Solid cone SPT.			SPTC	0	25/25 for 40mm **N>=50** Solid		18.0										
	18.12m: CORE LOSS. Washout.																	
	18.35m: UW, grey, SANDSTONE. Very weak, fine to medium grained, moist. *18.53 - 18.70m:* UW. Fine to coarse grained.			HQTT	83			18.5				82	*18.35m:* J, 0°, UN, R, VN, CN *18.45m:* J, 0°, UN, R, VN, CN *18.53m:* DD *18.62m:* J, 0°, UN, R, VN, CN *18.75m:* DD *18.81m:* DD *18.90m:* DD					
	19.00m: UW, grey, SANDSTONE. Very weak, moist, fine to coarse, subrounded gravel-sized sandstone & siltstone clasts.							19.0					*19.11m:* J, 0°, UN, R, VN, CN					
	19.13m: UW, grey, SANDSTONE. Very weak, fine to medium grained, moist.												*19.13m:* J, 0°, PL-UN, R-SM, VN, Clay on joint					Box 5, 16.60-19.50m
	19.68 - 19.70m: UW, SILTSTONE. Very weak. *19.70 - 19.78m:* UW. Fine to coarse grained. *19.78 - 19.85m:* UW. Fine to medium grained. *19.85 - 20.04m:* UW. Fine to coarse grained.							19.5				90	*19.59m:* J, 0°, PL, SM, VN, Clay on joint *19.70m:* DD *19.79m:* J, 0°, PL, SM, VN, CN					

COMMENTS: Standpipe piezometer installed with screen interval at 8.00 - 13.00 m bgl.

Hole Depth 21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH104

SHEET: 5 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925502.74 mN 1745273.48 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.36m
R.L. COLLAR: 21.36m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 04/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm) (2000 600 200 60 20)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.04m:* UW, grey spotted white, SANDSTONE. Very weak, fine to coarse grained, moist. *20.04 - 20.30m:* UW. Weak, subrounded gravel-sized sandstone & siltstone clasts. *20.80 - 20.85m:* UW. Recovered as rounded, medium to coarse gravel sized SANDSTONE clasts. *20.85m:* CORE LOSS.	UW	ES VS S MS W VW EW	HQTT	90	B21-1608 @ 19.98m UW SANDSTONE Goodrich Drillability;	1 0 -1 -2 -3	20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5				90	*20.00m:* DD *20.21m:* DD *20.80m:* DD					Box 6, 19.50-21.00m
	21m: END OF BOREHOLE																	

COMMENTS: Standpipe piezometer installed with screen interval at 8.00 - 13.00 m bgl.

Hole Depth 21m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH104**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925502.74 mN 1745273.48 mE	DRILL TYPE:	HOLE STARTED: 03/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 04/06/2021
R.L.:	21.36m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

0.00-7.20m

7.20-10.35m

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH104**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5925502.74 mN 1745273.48 mE	DRILL TYPE:	HOLE STARTED: 03/06/2021	
R.L.: 21.36m	DRILL METHOD: RC	HOLE FINISHED: 04/06/2021	
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling	
		LOGGED BY: AMHO	CHECKED: ROM

10.35-13.50m

13.50-16.60m

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH104**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925502.74 mN 1745273.48 mE	DRILL TYPE:	HOLE STARTED: 03/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 04/06/2021
R.L.:	21.36m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

16.60-19.50m

19.50-21.00m

General Log - DESX005 - Fix RQD - 16/12/2021 4:59:48 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH105

SHEET: 1 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925517.37 mN, 1745322.02 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.31m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James/Ben
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 08/06/2021
FINISH DATE: 09/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* SILT, some organics, minor clay; brown. Very stiff, moist. Organics, rootlets. [Fill].			HA	87		26	0.5										
				SPTS	100	122/31 kPa 1/0 1/1 1/1 **N=4**		1.0										
	1.95m: Clayey SILT; greyish brown. Firm, moist to wet, high plasticity. [Fill].						25	1.5										
	2.10m: SILT, some clay; brown mottled orange. Stiff, moist, high plasticity. [Fill].							2.0										
	2.25m: SILT, some organics, minor clay and minor sand, trace gravel; brown mottled dark brown, Blocky. Stiff, moist, low plasticity. Sand, fine to medium; gravel, medium. Organics, carbonaceous material. [Fill].			HQTT	67		24											
	2.65m: CORE LOSS - Suspect material dropped out of barrel.							2.5										
Tauranga Group	*3.00m:* Silty CLAY, trace organics and trace sand; brownish grey mottled orange. Firm to stiff, moist, high plasticity. Sand, fine. Organics, carbonaceous material.			SPT	100	1/0 1/1 2/2 **N=6**		3.0										
	3.85 - 4.35m: Sand content decreases.			HQTT	100	81/46 kPa	23	3.5										Box 1, 0.00-4.10m
	4.35m: Clayey SILT, some organics; light greyish brown streaked light orange. Soft to firm, moist, high plasticity. Organics, carbonaceous material.							4.0										
	4.50m: NOT LOGGED - Push tube sealed prior to logging.			PT	100	28/21 kPa	22	4.5										

COMMENTS: Straddle packer test undertaken at 16 - 22.5 m.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:29 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH105

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis	CO-ORDINATES: (NZTM2000) 5925517.37 mN 1745322.02 mE	R.L. GROUND: 26.31m
JOB No.: 1015174.0000.02	DIRECTION: 180°	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: James/Ben
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 08/06/2021
FINISH DATE: 09/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic clayey SILT; dark brown mottled black. Firm, moist, high plasticity. Organics, carbonaceous material.			HQTT	100	● 28/6 kPa	21	5.5										
	5.25m: Organic clayey SILT; dark brown mottled black. Soft to firm, wet, high plasticity. Organics, carbonaceous material.																	
	5.35m: Organic silty SAND; light greyish brown streaked dark brown. Loose, moist. Sand, uniformly graded. Organics, carbonaceous material.																	
	5.45m: Organics clayey SILT; dark brown mottled black. Soft, wet, high plasticity. Organics, carbonaceous material.																	
	5.75m: Clayey silty SAND; light grey mottled dark brownish black. Loose, moist. Sand, uniformly graded.							6.0										
	6.00m: CORE LOSS - Suspect washed out.			SPT	100	2/1 1/1 1/0 **N=3**	20											
	6.25m: Clayey silty SAND; light grey mottled dark brownish black. Loose, moist. Sand, uniformly graded.							6.5										
	6.40m: Organic silty CLAY; dark brown mottled black. Stiff, moist, high plasticity. Organics, carbonaceous material.			HQTT	100													
	6.95m: Organic silty CLAY, minor sand; brownish black. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous material.							7.0										
	7.70m: Organic silty CLAY; dark brown mottled brownish black. Firm to stiff, moist, high plasticity. Organics, carbonaceous material.			SPT	100	52/15 kPa 0/1 1/1 1/2 **N=5**	19	7.5										
	8.10m: SILT, some organics and some sand; grey mottled brownish black. Firm to stiff, moist, medium plasticity. Organics, carbonaceous material.			HQTT	100			8.0										
	9.00m: SILT, some organics and some clay; greenish grey mottled brownish black, Blocky. Firm to stiff, moist, medium plasticity. Organics, carbonaceous material.			SPT	100	89/15 kPa 1/1 2/2 2/2 **N=8**	18	8.5										
								9.0										
							17	9.5										

Box 2, 4.10-6.75m

Box 3, 6.75-9.85m

COMMENTS: Straddle packer test undertaken at 16 - 22.5 m.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH105

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925517.37 mN 1745322.02 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.31m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James/Ben
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 08/06/2021
FINISH DATE: 09/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* SILT, some organics and some clay; greenish grey mottled brownish black, Blocky. Stiff, moist, medium plasticity. Organics, carbonaceous material.			HQTT	100		16	10.5										
	10.10m: Silty CLAY, some organics; greyish brown mottled brownish black. Stiff, moist, high plasticity. Organics, carbonaceous material.			SPT	100	70/18 kPa 0/1 1/2 1/2 **N=6**		11.0										
				HQTT	100		15	11.5										
				SPT	100	83/28 kPa 0/1 2/1 1/2 **N=6**	14	12.0										
				HQTT	100			12.5										
	13.15m: Silty CLAY, some organics; greyish brown mottled brownish black. Stiff, moist, high plasticity. Organics, carbonaceous material. WITH ZONES OF: Silty SAND; greyish brown mottled brownish black. Loosely packed, moist.						13	13.0										Box 4, 9.85-13.20m
				SPT	100	58/28 kPa 1/1 1/2 2/3 **N=8**		13.5										
	14.35m: Organic SILT, some clay; greyish brown. Stiff, moist, medium plasticity. Organics, carbonaceous material. *14.55 - 14.80m:* Grading to light greyish brown.			HQTT	100		12	14.0										
	14.80m: Silty SAND; greyish brown. Dense, moist, medium plasticity.							14.5										

COMMENTS: Straddle packer test undertaken at 16 - 22.5 m.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH105

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925517.37 mN 1745322.02 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.31m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James/Ben
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 08/06/2021
FINISH DATE: 09/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* CW, brownish grey, SANDSTONE. Extremely weak, Recovered as SAND, trace silt; brownish grey. Very dense, moist. Sand, fine to medium. Remoulds to Sandy SILT, medium plasticity.			SPTS	99	8/8 10/12 20/10 for 20mm **N>=50**	11	15.5										
	15.43m: MW, brownish grey, SANDSTONE. Extremely weak (very dense), fine grained, Recovered as: Silty SAND; very dense, moist.			HQTT	100							100						
	15.80m: MW, brownish grey, SANDSTONE. Extremely weak, Recovered as: Silty SAND; very dense, moist.						10	16.0										
				SPTC	100	14/36 for 75mm **N>=50** Solid		16.5										Box 5, 13.20-16.50m
	16.65m: CORE LOSS - Suspect material dropped out of barrel.																	
	16.70m: SW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained.			HQTT	85		9	17.0				60	*17.10m:* J, UN, R-SM, VN					
								17.5					*17.60m:* J, PL, R-SM, VN *17.75m:* J, PL, R-SM, T					
				SPTC	100	30/37 for 75mm **N>=50** Solid		18.0										
	18.15m: CORE LOSS - Suspect material dropped out of barrel.						8											
	18.40m: SW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained.			HQTT	81			18.5				76	*18.47m:* DD/0° *18.58m:* DD/0°					
								19.0										
						B21-1609 @ 19.33m MW SANDSTONE Goodrich Drillability;	7	19.5				100	*19.71m:* DD/0° *19.72m:* DD/0° *19.82m:* DD/0° *19.87m:* DD/0°					

COMMENTS: Straddle packer test undertaken at 16 - 22.5 m.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH105

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925517.37 mN 1745322.02 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.31m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James/Ben
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 08/06/2021
FINISH DATE: 09/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* SW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained.	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	100	BH105 @ 20.20m uw f-m gr sst vw Sample description from sample; BH105 @ 20.73m uw f-c gr sst vw Sample description from sample	6	20.5			2000 600 200 60 20	100	*20.03m:* DD/0° *20.14m:* DD/0° *20.17m:* DD/0°	25 50 75				Box 6, 18.00-20.20m
	21.00m: CORE LOSS - Suspect material dropped out of barrel.							21.0										
	21.20m: SW, grey, SANDSTONE. Extremely weak to very weak, fine to medium grained.					B21-1610 @ 21.20m UW SANDSTONE Splitting Tensile Strength (Mpa);	5	21.5					*21.30m:* DD *21.35m:* J/10°, PL, SM, VN *21.40m:* DD/0° *21.58m:* DD/0°					
	21.70m: SW, black and dark grey, SILTSTONE. Extremely weak (hard), fine grained. RECOVERED AS: ORGANICS, some silt and some sand; black and dark grey. Firm, moist, low plasticity. Organics, carbonaceous material.			HQTT	87							87						
	21.75m: UW-SW, grey, SANDSTONE. Very weak, fine to medium grained.							22.0					*22.05m:* DD/0° *22.12m:* DD/0°					
							4	22.5					*22.25m:* DD/0° *22.36m:* DD/0°					
	22.50m: UW, grey, SANDSTONE. Very weak, fine to medium grained.			HQTT	97							97	*22.55m:* DD/0° *22.63m:* DD/0° *22.79m:* DD/0°					Box 7, 20.20-22.95m
							3	23.0					*22.99m:* DD/0° *23.07m:* DD/0° *23.15m:* DD/0° *23.25m:* DD/0° *23.35m:* DD/0° *23.45m:* DD/0° *23.53m:* DD/20°					
								23.5					*23.71m:* DD/0° *23.74m:* DD/0° *23.77m:* DD/0°					
	23.95m: CORE LOSS - Suspect material dropped out of barrel.							24.0										
	24.00m: UW, grey, SANDSTONE. Very weak, fine to medium grained.					B21-1611 @ 24.23m UW SANDSTONE Goodrich Drillability;	2	24.5				100	*24.10m:* DD/0° *24.15m:* DD/20° *24.21m:* DD/0° *24.39m:* DD/0° *24.45m:* DD/0° *24.58m:* DD/0° *24.93m:* DD/0°					

COMMENTS: Straddle packer test undertaken at 16 - 22.5 m.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH105

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925517.37 mN 1745322.02 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.31m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James/Ben
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 08/06/2021
FINISH DATE: 09/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW, grey, SANDSTONE. Very weak, fine to medium grained. *25.21 - 25.40m:* UW, Conglomeratic SANDSTONE. Fine and coarse grained. *25.40 - 25.48m:* UW, SILTSTONE. Fine grained.	UW	ES	HQTT	100		1 0 -1 -2 -3	25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0 29.5				100	*24.98m:* DD/0° *25.05m:* DD/0° *25.16m:* DD/0° *25.18m:* DD/0° *25.28m:* J/20°, PL, R, N *25.42m:* DD/45°					Box 8, 22.95-25.50m
	25.5m: END OF BOREHOLE																	

COMMENTS: Straddle packer test undertaken at 16 - 22.5 m.

Hole Depth 25.5m

Scale 1:25

Rev.: A

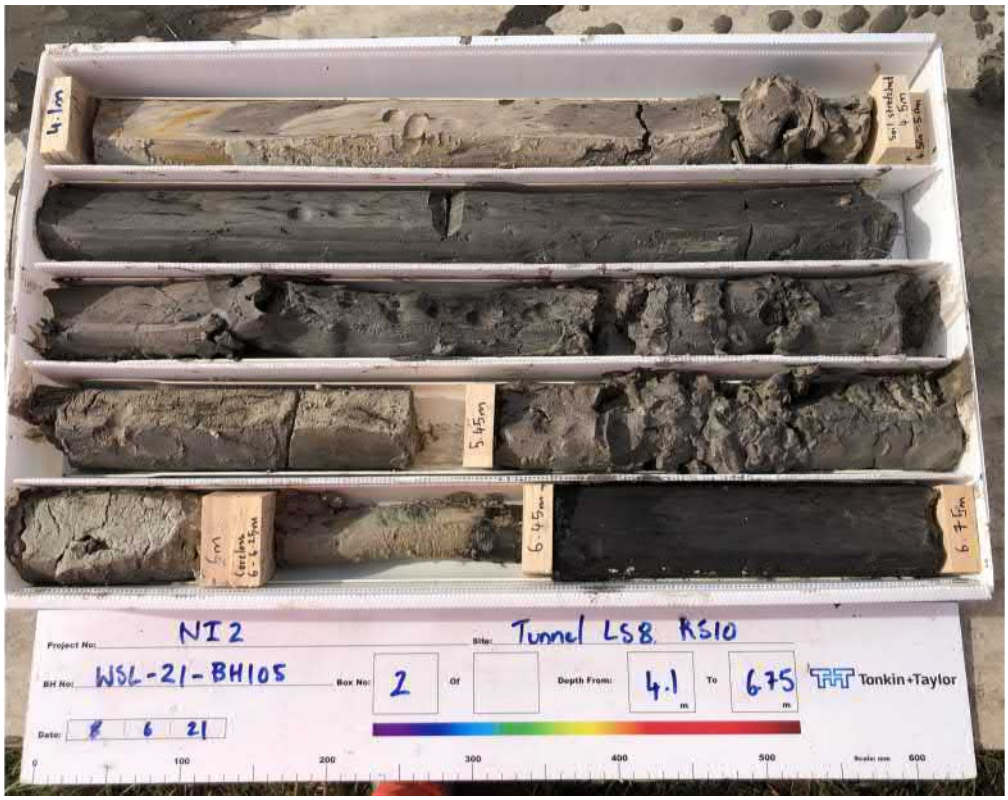
General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH105**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925517.37 mN 1745322.02 mE	DRILL TYPE:	HOLE STARTED: 08/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 09/06/2021
R.L.:	26.31m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: BLSP CHECKED: ROM

0.00-4.10m



4.10-6.75m

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH105**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5925517.37 mN 1745322.02 mE	DRILL TYPE:	HOLE STARTED: 08/06/2021
R.L.: 26.31m	DRILL METHOD: RC	HOLE FINISHED: 09/06/2021
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling
		LOGGED BY: BLSP CHECKED: ROM

6.75-9.85m

9.85-13.20m

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH105**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925517.37 mN 1745322.02 mE	DRILL TYPE:	HOLE STARTED: 08/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 09/06/2021
R.L.:	26.31m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: BLSP CHECKED: ROM

13.20-16.50m

16.50-20.20m

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH105**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925517.37 mN 1745322.02 mE	DRILL TYPE:	HOLE STARTED: 08/06/2021
R.L.:	26.31m	DRILL METHOD: RC	HOLE FINISHED: 09/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

20.20-22.95m

22.95-25.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:11:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH106

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925553.00 mN, 1745400.00 mE (NZTM2000)

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.59m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/James/Ben/

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 11/06/2021

FINISH DATE: 15/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* CORE LOSS - Suspect material is SILT, minor clay, trace gravel; brown mottled orange, Blocky. Stiff, moist, medium plasticity. Gravel, medium. (FILL).			HA	0		28	0.5										
	1.25m: SILT, minor clay, trace organics; light greyish brown mottled orange, Fissured. Firm, moist, high plasticity. (FILL).			HQTT	100			1.0										
	1.50m: CORE LOSS - Suspect material dropped out of barrel.			SPT	22	UTP Shear vane failed 0/1 0/1 0/1 **N=2**	27	1.5										
	1.85m: SILT, minor clay, trace organics; light greyish brown mottled orange, Fissured. Firm, moist, high plasticity. (FILL).																	
	1.95m: CORE LOSS - Suspect washed out							2.0										
	2.15m: Clayey SILT, trace organics; light brownish grey mottled dark brown, Fissured. Firm, moist, medium to high plasticity. Organics, rootlets. (FILL).																	
	2.30m: SILT, trace organics and trace clay; dark brown, Homogeneous. Soft to firm, moist to wet, medium plasticity. Organics, rootlets (partially decomposed) carbonaceous material. INTERMIXED WITH: Silty CLAY; light grey mottled orange, Fissured. Firm, moist, high plasticity. (FILL).			HQTT	81		26	2.5										
	3.00m: CORE LOSS - Suspect material dropped out of barrel.					71/15 kPa		3.0										
Tauranga Group	*3.05m:* Silty CLAY, trace organics; light grey streaked orange. Stiff, moist, high plasticity. Organics, carbonaceous flecks.			SPT	89	1/1 2/1 2/2 **N=7**												
				HQTT	100		25	3.5										
	4.25m: SILT, some sand, trace organics and trace clay; brownish grey streaked brown. Firm, moist to wet, medium plasticity. Sand, fine. Organics, rootlets.							4.0										
	4.60m: Organic silty CLAY; dark brown mottled brown. Stiff to very stiff, moist, high plasticity. Organics, wood fragments (decomposed).			SPT	100	UTP Shear vane failed 1/1 1/1 1/1 **N=4**	24	4.5								PQ		Box 1, 1.25-4.50m

BOREHOLE No.: WSL-21-BH106

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole test undertaken on 15/06/21 following completion of hole with casing installed down to 16.25 m. Vibrating wire piezometer installed at 23.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH106

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925553.00 mN, 1745400.00 mE (NZTM2000)

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.59m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/James/Ben/

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 11/06/2021

FINISH DATE: 15/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic silty CLAY; dark brown mottled brown. Stiff to very stiff, moist, high plasticity. Organics, wood fragments (decomposed).						23	5.5										
	5.70m: Sandy SILT, trace organics and trace clay; light greyish brown streaked brown. Firm, moist to wet, low plasticity. Sand, fine. Organics, rootlets. INTERBEDDED WITH: Silty CLAY; light grey mottled orange. Soft to firm, moist, high plasticity.							6.0										
	6.00m: SILT, some sand, trace organics and trace clay; brown streaked dark brown. Firm to stiff, moist to wet, medium plasticity. Sand, fine. Organics, rootlets. INTERBEDDED WITH: Clayey SILT; light grey mottled dark brown. Firm to stiff, moist, high plasticity. *6.10 - 6.45m:* SPT CORELOSS; however, recovered during subsequent HQ increment.			SPT	22	63/21 kPa 1/0 1/1 1/2 **N=5**												
	6.55m: Sandy SILT, minor organics; brown streaked dark brown. Stiff, moist, non-plastic. Sand, fine. Organics, carbonaceous material. INTERBEDDED WITH: Organic clayey SILT; brown streaked dark brown. Firm, moist, high plasticity.			HQTT	100		22	6.5										
								7.0										
				SPT	100	92/66 kPa 1/1 1/1 1/1 **N=4**	21	7.5										
	8.35m: Organic clayey SILT; dark greyish brown mottled black, Homogeneous. Stiff, moist, medium plasticity. Organics, carbonaceous material.			HQTT	100			8.0										
								8.5										
	9.00 - 9.63m: Grades to brown..						20	9.0										
				SPT	100	77/60 kPa 0/0 1/1 1/1 **N=4**												
	9.63m: Organic silty CLAY; dark brown mottled black, Fissured. Firm, moist, high plasticity. Organics, carbonaceous material.						19	9.5							15/06/2021	PQ	Box 2, 4.50-7.50m	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole test undertaken on 15/06/21 following completion of hole with casing installed down to 16.25 m. Vibrating wire piezometer installed at 23.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH106

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925553.00 mN 1745400.00 mE

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.59m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/James/Ben/

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 11/06/2021

FINISH DATE: 15/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.03m:* Organic clayey SILT; dark brown. Firm, moist, medium plasticity.			HQTT	100			10.5										
	10.50m: PEAT; black. Firm, moist.			SPT	100	30/6 kPa 0/1 0/1 0/1 **N=2**	18											
	10.95m: Organic clayey SILT; dark brown. Firm, moist, low plasticity.							11.0										
	11.14m: Organic silty CLAY; dark brown mottled black. Firm, moist, high plasticity. Organics, carbonaceous material.			HQTT	100													
	11.54m: Sandy SILT, minor organics; dark brown mottled black, Homogeneous. Firm to stiff, moist, non-plastic. Organics, wood fragments (decomposed).						17	11.5										
	12.00m: Silty CLAY, minor organics; light greyish brown mottled black. Firm, moist, high plasticity. Organics, carbonaceous material. INTERBEDDED WITH: Sandy SILT; dark greyish brown mottled black. Stiff, moist, low plasticity.			SPT	100	60/45 kPa 1/1 2/2 2/2 **N=8**		12.0										
	12.45m: CORE LOSS - Suspect washed out							12.5										
	12.55m: SILT, some organic and some clay; light greyish brown mottled black, Homogeneous. Firm, moist, high plasticity. Organics, carbonaceous material. INTERBEDDED WITH: Sandy SILT; dark greyish brown mottled black, Homogeneous. Stiff, moist, medium plasticity.			HQTT	90		16											
	12.95m: Organic SILT, some clay; brown mottled dark brown. Firm to stiff, moist, low plasticity.							13.0										
								13.5										
				SPT	100	89/74 kPa 0/1 0/1 1/1 **N=3**	15											
								14.0										
				HQTT	86		14	14.5										

Box 3, 7.50-10.95m

Box 4, 10.95-14.40m

PQ

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole test undertaken on 15/06/21 following completion of hole with casing installed down to 16.25 m. Vibrating wire piezometer installed at 23.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH106

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925553.00 mN, 1745400.00 mE (NZTM2000)

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.59m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/James/Ben/

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 11/06/2021

FINISH DATE: 15/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* NOT LOGGED - Push tube sealed prior to logging.			PUSH TUBE	100			15.5										
	15.50m: Organic clayey SILT, minor sand; grey streaked black, Homogeneous. Stiff, moist, high plasticity. Sand, fine. Organics, carbonaceous material.			HQTT	100		13	16.0								PQ		
	16.14m: SAND, some silt; grey. Medium dense, moist. Sand, fine.																	
	16.24m: Clayey SILT, some sand, minor organics; grey streaked black. Stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous material.																	
	16.32m: SAND, some silt; grey. Medium dense, moist, non-plastic. Sand, fine.			SPT	100	UTP 2/3 3/4 4/4 **N=15**	12	16.5										
East Coast Bays Formation	*16.42m:* CW, grey, SANDSTONE. Extremely weak, fine grained, moist. RECOVERED AS: SAND, some silt; grey, Bedded. Medium dense, moist. Sand, fine. With layers of: SILT, some clay; grey. Very stiff, moist, medium plasticity..																	
	16.95m: CORE LOSS - Suspect washed out			HQTT	62			17.0										
	17.35m: CW, dark brownish grey, Silty SANDSTONE. Extremely weak, moist. RECOVERED AS: SAND, some silt; dark brownish grey, Bedded. Medium dense, moist. Sand, fine. With layers of : SILT, some clay; grey. Very stiff, moist, medium plasticity..						11	17.5										
				SPT	100	4/4 5/6 9/10 **N=30**		18.0										
	18.52m: CW, grey, Silty SANDSTONE. Extremely weak, fine to medium grained, moist. RECOVERED AS: SAND, some silt; grey, Bedded. Dense, moist. Sand, fine some medium. With lenses of: SILT, some clay; grey. Soft, wet, high plasticity..			HQTT	81		10	18.5										
	19.05m: CW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine grained, moist, Recovered as: SAND, some silt; grey, Dense, moist. Sand, fine. Remoulds to: Sandy SILT, high plasticity.							19.0				43	*19.08m:* DD/0° *19.16m:* DD/0°					
	19.30m: CORE LOSS - Suspect material dropped out of barrel.																	
	19.50m: HW, grey, massive, SANDSTONE. Extremely weak (dense), poorly cemented, fine grained, Recovered as: SAND, some silt; Dense, moist..			SPTC	100	6/7 11/11 11/13 **N=46** Solid	9	19.5										Box 5, 14.40-19.05m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole test undertaken on 15/06/21 following completion of hole with casing installed down to 16.25 m. Vibrating wire piezometer installed at 23.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH106

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: 5925553.00 mN (NZTM2000) 1745400.00 mE	R.L. GROUND: 28.59m
JOB No.: 1015174.0000.02		R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	DIRECTION: 180°	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/James/Ben/
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 11/06/2021
FINISH DATE: 15/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* CORE LOSS - Suspect material dropped out of barrel. *20.05m:* MW, grey, massive, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt; Very dense, moist.. *20.20m:* SW, grey, massive, SANDSTONE. Extremely weak (very dense), poorly cemented, fine grained, Recovered as: SAND, some silt; Very dense, moist.. *20.42m:* SW, grey, massive, SANDSTONE. Extremely weak (very dense), moderately cemented, fine and coarse grained, Recovered as: SAND, some silt; Very dense, moist..	UW SW MW HW CW	EW UW MW SW FS	SPTC	100	B21-1612 @ 20.60m SW SANDSTONE Splitting Tensile Strength (Mpa); 7/8 11/12 14/13 for 55mm N>=50 Solid	8	20.5		2000 800 300 60 20		*20.11m:* DD/0° *20.39m:* DD/0° *20.42-20.47m:* DD/0° *20.51m:* DD/0°	25 50 75				
	21.45m: CORE LOSS - Suspect material dropped out of barrel.						7	21.5										
	21.70m: SW, grey, massive, SANDSTONE. Extremely weak (very dense), moderately cemented, fine and coarse grained, Recovered as: SAND, some silt; Very dense, moist..			HQTT	75	B21-1613 @ 21.90m SW SANDSTONE Goodrich Drillability;		22.0				75	*21.91m:* DD/0° *22.13m:* DD/0° *22.34m:* DD/0°					
	22.50m: UW-SW, grey, massive, SANDSTONE. Very weak, moderately cemented, fine grained. INTERBEDDED WITH: Grey, massive, SILTSTONE. Very weak, fine grained. 50mm thick, 0 to 5° inclined.			SPTC	33	B21-1614 @ 22.50m SW SANDSTONE for 75mm N>=50 Solid	6	22.5					*22.40-22.50m:* DD *22.80-22.90m:* DD					
	23.18m: UW, grey, massive, SANDSTONE. Very weak, moderately cemented, fine to coarse grained.			HQTT	100	B21-1615 @ 22.90m UW SILTSTONE XRD Quantitative (Fines Fraction); BH106 @ 23.05m SW-UW SANDSTONE Sample description from target	5	23.0 23.5				79	*22.96m:* BF/5°, PL, R-SM, VN *22.99m:* BF/5°, PL, R-SM, VN *23.03m:* J/0°, PL, PO, VN *23.18m:* DD/0° *23.28m:* BF/0°, PL, R *23.63m:* J/25°, PL, R, VN *23.69m:* DD/0°,					Box 6, 19.05-23.45m
							4	24.0 24.5				90	*23.91m:* DD/30° *23.97m:* DD/5° *24.08m:* DD/0° *24.15m:* DD/0° *24.17m:* DD/0° *24.21m:* DD/0° *24.36m:* DD/0° *24.46m:* J/5°, PL, R-SM *24.49m:* J/5°, PL, SM *24.77m:* J/30°, PL, R					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole test undertaken on 15/06/21 following completion of hole with casing installed down to 16.25 m. Vibrating wire piezometer installed at 23.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH106

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925553.00 mN 1745400.00 mE

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.59m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/James/Ben/

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 11/06/2021

FINISH DATE: 15/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW, grey, massive, SANDSTONE. Very weak, moderately cemented, fine to coarse grained, [CONT].	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	100			25.5				90	*25.16-25.31m:* BZ, UN, R					Box 7, 23.45-25.50m
	25.5m: END OF BOREHOLE																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole test undertaken on 15/06/21 following completion of hole with casing installed down to 16.25 m. Vibrating wire piezometer installed at 23.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH106**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5925553.00 mN 1745400.00 mE	DRILL TYPE:	HOLE STARTED: 11/06/2021	
R.L.: 28.59m	DRILL METHOD: RC	HOLE FINISHED: 15/06/2021	
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling	
		LOGGED BY: BLSP	CHECKED: ROM

0.00-4.50m

4.50-7.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH106**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925553.00 mN 1745400.00 mE	DRILL TYPE:	HOLE STARTED: 11/06/2021
R.L.:	28.59m	DRILL METHOD: RC	HOLE FINISHED: 15/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

7.50-10.95m

10.95-14.40m

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH106**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925553.00 mN 1745400.00 mE	DRILL TYPE:	HOLE STARTED: 11/06/2021
R.L.:	28.59m	DRILL METHOD: RC	HOLE FINISHED: 15/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

14.40-19.05m

19.05-23.45m

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH106**

SHEET: 4 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925553.00 mN 1745400.00 mE	DRILL TYPE:	HOLE STARTED: 11/06/2021
R.L.:	28.59m	DRILL METHOD: RC	HOLE FINISHED: 15/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

23.45-25.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:17:05 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH108

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925679.58 mN 1745570.62 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.61m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy/Mark
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Top	*0.00m:* Topsoil.																	
Fill	*0.05m:* SILT, some organics and some clay; brown streaked grey. Soft to firm, moist, medium plasticity. Organics, rootlets (fresh). (FILL).			HA	150			0.5										
	0.45m: SILT, some organics, trace sand; dark brown, Lensoidal. Firm, moist, low plasticity. Sand, fine. Organics, rootlets (fresh). (FILL).																	
	0.65m: SILT, some organics and some clay; brown streaked grey, Lensoidal. Firm, moist, medium plasticity. Organics, rootlets (fresh). (FILL).			HQTT	100		27	1.0										
	1.60m: Silty CLAY; grey streaked dark brown, Fissured. Firm, moist, high plasticity. (FILL).			SPT	100	UTP 1/0 1/2 2/2 **N=7**	26	1.5										
	1.95m: SILT, some organics, minor clay; dark brown. Firm, moist, medium plasticity. Organics, rootlets (partially decomposed). (FILL).																	
	2.20m: Silty CLAY, trace organics; grey streaked orange. Firm to stiff, moist, high plasticity. Organics, rootlets (decomposed). (FILL).			HQTT	86		25	2.5										
Tauranga Group	*2.85m:* CORE LOSS - Suspect run above overcored.							3.0										
	3.00m: Clayey SILT; grey streaked orange. Firm to stiff, moist, high plasticity.			SPT	100	80/24 kPa 0/1 0/1 1/1 **N=3**	24	3.5										
	3.95m: SILT, some clay, trace sand; grey streaked orange. Firm, moist, medium plasticity. Sand, fine.			HQTT	100			4.0										
	4.50m: SILT, some sand; brown mottled orange, Blocky. Soft, moist to wet. Sand, medium some coarse.			SPT	100	33/6 kPa 0/0 0/1 0/1 **N=2**	23	4.5										
	4.60m: SILT, some clay and some sand; grey mottled orange. Firm, moist, low plasticity. Sand, fine.																	
	4.50 - 7.90m: Brownish grey.																Box 1, 0.00-4.35m	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 21/06/21 following completion of hole with casing installed down to 13.50 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH108

SHEET: 2 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925679.58 mN, 1745570.62 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.61m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy/Mark
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* SILT, some clay and some sand, trace organics; grey streaked black. Firm, moist, low plasticity. Sand, fine. [CONT].			HQTT	90		22	5.5										
	6.00m: Silty SAND, trace organics; grey, Massive. Loose, moist. Sand, fine to coarse. Organics, carbonaceous flecks.			SPT	100	57/9 kPa 0/1 1/1 1/2 **N=5**		6.0										
	6.35m: SILT, some clay; grey. Stiff, moist, high plasticity.			HQTT	100		21	6.5										
	6.95m: SILT, some sand, trace clay; grey. Firm, moist, low to medium plasticity. Sand, fine.							7.0										Box 2, 4.35-6.95m
	7.35m: Clayey SILT; grey, Bedded. Stiff to very stiff, moist, high plasticity. WITH LAYERS OF: Sandy SILT; grey. Firm, moist, low plasticity. Sand, fine.																	
	7.50m: SILT, some sand, trace clay; grey. Stiff, moist, low plasticity. Sand, fine.			SPT	100	71/15 kPa 0/1 1/1 2/2 **N=6**	20	7.5										
East Coast Bays Formation	*7.90m:* CW, grey, MUDSTONE. Extremely weak, moist. RECOVERED AS: Silty CLAY; grey. Very stiff locally Firm, moist, high plasticity.							8.0										
	8.20m: CW, grey, SANDSTONE. Extremely weak, moist. RECOVERED AS: Silty SAND, some clay, trace organics; grey. Medium dense, moist. Remoulds to: Sandy SILT, High plasticity.			HQTT	100		19	8.5										
				SPT	100	UTP 2/3 2/3 3/3 **N=11**		9.0										
	9.80m: CW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: Clayey SILT; grey. Stiff to very stiff, wet, high			HQTT	100		18	9.5										Box 3, 6.95-10.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 21/06/21 following completion of hole with casing installed down to 13.50 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH108

SHEET: 3 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925679.58 mN 1745570.62 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.61m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy/Mark
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* CW, grey, SANDSTONE. Extremely weak (dense), fine to medium grained, moist. RECOVERED AS: Silty SAND; grey. Dense, non-plastic. Sand, fine. Remoulds to: Sandy SILT, High plasticity.	UW SW MW HW CW	EW VW MS SS VS ES	HQTT	100								*10.24m:* DD/0° *10.30m:* DD/0°					
	10.10m: MW, grey, SILTSTONE. Extremely weak (hard), fine to medium grained, moist, Recovered as: Silty CLAY. Hard, moist, high plasticity..												*10.40m:* DD/0° *10.44m:* DD/0° *10.47m:* DD/5°					
	10.75m: MW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt; Dense, moist..			SPT	100	4/5 6/7 9/12 **N=34**	17	10.5										
				HQTT	100		16	11.0					*11.40-11.45m:* DD/0°					
	12.00m: NO RECOVERY.			SPTC	99	5/10 9/10 14/17 for 70mm **N>=50** Solid		11.5					*11.65-11.90m:* DD/0° *11.95m:* DD/5° *12.00-12.15m:* DD/0°					
	12.40m: UW, grey, Muddy SILTSTONE. Extremely weak (hard), fine to medium grained. 50 to 100mm thick. INTERBEDDED WITH: UW, grey, SANDSTONE. Extremely weak (very dense), fine grained. 50 to 100mm thick.			HQTT	100		15	12.0					*12.32m:* DD/0° *12.46m:* DD/0° *12.57m:* DD/5° *12.65m:* DD/5° *12.72m:* J/5°, PL, R-SM, VN, Carbonaceous specks *12.74m:* J/5°, PL, R-SM, VN *12.80m:* DD/0° *12.90m:* DD/0°					
	13.15m: UW, grey, SANDSTONE. Extremely weak (very dense), fine to coarse grained, Recovered as: SAND, some silt; Very dense, moist..					BH108 @ 13.17m uw fg sst ew-vw Sample description from sample		12.5					*13.09m:* DD/0° *13.18m:* J/5°, PL-UN, R-SM, N					Box 4, 10.00-13.35m
	13.70m: UW, grey, SILTSTONE. Extremely weak (hard), fine to medium grained, Recovered as: Silty CLAY. Hard, moist, high plasticity..			SPTC	50	11/35 50 for 50mm **N>=50** Solid	14	13.0					*13.50m:* DD/0°					
	13.80m: CORE LOSS - Suspect material dropped out of barrel.			HQTT	38			13.5										
	14.40m: UW, grey, SANDSTONE. Extremely weak (very dense), fine to coarse grained, Recovered as: SAND, some silt; Very dense, moist..						13	14.0					*14.60m:* DD/0°					
								14.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 21/06/21 following completion of hole with casing installed down to 13.50 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH108

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925679.58 mN, 1745570.62 mE (NZTM2000)

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.61m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy/Mark

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 16/06/2021

FINISH DATE: 18/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* UW, grey, SANDSTONE. Extremely weak (very dense), fine to coarse grained, Recovered as: SAND, some silt; Very dense, moist. [CONT].	UW SW MW HW CW DW	EW VW MW SW VS ES	SPTC	100	13/37 for 60mm **N>=50** Solid	12	15.5					*15.12-15.46m:* J/85°, UN, R, N *15.30m:* J/30°, PL-UN, R, N	25 50 75				
				HQTT	100			16.0					*15.66m:* DD/0° *15.71m:* DD/0°					
	16.30m: UW, grey, bedded, SILTSTONE. Very weak, fine grained, trace carbonaceous material.												*16.15-16.25m:* BZ *16.25m:* J/10°, PL, R-SM, VN *16.33m:* DD/0° *16.35m:* BF/0°, UN, R-SM, VN *16.40m:* DD/0°					Box 5, 13.35-16.50m
	16.50m: UW, grey, SANDSTONE. Very weak, fine to coarse grained.			HQTT	100		11	16.5					*16.45m:* BF/0°, PL-UN, R, VN					
	17.20m: UW, grey, SANDSTONE with carbonaceous flecks. Very weak, fine to coarse grained. INTERBEDDED WITH: Grey, bedded, SILTSTONE. Very weak. 50 to 100mm thick, 0 to 5° inclined.							17.0					*17.32m:* DD/0°					
	17.59 - 17.77m: Coarse grained.							17.5					*17.39m:* DD/5° *17.42m:* DD/0° *17.53m:* DD/0° *17.57m:* DD/0°					
						BH108 @ 17.78m uw f-c gr sst ew-vw Sample description from sample	10					100						
	18.16 - 18.22m: With black carbonaceous laminations.			HQTT	100	B21-1616 @ 18.17m UW SILTSTONE XRD Quantitative (Fines Fraction);	9	18.0					*17.95m:* DD/0° *17.98m:* DD/0° *18.02m:* DD/0° *18.04m:* J/5°, PL-UN, PO, VN, Calcium *18.09m:* J/5°, PL-UN, PO, VN *18.16m:* BF/0° *18.23m:* DD/5°					
								18.5					*18.53m:* DD/0° *18.56m:* DD/0° *18.70m:* DD/0° *18.83m:* DD/0°					
								19.0					*18.90m:* J, 45°, UN, SM, MN *19.00m:* DD/5°					
	19.50m: CORE LOSS - Suspect material dropped out of barrel.			HQTT	94		8	19.5					*19.16m:* DD/0° *19.21m:* DD/0° *19.23m:* DD/0° *19.24m:* DD/0° *19.26m:* DD/0° *19.31m:* DD/0° *19.40m:* DD/0°					Box 6, 16.50-19.50m
	19.60m: UW, grey, SANDSTONE with carbonaceous flecks. Very weak, fine to coarse grained. INTERBEDDED WITH: Grey, bedded, SILTSTONE. Very weak. 50 to 100mm thick, 0 to 5° inclined. *19.94 - 20.00m:* With carbonaceous material.												*19.65m:* DD/0° *19.70m:* DD/0° *19.74m:* DD/0° *19.79m:* DD/0° *19.83m:* DD/0°					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 21/06/21 following completion of hole with casing installed down to 13.50 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH108

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925679.58 mN 1745570.62 mE

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.61m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy/Mark

LOGGED BY: BLSP

CHECKED: ROM

START DATE: 16/06/2021

FINISH DATE: 18/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, SANDSTONE with carbonaceous flecks. Very weak, fine to coarse grained, [CONT]. INTERBEDDED WITH: Grey, bedded, SILTSTONE. Very weak. 50 to 100mm thick, 0 to 5° inclined. *20.15m:* UW, grey, SANDSTONE. Weak, fine and coarse grained. *20.00 - 20.52m:* With black carbonaceous laminations. *21.42 - 21.47m:* With black carbonaceous laminations. *22.70 - 23.12m:* JOINT, healed.	UW SW MW HW CW DW	ES VS S MS W VW EW	HQTT HQTT HQTT HQTT	93 100 93 100	B21-1617 @ 20.90m UW SANDSTONE Splitting Tensile Strength (Mpa); BH108 @ 21.00m uw f-c gr sst vw Sample description from sample BH108 @ 21.41m UW, grey, SANDSTONE.Weak, fine and coarse grained. Sample description from log B21-1618 @ 21.80m UW SANDSTONE Goodrich Drillability; B21-1619 @ 22.35m UW SANDSTONE Splitting Tensile Strength (Mpa); Equivalent Quartz and Schimazek wear factor;	7 6 5 4 3	20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5		2000 600 200 60 20		*19.92m:* DD/0° *20.03m:* DD/0° *20.12m:* DD/0° *20.26m:* DD/0° *20.35m:* DD/45° *20.41-20.53m:* BZ *20.82-21.90m:* BZ *21.20-21.33m:* J/85°, UN, R-SM, T, Calcium *21.73-21.75m:* J, 45-50°, PL, SM, VN, Clay infill *22.09-22.45m:* BZ/55°, PL, R-SM, VN *22.70-23.10m:* J, 70-85°, UN, R-SM, T *22.84m:* DD/0° *23.10-23.18m:* , 45-50°, PL, SM, VN, Clay infill *23.28-23.41m:* J/80°, PL, R-SM, VN *23.33-23.47m:* J/70°, PL-UN, R-SM, VN *23.41-23.48m:* J/60°, PL, R, T *23.70-23.90m:* /60°, PL, R, VN *24.69m:* J/10°, PL, SM, VN	25 50 75				Box 7, 19.50-22.50m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 21/06/21 following completion of hole with casing installed down to 13.50 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH108

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis	CO-ORDINATES: 5925679.58 mN (NZTM2000) 1745570.62 mE	R.L. GROUND: 27.61m
JOB No.: 1015174.0000.02	DIRECTION: 180°	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy/Mark
LOGGED BY: BLSP
CHECKED: ROM
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW, grey, SANDSTONE. Weak, fine and coarse grained, [CONT]. *25.14 - 25.65m:* Coarse grained.	UW SW MW HW CW	EW VS S MS HS VW EW	HQTT	100		2	25.5					*25.01m:* DD/5° *25.20m:* DD/0° *25.30m:* DD/0°	25 50 75				Box 8, 22.50-25.50m
	26.30 - 26.73m: Medium to coarse grained.			HQTT	100		1	26.0 26.5				78	*25.68-26.09m:* J, 70-90°, UN, R-SM, N *25.80-26.09m:* BZ					
	26.73 - 27.71m: Medium grained, with some coarse.			HQTT	100		0	27.0 27.5				100	*27.61m:* DD/0°					Box 9, 25.50-28.30m
	28.30 - 28.53m: Medium to coarse grained.			HQTT	100		-1	28.0 28.5				100	*29.11m:* DD/5°					
	30m: END OF BOREHOLE						-2	29.0 29.5					*29.37m:* DD/0° *29.41m:* DD/10° *29.43m:* DD/0°					Box 10, 28.30-30.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 21/06/21 following completion of hole with casing installed down to 13.50 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH108**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925679.58 mN 1745570.62 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	27.61m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

0.00-4.35m

4.35-6.95m

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH108**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925679.58 mN 1745570.62 mE	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 16/06/2021 HOLE FINISHED: 18/06/2021 DRILLED BY: McMillan Drilling
R.L.:	27.61m		LOGGED BY: BLSP CHECKED: ROM
DATUM:	AUCKHT1946		

6.95-10.00m

10.00-13.35m

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH108**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925679.58 mN 1745570.62 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	27.61m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

13.35-16.50m

16.50-19.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH108**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925679.58 mN 1745570.62 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	27.61m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

19.50-22.50m

22.50-25.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH108**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925679.58 mN 1745570.62 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	27.61m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: BLSP CHECKED: ROM

25.50-28.30m

28.30-30.00m

General Log - DESX005 - Fix RQD - 8/12/2021 2:20:58 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH109

SHEET: 1 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925692.58 mN, 1745591.85 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.24m
R.L. COLLAR: 27.74m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 23/06/2021
FINISH DATE: 24/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* SILT, some clay; brown mottled orange. Very stiff, moist, low plasticity. (FILL).			HA	100		27	0.5										
	0.60 - 1.50m: Minor sand. Sand, fine.							1.0										
				HQTT	100	UTP	26	1.5										
				SPTS	100	0/2 1/1 2/2 **N=6**												
	1.95m: Clayey SILT, some sand; dark brown mottled grey. Firm, moist, medium plasticity. Sand, fine. (FILL).							2.0										
Tauranga Group	*2.20m:* Silty CLAY, minor sand, trace organics; light brown streaked orange. Stiff to very stiff, moist, high plasticity. Organics, rootlets.			HQTT	90		25	2.5										
						125/43 kPa												
				SPTS	100	1/1 2/1 2/3 **N=8**	24	3.0								PQ3		
	3.25m: Clayey SILT, trace organics; light brown speckled black. Stiff, moist, medium plasticity.							3.5										
	3.70 - 4.40m: Brownish grey.			HQTT	100		23	4.0							24/06/2021			
	4.45m: Silty SAND, minor clay, trace organics; light grey. Medium dense, moist. Sand, fine, Loose.			SPTS	100	1/0 1/0 1/2 **N=4**		4.5										Box 1, 0.00-3.45m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Terminal packer test 18.0 - 24.0 mbgl. VWP installed at 22.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH109

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925692.58 mN 1745591.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.24m
R.L. COLLAR: 27.74m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 23/06/2021
FINISH DATE: 24/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Silty SAND; light grey. Medium dense, moist. Sand, fine. Beds 50 - 100 mm thick. INTERBEDDED WITH: Clayey SILT; light grey. Firm, moist, medium plasticity. Beds 20 - 50 mm thick.			HQTT	100		22	5.5										
	5.50m: Sandy SILT, minor clay, trace organics; brown. Firm, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed). *5.75 - 5.80m:* Clayey SILT. Soft.																	
	5.80m: Clayey SILT, minor sand; grey. Firm, moist, medium plasticity.					● 35/13 kPa		6.0										
	6.10m: SILT, some sand, minor clay; grey. Firm to stiff, moist, medium plasticity. Sand, fine.			SPTS	100	0/0 1/1 2/1 **N=5**	21											
	6.67m: Sandy SILT, minor clay. Firm, moist, low plasticity. Sand, fine.			HQTT	100			6.5										Box 2, 3.45-6.80m
	7.45m: Clayey SILT; grey. Stiff, moist, medium plasticity.							7.0										
	7.55m: Sandy SILT, minor clay; grey. Firm, moist, low plasticity. Sand, fine.			SPTS	100	1/0 1/2 1/2 **N=6**	20											
	7.90m: Silty SAND, trace clay; grey. Medium dense, moist. Sand, fine.			HQTT	100			7.5										
East Coast Bays Formation	*8.95m:* CW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: SILT, some clay, minor sand; grey. Stiff, moist, low plasticity. Sand, fine.			SPTS	100	2/3 3/3 4/4 **N=14**	19	8.0										
	9.45m: HW, grey, Clayey SILTSTONE. Extremely weak, moist, RECOVERED AS: Clayey SILT; grey. Stiff, moist medium plasticity. 20 to 50mm spaced, 50 to 100mm thick. INTERBEDDED WITH: HW, grey, Silty SANDSTONE. Extremely weak, poorly cemented, fine grained, moist, RECOVERED AS: Silty SAND, minor clay. Medium dense, moist. Sand, fine.. 50 to 100mm spaced, 20 to 50mm thick.			HQTT	100			8.5										
							18	9.0										
								9.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Terminal packer test 18.0 - 24.0 mbgl. VWP installed at 22.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH109

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925692.58 mN 1745591.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.24m
R.L. COLLAR: 27.74m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 23/06/2021
FINISH DATE: 24/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* HW, grey, Clayey SILTSTONE. Extremely weak, moist, RECOVERED AS: Clayey SILT; grey. Stiff, moist medium plasticity. 20 to 50mm spaced, 50 to 100mm thick. INTERBEDDED WITH: HW, grey, Silty SANDSTONE. Extremely weak, poorly cemented, fine grained, moist, RECOVERED AS: Silty SAND, minor clay. Medium dense, moist. Sand, fine. 50 to 100mm spaced, 20 to 50mm thick.			HQTT	100		17	10.5										
	10.50m: HW, grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: SAND, some silt; grey. Medium dense, moist. Sand, fine.			SPTS	100	2/3 3/5 5/6 **N=19**												
	11.35m: MW, grey, SILTSTONE. Extremely weak, moist, RECOVERED AS: Silty CLAY. Hard, moist, high plasticity..			HQTT	100		16	11.0										
	11.55m: SW, grey, SANDSTONE. Extremely weak, poorly cemented, fine grained, RECOVERED AS: SAND, some silt. Dense to very dense, moist.							11.5										
	11.70m: SW, grey, SILTSTONE. Extremely weak, moist, RECOVERED AS: Silty CLAY. Hard, moist, high plasticity..							12.0										
	12.28m: UW, grey, laminated, SILTSTONE. Very weak, moist.			SPTS	100	6/16 24/26 for 57mm **N>=50**	15											
	12.33m: UW, grey, SANDSTONE. Very weak, fine grained, moist. *12.43 - 12.48m:* UW, SILTSTONE. Very weak, moist. *12.52 - 12.62m:* UW. Fine to coarse grained.							12.5					*12.50m:* J, 20°, UN, R, N *12.52m:* BF, 2°, UN, R, VN					
	12.80m: UW, grey, Clayey SILTSTONE. Very weak, moist. 20 to 50mm spaced, 50 to 150mm thick. INTERBEDDED WITH: UW, grey, Silty SANDSTONE. Very weak, well cemented, fine grained, moist. 50 to 150mm spaced, 20 to 50mm thick. *13.18 - 13.20m:* UW, with carbonaceous material.			HQTT	100		14	13.0				79	*12.63-12.67m:* BZ, 2-20°, UN, R, N *12.71m:* DD *12.94m:* DD *13.09m:* J, 15°, UN, R, VN *13.15m:* BF, 2°, UN, SM, N *13.16m:* DD *13.22m:* J, 7°, UN, R, N					Box 4, 10.20-13.35m
	13.35m: UW, grey, SANDSTONE. Very weak, well cemented, fine grained, moist.							13.5					*13.41m:* BF, 2°, PL, R, VN					
	13.50m: No recovery - Solid cone SPT.			SPTC	0	8/26 50 for 55mm **N>=50** Solid												
	13.71m: UW, grey, SANDSTONE. Very weak, well cemented, fine grained, moist.			HQTT	100		13	14.0				91	*13.96-14.02m:* BZ, 2-80°, UN, R, N					
	14.90 - 15.00m: UW. Fine to coarse grained.							14.5					*14.59m:* BF, 2°, PL, R, VN *14.76m:* BF, 2°, UN, R, T					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Terminal packer test 18.0 - 24.0 mbgl. VWP installed at 22.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH109

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925692.58 mN 1745591.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.24m
R.L. COLLAR: 27.74m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 23/06/2021
FINISH DATE: 24/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* NO RECOVERY - Solid SPT, no overcore recovered.	UW SW MW HW CW	EW VW W MS VS ES	SPTC	0	16/50 for 55mm **N>=50** Solid	12	15.5										
	15.13m: UW, grey, SANDSTONE. Very weak, well cemented, fine grained, moist. *15.13 - 15.55m:* UW. Fine to coarse grained.			HQTT	100							95	*15.85m:* BF, 2°, PL, R, N *15.92m:* DD					
	15.93m: UW, grey, SILTSTONE. Very weak, moist.						11	16.0										
	16.19m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist. *16.29m:* UW, grey, SILTSTONE. Very weak, moist.							16.5										Box 5, 13.35-16.50m
	16.50m: UW, grey, Silty SANDSTONE. Very weak, fine grained, moist. *16.63m:* UW, grey, SANDSTONE. Very weak, well cemented, coarse grained, Gravel, fine, angular.			HQTT	100								*16.67m:* BF, 2°, PL, R, N *16.70m:* DD					
	16.93m: UW, grey, SANDSTONE. Weak, fine to coarse grained.						10	17.0				98	*17.24m:* BF, 2°, PL, R, N					
								17.5					*17.54m:* BF, 2°, UN, R, N *17.76m:* BF, 5°, PL, R, VN					
	18.25m: UW, grey, SILTSTONE. Weak, moist.						9	18.0					*18.29m:* DD *18.35m:* J, 7°, UN, R, VN					
	18.44m: UW, grey, SANDSTONE. Weak, well cemented, fine to coarse grained.							18.5					*18.43m:* BF, 2°, PL, R, VN					
	18.72m: UW, grey, SILTSTONE. Weak, moist.			HQTT	100							80	*18.75m:* J, 7°, PL, R, VN *18.83m:* DD					
	19.02m: UW, grey, Silty SANDSTONE. Weak, well cemented, fine grained.						8	19.0					*19.05m:* DD *19.26m:* BF, 5°, PL, R, VN					Box 6, 16.50-19.05m
	19.50m: UW, grey, SANDSTONE. Weak, well cemented, coarse grained, Gravel, fine, angular.			HQTT	100			19.5				100	*19.80m:* BF, 2°, PL, R, VN					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Terminal packer test 18.0 - 24.0 mbgl. VWP installed at 22.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH109

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925692.58 mN 1745591.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.24m
R.L. COLLAR: 27.74m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 23/06/2021
FINISH DATE: 24/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log / Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, SANDSTONE. Weak, well cemented, coarse grained, Gravel, fine, angular. [CONT].			HQTT	100		20.5			87	*20.30m:* BF, 2°, PL, R, VN *20.46m:* BF, 2°, UN, R, VN *20.50m:* BF, 2°, PL, R, N *20.55m:* BF, 2°, PL, R, N *20.59m:* DD					
	20.75m: UW, grey, Silty SANDSTONE with carbonaceous material. Weak, well cemented, fine grained.						21.0				*20.83m:* BF, 2°, ST, R, MN					
	21.05m: UW, grey, SANDSTONE. Weak, well cemented, coarse grained, Gravel, fine, angular.			HQTT	100					100						Box 7, 19.05-21.40m
	21.50m: UW, grey, SANDSTONE. Weak, well cemented, fine to coarse grained.						21.5									
	22.03m: UW, grey, SANDSTONE. Weak, well cemented, fine grained.						22.0				*22.03m:* BF, 2°, UN, R, N *22.25m:* BF, 5°, PL, R, N *22.43m:* BF, 5°, PL, R, T					
	23.03 - 24.40m: UW, Silty SANDSTONE.			HQTT	100		22.5			100	*22.82m:* J, 70°, PL, R, VN *23.13m:* DD					
	24.00m: UW, grey, SANDSTONE. Weak, well cemented, fine to coarse grained, Gravel, fine, rounded.						23.0				*23.72m:* BF, 2°, UN, SM, VN					Box 8, 21.40-24.00m
	24.39m: UW, grey, Silty SANDSTONE. Weak, well cemented, fine to coarse grained, Gravel, fine, rounded.			HQTT	100		23.5				*23.96m:* BF, 2°, PL, R, N					
							24.0				*24.25m:* BF, 7°, UN, R, VN *24.39m:* DD					
							24.5			87	*24.61m:* BF, 2°, PL, R, VN					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Terminal packer test 18.0 - 24.0 mbgl. VWP installed at 22.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH109

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925692.58 mN 1745591.85 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.24m

R.L. COLLAR: 27.74m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: AMHO

CHECKED: ROM

START DATE: 23/06/2021

FINISH DATE: 24/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW, grey, Silty SANDSTONE. Weak, well cemented, fine to coarse grained, Gravel, fine, rounded. [CONT].	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	100		2	25.5			2000 600 200 60 20	86	*25.00-25.23m:* BZ, 2-79°, PL, R, N *25.30m:* J, 70°, UN, R, N	25 50 75				Box 9, 24.00-25.50m
	25.5m: END OF BOREHOLE						1	26.0										
								26.5										
							0	27.0										
								27.5										
							-1	28.0										
								28.5										
							-2	29.0										
								29.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Terminal packer test 18.0 - 24.0 mbgl. VWP installed at 22.0m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH109**

SHEET: 1 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925692.58 mN 1745591.85 mE	DRILL TYPE:	HOLE STARTED: 23/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 24/06/2021
R.L.:	27.24m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

0.00-3.45m

3.45-6.80m

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH109**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925692.58 mN 1745591.85 mE	DRILL TYPE:	HOLE STARTED: 23/06/2021
R.L.:	27.24m	DRILL METHOD: RC	HOLE FINISHED: 24/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

6.80-10.20m

10.20-13.35m

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH109**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925692.58 mN 1745591.85 mE	DRILL TYPE:	HOLE STARTED: 23/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 24/06/2021
R.L.:	27.24m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

13.35-16.50m

16.50-19.05m

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH109**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925692.58 mN 1745591.85 mE	DRILL TYPE:	HOLE STARTED: 23/06/2021
R.L.:	27.24m	DRILL METHOD: RC	HOLE FINISHED: 24/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

19.05-21.40m

21.40-24.00m

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH109**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925692.58 mN 1745591.85 mE	DRILL TYPE:	HOLE STARTED: 23/06/2021
R.L.:	27.24m	DRILL METHOD: RC	HOLE FINISHED: 24/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

24.00-25.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:24:13 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 1 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925725.71 mN, 1745661.93 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Silty CLAY, minor sand; dark grey mottled orange. Stiff, moist, high plasticity. Sand, fine. Rootlets. INTERMIXED WITH: SILT, minor clay and minor sand; dark brown. Stiff, moist, low to medium plasticity. Sand, fine. (FILL).			HA	100		31	0										
	0.50m: Silty CLAY, minor sand; dark grey mottled orange. Stiff, moist, high plasticity. Sand, fine. (FILL).							0.5										
	0.75m: SILT, minor clay and minor sand; brown. Firm to stiff, moist, medium to high plasticity. Sand, fine. (FILL).							1.0										
	1.10m: Organic SILT, minor sand; brown streaked black. Stiff, moist, medium to high plasticity. Sand, fine. Organics, decomposed rootlets. INTERMIXED WITH: PEAT (FIBROUS AND AMORPHOUS); black. Firm to stiff, moist. (FILL).			HQ3	100		30											
				SPT	100	76/16 kPa 0/1 0/1 1/0 **N=4**		1.5										
								2.0										
	2.30m: Peaty SILT, minor sand; brown streaked black. Firm to stiff, moist, low plasticity. Black; sand, fine. Organics, decomposed rootlets. (FILL). *2.40 - 2.50m:* Silty CLAY; light brownish orange. Stiff, high plasticity.			HQ3	100		29	2.5										
	3.00m: Organic sandy SILT; brown. Stiff, moist, low plasticity. Sand, fine. Organics, decomposed material. (FILL).							3.0										
	3.13m: PEAT (FIBROUS AND AMORPHOUS); black. Firm to stiff, moist. (FILL).			SPT	100	0/- kPa SV test failed 0/0 1/0 1/1 **N=3**	28											
Tauranga Group	*3.45m:* Silty sandy CLAY; dark grey mottled orange. Stiff to very stiff, moist, high plasticity. Sand, fine. (UNDIFFERENTIATED).			HQ3	100			3.5										
							27	4.0										
				SPT	100	129/4 kPa 1/2 1/2 3/2 **N=8**		4.5										

Box 1, 0.00-3.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 2 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925725.71 mN 1745661.93 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.10m:* Sandy SILT, minor clay; light grey. Very stiff, moist, medium to high plasticity. Sand, fine. *5.70 - 6.05m:* Trace clay.			SPT	89	0/- kPa SV test failed 1/1 1/1 2/1 **N=5**	25	6.0										Box 2, 3.00-6.45m
	6.42m: Sandy SILT, trace organics; light grey speckled black. Firm, moist, medium to high plasticity. Sand, fine. Organics, decomposed specks. Slightly sensitive. *7.45 - 7.48m:* Light grey mottled orange.			HQ3	100		24	7.0										
	7.50m: NO RECOVERY. - Push Tube Sample.			PT	0			7.5										
	8.00m: Sandy SILT, trace organics; light grey speckled black. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, decomposed specks. Slightly sensitive.			HQ3	100		23	8.0										
	9.00m: Sandy SILT, trace organics; grey streaked black. Stiff, moist, medium to high plasticity. Sand, fine. Organics, carbonaceous flecks. INDISTINCTLY INTERBEDDED WITH: Silty SAND, trace organics; grey speckled black. Very loose to loose, moist. Organics, carbonaceous flecks. (Residual Soil).			SPT	100	54/18 kPa 0/1 1/1 1/1 **N=4**	22	9.0										Box 3, 6.45-9.50m
	9.50m: Sandy SILT, trace organics; grey speckled black. Stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous flecks. INDISTINCTLY INTERBEDDED WITH: Silty CLAY, trace organics. Very stiff, moist, high plasticity. Organics, carbonaceous flecks. (Residual Soil). *9.88 - 10.05m:* SAND, minor silt; grey. Loosely packed, wet. Sand, fine.							9.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 3 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925725.71 mN 1745661.93 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Sandy SILT, trace organics; grey speckled black. Stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous flecks. INDISTINCTLY INTERBEDDED WITH: Silty CLAY, trace organics; grey speckled black. Very stiff, moist, high plasticity. Organics, carbonaceous flecks. (Residual Soil) [CONT].			HQ3	100													
	10.55 - 10.75m: SAND, minor silt; grey. Loosely packed, wet. Sand, fine.			SPT	100	97/30 kPa 1/1 1/1 1/1 **N=4**		10.5										
	10.80 - 10.90m: SAND, minor silt; grey. Loosely packed, wet. Sand, fine.																	
	10.90m: Sandy SILT, trace organics; grey speckled black. Firm to stiff, moist, medium to high plasticity. Sand, fine. Organics, carbonaceous flecks.			HQ3	100			11.0										
	11.45 - 11.70m: Silty CLAY; grey. Very stiff, moist, high plasticity.							11.5										
	12.40m: Silty CLAY, minor sand, trace organics; grey speckled black. Very stiff, wet, high plasticity. Sand, fine. Organics, carbonaceous flecks.			SPTS	100	71/18 kPa 2/2 2/3 3/3 **N=11**		12.0										
	13.25m: Sandy SILT, trace organics; grey. Very stiff, moist, low to medium plasticity. Sand, fine. Organics, carbonaceous flecks.			HQ3	95			12.5										
	13.50m: SAND, some silt, trace organics; grey speckled greenish grey. Loose to medium dense, moist. Sand, fine. Organics, carbonaceous flecks.			SPTS	100	40/15 kPa 1/1 2/1 2/2 **N=7**		13.0										
				HQ3	100			13.5										
								14.0										
								14.5										

RL (m): 21, 20, 19, 18, 17

Box 4, 9.50-12.85m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 4 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925725.71 mN 1745661.93 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* SAND, some silt, trace organics; grey speckled greenish grey. Loose to medium dense, moist. Sand, fine. Organics, carbonaceous flecks. [CONT].			SPTS	100	2/2 2/2 2/4 **N=10**	16	15.5										
	15.70m: Sandy SILT; grey. Stiff, moist, low plasticity. Sand, fine.																	
	15.83m: Silty SAND; grey, Blocky. Loosely packed, moist. Sand, fine to medium.			HQ3	100		15	16.0										Box 5, 12.85-16.05m
	16.50 - 16.70m: SILT, some clay, minor organics and minor sand; grey streaked black. Very stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous material.			SPTS	100	23/7 kPa Sandy 2/2 2/2 3/4 **N=11**		16.5										
	16.92m: Silty SAND; greenish grey, Blocky. Loosely packed, moist. Sand, fine to medium.						14	17.0										
	17.20m: SAND, some silt. Loosely packed, moist. Sand, fine.			HQ3	100			17.5										
East Coast Bays Formation	*17.52m:* HW, grey, Sandy SILTSTONE. Extremely weak (hard), uncemented to poorly cemented, fine grained, Recovered as Sandy SILT trace organics, moist, High plasticity, very stiff. Sand, fine; organics, carbonaceous flecks.																	
	17.95m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to medium grained, Recovered as SAND, some silt; medium dense, moist, fine. Remoulds to Sandy SILT, High plasticity.			SPTS	100	216/- kPa 3/4 5/5 6/8 **N=24**	13	18.0										
	18.90 - 19.75m: Silty SANDSTONE.			HQ3	100		12	18.5 19.0										Box 6, 16.05-19.35m
	19.75m: NO RECOVERY - Suspect slipped out of SPT spoon.			SPTS	56	3/4 5/5 6/6 **N=22**		19.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 5 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925725.71 mN 1745661.93 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, (SAND, some silt; medium dense, moist, fine) [CONT].					pH / ASS @ 20.00m pH = 7	11	20.5										
				SPTS	100	3/5 5/7 7/10 **N=29**	10	21.0										
				HQ3	100		9	21.5										
	22.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/5 5/6 7/8 **N=26** Solid		22.0										
	22.95m: MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, (SAND, some silt; medium dense, moist, fine).			HQ3	100	BH110 @ 22.95m MW, grey, Silty SANDSTONE. Extremely weak (medium dense) uncemented to poorly cemented, fine grained. Sample description from log PSD AL	8	22.5										
	24.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	pH / ASS @ 24.00m pH = 7 6/5 6/7 7/9 **N=29** Solid	7	23.0										
	24.45m: MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, (SAND, some silt; medium dense, moist, fine).							23.5										
								24.0										
								24.5										

Box 7, 19.35-23.10m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 6 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925725.71 mN 1745661.93 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, (SAND, some silt; dense, moist, fine) [CONT]. *25.30 - 25.50m:* Dense.			HQ3	100													
	25.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/7 7/8 9/10 **N=34** Solid		25.5										
	25.95m: MW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine grained.			HQ3	97			26.0										Box 8, 23.10-26.95m
	27.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/7 7/7 8/10 **N=33** Solid		27.0										
	27.45m: MW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine to medium grained. *28.38 - 28.50m:* Extremely weak (very dense).			HQ3	100			27.5 28.0										
	28.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	9/13 15/15 13/13 **N>=50** Solid		28.5										
	28.95m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained.			HQ3	100			29.0 29.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH110

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925725.71 mN 1745661.93 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 31.14m
R.L. COLLAR: 31.14m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 22/06/2021
FINISH DATE: 23/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	7/10 12/12 12/14 **N>=50** Solid	1	30.5										
	30.45m: CORE LOSS - Suspect core bound.			HQ3	19		0	31.0										
	31.25m: MW, grey, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained.							31.5										
	31.50m: NO RECOVERY.			SPTC	0	11/15 16/16 15/7 for 25mm **N>=50** Solid	-1	32.0										Box 9, 26.95-32.15m
	31.90m: MW, grey speckled light green, SANDSTONE. Extremely weak to very weak, moderately cemented, fine to coarse grained, Remoulds to Sandy SILT, low plasticity.																	
	32.45m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			HQ3	95			32.5				95	*32.47m:* DD *32.55m:* DD, 6°, PL, SM, VN, CN *32.62m:* BF, 10°, PL, SM, VN, CN *32.85m:* DD					Box 10, 32.15-33.00m
	33m: END OF BOREHOLE						-2	33.0										
							-3	33.5										
								34.0										
								34.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 21.0 - 27.0 m bgl.

Hole Depth 33m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH110**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925725.71 mN 1745661.93 mE	DRILL TYPE:	HOLE STARTED: 22/06/2021
R.L.:	31.14m	DRILL METHOD: RC	HOLE FINISHED: 23/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

0.00-3.00m

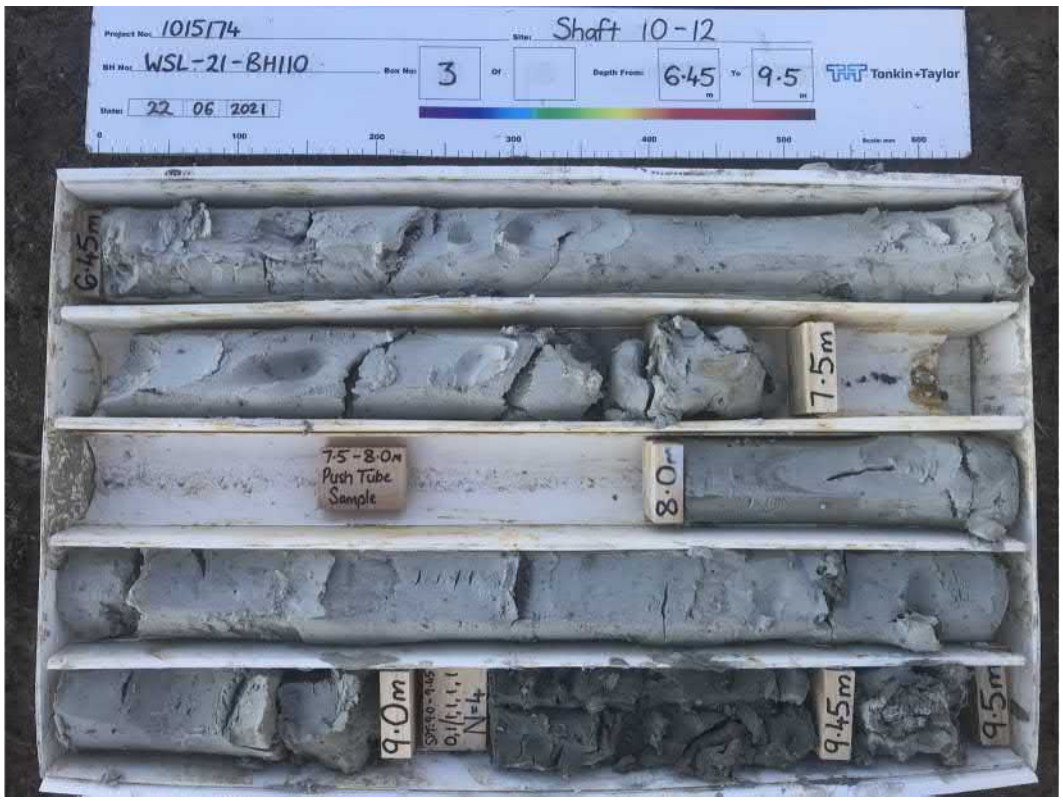
3.00-6.45m

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH110**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925725.71 mN 1745661.93 mE	DRILL TYPE:	HOLE STARTED: 22/06/2021
R.L.:	31.14m	DRILL METHOD: RC	HOLE FINISHED: 23/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU



6.45-9.50m

9.50-12.85m

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH110**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925725.71 mN 1745661.93 mE	DRILL TYPE:	HOLE STARTED: 22/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 23/06/2021
R.L.:	31.14m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

12.85-16.05m

16.05-19.35m

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH110**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925725.71 mN 1745661.93 mE	DRILL TYPE:	HOLE STARTED: 22/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 23/06/2021
R.L.:	31.14m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

19.35-23.10m

23.10-26.95m

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH110**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925725.71 mN 1745661.93 mE	DRILL TYPE:	HOLE STARTED: 22/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 23/06/2021
R.L.:	31.14m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

26.95-32.15m

32.15-33.00m

General Log - DESX005 - Fix RQD - 8/12/2021 11:43:48 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 1 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925818.00 mN 1745839.35 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m
R.L. COLLAR: 34.40m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, minor organics; light brown. Firm, moist, medium plasticity. Organics, rootlets (fresh). (TOPSOIL).																	
	0.10m: Silty CLAY, some sand, trace organics; light grey mottled orange. Very stiff, moist, high plasticity. Sand, fine. Organics, rootlets (fresh). (FILL).			HA	100	>216 kPa		0.5										
	0.60m: Clayey SILT, minor sand, trace organics; brown mottled orange. Very stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh). (FILL).					172/46 kPa UTP	33	1.0										
	1.05m: Sandy SILT, some clay, trace organics; dark brown mixed orange, Lensoidal. Hard, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh). (FILL).					UTP												
	1.20m: Clayey SILT, minor sand, trace organics; brown mottled orange. Very stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh). (FILL).			HQ3	100			1.5										
	1.35m: Sandy SILT, some clay, trace organics; dark brown mixed orange, Blocky. Hard, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh). (FILL).					UTP												
	1.65m: Sandy SILT; dark grey. Firm, moist, low to medium plasticity. (FILL).			SPT	73	1/1 1/1 1/1 **N=4**	32	2.0										
	1.83m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	1.95m: Sandy SILT; dark grey. Firm, moist, medium plasticity. (FILL).			HQ3	52			2.5										
	2.50m: CORE LOSS - Suspect washed out.						31	3.0							18/06/2021			
	3.00m: Sandy SILT; dark brown mixed grey. Stiff, moist, medium plasticity. (FILL).			SPT	89	UTP SV test failed 0/0 0/1 1/1 **N=3**												
				HQ3	100			3.5										Box 1, 0.00-3.65m
						62/7 kPa	30											
	4.05m: Sandy SILT; dark brown mixed grey. Stiff, moist, medium plasticity. INTERMIXED WITH: SILT, some clay; grey mottled orange. Stiff, moist, medium to high plasticity. (FILL).			HQ3	100			4.0										
	4.50m: SILT, some clay, minor sand; brown spotted dark grey. Very stiff, moist, medium plasticity. (FILL).			SPT	73	216/- kPa 1/2 1/2 2/2 **N=7**	29	4.5										
	4.83m: NO RECOVERY - Suspect slipped out of SPT spoon.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:55 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 2 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925818.00 mN 1745839.35 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m
R.L. COLLAR: 34.40m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	*5.00m:* Sandy SILT, trace clay; brown mottled dark grey. Firm to stiff, moist, medium plasticity. Sand, fine. (FILL). [CONT].																	
Tauranga Group	*5.50m:* SILT, some clay and some sand; grey mottled orange. Very stiff, moist, medium to high plasticity. Sand, fine.			HQ3	100		28	5.5										
	5.90m: Sandy SILT, some clay; grey mottled orange. Very stiff, moist, medium to high plasticity. Sand, fine.			SPT	91	150/63 kPa 1/1 2/3 2/3 **N=10**		6.0										
	6.85 - 7.35m: Minor clay.			HQ3	100		27	6.5										Box 2, 3.65-6.80m
	7.35m: Sandy SILT; grey mottled orange. Stiff, moist, medium plasticity. Sand, fine.			SPT	100	82/- kPa 1/0 1/1 1/1 **N=4**		7.0										
	8.90 - 9.00m: Orange.			HQ3	100		26	7.5										
	9.00m: Sandy SILT; light grey. Firm to stiff, moist, medium plasticity. Sand, fine.			SPT	100	62/29 kPa 1/1 1/2 2/2 **N=7**		8.0										
							25	8.5										
								9.0										
							24	9.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925818.00 mN, 1745839.35 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m
R.L. COLLAR: 34.40m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Sandy SILT; light grey. Firm to stiff, moist, medium plasticity. Sand, fine. [CONT].			HQ3	97			10.5										
	10.50m: Sandy SILT, trace organics and trace clay; grey, Blocky. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, wood fragments (decomposed).			SPT	100	69/35 kPa 0/0 0/0 0/3 **N=3**	23	11.0										
				HQ3	100			11.5										
				SPT	100	0/- kPa SV test failed 1/0 1/1 2/2 **N=6**	22	12.0										
				HQ3	100			12.5										
				SPT	100	63/30 kPa 1/1 2/2 1/2 **N=7**	21	13.0										
				HQ3	100			13.5										Box 4, 10.05-13.30m
	14.42m: Sandy SILT, trace organics and trace clay; grey, Blocky. Stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous flecks. INTERBEDDED WITH: Silty CLAY; grey. Stiff, moist, high plasticity.						20	14.0										
							19	14.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 4 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925818.00 mN 1745839.35 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m
R.L. COLLAR: 34.40m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Sandy SILT, trace organics and trace clay; grey, Blocky. Stiff, moist, low plasticity. Sand, fine. Organics, carbonaceous flecks. INTERBEDDED WITH: Silty CLAY; grey. Stiff, moist, high plasticity.			SPT	100	2/2 2/3 3/3 N=8												
	15.85m: Sandy SILT, trace organics and trace clay; grey. Stiff, moist, medium plasticity. Organics, carbonaceous flecks.			HQ3	100													
	16.50m: Silty CLAY; dark grey. Very stiff, moist, high plasticity.					79/29 kPa												
	16.60m: Sandy SILT; grey. Very stiff, moist, medium plasticity. Sand, fine.			SPT	78	3/2 3/4 4/3 N=14												
				HQ3	84													
	17.83m: CORE LOSS - Suspect washed out.																	
	18.00m: SAND, minor silt; grey. Medium dense, moist, medium plasticity. Sand, fine.			SPTS	100	216/- kPa 2/2 4/4 5/5 N=18												
	18.55m: Sandy SILT; grey. Very stiff, moist. Sand, fine. INTERBEDDED WITH: Silty CLAY; dark grey. Very stiff, moist, high plasticity.			HQ3	100													
	19.20m: Sandy SILT; grey. Stiff, moist, low plasticity. Sand, fine.																	
	19.45m: Silty SAND; grey. Medium dense, moist. Sand, fine.			SPTS	100	UTP 3/2 3/3 3/4 N=13												

Box 5, 13.30-16.40m

Box 6, 16.40-19.95m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 5 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925818.00 mN 1745839.35 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m
R.L. COLLAR: 34.40m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 16/06/2021
FINISH DATE: 18/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.00m:* Sandy SILT; grey. Very stiff, moist, low plasticity. Sand, fine. [CONT].					pH & ASS @ 20.00m pH = 7												
	20.35m: Silty SAND; grey. Medium dense, moist. Sand, fine.							20.5										
	21.05 - 22.55m: Light greyish green.			SPT	100	3/2 2/4 3/5 **N=14**	13	21.0										
				HQ3	100			21.5										
							12	22.0										
	22.55m: SAND, minor silt; light greenish grey. Medium dense, moist. Sand, fine.			SPTS	100	3/3 4/4 4/5 **N=17**		22.5										
	23.30 - 24.45m: Silty SANDSTONE.			HQ3	100		11	23.0										
								23.5										
							10	24.0										
				SPTS	100	57/16 kPa pH & ASS @ 24.00m pH = 7 4/3 3/5 6/6 **N=20**												
	24.45m: Sandy SILT; light greyish green. Very stiff, moist, low plasticity. Sand, fine.							24.5										
	24.80m: Silty SAND; light greenish grey. Medium dense, moist. Sand, fine.						9											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 6 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925818.00 mN 1745839.35 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m

R.L. COLLAR: 34.40m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 16/06/2021

FINISH DATE: 18/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*25.00m:* Silty SAND; light greenish grey. Medium dense, moist. Sand, fine. [CONT].			HQ3	100		25.5										
				SPT	100	3/4 4/5 5/6 **N=20**	8										
	25.92 - 25.93m: Mottled orange.						26.0										
	26.28 - 26.57m: Light greyish green mottled orange.			HQ3	100		26.5										Box 8, 23.25-26.55m
	26.60 - 26.70m: Light greyish green mottled orange.																
East Coast Bays Formation	*26.70m:* HW, dark grey speckled, Sandy SILTSTONE. Extremely weak (very stiff), fine grained, Recovered as: Sandy SILT, minor clay, Hard, moist, high plasticity.					BH112 @ 26.70m mw zst ew Sample description from sample	7										
	26.97m: MW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to medium grained, (SAND with some silt; grey, fine, moist, medium dense).					AL PSD	27.0										
				SPT	100	4/4 5/6 7/9 **N=27**	27.5										
				HQ3	100		6										
							28.0										
				SPT	100	5/5 7/9 10/12 **N=38**	28.5										
							5										
				HQ3	100		29.0										
							29.5										Box 9, 26.55-30.00m
							4										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH112

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925818.00 mN 1745839.35 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 33.80m

R.L. COLLAR: 34.40m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent/ James

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 16/06/2021

FINISH DATE: 18/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* MW, grey, SANDSTONE. Extremely weak (medium dense) grading to Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained, (SAND with some silt; grey, fine, moist, medium dense to very dense). [CONT].	UW SW MW HW CW	ES VS WS MS W VW EW	SPTS	100	12/15 23/27 for 45mm **N>=50**	3	30.5			2000 600 200 60 20				25 50 75				
	30.37m: UW, grey, SANDSTONE. Very weak locally Extremely weak (very dense), poorly cemented to moderately cemented, fine to medium grained, (SAND with some silt; grey, fine to medium, moist, very dense).			HQ3	95							44	*30.45m:* J, 25°, PL, SM, VN, CN *30.62m:* J, 32°, PL, R, VN, CN *30.83m:* J, 22°, PL, R, VN, CN						
	30.90m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.							31.0					*30.87-31.03m:* J, 70°, PL, SM, VN, CN *30.91m:* J, 22°, PL, SM, VN, iron oxide stained *30.93m:* J, 22°, PL, SM, VN, clay veneer *31.06m:* J, 40°, PL, SM, CN *31.12-31.50m:* J, 78-90°, PL, R, VN, CN *31.26m:* BF, 4°, UN, R, VN, CN						Box 10, 30.00-31.50m
	31.5m: END OF BOREHOLE						2 1 0 -1	31.5 32.0 32.5 33.0 33.5 34.0 34.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 27.93m bgl

Hole Depth 31.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH112**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925818.00 mN 1745839.35 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	33.80m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

0.00-3.65m

3.65-6.80m

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH112**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925818.00 mN 1745839.35 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	33.80m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

6.80-10.05m

10.05-13.30m

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH112**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925818.00 mN 1745839.35 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
R.L.:	33.80m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

13.30-16.40m

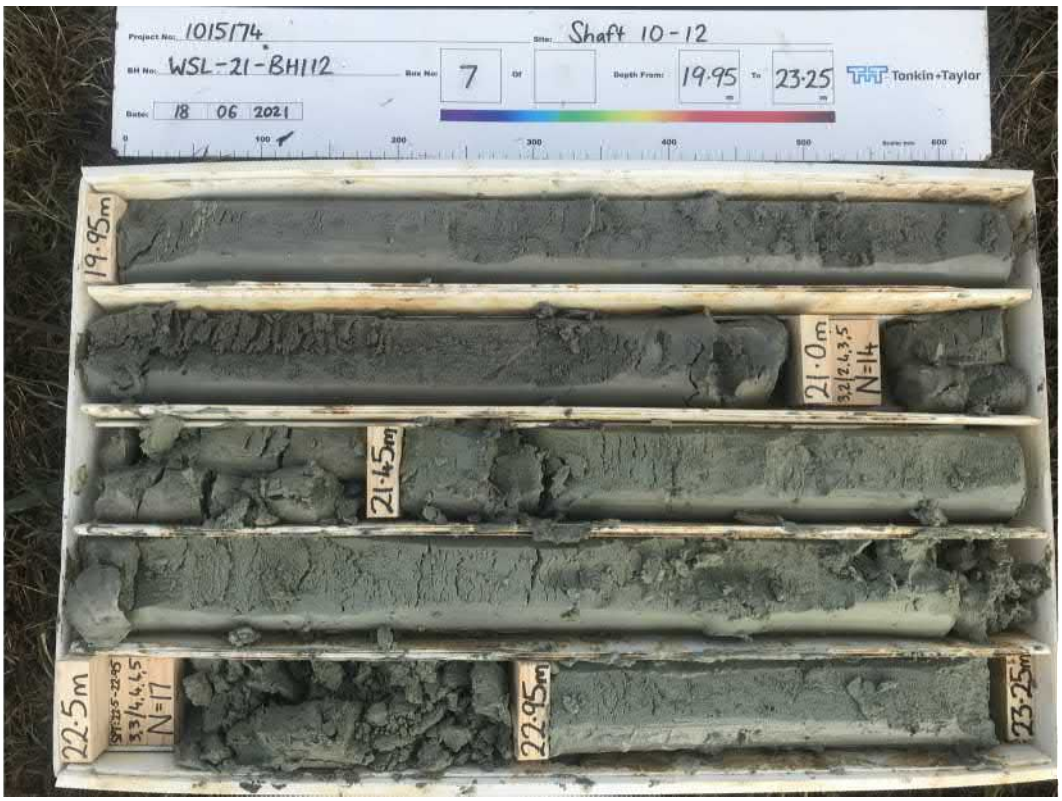
16.40-19.95m

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH112**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925818.00 mN 1745839.35 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
R.L.:	33.80m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU



19.95-23.25m

23.25-26.55m

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH112**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925818.00 mN 1745839.35 mE	DRILL TYPE:	HOLE STARTED: 16/06/2021
R.L.:	33.80m	DRILL METHOD: RC	HOLE FINISHED: 18/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

26.55-30.00m

30.00-31.50m

General Log - DESX005 - Fix RQD - 16/12/2021 5:00:56 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH114

SHEET: 1 OF 3

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925943.42 mN, 1746044.63 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.68m
R.L. COLLAR: 17.68m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 07/10/2021
FINISH DATE: 08/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics; dark brown. Firm, moist, low plasticity. Sand, fine. Organics, rootlets.																	
	0.10m: SILT, some sand, minor clay, trace organics; brown mixed orange. Stiff, moist, low to medium plasticity. Sand, fine. Organics, rootlets.					2 x Glass Jar / 1 x Plastic Jar @ 0.10m												
	0.60m: SILT, some sand, minor clay, trace organics and trace gravel; dark brown mixed orange. Stiff, moist, low to medium plasticity. Sand, fine; gravel, fine to medium, sub-angular to angular, unweathered, Sandstone. Organics, rootlets.			HA	100	UTP; 2 x Glass Jar / 1 x Plastic Jar @ 0.50m; UTP	17	0.5; 1.0									
	1.77m: NO RECOVERY - Suspect slipped out of SPT spoon.			HQTT; SPT	100; 49	UTP; 0/1 0/1 1/1 **N=3**	16	1.5										
	1.95m: SILT, some sand, minor clay, trace organics and trace gravel; dark brown mixed orange. Stiff, moist, low to medium plasticity. Sand, fine; gravel, fine to medium, sub-angular to angular, unweathered, Sandstone. Organics, rootlets.																	
	2.20m: Silty CLAY, some sand; grey mottled orange. Stiff, moist, medium plasticity. Sand, fine.			HQTT	86		15	2.0; 2.5										
	2.85m: CORE LOSS - Suspect washed out.																	
	3.00m: Silty CLAY, some sand; grey mottled orange. Hard, moist, high plasticity. Sand, fine. INTERMIXED WITH: Silty SAND; grey. Loosely packed, moist. Sand, fine.			SPT	84	>225 kPa; 1/1 2/2 3/2 **N=9**		3.0										
	3.38m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	3.45m: CORE LOSS - Suspect washed out.			HQTT	30		14	3.5; 4.0							08/10/2021			Box 1, 0.00-3.45m
	4.18m: Sandy SILT, minor clay; greyish brown mottled orange. Stiff, moist, medium to high plasticity. Sand, fine.																	
	4.50m: Sandy SILT, trace gravel; brown. Stiff, moist, medium to high plasticity. Sand, fine; gravel, fine, sub-angular to angular, unweathered, Sandstone.			SPT	78	0/- kPa SV test failed; 1/0 0/1 0/1 **N=2**	13	4.5										
	4.88m: NO RECOVERY - Suspect slipped out of SPT spoon.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer test undertaken on 8/11/2021 between 11.0 - 15.0m bgl. Standpipe piezometer installed with screened interval at 10.5 - 13.5m bgl.

Hole Depth 15m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 9:45:16 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH114

SHEET: 2 OF 3

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925943.42 mN 1746044.63 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.68m
R.L. COLLAR: 17.68m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 07/10/2021
FINISH DATE: 08/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic SILT, some sand; brown streaked dark brown. Firm to stiff, moist, low plasticity. Sand, fine. Organics, rootlets (partially decomposed).																	
	5.45m: SILT, minor organics and minor sand; light green streaked dark brown, Blocky. Firm to stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (decomposed).																	
	6.05m: Organic SILT, some sand, minor clay; brown streaked dark brown. Firm to stiff, moist, low to medium plasticity. Sand, fine. Organics, rootlets (partially decomposed).			SPT	100	53/19 kPa 0/0 0/1 0/1 **N=2**		6.0										
	6.75m: Sandy SILT, trace organics; light grey streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed).			HQTT	100			6.5										
	6.95m: Silty SAND; light grey. Loosely packed, moist. Sand, fine.																	
	7.20m: Sandy SILT, trace organics; light grey streaked dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed).							7.0										
	7.35 - 7.40m: Sandy SILT, some organics; grey. Firm to stiff, moist, low plasticity. Organics, wood fragments (partially decomposed)																	
	7.50m: Organic clayey SILT, some sand; dark brown. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed).			SPT	100	119/38 kPa 0/1 1/2 2/3 **N=8**		7.5										
	7.70m: Silty SAND, some organics; brown. Loosely packed, moist. Sand, fine.																	
East Coast Bays Formation	*7.95m:* MW, grey, SANDSTONE. Extremely weak, uncemented to poorly cemented, fine to medium grained. INDISTINCTLY INTERBEDDED WITH: MW, grey, MUDSTONE. Extremely weak (hard), poorly cemented to moderately cemented.			HQTT	57			8.0										
	8.55m: CORE LOSS - Suspect washed out.							8.5										
	9.00m: UW, grey, SANDSTONE. Extremely weak, uncemented to poorly cemented, fine to medium grained, Recovered as: SAND, some silt. Medium dense, moist.			SPT	100	4/6 8/8 9/10 **N=35**		9.0										
								9.5										

Box 2, 3.45-7.50m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer test undertaken on 8/11/2021 between 11.0 - 15.0m bgl. Standpipe piezometer installed with screened interval at 10.5 - 13.5m bgl.

Hole Depth 15m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 9:45:17 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH114

SHEET: 3 OF 3

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925943.42 mN 1746044.63 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.68m

R.L. COLLAR: 17.68m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Vincent

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 07/10/2021

FINISH DATE: 08/10/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.20m:* UW, grey, MUDSTONE. Extremely weak (hard), poorly cemented to moderately cemented, Recovered as: Silty CLAY. Hard, moist..			HQTT	90		7	10.5					*10.00m:* DD, Pull apart *10.38m:* BF, 38°, PL, SM, VN, CN					
	10.40m: CORE LOSS - Suspect washed out.																	
	10.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/10 9/8 8/10 **N=35** Solid							*10.50-10.95m:* , No Recovery					
	10.95m: UW, grey, MUDSTONE. Extremely weak to very weak, poorly cemented to moderately cemented. 20 to 70mm thick, 35 to 40° inclined. DISTINCTLY INTERBEDDED WITH: UW, grey, SANDSTONE. Extremely weak, uncemented to poorly cemented, fine to medium grained. 10 to 100mm thick.			HQTT	86		6	11.5				37	*10.95-12.00m:* , Drilling induced breaks along extremely weak Sandstone bedding *11.45m:* BF, 40°, PL, SM, CN *11.60-11.66m:* BZ, brecciated EW Sandstone *11.60m:* J, 30°, PL, SM, VN, CN *11.66m:* BF, 38°, PL, SM, VN, CN					Box 3, 7.50-11.60m
	11.85m: CORE LOSS - Suspect washed out.																	
	12.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	12/17 22/20 8 for 35mm **N>=50** Solid		12.0					*11.85-12.34m:* , No Recovery					
	12.34m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			HQTT	78		5	12.5				72	*12.46m:* DD *12.65m:* J, 62°, PL, SM, VN, CN *12.70m:* BF, 28°, PL, SM, VN, CN					
	13.32m: CORE LOSS - Suspect washed out.							13.0										
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	11/27 30/20 for 60mm **N>=50** Solid		13.5					*13.50-13.79m:* , No Recovery					
	13.79m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			HQTT	100		4	14.0				82	*13.96m:* BF, 38°, PL, SM, VN, fine grained sandinfill *14.22m:* J, 18°, PL, R, VN, CN *14.23m:* BF, 55°, PL, R, VN, CN *14.36m:* DD, 0°					
	14.80 - 14.88m: UW. Extremely weak.							14.5										
	15m: END OF BOREHOLE. Target depth.						3						*14.91m:* BF, 55°, PL, R, VN, CN					Box 4, 11.60-15.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer test undertaken on 8/11/2021 between 11.0 - 15.0m bgl. Standpipe piezometer installed with screened interval at 10.5 - 13.5m bgl.

Hole Depth 15m

Scale 1:25

Rev.: A

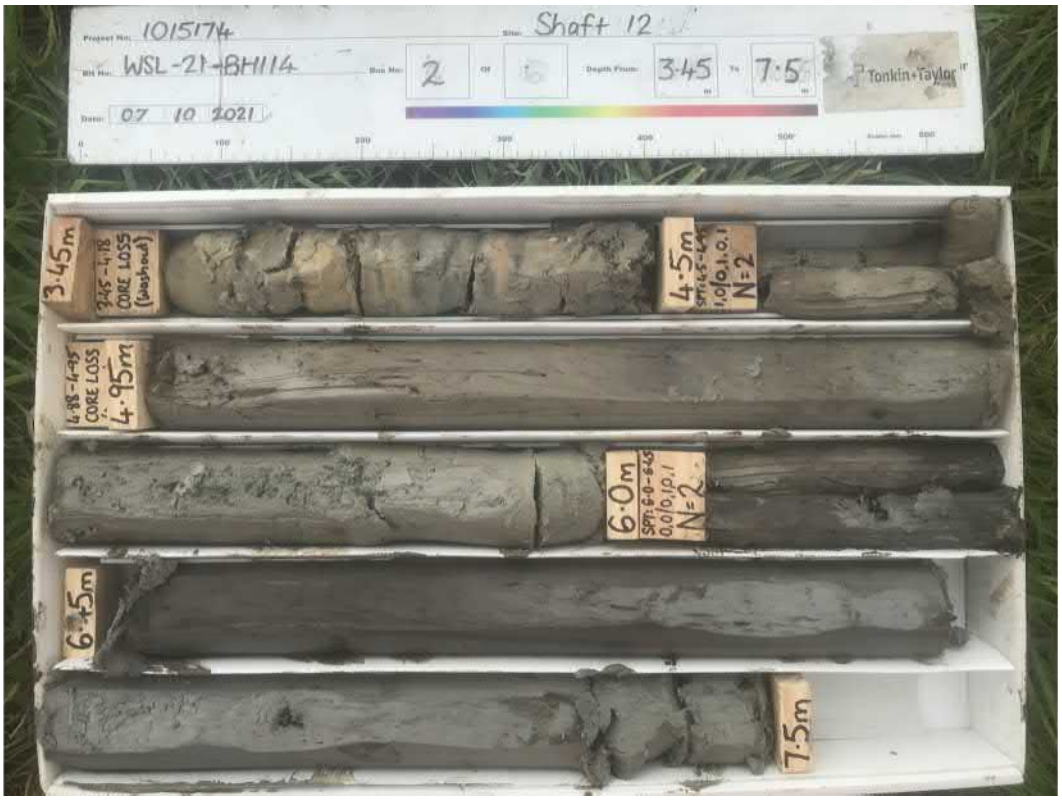
General Log - DESX005 - Fix RQD - 9/12/2021 9:45:17 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH114**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925943.42 mN 1746044.63 mE	DRILL TYPE:	HOLE STARTED: 07/10/2021
R.L.:	17.68m	DRILL METHOD: RC	HOLE FINISHED: 08/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-3.45m



3.45-7.50m

General Log - DESX005 - Fix RQD - 9/12/2021 9:45:17 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH114**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925943.42 mN 1746044.63 mE	DRILL TYPE:	HOLE STARTED: 07/10/2021
R.L.:	17.68m	DRILL METHOD: RC	HOLE FINISHED: 08/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

7.50-11.60m

11.60-15.00m

General Log - DESX005 - Fix RQD - 9/12/2021 9:45:17 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH115

SHEET: 1 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925923.52 mN, 1746077.26 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR: 21.60m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 05/10/2021
FINISH DATE: 06/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
Fill	*0.00m:* Sandy SILT, minor clay, trace organics; brownish orange spotted dark grey. Firm to stiff, moist, low to medium plasticity. Sand, fine to medium. Organics, rootlets. (FILL)	HA	100	UTP	21	0.5
	0.65m: SILT, minor clay and minor sand; grey streaked dark grey. Stiff, moist, medium plasticity. Sand, fine. (FILL)					
	0.85m: Sandy SILT, minor clay, trace organics and trace gravel; dark brown streaked dark grey. Stiff, moist, low to medium plasticity. Sand, fine to medium; gravel, fine, sub-angular to angular, unweathered, Sandstone. Organics, rootlets. (FILL)			UTP		1.0
	1.20m: CORE LOSS. Material disturbed by drilling process.	HQTT	100			1.5
	1.50m: Sandy SILT, minor clay, trace organics and trace gravel; dark brown streaked dark grey. Stiff, moist, low to medium plasticity. Sand, fine to medium; gravel, fine, sub-angular to angular, unweathered, Sandstone. Organics, rootlets. (FILL)	SPT	44	UTP 0/1 0/1 0/1 **N=2**	20	
	1.70m: NO RECOVERY - Suspect slipped out of SPT spoon.					
	1.95m: Sandy SILT, minor gravel; dark brown streaked dark grey. Stiff, moist, low plasticity. Sand, fine to medium; gravel, fine, sub-angular to angular, unweathered, Sandstone. (FILL)	HQTT	100			2.0
	2.25m: SILT, some sand, minor clay; light brown mottled grey. Stiff, moist, medium plasticity. Sand, fine. (FILL)					
	2.50m: Sandy SILT, minor gravel, trace organics; dark brown streaked brown. Stiff, moist, low plasticity. Sand, fine to medium; gravel, fine, sub-angular to angular, unweathered, Sandstone. Organics, wood fragments (fresh). (FILL)				19	2.5
	2.95 - 3.00m: GRAVEL; grey. Loosely packed. Gravel, fine to medium, sub-angular to angular, unweathered, Sandstone.					3.0
Tauranga Group	*3.00m:* SILT, some clay, minor sand; brownish orange mottled grey. Stiff, moist, medium to high plasticity. Sand, fine	SPT	71	UTP 1/1 1/2 1/2 **N=6**		
		HQTT	100		18	3.5
						4.0
	4.55m: Organic SILT; dark brown mottled brown. Medium plasticity	SPT	100	0/- kPa SV failed 1/0 0/1 0/1 **N=2**	17	4.5

ROCK DEFECTS: Defect Log; Fracture Spacing (mm); RQD (%); Description & Additional Observations

Rock Weathering: UW SW MW HW CW DW
Rock Strength: ES VS S MS M W VW EW

Fluid Loss (%): 25 50 75

Water Level: ▼ 06/10/2021

Casing; Installation: Box 1, 0.00-3.45m; Core Box No

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 06/10/21 following completion of hole with casing installed down to 10.50 m. Nested standpipe piezometer installed with screened intervals at 5.0 - 8.0m bgl and 16.0 - 19.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 9:46:10 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH115

SHEET: 2 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925923.52 mN, 1746077.26 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR: 21.60m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 05/10/2021
FINISH DATE: 06/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic SILT; dark brown mottled brown. Medium plasticity. [CONT]																	
	5.35m: Organic SILT; dark brown mottled brown. Medium plasticity. Organics, wood fragments (partially decomposed). Oxidises black			HQTT	105			5.5										
	5.60m: Sandy SILT, minor organics; grey spotted dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed)						16											
	6.00m: NOT LOGGED. - Push tube sample.			PT	0	0/- kPa SV failed		6.0										
	6.50m: SILT, some sand, minor organics; greyish brown spotted dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, wood fragments (partially decomposed)			HQTT	100		15	6.5										Box 2, 3.45-6.70m
	7.55m: NO RECOVERY - Suspect slipped out of SPT spoon.			SPT	100	0/- kPa SV failed 0/1 1/1 1/2 **N=5**	14	7.0 7.5										
	7.95m: SILT, some sand, minor organics; greyish brown spotted dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed)							8.0										
	8.10m: Sandy SILT, minor organics; light greyish brown spotted dark brown. Loosely packed, moist, low plasticity. Sand, fine. Organics, wood fragments (partially decomposed).			HQTT	100		13	8.5										
	8.95m: Silty SAND, trace organics; light green. Loosely packed, moist. Sand, fine. Organics, carbonaceous material			SPTC	100	>225 kPa 1/1 3/5 5/8 **N=21** Solid		9.0										
East Coast Bays Formation	*9.40m:* MW, grey streaked black, SANDSTONE. Extremely weak, poorly cemented, fine grained, Recovered as: SAND. some silt. Tightly packed, moist..						12	9.5										
	9.55m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained. 50 to 120mm thick. INDISTINCTLY INTERBEDDED WITH: UW, dark grey, SILTSTONE. Very weak, moderately cemented. 60 to 80mm thick, 25 to 30° inclined.											43	*9.55m:* BF, 22°, PL, SM, VN, \ *9.56m:* J, 78°, PL, SM, VN, CN *9.61m:* BF, 28°, PL, SM, VN, CN *9.69m:* BF, 28°, PL, SM, VN, CN *9.76m:* BF, 32°, PL, SM, VN, CN *9.86m:* BF, 32°, PL, SM, VN, CN					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 06/10/21 following completion of hole with casing installed down to 10.50 m. Nested standpipe piezometer installed with screened intervals at 5.0 - 8.0m bgl and 16.0 - 19.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 9:46:11 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH115

SHEET: 3 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925923.52 mN 1746077.26 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR: 21.60m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 05/10/2021
FINISH DATE: 06/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained.	HQTT	100		11	10.5	43	*10.20m:* J, 45°, PL, R, VN, CN *10.28m:* DD, 0°					
	10.50m: NO RECOVERY - Solid SPT, no overcore recovered.	SPTC	0	4/10 18/20 12 for 35mm **N>=50** Solid				*10.45m:* DD, 0° *10.50-10.84m:* , No Recovery					
	10.84m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained.	HQTT	100		10	11.0	78	*10.93m:* BF, 28°, PL, SM, VN, CN *10.94m:* J, 35°, PL, R, VN, CN *10.98m:* BF, 28°, PL, SM, VN, CN *11.10m:* J, 15°, PL, R, VN, CN					
	11.40m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained. 50 to 120mm thick. INDISTINCTLY INTERBEDDED WITH: UW, dark grey, SILTSTONE. Very weak, moderately cemented. 60 to 80mm thick, 25 to 30° inclined.					11.5		*11.41m:* J, 62°, PL, R, VN, CN *11.58m:* BF, 22°, PL, R, VN, CN *11.59m:* J, 68°, PL, R, VN, CN					
	12.00m: NO RECOVERY - Solid SPT, no overcore recovered.	SPTC	0	10/40 for 70mm **N>=50** Solid		12.0		*11.77-12.00m:* J, 78°, PL, SM, VN, CN *11.83m:* BF, 38°, PL, SM, VN, CN *11.90m:* BF, 32°, PL, SM, VN, CN *12.00-12.14m:* , No Recovery					
	12.14m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained. 50 to 120mm thick. INDISTINCTLY INTERBEDDED WITH: UW, dark grey, SILTSTONE. Very weak, moderately cemented. 60 to 80mm thick, 25 to 30° inclined.	HQTT	81		9	12.5	33	*12.18m:* BF, 30°, PL, SM, VN, CN *12.19m:* BF, 30°, PL, SM, VN, CN *12.31m:* BF, 22°, PL, SM, VN, CN *12.32m:* J, 55°, PL, SM, VN, CN *12.45m:* BF, 0° *12.54m:* BF, 18°, PL, SM, VN, CN *12.55m:* DD, 0° *12.59m:* BF, 42°, PL, SM, VN, CN *12.63m:* BF, 22°, PL, SM, VN, CN *12.68m:* DD, 0° *12.71m:* BF, 32°, PL, SM, VN, CN *12.79m:* BF, 28°, PL, SM, VN, CN *12.84m:* BF, 38°, PL, SM, VN, CN *12.85m:* J, 35°, PL, SM, VN, CN *12.93m:* BF, 38°, PL, SM, VN, CN *13.07m:* BF, 38°, PL, SM, VN, CN					
	13.02 - 13.06m: UW, grey, SANDSTONE. Extremely weak, uncemented to poorly cemented, fine grained.					13.0							
	13.24m: CORE LOSS - Suspect washed out.												
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.	SPTC	0	9/12 13/17 20 for 75mm **N>=50** Solid	8	13.5		*13.24-13.88m:* , No Recovery					Box 4, 10.05-13.88m
	13.88m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained. *14.05 - 14.15m:* UW, grey, Conglomeratic SANDSTONE. Very weak, moderately cemented, fine to coarse grained.	HQTT	134		7	14.0	79	*13.95m:* J, 20-65°, UN, SM, VN, CN *14.28m:* BF, 28°, PL, SM, VN, CN *14.35m:* DD, 0° *14.54-14.62m:* DD, 0°, Discing of core					
						14.5							

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 06/10/21 following completion of hole with casing installed down to 10.50 m. Nested standpipe piezometer installed with screened intervals at 5.0 - 8.0m bgl and 16.0 - 19.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 9:46:11 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH115

SHEET: 4 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925923.52 mN 1746077.26 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 21.60m
R.L. COLLAR: 21.60m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vincent
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 05/10/2021
FINISH DATE: 06/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained, [CONT].			HQTT	100		6	15.5				89	*15.07-15.19m:* J, 78°, PL, SM, VN, CN *15.11m:* J, 58°, PL, SM, VN, CN *15.29m:* BF, 40°, PL, R, VN, CN *15.39m:* BF, 32°, PL, SM, VN, CN *15.49m:* J, 12°, PL, R, VN, CN					
	15.28m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained. 50 to 120mm thick. INDISTINCTLY INTERBEDDED WITH: UW, dark grey, SILTSTONE. Very weak, moderately cemented. 60 to 80mm thick, 25 to 30° inclined.							16.0					*15.84m:* J, 72°, PL, SM, VN, CN *15.85m:* J, 72°, T *15.95m:* BF, 28°, PL, SM, VN, CN *16.20m:* J, 68°, PL, SM, VN, CN *16.21m:* BF, 28°, PL, SM, VN, CN *16.27m:* BF, 33°, PL, SM, VN, CN *16.36m:* BF, 22°, PL, SM, VN, CN					Box 5, 13.88-16.50m
							5	16.5					*16.50m:* BF, 65°, PL, SM, VN, CN *16.68m:* DD, 0° *16.82m:* DD, 0° *16.84m:* DD, 0°					
	17.10 - 17.30m: UW, grey, SANDSTONE. Extremely weak, uncemented to poorly cemented, fine grained.			HQTT	87			17.0				55	*17.03m:* BF, 38°, PL, SM, VN, Clay veneer *17.16m:* BF, 43°, PL, PO, VN, Clay veneer, polished, minor oxidisation, Potential slip plane					
	17.30m: CORE LOSS - Suspect washed out.						4	17.5					*17.30-17.50m:* , No Recovery					
	17.50m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained. 50 to 120mm thick. INDISTINCTLY INTERBEDDED WITH: UW, dark grey, SILTSTONE. Very weak, moderately cemented. 60 to 80mm thick, 25 to 30° inclined.							18.0					*17.60m:* J, 0-5°, UN, R, VN, CN *17.61m:* J, 12°, PL, R, VN, CN *17.66m:* J, 5°, UN, R, VN, CN *18.00m:* BF, 45°, PL, SM, VN, CN *18.16m:* DD, 0° *18.33m:* BF, 38°, PL, SM, VN, CN					
				HQTT	100		3	18.5				71	*18.52m:* BF, 28°, PL, SM, VN, CN *18.87m:* BF, 28-35°, PL, SM, VN, CN					
								19.0					*19.15m:* BF, 48°, PL, SM, VN, CN *19.26m:* BF, 38°, PL, SM, VN, CN *19.32m:* BF, 32°, PL, SM, VN, CN *19.42m:* BF, 46°, PL, T					Box 6, 16.50-19.50m
	19.5m: END OF BOREHOLE. Target depth.						2	19.5					*19.48m:* J, 62°, PL, SM, VN, CN					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 06/10/21 following completion of hole with casing installed down to 10.50 m. Nested standpipe piezometer installed with screened intervals at 5.0 - 8.0m bgl and 16.0 - 19.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

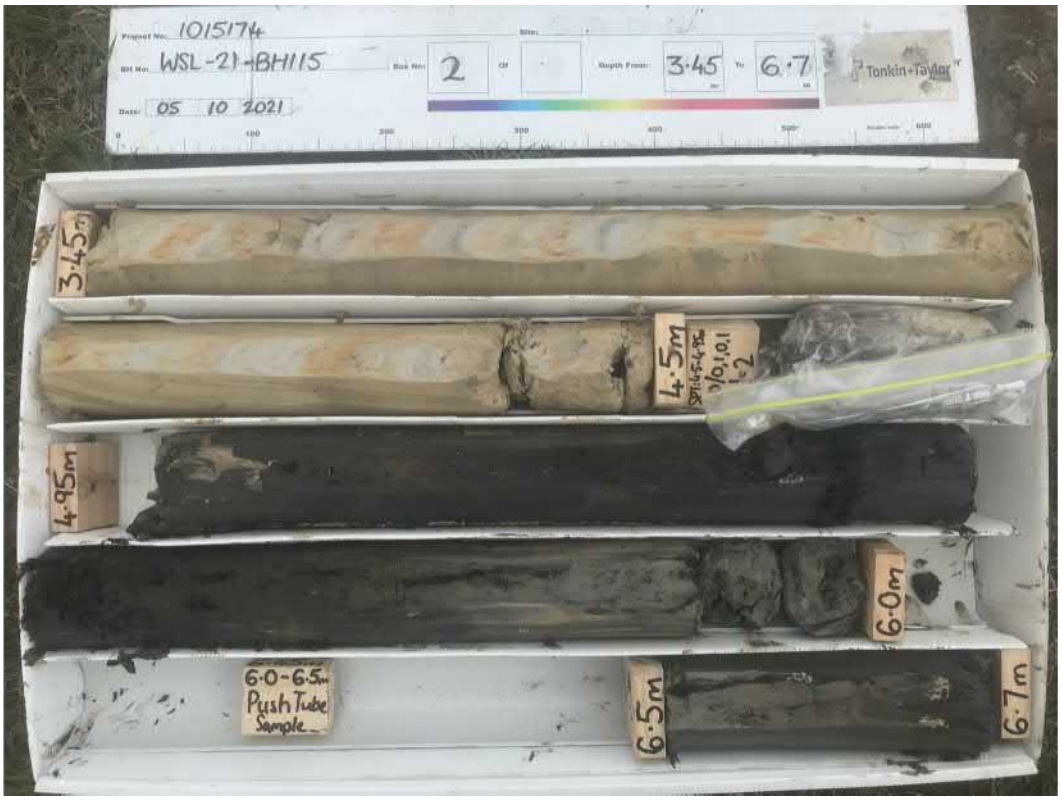
General Log - DESX005 - Fix RQD - 9/12/2021 9:46:11 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH115**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925923.52 mN 1746077.26 mE	DRILL TYPE:	HOLE STARTED: 05/10/2021
R.L.:	21.60m	DRILL METHOD: RC	HOLE FINISHED: 06/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-3.45m



3.45-6.70m

General Log - DESX005 - Fix RQD - 9/12/2021 9:46:11 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH115**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925923.52 mN 1746077.26 mE	DRILL TYPE:	HOLE STARTED: 05/10/2021
		DRILL METHOD: RC	HOLE FINISHED: 06/10/2021
R.L.:	21.60m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

6.70-10.05m

10.05-13.88m

General Log - DESX005 - Fix RQD - 9/12/2021 9:46:11 am - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH115**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925923.52 mN 1746077.26 mE	DRILL TYPE:	HOLE STARTED: 05/10/2021
R.L.:	21.60m	DRILL METHOD: RC	HOLE FINISHED: 06/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

13.88-16.50m

16.50-19.50m

General Log - DESX005 - Fix RQD - 9/12/2021 9:46:11 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH116

SHEET: 1 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925970.35 mN, 1746155.08 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 16.92m
R.L. COLLAR: 16.92m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: CMCD
START DATE: 05/11/2021
FINISH DATE: 09/11/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*0.00m:* NOT LOGGED - Hydrovac excavation.			HVAC	0		16	0.5 1.0							08/11/2021			
	1.50m: Sandy SILT, trace organics; grey. Firm to stiff, moist, low to medium plasticity. Organics, carbonaceous flecks. *2.00 - 2.40m:* Minor organics. Organics, carbonaceous flecks.			HQTT	100		15	1.5 2.0 2.5										
East Coast Bays Formation	*3.22m:* CW, grey, Silty SANDSTONE. Extremely weak (medium dense), fine grained, Recovered as: Silty SAND, trace organics; Medium dense, moist. Organics, carbonaceous flecks..			SPTS	100	74/25 kPa 0/1 2/2 3/3 **N=10**	14	3.0 3.5										
	4.35m: CORE LOSS - Suspect washed out.			HQTT	86		13	4.0										
	4.50m: NOT LOGGED. - Push Tube Sample.			PT	0	129/45 kPa		4.5										Box 1, 0.00-4.75m
	4.75m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to coarse grained, moist. 20 to 400mm thick. INDISTINCTLY INTERBEDDED						12									HWT		

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 09/11/21 following completion of hole with casing installed down to 7.0 m. Standpipe piezometer installed with screened interval at 10.0 - 15.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH116

SHEET: 2 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925970.35 mN, 1746155.08 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 16.92m
R.L. COLLAR: 16.92m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: CMCD
START DATE: 05/11/2021
FINISH DATE: 09/11/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.05 - 5.35m:* Fine grained.																	
	5.00m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to coarse grained, moist. 20 to 400mm thick. INDISTINCTLY INTERBEDDED WITH: HW, grey, SILTSTONE. Extremely weak (hard), poorly cemented, fissile, [CONT]. 10 to 30mm thick.			HQTT	72			5.5										
	5.65m: CORE LOSS - Suspect washed out.																	
	6.00m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to coarse grained, moist, Recovered as: Silty SAND, medium dense, moist.			SPTS	100	2/3 3/5 5/9 **N=22**	11	6.0										
	6.50 - 6.60m: Fine grained.			HQTT	93		10	6.5										
	7.13 - 7.43m: Fine grained.							7.0							HWT			
	7.43m: CORE LOSS - Suspect washed out.							7.5										
	7.50m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to medium grained, moist, Recovered as: Silty SAND, medium dense, moist.			SPTS	100	4/7 7/8 9/11 **N=35**	9	8.0										
	8.20 - 8.70m: MW, grey, SILTSTONE. Extremely weak (hard), poorly cemented.			HQTT	76			8.5										Box 2, 4.75-8.55m
	8.75m: CORE LOSS - Suspect washed out.						8	9.0										
	9.00m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to medium grained, moist, Recovered as: SAND, some silt. Medium dense, moist.			SPTS	100	2/6 6/7 11/14 **N=38**												
	9.35m: HW, grey, Silty SANDSTONE. Extremely weak (dense), poorly cemented, fine grained, moist, Recovered as: Silty SAND, Medium dense, moist.							9.5										
	9.55m: HW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine to medium grained, moist, Recovered as: SAND, some silt, Medium dense, moist.																	
	9.70m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented to moderately cemented, fine grained, moist,						7											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 09/11/21 following completion of hole with casing installed down to 7.0 m. Standpipe piezometer installed with screened interval at 10.0 - 15.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH116

SHEET: 3 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925970.35 mN 1746155.08 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 16.92m
R.L. COLLAR: 16.92m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: CMCD
START DATE: 05/11/2021
FINISH DATE: 09/11/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented to moderately cemented, fine grained, moist, Recovered as: SAND, minor silt, Very dense, moist [CONT].	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	76								*10.00m:* B					
	10.25m: CORE LOSS - Suspect washed out.																	
	10.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	1/3 8/8 10/12 **N=38** Solid		10.5										
	10.95m: MW, grey, SANDSTONE. Extremely weak (dense), uncemented to poorly cemented, fine grained, moist, Recovered as: SAND, minor silt, Very dense, moist..			HQTT	86		6	11.0										
	11.85m: CORE LOSS - Suspect washed out.							11.5										
	12.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	7/14 17/22 11 for 40mm **N>=50** Solid	5	12.0										
	12.34m: SW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine grained, moist, Recovered as: SAND, minor silt. Very dense, moist.			HQTT	100	ASS / pH @ 13.00m	4	12.5 13.0										Box 3, 8.55-12.85m
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	15/32 50 for 40mm **N>=50** Solid		13.5										
	13.69m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained.			HQTT	115		3	14.0				40	*13.72m:* DD *13.74m:* J, 60°, PL, SM, VN, CN, *13.85m:* DD, *13.85-13.95m:* J, 72°, PL, SM, VN, CN *13.92m:* BF, 20°, PL, SM, VN, CN *14.02m:* BF, 22°, PL, SM, VN, CN *14.14m:* BF, 18°, PL, SM, VN, CN *14.33m:* J, 54°, PL, SM, T *14.52m:* J, 60°, PL, SM, T *14.56m:* *14.63-14.79m:* J, 78°, PL, SM *14.79m:* BF, 16°, PL, SM, VN, CN					
	14.85m: CORE LOSS - Suspect washed out.						2	14.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 09/11/21 following completion of hole with casing installed down to 7.0 m. Standpipe piezometer installed with screened interval at 10.0 - 15.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH116

SHEET: 4 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5925970.35 mN 1746155.08 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 16.92m
R.L. COLLAR: 16.92m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: CMCD
START DATE: 05/11/2021
FINISH DATE: 09/11/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* NO RECOVERY - Solid SPT, no overcore recovered.	UW SW MW HW CW	EW VS S MS W	SPTC	0	12/38 for 75mm **N>=50** Solid	1	15.5			2000 600 200 60 20	67	*14.85-15.15m:* , No Data *15.23m:* DD *15.49m:* J, 60°, PL, SM, VN, CN *15.50m:* BF, 28°, PL, SM, VN, CN *15.51-15.58m:* J, 62°, PL, SM, VN, CN *15.52m:* J, 62°, PL, SM, VN, CN *15.59-15.65m:* J, 40°, PL, SM, VN, Calcium, carbonate veneer *15.86m:* BF, 16°, PL, SM, VN, CN	25 50 75				Box 4, 12.85-16.40m
	15.15m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine grained.			HQTT	100		0	16.0					*16.13m:* J, 32°, PL, SM, VN, CN *16.17m:* BF, 28°, PL, SM, VN, CN *16.35m:* J, 65°, PL, SM, VN, CN *16.38m:* BF, 28°, PL, SM, VN, CN *16.46m:* J, 38°, PL, SM, VN, CN *16.56m:* J, 45-78°, UN, R, CN					
				HQTT	100	ASS / pH @ 17.00m	-1	17.0				44	*16.71-16.81m:* J, 75°, PL, R, VN, CN *16.79-16.84m:* J, 70°, PL, SM, VN, CN *16.83m:* BF, 18°, PL, SM, VN, CN *16.89-16.92m:* J, 62°, T, Calcium carbonate veneer *16.92-16.96m:* J, 45°, PL, SM, VN, Calcium carbonate infill *17.06m:* BF, 12°, PL, SM, VN, CN *17.08-17.15m:* J, 50°, PL, SM, VN, CN *17.29m:* DD					
	18.40 - 18.95m: Fine to coarse grained.			HQTT	100		-2	18.5				37	*17.62m:* J, 45°, PL, SM, VN, Calcium carbonate veneer *17.63m:* J, 50°, PL, SM, VN, CN *17.72-17.78m:* J, 48°, PL, SM, VN, CN *17.78-17.81m:* J, 45°, PL, SM, VN, CN *17.79-17.84m:* J, 38°, PL, SM, VN, CN *17.85-17.89m:* J, 48°, PL, SM, VN, CN *18.17m:* J, 52°, PL, SM, VN, CN *18.19m:* J, 62°, PL, SM, VN, CN *18.33m:* J, 48°, PL, SM, VN, CN *18.35-18.53m:* BZ *18.35m:* J, 35°, PL, SM, VN, CN *18.52m:* J, 48°, PL, R, VN, CN *18.53m:* J, 52°, PL, R, VN, CN *18.61m:* J, 40°, PL, SM, VN, CN *18.64m:* J, 18°, PL, SM, VN, CN *18.66m:* J, 38°, PL, SM, VN, CN *18.68-18.85m:* J, 18-72°, PL, R, CN *18.86m:* J, 52°, PL, R, VN, CN *18.91m:* J, 44°, PL, SM, VN, Calcium carbonate veneer *19.00m:* BF, 16°, PL, SM, VN, CN *19.10m:* BF, 22°, PL, SM, VN, CN *19.19m:* BF, 18°, PL, SM, VN, CN *19.30m:* BF, 18°, PL, SM, VN, CN *19.36m:* BF, 22°, PL, SM, VN, CN *19.45m:* BF, 20°, PL, SM, VN, CN					Box 5, 16.40-19.30m
	19.5m: END OF BOREHOLE. Target depth.						-3	19.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Wireline downhole geophysics undertaken on 09/11/21 following completion of hole with casing installed down to 7.0 m. Standpipe piezometer installed with screened interval at 10.0 - 15.0m bgl.

Hole Depth 19.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH116**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925970.35 mN 1746155.08 mE	DRILL TYPE:	HOLE STARTED: 05/11/2021
R.L.:	16.92m	DRILL METHOD: RC	HOLE FINISHED: 09/11/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: CMCD

0.00-4.75m

4.75-8.55m

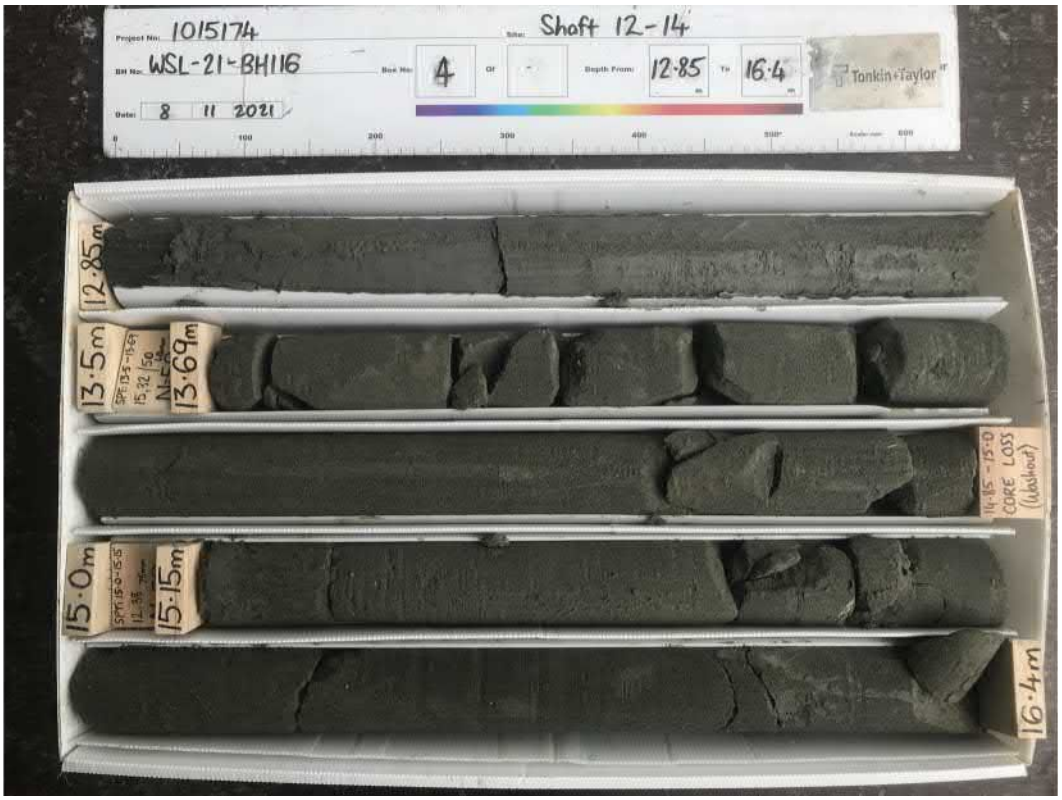
General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH116**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925970.35 mN 1746155.08 mE	DRILL TYPE:	HOLE STARTED: 05/11/2021
		DRILL METHOD: RC	HOLE FINISHED: 09/11/2021
R.L.:	16.92m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: CMCD

8.55-12.85m



12.85-16.40m

General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH116**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5925970.35 mN 1746155.08 mE	DRILL TYPE:	HOLE STARTED: 05/11/2021
R.L.:	16.92m	DRILL METHOD: RC	HOLE FINISHED: 09/11/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: CMCD

16.40-19.30m

19.30-19.50m

General Log - DESX005 - Fix RQD - 9/12/2021 3:09:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH118

SHEET: 1 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926202.44 mN 1746458.86 mE

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.41m

R.L. COLLAR: 25.41m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: AMHO

CHECKED: ROM

START DATE: 10/06/2021

FINISH DATE: 11/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Depth (m)	RL (m)	Sampling Method	Core Recovery (%)	Testing
Topsoil	*0.00m:* SILT, minor clay and minor sand, trace organics; brown. Very stiff, moist, non-plastic. Sand, fine. Organics, rootlets. [TOPSOIL].	0.5	25	HA	100	
Tauranga Group	*0.80m:* SILT, some clay, trace organics; brown mottled light brownish orange. Stiff, moist, low plasticity. Organics, rootlets.	1.0	24			
	1.50m: SILT, some clay, trace organics; grey mottled light brownish orange. Stiff, moist, low plasticity. Organics, rootlets.	1.5		SPTS	100	UTP 1/1 1/1 1/2 **N=5**
	2.33m: Sandy SILT, minor clay; grey. Firm, moist, non-plastic. Sand, fine.	2.0	23	HQTT	52	
	2.50m: CORE LOSS - Adhesion from the clayey SILT material greater than the push force..	2.5				
Residual East Coast Bays Formation	*3.00m:* SILT, minor clay and minor sand; grey. Stiff, moist, medium plasticity. Sand, fine.	3.0		SPTS	100	34/6 kPa 1/1 2/1 2/2 **N=7**
	3.20m: Clayey SILT; grey. Stiff, moist, medium plasticity.		22			
	3.55m: Sandy SILT, minor clay; grey. Firm, moist, medium plasticity. Sand, fine.	3.5				
	3.59m: Clayey SILT; grey. Stiff, moist, medium plasticity.					
East Coast Bays Formation	*3.85m:* CW, grey, SILTSTONE. Extremely weak. RECOVERED AS: Sandy SILT, minor clay; grey. Firm to stiff, moist, high plasticity. Sand, fine.	4.0		HQTT	100	
	4.75m: CW, grey, SANDSTONE. Extremely weak, poorly cemented. RECOVERED AS: Silty SAND; grey. Medium dense, moist. Sand, fine. Remoulds to: Sandy SILT, medium to high	4.5	21	SPTS	100	37/3 kPa 1/2 1/3 3/3 **N=10**

ROCK DEFECTS: Defect Log; Fracture Spacing (mm); RQD (%); Description & Additional Observations

Fluid Loss (%); Water Level (11/06/2021, 11/06/2021); Casing (PQ3); Installation (Box 1, 0.00-3.75m); Core Box No

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 6.0 - 9.0 m bgl. Wireline downhole test undertaken on 14/06/21 following completion of hole with casing installed down to 12.00 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH118

SHEET: 2 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926202.44 mN, 1746458.86 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.41m
R.L. COLLAR: 25.41m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 10/06/2021
FINISH DATE: 11/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.00m:* CW, grey, SANDSTONE. Extremely weak, poorly cemented. RECOVERED AS: Silty SAND; grey. Medium dense, moist. Sand, fine. Remoulds to: Sandy SILT, medium to high plasticity, [CONT] .																	
	5.45m: CW, grey, SILTSTONE. Extremely weak. RECOVERED AS: Sandy SILT, minor clay; grey. Stiff, moist, medium to high plasticity. Sand, fine.																	
	5.73m: HW, grey, SANDSTONE. Extremely weak. RECOVERED AS: Silty SAND; grey. Medium dense, moist. Sand, fine.																	
	6.13m: HW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: SILT, some sand, minor clay; grey. Very stiff, moist, medium to high plasticity. *6.45 - 6.73m:* HW. Trace carbonaceous material. *6.50 - 6.55m:* Fine SAND lens.			SPTS	100	106/15 kPa 2/3 2/4 3/4 **N=13**	20	5.5										
	6.73m: HW, grey, SANDSTONE. Extremely weak, fine to medium grained, moist. RECOVERED AS: SAND, some silt; grey. Very dense, moist. Sand, fine to medium.			HQTT	100		19	6.0										
	7.37m: HW, grey, SANDSTONE. Extremely weak, fine grained, moist. RECOVERED AS: Sandy SILT, minor clay; grey. Very stiff, moist, medium to high plasticity. Sand, fine.			SPTS	100	2/3 4/5 6/7 **N=22**	18	6.5										
	7.92m: HW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: SILT, some clay; grey. Hard, moist, medium plasticity.							7.0										
	8.04m: HW, grey, SANDSTONE. Extremely weak, fine grained, moist. RECOVERED AS: SAND, minor silt; grey. Very dense, moist. Sand, fine.						17	7.5										
	8.17m: MW, grey, SANDSTONE. Extremely weak, fine to medium grained, moist, RECOVERED AS: SAND, some silt, minor clay; grey. Dense, wet. Sand, fine to medium. 40 to 100mm spaced, 50 to 300mm thick. INTERBEDDED WITH: MW, grey, SILTSTONE. Extremely weak, moist, RECOVERED AS: SILT, some clay; grey. Hard, moist, medium plasticity. 50 to 300mm spaced, 40 to 100mm thick.			HQTT	100			8.0										
	8.77m: MW, grey, SANDSTONE. Extremely weak, fine to coarse grained, moist. RECOVERED AS: SAND; grey. Dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.							8.5										
	9.20m: MW, grey, SANDSTONE. Extremely weak, well cemented, fine grained, moist. RECOVERED AS: SAND, some silt; grey. Very dense. Sand, fine.			SPTS	100	6/7 9/10 15/16 for 70mm **N>=50**	16	9.0										
	9.40m: MW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: SILT, some clay; grey. Hard, moist, medium plasticity.							9.5										
	9.50m: MW, grey, SANDSTONE. Extremely weak, poorly cemented, fine to medium grained, moist. RECOVERED AS: SAND; grey. Loose, moist. Sand, fine to medium.																	
	9.90m: CORE LOSS - Uncemented sands washed away..																	

Box 2, 3.75-6.92m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 6.0 - 9.0 m bgl. Wireline downhole test undertaken on 14/06/21 following completion of hole with casing installed down to 12.00 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH118

SHEET: 3 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926202.44 mN 1746458.86 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.41m
R.L. COLLAR: 25.41m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 10/06/2021
FINISH DATE: 11/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT | DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation) | Rock Weathering | Rock Strength | Sampling Method | Core Recovery (%) | Testing | RL (m) | Depth (m) | Graphic Log | ROCK DEFECTS: Defect Log | Fracture Spacing (mm) | RQD (%) | Description & Additional Observations | Fluid Loss (%) | Water Level | Casing | Installation | Core Box No

East Coast Bays Formation

10.35m: UW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: Organic SILT, some clay; black. Hard, moist, low plasticity. Organics, carbonaceous material.
10.50m: NO RECOVERY - Solid cone SPT.

HQTT 57
SPTC 0 — 10/21 26/24 for 60mm **N>=50** Solid

10.79m: UW, grey, SANDSTONE. Extremely weak, moderately cemented, fine to medium grained, moist. RECOVERED AS: SAND, minor silt; grey. Dense, moist. Sand, fine to medium, sub-rounded to sub-angular.
11.03m: CORE LOSS - Soft material washed away..

11.43m: UW, grey, SANDSTONE. Extremely weak, moderately cemented, fine to medium grained, moist. RECOVERED AS: SAND; grey. Dense, moist. Sand, fine to medium.

HQTT 66

11.60m: J, 5°, UN, R
11.73m: DD
11.87m: DD

12.00m: NO RECOVERY - Solid cone SPT.

SPTC 0 — 11/21 25/25 for 70mm **N>=50** Solid

12.30m: UW, grey, SANDSTONE. Extremely weak, moderately cemented, fine to coarse grained, moist. RECOVERED AS: SAND, some gravel; grey. Very dense, moist. Sand, fine to coarse, sub-rounded to sub-angular; gravel, fine, sub-rounded to sub-angular.

HQTT 100

12.47m: J, 7°, UN, R
12.70m: DD
12.87m: DD
13.18m: DD
13.39m: DD

13.95 - 14.00m: UW. Fine to medium grained.

13.95m: UW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: SILT, some clay; black. Hard, moist, low plasticity.
14.10m: UW, grey, SANDSTONE. Extremely weak, well cemented, fine to medium grained, moist. RECOVERED AS: SAND; grey. Very dense, moist. Sand, fine to medium.
14.42 - 14.44m: UW, with carbonaceous material.

HQTT 100

13.72m: J, 5°, UN, R
13.85m: DD
13.92m: J, 10°, UN, R
13.95m: DD
14.10m: DD
14.24m: DD
14.48m: J, 5°, PL, SM
14.56m: J, 5°, PL, SM

RQD (%): 66 | 100 | 88

Box 3, 6.92-10.85m
Box 4, 10.85-14.10m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 6.0 - 9.0 m bgl. Wireline downhole test undertaken on 14/06/21 following completion of hole with casing installed down to 12.00 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH118

SHEET: 4 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926202.44 mN 1746458.86 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.41m
R.L. COLLAR: 25.41m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 10/06/2021
FINISH DATE: 11/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* UW, grey, SILTSTONE. Extremely weak, moist. RECOVERED AS: SILT, some clay; black. Hard, moist, low plasticity.																	
	15.13m: UW, grey, SANDSTONE. Extremely weak, well cemented, fine to medium grained, moist. RECOVERED AS: SAND; grey. Very dense, moist. Sand, fine to medium.												*15.18m:* J, 7°, PL, SM					
	15.67m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.			HQTT	100							91	*15.59m:* DD *15.83m:* DD *15.95m:* J, 2°, PL, SM					
	16.07m: UW, grey, SILTSTONE. Very weak, moist.												*16.08m:* J, 10°, ST, R					
	16.29m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.												*16.29m:* DD *16.35m:* J, 10°, ST, R *16.43m:* J, 2°, PL, SM					
	16.84 - 16.86m: UW, grey, SILTSTONE. Very weak, moist.			HQTT	100							100	*16.79m:* DD					Box 5, 14.10-16.86m
	17.50m: UW, grey, SILTSTONE. Very weak, moist. 60 to 100mm thick. INTERBEDDED WITH: UW, grey, SANDSTONE. Very weak, well cemented, fine to medium grained, moist. 40 to 100mm thick. *17.53 - 17.57m:* UW, with carbonaceous material. *17.68 - 17.72m:* UW, with carbonaceous material.												*17.09m:* J, 5°, PL, R *17.36m:* DD *17.57m:* DD *17.72m:* J, 2°, PL, SM					
	18.22 - 18.24m: UW, with carbonaceous material.			HQTT	100	ASS/pH @ 18.00m Field measured pH 7						85	*17.94m:* J, 5°, UN, R *17.99m:* DD *18.08m:* DD *18.12m:* DD					
	18.25m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.												*18.27m:* J, 2°, PL, SM					
	18.65m: UW, grey, SANDSTONE. Very weak, well cemented, fine to medium grained, moist. 20 to 50mm thick. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moist. 10 to 40mm thick.												*18.62m:* J, 2°, PL, SM					
	18.75m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.												*18.75m:* DD					
	19.30m: UW, grey, SANDSTONE. Very weak, well cemented, fine grained, moist. 20 to 50mm thick. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moist. 10 to 50mm thick.												*19.40m:* DD					
	19.50m: UW, grey, SILTSTONE. Very weak, moist.					B21-1620 @ 19.50m UW SILTSTONE XRD Quantitative (Fines Fraction):						1180	*19.61m:* BF, 2°, PL, SM *19.63m:* BF, 2°, PL, SM					
	19.72m: UW, grey, SANDSTONE. Very weak, well cemented, fine grained, moist. *19.77 - 19.78m:* UW, with carbonaceous material.					B21-1621 @ 19.60m												Box 6, 16.86-20.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 6.0 - 9.0 m bgl. Wireline downhole test undertaken on 14/06/21 following completion of hole with casing installed down to 12.00 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH118

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926202.44 mN, 1746458.86 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.41m
R.L. COLLAR: 25.41m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 10/06/2021
FINISH DATE: 11/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log / Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.30 - 20.37m:* UW, with carbonaceous material.			HQTT	100	UW SANDSTONE Atterberg Limits (LL,PL,PI); Moisture content; Linear shrinkage MC AL B21-1622 @ 20.00m UW SANDSTONE Splitting Tensile Strength (Mpa); Equivalent Quartz and Schimazek wear factor; BH118 @ 20.10m UW,grey, SANDSTONE.Very weak,well cemented, fine grained, moist. Sample description from log B21-1623 @ 20.58m UW SANDSTONE Goodrich Drillability; BH118 @ 20.73m uw sst f-c ew-vw Sample description from sample ASS/pH @ 22.00m Field measured pH 7	20.5 / 5			1180	*20.00m:* DD *20.02m:* DD *20.08m:* DD *20.10m:* BF, 2°, PL, SM *20.14m:* BF, 2°, PL, SM *20.18m:* DD *20.20m:* DD *20.28m:* J, 7°, UN, R *20.30m:* BF, 2°, PL, SM *20.43m:* J, 7°, UN, R *20.61m:* J, 10°, UN, R	25 50 75				
	20.61m: UW, grey, SILTSTONE. Very weak, moist. *20.63 - 20.75m:* UW, with carbonaceous material.															
	20.77m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.						21.0 / 4									
	21.10m: UW, brown, SILTSTONE. Very weak, moist.															
	21.30m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.										*21.13-21.15m:* BZ, 2-10°, UN, R *21.24m:* J, 10°, UN, R *21.31m:* BF, 2°, PL, SM					
	21.86 - 21.88m: UW, with carbonaceous material.			HQTT	100		21.5			83	*21.43m:* BF, 0°, PL, SM *21.67m:* BF, 2°, ST, R *21.70m:* DD					
	22.55m: UW, grey, SILTSTONE. Very weak, moist.						22.0 / 3				*21.97-22.02m:* BZ, 2-10°, UN, R *22.10m:* BF, 2°, UN, R					
	22.70m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.						22.5				*22.45-22.50m:* BZ, 10°, UN, R					Box 7, 20.00-22.75m
	23.20m: CORE LOSS - Broken Zone washed away.			HQTT	87		23.0 / 2			79	*23.07m:* BF, 0°, PL, SM					
	23.40m: UW, grey, SILTSTONE. Very weak, moist.						23.5				*23.44m:* BF, 2°, PL, SM *23.47m:* BF, 2°, PL, SM *23.54m:* BF, 2°, PL, SM *23.56m:* BF, 2°, PL, SM					
	23.57m: UW, grey, SANDSTONE. Very weak, fine to medium grained, moist.						24.0 / 1				*23.89m:* DD *24.04m:* DD					
							24.5			99	*24.19m:* BF, 0°, PL, SM *24.22m:* BF, 5°, UN, R *24.28m:* J, 5°, UN, R *24.55m:* DD					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 6.0 - 9.0 m bgl. Wireline downhole test undertaken on 14/06/21 following completion of hole with casing installed down to 12.00 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH118

SHEET: 6 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926202.44 mN, 1746458.86 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.41m
R.L. COLLAR: 25.41m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 10/06/2021
FINISH DATE: 11/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT: East Coast Bays Formation

DESCRIPTION OF CORE
SOIL: Classification, colour, consistency / density, moisture, plasticity
ROCK: Weathering, colour, fabric, name, strength, cementation

25.50m: CORE LOSS - Sands washed away.

25.60m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained, moist.

28.02 - 28.13m: UW, grey, SILTSTONE. Very weak, moist.

29.85m: CORE LOSS - Sands washed away.

30m: END OF BOREHOLE

Depth (m)	RL (m)	Sampling Method	Core Recovery (%)	RQD (%)	Defect Log	Fracture Spacing (mm)	Description & Additional Observations
25.5	0	HQTT	100	99			*25.25m:* DD
26.0	-1	HQTT	93	93			*25.60m:* DD *25.70m:* DD *26.11m:* DD
27.0	-2	HQTT	100	100			*27.05m:* DD *27.35m:* J, 2°, UN, R *27.45m:* BF, 0°, PL, SM *27.55m:* DD *28.00m:* J, 10°, UN, R
29.0	-3	HQTT	90	78			*29.02m:* J, 5°, UN, R *29.06m:* J, 7°, UN, R *29.09m:* J, 5°, UN, R *29.42m:* DD *29.50m:* BF, 2°, UN, R *29.80m:* BF, 2°, UN, R
29.5	-4						

Box 8, 22.75-25.80m
Box 9, 25.80-28.50m
Box 10, 28.50-30.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 6.0 - 9.0 m bgl. Wireline downhole test undertaken on 14/06/21 following completion of hole with casing installed down to 12.00 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:06:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH118**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926202.44 mN 1746458.86 mE	DRILL TYPE:	HOLE STARTED: 10/06/2021
R.L.:	25.41m	DRILL METHOD: RC	HOLE FINISHED: 11/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

0.00-3.75m

3.75-6.92m

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH118**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926202.44 mN 1746458.86 mE	DRILL TYPE:	HOLE STARTED: 10/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 11/06/2021
R.L.:	25.41m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

6.92-10.85m

10.85-14.10m

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH118**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926202.44 mN 1746458.86 mE	DRILL TYPE:	HOLE STARTED: 10/06/2021
R.L.:	25.41m	DRILL METHOD: RC	HOLE FINISHED: 11/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

14.10-16.86m

16.86-20.00m

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH118**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926202.44 mN 1746458.86 mE	DRILL TYPE:	HOLE STARTED: 10/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 11/06/2021
R.L.:	25.41m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

20.00-22.75m

22.75-25.80m

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH118**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926202.44 mN 1746458.86 mE	DRILL TYPE:	HOLE STARTED: 10/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 11/06/2021
R.L.:	25.41m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

25.80-28.50m

28.50-30.00m

General Log - DESX005 - Fix RQD - 8/12/2021 1:06:07 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 1 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926240.95 mN 1746521.49 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m
R.L. COLLAR: 27.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: TRMC
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 08/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Topsoil	*0.00m:* SILT, some organics (fibrous, anorphous and rootlets), trace clay and trace sand; brown. Soft, moist, non-plastic. Sand, fine. [TOPSOIL].			HA	100		27	0.5	TS									
Tauranga Group	*0.90m:* SILT, some clay, minor organics (rootlets) and minor gravel; brown mottled orange. Stiff, moist, low plasticity. Gravel, fine, sub-angular, basalt. [FILL]. *1.57 - 1.88m:* Becomes firm.			SPT	100	UTP 2/1 2/1 2/2 **N=7**	26	1.0 1.5										
	1.88m: SILT, some clay, trace sand; light brown mottled orange. Firm to stiff, moist, medium plasticity. Sand, fine.			HQTT	100		25	2.0							04/06/2021			
	2.41m: SILT, some clay, minor sand; light brown mottled orange. Firm, moist, medium to high plasticity. Sand, fine.			SPT	100	40/13 kPa 0/0 1/1 1/1 **N=4**	24	2.5 3.0										
	3.25m: Silty CLAY; light brown mottled orange. Firm, moist, high plasticity.			HQTT	71		23	3.5 4.0										Box 1, 0.00-3.00m
	3.57m: SILT, some clay, trace sand; light brown spotted orange. Firm to stiff, moist, low to medium plasticity. Sand, fine.																	
	4.20m: CORE LOSS - washed out of barrel.					49/15 kPa												
Weathered East Coast Bays Formation	*4.50m:* Sandy SILT, minor clay; dark grey. Firm, moist, medium plasticity. Sand, fine and coarse. Occasional fine gravel (siltstone) [Residual Soil].			SPT	100	1/0 1/1 1/1 **N=4**		4.5									PQ3 (HD:30.00m)	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:41 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 2 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926240.95 mN, 1746521.49 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m
R.L. COLLAR: 27.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: TRMC
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 08/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Weathered East Coast Bays Formation	*5.07m:* SILT, some clay, trace sand; dark grey. Firm to stiff, moist, medium to high plasticity. Sand, fine to medium. [Residual Soil]. *5.21m:* Sandy SILT, minor clay, trace gravel; dark grey. Firm, moist, low plasticity. Sand, fine and coarse; gravel, fine, sub-rounded to sub-angular, moderately weathered, siltstone. [Residual Soil]. *5.95 - 5.96m:* CARBONACEOUS MATERIAL; black. Hard, dry. *6.50m:* Sandy SILT, some clay; dark grey. Firm, moist, low to medium plasticity. Sand, fine and coarse. [Residual Soil]. *7.63m:* Sandy SILT, minor clay; dark grey. Firm, moist, low to medium plasticity. Sand, fine to coarse. [Residual Soil]. *9.69 - 9.70m:* Single coarse sandstone gravel, 25mm. *9.73m:* Silty SAND, minor clay; dark grey. Loosely packed, moist, dilatant. Sand, fine to coarse. [Residual Soil].	UW SW MW HW CW	ES VS S MS W VW EW	SPT HQTT SPT HQTT SPT	100 100 100 100 100	46/22 kPa 1/1 1/2 1/3 **N=7** 40/7 kPa 1/1 1/1 2/2 **N=6** 33/12 kPa 2/1 2/3 3/3 **N=11**	22 21 20 19 18	5.5 6.0 6.5 7.0 7.5 8.0 8.5 9.0 9.5		2000 600 200 60 20			25 50 75	08/06/2021	PQ3 (HD:30.00m)		Box 2, 3.00-6.63m Box 3, 6.63-9.80m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 3 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926240.95 mN, 1746521.49 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m
R.L. COLLAR: 27.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: TRMC
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 08/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Weathered East Coast Bays Formation	*10.07m:* Sandy SILT, minor clay; dark grey. Stiff, moist, low plasticity. Sand, fine to coarse. [Residual Soil].	UW SW MW HW CW	EIS VS S MS HW UW EW	HQTT	100		17											
	10.14 - 10.15m: Single coarse sandstone gravel, elongated 20mm.							10.5										
				SPT	100	76/33 kPa 2/3 3/2 3/4 **N=12**												
	11.05m: Sandy SILT, trace clay; dark grey, Blocky. Firm, moist, non-plastic. Sand, medium to coarse. [Residual Soil].			HQTT	100		16	11.0										
								11.5										
	11.88m: SILT, some sand, minor clay; dark grey. Very stiff, moist, medium plasticity. Sand, fine. [Residual Soil].							12.0										
	12.00m: SILT, some clay; dark grey. Very stiff, moist, high plasticity. [Residual Soil].					UTP	15											
	12.08m: SILT, some sand, minor clay; dark grey. Stiff, moist, medium plasticity. Sand, fine. [Residual Soil].			SPT	100	2/2 4/5 6/7 **N=22**												
	12.37m: Sandy SILT, minor clay; dark grey. Stiff, moist, low plasticity. Sand, fine to coarse. [Residual Soil].							12.5										
	12.56m: CW, dark grey, SANDSTONE. Extremely weak, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Medium dense, moist. Sand, fine grading to medium. Remoulds to: Sandy SILT, medium to high plasticity.			HQTT	100		14	13.0										Box 4, 9.80-13.20m
	13.09 - 13.13m: CW, dark grey, SILTSTONE. Extremely weak (very stiff), Recovered as: SILT, some clay; moist, medium plasticity..																	
	13.13m: HW, dark grey, SANDSTONE. Extremely weak, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Medium dense, moist. Sand, fine grading to medium.							13.5										
				SPT	100	2/3 3/4 4/6 **N=17**												
	14.17 - 14.20m: HW, dark grey, SILTSTONE. Extremely weak (very stiff), Recovered as: SILT, some clay; moist, medium plasticity..							14.0										
	14.12m: MW, dark grey, SANDSTONE. Extremely weak, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Medium dense, moist. Sand, fine grading to medium.			HQTT	78		13											
	14.66 - 14.67m: MW, dark grey, SILTSTONE. Extremely weak (very stiff), Recovered as: SILT, some clay; moist, medium plasticity..							14.5										
	14.77m: CORE LOSS - washed out of barrel.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 4 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926240.95 mN 1746521.49 mE
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m
R.L. COLLAR: 27.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: TRMC
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 08/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* MW, dark grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Medium dense, moist. Sand, fine grading to medium.			SPT	100	2/2 4/4 5/6 **N=19**	12	15.5										
	15.61 - 15.65m: SW, dark grey, SILTSTONE. Extremely weak (very stiff), Recovered as: SILT, some clay; moist, medium plasticity..			HQTT	100		11	16.0										
	16.31m: SW, dark grey, SILTSTONE. Extremely weak, poorly cemented. INTERBEDDED WITH: SW, dark grey, SANDSTONE. Extremely weak, poorly cemented, fine grained, RECOVERED AS: Silty SAND, trace clay, dark grey. Very stiff, moist, low plasticity.							16.5										
	16.58m: SW, dark grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Medium dense, moist. Sand, fine grading to medium.			SPT	100	3/3 4/5 7/8 **N=24**												Box 5, 13.20-16.95m
				HQTT	100		10	17.0										
	17.64m: SW, dark grey, SILTSTONE. Extremely weak, poorly cemented. RECOVERED AS: SILT, some clay; dark grey. Very stiff to hard, moist, medium plasticity.							17.5										
	18.20m: SW, dark grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Dense, moist. Sand, fine grading to medium.			SPT	100	4/6 6/8 10/12 **N=36**	9	18.0										
	18.89 - 18.98m: Very weak. *18.91 - 18.96m:* Carbonaceous laminations.			HQTT	67			18.5				0						
	19.15m: CORE LOSS - fell from barrel, unable to be recovered.						8	19.0										
	19.50m: UW, dark grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: Silty SAND, trace clay; dark grey. Dense, moist. Sand, fine grading to medium.			SPT	100	7/10 13/13 16/8 for @		19.5										
	19.88m: UW, dark grey, SILTSTONE. Extremely weak, poorly																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 5 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926240.95 mN 1746521.49 mE

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m

R.L. COLLAR: 27.13m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: TRMC

CHECKED: ROM

START DATE: 03/06/2021

FINISH DATE: 08/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*19.92m:* UW, dark grey, SANDSTONE. Very weak, moderately cemented to well cemented, fine grained. *20.21 - 20.22m:* UW, dark grey, SILTSTONE. Very weak. *20.23 - 20.24m:* UW, dark grey, SILTSTONE. Very weak. *20.25 - 20.32m:* Carbonaceous laminations. *20.79 - 20.82m:* UW, dark grey, SILTSTONE. Very weak. *21.00m:* NO RECOVERY - Solid SPT, no overcore recovered. *21.28m:* UW, dark grey, SANDSTONE. Very weak, moderately cemented to well cemented, fine grained. *21.70 - 21.73m:* UW, dark grey, SILTSTONE. Very weak. *22.40 - 22.50m:* Stained brown, carbonaceous material. *22.50m:* NO RECOVERY - Solid SPT, no overcore recovered. *22.63m:* UW, dark grey, Volcaniclastic SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. *23.57m:* UW, dark grey, Volcaniclastic SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. INTERBEDDED WITH: UW, dark grey, SILTSTONE. Very weak, moderately cemented to well cemented. *23.84m:* UW, dark greenish grey speckled black, SILTSTONE. Very weak, moderately cemented to well cemented, black colouring is carbonaceous material. *23.90m:* CORE LOSS - fell from barrel, unable to be recovered. *24.00m:* UW, dark grey, Volcaniclastic SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.	UW SW MW HW CW	ES VS S MS W UW EW	SPTC HQTT SPTC HQTT	0 100 0 93	N>=50 SW-UW SANDSTONE? Sample description from target BH119 @ 20.44m SW-UW SANDSTONE? Sample description from target B21-1624 @ 20.85m SW SANDSTONE Point Load Strength Index (MPa); 1.27 / 3.19 for 55mm N>=50 Solid BH119 @ 21.47m UW, dark grey, SANDSTONE. Very weak, fine grained. Sample description from log 19/31 for 55mm N>=50 Solid UW SANDSTONE Goodrich Drillability; BH119 @ 23.10m SW-UW SANDSTONE? Sample description from target B21-1626 @ 23.33m UW SANDSTONE Splitting Tensile Strength (Mpa);	7 6 5 4 3	20.5 21.0 21.5 22.0 22.5 23.0 23.5 24.0 24.5			91 88 91	*20.30m:* BF, 10°, PL, R, CN *20.42m:* BF, 10°, PL, SM, CN *20.80m:* BF, 5°, PL, R, CN *21.55m:* DD *21.70m:* BF, 5°, PL, SM, CN *21.73m:* BF, 10°, PL, SM, CN *21.81m:* DD *21.93m:* J, 30°, PL, R, CN *22.00m:* DD *22.08m:* DD *22.16-22.24m:* BZ, PL, R *23.33m:* DD *23.52m:* J, 40°, UN, R, CN *23.58m:* BF, 10°, UN, R-SM, CN *23.94m:* BF, 5°, PL, R-SM, CN *24.53m:* J, 20°, PL, R, CN *24.75m:* DD *24.76m:* DD					Box 6, 16.95-20.66m Box 7, 20.66-24.12m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 6 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926240.95 mN, 1746521.49 mE (NZTM2000)
DIRECTION: 180°
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m
R.L. COLLAR: 27.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: TRMC
CHECKED: ROM
START DATE: 03/06/2021
FINISH DATE: 08/06/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.08m:* UW, dark greenish grey speckled black, SILTSTONE. Very weak, moderately cemented to well cemented, black colouring is carbonaceous material. *25.17 - 25.18m:* CARBONACEOUS: black. Hard. dry. *25.35m:* UW, dark grey, SANDSTONE. Very weak, moderately cemented to well cemented, fine to medium grained.			HQTT	100	BH119 @ 25.50m UW-SANDSTONE? Sample description from target	2 25.5					91	*25.08m:* BF, 0°, PL, SM, CN *25.17m:* BF, 20°, UN, SM, CN *25.23m:* DD *25.28m:* DD *25.35m:* BF, 0°, PL, SM, CN					
	26.09m: UW, dark grey, Volcaniclastic SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.			HQTT	100		1 26.0 26.5					100	*25.90m:* J, 20°, PL, R, CN *26.00m:* J, 25°, PL, R, CN *26.32m:* J, 10°, PL, R, CN *26.60m:* J, 15°, PL, R, CN					Box 8, 24.12-27.12m
	28.29m: UW, dark grey, SILTSTONE. Very weak, moderately cemented to well cemented. *28.31m:* UW, dark grey, SANDSTONE. Very weak, moderately cemented to well cemented, fine grained.			HQTT	100		0 27.0 27.5					99	*26.94m:* J, 25°, PL, R, CN *27.38m:* J, 15°, UN, R, CN *27.79m:* J, 10°, UN, R, CN *27.96m:* J, 10°, UN, R, CN					
				HQTT	100	BH119 @ 29.51m UW-SANDSTONE? Sample description from target B21-1627 @ 29.85m	-1 28.0 28.5					100	*28.29m:* BF, 5°, PL, R, CN *28.31m:* BF, 10°, PL, R, CN *28.33m:* DD *28.77m:* J, 15°, UN, R, CN					
	29.84 - 29.86m: UW, dark grey, SILTSTONE. Very weak. 30m: END OF BOREHOLE						-2 29.0 29.5						*29.17m:* DD *29.75m:* J, 10°, UN, R, CN *29.86m:* BF, 10°, UN, R, CN					Box 9, 27.12-30.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH119

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926240.95 mN, 1746521.49 mE (NZTM2000)

DIRECTION: 180°

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 27.13m

R.L. COLLAR: 27.13m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: TRMC

CHECKED: ROM

START DATE: 03/06/2021

FINISH DATE: 08/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W UW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation					UW SANDSTONE Splitting Tensile Strength (Mpa):											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH119**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926240.95 mN 1746521.49 mE	DRILL TYPE: N101 DRILL METHOD: RC	HOLE STARTED: 03/06/2021 HOLE FINISHED: 08/06/2021 DRILLED BY: McMillan Drilling
R.L.:	27.13m		
DATUM:	AUCKHT1946		LOGGED BY: TRMC CHECKED: ROM

0.00-3.00m

3.00-6.63m

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

Tonkin+Taylor

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH119**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland		JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5926240.95 mN 1746521.49 mE	DRILL TYPE: N101	HOLE STARTED: 03/06/2021	
R.L.: 27.13m	DRILL METHOD: RC	HOLE FINISHED: 08/06/2021	
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling	
		LOGGED BY: TRMC	CHECKED: ROM

6.63-9.80m

9.80-13.20m

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH119**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926240.95 mN 1746521.49 mE	DRILL TYPE: N101	HOLE STARTED: 03/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 08/06/2021
R.L.:	27.13m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: TRMC CHECKED: ROM

13.20-16.95m

16.95-20.66m

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH119**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926240.95 mN 1746521.49 mE	DRILL TYPE: N101	HOLE STARTED: 03/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 08/06/2021
R.L.:	27.13m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: TRMC CHECKED: ROM

20.66-24.12m

24.12-27.12m

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH119**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926240.95 mN 1746521.49 mE	DRILL TYPE: N101	HOLE STARTED: 03/06/2021
		DRILL METHOD: RC	HOLE FINISHED: 08/06/2021
R.L.:	27.13m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: TRMC CHECKED: ROM

27.12-30.00m

General Log - DESX005 - Fix RQD - 9/12/2021 3:23:42 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH120

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926292.03 mN, 1746607.28 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.92m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 06/05/2021
FINISH DATE: 11/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, minor organics; brown. Stiff, dry, low plasticity. Sand, fine. Organics, rootlets (fresh).			HA	0		28	0.5										
	0.65m: Sandy SILT, minor organics and minor clay; brown streaked orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh).																	
	0.95m: Sandy SILT, minor organics; brown mixed dark brown. Stiff, dry, low plasticity. Sand, fine. Organics, rootlets (fresh). *1.05 - 1.10m:* WOOD; brownish orange.							1.0										
	1.30m: Sandy SILT, minor organics; dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (fresh).			RC	100													
	1.58m: Sandy SILT, minor organics; brown mixed dark brown. Stiff, dry, low plasticity. Sand, fine. Organics, rootlets (fresh).			SPT	40	0/- kPa Shear vane test failed 2/4 5/4 4/5 **N=18**		1.5										
	1.68m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	1.95m: CORE LOSS - Suspect washed out.						27	2.0										
	2.05m: Sandy SILT, minor organics; brown mixed dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, rootlets (fresh).			RC	67													
Tauranga Group	*2.25m:* Sandy SILT, minor organics and minor clay; orange mottled light grey. Stiff, moist, medium plasticity. Sand, fine. Organics, decomposed.			RC	100	0/- kPa Shear vane test failed		2.5										
	3.32m: NO RECOVERY - Suspect slipped out of SPT spoon.			SPTS	71	107/57 kPa 1/1 2/2 2/2 **N=8**	26	3.0							07/05/2021			
	3.45m: SILT, some sand, minor organics and minor clay; light grey mottled orange. Stiff, moist, medium to high plasticity. Sand, fine. Organics, decomposed.			RC	100			3.5										
	4.45m: Sandy SILT, minor organics, trace clay; light grey. Stiff, moist, low to medium plasticity. Sand, fine. Organics, decomposed.			SPTS	100	51/18 kPa 0/1 1/1 2/1 **N=5**	25	4.0										
							24	4.5										

Box 1, 0.00-3.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 20.0 - 25.0 m bgl. Wireline downhole test undertaken on 11/05/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:02 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH120

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: 5926292.03 mN (NZTM2000) 1746607.28 mE	R.L. GROUND: 28.92m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 06/05/2021
FINISH DATE: 11/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW EW)	Rock Strength (ES VS S MS M W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Sandy SILT, minor organics, trace clay; light grey. Stiff, moist, low to medium plasticity. Sand, fine. Organics, decomposed. [CONT].																	
	6.12 - 6.13m: Dark grey.			SPTS	100	0/1 1/1 1/1 **N=4**	23	6.0										
				RC	100			6.5										
							22	7.0										
	7.73 - 7.78m: SILT, minor clay; light brown speckled grey. Stiff, moist, low to medium plasticity.			SPTS	100	49/4 kPa 0/1 2/1 1/2 **N=6**		7.5										
				RC	100		21	8.0							10/05/2021			Box 3, 6.00-9.00m
								8.5										
	9.00m: NOT LOGGED. - Push Tube Sample.			PT	0	BH120 PH1.4a UU @ 9.00m TG/ECBF SOIL INTERFACE ? Sample description from target	20	9.0										
East Coast Bays Formation	*9.50m:* CW, grey, SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT; moist, medium to high plasticity. Sand, fine.			RC	100		19	9.5										

Box 2, 3.00-6.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 20.0 - 25.0 m bgl. Wireline downhole test undertaken on 11/05/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:07:03 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH120

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926292.03 mN, 1746607.28 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.92m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 06/05/2021
FINISH DATE: 11/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* HW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, Recovered as: Silty SAND, grey. Moist [CONT].	UW SW MW HW	ES VS S MS W VW EW	RC	100		18	10.5										
	10.50m: HW, grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT; moist, low plasticity. Sand, fine.			SPTS	0	UTP 2/1 2/2 3/4 **N=11**		11.0										
	10.75m: HW, grey, SILTSTONE. Extremely weak (very stiff), poorly cemented, Recovered as: SILT, minor clay and minor sand; moist, low plasticity. Sand, fine.																	
	10.95m: MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, Recovered as: Silty SAND, grey. Medium Dense, moist.			RC	93			11.5							11/05/2021			
	11.93m: CORE LOSS - Suspect washed out.						17	12.0										Box 4, 9.00-12.45m
	12.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTS	100	4/6 6/8 7/7 **N=28**												
	12.45m: SW, grey, SANDSTONE with carbonaceous flecks. Extremely weak (medium dense), poorly cemented, fine to medium grained, Recovered as: SAND, some organics, grey. Medium Dense, moist; organics, carbonaceous flecks.			RC	100	BH120 @ 13.00m MW-SW SANDSTON E? Sample description from target	16	12.5 13.0				0						
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	4/6 6/7 7/7 **N=27** Solid	15	13.5										
	13.95m: SW, grey, SANDSTONE. Extremely weak (medium dense), poorly cemented, fine to medium grained, Recovered as: SAND, grey. Medium Dense, moist.			RC	100			14.0 14.5				100						
	14.82 - 14.83m: UW, grey, SILTSTONE. Extremely weak (hard), moderately cemented. *14.84 - 14.85m:* SANDSTONE with black carbonaceous laminations.						14											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 20.0 - 25.0 m bgl. Wireline downhole test undertaken on 11/05/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:07:03 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH120

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: (NZTM2000) 5926292.03 mN 1746607.28 mE	R.L. GROUND: 28.92m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 06/05/2021
FINISH DATE: 11/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	3/6 6/8 6/7 **N=27** Solid	13	15.5										
	15.45m: UW, grey, SANDSTONE. Extremely weak (medium dense), poorly cemented, fine to coarse grained, Recovered as: SAND, grey. Medium Dense, moist. *15.58 - 15.62m:* SANDSTONE with black carbonaceous laminations. *15.62 - 15.64m:* UW, grey, SILTSTONE. Extremely weak (hard), moderately cemented. *15.99 - 16.02m:* UW, grey, SILTSTONE. Extremely weak (hard), moderately cemented. *16.02 - 16.50m:* UW. Fine grained.			RC	97			16.0				91						Box 5, 12.45-16.20m
	16.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/8 9/12 13/14 **N=48** Solid	12	16.5										
	16.95m: UW, grey, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained, Recovered as: SAND, grey. Very dense, moist.			RC	95			17.0				95						
	18.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/12 13/15 14/8 for 40mm **N>=50** Solid	11	17.5										
	18.42m: UW, grey, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to medium grained, Recovered as: SAND, grey. Very dense, moist. *18.67m:* CORE LOSS - Suspect washed out.			RC	23			18.0				0						
	19.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	3/10 10/12 13/15 **N>=50** Solid	10	18.5										
								19.0					*19.80m:* DD					
							9	19.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 20.0 - 25.0 m bgl. Wireline downhole test undertaken on 11/05/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:07:03 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH120

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: 5926292.03 mN (NZTM2000) 1746607.28 mE	R.L. GROUND: 28.92m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 06/05/2021
FINISH DATE: 11/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, grey. Very dense, moist [CONT].					pH / ASS @ 20.00m pH = 7		20.5					*20.13m:* DD *20.46m:* DD					
	21.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/11 11/12 11/10 **N=44** Solid		21.0										
	21.45m: UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, grey. Very dense, moist.			RC	95	BH120_S1 @ 21.45m UW SANDSTONE Sample description from target		21.5				95	*21.60m:* DD *21.82m:* DD *21.93m:* DD *22.12m:* DD *22.33m:* DD					Box 6, 16.20-21.45m
	22.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/9 11/15 13/11 for 60mm **N>=50** Solid		22.0										
	22.94m: UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, grey. Very dense, moist.			RC	100	pH / ASS @ 22.94m pH = 7 B21-1628 @ 23.10m UW SANDSTONE Goodrich Drillability;		22.5				100	*22.98m:* DD *23.48m:* DD *23.81m:* DD *23.94m:* DD					
	24.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/12 13/15 15/7 for 40mm **N>=50** Solid		23.0										
	24.43m: UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, grey. Very dense, moist.							23.5				90						
								24.0										
								24.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 20.0 - 25.0 m bgl. Wireline downhole test undertaken on 11/05/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:03 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH120

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926292.03 mN 1746607.28 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.92m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 06/05/2021

FINISH DATE: 11/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.18m:* UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained. 30 to 120mm thick. INTERBEDDED WITH: UW, grey, SILTSTONE. Extremely weak (hard), poorly cemented. 10 to 55mm thick	UW SW MW HW CW	ES VS S MS W VW EW	RC	97	B21-1629 @ 25.30m UW SANDSTON E						90	*24.96m:* DD *25.01m:* DD *25.06m:* DD *25.18 - 25.50m:* Bedding 0 to 5° inclined. *25.40m:* DD *25.46m:* DD					Box 7, 21.45-25.30m
	25.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	Weathering (LOPL, PI); Moisture content; 25mm N*=50 MC Solid AL	25.5											
	25.75m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained. 6 to 200mm thick. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented. 5 to 90mm thick, 0 to 15° inclined.			RC	92	B21-1630 @ 25.75m UW SANDSTON E Goodrich Drillability; pH / ASS @ 26.00m pH = 7	3	26.0				82	*25.86m:* DD *26.03m:* DD *26.06m:* DD *26.26m:* DD *26.35m:* BF, 5°, PL, SM, VN, CN *26.47m:* DD *26.67m:* BF, 0°, PL, SM, VN, Carbonaceous material on fracture surface *26.69m:* BF, 0°, PL, SM, VN, Carbonaceous material on fracture surface					
	26.90m: CORE LOSS - Suspect washed out.						2	26.5										
	27.00m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained. 6 to 200mm thick. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented. 5 to 90mm thick, 0 to 15° inclined.			RC	80		1	27.0				80	*26.86m:* DD *27.10m:* DD *27.21m:* DD *27.27m:* DD *27.29m:* DD *27.30m:* J, 90°, PL, SM, VN, CN *27.31m:* DD *27.45m:* BF, 14°, PL, SM, VN, CN *27.48m:* DD, 3° *27.52m:* DD *27.73-27.85m:* DD, Drilling induced discing *27.85m:* DD *27.89m:* DD					
	28.20m: CORE LOSS - Suspect washed out.						0	27.5										
	28.50m: UW, grey, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained. 6 to 200mm thick. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented. 5 to 90mm thick, 0 to 15° inclined.			RC	100		-1	28.0				89	*28.20m:* BF, 0-18°, PL, R, VN, CN *28.60m:* DD *28.67m:* BF, 8°, PL, SM, VN, CN *29.00m:* DD *29.01m:* DD *29.06m:* BF, 0°, PL, SM, VN, CN *29.11m:* BF, 15°, PL, R, VN, CN, Drilling induced discing *29.12-29.14m:* DD *29.35m:* DD *29.39m:* DD *29.43m:* DD *29.49m:* J, PL, R, CN *29.57m:* DD *29.59m:* DD *29.62m:* J, 80-90°, PL, R, VN, CN *29.66m:* DD *29.90m:* DD					Box 8, 25.30-28.60m
	30m: END OF BOREHOLE						-2	28.5										Box 9, 28.60-30.00m
								29.0										
								29.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval at 20.0 - 25.0 m bgl. Wireline downhole test undertaken on 11/05/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 11:07:03 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH120**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926292.03 mN 1746607.28 mE	DRILL TYPE:	HOLE STARTED: 06/05/2021
R.L.:	28.92m	DRILL METHOD: RC	HOLE FINISHED: 11/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

0.00-3.00m

3.00-6.00m

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:03 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH120**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926292.03 mN 1746607.28 mE	DRILL TYPE:	HOLE STARTED: 06/05/2021
R.L.:	28.92m	DRILL METHOD: RC	HOLE FINISHED: 11/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

6.00-9.00m

9.00-12.45m

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:03 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH120**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926292.03 mN 1746607.28 mE	DRILL TYPE:	HOLE STARTED: 06/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 11/05/2021
R.L.:	28.92m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

12.45-16.20m

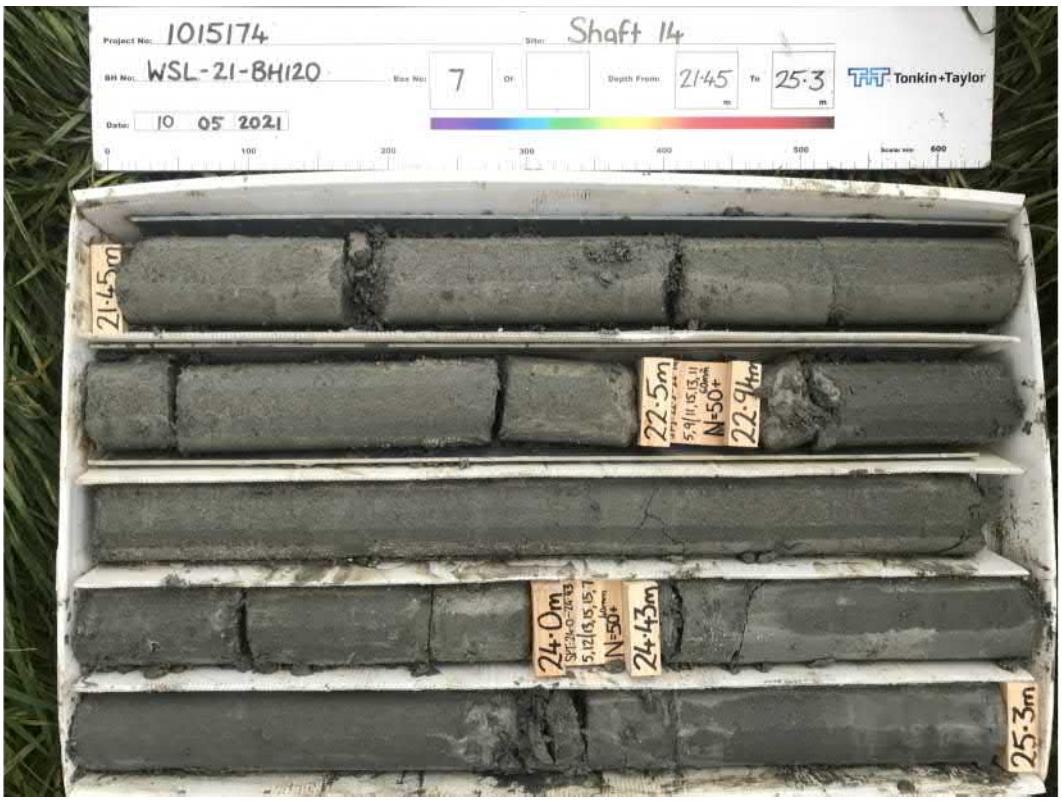
16.20-21.45m

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:03 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH120**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926292.03 mN 1746607.28 mE	DRILL TYPE:	HOLE STARTED: 06/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 11/05/2021
R.L.:	28.92m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU



21.45-25.30m

25.30-28.60m

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:03 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH120**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926292.03 mN 1746607.28 mE	DRILL TYPE:	HOLE STARTED: 06/05/2021
R.L.:	28.92m	DRILL METHOD: RC	HOLE FINISHED: 11/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

28.60-30.00m

General Log - DESX005 - Fix RQD - 8/12/2021 1:07:03 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH121

SHEET: 1 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926354.05 mN, 1746667.47 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.57m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 03/05/2021

FINISH DATE: 05/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics, trace gravel; brown. Firm, moist, low plasticity. Sand, fine to coarse; gravel, fine, sub-angular to angular, basalt.			HQ3	64	Contam / Asbestos @ 0.50m PID - 0.3ppm	26	0.5										
	0.10m: Sandy CLAY and SILT, some organics, trace gravel; light brown mixed brown. Firm, moist, low plasticity. Sand, fine to coarse; gravel, fine, sub-angular to angular, basalt.																	
	0.20m: Silty sandy GRAVEL, some organics; brown. Very loose to loose, moist. Sand, fine to coarse; gravel, fine, sub-angular to angular, basalt. [Recovered as}.																	
	0.28m: Silty gravelly CLAY, some organics and some sand; brown mottled light brown. Firm, moist, high plasticity. Sand, fine to coarse; gravel, fine, sub-angular to angular, basalt.																	
	0.48m: CORE LOSS - Suspect washed out.																	
	0.75m: Silty CLAY, some sand, trace organics; light brown mottled orange. Stiff, moist, high plasticity. Sand, fine. Organics, rootlets (fresh).			HQ3	63	Contam / Asbestos @ 1.00m PID - 0.1ppm		1.0										
	1.22m: CORE LOSS - Suspect washed out.																	
	1.50m: SILT, some clay and some sand, trace organics; light brown mottled orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh).			SPTS	80	1/2 1/2 2/2 **N=7**	25	1.5								HWT (HD:3.00m)		
	1.86m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	1.95m: SILT, some clay and some sand, trace organics; light brown mottled orange. Stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).			HQ3	100			2.0										
Tauranga Group	*2.50m:* SILT, some sand, trace organics; light brown mottled orange. Stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).			HQ3	100		24	2.5							04/05/2021			
	2.85m: Sandy SILT, trace organics and trace clay; light brown mottled orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh).			SPTS	100	52/22 kPa 0/0 1/1 1/1 **N=4**		3.0								HWT (HD:6.00m)		
	3.80 - 4.00m: Sandy SILT, trace organics. Organics, rootlets (fresh).			HQ3	100		23	3.5										
	4.35m: Sandy SILT, minor clay, trace organics; light brown spotted dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, decomposed.							4.0										
	4.50m: NO RECOVERY - Solid SPT, no overcore recovered.			PT	0	48/24 kPa BH121_S1 @ 4.50m TG Sample description from target PSD MC	22	4.5								HWT (HD:7.50m)		Box 1, 0.00-3.45m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer testing undertaken between 12.0 - 25.5 m bgl

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH121

SHEET: 2 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926354.05 mN, 1746667.47 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.57m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 03/05/2021

FINISH DATE: 05/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*5.00m:* Sandy SILT, trace organics and trace clay; light brown spotted dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, decomposed. . *5.10 - 5.15m:* SILT, trace organics; brownish grey. Stiff, moist, low plasticity. Organics, decomposed. *5.15m:* Sandy SILT, trace organics and trace clay; light brown speckled black. Stiff, moist, medium to high plasticity. Sand, fine. Organics, carbonaceous material.			HQ3	100	AL	21	5.5										
	6.20m: CW, light brown speckled black, Sandy SILTSTONE. Extremely weak (loose), Recovered as Sandy SILT, trace organics; moist, Sand, fine to medium. Organics, carbonaceous material, medium plasticity.			SPTS	100	76/15 kPa 1/1 2/2 2/2 **N=8**	20	6.0 6.5							05/05/2021			Box 2, 3.45-6.70m
	7.32 - 7.43m: SILT, some clay, trace organics; grey. Stiff, moist, medium plasticity. Organics, decomposed.			HQ3	100			7.0								HWT (HD 7.50m)		
	7.83 - 7.90m: SILT, some clay; grey. Stiff, moist, medium plasticity.			SPTS	100	101/3 kPa 1/2 2/2 3/5 **N=12**	19	7.5										
	8.25m: HW, grey, MUDSTONE. Extremely weak (hard), poorly cemented, Recovered as: Silty CLAY. moist, high plasticity.			RC	100			8.0										
	8.40m: HW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine to medium grained, Recovered as: Silty SAND, medium dense, moist. Remoulds to: Sandy SILT, medium plasticity.						18	8.5										
	8.92 - 9.00m: SW, grey, MUDSTONE. Extremely weak (hard), poorly cemented, (SILT, some clay, minor sand. most, medium, plasticity).			RC	100			9.0										
	9.50 - 9.60m: SW, grey, MUDSTONE. Extremely weak (hard), poorly cemented, (SILT, some clay, minor sand. most, medium, plasticity).			SPTS	100	3/3 4/6 6/6 **N=22**	17	9.5										Box 3, 6.70-9.65m
	9.60m: MW, grey speckled black, SANDSTONE. Extremely weak (very dense), poorly cemented, fine grained, Recovered as: SAND, some silt, Very dense, moist. Remoulds to Sandy SILT, medium plasticity.			RC	100													
	9.70 - 9.92m: Uncemented to poorly cemented, fine to medium grained.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer testing undertaken between 12.0 - 25.5 m bgl

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH121

SHEET: 3 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926354.05 mN 1746667.47 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.57m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 03/05/2021
FINISH DATE: 05/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.00m:* MW, grey speckled black, SANDSTONE. Extremely weak (very dense), poorly cemented, fine grained, Recovered as: SAND, some silt, Very dense, moist. Remoulds to Sandy SILT, medium plasticity [CONT]. *10.13 - 10.25m:* UW, grey, Sandy SILTSTONE. Extremely weak (hard), poorly cemented, Sandy SILT, some clay, most, medium, plasticity). *10.25m:* CORE LOSS - Suspect washed out.	UW SW MW HW CW	ES VS S MS W VW EW	RC	64	pH / ASS @ 10.00m pH - 7	16	10.5										
	10.50m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt, Very dense, moist. Remoulds to Sandy SILT, medium plasticity.			SPTS	100	4/5 8/10 12/13 **N=43**		11.0										
				RC	95		15	11.5										
	12.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/11 14/15 18/3 for 15mm **N>=50** Solid		12.0										
	12.39m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt, Very dense, moist. Remoulds to Sandy SILT, low plasticity. *12.99 - 13.03m:* Carbonaceous SANDSTONE. Black carbonaceous laminations.			RC	100		14	12.5				100	*13.20m:* DD					
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/10 11/14 16/9 for 40mm **N>=50** Solid	13	13.0 13.5										
	13.91m: UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt, Very dense, moist. . *14.70 - 15.00m:* Fine to coarse grained.			RC	100		12	14.0 14.5				100	*14.03m:* DD *14.26m:* DD *14.92m:* DD					Box 4, 9.85-13.30m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer testing undertaken between 12.0 - 25.5 m bgl

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH121

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926354.05 mN, 1746667.47 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.57m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 03/05/2021
FINISH DATE: 05/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/11 14/15 15/6 for 30mm **N>=50** Solid	11	15.5										
	15.40m: UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt, Very dense, moist. .			RC	100			16.0				100	*15.55m:* DD *15.83m:* DD *16.17m:* DD *16.33m:* DD *16.47m:* DD					
							10	16.5					*16.67m:* DD					Box 5, 13.30-16.80m
				RC	92			17.0				92	*17.14m:* DD *17.28m:* DD					
							9	17.5					*17.46m:* DD *17.56m:* DD					
	17.88m: CORE LOSS - Suspect washed out.							18.0					*17.78m:* DD					
	18.00m: UW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to medium grained, Recovered as: SAND, some silt, Very dense, moist. .						8	18.5					*18.17m:* DD *18.35m:* DD *18.50m:* DD					
	18.45m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. 3 to 120mm thick, 0 to 8° inclined. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented to well cemented. 2 to 80mm thick.			RC	100							87	*18.68m:* DD *18.88m:* DD *18.98m:* BF, 0-4°, PL, SM, VN, CN					
								19.0					*19.12m:* BF, 0-5°, PL, SM, VN, CN					
							7	19.5					*19.41m:* DD					Box 6, 16.80-19.70m
												90	*19.77m:* DD *19.89m:* DD *19.89-20.11m:* J, 82°, PL, R, VN, CN					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer testing undertaken between 12.0 - 25.5 m bgl

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH121

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926354.05 mN, 1746667.47 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.57m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 03/05/2021

FINISH DATE: 05/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. 3 to 120mm thick, 0 to 8° inclined. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented to well cemented, [CONT]. 2 to 80 mm thick.	UW SW MW HW CW	EW VS S MS HS VW EW	RC	95	BH121 @ 20.50m UW SANDSTONE Sample description from target	6	20.5				90	*20.22-20.40m:* J, 62-80°, PL, R, VN, CN *20.38-20.49m:* J, 78°, PL, R, VN, CN *20.49m:* DD *20.64m:* DD					
	20.92m: CORE LOSS - Suspect washed out.							21.0					*20.88m:* BF, 0-22°, PL, SM, VN, CN					
	21.00m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. 3 to 120mm thick, 0 to 8° inclined. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented to well cemented. 2 to 80mm thick.					B21-1631 @ 21.00m UW SANDSTONE Goodrich Drillability;	5	21.5					*21.22m:* DD *21.33m:* BF, 0-7°, PL, SM, VN, CN *21.43m:* BF, 0-4°, PL, SM, VN, CN *21.47m:* BF, 0-4°, PL, SM, VN, CN *21.51m:* DD					
	21.51m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			RC	100							95	*21.70m:* DD *21.83m:* DD					
	21.82m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. 2 to 180mm thick, 0 to 14° inclined. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented to well cemented. 2 to 80mm thick.						4	22.0					*22.08m:* DD *22.12m:* DD					
								22.5					*22.23-22.50m:* J, 82-90°, PL, T, Healed joint. Calcite veneer (1mm) *22.47m:* J, 42°, PL, SM, VN, CN *22.50-22.61m:* J, 90°, PL, T, Healed joint. Calcite veneer (opened from drilling) *22.64m:* DD *22.73m:* BF, 0-5°, PL, SM, VN, CN *22.77m:* DD					Box 7, 19.70-22.80m
	23.68 - 23.71m: SANDSTONE with black carbonaceous laminations.			RC	100		3	23.0				92	*22.79-23.13m:* J, 85-90°, PL, T, Healed joint. Calcite veneer (1mm) *22.83m:* DD *22.85m:* DD *22.90m:* DD *23.13-23.22m:* DD, Drilling induced fracturing *23.37-23.43m:* DD, Drilling induced fracturing *23.49m:* DD *23.63m:* BF, 0-3°, PL, SM, VN, CN *23.80m:* DD, , *23.90m:* BF, 5°, PL, SM, VN, CN					
								23.5										
								24.0										
							2	24.5				99	*24.30m:* DD *24.32m:* DD *24.40m:* DD *24.70m:* BF, 0-12°, ST, SM, VN, CN *24.90m:* DD *24.91m:* DD					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer testing undertaken between 12.0 - 25.5 m bgl

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH121

SHEET: 6 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926354.05 mN 1746667.47 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 26.57m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 03/05/2021
FINISH DATE: 05/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. 2 to 180mm thick, 0 to 14° inclined. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented to well cemented, [CONT]. 2 to 80 mm thick.	UW SW MW HW CW	ES VS WS MS UW EW	RC	100	pH / ASS @ 25.00m pH - 7; B21-1632 @ 25.28m UW SANDSTONE Splitting Tensile Strength (Mpa); BH121 @ 25.50m interbedded uw sst and zst vw Sample description from sample	1	25.5				99	*25.00m:* DD *25.06m:* DD *25.14m:* DD *25.18m:* DD *25.20m:* DD *25.23m:* DD *25.26m:* DD *25.33m:* DD	25 50 75				Box 8, 22.80-25.70m
				RC	88		0	26.0 26.5				87	*25.72m:* DD *25.81m:* DD *25.93m:* J, 48°, ST, T *25.96m:* BF, 12°, PL, SM, CN *26.03m:* DD *26.32m:* DD *26.43m:* DD *26.58m:* DD *26.70m:* DD					
	26.82m: CORE LOSS - Suspect washed out.							27.0										
	27.00m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained. 2 to 180mm thick, 0 to 14° inclined. INTERBEDDED WITH: UW, grey, SILTSTONE. Very weak, moderately cemented to well cemented. 2 to 80mm thick.			RC	100		-1	27.5 28.0				100	*27.08m:* DD *27.33m:* DD *27.49m:* BF, 0-12°, PL, SM, VN, Carbonaceous material on fracture surface *27.50m:* DD *27.80-27.94m:* J, 70°, PL, SM, VN, CN, discontinues into Sandstone *27.84m:* DD *28.05m:* DD *28.29m:* DD					Box 9, 25.70-28.80m
	29.12 - 29.53m: UW, grey, SANDSTONE. Very weak, moderately cemented, fine to medium grained.			RC	100	BH121 @ 28.80m UW SANDSTONE/ SILTSTONE Sample description from target; B21-1633 @ 29.10m UW SANDSTONE Splitting Tensile Strength (Mpa);	-2 -3	28.5 29.0 29.5				100	*29.05m:* DD *29.26m:* DD *29.62m:* BF, 0-3°, PL, SM, VN, CN *29.78m:* DD *29.92m:* DD					Box 10, 28.80-30.00m
	30m: END OF BOREHOLE																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Packer testing undertaken between 12.0 - 25.5 m bgl

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH121**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926354.05 mN 1746667.47 mE	DRILL TYPE:	HOLE STARTED: 03/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 05/05/2021
R.L.:	26.57m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

0.00-3.45m

3.45-6.70m

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH121**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926354.05 mN 1746667.47 mE	DRILL TYPE:	HOLE STARTED: 03/05/2021
R.L.:	26.57m	DRILL METHOD: RC	HOLE FINISHED: 05/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

6.70-9.65m

9.65-13.30m

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH121**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926354.05 mN 1746667.47 mE	DRILL TYPE:	HOLE STARTED: 03/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 05/05/2021
R.L.:	26.57m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

13.30-16.80m

16.80-19.70m

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH121**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926354.05 mN 1746667.47 mE	DRILL TYPE:	HOLE STARTED: 03/05/2021
R.L.:	26.57m	DRILL METHOD: RC	HOLE FINISHED: 05/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

19.70-22.80m

22.80-25.70m

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH121**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926354.05 mN 1746667.47 mE	DRILL TYPE:	HOLE STARTED: 03/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 05/05/2021
R.L.:	26.57m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

25.70-28.80m

28.80-30.00m

General Log - DESX005 - Fix RQD - 16/12/2021 5:02:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 1 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926347.63 mN 1746676.36 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 19/04/2021
FINISH DATE: 22/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* CORE LOSS - Suspect washed out.			RC	37		28	0.5					*0.00m:* Hand auger refusal on loose concrete at 0.2 m					
	0.95m: Sandy SILT, minor clay and minor gravel, trace organics; brown mottled brownish yellow. Stiff, moist, medium plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Vesicular Basalt. Organics, rootlets (partially decomposed).							1.0										
	1.62m: SILT, some clay and some sand, trace organics; light brown mottled orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (partially decomposed).			SPT	56	0/- kPa SV test failed 1/1 2/1 1/2 **N=6**	27	1.5										
	1.75m: CORE LOSS - Suspect washed out.																	
	1.95m: SILT, some clay and some sand; light brown mottled orange. Stiff, moist, medium plasticity. Sand, fine.			RC	86		26	2.0										
	2.30m: Sandy SILT, minor gravel; brown mixed reddish brown. Firm, moist, low plasticity. Silt, Sensitive; sand, fine; gravel, fine to coarse, sub-angular to angular, unweathered, Basalt.							2.5										
	2.65m: Sandy SILT, minor clay and minor gravel; dark brown spotted dark grey. Stiff, moist, low plasticity. Sand, fine; gravel, fine to medium, sub-angular to angular, unweathered, Basalt.																	
	2.80m: CORE LOSS - Suspect washed out.							3.0										
Tauranga Group	*3.00m:* SILT, some clay, minor sand, trace organics; light grey mottled brownish orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh).			SPT	84	0/- kPa SV test failed 1/0 1/2 1/2 **N=6**	25											
	3.38m: CORE LOSS - Suspect material dropped out of barrel.							3.5										
	3.45m: SILT, some clay and some sand, trace organics; light grey mottled brownish orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh).			RC	86													Box 1, 0.00-4.25m
	4.35m: CORE LOSS - Suspect washed out.						24	4.0										
	4.50m: SILT, minor clay, trace sand; light grey mottled grey. Stiff, moist, low to medium plasticity. Sand, fine.			SPT	78	100/33 kPa 1/1 1/1 2/2 **N=6**		4.5										
	4.75m: PEAT (AMORPHOUS) and SILT; brown spotted black. Soft to firm, moist, medium plasticity.																	
	4.85m: CORE LOSS - Suspect washed out.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 2 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926347.63 mN, 1746676.36 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 19/04/2021
FINISH DATE: 22/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*4.95m:* Sandy SILT, minor clay; light grey mottled orange. Stiff, moist, medium to high plasticity. Sand, fine.						23	5.5										
	5.40m: PEAT (FIBROUS AND AMORPHOUS) and SILT; brown spotted black. Soft to firm, moist, medium plasticity.																	
	5.48m: SILT, some sand, minor organics, trace clay; brown spotted black. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, twigs (decomposed).																	
	6.00m: NOT LOGGED. Push tube sample.					BH122 S1 @ 6.00m TG Sample description from target PSD AL	22	6.0										
	6.50m: SILT, some organics, trace clay and trace sand; light greyish brown streaked dark brown. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, twigs (decomposed).			RC	100			6.5										
	7.10 - 7.20m: Some sand.																	
	7.20 - 7.40m: Sandy SILT, some organics. Organics, rootlets (decomposed).						21	7.0										
						80/36 kPa		7.5										
	7.60m: Sandy SILT, some organics; light greyish brown streaked dark brown. Firm, moist, medium plasticity. Sand, fine. Organics, twigs (decomposed).			SPT	100	0/1 1/1 1/1 **N=4**													
				RC	100		20	8.0										Box 2, 4.25-7.95m
East Coast Bays Formation	*8.85m:* SILT, minor sand; grey. Stiff, moist, high plasticity. Sand, fine.							8.5										
	9.00m: Sandy SILT, some organics; grey. Stiff, moist, high plasticity. Sand, fine. Organics, carbonaceous flecks.																	
				SPT	111	61/24 kPa 1/1 1/1 1/2 **N=5**	19	9.0										
	9.62 - 9.70m: SILT, some clay; grey. Stiff, moist, medium plasticity.							9.5										

Water Level: 20/04/2021, 21/04/2021, 22/04/2021, 21/04/2021

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926347.63 mN, 1746676.36 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 19/04/2021
FINISH DATE: 22/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.10m:* CW, grey, SANDSTONE. Extremely weak (medium dense), Recovered as: SAND, some organics; moist, medium plasticity. Sand, fine to medium. Organics, carbonaceous flecks. Remoulds to: Sandy SILT, medium plasticity.			RC	95		18	10.5										
	10.45 - 10.50m: SILT, some clay; grey. Stiff, moist, medium plasticity.			SPT	100	80/25 kPa; 2/2 3/4 5/5 **N=17**												
				RC	100		17	11.5										Box 3, 7.95-11.25m
	12.00m: CW, grey, SILTSTONE. Extremely weak (stiff), Sandy SILT; moist, high plasticity. Sand, fine..			SPTS	78	UTP; 4/4 5/5 8/9 **N=27**	16	12.0										
	12.20m: CW, grey, SANDSTONE. Extremely weak (medium dense), Recovered as: SAND, minor silt; moist, low plasticity. Sand, fine to medium. Remoulds to Sandy SILT, medium plasticity.							12.5										
	12.35m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	12.45m: HW, grey, SANDSTONE. Extremely weak (medium dense), fine to coarse grained, (SAND, minor silt, trace organics; grey. Medium dense, moist, poorly graded. Organics, carbonaceous flecks). *12.66 - 13.08m:* MW-HW. Extremely weak (dense).			RC	95			13.0										
	13.00 - 13.05m: Sandy SILT; grey. Stiff, moist, low plasticity. Sand, fine. *13.05 - 13.50m:* MW-HW. Extremely weak (dense).						15											
	13.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/7 9/10 11/11 **N=41** Solid		13.5										
	13.95m: MW, grey, SANDSTONE. Extremely weak (dense), fine to coarse grained, (SAND, minor silt, trace organics; grey. Dense, moist, poorly graded. Organics, carbonaceous flecks).			RC	100		14	14.0										
								14.5										Box 4, 11.25-14.90m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 4 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926347.63 mN 1746676.36 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 19/04/2021
FINISH DATE: 22/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* NO RECOVERY - Solid SPT, no overcore recovered.	UW SW MW HW CW	EW VS S MS M W	SPTC	0	5/10 10/11 12/16 **N=49** Solid	13	15.5			2000 600 200 60 20			25 50 75				
	15.45m: MW, grey, SANDSTONE. Extremely weak (dense), fine to coarse grained, (SAND, minor silt, trace organics; grey. Dense, moist, poorly graded. Organics, carbonaceous flecks). *15.70 - 15.73m:* MW, grey, SILTSTONE. Extremely weak (hard), SILT, some clay; grey. Stiff, moist, medium plasticity.			RC	100	B21-1634 @ 15.70m UW SANDSTONE Atterberg Limits (LL,PL,PI); Moisture content; Linear shrinkage AL MC	12	16.0										
	16.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/9 10/12 12/13 **N=47** Solid		16.5										
	16.95m: SW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine to coarse grained, (SAND, minor silt, trace organics; grey. Dense to very dense, moist, poorly graded. Organics, carbonaceous flecks).			RC	90		11	17.0				0						
	17.90m: CORE LOSS - Suspect washed out.							17.5										
	18.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	7/9 10/11 13/16 **N>=50** Solid		18.0										
	18.45m: SW, grey, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to coarse grained, (SAND, minor silt, trace organics; grey. Dense, moist, poorly graded. Organics, carbonaceous flecks).			RC	67		10	18.5				0						
	19.15m: CORE LOSS - Suspect washed out.							19.0										
	19.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	6/10 10/11 14/12 **N=47** Solid	9	19.5										

Box 5, 14.90-19.15m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 5 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926347.63 mN, 1746676.36 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 19/04/2021

FINISH DATE: 22/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log / Fracture Spacing (mm) / RQD (%) / Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* UW, grey, distinctly bedded, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to coarse grained. 5 to 100mm thick, 0 to 4° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak, [CONT]. 5 to 40mm thick.	UW SW MW HW CW	ES VS S MS W VW EW				20.5							
	20.90m: CORE LOSS - Suspect washed out.						21.0							
	21.00m: UW, grey, distinctly bedded, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to coarse grained. 20 to 90mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 35 to 120mm thick.			SPTC	0	9/20 50 for 70mm **N>=50** Solid								
	21.60m: UW, grey, indistinctly bedded, SANDSTONE. Very weak, moderately cemented, fine to coarse grained. 0 to 5° inclinedUW, grey, indistinctly bedded, SILTSTONE. Very weak. *21.75 - 22.25m:* Extremely weak (very dense)			RC	92	B21-1635 @ 21.80m UW SANDSTONE Atterberg Limits (LL,PL,PI); Moisture content; Linear shrinkage MC AL	21.5		RQD 0	*21.22 - 22.50m:* Driller's note - Approx 20% water loss during run				
	22.40m: CORE LOSS - Suspect washed out.						22.0		*21.22-22.75m:* DD, Drilling induced defects *21.75-22.25m:* BZ					
	22.50m: UW, grey, distinctly bedded, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. 5 to 30mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 2 to 10mm thick. *23.25 - 23.28m:* SANDSTONE. Extremely weak (very dense), poorly cemented. *23.40 - 23.90m:* SANDSTONE. 100 to 300mm thick. INTERBEDDED WITH: SILTSTONE. 5 to 80mm thick.			SPTC	0	10/40 for 65mm **N>=50** Solid	22.5		*22.25-22.45m:* DD, Drilling induced defects					
				RC	93		23.0		RQD 82 *22.64-22.77m:* J, 10-40°, T, Healed joint *22.78m:* DD *22.81m:* J, 38-90°, ST, R, CN *22.85m:* DD *22.89m:* BF, 10°, PL, SM, , CN *22.94m:* DD *22.98m:* DD *23.02m:* DD *23.06m:* DD *23.08m:* DD *23.19m:* DD *23.38m:* DD *23.41m:* DD *23.42m:* J, 70°, PL, SM, CN *23.48m:* DD *23.56m:* BF, 8°, PL, SM, VN, CN *23.59m:* BF, 8°, PL, SM, VN, CN *23.73m:* DD					Box 6, 19.15-23.10m
	23.90m: CORE LOSS - Suspect washed out.						23.5							
	24.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	15/35 for 20mm **N>=50** Solid	24.0							
	24.10m: UW, grey, distinctly bedded, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. 100 to 300mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 5 to 80mm thick.					B21-1636 @ 24.40m UW SANDSTONE Atterberg Limits (LL,PL,PI); Moisture content; Linear shrinkage MC AL	24.5		RQD 70 *24.18m:* DD *24.23m:* BF, 4°, PL, R, VN, CN *24.26m:* BF, 4°, PL, T *24.28m:* BF, 0-2°, PL, SM, VN, CN *24.34m:* BF, 5°, PL, R, *24.37m:* DD *24.39m:* BF, 4°, PL, SM, VN, CN *24.48m:* DD *24.55m:* BF, 0-5°, PL, SM, VN, CN *24.64m:* DD *24.66m:* DD *24.72m:* DD *24.82-24.83m:* BZ					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 6 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926347.63 mN 1746676.36 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 19/04/2021

FINISH DATE: 22/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* UW, grey, distinctly bedded, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained, [CONT]. 100 to 300mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 5 to 80mm thick.			RC	86	B21-1637 @ 24.65m UW SANDSTONE XRD Quantitative (Fines Fraction);	3	25.5				70	*24.87m:* DD *24.96m:* DD *24.97m:* DD *25.13m:* DD *25.16m:* BF, 3°, PL, SM, VN, CN *25.18m:* DD					
	25.30m: CORE LOSS - Suspect washed out.																	
	25.50m: UW, grey, distinctly bedded, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. 2 to 120mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 2 to 80mm thick. *25.62 - 25.63m:* Black carbonaceous laminations.			RC	90	B21-1638 @ 25.10m UW SANDSTONE Splitting Tensile Strength (Mpa); Equivalent Quartz and Schimazek wear factor; BH122_S4 @ 25.53m UW SANDSTONE Sample description from target	2	26.0 26.5				85	*25.52m:* DD *25.71m:* BF, 7°, PL, SM, VN, CN *25.73m:* BF, 7°, PL, SM, VN, CN *25.85m:* BF, 5°, PL, SM, VN, CN *25.86m:* DD *25.91m:* DD *25.96m:* DD *26.01m:* DD *26.05m:* DD *26.08m:* DD *26.12m:* DD *26.13m:* BF, 0-12°, PL, SM, VN, CN *26.17m:* DD *26.25m:* DD *26.37m:* DD *26.44m:* DD *26.56m:* DD *26.59m:* DD *26.65m:* DD *26.75m:* DD *26.80m:* DD					Box 7, 23.10-26.35m
	26.82 - 26.86m: Extremely weak (very dense). *26.85m:* CORE LOSS - Suspect washed out.																	
	27.00m: UW, grey, distinctly bedded, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. 2 to 120mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 2 to 80mm thick. *28.15 - 28.45m:* Poorly cemented.			RC	100		1	27.0 27.5				48	*27.05m:* DD *27.06m:* DD *27.11m:* DD *27.15-27.29m:* J, 90°, T, healed *27.22m:* DD *27.38-27.46m:* J, 60-90°, ST, R, VN, CN, Suspected opened by drilling *27.55m:* DD *27.72-27.82m:* J, 80-90°, PL, SM, VN, CN *27.75m:* DD *27.87m:* DD *27.88m:* DD *28.03m:* DD *28.04m:* DD *28.07m:* DD *28.13m:* J, 67°, PL, SM, CN *28.15-28.45m:* BZ, poor rock cementation					
	28.15m: UW, grey, indistinctly bedded, SANDSTONE. Extremely weak (very dense), uncemented to poorly cemented, fine to coarse grained. INTERBEDDED WITH: UW, grey, indistinctly bedded, SILTSTONE. Extremely weak to very weak, poorly cemented to moderately cemented.																	
	28.45m: UW, grey, distinctly bedded, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained. 2 to 120mm thick, 0 to 5° inclined. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak. 2 to 80mm thick.			RC	100		0 -1	28.0 28.5 29.0 29.5				23	*28.48m:* DD *28.49m:* DD *28.55m:* DD *28.67m:* BF, 4°, PL, SM, VN, CN *28.75m:* DD *28.75-28.85m:* BZ *29.02m:* DD *29.05-29.60m:* J, 60-90°, T, lattice of healed joints. Veins infilled with calcite (1 - 6mm) *29.05m:* DD *29.06m:* J, 22°, PL, SM, VN, CN *29.07m:* J, 40°, ST, CN *29.10-30.00m:* J, 78-90°, ST, R, VN, CN, Joint healed between 29.1 - 29.3 m *29.64m:* BF, 0-5°, PL, R, VN, CN *29.67m:* DD *29.70m:* J, 35°, PL, SM, VN, CN *29.70-29.88m:* BZ *29.79m:* BF, 0°, PL, R, VN, CN					Box 8, 26.35-29.30m Box 9, 29.30-30.00m
	30m: END OF BOREHOLE																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

Tonkin+Taylor

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH122

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926347.63 mN, 1746676.36 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.42m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 19/04/2021
FINISH DATE: 22/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
	SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	UW SW MW HW CW	ES VS S MS W VW EW							2000 600 200 60 20			25 50 75				

29.87m: DD

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 5.00 - 9.00 m and 11.00 -15.00 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH122**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926347.63 mN 1746676.36 mE	DRILL TYPE:	HOLE STARTED: 19/04/2021
R.L.:	28.42m	DRILL METHOD: RC	HOLE FINISHED: 22/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-4.25m

4.25-7.95m

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH122**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926347.63 mN 1746676.36 mE	DRILL TYPE:	HOLE STARTED: 19/04/2021
		DRILL METHOD: RC	HOLE FINISHED: 22/04/2021
R.L.:	28.42m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

7.95-11.25m

11.25-14.90m

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH122**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926347.63 mN 1746676.36 mE	DRILL TYPE:	HOLE STARTED: 19/04/2021
R.L.:	28.42m	DRILL METHOD: RC	HOLE FINISHED: 22/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

14.90-19.15m

19.15-23.10m

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH122**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926347.63 mN 1746676.36 mE	DRILL TYPE:	HOLE STARTED: 19/04/2021
		DRILL METHOD: RC	HOLE FINISHED: 22/04/2021
R.L.:	28.42m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

23.10-26.35m

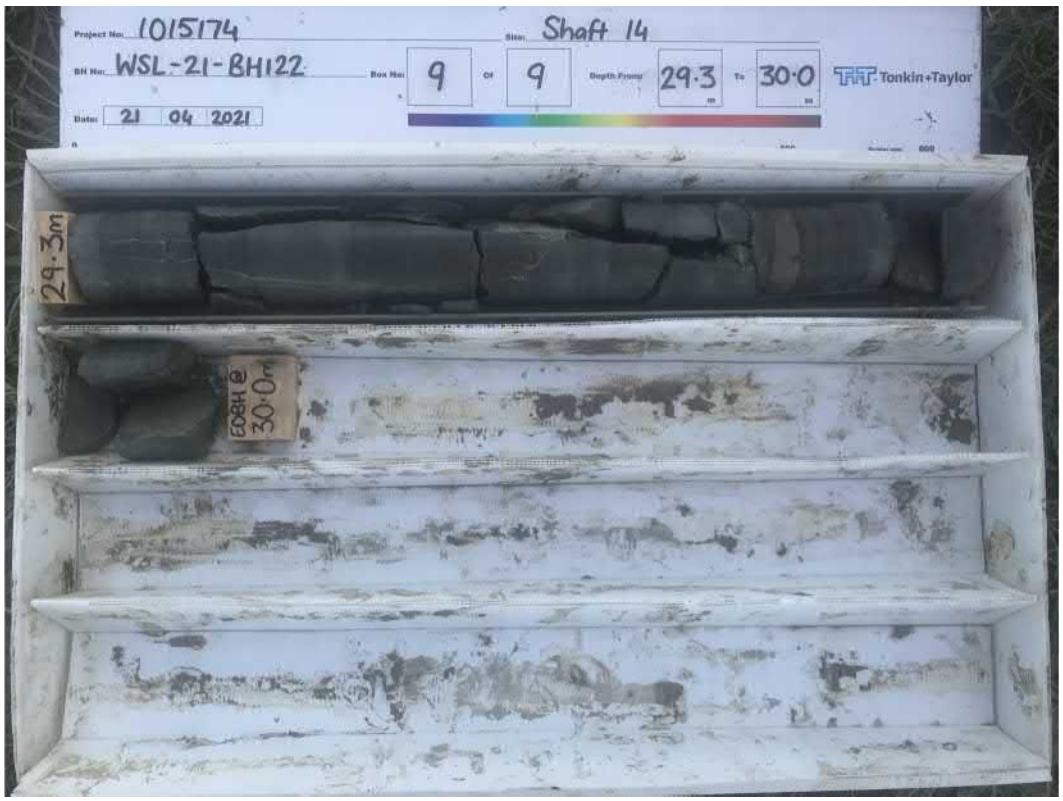
26.35-29.30m

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH122**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926347.63 mN 1746676.36 mE	DRILL TYPE:	HOLE STARTED: 19/04/2021
		DRILL METHOD: RC	HOLE FINISHED: 22/04/2021
R.L.:	28.42m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC



29.30-30.00m

General Log - DESX005 - Fix RQD - 16/12/2021 5:03:38 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 1 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926335.57 mN, 1746662.85 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.80m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 23/04/2021

FINISH DATE: 28/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, minor gravel; brown mixed light brownish orange. Firm, moist, low plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt.														23/04/2021			
	0.35m: Sandy SILT, minor clay and minor gravel; brown mixed light brownish orange. Very stiff to hard, moist, medium plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt.			RC	70	Contam / Asbestos @ 0.50m	28	0.5										
	0.80m: Sandy SILT, minor gravel; brown mixed light brownish orange. Firm, moist, low plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt.																	
	0.95m: Sandy SILT, minor clay and minor gravel; brown mixed light brownish orange. Very stiff to hard, moist, medium plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt.					Contam / Asbestos @ 1.00m		1.0										
	1.05m: CORE LOSS - Suspect washed out.														27/04/2021			
	1.50m: Sandy SILT, some organics, minor gravel; light brown mixed light brownish orange. Stiff to very stiff, moist, low to medium plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt. Organics, wood fragments (fresh).			SPTS	67	1/1 2/2 2/1 **N=7**	27	1.5										
	1.80m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	1.95m: Sandy SILT, some organics, minor gravel, trace clay; light brown mixed light brownish orange. Stiff to very stiff, moist, low to medium plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt. Organics, wood fragments (fresh).					Contam / Asbestos @ 2.00m		2.0										
	2.25m: Sandy SILT, some gravel, minor organics; light brown mottled orange. Very stiff, moist, low plasticity. Gravel, fine to coarse, sub-angular to angular, unweathered, Basalt. Organics, wood fragments (fresh).			RC	86													
	2.45m: Sandy SILT, some organics; brown. Very stiff, moist, low plasticity. Organics, rootlets (fresh).					Contam / Asbestos @ 2.50m		2.5					*2.50m:* Contamination odour recognized in fill materials at approximately 2.5m bgl - contamination samples collected					
	2.70m: Sandy SILT, minor clay, trace organics and trace gravel; light brown mixed brown. Stiff to very stiff, moist, low to medium plasticity. Gravel, fine, sub-angular to angular, unweathered, Basalt. Organics, carbonaceous material.					AL PSD	26											
	2.85m: CORE LOSS - Suspect washed out.					119/37 kPa		3.0										
Tauranga Group	*3.00m:* SILT, some organics and some clay and some sand; light brown mottled orange. Very stiff, moist, medium plasticity. Organics, rootlets (fresh). *3.30 - 4.05m:* Speckled black.			SPTS	100	1/1 1/2 2/1 **N=6**												Box 1, 0.00-3.45m
	4.05m: CORE LOSS - Suspect washed out.			RC	57		25	3.5 4.0										
	4.50m: SILT, some organics, minor clay and minor sand; light brown streaked dark brown. Very stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed). *4.75 - 4.92m:* Organic SILT; dark brown. Firm, moist, low plasticity.			SPTS	89	UTP 1/1 1/2 2/2 **N=7**	24	4.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 2 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: 5926335.57 mN (NZTM2000) 1746662.85 mE	R.L. GROUND: 28.80m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 23/04/2021
FINISH DATE: 28/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW DW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* SILT, some organics, minor clay and minor sand; light brown streaked dark brown. Very stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed). [CONT].						23	5.5										
	5.25m: SILT, some organics; light brown streaked dark brown. Firm, moist, low plasticity. Organics, rootlets (decomposed).																	
	5.60m: Sandy SILT, minor clay, trace organics; light brown mottled orange. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed).																	
	5.75m: CORE LOSS - Suspect washed out.							6.0										
	6.00m: SILT, some organics and some sand, minor clay; light brown streaked dark brown. Stiff, moist, high plasticity. Sand, fine. Organics, rootlets (partially decomposed). *6.15 - 6.85m:* Some sand.			SPTS	100	104/45 kPa 0/0 0/1 1/1 **N=3**												
	6.85m: Sandy SILT, some organics; light grey streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (decomposed).			RC	81		22	6.5										
	7.30m: CORE LOSS - Suspect washed out.					77/24 kPa		7.0										
	7.50m: NOT LOGGED. - Push Tube Sample.			PT	0	Push Tube @ 7.50m TG Sample description from target		7.5										
	8.00m: Sandy SILT, minor organics; light grey streaked dark brown. Stiff, moist, low to medium plasticity. Sand, fine. Organics, rootlets (decomposed).			RC	65		21	8.0										Box 2, 3.45-8.00m
	8.65m: CORE LOSS - Suspect washed out.					74/21 kPa		8.5							28/04/2021			
	9.00m: Sandy SILT, minor organics; grey speckled dark brown. Stiff, moist, low to medium plasticity. Sand, fine. Organics, rootlets (decomposed).			SPTS	100	0/1 1/1 1/1 **N=4**	20	9.0										
							19	9.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 3 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926335.57 mN, 1746662.85 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.80m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 23/04/2021
FINISH DATE: 28/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*10.08m:* Sandy SILT, minor organics and minor clay; grey speckled black. Very stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous flecks. [Residual Soil].			RC	100			10.5										
	10.60m: CW, grey speckled black, Silty SANDSTONE. Extremely weak (medium dense), Recovered as Sandy SILT, minor organics; moist, medium plasticity. Sand, fine to medium. Organics, carbonaceous flecks.			SPTS	100	149/48 kPa 2/2 2/4 4/6 **N=18**	18	11.0							29/04/2021			
	11.38 - 11.43m: CW, grey, Sandy SILTSTONE. Extremely weak (very stiff), (Sandy SILT, minor clay; moist, medium plasticity. Sand, fine).			RC	81			11.5										
	11.80m: CORE LOSS - Suspect washed out.						17	12.0										
	12.00m: CW, grey, Silty SANDSTONE. Extremely weak (medium dense), Recovered as Sandy SILT; moist, medium plasticity. Sand, fine to medium.			SPT	100	2/4 5/6 7/6 **N=24**												
	12.25m: MW, grey, SANDSTONE. Extremely weak (medium dense), poorly cemented, fine to coarse grained, Recovered as: Silty SAND, medium dense, moist. *12.33 - 12.45m:* MW, grey, SILTSTONE. Extremely weak (hard), poorly cemented. *12.55 - 15.00m:* Extremely weak (dense).			RC	95		16	12.5 13.0										
	13.30 - 13.36m: MW, grey, SILTSTONE. Extremely weak (hard), poorly cemented.							13.5										
				SPT	100	4/5 7/7 10/12 **N=36**	15	14.0										
				RC	100		14	14.5										Box 3, 8.00-11.55m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 4 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926335.57 mN, 1746662.85 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.80m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 23/04/2021

FINISH DATE: 28/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/7 8/10 10/12 **N=40** Solid	13	15.5										Box 4, 11.55-15.45m
	15.45m: MW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine to medium grained, Recovered as: Silty SAND, Dense, moist. *15.95 - 16.12m:* Uncemented to poorly cemented. *16.12 - 16.21m:* MW, grey, MUDSTONE. Extremely weak to very weak, poorly cemented.			RC	100			16.0					*15.54m:* J, PL, SM, VN, CN					
				RC	100													
	16.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/7 9/10 9/11 **N=39** Solid	12	16.5										
	16.95m: MW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine to coarse grained, Recovered as: Silty SAND, Dense, moist. *17.73 - 18.00m:* Fine to medium grained.			RC	100			17.0 17.5										
	18.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	3/7 8/7 7/8 **N=30** Solid	11	18.0										
	18.45m: MW, grey, SANDSTONE. Extremely weak (dense), poorly cemented, fine to coarse grained, Recovered as: Silty SAND,Dense, moist.			RC	71			18.5										
	19.20m: CORE LOSS - Suspect washed out.						10	19.0										Box 5, 15.45-19.50m
	19.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	5/7 9/11 11/13 **N=44** Solid	9	19.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 5 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926335.57 mN 1746662.85 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.80m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 23/04/2021

FINISH DATE: 28/04/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* MW, grey, SANDSTONE. Extremely weak (dense), uncemented to poorly cemented, fine to coarse grained, Recovered as: SAND, some silt, Dense, moist [CONT]. *20.39 - 20.45m:* UW, grey, Sandy SILTSTONE. Extremely weak (hard), poorly cemented.	UW SW MW HW CW	ES VS S MS W VW EW					20.5										
	20.45m: CORE LOSS - Suspect washed out.																	
	21.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	15/27 42/8 for 25mm **N>=50** Solid		21.0										
	21.25m: SW, grey, bedded, SANDSTONE. Extremely weak to very weak, poorly cemented to moderately cemented, fine to medium grained. 1 to 5mm spaced, 35 to 230mm thick. INTERBEDDED WITH: SW, grey, bedded, SILTSTONE. Very weak, moderately cemented. 20 to 130mm thick, 0 to 5° inclined. *21.39 - 21.42m:* Poorly cemented. *21.59 - 21.62m:* Poorly cemented. *21.74 - 21.95m:* Poorly cemented.			RC	100			21.5				64	*21.32m:* DD *21.46m:* DD *21.52m:* BF, 13°, PL, SM, VN, CN *21.65m:* DD					
	22.22 - 22.27m: Poorly cemented.			RC	75			22.0				48	*21.99m:* DD *22.06m:* DD *22.09m:* DD *22.17m:* DD *22.20m:* DD					
	22.30m: CORE LOSS - Suspect washed out.							22.5										
	22.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	15/35 for 50mm **N>=50** Solid												
	22.63m: UW, grey, distinctly bedded, SILTSTONE. Very weak, moderately cemented. 1 to 90mm thick, 0 to 12° inclinedUW, grey, distinctly bedded, SANDSTONE. Extremely weak to very weak, poorly cemented to moderately cemented, fine to medium grained. 1 to 60mm thick. *22.91 - 22.94m:* Poorly cemented. *23.09 - 23.12m:* Poorly cemented.			RC	100			23.0				0	*22.69m:* DD *22.73m:* DD *22.76m:* DD *22.83m:* BF, 0°, PL, SM, VN, CN *22.88m:* DD *22.91m:* DD *22.93m:* DD *22.98m:* DD *23.02m:* BF, 2-5°, PL, SM, VN, CN *23.08m:* DD					
				RC	100			23.5				0	*23.09m:* DD *23.14m:* BF, 5°, PL, SM, VN *23.21m:* BF, 2°, PL, SM, VN, CN *23.22m:* DD *23.24m:* DD *23.43m:* DD *23.48m:* DD *23.53m:* DD *23.65m:* DD *23.73m:* DD *23.76m:* DD *23.88m:* DD					Box 6, 19.50-23.80m
	24.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	19/31 for 30mm **N>=50** Solid		24.0					*23.96m:* DD					
	24.11m: UW, grey, distinctly bedded, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to medium grained. 1 to 260mm thick. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak, moderately cemented. 1 to 50 mm thick, 0 to 5° inclined. *24.23 - 24.24m:* Poorly cemented. *24.78 - 24.84m:* Poorly cemented.							24.5				12	*24.21m:* DD *24.23m:* BF, 15°, PL, R, CN *24.29m:* DD *24.40m:* DD *24.50-24.77m:* DD, Drilling induced fractures along weak bedding planes *24.58m:* J, 72°, PL, SM, CN *24.74-24.82m:* J, 68°, PL, SM, VN, , Healed joint - calcite veneer *24.82-25.06m:* DD, Drilling induced					

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 6 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926335.57 mN 1746662.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.80m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 23/04/2021
FINISH DATE: 28/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.15m:* CORE LOSS. - Suspect washed out &confirmed approximately 100mm dropout.			RC	76			25.5				12	fractures along weak bedding planes *24.95-25.15m:* J, 68-80°, PL, SM, VN, Calcite veneer *24.98-25.10m:* BZ					
	25.50m: UW, grey, distinctly bedded, SANDSTONE. Very weak, poorly cemented to moderately cemented, fine to coarse grained. 1 to 130mm thick. INTERBEDDED WITH: UW, grey, distinctly bedded, SILTSTONE. Very weak, moderately cemented. 1 to 80 mm thick, 0 to 24° inclined.			RC	97		3	26.0				37	*25.58m:* DD *25.62-25.73m:* J, 72-90°, UN, SM, VN, CN *25.62m:* DD *25.66m:* DD *25.68m:* DD *25.72m:* DD *25.77m:* DD *25.92m:* DD *26.20m:* DD *26.26m:* DD *26.29m:* DD *26.34m:* DD *26.37m:* J, 45°, PL, SM, VN, CN *26.40m:* DD *26.45m:* DD *26.45-26.47m:* DD *26.47m:* DD *26.54m:* DD *26.72m:* DD *26.75m:* DD					
							2	26.5										
								27.0					*26.85-26.95m:* DD, Broken during core removal process					
				RC	97		1	27.5				78	*27.39m:* BF, 12°, PL, SM, , CN *27.50m:* DD *27.70m:* DD *27.75m:* J, 5-75°, PL, SM, VN, CN *27.78m:* DD *27.84m:* DD *27.88m:* J, 12°, PL, SM, VN, CN *27.94m:* DD *27.97m:* DD *28.03m:* DD *28.10m:* DD *28.15m:* J, 28°, PL, T, Healed joint- Calcite veneer *28.28-28.40m:* J, 65°, PL, T, Healed joint- Calcite infill *28.32-28.35m:* J, 50°, PL, T, Healed joint- Calcite veneer *28.39m:* DD *28.50-28.81m:* BZ, Potentially drilling induced					
	28.13 - 28.14m: Carbonaceous SANDSTONE. Fine to medium grained. *28.14 - 28.40m:* UW, grey, SANDSTONE. Very weak, moderately cemented to well cemented, fine to coarse grained.						0	28.0										
								28.5										
	29.17 - 29.18m: Poorly cemented.							29.0				52	*28.88-28.93m:* BZ *28.94-29.08m:* J, 75°, PL, T, Healed joint- Calcite veneer *28.94m:* DD *29.08m:* DD *29.14m:* DD *29.31-29.44m:* BZ					
							-1	29.5					*29.59m:* DD					
	29.85 - 29.86m: Carbonaceous SANDSTONE. Fine to medium grained.												*29.75m:* DD				Box 7, 23.80-27.30m	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH123

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926335.57 mN 1746662.85 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 28.80m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 23/04/2021
FINISH DATE: 28/04/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
				RC	99							52						
	30.1m: END OF BOREHOLE						-2 -3 -4 -5 -6	30.5 31.0 31.5 32.0 32.5 33.0 33.5 34.0 34.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 25.12 m bgl. Wireline downhole test undertaken on 29/04/21 following completion of hole with casing installed down to 12.0 m.

Hole Depth 30.1m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH123**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926335.57 mN 1746662.85 mE	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 23/04/2021 HOLE FINISHED: 28/04/2021 DRILLED BY: McMillan Drilling
R.L.:	28.80m		LOGGED BY: ROM CHECKED: TRMC
DATUM:	AUCKHT1946		

0.00-3.45m

3.45-8.00m

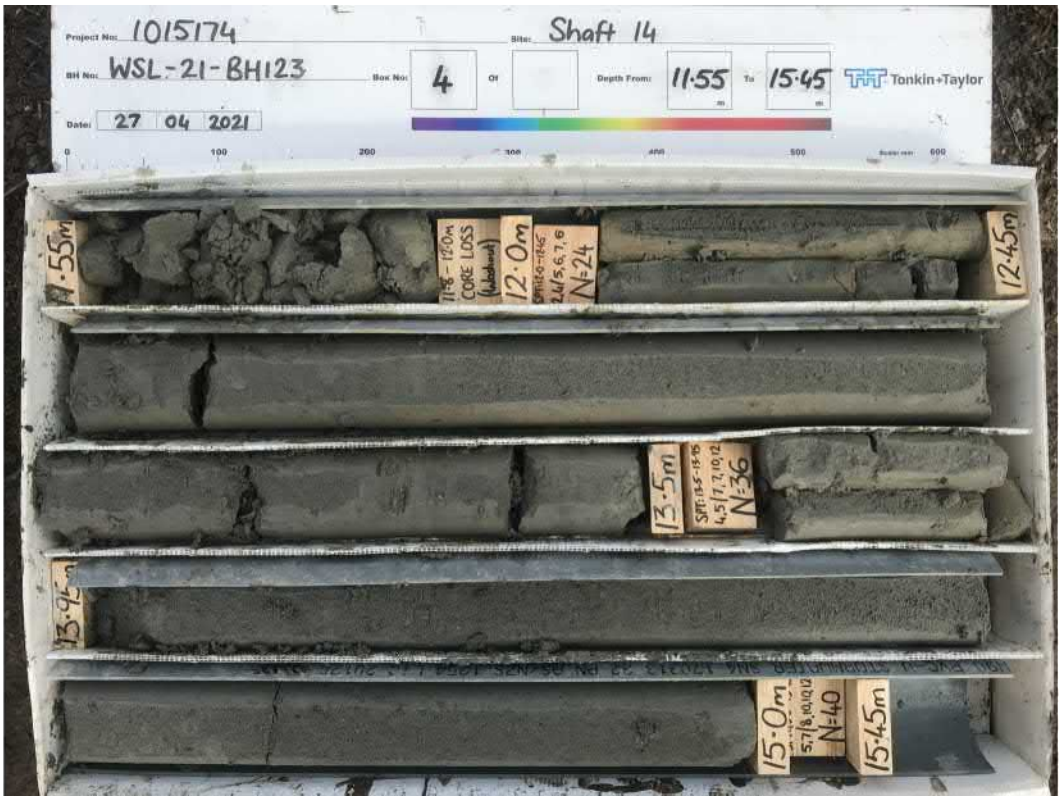
General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH123**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926335.57 mN 1746662.85 mE	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 23/04/2021 HOLE FINISHED: 28/04/2021 DRILLED BY: McMillan Drilling
R.L.:	28.80m		
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

8.00-11.55m



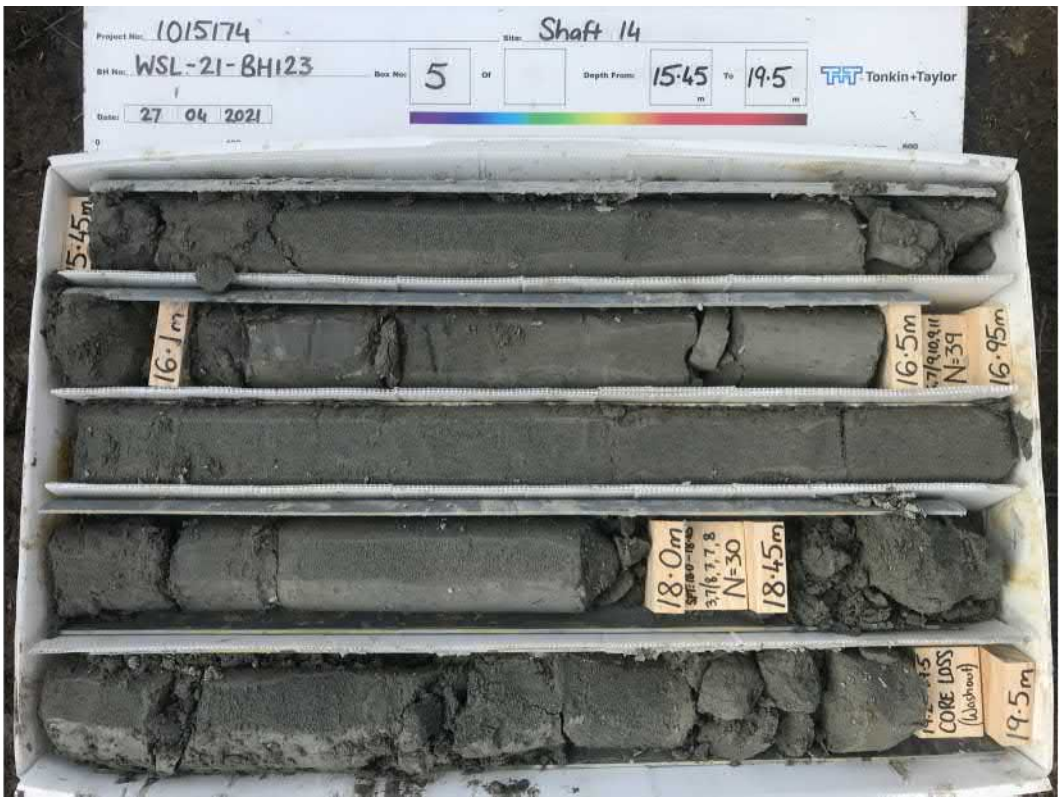
11.55-15.45m

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH123**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926335.57 mN 1746662.85 mE	DRILL TYPE:	HOLE STARTED: 23/04/2021
R.L.:	28.80m	DRILL METHOD: RC	HOLE FINISHED: 28/04/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC



15.45-19.50m

19.50-23.80m

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH123**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926335.57 mN 1746662.85 mE	DRILL TYPE:	HOLE STARTED: 23/04/2021
		DRILL METHOD: RC	HOLE FINISHED: 28/04/2021
R.L.:	28.80m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

23.80-27.30m

27.30-30.10m

General Log - DESX005 - Fix RQD - 16/12/2021 5:04:30 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH125

SHEET: 1 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926498.08 mN 1746876.71 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.08m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 20/10/2021
FINISH DATE: 21/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*0.00m:* Sandy SILT, some organics; dark brown. Firm, moist, low plasticity. Sand, fine. Organics, rootlets (fresh).			HA	100	87/45 kPa	25	0	TS									
	0.15m: Sandy SILT; light grey mottled orange. Stiff, moist, medium plasticity. Sand, fine.							0.5										
						66/35 kPa	24	1.0										
				HQTT	100			1.5										
						0/- kPa SV test failed												
				HQTT	100		23	2.0										
								2.5										
						0/- kPa SV test failed		3.0							21/10/2021			Box 1, 0.00-3.00m
	3.26m: NO RECOVERY - Suspect slipped out of SPT spoon.			SPTS	58	1/1 1/2 2/2 **N=7**	22											
	3.45m: Sandy SILT; light grey mottled pinkish orange. Stiff, moist, medium to high plasticity. Sand, fine.							3.5										
	3.85m: Sandy SILT; brown. Stiff, moist, low plasticity. Sand, fine.			HQTT	100		21	4.0										
	4.20m: Sandy SILT; grey. Stiff, moist, medium to high plasticity. Sand, fine.																	
	4.50m: NO RECOVERY. Push Tube Sample.			PT	0	71/38 kPa		4.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval between 15.0 - 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH125

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926498.08 mN 1746876.71 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.08m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 20/10/2021
FINISH DATE: 21/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Sandy SILT; grey. Stiff, moist, medium plasticity. Sand, fine.	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	100		20	5.5										
				SPTS	100	61/32 kPa 0/2 1/2 1/3 **N=7**	19	6.0										
	6.38m: SILT, minor sand; grey streaked dark grey. Stiff, moist, low to medium plasticity. Sand, fine.																	
	6.45m: Sandy SILT; light brown. Firm, moist, medium to high plasticity. Sand, fine.			HQTT	71		18	6.5 7.0										Box 2, 3.00-6.45m
	7.20m: CORE LOSS - Suspect washed out.							7.5										
	7.50m: SILT, minor sand; light brown streaked brown. Stiff, moist, low to medium plasticity. Sand, fine.					48/29 kPa												
	7.72m: Sandy SILT; light greyish brown. Firm, moist, low to medium plasticity. Sand, fine.			HQTT	100		17	8.0 8.5										
				SPTS	100	38/16 kPa 0/1 1/1 1/2 **N=5**	16	9.0 9.5										Box 3, 6.45-9.75m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval between 15.0 - 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH125

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926498.08 mN 1746876.71 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.08m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 20/10/2021
FINISH DATE: 21/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Sandy SILT; light greyish brown. Firm, moist, low to medium plasticity. Sand, fine. [CONT].			HQTT	100		15											
	10.50m: Sandy SILT; brown mottled orange. Stiff, moist, low to medium plasticity. Sand, fine.					83/32 kPa		10.5										
				HQTT	100		14	11.0										
	11.85 - 12.55m: Light greyish brown. Firm.							11.5										
						42/19 kPa		12.0										
				SPTS	100	0/1 1/1 2/2 **N=6**	13											
	12.55m: Sandy SILT; grey, Blocky. Firm, moist, medium plasticity. Sand, fine.							12.5										
				HQTT	100		12	13.0										Box 4, 9.75-13.05m
	13.15 - 14.45m: Light greyish brown.																	
	13.50 - 14.45m: Stiff.					77/32 kPa		13.5										
				HQTT	100		11	14.0										
	14.45m: Sandy SILT; grey, Blocky. Firm, moist, low to medium plasticity. Sand, fine. INDISTINCTLY INTERBEDDED WITH: SILT, minor sand; brown. Firm, moist, medium to high plasticity.							14.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval between 15.0 - 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH125

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis	CO-ORDINATES: 5926498.08 mN (NZTM2000) 1746876.71 mE	R.L. GROUND: 25.08m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR:
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 20/10/2021
FINISH DATE: 21/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Sandy SILT; light brownish grey, Blocky. Firm, moist, medium plasticity. Sand, fine.			SPTS	100	1/1 2/2 2/2 **N=8**	10	15.0										
				HQTT	100		9	15.5										
	16.50 - 16.95m: Stiff.					71/27 kPa		16.0										Box 5, 13.05-16.30m
				SPTS	100	1/2 2/2 2/3 **N=9**		16.5										
	16.95m: Sandy SILT; light brownish grey speckled green, Blocky. Firm, moist, medium plasticity. Sand, fine to medium.			HQTT	100		8	17.0										
								17.5										
	18.00m: Sandy SILT; grey, Blocky. Stiff, moist, medium plasticity. Sand, fine. DISTINCTLY INTERBEDDED WITH: SILT, minor clay; grey. Stiff to very stiff, moist, medium to high plasticity.					74/9 kPa		18.0										
				SPTS	100	0/1 2/3 3/3 **N=11**	7	18.5										
	18.55m: Sandy SILT; light brownish grey speckled green, Blocky. Firm, moist, low plasticity. Sand, fine to medium.																	
	18.70m: Sandy SILT; light greyish brown. Firm, moist, low plasticity. Sand, fine.			HQTT	100	ASS / pH @ 19.00m	6	19.0										
								19.5										Box 6, 16.30-19.50m
				SPTS	100	0/- kPa SV test failed 1/2 1/3 2/3 **N=9**												

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval between 15.0 - 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH125

SHEET: 5 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926498.08 mN 1746876.71 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.08m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 20/10/2021
FINISH DATE: 21/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.00m:* Sandy SILT; light greyish brown. Firm, moist, low plasticity. Sand, fine. [CONT].																	
East Coast Bays Formation	*20.55m:* HW, grey, Silty SANDSTONE. Extremely weak (medium dense), uncemented, fine grained, moist. 20 to 300mm thick. INDISTINCTLY INTERBEDDED WITH: HW, dark grey, SILTSTONE. Extremely weak (very stiff), uncemented to poorly cemented. 30 to 100mm thick.			SPTS	100	1/2 3/2 3/4 **N=12**	5 4	20.5 21.0										
	22.00m: MW, grey, Silty SANDSTONE. Extremely weak (medium dense), uncemented, fine grained, moist. 20 to 300mm thick. INDISTINCTLY INTERBEDDED WITH: MW, dark grey, SILTSTONE. Extremely weak (very stiff), uncemented to poorly cemented. 30 to 100mm thick.			HQTT	100			21.5 22.0										
				SPTS	100	3/4 4/5 5/8 **N=22**	3	22.5										Box 7, 19.50-22.95m
						ASS / pH @ 23.00m	2	23.0										
	23.50m: MW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine grained, Recovered as; SAND, some silt. medium dense, moist.			HQTT	100			23.5										
				SPTS	100	3/2 4/9 10/12 **N=35**	1	24.0 24.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval between 15.0 - 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH125

SHEET: 6 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926498.08 mN 1746876.71 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 25.08m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 20/10/2021
FINISH DATE: 21/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)
East Coast Bays Formation	*25.00m:* MW, grey, SANDSTONE. Extremely weak (medium dense), uncemented to poorly cemented, fine grained, Recovered as; SAND, some silt. medium dense, moist [CONT].	UW SW MW HW CW	ES VS S MS W VW EW	HQTT	81		0	25.5
	25.30m: CORE LOSS - Suspect washed out							
	25.50m: MW, grey, SANDSTONE with carbonaceous flecks. Extremely weak (dense), uncemented to poorly cemented, fine grained, Recovered as; SAND, some silt. Dense, moist.			SPTS	100	4/7 8/10 11/15 **N=44**	-1	26.0
	26.15m: CORE LOSS - Suspect obstruction in front of barrel. Core washed out.			HQTT	19			26.5
	27.00m: MW, grey, SANDSTONE with carbonaceous flecks. Extremely weak (very dense), uncemented to poorly cemented, fine grained, Recovered as; SAND, some silt. Very dense, moist.			SPTS	100	4/7 9/11 15/15 for 55mm **N>=50**	-2	27.0
	27.69m: MW, grey, SANDSTONE with carbonaceous flecks. Extremely weak (very dense), poorly cemented to moderately cemented, fine grained, Recovered as; SAND, some silt. Very dense, moist.			HQTT	100			27.5
	27.82m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine grained, Recovered as; SAND, some silt. Very dense, moist.						-3	28.0
	28.50m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	100	8/12 13/15 17/5 for 15mm **N>=50** Solid		28.5
	28.89m: MW, grey, SANDSTONE. Extremely weak (very dense), poorly cemented, fine grained, Recovered as; SAND, some silt. Very dense, moist.			HQTT	100		-4	29.0
	30m: END OF BOREHOLE. Target depth.			HQTT	100			29.5

ROCK DEFECTS: Defect Log | Fracture Spacing (mm) (2000, 600, 200, 60, 20) | RQD (%) | Description & Additional Observations

Graphic Log | Fluid Loss (%) (25, 50, 75) | Water Level | Casing | Installation | Core Box No

Box 8, 22.95-27.00m

Box 9, 27.00-30.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screened interval between 15.0 - 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH125**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926498.08 mN 1746876.71 mE	DRILL TYPE:	HOLE STARTED: 20/10/2021
R.L.:	25.08m	DRILL METHOD: RC	HOLE FINISHED: 21/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-3.00m

3.00-6.45m

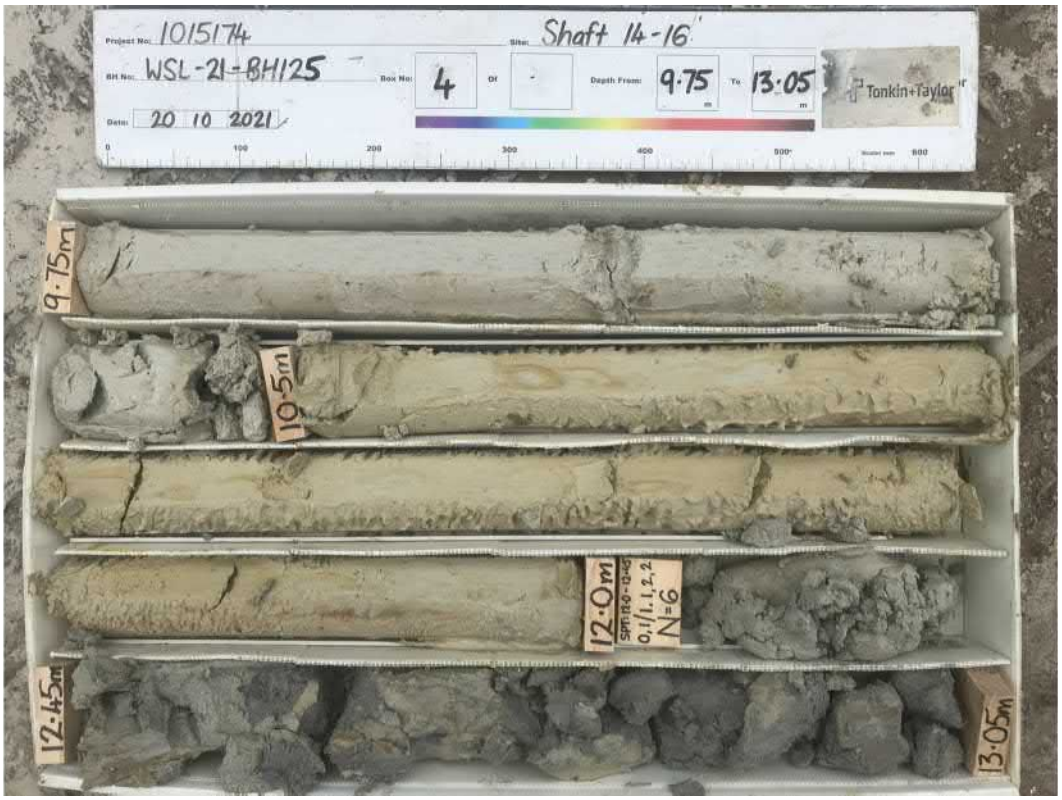
General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH125**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926498.08 mN 1746876.71 mE	DRILL TYPE:	HOLE STARTED: 20/10/2021
		DRILL METHOD: RC	HOLE FINISHED: 21/10/2021
R.L.:	25.08m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

6.45-9.75m



9.75-13.05m

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH125**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926498.08 mN 1746876.71 mE	DRILL TYPE:	HOLE STARTED: 20/10/2021
R.L.:	25.08m	DRILL METHOD: RC	HOLE FINISHED: 21/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

13.05-16.30m

16.30-19.50m

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH125**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926498.08 mN 1746876.71 mE	DRILL TYPE:	HOLE STARTED: 20/10/2021
		DRILL METHOD: RC	HOLE FINISHED: 21/10/2021
R.L.:	25.08m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

19.50-22.95m

22.95-27.00m

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc
v1.0

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH125**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926498.08 mN 1746876.71 mE	DRILL TYPE:	HOLE STARTED: 20/10/2021
		DRILL METHOD: RC	HOLE FINISHED: 21/10/2021
R.L.:	25.08m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

27.00-30.00m

General Log - DESX005 - Fix RQD - 9/12/2021 4:02:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH126

SHEET: 1 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926535.51 mN 1746938.03 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.31m
R.L. COLLAR: 24.31m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 18/10/2021
FINISH DATE: 20/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics; brown. Firm, moist. Organics, rootlets (fresh).			HA	100		24	0	TS									
	0.10m: Silty CLAY, trace organics; light grey streaked reddish pink. Very stiff, moist, medium to high plasticity.							0.5							20/10/2021			
	0.65m: SILT, some clay, trace organics; light grey streaked reddish pink. Very stiff, moist, medium plasticity.							1.0										
				HQTT	100		23	1.5										
Tauranga Group	*1.50m:* Silty SAND; orange mottled grey. Loosely packed, moist. Sand, fine.			SPTS	78	0/- kPa SV test failed 1/2 2/3 2/3 **N=10**												
	1.60m: Sandy SILT; light brown mottled pinkish orange. Firm, moist, medium plasticity. Sand, fine.																	
	1.85m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	1.95m: Sandy SILT; light brown mottled pinkish orange. Firm to stiff, moist, medium plasticity. Sand, fine.			HQTT	24		22	2.0										
	2.07m: CORE LOSS - Suspect washed out.																	
	2.45m: Sandy SILT; light brown mottled pinkish orange. Firm to stiff, moist, low to medium plasticity. Sand, fine.			HQTT	100	0/- kPa SV test failed		2.5										
	2.90 - 4.40m: Light brown.			SPTS	100	71/29 kPa 0/1 0/1 1/2 **N=4**	21	3.0										
				HQTT	90			3.5										Box 1, 0.00-3.55m
	4.40m: CORE LOSS - Suspect washed out.																	
	4.50m: Sandy SILT; light brown. Firm to stiff, moist, low plasticity. Sand, fine.					0/- kPa SV test failed	20	4.0 4.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH126

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: 5926535.51 mN (NZTM2000) 1746938.03 mE	R.L. GROUND: 24.31m
JOB No.: 1015174.0000.02		R.L. COLLAR: 24.31m
LOCATION: Whenuapai/Redhills, Auckland	DIRECTION:	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 18/10/2021
FINISH DATE: 20/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*6.35m:* Sandy SILT; grey. Firm to stiff, moist, medium plasticity. Sand, fine.			HQTT	70		19	5.5										
				SPTS	100	64/19 kPa 0/0 1/1 1/2 **N=5**	18	6.0										
	6.75m: SILT, minor sand; grey. Firm to stiff, moist, medium to high plasticity. Sand, fine.			HQTT	100			6.5										
	7.50m: NOT LOGGED. Push Tube Sample.			PT	0	0/- kPa SV test failed	17	7.0 7.5										
	8.00m: Sandy SILT; grey. Firm to stiff, moist, medium plasticity. Sand, fine.			HQTT	100			8.0										
	8.40m: SILT, some sand, trace organics; grey. Firm to stiff, moist, medium to high plasticity. Sand, fine. Organics, carbonaceous flecks.						16	8.5										
	8.90m: Sandy SILT; grey. Firm to stiff, moist, medium plasticity. Sand, fine.			SPTS	100	45/4 kPa 0/1 1/1 1/2 **N=5**	15	9.0 9.5										Box 2, 3.55-7.15m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH126

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: 5926535.51 mN (NZTM2000) 1746938.03 mE	R.L. GROUND: 24.31m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR: 24.31m
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 18/10/2021
FINISH DATE: 20/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Sandy SILT; grey. Firm to stiff, moist, medium plasticity. Sand, fine. [CONT]. *10.50 - 12.80m:* Light brown. *12.80 - 12.85m:* Light brown mottled orange. *12.85 - 15.00m:* Light brown.	UW SW MW HW CW	EW VW MW SW ES	HQTT HQTT SPTS HQTT HQTT	100 100 100 100 100	0/- kPa SV test failed 56/29 kPa 0/1 2/1 2/3 **N=8** 50/29 kPa	14 13 12 11 10	10.5 11.0 11.5 12.0 12.5 13.0 13.5 14.0 14.5			2000 600 200 60 20				25 50 75				Box 3, 7.15-10.30m Box 4, 10.30-13.50m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH126

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926535.51 mN 1746938.03 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.31m
R.L. COLLAR: 24.31m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 18/10/2021
FINISH DATE: 20/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Sandy SILT; light brown. Firm to stiff, moist, low plasticity. Sand, fine. [CONT].			SPTS	100	1/2 2/2 2/4 **N=10**	9	15.5										
	15.85 - 16.00m: Light brown mottled orange.			HQTT	100		8	16.0										
				SPTS	100	53/32 kPa 1/1 2/2 3/3 **N=10**		16.5										
	16.95 - 17.05m: Light brown mottled orange.							17.0										Box 5, 13.50-17.25m
	17.25 - 19.70m: Light greyish brown.			HQTT	100	pH / ASS @ 17.00m	7	17.5										
				SPTS	100	58/25 kPa 1/2 2/2 3/3 **N=10**	6	18.0										
	18.22 - 18.25m: SILT, minor clay; grey. Stiff, moist, medium plasticity.			HQTT	100			18.5										
							5	19.0										
				SPTS	100	56/32 kPa 2/2 3/3 4/5 **N=15**		19.5										
	19.70m: Silty SAND; light brownish grey. Loosely packed, moist. Sand, fine.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH126

SHEET: 5 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926535.51 mN 1746938.03 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.31m
R.L. COLLAR: 24.31m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 18/10/2021
FINISH DATE: 20/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW DW)	Rock Strength (ES VS S MS M W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.00m:* Sandy SILT; grey. Stiff, moist, low plasticity. Sand, fine.					pH / ASS @ 21.00m 61/19 kPa	4	20.5										Box 6, 17.25-20.55m
	21.15m: SILT and SAND; grey. Stiff, moist, low plasticity. Sand, fine. Low plasticity upon adding moisture to sample. Crumbles when dry.			SPTS	100	2/2 3/4 4/5 **N=16**	3	21.0										
	21.45m: Sandy SILT; grey. Stiff, moist, low plasticity. Sand, fine.			HQTT	100		2	21.5										
				SPTS	100	0/- kPa SV test failed 1/2 3/3 4/5 **N=15**	1	22.0										
				HQTT	100		0	22.5										Box 7, 20.55-23.80m
	24.00m: NOT LOGGED. - Push Tube Sample.			PT	0	101/53 kPa		23.0										
	24.50m: Sandy SILT; grey. Stiff, moist, low plasticity. Sand, fine.							23.5										
East Coast Bays Formation	*24.65m:* MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, moist, Recovered as: Silty SAND, medium dense, moist..							24.0										
								24.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH126

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926535.51 mN 1746938.03 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.31m
R.L. COLLAR: 24.31m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 18/10/2021
FINISH DATE: 20/10/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.10m:* CORE LOSS - Suspect washed out.			HQTT	60		-1	25.5										
	25.50m: MW, grey, Silty SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, moist, Recovered as: Silty SAND, medium dense, moist..			SPTS	100	96/46 kPa 3/3 4/6 6/8 **N=24**												
				HQTT	100		-2	26.0 26.5										
				SPTS	100	3/2 3/3 6/7 **N=19**	-3	27.0 27.5										Box 8, 23.80-27.45m
				HQTT	100		-4	28.0 28.5										
				SPTS	100	4/4 6/8 8/10 **N=32**												
				HQTT	57		-5	29.0 29.5										Box 9, 27.45-30.00m
	29.55m: CORE LOSS - Suspect washed out. 30m: END OF BOREHOLE. Target depth.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl.

Hole Depth 30m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH126**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926535.51 mN 1746938.03 mE	DRILL TYPE:	HOLE STARTED: 18/10/2021
R.L.:	24.31m	DRILL METHOD: RC	HOLE FINISHED: 20/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-3.55m

3.55-7.15m

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH126**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926535.51 mN 1746938.03 mE	DRILL TYPE:	HOLE STARTED: 18/10/2021
R.L.:	24.31m	DRILL METHOD: RC	HOLE FINISHED: 20/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

7.15-10.30m

10.30-13.50m

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH126**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926535.51 mN 1746938.03 mE	DRILL TYPE:	HOLE STARTED: 18/10/2021
		DRILL METHOD: RC	HOLE FINISHED: 20/10/2021
R.L.:	24.31m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

13.50-17.25m

17.25-20.55m

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH126**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926535.51 mN 1746938.03 mE	DRILL TYPE:	HOLE STARTED: 18/10/2021
R.L.:	24.31m	DRILL METHOD: RC	HOLE FINISHED: 20/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

20.55-23.80m

23.80-27.45m

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH126**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926535.51 mN 1746938.03 mE	DRILL TYPE:	HOLE STARTED: 18/10/2021
R.L.:	24.31m	DRILL METHOD: RC	HOLE FINISHED: 20/10/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

27.45-30.00m

General Log - DESX005 - Fix RQD - 9/12/2021 4:17:33 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH127

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926558.78 mN 1747036.42 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.45m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 13/05/2021
FINISH DATE: 13/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, trace organics; dark brown. Firm, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).			HA	100		24	0.5										
	0.30m: Silty CLAY, some sand, trace organics; brown. Hard, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).																	
	0.60m: Sandy SILT, some clay, trace organics; light brown mottled orange. Hard, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh). *1.10 - 1.50m:* Light grey mottled orange.							1.0										
				RC	100		23	1.5										
Tauranga Group	*1.50m:* SILT, some clay and some sand, trace organics; light grey. Hard, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).			SPTS	84	0/- kPa Shear vane test failed 1/2 2/3 3/4 **N=12**												
	1.88m: NO RECOVERY - Suspect slipped out of SPT spoon.							2.0										
	1.95m: SILT, some sand, minor clay, trace organics; light grey mottled orange. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).																	
	2.10m: SILT, minor clay and minor sand, trace organics; light grey mottled light brown. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).																	
	2.40m: Sandy SILT, minor clay, trace organics; light grey mottled orange. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).			RC	52	UTP	22	2.5										
	2.50m: CORE LOSS - Suspect washed out.																	
	3.00m: Organic SILT, minor clay and minor sand; brown streaked dark brown. Stiff to very stiff, moist, medium to high plasticity. Sand, fine. Organics, decomposed.			SPTS	84	1/1 1/2 2/2 **N=7**		3.0										
	3.70 - 3.85m: Organic sandy SILT. Sand, fine. *3.85 - 4.00m:* Brown streaked green. *4.00 - 4.45m:* Organic sandy SILT. Sand, fine.			RC	100		21	3.5											
								4.0										
				SPTS	100	66/21 kPa 0/0 1/1 2/1 **N=5**	20	4.5										

Box 1, 0.00-3.75m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 6.6 - 9.6 m bgl and 21.0 -24.0 m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:03 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH127

SHEET: 2 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926558.78 mN 1747036.42 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.45m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 13/05/2021

FINISH DATE: 13/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic SILT, minor clay and minor sand; brown streaked dark brown. Stiff to very stiff, moist, medium to high plasticity. Sand, fine. Organics, decomposed. [CONT].						19	5.5										
	5.90m: Peaty SILT; black streaked brown. Firm to stiff, moist, medium to high plasticity.																	
	6.00m: NOT LOGGED. - Push Tube Sample.			PT	100	Push Tube @ 6.00m TG Sample description from target AL PSD PSD AL	18	6.0 6.5										
	6.50m: PEAT (AMORPHOUS); black. Soft to firm, wet.																	
	6.80m: Organic SILT, minor sand; brown streaked dark brown. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, decomposed.			RC	100			7.0										
	7.50 - 7.55m: PEAT (AMORPHOUS); black. Soft, wet.						17	7.5										
	7.55m: SILT, some organics and some sand; light brown streaked dark brown. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, decomposed.			SPTS	100	110/57 kPa 0/1 2/2 1/3 **N=8**												
	8.70 - 8.78m: Sandy SILT, some organics. Sand, fine. *8.78 - 8.80m:* WOOD.			RC	100			8.0										
	8.95 - 9.00m: WOOD.						16	8.5										
	9.05m: Sandy SILT, minor organics; light brown. Stiff, moist, medium to high plasticity. Sand, fine to medium. Organics, decomposed.			SPTS	100	0/- kPa Shear vane test failed 1/1 2/1 3/2 **N=8**		9.0										
							15	9.5										Box 2, 3.75-7.00m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 6.6 - 9.6 m bgl and 21.0 -24.0 m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH127

SHEET: 3 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926558.78 mN 1747036.42 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.45m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 13/05/2021
FINISH DATE: 13/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Sandy SILT, minor organics; light brown. Stiff, moist, medium to high plasticity. Sand, fine to medium. Organics, decomposed. [CONT].			RC	100		14	10.5										
				SPT	100	61/30 kPa 0/1 1/1 2/1 **N=5**		11.0										
				RC	100		13	11.5										
				SPTS	100	69/30 kPa 0/1 2/1 2/2 **N=7**		12.0										
	12.35m: Sandy SILT, minor organics; brown, Blocky. Stiff, moist, medium plasticity. Sand, fine to coarse. Organics, decomposed.			RC	100		12	12.5										
				SPTS	100	60/10 kPa 0/1 2/1 2/1 **N=6**	11	13.0										
	14.10m: Sandy SILT, minor organics; brown. Firm to stiff, moist, medium plasticity. Sand, fine to medium. Organics, decomposed.			RC	100			13.5										
							10	14.0										
								14.5										

Box 4, 10.10-13.30m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 6.6 - 9.6 m bgl and 21.0 -24.0 m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH127

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926558.78 mN 1747036.42 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.45m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 13/05/2021
FINISH DATE: 13/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Sandy SILT, minor organics; brown. Firm to stiff, moist, medium to high plasticity. Sand, fine to medium. Organics, decomposed. [CONT].			SPTS	100	0/1 2/2 1/3 **N=8**	9	15.5										
				RC	100			16.0										Box 5, 13.30-16.40m
				SPTS	100	45/10 kPa 0/2 1/2 2/2 **N=7**	8	16.5										
	17.90 - 18.75m: Light brown.			RC	100		7	17.0 17.5										
				SPTS	100	39/19 kPa 1/1 0/1 0/2 **N=3**	6	18.0 18.5										
	18.75m: Sandy SILT, minor organics; brown, Blocky. Stiff, moist, medium to high plasticity. Sand, fine to coarse. Organics, decomposed.			RC	100			19.0										Box 6, 16.40-19.50m
	19.65m: Sandy SILT; grey. Stiff, moist, medium to high plasticity. Sand, fine to coarse.			SPTS	100	57/21 kPa 0/2 1/1 2/2 **N=6**	5	19.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 6.6 - 9.6 m bgl and 21.0 -24.0 m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH127

SHEET: 5 OF 6

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 13/05/2021
FINISH DATE: 13/05/2021
CONTRACTOR: McMillan Drilling

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926558.78 mN 1747036.42 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.45m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.00m:* Sandy SILT; grey. Firm to stiff, moist, medium to high plasticity. Sand, fine to coarse. [CONT].			SPTS	100	34/9 kPa BH127 exposed @ 21.00m disturbance. Sample description from target depth. 2/2 2/3 3/5 N=18	4	20.5										
East Coast Bays Formation	*21.40m:* Sandy SILT; grey, Blocky. Stiff, moist, medium to high plasticity. Sand, fine to coarse.							21.0										
	21.50m: CW, grey, Silty SANDSTONE. Extremely weak (medium dense), Recovered as: Silty SAND, trace organics; moist. Sand, fine to coarse. Organics, carbonaceous. Remoulds to: Sandy SILT, high plasticity..			RC	100		3	21.5										
								22.0										
	22.68m: CW, grey, Sandy SILTSTONE. Extremely weak (stiff), Recovered as: Sandy SILT; grey. Stiff, moist, medium to high plasticity. Sand, fine to coarse.. *22.77 - 22.79m:* SILT, trace sand. Sand, fine. *22.83 - 22.85m:* SILT, trace sand. Sand, fine.			SPTS	100	70/9 kPa 2/2 2/4 3/5 N=14	2	22.5										Box 7, 19.50-22.95m
				RC	100			23.0										
	23.55m: CW, grey, Sandy SILTSTONE. Extremely weak (stiff), Recovered as: Sandy SILT; grey. Stiff, moist, medium to high plasticity. Sand, fine to coarse. INTERBEDDED WITH: SILT; grey. Very stiff, moist, medium to high plasticity.						1	23.5										
				RC	100			24.0										
	24.00m: CW, grey, Silty SANDSTONE. Extremely weak (medium dense), Recovered as: Silty SAND; moist. Sand, fine to coarse. Remoulds to: Sandy SILT, high plasticity..			SPTS	100	179/42 kPa 3/3 4/5 5/6 N=20												
	24.25m: CW, grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT; moist, medium to high plasticity. Sand, fine to coarse..						0	24.5										
	24.32m: NO RECOVERY - Suspect slipped out of SPT spoon.																	
	24.45m: CW, grey, Sandy SILTSTONE. Extremely weak (stiff), Recovered as: Sandy SILT; moist, medium to high plasticity. Sand, fine to coarse..																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 6.6 - 9.6 m bgl and 21.0 -24.0 m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH127

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926558.78 mN, 1747036.42 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 24.45m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 13/05/2021

FINISH DATE: 13/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* CW, grey, Sandy SILTSTONE. Extremely weak (stiff), Recovered as: Sandy SILT; moist, medium to high plasticity. Sand, fine to coarse. [CONT]. *25.20 - 25.25m:* SILT, minor sand. Sand, fine.			RC	100		-1	25.5										Box 8, 22.95-25.50m
	25.5m: END OF BOREHOLE						-2	26.0 26.5 27.0										
							-3	27.5 28.0										
							-4	28.5 29.0										
							-5	29.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested piezometer with screen interval at 6.6 - 9.6 m bgl and 21.0 -24.0 m bgl.

Hole Depth 25.5m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH127**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926558.78 mN 1747036.42 mE	DRILL TYPE:	HOLE STARTED: 13/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 13/05/2021
R.L.:	24.45m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

0.00-3.75m

3.75-7.00m

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH127**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926558.78 mN 1747036.42 mE	DRILL TYPE:	HOLE STARTED: 13/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 13/05/2021
R.L.:	24.45m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

7.00-10.10m

10.10-13.30m

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH127**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926558.78 mN 1747036.42 mE	DRILL TYPE:	HOLE STARTED: 13/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 13/05/2021
R.L.:	24.45m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

13.30-16.40m

16.40-19.50m

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH127**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926558.78 mN 1747036.42 mE	DRILL TYPE:	HOLE STARTED: 13/05/2021
R.L.:	24.45m	DRILL METHOD: RC	HOLE FINISHED: 13/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

19.50-22.95m

22.95-25.50m

General Log - DESX005 - Fix RQD - 10/12/2021 4:21:04 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH128

SHEET: 1 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926578.61 mN, 1747062.89 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.83m

R.L. COLLAR: 20.00m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 17/05/2021

FINISH DATE: 19/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Sandy SILT, some organics; dark brown. Very stiff, moist, low plasticity. Sand, fine to medium. Organics, rootlets (fresh).					Contam / Asbestos (Split+Dup) @ 0.00m PID - 0.6ppm		0										
	0.45m: Sandy SILT, minor organics and minor clay; brown mixed orange. Very stiff, moist, low plasticity. Sand, fine to medium. Organics, rootlets.			HA	100	188/39 kPa Contam / Asbestos @ 0.50m PID - 3.3ppm	22	0.5										
	0.95 - 1.10m: Greyish brown mixed orange.					176/67 kPa		1.0										
	1.10m: Silty SAND; light grey mottled orange. Very stiff, dry to moist. Sand, fine.					191/63 kPa												
	1.30m: CORE LOSS - Suspect washed out.			RC	100			1.5										
	1.50m: Sandy SILT; grey. Very stiff, moist, low plasticity. Sand, fine. INTERMIXED WITH: SILT, some sand; orange. Very stiff, moist, medium to high plasticity. Sand, fine.			SPTS	100	UTP 1/2 1/2 3/3 **N=9**	21											
	2.25m: CORE LOSS - Suspect core bound.			RC	29	107/49 kPa		2.0										
Tauranga Group	*3.00m:* Organic SILT; brown mottled black. Firm, moist, high plasticity.						20	2.5										
	3.06m: NO RECOVERY - Suspect slipped out of SPT spoon.			SPTS	13	0/0 0/1 1/1 **N=3**		3.0										
	3.45m: Organic SILT; brown mottled black. Firm, moist, high plasticity.			RC	100			3.5					*3.45 - 3.75m:* 100% core lost downhole during initial retrieval of inner tube. Core recovered in next attempt. Organic silt with potentially high compressibility observed on inner tube nozzle. Push Tube opted for 3.75 - 4.25m					
	3.75m: NOT LOGGED. - Push Tube Sample.			PT	100	Push Tube @ 3.75m	19	4.0										
	4.25m: SILT, minor clay and minor sand, trace organics; light greyish brown spotted black. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, carbonaceous material.							4.5							18/05/2021			Box 1, 0.00-4.25m
				SPTS	100	124/27 kPa 1/0 1/2 1/1 **N=5**	18											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl

Hole Depth 25.05m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH128

SHEET: 2 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926578.61 mN, 1747062.89 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.83m

R.L. COLLAR: 20.00m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 17/05/2021

FINISH DATE: 19/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* SILT, minor clay and minor sand, trace organics; light greyish brown spotted black. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, carbonaceous material. [CONT].																	
	5.25m: Peaty SILT; brown mottled black. Stiff, moist, low to medium plasticity.																	
	5.40m: PEAT (AMORPHOUS); black. Stiff, moist.							5.5										
	6.00m: NOT LOGGED. - Push Tube Sample.			PT	100	101/31 kPa BH128 @ 6.00m TG Sample description from target AL MC	17	6.0										
	6.50m: Organic SILT, some sand; brown streaked black. Stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (decomposed).							6.5										
	7.05 - 7.35m: Organic sandy SILT; light greyish brown streaked black. Very stiff, moist, low plasticity. Sand, fine. Organics, rootlets (decomposed).			RC	100		16	7.0							24/05/2021			Box 2, 4.25-7.30m
	7.35m: Silty SAND, some organic; light brown streaked black. Medium dense to dense, moist. Sand, fine to medium. Organics, rootlets (decomposed).							7.5										
	7.64m: SAND, minor silt, trace organic; light greyish brown spotted black. Medium dense to dense, moist. Sand, fine to medium. Organics, decomposed.			SPTS	78	UTP Shear Vane Failed 3/5 9/11 11/9 **N=40**	15											
	7.85m: NO RECOVERY - Suspect slipped out of SPT spoon.							8.0										
	7.95m: Sandy SILT, some organic; light brown streaked black. Very stiff, moist, low to medium plasticity. Sand, fine to medium. Organics, rootlets (decomposed).			RC	57													
	8.02m: Silty SAND, some organic; light brown streaked black. Medium dense to dense, moist. Sand, fine to medium. Organics, rootlets (decomposed).							8.5										
	8.12m: SAND, minor silt, trace organic; light greyish brown spotted black. Medium dense to dense, moist. Sand, fine to medium. Organics, decomposed.																	
	8.35m: Silty SAND, some organic; brown streaked black. Medium dense to dense, moist. Sand, fine to medium. Organics, rootlets (decomposed).						14											
	8.55m: CORE LOSS - Suspect washed out.							9.0										
	9.00m: Silty SAND, some organic; brown streaked black. Medium dense to dense, moist. Sand, fine to medium. Organics, rootlets (decomposed).			SPTS	67	0/- kPa Shear Vane Failed 2/3 4/9 10/9 **N=32**												
	9.30m: NO RECOVERY - Suspect slipped out of SPT spoon.							9.5										
	9.45m: Silty SAND, some organic; brown streaked black. Medium dense to dense, moist. Sand, fine to medium. Organics, rootlets (decomposed). INDISTINCTLY INTERBEDDED WITH: SAND, some silt; brown spotted black. Medium dense, moist. Sand, fine to medium.						13											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl

Hole Depth 25.05m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH128

SHEET: 3 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926578.61 mN, 1747062.89 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.83m
R.L. COLLAR: 20.00m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: TRMC
START DATE: 17/05/2021
FINISH DATE: 19/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Silty SAND, some organic; brown streaked black. Medium dense to dense, moist. Sand, fine to medium. Organics, rootlets (decomposed). INDISTINCTLY INTERBEDDED WITH: SAND, some silt; brown spotted black. Medium dense, moist. Sand, fine to medium. [CONT]. *10.40 - 10.65m:* Minor organics; dark brown. Organics, carbonaceous material.			RC	95		12	10.5										
	10.65m: SAND, some silt, minor organics, trace gravel; dark brown spotted black. Loose to medium dense, moist. Sand, fine to coarse; gravel, fine, sub-angular to angular, Sandstone. Organics, carbonaceous material.			SPTS	100	0/- kPa Shear Vane Failed 1/2 3/2 3/3 **N=11**												
	10.80m: Sandy SILT, trace organics and trace gravel; light brownish grey. Very stiff, moist, low to medium plasticity. Organics, carbonaceous material. (Typically crumbles when deformed initially. Plastic upon remoulding).			RC	100		11	11.0 11.5										Box 3, 7.30-11.20m
	12.40 - 12.45m: Silty SAND, trace organics; light brown. Loose, moist. Organics, carbonaceous material.			SPTS	100	74/21 kPa 1/1 2/1 2/3 **N=8**		12.0										
				RC	100		10	12.5 13.0										
	13.60 - 13.62m: Some organics; dark brown. Organics, decomposed. *13.62 - 13.65m:* SILT, minor sand; light brownish grey. Very stiff, moist, low plasticity.			SPTS	100	80/18 kPa 0/2 2/2 2/3 **N=9**	9	13.5										
				RC	100		8	14.0 14.5										Box 4, 11.20-14.55m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl

Hole Depth 25.05m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH128

SHEET: 4 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926578.61 mN, 1747062.89 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.83m

R.L. COLLAR: 20.00m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 17/05/2021

FINISH DATE: 19/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Sandy SILT, trace organics and trace gravel; light brownish grey. Very stiff, moist, low to medium plasticity. Organics, carbonaceous material. (Typically crumbles when deformed initially. Plastic upon remoulding) [CONT].			SPTS	100	1/1 2/1 3/2 **N=8**		15.5										
	15.75m: SAND, trace gravel; greyish brown, Blocky. Very stiff, moist. Sand, fine to coarse; gravel, fine, sub-rounded, Siltstone.			RC	100			16.0										
	15.98m: Sandy SILT, trace organics and trace gravel; light brownish grey. Very stiff, moist, medium plasticity. Organics, carbonaceous material. (Typically crumbles when deformed initially. Plastic upon remoulding).																	
	16.42m: SAND, trace gravel; greyish brown, Blocky. Very stiff, moist. Sand, fine to coarse; gravel, fine, sub-rounded, Siltstone.					71/15 kPa		16.5										
	16.50m: Sandy SILT, trace gravel; light brownish grey. Very stiff, moist, low to medium plasticity. (Typically crumbles when deformed initially. Plastic upon remoulding).			SPTS	100	1/2 1/2 3/2 **N=8**												
				RC	100			17.0										
								17.5										
	18.00m: SAND, trace gravel; greyish brown, Blocky. Very stiff, moist. Sand, fine to coarse; gravel, fine, sub-rounded, Siltstone.					42/12 kPa		18.0										
	18.15m: Sandy SILT, trace gravel; light brownish grey. Very stiff, moist, low to medium plasticity. (Typically crumbles when deformed initially. Plastic upon remoulding).			SPTS	100	2/2 2/2 2/4 **N=10**												
				RC	100			18.5										
								19.0										
	19.20m: SAND, trace gravel; greyish brown, Blocky. Very stiff, moist. Sand, fine to coarse; gravel, fine, sub-rounded, Siltstone.																	
	19.50m: Sandy SILT, trace gravel; light brownish grey. Very stiff, moist, low to medium plasticity. (Typically crumbles when deformed initially. Plastic upon remoulding).					45/9 kPa		19.5										
	19.62m: Silty SAND; light brownish grey. Medium dense, moist. Sand, fine to medium.			SPTS	100	2/1 2/2 4/3 **N=11**												
	19.90m: Silty SAND, trace gravel; greyish brown, Blocky. Very																	

Box 5, 14.55-17.30m

Box 6, 17.30-19.95m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl

Hole Depth 25.05m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH128

SHEET: 5 OF 6

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926578.61 mN, 1747062.89 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.83m

R.L. COLLAR: 20.00m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 17/05/2021

FINISH DATE: 19/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.00m:* Silty SAND, trace gravel; greyish brown, Blocky. Very stiff, moist. Sand, fine to coarse; gravel, fine, sub-rounded, Siltstone. [CONT].																	
East Coast Bays Formation	*20.37m:* CW, grey streaked black, SILTSTONE. Extremely weak (very stiff), Recovered as: SILT, minor clay and minor sand, trace organics; moist, medium plasticity. Organics, carbonaceous material..							20.5										
	20.68m: CW, greyish brown mottled grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT, some organics; moist, medium plasticity. Sand, fine to medium. Organics, carbonaceous material..																	
	20.81m: CW, light brownish grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as Sandy SILT, trace gravel; moist, medium plasticity. Gravel, fine, sub-rounded, siltstone..			SPTS	100	0/- kPa Shear Vane Failed 2/2 3/3 3/5 **N=14**	2	21.0					*21.00 - 24.00m:* Pump test attempted. Due to a very low flow rate (approx 1Litre/00:01:40), a slug test was carried out as a replacement testing method.					
	21.00m: CW, grey, SANDSTONE. Extremely weak (medium dense), Recovered as: Silty SAND, moist. Remoulds to: Sandy SILT, medium plasticity.																	
	21.40m: CW, light brownish grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT, trace gravel; moist, medium plasticity..							21.5										
				RC	100		1	22.0										
	22.40m: CW, dark brown mottled grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT, some organics; moist, medium plasticity. Sand, fine to medium. Organics, carbonaceous material..							22.5										
	22.50m: CW, grey, SANDSTONE. Extremely weak (medium dense), Recovered as: Silty SAND; moist, Remoulds to: Sandy SILT, medium plasticity..			SPTS	100	0/- kPa Shear Vane Failed 3/3 3/5 6/8 **N=22**	0											
	22.84m: CW, light brownish grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT, trace gravel; moist, medium to high plasticity..							23.0										
	23.05 - 23.19m: Organics. Organics, carbonaceous material.																	
				RC	100		-1	23.5										
	23.58 - 23.65m: SILT, minor clay and minor sand, trace organics; grey streaked black. Firm, moist, low to medium plasticity. Sand, fine. Organics, carbonaceous material.					● 80/33 kPa												
	23.95m: CW, grey, SANDSTONE. Extremely weak (medium dense), Recovered as: Silty SAND; moist, Remoulds to: Sandy SILT, medium plasticity.			SPTS	100	0/- kPa Shear Vane Failed 2/3 4/5 6/8 **N=23**		24.0										
	24.45m: CW, light brownish grey, Sandy SILTSTONE. Extremely weak (very stiff), Recovered as: Sandy SILT, trace organics and trace gravel; moist, medium plasticity. Organics, carbonaceous material..							24.5										
	24.68 - 24.75m: Organics. Organics, carbonaceous material						-2											

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl

Hole Depth 25.05m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH128

SHEET: 6 OF 6

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926578.61 mN, 1747062.89 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.83m

R.L. COLLAR: 20.00m

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: TRMC

START DATE: 17/05/2021

FINISH DATE: 19/05/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
	25.05m: END OF BOREHOLE					89/21 kPa	-3 -4 -5 -6 -7	25.5 26.0 26.5 27.0 27.5 28.0 28.5 29.0 29.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 20.0 m bgl

Hole Depth 25.05m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH128**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926578.61 mN 1747062.89 mE	DRILL TYPE:	HOLE STARTED: 17/05/2021
R.L.:	22.83m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

0.00-4.25m

4.25-7.30m

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH128**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926578.61 mN 1747062.89 mE	DRILL TYPE: DRILL METHOD: RC	HOLE STARTED: 17/05/2021 HOLE FINISHED: 19/05/2021 DRILLED BY: McMillan Drilling
R.L.:	22.83m		
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: TRMC

7.30-11.20m

11.20-14.55m

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH128**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926578.61 mN 1747062.89 mE	DRILL TYPE:	HOLE STARTED: 17/05/2021
R.L.:	22.83m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

14.55-17.30m

17.30-19.95m

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH128**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926578.61 mN 1747062.89 mE	DRILL TYPE:	HOLE STARTED: 17/05/2021
R.L.:	22.83m	DRILL METHOD: RC	HOLE FINISHED: 19/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: TRMC

19.95-23.25m

23.25-25.05m

General Log - DESX005 - Fix RQD - 9/12/2021 4:24:00 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH130

SHEET: 1 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926680.56 mN 1747254.21 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.05m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 31/05/2021

FINISH DATE: 02/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
TSoil	*0.00m:* Sandy SILT, minor organics; brown. Stiff, moist, low plasticity. Organics, rootlets.								TS									
Tauranga Group	*0.30m:* Silty CLAY, some sand, trace organics; light brown mottled orange. Firm, moist, high plasticity. Sand, fine. Organics, rootlets (fresh). *0.40 - 1.61m:* Trace sand; light grey mottled orange. Sand, fine.			HA	100		17	0.5										
				HQ3	100		16	1.0										
	1.61m: NO RECOVERY - Confirmed slipped out of SPT spoon. - SPT spoon catcher detached.			SPTS	24	0/1 0/2 1/2 **N=5**		1.5										
	1.95m: Silty CLAY, minor sand, trace organics; light grey mottled orange. Firm, moist, high plasticity. Sand, fine. Organics, rootlets (fresh).			HQTT	100		15	2.0										
	2.48m: Organic silty CLAY; brown spotted black. Firm, moist, high plasticity. Organics, decomposed.							2.5										
	2.69m: Organic clayey SILT; dark brown. Firm to stiff, moist, medium plasticity. Organics, decomposed. *2.95 - 3.18m:* Some clay.			SPTS	100	54/18 kPa 0/0 0/0 0/0 **N=0**	14	3.0							01/06/2021			Box 1, 0.00-3.00m
	3.18 - 3.23m: Sandy SILT; greenish grey, Blocky. Stiff, moist, low plasticity.																	
	3.32m: NO RECOVERY - Confirmed slipped out of SPT spoon.																	
	3.45m: SILT, minor organics and minor clay; brown streaked dark brown. Firm to stiff, moist, medium plasticity. Organics, decomposed.			HQTT	100		13	4.0										
	4.50m: PEAT (AMORPHOUS); black. Firm to stiff, moist. Highly sensitive.			SPTS	100	54/9 kPa 0/0 0/0 0/0 **N=0**		4.5							02/06/2021			

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 15.06m bgl

Hole Depth 22.8m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH130

SHEET: 2 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926680.56 mN 1747254.21 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.05m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 31/05/2021

FINISH DATE: 02/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* PEAT (AMORPHOUS); black. Firm to stiff, moist. Highly sensitive [CONT].																	
	6.18m: Organic SILT; brown streaked dark brown. Firm to stiff, moist, non-plastic. Organics, decomposed.			SPTS	100	55/4 kPa 0/0 0/0 0/0 **N=0**	11	6.0										
	6.50m: PEAT (FIBROUS AND AMORPHOUS) SILT; black, Blocky. Firm to stiff, moist, non-plastic. Organics, decomposed.							6.5										Box 2, 3.00-6.55m
	6.55m: Organic SILT; brown streaked dark brown. Firm to stiff, moist, non-plastic. Organics, decomposed.			HQTT	100		10	7.0										
	7.45m: SILT, some clay, minor organics and minor sand; light grey streaked dark brown. Firm, moist, medium plasticity. Sand, fine. Organics, decomposed.			SPTS	100	37/2 kPa 0/0 1/1 1/1 **N=4**	9	7.5										
				HQTT	100			8.0										
	8.90m: Sandy SILT, minor organics; light grey streaked dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, decomposed.							8.5										
	9.25m: SILT, minor organics and minor sand; light grey streaked dark brown. Stiff, moist, low plasticity. Sand, fine. Organics, decomposed.			SPTS	100	0/1 1/1 1/2 **N=5**	8	9.0										
	9.45m: Sandy SILT, some clay, minor organics; light grey streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, decomposed.							9.5										Box 3, 6.55-9.70m
	9.70m: Clayey SILT; light grey streaked dark brown. Stiff, moist, high plasticity.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 15.06m bgl

Hole Depth 22.8m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH130

SHEET: 3 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926680.56 mN 1747254.21 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.05m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 31/05/2021

FINISH DATE: 02/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Clayey SILT; light grey streaked dark brown. Stiff, moist, high plasticity. [CONT].			HQTT	100			10.5										
	10.50m: NO RECOVERY. - Push Tube Sample.			PT	100	BH130 78/21 kPa @ 10.50m TG Sample description from target AL AL PSD		11.0										
	11.00m: Sandy SILT; light grey streaked dark brown. Stiff, moist, low plasticity. Sand, fine.																	
	11.15m: SILT, some clay; light grey streaked dark brown. Stiff, moist, medium plasticity.																	
	11.25m: Sandy SILT, minor organics; light grey streaked dark brown. Stiff, dry to moist, low plasticity. Sand, fine. Organics, decomposed.			HQTT	100			11.5										
	11.55m: Sandy SILT; light grey streaked dark brown. Stiff, dry, low plasticity. Sand, fine.																	
	12.25m: Sandy SILT, minor organics; light grey streaked dark green. Stiff, moist, low plasticity. Sand, fine. Organics, decomposed.			SPTS	100	69/27 kPa 0/0 2/1 1/1 **N=5**		12.0										
								12.5										
East Coast Bays Formation	*13.25m:* CW, grey, fissured, SANDSTONE. Extremely weak (loose), fine grained, Recovered as: Silty SAND, trace carbonaceous and trace clay, moist, fine, very loose to loose. Remoulds to: Sandy SILT, medium to high plasticity.							13.0										Box 4, 9.70-13.25m
				SPTS	100	39/12 kPa 0/1 1/1 1/1 **N=4**		13.5										
				HQTT	100			14.0										
								14.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 15.06m bgl

Hole Depth 22.8m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH130

SHEET: 4 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926680.56 mN 1747254.21 mE

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.05m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 31/05/2021

FINISH DATE: 02/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*15.00m:* CW, grey, SILTSTONE. Extremely weak (stiff), Recovered as: Clayey SILT; moist, high plasticity, stiff.			SPT	100	1/1 2/3 3/3 N=11	2	15.00										
	15.35m: CW, grey, SILTSTONE. Extremely weak (stiff), Recovered as: Sandy SILT, trace clay; moist, medium to high plasticity, stiff.						1	15.5										
	15.95m: CW, grey, SANDSTONE. Extremely weak, Recovered as: SAND, some silt; Loosely packed, moist, fine to medium. Remoulded to: Sandy SILT, medium to high plasticity.			HQTT	100			16.0										
	16.45m: CW, grey, SILTSTONE. Extremely weak (very stiff), Recovered as: Silty CLAY; moist, high plasticity, very stiff.						0	16.5										Box 5, 13.25-16.40m
	16.50m: NO RECOVERY. - Push Tube Sample.			PT	100	BH130 @ 16.50m CW SANDTSTONE/ SILTSTONE (ECBF) Sample description from target												
	17.00m: CW, grey, SANDSTONE. Extremely weak (medium dense), poorly cemented, fine grained, Recovered as: SAND, some silt; grey, loosely packed, moist, fine to medium. INDISTINCTLY INTERBEDDED WITH: CW, grey, SILTSTONE. Extremely weak (very stiff), (Silty CLAY; grey, very stiff, moist, high plasticity).							17.0										
	17.25m: HW, grey, MUDSTONE. Extremely weak (very stiff), poorly cemented, Recovered as: Silty CLAY, moist, high plasticity, very stiff.							17.5										
	17.40m: MW, grey, SANDSTONE. Extremely weak, poorly cemented, fine to medium grained, Recovered as: SAND, some silt. Loosely packed.						-1											
	17.90 - 18.00m: Silty SANDSTONE. Fine to medium grained.			SPTS	100	3/4 6/7 8/10 N=31		18.0										
	18.42 - 18.72m: Silty SANDSTONE. Fine to medium grained.							18.5										
	18.72m: MW, grey, SANDSTONE. Extremely weak, poorly cemented, fine to medium grained, Recovered as: SAND, minor silt, Loosely packed. Remoulds to Sandy SILT.			HQTT	67		-2											
	18.90m: CORE LOSS - Suspect washed out.							19.0										
	19.25m: MW, grey, Sandy SILTSTONE. Extremely weak, poorly cemented to moderately cemented, fine to medium grained, Recovered as: Sandy SILT; grey, moist, low plasticity, very stiff. Remoulds to Sandy SILT.							19.5										
	19.50m: MW, grey, Silty SANDSTONE. Extremely weak, poorly cemented, fine to medium grained, Recovered as: SAND, minor silt; grey, moist, very dense. Remoulds to Sandy SILT.			SPTS	100	4/8 10/14 12/14 N>=50												
	19.61m: SW, grey, Sandy SILTSTONE. Extremely weak, poorly cemented to moderately cemented, fine to medium grained, Recovered as: Sandy SILT; grey, moist, low plasticity, very stiff.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 15.06m bgl

Hole Depth 22.8m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: WSL-21-BH130

SHEET: 5 OF 5

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926680.56 mN, 1747254.21 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 17.05m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain

LOGGED BY: ROM

CHECKED: FLRU

START DATE: 31/05/2021

FINISH DATE: 02/06/2021

CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*20.00m:* SW, grey, Silty SANDSTONE. Extremely weak, poorly cemented to moderately cemented, fine to medium grained, Recovered as Sandy Silt; grey, moist, low plasticity, very stiff. Remoulds to Sandy SILT[CONT].	UW SW MW HW CW	FS VS S MS W VW EW				-3											
	20.30m: SW, grey, SANDSTONE. Very weak locally Extremely weak (very dense), poorly cemented, fine grained, (SAND, minor silt; grey, moist, dense to very dense). 50 to 130mm thick. DISTINCTLY INTERBEDDED WITH: SW, grey, MUDSTONE. Very weak locally Extremely weak (very stiff), poorly cemented to moderately cemented, (CLAY, minor silt; grey, moist, very stiff, low plasticity). 30 to 90mm thick, 0 to 8° inclined.							20.5					*20.30-21.00m:* DD, Drilling induced fracturing due to poorly cemented nature of rock					
	21.00m: NO RECOVERY - Solid SPT, no overcore recovered.			SPTC	0	7/19 22/22 26 for 20mm **N>=50** Solid	-4	21.0										
	21.35m: UW, grey, SANDSTONE. Very weak locally Extremely weak (very dense), poorly cemented to moderately cemented, fine grained, (SAND, minor silt; grey, moist, very dense). 15 to 150 mm thick. DISTINCTLY INTERBEDDED WITH: UW, grey, MUDSTONE. Very weak locally Extremely weak (very stiff), poorly cemented to moderately cemented, (CLAY, some silt; grey, moist, low plasticity, very stiff). 10 to 60mm thick, 5 to 18° inclined.			HQTT	100			21.5					*21.32-21.39m:* J, 90°, PL, SM, VN, Slight clay veneer (					
							-5	22.0					*21.35-22.50m:* DD, Drilling induced fracturing due to poorly cemented nature of rock					
	22.50m: NO RECOVERY - Solid SPT, no overcore recovered. - Push Tube Sample.			SPTC	0	9/25 28/22 for 70mm **N>=50** Solid		22.5										Box 7, 20.25-22.80m
	22.8m: END OF BOREHOLE						-6	23.0										
								23.5										
							-7	24.0										
								24.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at 15.06m bgl

Hole Depth 22.8m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH130**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926680.56 mN 1747254.21 mE	DRILL TYPE:	HOLE STARTED: 31/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 02/06/2021
R.L.:	17.05m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

0.00-3.00m

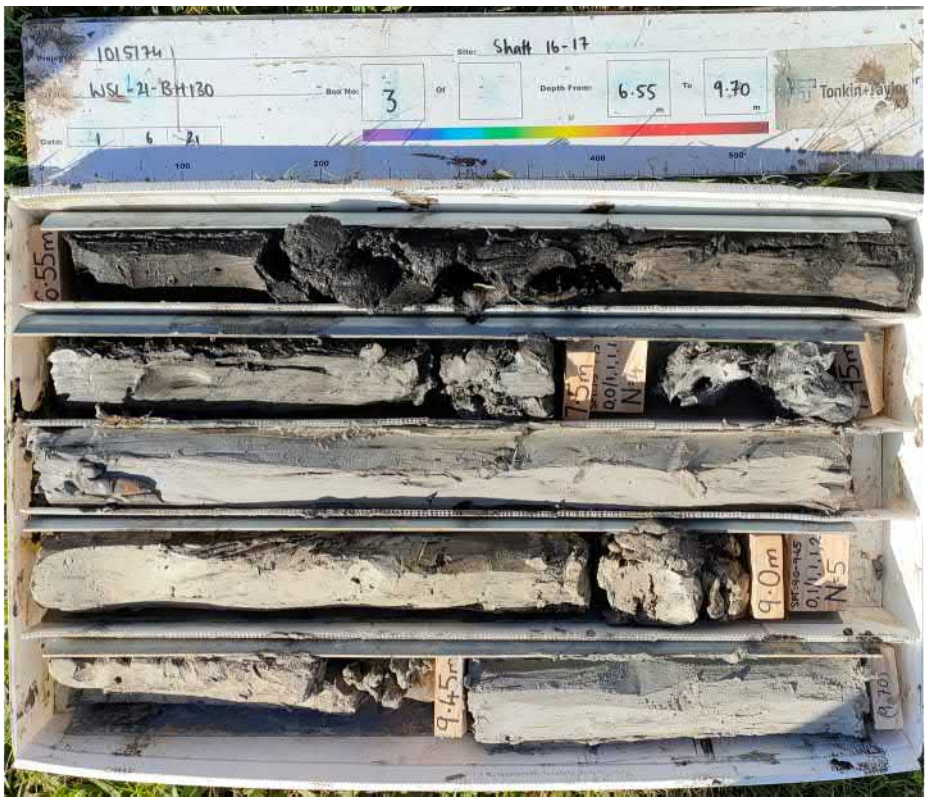
3.00-6.55m

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc
v1.0

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH130**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926680.56 mN 1747254.21 mE	DRILL TYPE:	HOLE STARTED: 31/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 02/06/2021
R.L.:	17.05m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU



6.55-9.70m

9.70-13.25m

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH130**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926680.56 mN 1747254.21 mE	DRILL TYPE:	HOLE STARTED: 31/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 02/06/2021
R.L.:	17.05m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

13.25-16.40m

16.40-20.25m

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH130**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926680.56 mN 1747254.21 mE	DRILL TYPE:	HOLE STARTED: 31/05/2021
R.L.:	17.05m	DRILL METHOD: RC	HOLE FINISHED: 02/06/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

20.25-22.80m

General Log - DESX005 - Fix RQD - 9/12/2021 5:21:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH131

SHEET: 1 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926728.32 mN 1747340.34 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.71m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 26/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Depth (m)	Sampling Method	Core Recovery (%)	Testing	RL (m)
Top	*0.00m:* Sandy SILT, minor organics and minor clay; light brown speckled white. Stiff, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh). [TOPSOIL].	0.0				
Fill	*0.15m:* CLAY and SILT, minor sand, trace organics; dark brown mixed light brown. Very stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh). [FILL].					
Fill	*0.50m:* Silty CLAY, minor sand; brownish orange mottled orange. Hard, moist, high plasticity. Sand, fine. Some rootlets. [FILL].	0.5	HA	100		15
Tauranga Group	*1.10m:* Silty sandy CLAY, trace organics; grey speckled white. Hard, moist, high plasticity. Sand, fine. Organics, rootlets (fresh).	1.0	HQTT	100	214/- kPa	
Tauranga Group	*1.70m:* Clayey sandy SILT, trace organics; grey speckled white. Very stiff to hard, moist, medium to high plasticity. Sand, fine. Organics, rootlets (fresh).	1.5	SPT	100	2/2 2/2 3/3 N=10	14
Tauranga Group	*1.95m:* SILT, some clay and some sand, trace organics; grey speckled white. Very stiff to hard, moist, medium plasticity. Sand, fine. Organics, rootlets (fresh).	2.0	HQTT	100		
Tauranga Group	*2.65m:* SILT, some organics, minor sand; light brown streaked dark brown. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, decomposed. Sensitive.	2.5				13
Tauranga Group	*3.45m:* Sandy SILT, trace organics; light brownish grey. Stiff, moist, medium plasticity. Sand, fine. Organics, decomposed.	3.0	SPT	100	54/2 kPa 0/1 0/1 0/1 N=2	
Tauranga Group	*3.80 - 3.85m:* SAND; light brownish orange streaked green. Very dense, moist. Sand, medium.	3.5	HQTT	100		12
Tauranga Group	*4.15m:* Silty SAND, trace organics; light brownish grey. Loose, moist. Sand, fine to medium. Organics, decomposed.	4.0	HQTT	100		
Tauranga Group	*4.56m:* Organic sandy SILT; brown streaked dark brown. Firm, moist, low plasticity. Sand, fine. Organics, decomposed. High sensitivity.	4.5	SPT	84	4/1 2/1 1/1 N=5	11

ROCK DEFECTS: Defect Log; Fracture Spacing (mm) (2000, 600, 200, 60, 20); RQD (%); Description & Additional Observations

Rock Weathering: UW, SW, MW, HW, CW
Rock Strength: ES, VS, S, MS, W, VW, EW

Fluid Loss (%): 25, 50, 75

Water Level: 27/05/2021

Casing

Installation: Box 1, 0.00-3.00m

Core Box No

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 14.80 - 17.80m bgl with in-situ hydraulic conductivity (slug) testing undertaken at screen interval.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:24 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH131

SHEET: 2 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervis
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926728.32 mN 1747340.34 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.71m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 26/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.15m:* Organic silty SAND; brown streaked dark brown. Loosely packed, moist. Sand, fine. Organics, decomposed.							5.5										
	5.80m: CORE LOSS - Suspect washed out.																	
	6.00m: NOT LOGGED. - Push Tube Sample.			PT	100	Push Tube @ 6.00m		6.0										Box 2, 3.00-6.50m
	6.50m: Organic silty SAND; brown streaked dark brown. Loosely packed, moist. Sand, fine. Organics, decomposed.			HQTT	100			6.5										
	6.75m: PEAT (AMORPHOUS); black. Firm to stiff, moist. High sensitivity.			HQTT	100	42/2 kPa												
	7.45 - 7.48m: SAND; light brown. Loosely packed, moist. Sand, fine to medium.							7.0										
	7.50m: NOT LOGGED. - Push Tube Sample.			PT	100	BH131 UU @ 7.50m TG Sample description from target		7.5										
	8.00m: PEAT (FIBROUS AND AMORPHOUS); black. Firm to stiff, moist. High sensitivity, medium plasticity.			HQTT	100			8.0										
	8.98 - 9.05m: SAND; light brown. Loosely packed, moist. Sand, fine to medium.							8.5										
	9.05m: Organic SILT; brown streaked dark brown. Firm, moist, medium plasticity. Organics, decomposed. High sensitivity.			SPT	100	57/12 kPa 1/0 0/0 0/0 **N=0**		9.0										
	9.40m: PEAT (FIBROUS AND AMORPHOUS); black. Firm to stiff, moist. High sensitivity, .							9.5										Box 3, 6.50-9.75m
	9.80m: PEAT (FIBROUS AND AMORPHOUS) and SILT; brown mottled black. Firm, moist, medium plasticity. High sensitivity.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 14.80 - 17.80m bgl with in-situ hydraulic conductivity (slug) testing undertaken at screen interval.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH131

SHEET: 3 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926728.32 mN, 1747340.34 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.71m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 26/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.35m:* PEAT (FIBROUS AND AMORPHOUS); black. Firm to stiff, moist. High sensitivity, medium plasticity.			HQTT	100	ph / ASS @ 10.00m pH = 7 PSD AL	5	10.5										
	10.50m: NOT LOGGED. - Push Tube Sample.					UTP Fibrous												
	11.00m: PEAT (FIBROUS AND AMORPHOUS); black. Firm to stiff, moist. Trace decomposed wood, high sensitivity, medium plasticity.						4	11.0										
								11.5										
				SPT	100	57/- kPa 0/1 0/0 0/0 **N=0**		12.0										
	12.55 - 12.70m: PEAT (FIBROUS AND AMORPHOUS) and SILT; brown mottled black. Firm to stiff, moist, low plasticity. High sensitivity.						3	12.5										Box 4, 9.75-12.90m
	12.95m: Organic SILT; brown streaked dark brown. Stiff, moist, medium plasticity. Organics, wood fragments (decomposed).			HQTT	100			13.0										
	13.50m: SAND, some silt, trace organics; light brownish grey spotted black. Loose, moist. Sand, fine to medium. Organics, wood fragments (partially decomposed).			SPT	100	67/18 kPa 2/2 0/1 1/1 **N=3**	2	13.5										
	13.60m: Organic SILT; brown streaked dark brown. Firm, moist, medium to high plasticity. Organics, decomposed. INTERMIXED WITH: SAND, some silt; light greenish brown. Loosely packed, moist. Sand, fine to medium.					pH / ASS @ 14.00m pH = 7		14.0										
	14.20m: Organic SILT, some sand, minor clay; brown streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, wood fragments (partially decomposed).			HQTT	100		1	14.5										
	14.60m: SILT, some clay, minor organic and minor sand; brown streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, wood fragments (decomposed).																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 14.80 - 17.80m bgl with in-situ hydraulic conductivity (slug) testing undertaken at screen interval.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH131

SHEET: 4 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926728.32 mN 1747340.34 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.71m
R.L. COLLAR:
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Jeremy Cain
LOGGED BY: ROM
CHECKED: FLRU
START DATE: 26/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* SILT, some clay, minor organic and minor sand; brown streaked dark brown. Stiff, moist, medium plasticity. Sand, fine. Organics, wood fragments (decomposed). [CONT].			SPT	100	0/0 0/0 1/3 **N=4**												
				HQTT	100		0	15.5										
								16.0										Box 5, 12.90-16.10m
	16.50m: NOT LOGGED. - Push Tube Sample.			PT	100	BH131 @ 16.50m TG Sample description from target AL MC	-1	16.5										
	17.00m: Sandy SILT, minor organic and minor clay; light greyish brown streaked dark brown. Firm to stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (decomposed).			SPT	100	0/0 0/0 0/2 **N=2**		17.0										
				HQTT	100		-2	17.5										
	18.10 - 19.55m: Some sand. Sand, fine.			SPT	100	42/6 kPa 0/0 0/2 2/2 **N=6**		18.0										
				HQTT	100		-3	18.5										
								19.0										
	19.55m: Sandy SILT, minor organic; brown. Stiff to very stiff, moist, medium to high plasticity. Sand, fine. Organics, rootlets (decomposed).			SPT	100	71/3 kPa 1/3 2/3 3/3 **N=11**	-4	19.5										Box 6, 16.10-19.95m
	19.95m: END OF BOREHOLE																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Standpipe piezometer installed with screen interval at 14.80 - 17.80m bgl with in-situ hydraulic conductivity (slug) testing undertaken at screen interval.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH131**

SHEET: 1 OF 3

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926728.32 mN 1747340.34 mE	DRILL TYPE:	HOLE STARTED: 26/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 28/05/2021
R.L.:	15.71m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: ROM CHECKED: FLRU

0.00-3.00m

3.00-6.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH131**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926728.32 mN 1747340.34 mE	DRILL TYPE:	HOLE STARTED: 26/05/2021
R.L.:	15.71m	DRILL METHOD: RC	HOLE FINISHED: 28/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

6.50-9.75m

9.75-12.90m

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:25 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH131**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926728.32 mN 1747340.34 mE	DRILL TYPE:	HOLE STARTED: 26/05/2021
R.L.:	15.71m	DRILL METHOD: RC	HOLE FINISHED: 28/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: ROM CHECKED: FLRU

12.90-16.10m

16.10-19.95m

General Log - DESX005 - Fix RQD - 8/12/2021 2:36:25 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 1 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926759.56 mN 1747399.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.10m
R.L. COLLAR: 15.10m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* ORGANIC FRAGMENTS; brown. Loose, dry. Organics, bark. [FILL].								TS									
	0.20m: Clayey SILT, some gravel, minor cobbles; grey. Very stiff, moist, medium plasticity. Gravel, sub-rounded, basalt, 2-6cm; cobbles, sub-rounded to sub-angular, basalt, 2-6cm. [FILL].							0.5										
Tauranga Group	*0.60m:* Silty CLAY, trace carbonaceous material; brownish grey mottled orange. Very stiff, moist, high plasticity. *0.90 - 0.95m:* Wood fragments.			HA	100			1.0										
	1.20m: SILT, some clay, trace carbonaceous material; dark brown. Very stiff, dry, low plasticity. *1.20 - 1.40m:* Light brown mottled orange.			HQTT	100	158/31 kPa		1.5										
	1.95 - 2.15m: Greyish brown.			SPT	100	1/1 1/2 1/2 **N=6**		2.0										
	2.15m: Silty CLAY, trace carbonaceous flecks; light grey mottled orange. Stiff, moist, high plasticity.			HQTT	100			2.5										
	2.80m: Silty CLAY; light brown. Stiff, moist, high plasticity. *3.10 - 3.20m:* Dark brown. Organic silty CLAY.			SPT	100	77/17 kPa 1/1 1/2 2/2 **N=7**		3.0										Box 1, 0.00-3.20m
	3.45 - 3.50m: Dark brown. Organic silty CLAY.			HQTT	100			3.5							27/05/2021			
	4.15m: Silty SAND; light brown. Loose to medium dense, moist. Sand, fine to medium.							4.0										
	4.30m: PEAT (FIBROUS); black. Soft, moist.					0/- kPa SV Failed									26/05/2021			
	4.60m: Organic silty CLAY; dark brown. Soft, moist, low plasticity. High sensitivity, trace organic material, rootlets.			SPT	100	0/0 1/0 1/1 **N=3**		4.5								PQ3		

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:18 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 2 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926759.56 mN, 1747399.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.10m
R.L. COLLAR: 15.10m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* Organic silty CLAY; dark brown. Firm, moist, low plasticity. High sensitivity, trace organic material, rootlets. [CONT].			HQTT	100		10	5.5										
	6.00m: PEAT (AMORPHOUS); black. Firm, moist to wet. Low plasticity.			SPT	100	● 46/3 kPa 0/0 0/0 1/0 **N=1**	9	6.0										
	6.20m: Organic silty CLAY; dark brown. Firm, moist, low plasticity. Organics, carbonaceous material. High sensitivity, trace organic material.			HQTT	100			6.5							25/05/2021			Box 2, 3.20-6.20m
	7.50m: PEAT (AMORPHOUS); black. Firm, moist. Low plasticity, high sensitivity. *7.80 - 10.00m:* Trace wood fragments.			SPT	100	● 46/6 kPa 0/0 0/0 1/0 **N=1**	8	7.0										
	7.95m: Organic silty CLAY; greyish brown mottled with some black. Firm, moist, low to medium plasticity. Organics, carbonaceous material. Trace of rootlets.			HQTT	100			7.5										
	9.00m: Organic clayey SILT; dark brown mottled reddish brown. Firm, dry, low to medium plasticity. Organics, wood fragments (partially decomposed). High sensitivity, trace organic material, rootlets.			SPT	100	● 31/6 kPa 0/0 0/0 0/0 **N=0**	7	8.0										
	9.45m: Clayey sandy SILT, trace organic; greyish brown. Firm, moist, medium to high plasticity. Sand, fine, grey. Organics, wood fragments (partially decomposed).			HQTT	100	ASS/pH @ 9.75m Field measured pH 7	6	8.5										
								9.0										
								9.5								PQ3		Box 3, 6.20-9.30m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 3 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926759.56 mN 1747399.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.10m
R.L. COLLAR: 15.10m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.00m:* Clayey sandy SILT, trace organic; greyish brown. Firm, moist, medium to high plasticity. Sand, fine, grey. Organics, wood fragments (partially decomposed). [CONT].			HQTT	100		5						*10.10 - 10.35m:* Contam pH sample					
	10.40 - 10.43m: Fine SAND lense; light brown. Loose, moist.			SPT	100	43/6 kPa 0/0 1/0 0/1 **N=2**		10.5										
	11.10 - 11.30m: Trace wood fragments.			HQTT	100		4	11.0										
	11.50 - 11.55m: Some wood fragments.							11.5										
	11.65 - 11.75m: Some wood fragments.																	
	12.10m: NO RECOVERY - Root obstruction.			SPT	22	43/6 kPa 0/1 1/0 1/0 **N=2**	3	12.0										Box 4, 9.30-12.50m
	12.45m: Organic SILT, minor clay; dark greyish brown. Firm, moist, medium plasticity. Organics, wood fragments (partially decomposed). High sensitivity.							12.5										
	12.75 - 12.80m: Root.																	
	12.90m: Clayey SILT, trace organics; greyish brown. Firm, moist, high plasticity.			HQTT	100		2	13.0										
	13.00m: Sandy SILT, trace organics; greyish brown speckled black. Soft to firm, moist. Organics, carbonaceous material.																	
	13.55 - 13.70m: Brown.			SPT	100	0/0 0/0 0/0 **N=0**		13.5								PQ3		
	13.70m: Silty CLAY, trace organics; brownish grey speckled black. Soft, moist, high plasticity. Organics, carbonaceous material.																	
	14.20 - 14.45m: Brown.			HQTT	100	ASS/pH @ 14.75m Field measured pH 7 75/18 kPa	1	14.0										
	14.90m: Clayey SILT, trace organics; grey speckled black. Soft to							14.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 4 OF 7

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926759.56 mN, 1747399.90 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.10m
R.L. COLLAR: 15.10m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Clayey SILT, trace organics; grey speckled black. Firm, moist, medium to high plasticity. Organics, carbonaceous material. [CONT].			SPT	100	0/0 1/1 2/1 **N=5**	0	15.5										
				HQTT	100		-1	16.0										Box 5, 12.50-16.00m
	16.50m: Silty CLAY, trace organics; grey. Firm to stiff, moist, high plasticity. Organics, carbonaceous material.					● 61/15 kPa		16.5										
				SPT	100	0/0 0/1 1/1 **N=3**		17.0										
				HQTT	100		-2	17.5										
	18.45 - 20.65m: Speckled black.					● 31/2 kPa		18.0										
				SPT	100	0/0 0/0 1/2 **N=3**	-3	18.5										
				HQTT	100			19.0										Box 6, 16.00-19.00m
				SPT	100	● 31/12 kPa 0/1 1/1 2/2 **N=6**	-4	19.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 5 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: (NZTM2000) 5926759.56 mN 1747399.90 mE	R.L. GROUND: 15.10m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR: 15.10m
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*20.00m:* Silty CLAY, trace organics; grey. Firm, moist, high plasticity. Organics, carbonaceous material.			HQTT	100		-5	20.5										
	20.65m: Clayey SILT, some sand; grey. Firm, moist, medium plasticity. Sand, fine.																	
	20.95m: Sandy SILT, some organics and some clay; dark greyish brown. Firm, moist, low plasticity. Sand, fine. Organics, wood fragments.			SPT	100	1/0 2/1 0/2 **N=5**	-6	21.0										
	21.45 - 21.85m: Firm.							21.5										
	22.05m: Clayey SILT, some sand, trace organics; dark brownish grey. Firm, moist, medium plasticity. Sand, fine. Organics, wood fragments.			HQTT	100		-7	22.0										Box 7, 19.00-22.10m
	22.10 - 22.15m: Sandy SILT, some clay; dark brownish grey. Stiff, moist, low plasticity. Sand, fine.																	
	22.50m: Silty CLAY; dark brownish grey. Firm, moist, high plasticity.			SPT	100	● 46/12 kPa 0/1 2/2 3/2 **N=9**		22.5										
	22.65m: Clayey SILT, some sand, trace organics; dark brownish grey. Stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous material.						-8	23.0										
	23.10 - 23.25m: With some fine sand.			HQTT	100			23.5										
East Coast Bays Formation	*23.70m:* CW, grey, Sandy SILTSTONE. Extremely weak, RECOVERED AS: Sandy SILT, minor clay, trace carbonaceous material; grey. Stiff, moist, medium to high plasticity. Sand, sub-rounded to sub-angular. .			SPT	100	● 92/12 kPa 3/5 6/7 9/9 **N=31**	-9	24.0										
	24.20m: CW, grey, SANDSTONE. Extremely weak, fine grained. RECOVERED AS: Silty SAND. Medium dense, moist. Sand, sub-rounded to sub-angular. Remoulds to: Sandy SILT medium to high plasticity.																	
	24.55m: CORE LOSS. Washed out.			HQTT	109			24.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 6 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926759.56 mN 1747399.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.10m
R.L. COLLAR: 15.10m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*25.00m:* CW, grey, SANDSTONE. Extremely weak, uncemented. RECOVERED AS: SAND, some silt; grey. Loose. Sand, fine to coarse, sub-rounded to sub-angular. Remoulds to: Sandy SILT medium plasticity.			HQTT	100		-10	25.5										
	25.05m: HW, grey, SANDSTONE. Extremely weak, poorly cemented, fine to coarse grained. RECOVERED AS: Silty SAND, minor clay. Dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.																	
	25.33m: MW, grey, SANDSTONE. Extremely weak, moderately cemented, fine to coarse grained. RECOVERED AS: Silty SAND, minor clay. Medium dense to dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.			SPTC	0	7/7 11/9 10/12 **N=42** Solid												
	25.50m: NO RECOVERY - Solid cone SPT.																	
	25.95m: MW, grey, SANDSTONE. Extremely weak, poorly cemented, fine to coarse grained. RECOVERED AS: Silty SAND, minor clay. Dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.			HQTT	30		-11	26.0										Box 8, 22.10-25.95m
	26.13m: CORE LOSS. Washed out.							26.5					*26.05-26.15m:* BZ, 25-80°, UN, R, VN					
	26.85m: MW, grey, SANDSTONE. Extremely weak, moderately cemented, fine to coarse grained. RECOVERED AS: Silty SAND. Very dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.																	
	27.00m: NO RECOVERY - Solid cone SPTC.			SPTC	0	10/12 13/14 17/6 for 30mm **N>=50** Solid	-12	27.0					*26.95-27.00m:* J, 80°, UN, R, N					
	27.41m: CORE LOSS. Washed out.			HQTT	53			27.5										
	27.60m: MW, grey, SANDSTONE. Extremely weak, well cemented, fine to medium grained. RECOVERED AS: Silty SAND, minor clay. Very dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.																	
	27.70m: MW, grey, SANDSTONE. Extremely weak, well cemented, coarse grained. RECOVERED AS: Gravelly SAND. Very dense, moist. Sand, fine to coarse; gravel, fine, angular.						-13	28.0										
	27.93m: CORE LOSS. Washed out.																	
	28.25m: MW, grey, SANDSTONE. Extremely weak, moderately cemented, fine grained. RECOVERED AS: Silty SAND. Very dense, moist. Sand, fine to coarse, sub-rounded to sub-angular.																	
	28.50m: NO RECOVERY - Solid cone SPT.			SPTC	0	13/11 15/20 15 for 40mm **N>=50** Solid		28.5										
	28.84m: MW, grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: Silty SAND. Medium dense, moist. Sand, fine to medium.																	
	29.05m: MW, grey, SANDSTONE. Extremely weak, well cemented, fine to coarse grained. RECOVERED AS: SAND, some silt. Very dense, moist. Sand, fine to coarse.						-14	29.0										
	29.15m: CORE LOSS. Washed out.																	
	29.45m: MW, grey, SANDSTONE. Extremely weak, uncemented, fine grained. RECOVERED AS: SAND, some silt. Dense, moist. Sand, fine to medium, sub-angular.			HQTT	65			29.5										
	29.80m: MW, grey, SANDSTONE. Extremely weak, poorly cemented, fine grained. RECOVERED AS: SAND, some silt.																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH132

SHEET: 7 OF 7

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926759.56 mN 1747399.90 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 15.10m
R.L. COLLAR: 15.10m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 25/05/2021
FINISH DATE: 27/05/2021
CONTRACTOR: McMillan Drilling

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	ROCK DEFECTS: Fracture Spacing (mm)	ROCK DEFECTS: RQD (%)	ROCK DEFECTS: Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
East Coast Bays Formation	*30.00m:* NO RECOVERY - Solid cone SPT.	UW SW MW HW CW	ES VS S MS W VW EW	SPTC	0	15/23 25/25 for 70mm **N>=50** Solid	-15							25 50 75				
	30.30m: MW, grey, SILTSTONE. Extremely weak. RECOVERED AS: Clayey SILT. Very stiff, moist, medium plasticity.							30.5										
	30.60m: MW, grey, SANDSTONE. Extremely weak, uncemented, fine to coarse grained. RECOVERED AS: SAND, some silt. Loose, moist. Sand, fine to coarse.																	
	30.90m: MW, grey, SANDSTONE. Extremely weak, moderately cemented, fine to coarse grained. RECOVERED AS: SAND, minor silt. Dense, moist. Sand, fine to coarse.			HQTT	100		-16	31.0			2000 600 200 60 20	100						Box 9, 25.95-31.20m
	31.00m: MW, grey, SANDSTONE. Very weak, fine to coarse grained.																	
	31.20 - 31.25m: Extremely weak, poorly cemented. RECOVERED AS: SAND, minor silt. Dense, moist. Sand, fine to coarse.												*31.38m:* DD					
	31.50m: NO RECOVERY - Solid cone SPT.			SPTC	0	20/30 for 50mm **N>=50** Solid		31.5										
	31.65m: UW, grey, SANDSTONE. Very weak, well cemented, fine grained.												*31.70m:* J, 30°, UN, R, N					
	31.75 - 31.80m: UW-SW, grey, indistinctly bedded, SILTSTONE. Very weak.												*31.75-31.80m:* J, 5°, PL, SM, T					
	32.07 - 32.08m: Lense of very UW, grey SILTSTONE. Very weak. *32.15 - 32.17m:* Lense of very UW, grey SILTSTONE. Very weak.			HQTT	100		-17	32.0				82	*32.10m:* DD *32.15m:* DD *32.18m:* DD					
	32.36m: UW, grey, SILTSTONE. Very weak, well cemented, Trace carbonaceous material, piece of almost coal.							32.5					*32.42m:* BF, 5°, PL, SM, N *32.48m:* J, 20°, ST, SM, N					
	32.65 - 32.70m: UW, grey, SANDSTONE. Very weak, well cemented, fine to coarse grained.																	
	32.75m: UW, grey, SANDSTONE. Weak, well cemented, fine grained, Interbedded with thinly laminated to laminated beds of carbonaceous rick fine SANDSTONE. Weak, well cemented. Subhorizontal bedding.												*32.82m:* DD *32.87m:* DD *32.90m:* DD *32.95m:* DD					
	33.00m: NO RECOVERY - Solid cone SPT.			SPTC	0	20/30 for 50mm **N>=50** Solid	-18	33.0										Box 10, 31.20-33.15m
	33.13m: END OF BOREHOLE						-19	33.5										
								34.0										
								34.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. Nested standpipe piezometer with screen intervals installed at 4.0 - 7.0 mbgl and 13.0 - 16.0 mbgl.

Hole Depth 33.13m

Scale 1:25

Rev.: A

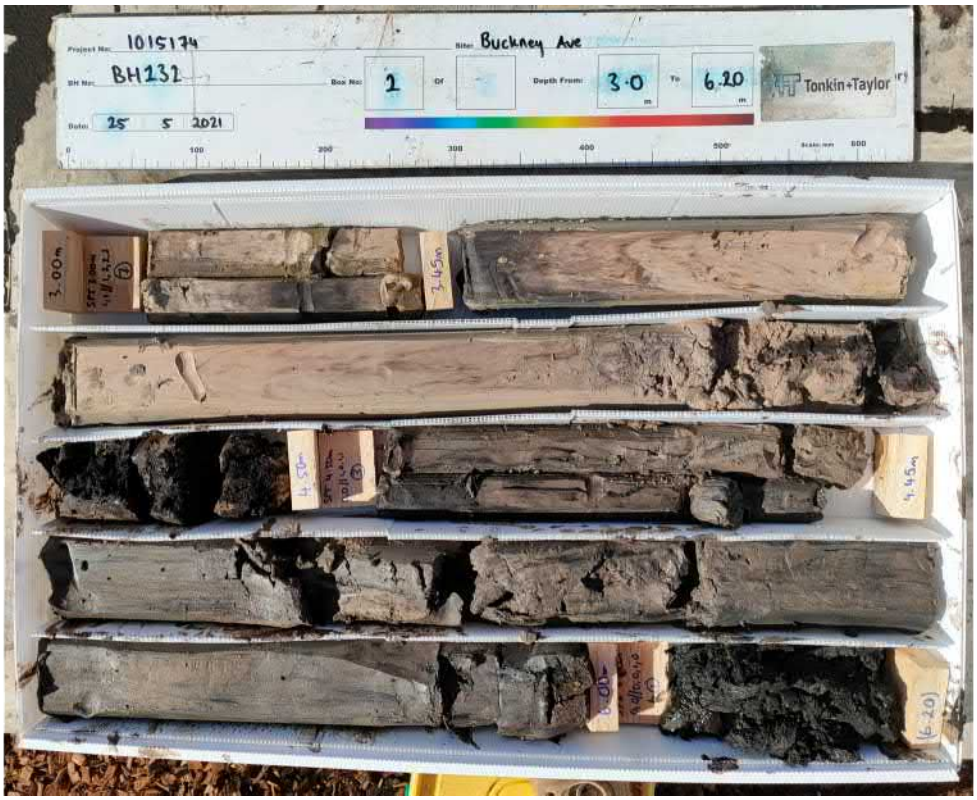
General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH132**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926759.56 mN 1747399.90 mE	DRILL TYPE:	HOLE STARTED: 25/05/2021
R.L.:	15.10m	DRILL METHOD: RC	HOLE FINISHED: 27/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

0.00-3.20m



3.20-6.20m

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH132**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site	LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000) 5926759.56 mN 1747399.90 mE	DRILL TYPE:	HOLE STARTED: 25/05/2021
R.L.: 15.10m	DRILL METHOD: RC	HOLE FINISHED: 27/05/2021
DATUM: AUCKHT1946		DRILLED BY: McMillan Drilling
		LOGGED BY: AMHO CHECKED: ROM

6.20-9.30m

9.30-12.50m

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH132**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926759.56 mN 1747399.90 mE	DRILL TYPE:	HOLE STARTED: 25/05/2021
R.L.:	15.10m	DRILL METHOD: RC	HOLE FINISHED: 27/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM

12.50-16.00m

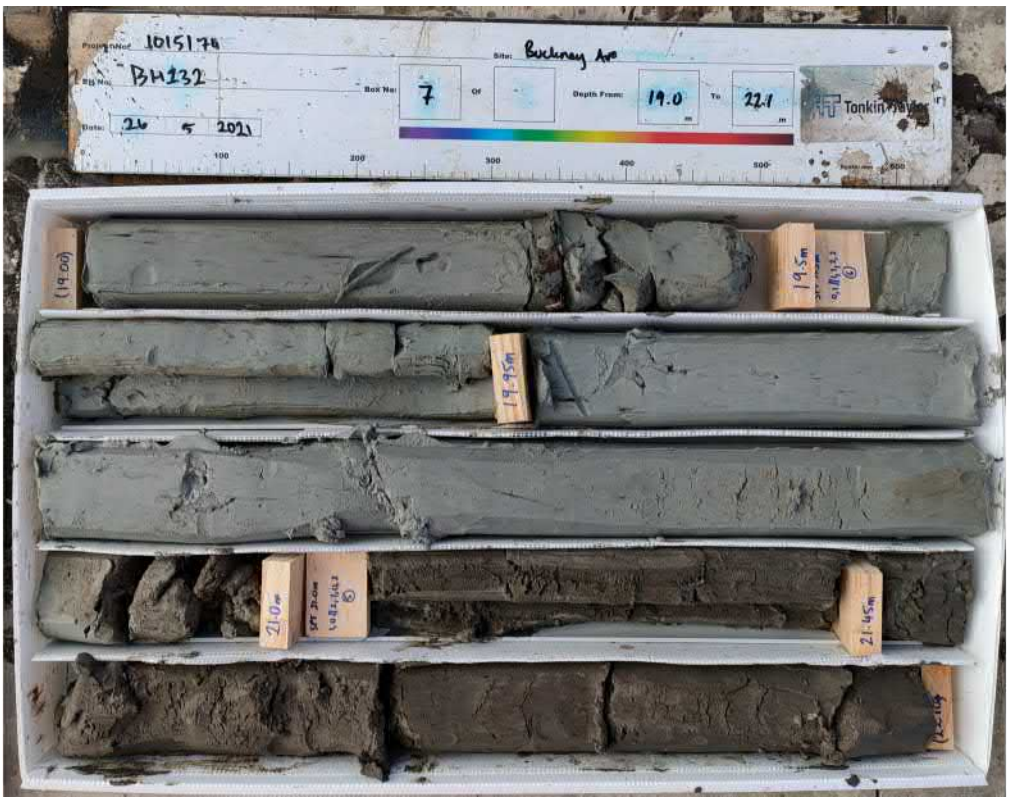
16.00-19.00m

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

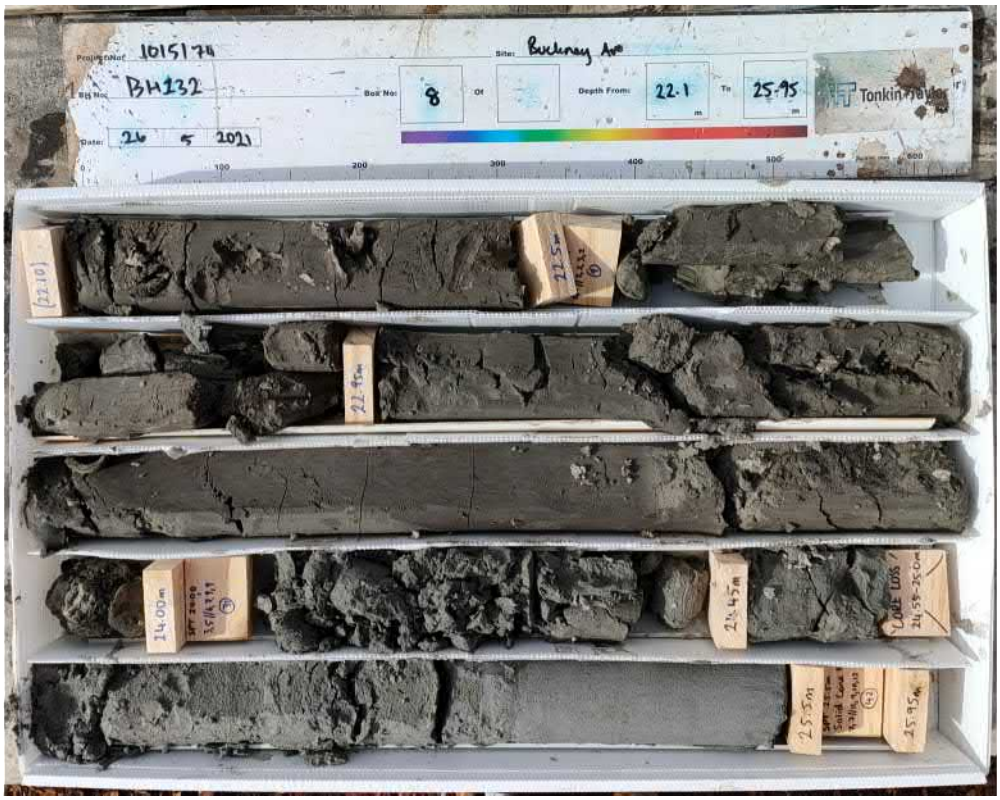
CORE PHOTOS

BOREHOLE No.: **WSL-21-BH132**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926759.56 mN 1747399.90 mE	DRILL TYPE:	HOLE STARTED: 25/05/2021
R.L.:	15.10m	DRILL METHOD: RC	HOLE FINISHED: 27/05/2021
DATUM:	AUCKHT1946		DRILLED BY: McMillan Drilling
			LOGGED BY: AMHO CHECKED: ROM



19.00-22.10m



22.10-25.95m

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH132**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926759.56 mN 1747399.90 mE	DRILL TYPE:	HOLE STARTED: 25/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 27/05/2021
R.L.:	15.10m		DRILLED BY: McMillan Drilling
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

25.95-31.20m

31.20-33.15m

General Log - DESX005 - Fix RQD - 8/12/2021 2:45:19 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH133

SHEET: 1 OF 4

Tonkin+Taylor

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: (NZTM2000) 5926785.45 mN 1747402.02 mE
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 14.13m
R.L. COLLAR: 14.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 27/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* SILT, some clay, trace organics and trace gravel; greyish brown mottled orange. Hard, moist, low plasticity. Gravel, coarse. Organics, wood fragments and carbonaceous material. [FILL].			HA	100	PID @ 0.00m 1.3 ppm PID @ 0.50m 0.9ppm	14	0							DRY 31/05/2021			
				HQTT	100		13	1.0										
				SPT	100	2/2 1/2 2/1 **N=6**		1.5										
	1.95m: CORE LOSS - Washed out. *2.55 - 2.65m:* Soft.			HQTT	43		12	2.0										
	2.55m: Clayey SILT, trace organics; brown mottled orange. Very stiff, moist, medium plasticity. Organics, wood fragments. [FILL].							2.5										
	3.00m: SPT - NO RECOVERY.			SPT	0	0/- kPa core turning with shear 2/1 2/2 3/3 **N=10**	11	3.0										
	3.45m: Clayey SILT, trace organics and trace gravel; greyish brown and brown. Firm, moist, medium plasticity. Gravel, medium to coarse, angular, asphalt fragments. [FILL].			HQTT	48			3.5										
	3.80m: LINING AND GEO-CLOTH. *3.85m:* ASPHALT. *3.95m:* CORE LOSS - Suspect washed out.						10	4.0										
Tauranga Group	*4.50m:* Organic SILT; black. Soft to firm, moist, low plasticity. High sensitivity. *4.95 - 5.55m:* Wet.			SPT	100	1/0 0/0 0/0 **N=0**		4.5								PQ3		

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at approx 13.0 m bgl.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:50 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH133

SHEET: 2 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: (NZTM2000) 5926785.45 mN 1747402.02 mE	R.L. GROUND: 14.13m
JOB No.: 1015174.0000.02	DIRECTION:	R.L. COLLAR: 14.13m
LOCATION: Whenuapai/Redhills, Auckland	ANGLE FROM HORIZ.: -90°	DATUM: AUCKHT1946
		SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 27/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*5.00m:* PEAT (AMORPHOUS); black. Soft, moist. High sensitivity.							5.5										Box 1, 0.00-5.25m
	6.00m: Push tube sample.			PT	100	23/5 kPa BH133_ UU @ 6.00m TG Sample description from target	8	6.0								PQ3		
	6.50m: Peaty clayey SILT; dark brown. Soft, wet, low plasticity, oxidized. Clay, high sensitivity. Organics, amorphous. *7.30 - 7.35m:* Wood fragments.			HQTT	100			6.5										
							7	7.0										
				SPT	100	0/0 0/0 0/1 **N=1**		7.5										
				HQTT	100		6	8.0										
								8.5										Box 2, 5.25-8.90m
	8.90m: PEAT (AMORPHOUS); black. Firm locally Soft to firm, moist to wet. High sensitivity. *9.00 - 9.05m:* Wood fragments.			SPT	100	58/6 kPa 1/0 0/0 1/0 **N=1**	5	9.0										
						ASS @ 9.75m		9.5										

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at approx 13.0 m bgl.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:51 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH133

SHEET: 3 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi
JOB No.: 1015174.0000.02
LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5926785.45 mN, 1747402.02 mE (NZTM2000)
DIRECTION:
ANGLE FROM HORIZ.: -90°

R.L. GROUND: 14.13m
R.L. COLLAR: 14.13m
DATUM: AUCKHT1946
SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 27/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan

GEOLOGICAL UNIT	DESCRIPTION OF CORE (SOIL: Classification, colour, consistency / density, moisture, plasticity; ROCK: Weathering, colour, fabric, name, strength, cementation)	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*10.05m:* Organic silty CLAY; dark brown. Soft to firm, wet, low plasticity. High sensitivity.			HQTT	100	0/0 0/0 0/0 N=0	4	10.0										
	10.45m: Clayey SILT, some organic; brown. Firm, moist, medium plasticity. Trace carbonaceous material.					29/2 kPa		10.5										
	10.55m: Organic CLAY, some silt; dark brown. Firm, wet, low plasticity. High sensitivity.			SPT	100													
	10.75m: Silty CLAY, some organics; brown speckled dark brown. Firm, moist, low plasticity. Organics, carbonaceous material. High sensitivity.																	
	10.95m: Organic CLAY, some silt; dark brown mottled greyish brown. Firm, moist, low plasticity. Organics, wood fragments (decomposed). High sensitivity.			HQTT	100		3	11.0										
	11.30m: Silty CLAY, some organics; brown. Firm, moist, high plasticity. Organics, carbonaceous material. High sensitivity.							11.5										
	11.55m: Clayey SILT, trace organics; grey mottled light brown. Firm, moist, medium plasticity. Organics, carbonaceous material.					49/3 kPa												
	12.00m: Push tube sample.			PT	100	BH133 @ 12.00m TG Sample description from target AL	2	12.0										
	12.50m: Organic SILT, some clay; brownish grey. Firm, moist, medium plasticity.							12.5										
	12.55m: Silty CLAY, trace organics; light brownish grey. Firm, moist, high plasticity. Organics, carbonaceous material.			HQTT	100		1	13.0										
						61/18 kPa		13.5										
				SPT	100	0/0 0/0 1/1 N=2												
				HQTT	100		0	14.0										
								14.5										
						ASS @ 14.75m												
						52/12 kPa												

Box 3, 8.90-12.50m

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at approx 13.0 m bgl.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:51 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: WSL-21-BH133

SHEET: 4 OF 4

PROJECT: Package 2 Whenuapai / Redhill [Supervi	CO-ORDINATES: (NZTM2000) 5926785.45 mN 1747402.02 mE	R.L. GROUND: 14.13m
JOB No.: 1015174.0000.02		R.L. COLLAR: 14.13m
LOCATION: Whenuapai/Redhills, Auckland	DIRECTION:	DATUM: AUCKHT1946
	ANGLE FROM HORIZ.: -90°	SURVEY: Total Station\Surveyed

DRILLED BY: Vinnie
LOGGED BY: AMHO
CHECKED: ROM
START DATE: 27/05/2021
FINISH DATE: 28/05/2021
CONTRACTOR: McMillan

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering	Rock Strength	Sampling Method	Core Recovery (%)	Testing	RL (m)	Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm)	RQD (%)	Description & Additional Observations	Fluid Loss (%)	Water Level	Casing	Installation	Core Box No
Tauranga Group	*15.00m:* Push tube sample.			PT	100	BH133 @ 15.00m TG Sample description from target MC AL PSD	-1	15.5										
	15.50m: Clayey SILT; light brownish grey speckled dark brown. Firm locally Firm to stiff, moist, high plasticity.			HQTT	10		-2	16.0										Box 4, 12.50-16.00m
	15.90 - 16.05m: Soft to firm.																	
	16.40 - 16.50m: Trace organics. Organics, carbonaceous material.			SPT	100	31/2 kPa 0/0 0/0 0/1 **N=1**		16.5										
	16.95m: Silty CLAY; light brownish grey speckled dark brown. Firm, moist, high plasticity.			HQTT	100		-3	17.0										
	17.10m: Clayey SILT; grey. Stiff, moist, high plasticity.																	
	17.15m: Silty CLAY; light brownish grey. Firm, moist, high plasticity.																	
	17.20m: Clayey SILT, trace organics; grey speckled dark brown. Firm, moist, high plasticity. Organics, carbonaceous material.							17.5										
	18.10m: Sandy SILT, some clay; grey. Firm to stiff, moist, low plasticity. Sand, fine.			SPT	100	46/15 kPa 0/0 1/2 3/2 **N=8**	-4	18.0										
	18.40m: Silty SAND; grey. Loose, moist. Sand, fine to medium, rounded to sub-rounded.			HQTT	100			18.5										
	18.45m: Sandy SILT, some clay, trace organics; grey. Firm to stiff, moist, medium plasticity. Sand, fine. Organics, carbonaceous material.																	
	18.80m: Silty SAND; grey. Loose, wet. Sand, fine to medium, rounded to sub-rounded.																	
	19.00m: Sandy SILT, some clay; grey. Firm, moist, low plasticity. Sand, fine.						-5	19.0										Box 5, 16.00-19.20m
	19.25m: Silty SAND; grey. Loose to medium dense, moist. Sand, fine to medium, rounded to sub-rounded.																	
	19.45m: Sandy SILT, some clay; grey. Stiff, moist, low plasticity. Sand, fine.			SPT	100	64/23 kPa 0/2 2/2 3/2 **N=9**		19.5										Box 6, 19.20-19.95m
	19.60m: Silty SAND; grey. Loose to medium dense, moist. Sand, fine to medium, rounded to sub-rounded.																	
	19.95m: END OF BOREHOLE																	

COMMENTS: Shear vane testing has been undertaken in soils exposed at the end of the core barrel. VWP installed at approx 13.0 m bgl.

Hole Depth 19.95m

Scale 1:25

Rev.: A

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:51 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH133**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926785.45 mN 1747402.02 mE	DRILL TYPE:	HOLE STARTED: 27/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 28/05/2021
R.L.:	14.13m		DRILLED BY: McMillan
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

0.00-5.25m

5.25-8.90m

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:51 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH133**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926785.45 mN 1747402.02 mE	DRILL TYPE:	HOLE STARTED: 27/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 28/05/2021
R.L.:	14.13m		DRILLED BY: McMillan
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

8.90-12.50m

12.50-16.00m

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:51 pm - Produced with Core-GS by GeRoc

CORE PHOTOS

BOREHOLE No.: **WSL-21-BH133**

PROJECT: Package 2 Whenuapai / Redhill [Supervision of On-Site		LOCATION: Whenuapai/Redhills, Auckland	JOB No.: 1015174.0000.02
CO-ORDINATES: (NZTM2000)	5926785.45 mN 1747402.02 mE	DRILL TYPE:	HOLE STARTED: 27/05/2021
		DRILL METHOD: RC	HOLE FINISHED: 28/05/2021
R.L.:	14.13m		DRILLED BY: McMillan
DATUM:	AUCKHT1946		LOGGED BY: AMHO CHECKED: ROM

16.00-19.20m

19.20-19.95m

General Log - DESX005 - Fix RQD - 8/12/2021 2:53:51 pm - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: HDD Exit

SHEET: 1 OF 1

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925823.22 mN, 1743967.87 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 36.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: GIS\Web map viewer

DRILLED BY: RVDK

LOGGED BY: RVDK

CHECKED: ROM

START DATE: 19/04/2021

FINISH DATE: 19/04/2021

CONTRACTOR: Tonkin+Taylor

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Clayey SILT, dark brown. Soft, moist, low plasticity.					HDD Exit 0.0-0.1m @ 0.00m PID= 0.4PPM		TS									
Tauranga Group	*0.40m:* Silty Clay, mottled brown, grey and orange. Soft to firm, moist, high plasticity.			HA	0	HDD Exit 0.4-1.0m @ 0.40m PID=0.7 PPM	0.5										

COMMENTS:

Hole Depth 1m

Scale 1:5

Rev.: A

General Log - DESX005 - Fix RQD - 21/01/2022 11:51:59 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

BOREHOLE No.: Shaft 8

SHEET: 1 OF 1

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925417.76 mN, 1745151.09 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: GIS\Web map viewer

DRILLED BY: RVDK

LOGGED BY: RVDK

CHECKED: ROM

START DATE: 19/04/2021

FINISH DATE: 19/04/2021

CONTRACTOR: Tonkin+Taylor

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Silty CLAY with some gravel and cobbles mottled grey, orange and brown. Firm, moist, medium plasticity, minor red scoria..					Shaft 8 0.0-0.1m @ 0.00m PID=0.6PPM											
Tauranga Group	*0.20m:* Clayey SILT, mottled light orange and grey. Firm, dry, medium plasticity.																
	0.30m: Silty CLAY, orange, firm, dry to moist, moderate plasticity.			HA	0	Shaft 8 0.3-1.0m @ 0.30m PID=0.6PPM	0.5										
	0.80m: Clayey SILT, mottled brown and grey. Very soft to soft, moist, moderate plasticity.																

COMMENTS:

Hole Depth 1m

Scale 1:5

Rev.: A

General Log - DESX005 - Fix RQD - 21/01/2022 11:52:17 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: HDD Exit

SHEET: 1 OF 1

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925823.22 mN, 1743967.87 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 36.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: GIS\Web map viewer

DRILLED BY: RVDK

LOGGED BY: RVDK

CHECKED: ROM

START DATE: 19/04/2021

FINISH DATE: 19/04/2021

CONTRACTOR: Tonkin+Taylor

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW SW MW HW CW)	Rock Strength (ES VS S MS W VW EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000 600 200 60 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25 50 75)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Clayey SILT, dark brown. Soft, moist, low plasticity.					HDD Exit 0.0-0.1m @ 0.00m PID= 0.4PPM		TS									
Tauranga Group	*0.40m:* Silty Clay, mottled brown, grey and orange. Soft to firm, moist, high plasticity.			HA	0	HDD Exit 0.4-1.0m @ 0.40m PID=0.7 PPM	0.5										

COMMENTS:

Hole Depth 1m

Scale 1:5

Rev.: A

General Log - DESX005 - Fix RQD - 21/01/2022 11:51:59 am - Produced with Core-GS by GeRoc

BOREHOLE LOG

Tonkin+Taylor

BOREHOLE No.: Shaft 8

SHEET: 1 OF 1

PROJECT: Package 2 Whenuapai / Redhill [Supervis

JOB No.: 1015174.0000.02

LOCATION: Whenuapai/Redhills, Auckland

CO-ORDINATES: 5925417.76 mN, 1745151.09 mE (NZTM2000)

DIRECTION:

ANGLE FROM HORIZ.: -90°

R.L. GROUND: 22.00m

R.L. COLLAR:

DATUM: AUCKHT1946

SURVEY: GIS\Web map viewer

DRILLED BY: RVDK

LOGGED BY: RVDK

CHECKED: ROM

START DATE: 19/04/2021

FINISH DATE: 19/04/2021

CONTRACTOR: Tonkin+Taylor

GEOLOGICAL UNIT	DESCRIPTION OF CORE SOIL: Classification, colour, consistency / density, moisture, plasticity ROCK: Weathering, colour, fabric, name, strength, cementation	Rock Weathering (UW, SW, MW, HW, CW)	Rock Strength (ES, VS, S, MS, M, W, VW, EW)	Sampling Method	Core Recovery (%)	Testing	RL (m) / Depth (m)	Graphic Log	ROCK DEFECTS: Defect Log	Fracture Spacing (mm) (2000, 600, 200, 60, 20)	RQD (%)	Description & Additional Observations	Fluid Loss (%) (25, 50, 75)	Water Level	Casing	Installation	Core Box No
Fill	*0.00m:* Silty CLAY with some gravel and cobbles mottled grey, orange and brown. Firm, moist, medium plasticity, minor red scoria..					Shaft 8 0.0-0.1m @ 0.00m PID=0.6PPM											
Tauranga Group	*0.20m:* Clayey SILT, mottled light orange and grey. Firm, dry, medium plasticity.																
	0.30m: Silty CLAY, orange, firm, dry to moist, moderate plasticity.			HA	0	Shaft 8 0.3-1.0m @ 0.30m PID=0.6PPM	0.5										
	0.80m: Clayey SILT, mottled brown and grey. Very soft to soft, moist, moderate plasticity.																

COMMENTS:

Hole Depth 1m

Scale 1:5

Rev.: A

General Log - DESX005 - Fix RQD - 21/01/2022 11:52:17 am - Produced with Core-GS by GeRoc

Appendix C Sampling Procedures

C1 Soil sampling procedures

Soil sampling was completed by T+T field staff under the guidance of a Suitably Qualified and Experienced Practitioner (SQEP). as defined in the Users' Guide for the NESCS. Soil samples were collected in general accordance with MfE Contaminated Land Guideline No. 5 as follows:

- Soil samples were either collected directly from the auger head or directly from core samples.
- Recovered material was visually inspected for the presence of suspected ACM fragments.
- Freshly gloved hands were used to collect soil samples after first removing the outer smear zone.
- Photoionization Detector (PID) readings were taken from soil samples collected at each shallow sampling location, generally at 0.5 and 1.0 m below ground level (bgl).
- pH field screening was undertaken from soil and rock samples collected from defined depths around the proposed tunnelling depth within natural material. As per Mott Macdonald's updated specification a soil probe was used, with soil mixed with deionized water (1:1) method and pH recorded. Field screening was typically done within 15 minutes of drilling where possible.
- All samples were placed immediately into laboratory supplied sample containers –300 ml glass jars for chemical analyses and 500 ml plastic sample containers for asbestos testing.
- One duplicate soil sample was collected for every 10 samples.
- One split sample was collected for at least every 20 samples.
- Any non-dedicated/ non-disposable equipment used to collect the samples was decontaminated between sample locations using a three-stage decontamination process including initial scrub in tap water with Decon 90 (a phosphate-free detergent), a rinse in tap water and a final rinse using deionised water.
- Samples were shipped in chilled containers to Analytica Laboratories with split samples sent to Hill Laboratories under chain of custody documentation.

C2 Groundwater sampling procedures

Groundwater sampling was undertaken by a SQEP and in accordance with industry best practice and the Mott Macdonald Specifications. Prior to sampling groundwater wells were developed by McMillan Drilling with pressurized air to remove suspended fines and water affected by the drilling and installation works.

Groundwater sampling was conducted using low flow procedures. A bladder pump was utilised for the deeper wells (> 10 m depth) and a peristaltic pump was used for the shallow wells (< 10 m depth). The following methodology was followed:

- Depth to water (and any floating product) was measured using an oil/water interface probe.
- Prior to sampling, purging was conducted following low flow procedures.
- Water quality parameters including electrical conductivity, temperature, redox and pH were measured and recorded at regular intervals.
- Samples were collected following the stabilisation of the observed water quality parameters.
- Visual and olfactory characteristics of the groundwater was recorded.
- Two sets of groundwater samples were collected into laboratory supplied sample containers from each of the monitoring wells. One sample was submitted for analysis with the other sample held cold at the laboratory.

- One duplicate sample, field blank and trip blank were collected per consignment. Additional to this a rinsate sample was collected from the bladder pump /peristaltic pump on each day the equipment was used.
- Any non-dedicated/ non-disposable equipment used to collect the samples was decontaminated between sample locations using a three-stage decontamination process including initial scrub in tap water with Decon 90 (a phosphate-free detergent), a rinse in tap water and a final rinse using deionised water.
- Samples were shipped in chilled containers to Analytica Laboratories under chain of custody documentation.

Appendix D Groundwater Field Sheets

Job number: 1015774

Monitoring well: BH122 - shallow

Date: 9/7/21

Field staff: WSFA

Equipment: Peristaltic Pump

Peizo stick-up: ~~540~~ mm

Diameter: 32 mm

Depth to bottom: 9.193 m

Screen depth: 4 m - 9 mbtoe

Bladder pump placement: 6.5m btoc

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
4.384	14.42	0.2	—	—	—	16.4	2.58	1159	4.98	199.9	NO odour, minor turbidity
—	14.45	0.2	—	—	—	16.4	2.21	1160	4.98	201.2	"
—	14.48	0.2	—	—	—	16.4	2.05	1160	4.97	201.7	"
—	14.51	0.2	—	—	—	16.4	1.90	1161	4.97	202.0	"
—	14.54	0.2	—	—	—	16.4	1.82	1160	4.97	201.9	"
—	14.57	0.2	—	—	—	16.4	1.86	1161	4.98	201.2	"
—	15.00	0.2	—	—	—	16.3	2.16	1157	4.99	198.5	"
—	15.03	0.2	—	—	—	16.1	2.18	1142	4.99	197.7	"
—	15.06	0.2	—	—	—	16.1	2.21	1143	5.00	197.2	"

Job number: 1015174

Monitoring well: BH122 ~~shallow~~ deep

Date: 8/7/21

Field staff: RVDK / WEFA

Equipment: Bladder pump

Peizo stick-up: 540 mm

Diameter: 32 mm

Depth to bottom: 9.621 m btoc

Screen depth: top = 0m Bottom 15m

Bladder pump placement: middle of screen 7.5m

time at well = 8 am

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
6.166	8:34am	–	–	–	–	–	–	–	–	–	–
–	8:42am	0.2	20	10	10	11.5	4.63	2685	6.18	85.6	clear/no odour
–	8:53am	0.45	80	15	15	13.1	6.50	271.9	6.25	97.7	clear/no odour
	~~9:19~~	0.7	70	5	20	15.7	2.73	252.7	6.13	106.9	clear/no odour
	9:22	0.95	10	5	15	14.8	2.26	250.7	6.38	105.8	clear/no odour
	9:25	1.10	10	5	15	14.3	1.90	247.8	6.50	104.6	clear/no odour
	9:28	1.20	10	5	15	14.1	1.93	247.7	6.53	104.3	clear/no odour
	9:31	1.30	10	5	15	13.4	2.02	250.7	7.39	104.1	clear/no odour
	9:34	1.40	10	5	15	12.4	1.94	249.6	7.85	104.5	clear/no odour

cloudy, sunny

* unable to measure water level due to pump placement and peizo diameter

Stabilisation criteria:
pH ± 0.1, EC ± 5% T ± 0.3, DO ± 0.3, Turbidity ± 10% of prior reading or below 10

* We extended the tubing due to air bubbles pump not fully screened

/ Duplicate collected

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
–	9.37	1.5	10	5	15	12.7	1.71	249.7	7.52	104.8	clear / no odour
–	9.40	1.6	10	5	15	12.5	1.80	245.7	7.66	104.7	
–	9.43	1.7	10	5	15	12.7	1.78	242.8	7.55	105.9	

Job number:

Monitoring well: BH127 Shallow

Date: 09-07-21

Field staff: WETTA

Equipment: Peristaltic Pump.

Peizo stick-up: FLUSH TOBY

Diameter: 32 m

Depth to bottom: 9.431 m btoc

Screen depth: 6.6 – 9.6 m btoc

Peri
Bladder pump placement: ~8.1 m btoc

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
5.832	12.20	0.1	—	—	—	17.7	2.69	611	6.02	195.8	minor turbidity, No odour
—	12.22	0.1	—	—	—	17.4	2.63	603	6.03	192.3	"
—	12.24	0.1	—	—	—	17.0	2.80	594	6.03	191.9	"
—	12.26	0.1	—	—	—	17.3	2.68	589	6.01	191.8	"
—	12.28	0.1	—	—	—	17.4	2.65	588	6.01	191.6	"
—	12.30	0.1	—	—	—	17.4	2.66	587	6.01	191.7	"
—	12.32	0.1	—	—	—	17.4	2.67	586	6.01	191.8	"

level logger Removed @ ~12:10 pm.

Job number: 1015174
Monitoring well: BH127 - Deep
Date: 8-7-21
Field staff: WEFA
Equipment: Bladder Pump

Peizo stick-up: FLUSH TOBY
Diameter: 32mm
Depth to bottom: 23.742 mbtoc
Screen depth: 21m - 24m btoc.
Bladder pump placement: ~22.5m btoc

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
7.214	13.15	0.2	22	10	10	17.5	40.2%	225.8	16.56	175.0	clear / NO odours
—	13.20	0.2	22	10	10	17.5	3.69	227.2	16.52	158.6	clear / NO odours
—	13.25	0.2	22	10	10	17.9	2.14	227.8	14.53	135.5	"
—	13.30	0.2	22	10	10	17.3	1.85	227.5	11.88	133.3	"
—	13.35	0.2	22	10	10	17.1	1.61	225.6	13.40	133.6	"
—	13.40	0.2	22	10	10	17.7	1.49	224.5	13.58	135.2	"
—	13.45	0.2	22	10	10	17.9	1.48	226.4	11.42	135.7	"
—	13.50	0.2	22	10	10	17.2	1.53	227.3	16.57	138.4	"
—	13.55	0.2	22	10	10	16.9	1.55	226.0	11.46	141.6	

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
—	13:57	0.2	22	10	10	16.6	1.62	225.3	10.38	143.0	Clear / NO odors
"	13:59	0.2	22	10	10	16.5	1.59	225.2	10.42	143.3	"
"	14:01	0.2	22	10	10	16.2	1.59	225.2	10.33	143.7	"

8:02 am

Water level = 8.720 m after removing level logger

Job number: 101517 4

Monitoring well: BH110

Date: Thursday 18th Nov 21

Field staff: RVDK / BCG

Equipment: Bladder pump

Peizo stick-up: 0.53m

Diameter: 32mm inside diameter

Depth to bottom: 27.91m

Screen depth: 21 → 27 m

Bladder pump placement: 24 m

Sunny

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
8.290	8:18										
8.610	8:23	0.1	80	20	20	17.3	6.02	314.9	8.03	97.5	clear
8.875	8:31	0.35	80	20	20	17.4	5.19	377.2	6.50	75.9	clear / potential iron flecks
9.060	8:38	0.8	60	10	20	17.2	3.45	377.5	6.37	78.0	" "
9.170	8:42	1.1	60	10	20	17.2	2.73	320.2	6.34	76.3	" "
9.230	8:47	1.35	60	10	20	17.3	2.40	320.3	6.35	75.0	" "
			Parameters stable collected samples @ 8:49 am								
				Finished	collecting			samples @		9:15 am	

Duplicate 1
BH110 A
BH110 B

WL 9.265 m bgl (before removing pump)

WL 9.470 m bgl @ 9:24 after removing

Job number: 1015174

Monitoring well: BH115 (deep)

Date: Thu 18th Nov

Field staff: RVDK / BCG

Equipment: Bladder pump

Peizo stick-up: Flush

Diameter: 32mm

Depth to bottom: 19.210

Screen depth: 16 → 19

Bladder pump placement: 17.5m

Weather

* = Sunny

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
3.078											
2.995	3:05		40	10	10						
2.741	3:35	0.1	40	10	10						
3.05	3:39	0.2	60	15	15	21.2	9.03	205.3	8.19	-33.3	Yellow, ovange, cloudy
3.173	3.43	0.6	60	15	15	19.4	8.77	209.5	6.90	2.5	" "
3.192	3.47	0.85	60	15	15	18.9	8.11	207.7	6.47	41.4	" "
3.212	3.49	1	60	15	15	18.8	7.82	205.9	6.41	51.6	" "
3.198	3.51	1.2	60	15	15	18.9	7.80	205.6	6.40	52.7	" "
		Stabilized	Samples		collected			3:53pm			

WL = 3.158 @ 4:09 with pump

WL = 3.839 @ 4:11 w/ no pump

Job number: 1015174
Monitoring well: BH132 deep
Date: 18/11/21
Field staff: RVDK/BCG
Equipment: Bladder pump

Peizo stick-up: 0.66
Diameter: 32 mm
Depth to bottom: 16.60m
Screen depth: 13 → 16m
Bladder pump placement: 14.5m

Sunny / some cloud

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
6.933	11:02am										
6.608	11:19am										
6.952	11:23am	0.1	70	15	15	22.1	6.23	299.6	6.73	13.2	Clear
7.240	11:26	0.35	70	15	15	19.6	1.98	351.6	6.06	18.0	Reddish/orange
7.535	11:29	0.60	70	15	15	19.0	1.77	309.9	6.05	13.8	Reddish/orange
7.85	11:32	1.1	35	10	10	18.7	1.57	349.0	6.05	9.1	Reddish/orange
8.04	11:35	1.35	35	10	10	18.6	1.57	349.0	6.05	7.5	" "
8.435	11:38	1.6	35	10	10	18.6	1.47	348.6	6.05	3.8	" "
			Stabalised		parameters		samples collected		from		11:39am

* Drilling occurring 5 → 10 meters away

GW Level after sampling 9.225 m

9.495m

Job number: 1015174
Monitoring well: BH132 Shallow
Date: 18/11/21
Field staff: RVDK / BCG
Equipment: Bladder pump

Peizo stick-up: 0.7m
Diameter: 32mm
Depth to bottom: 7.450m
Screen depth: 4 → 7m
Bladder pump placement: 5.5m

Water level (mbTOC)	Time	Purge volume (L)	Controller pressure (PSI)	Drive duration (sec)	Refill duration (purge) (sec)	Temp *C	Dissolved oxygen (mg/L)	Conductivity uS/cm	pH	ORP (mV)	Comments
4.224m		0.0									
4.190m	12:21pm	0.25	70	15	15	19.5	0.92	387.1	5.46	78.0	yellow-orange cloudy
4.363	12:28	0.50	70	15	15	19.3	0.77	385.7	5.44	75.5	orange-red cloudy
4.341	12:31	0.75	70	15	15	19.3	0.70	386.3	5.43	74.3	orange-red cloudy
4.360	12:32	1.0	70	15	15	19.3	0.69	389.9	5.41	75.0	orange-red cloudy
4.298	12:48										After sampling
		Collected		Samples		@ 12:49pm					

@ 12:55 = 4.278 WL after removing pump

Job no 1015174
WL = 3.674 mbgl
Monitoring w = BH115 (shallow)
Date: Thu 18th Nov
field staff: RVDK / BCG
Equipm: Bladder pump
Peizo stick up: flush
Diameter: 32 mm
depth to bottom: 8.036 mbgl
Screen depth: 5 - 8 m
Bladder pump placement: 6.5

WL	Time	Purge L	Pressure	drive	fill	T	DO	Cond	pH	ORP	Comm
3.464	4:30										
3.646	4:32	0.1	60	10	15	21.8	4.19	884	6.21	76.1	Slightly Orange
3.844	4:36	0.35	60	10	15	19.4	9.6	867	6.09	92.3	"
4.064	4:40	0.60	60	10	15	18.6	0.32	843	6.06	98.9	"
4.380	4:44	1.20	60	10	15	18.4	0.24	834	6.07	101.7	"
4.555	4:48	1.50	60	10	15	18.6	0.20	952	6.08	98.0	"

Samples collected from 4:49pm

GW 5.035 @ 4:58pm w pump

GW 5.111 without pump 5:00pm

Collected Rinsate 1
sample by running
deionised water
through bladder pump
and filling bottles

Appendix E Results Tables

Appendix E Table 1: QA/QC soil duplicate results summary

Appendix E Table 2: QA/QC groundwater duplicate results summary

Appendix E Table 3: QA/QC soil split samples – results summary

Appendix E Table 4: QA/QC Trip blanks and field blanks associated with groundwater sampling investigations

Appendix E Table 5: QA/QC rinsate samples associated with groundwater sampling investigations

Appendix E Table 6: Summary table of analytical results of shallow soil testing for Whenuapai Package 2

Appendix E Table 7: Summary table of analytical results of deep soil testing for Whenuapai Package 2

Appendix E Table 8: TCLP Leachate analysis

Appendix E Table 9: Summary table of groundwater testing Whenuapai Package

Table E.1: QA/QC soil duplicate results summary

Sample ID	Shaft 8 – 0.00-0.10m	Duplicate 3	RPD	Shaft 10 BH108 – 0.0m	Duplicate 10	RPD
			%			%
Arsenic	5	5.4	8	0.91	1.3	35
Beryllium	0.24	0.22	9	0.64	0.39	49
Boron	4.1	3.9	5	<1.3	<1.3	0
Cadmium	0.061	0.092	41	0.056	0.06	7
Chromium	12	12.6	5	7.5	8	6
Copper	19.6	20.1	3	2.7	4.4	48
Lead	6.83	11.9	54	11.6	8.11	35
Mercury	<0.025	0.049	NC	0.085	0.081	5
Nickel	16.5	16.9	2	2.3	2.8	20
Zinc	50	39.9	22	10.5	9.6	9
4,4'-DDE	<0.005	<0.005	0	0.0076	0.02	90
C15-C36	<25	27	NC	67	52	25
C7-C36 (Total)	<50	<50	0	67	52	25
Sample ID	Shaft 10 BH108 – 0.5m	Duplicate 11	RPD	Shaft 16 BH128 – 0.0m	Duplicate 6	RPD
			%			%
Arsenic	0.91	1.8	66	10	6.7	40
Beryllium	0.47	0.45	4	0.3	0.24	22
Boron	<1.3	1.4	NC	4.1	3.5	16
Cadmium	0.071	0.055	25	0.19	0.12	45
Chromium	8.3	8.7	5	23.2	16	37
Copper	5.4	7.3	30	18.4	17.9	3
Lead	7.09	6.42	10	24.7	22.5	9
Mercury	0.067	0.053	23	0.17	0.16	6
Nickel	2.5	3.2	25	13.4	13.1	2
Zinc	8.92	12.1	30	50.4	42.4	17
C15 - C36	46	39	16	55	<25	NC
Total hydrocarbons (C7 - C36)	<50	<50	0	55	<50	NC
Benzo(a)pyrene	<0.010	<0.010	0	<0.010	0.011	NC

Sample ID	WSL-21-BH104-12m	Duplicate 7	RPD	WSL-21-BH118-22m	Duplicate 9	RPD
			%			%
pH	4.8	4.7	2	4.4	4.4	0
Chloride	3.4	3.7	8	3.8	3.8	0
Sulfate-S	9.1	9.3	2	11.2	18	47
Arsenic	0.3	0.36	18	2	3	40
Barium	41.7	41.5	0.5	275	215	24
Beryllium	0.62	0.66	6	0.32	0.33	3
Boron	2.2	2.3	4	2.8	2.5	11
Cadmium	0.015	0.018	18	0.044	0.034	26
Chromium	14.2	19	29	14.9	14	6
Cobalt	0.71	0.85	18	6.22	7.06	13
Copper	32.6	29.4	10	12.5	13.5	8
Lead	6.19	6.58	6	4.6	5.31	14
Manganese	23.8	28.5	18	777	391	66
Mercury	0.032	0.035	9	<0.025	0.027	NC
Nickel	1.6	1.8	12	11.2	14.2	24
Selenium	1.2	1.1	9	0.42	0.7	50
Tin	0.43	0.45	5	0.32	0.35	9
Vanadium	34.6	38.3	10	26.2	23.4	11
Zinc	13.7	21.1	43	38.3	40.2	5
Sulfur	<250	<250	0	1,500	1,600	6
Fluoride	110	110	0	170	200	16
Total Organic Carbon	0.13	0.26	67	0.58	0.57	2
Allophane Indicator	Weak	Weak	0	Moderate	Moderate	0

All results in mg/kg unless otherwise stated.
NC: RPD% could not be calculated correctly due to compound in either the sample or the duplicate detected at a concentration less than the laboratory limit of reporting.
Where both results were below the laboratory limit of reporting the RPD has been recorded as 0%.

Table E.2: QA/QC groundwater duplicate results summary

Sample ID	BH122 Deep A	Duplicate 01	RPD	Sample ID	BH110A	Duplicate 01	RPD
			%				%
Arsenic	0.0013	0.0012	8	Arsenic	<0.00050	<0.00050	NC
Cadmium	<0.00002	<0.00002	NC	Cadmium	<0.000020	<0.000020	NC
Chromium	0.0011	0.0012	9	Chromium	<0.00020	<0.00020	NC
Copper	0.00024	0.00037	43	Copper	<0.00020	<0.00020	NC
Lead	<0.00005	0.000071	NC	Lead	<0.000050	<0.000050	NC
Mercury	<0.00008	<0.00008	NC	Mercury	<0.000080	<0.000080	NC
Nickel	0.0018	0.0019	5	Nickel	0.0046	0.0046	NC
Zinc	0.016	0.017	6	Zinc	0.021	0.021	NC
Total Petroleum Hydrocarbons (TPH)	<LOR	<LOR	NC	Total Petroleum Hydrocarbons (TPH)	<LOR	<LOR	NC
Phenol	<0.002	<0.002	NC	Phenol	<0.002	<0.002	NC
4-Methylphenol	<0.0003	<0.0003	NC	4-Methylphenol	<0.0003	<0.0003	NC
Benzo[a]pyrene TEQ (LOR)	0.0008	0.0008	0	Benzo[a]pyrene TEQ (LOR)	0.0008	0.0008	0
Butyl benzyl phthalate	<0.001	<0.001	NC	Butyl benzyl phthalate	<0.001	<0.001	NC
Benzyl alcohol	<0.0003	<0.0003	NC	Benzyl alcohol	<0.0003	<0.0003	NC

All results in mg/L.

NC: RPD% could not be calculated correctly due to compound in either the sample or the duplicate detected at a concentration less than the laboratory limit of reporting.

Where both results were below the laboratory limit of reporting the RPD has been recorded as 0%.

Table E.3: QA/QC soil split samples - results summary

Sample ID	BH128 – 0.0m	BH128 – 0.0m split	RPD	HDD Entry 0.00-	Split HDD Entry 0.0-	RPD
			%			%
Arsenic	10	6	50	2.2	2	10
Beryllium	0.3	0.2	40	0.052	<0.2	NC
Boron	4.1	<20	NC	<1.25	<20	NC
Cadmium	0.19	0.11	53	0.062	<0.10	NC
Chromium	23.2	14	49	3.6	3	18
Copper	18.4	16	14	2.3	2	14
Lead	24.7	21	16	4.4	4	10
Mercury	0.17	0.17	0	0.063	<0.10	NC
Nickel	13.4	9	39	1.1	<2	NC
Zinc	50.4	33	42	7.88	8	2
C15-C36	55	152	94	<25	<40	NC
C7-C36 (Total)	55	163	99	<50	<70	NC
Benzo[a]pyrene TEQ	0.03	<0.04	NC	0.03	<0.04	NC

NC: RPD% could not be calculated correctly due to compound in either the sample or the duplicate detected at a concentration less than the laboratory limit of reporting.
Where both results were below the laboratory limit of reporting the RPD has been recorded as 0%.
Note: Analytes reported less than the laboratory limit of reporting is not included in the above table.

Table E.4: QA/QC Trip blanks and field blanks associated with groundwater sampling investigations

Sample Name	Trip Blank	Field Blank	Trip Blank
Sample Date	8/07/2021	09/07/2021	18/11/2021
QC Type	Quality	Quality	Quality
Testing suite	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC
Laboratory ID	21-30964	21-30964	21-48482-12
Metals			
Dissolved Arsenic	<0.0005	<0.0005	<0.00050
Dissolved Cadmium	<0.00002	<0.00002	<0.000020
Dissolved Chromium	<0.0002	<0.0002	<0.00020
Dissolved Copper	<0.0002	<0.0002	<0.00020
Dissolved Lead	<0.00005	<0.00005	<0.000050
Dissolved Mercury	<0.00008	<0.00008	<0.000080
Dissolved Nickel	<0.0002	<0.0002	<0.00020
Dissolved Zinc	<0.001	<0.001	0.0051
Total Petroleum Hydrocarbons (TPH)			
Semi-volatile organic compounds (SVOC)			
Phenol	<0.002	<0.002	<0.0020
4-Methylphenol	0.00061	<0.0003	<0.00030
Butyl benzyl phthalate	<0.001	<0.001	<0.0010
Benzyl alcohol	<0.0003	<0.0003	<0.00030

Notes:
All concentrations in g/m^3 (ppm)
Bold values above the laboratory limit of reporting

Table E.5: QA/QC rinsate samples associated with groundwater sampling investigations

Sample ID	Rinsate (8/07/2021)	Rinsate (9/07/2021)	Rinsate 1 (18/11/2021)
Nickel	0.00052	<0.0002	<0.00020
Phenol	0.0024	<0.002	<0.002
Benzo[a]pyrene LOR	0.0008	0.0008	0.0008
Butyl benzyl phthalate	0.0012	<0.001	<0.001
Benzyl alcohol	0.0041	0.0011	<0.00030

Table E.1: Summary table of analytical results of shallow soil testing for Whenuapai Package 2

Sample Name						HDD Exit 0.00-0.10m	HDD Exit 0.40-1.00m	Shaft 8 0.00-0.1m	Shaft 8 0.30-1.00m	Shaft 10 BH108 - 0.0m	Shaft 10 BH108 - 0.5m	Shaft 12 BH114 - 0.1m	Shaft 12 BH114 - 0.5m	Shaft 14 BH121 - 0.0m
Sample Date						19/04/2021	19/04/2021	19/04/2021	19/04/2021	17/06/2021	17/06/2021	7/10/2021	7/10/2021	3/05/2021
QC Type						Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Depth						0.0-0.10m	0.4-1.00m	0.00-0.10m	0.3-1.00m	0.0m	0.5m	0.0m	0.5m	0.0m
Testing suite	NES Commercial / Industrial [1]	AUP Permitted Activity Criteria [2]	Published Auckland Background Levels (non-volcanic) [3]	Ridge Road managed fill accpetance criteria [9]	Maximum	Metals (10), PAH, TPH, OCP, ONOP and asbestos	Metals (10), PAH, TPH, OCP	Metals (10), PAH, TPH, OCP, ONOP and asbestos	Metals (10), PAH, TPH, OCP	Metals (10), PAH, TPH, OCP and asbestos	Metals (10), PAH and TPH	Metals (10), PAH, TPH, OCP, ONOP and asbestos	Metals (10), PAH, TPH and OCP	Metals (10), PAH, TPH, OCP and asbestos
Laboratory ID						21-17935-3 / 2590821.3	21-17935-4	21-17935-5 / 2590821.5	21-17935-7	21-27853-1/ 21-27865-1	21-27853-2	21-43665-1/ 21-43661-1	21-43661-2	21-20712-1/ 21-31541-1
PID screening (field PPM)						0.4	0.7	0.6	0.6	Not collected	Not collected	Not collected	Not collected	0.3
pH screening (field)						-	-	-	-	-	-	-	-	-
Asbestos as ACM (w/w%)	0.05%	-	ND	1% w/w (AF/FA)	Asbestos NOT detected.	Asbestos NOT detected.	-	Asbestos NOT detected.	-	Asbestos NOT detected.	-	Asbestos NOT detected.	-	Asbestos NOT detected.
Asbestos Fibres/Fines (w/w%)	0.001%													
Metals														
Arsenic	70	100	**12**	70	10	1.7	4	5	4.1	0.91	0.91	1.3	0.99	3.3
Beryllium	220000 [4]	-	**-**	-	0.64	0.06	0.082	0.24	0.18	0.64	0.47	0.2	0.23	0.32
Boron	>10,000	-	**45**	-	4.1	2.1	<1.25	4.1	<1.25	<1.3	<1.3	1.4	<1.3	1.9
Cadmium	1300	7.5	**0.65**	7.5	0.38	0.38	0.028	0.061	0.016	0.056	0.071	0.026	0.019	0.047
Chromium	6300	400	**55**	400	23.2	4.7	6	12	14.7	7.5	8.3	8.9	9.2	13.3
Copper	>10,000	325	**45**	325	26.9	6.4	4.8	19.6	8.08	2.7	5.4	4.2	3.9	26.9
Lead	3300	250	**65**	250	24.7	6.19	6.93	6.83	6.35	11.6	7.09	13	9.64	9.87
Mercury	4200	0.75	**0.45**	0.75	0.21	0.06	0.12	<0.025	0.11	0.085	0.067	0.11	0.1	0.086
Nickel	6000 [6]	105	**35**	320	16.5	2.2	3	16.5	0.98	2.3	2.5	4.2	3	12.2
Zinc	400000 [6]	400	**180**	400	50.4	30	5.48	50	7.33	10.5	8.92	12.1	7.5	29.4
OCPs						<LOR	<LOR	<LOR	<LOR	<LOR	-	<LOR	<LOR	<LOR
4,4'-DDE	-	-	**<LOR**	-	**0.0076**	<0.005	<0.005	<0.005	<0.005	**0.0076**	-	<0.0050	<0.0050	<0.0050
TPHs						<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
C15-C36	NL [7]	NL [8]	**<LOR**	5600	**107**	**29**	<25	<25	<25	**67**	**46**	<25	<25	**56**
C7-C36 (Total)	-	-	**<LOR**	-	**107**	<50	<50	<50	<50	**67**	<50	<50	<50	**56**
PAHS						<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
ONOPS						<LOR	-	<LOR	-	-	-	<LOR	-	-
PFAS						-	-	-	-	-	-	-	-	-
SVOC						-	-	-	-	-	-	-	-	-

Notes:
All values in mg/kg unless otherwise indicated
'-' indicates not analysed or no relevant assessment criteria
<LOR = less than the laboratory limit of reporting
Asbestos NOT detected = asbestos not identified to be present by the laboratory method.
NL = Not limiting (i.e. >20,000 mg/kg)

Red vaues indicate that the results exceed NES Soil criteria: commercial/ industrial criteria
Underlined values indicates that the results exceed the AUP Permitted Activity Criteria
Bold values indicate that results exceed the public background concentrations for non-volcanic soils in the Auckland Region
Shaded values indicate that the results exceed typical managed fill criteria

1 - MfE, April 2012. Users Guide: National Environmental Standard for assessing and managing contaminants in soil to protect Human Health: Commercial/Industrial use (adopted for the protection of construction workers during the proposed works).
2 - Auckland Unitary Plan: Operative in Part Version (AUP). Permitted Activity Soil Criteria Table E30.6.1.4.1 (unless otherwise stated).
3 - Auckland Regional Council, Technical Publication 153, October 2001. Background concentrations of inorganic elements in soils from the Auckland Region: non-volcanic soils.
4 - USEPA Regional Screening Levels - Summary Table TR=1E-06, HQ=1 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
5 - Canadian Environmental Quality Guidelines (CCME, 2002) (http://st-ts.ccme.ca/)
6 - Assessment of Site Contamination National Environment Protection Measures (ASC NEPM) Toolbox – http://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
7 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Module 4 Tier 1 Soil acceptance criteria - Silty Clay - Surface (<1 m)
8 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Soil acceptance criteria for protection of groundwater quality, Surface (<1 m) Silty Clay, GW 4 m
9 - Ridge Road Managed Fill Acceptance Criteria

Table E.1: Summary table of analytical results of shallow soil testing for Whenuapai Package 2

Sample Name						Shaft 14 BH121- 0.5m	Shaft 16 BH128 - 0.0m	Shaft 16 BH128 - 0.5m	WSL-21-BH133-0.0m	WSL-21-BH133-0.5m
Sample Date						3/05/2021	18/05/2021	18/05/25021	28/05/2021	28/05/2021
QC Type						Regular	Regular	Regular	Regular	Regular
Depth						0.5m	0.0m	0.5m	0.0m	0.5m
Testing suite	NES Commercial / Industrial [1]	AUP Permitted Activity Criteria [2]	Published Auckland Background Levels (non-volcanic) [3]	Ridge Road managed fill accpetance criteria [9]	Maximum	Metals (10), PAH and TPH	Metals (10), PAH, TPH, OCP, ONOP and Asbestos	Metals (10), PAH, TPH and OCP	Metals (10), TPH, OCP, Asbestos, SVOC and PFAS	Metals (10), TPH, Asbestos and SVOC
Laboratory ID						21-20712-2	21-22644-1/ 21-22655-1	21-22644-2	21-24630-1/ 21-24627-1	21-24630-2/ 21-24627-2
PID screening (field PPM)						0.1	0.6	3.3	1.3	0.9
pH screening (field)						-	-	-	-	-
Asbestos as ACM (w/w%)	0.05%	-	ND	1% w/w (AF/FA)	Asbestos NOT detected.	-	Asbestos NOT detected.	-	Asbestos NOT detected.	Asbestos NOT detected.
Asbestos Fibres/Fines (w/w%)	0.001%									
Metals										
Arsenic	70	100	**12**	70	10	2.1	10	3.9	1.8	2.2
Beryllium	220000 [4]	-	-	-	0.64	0.19	0.3	0.15	0.23	0.18
Boron	>10,000	-	**45**	-	4.1	2.2	4.1	2.4	2.1	1.7
Cadmium	1300	7.5	**0.65**	7.5	0.38	0.048	0.19	0.048	0.048	0.045
Chromium	6300	400	**55**	400	23.2	11	23.2	16.4	8.9	8.8
Copper	>10,000	325	**45**	325	26.9	12.2	18.4	16.6	7.2	8.83
Lead	3300	250	**65**	250	24.7	8.94	24.7	19.1	9.17	15.3
Mercury	4200	0.75	**0.45**	0.75	0.21	0.086	0.17	0.18	0.08	0.087
Nickel	6000 [6]	105	**35**	320	16.5	6.02	13.4	13.8	6.71	6.23
Zinc	400000 [6]	400	**180**	400	50.4	24	50.4	20.1	16	23.1
OCPs						-	<LOR	<LOR	<LOR	-
4,4'-DDE	-	-	**<LOR**	-	**0.0076**	-	<0.0050	<0.0050	<0.005	-
TPHs						<LOR	<LOR	<LOR	<LOR	<LOR
C15-C36	NL [7]	NL [8]	**<LOR**	5600	**107**	**107**	**55**	<25	**37**	**29**
C7-C36 (Total)	-	-	**<LOR**	-	**107**	**107**	**55**	<50	<50	<50
PAHS						<LOR	<LOR	<LOR	<LOR	<LOR
ONOPS						-	<LOR	-	-	-
PFAS						-	-	-	<LOR	-
SVOC						-	-	-	<LOR	<LOR

Notes:
All values in mg/kg unless otherwise indicated
'-' indicates not analysed or no relevant assessment criteria
<LOR = less than the laboratory limit of reporting
Asbestos NOT detected = asbestos not identified to be present by the laboratory method.
NL = Not limiting (i.e. >20,000 mg/kg)

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2 - Auckland Unitary Plan: Operative in Part Version (AUP). Permitted Activity Soil Criteria Table E30.6.1.4.1 (unless otherwise stated).
3 - Auckland Regional Council, Technical Publication 153, October 2001. Background concentrations of inorganic elements in soils from the Auckland Region: non-volcanic soils.
4 - USEPA Regional Screening Levels - Summary Table TR=1E-06, HQ=1 (https://www.epa.gov/risk/regional-screening-levels-rsls-generic-tables)
5 - Canadian Environmental Quality Guidelines (CCME, 2002) (http://st-ts.ccme.ca/)
6 - Assessment of Site Contamination National Environment Protection Measures (ASC NEPM) Toolbox – http://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox.
7 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Module 4 Tier 1 Soil acceptance criteria - Silty Clay - Surface (<1 m)
8 - MfE 1999. Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Revised 2011. Soil acceptance criteria for protection of groundwater quality, Surface (<1 m) Silty Clay, GW 4 m
9 - Ridge Road Managed Fill Acceptance Criteria

Table E7: Summary table of analytical results of deep soil testing for Whenuapai Package 2

						Main Tunnel - pH testing and testing of natural soils					Main Tunnel - pH testing and testing of natural soils				
Sample Name						WSL-21-BH101	WSL-21-BH101	WSL-21-BH104	WSL-21-BH106	WSL-21-BH110	WSL-21-BH112	WSL-21-BH116	WSL-21-BH118	WSL-21-BH120	WSL-21-BH121
Sample Date						-	7/04/2021	3/06/2021	14/06/2021	23/06/2021	18/06/2021	09/11/2021	10/06/2021	10/05/2021	4/05/2021
QC Type						Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Depth	**NES Commercial / Industrial** [1]	**AUP Permitted Activity Criteria** [2]	**Published Auckland Background Levels (non-volcanic)** [3]	**Ridge Road managed fill accpetance criteria** [7]	**Maximum**	10-10.4m	28-28.7m	12m	21m	20m	24m	13m	22m	20m	10m
Testing suite						Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite
Laboratory ID						21-16211-1	21-16211-1	21-25541-1	21-26998-2	21-31081-1	21-29124-2	21-47139-1	21-26998-4	21-31081-2	21-21579-1
PID screening (field PPM)						-	-	-	-	-	-	-	-	-	-
pH screening (field)						7	7	7	No reading taken	7	7	7	7	7	7
pH*	-	-	-	-	7.6	7.5	7.6	4.8	5.1	4.1	3.2	4.2	4.4	3.9	3.9
Chloride*	-	-	-	-	20.4	9.8	3.8	3.4	<3.0	10.9	5.5	<3.0	3.8	6.1	<3
Sulfate-S*	-	-	-	-	107.4	67.5	78.8	9.1	25.5	29.2	<3.0	2,588.0	11.2	107.4	16.4
Arsenic	70	100	**12**	70	5.7	5.3	5.7	0.3	1.4	1.9	<0.13	5.8	2	4.1	2.8
Barium	2000 [5]	-	**350**	-	**939**	138	**357**	41.7	**729**	117	41.1	315	275	101	109
Beryllium	220000 [4]	-	-	-	1.87	0.3	0.44	0.62	0.31	0.88	0.74	0.37	0.32	0.46	0.59
Boron	>10,000	-	**45**	-	5.8	3.7	5.5	2.2	2	2.2	1.9	3.5	2.8	2	2.6
Cadmium	1300	7.5	**0.65**	7.5	0.14	0.033	0.073	0.015	0.054	0.047	<0.0050	0.17	0.044	0.015	0.048
Chromium	6300	400	**55**	400	24.4	24.3	20.1	14.2	17.2	14	12	17.5	14.9	13.1	13.1
Cobalt	350 [4]	-	**35**	-	20.3	8.32	9.88	0.71	9.41	13.2	2.1	21.7	6.22	10.5	8.05
Copper	>10,000	325	**45**	325	32.6	13.1	22.1	32.6	14.1	16.9	11.0	17.6	12.5	13.4	18.5
Lead	3300	250	**65**	250	14	4.8	8.99	6.19	4.3	4.7	4.5	5.0	4.6	6.37	5.88
Manganese	26000 [4]	-	**2500**	-	1070	180	423	23.8	146	96.3	55	192	777	100	99.9
Mercury	4,200	1	**0.45**	-	0.42	0.032	0.05	0.032	<0.025	<0.025	<0.025	0.061	<0.025	0.028	0.044
Nickel	6000 [6]	105	**35**	320	**37.9**	15.9	19.4	1.6	15.9	21.9	4.4	**36.5**	11.2	19.7	14.9
Selenium	5800 [4]	-	-	-	2.4	0.88	1.5	1.2	0.41	0.72	2.1	0.79	0.42	0.65	0.88
Tin	700000 [4]	-	**4**	-	2.2	0.43	0.57	0.43	0.39	0.65	0.33	0.38	0.32	0.43	0.46
Vanadium	5800 [4]	-	**160**	-	60.9	44.4	49	34.6	56.4	24.7	23.7	36.2	26.2	17.1	17.8
Zinc	400000 [5]	400	**180**	400	91.1	40.2	55.6	13.7	34.8	50.6	23.5	79.6	38.3	22.5	54
Sulfur*	6000000 [4]	-	**2300**	-	**4100**	1800	**3300**	<250	1,700	1,200	<250	**18,000**	1,500	**2,900**	1900
Fluoride*	47000 [4]	-	-	-	280	170	230	110	99.0	100	120	170	170	110	130
Total Organic Carbon	-	-	**0.6-14%**	-	**26.1**	12.1	0.99	0.13	0.23	0.22	<0.10	1.3	0.58	0.25	0.23
Allophane Indicator*	-	-	-	-	Moderate	Very Weak	Moderate	Weak	Moderate	Very Weak	Very Weak	Non - Reactive	Moderate	Non - Reactive	Non- Reactive

Notes:
All values in mg/kg unless otherwise indicated
'-' indicates not analysed or no relevant assessment criteria
<LOR = less than the laboratory limit of reporting

Red vaues indicate that the results exceed NES Soil criteria: commercial/ industrial criteria
Underlined values indicates that the results exceed the AUP Permitted Activity Criteria
Bold values indicate that results exceed the public background concentrations for non-volcanic soils in the Auckland Region
Shaded values indicate that the results exceed typical managed fill criteria

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7 - Ridge Road Quarry Managed Fill Acceptance Criteria

Table E7: Summary table of analytical results of deep soil testing for Whenuapai Package 2

						Main Tunnel - pH testing and testing of natural soils						Main Tunnel - pH testing and testing of natural soils		
Sample Name						WSL-21-BH121	WSL-21-BH125	WSL-21-BH126	WSL-21-BH130	WSL-21-BH131	WSL-21-BH132	WSL-21-BH132	WSL-21-BH133	WSL-21-BH133
Sample Date						5/05/2021	20/10/21	20/10/21	1/06/2021	27/05/2021	25/05/2021	25/05/2021	31/05/2021	31/05/2021
QC Type						Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Depth	**NES Commercial / Industrial [1]**	**AUP Permitted Activity Criteria [2]**	**Published Auckland Background Levels (non-volcanic) [3]**	**Ridge Road managed fill accpetance criteria [7]**	**Maximum**	25m	23m	17m	16m	10m	10m	15m	10m	15m
Testing suite						Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite
Laboratory ID						21-21579-1	21-45159-2	21-45159-3	21-25082-2	not collected yet	21-24443-1	21-24443-2	21-25085-1	21-25085-2
PID screening (field PPM)						-	-	-	-	-	-	-	-	-
pH screening (field)						7	7	7	7	7	7	7	7	7
pH*	-	-	-	-	7.6	5.9	3.8	4	3.7	4.3	4.8	4.3	4.3	3.8
Chloride*	-	-	-	-	20.4	14.5	5.3	19.1	<3.0	14.6	16.6	5.3	11.1	5.4
Sulfate-S*	-	-	-	-	107.4	34.5	6.7	<3.0	16.3	12.1	3.5	<3.1	4.3	<3
Arsenic	70	100	**12**	70	5.7	2.8	2.4	0.54	2.4	0.77	0.98	0.39	1.3	0.36
Barium	2000 [5]	-	**350**	-	**939**	**427**	90.4	31.9	30.1	206	181	40.2	124	52.5
Beryllium	220000 [4]	-	**-**	-	1.87	0.43	1.87	0.3	0.48	0.62	0.95	0.28	0.8	0.17
Boron	>10,000	-	**45**	-	5.8	5.8	3	1.5	2.3	1.5	2.9	<1.25	1.6	<1.25
Cadmium	1300	7.5	**0.65**	7.5	0.14	0.048	0.022	<0.0050	0.091	0.039	0.038	0.011	0.14	0.016
Chromium	6300	400	**55**	400	24.4	20.8	13.2	13.3	7.1	7.6	12	18.8	6.1	16.4
Cobalt	350 [4]	-	**35**	-	20.3	10	8.59	0.88	7.64	0.89	1.8	0.37	0.55	0.4
Copper	>10,000	325	**45**	325	32.6	17.9	31.1	19.8	11.7	6.7	2.8	5.3	1.4	6.3
Lead	3300	250	**65**	250	14	5.56	7.2	4.7	5	8.97	4.3	10.2	12.3	14
Manganese	26000 [4]	-	**2500**	-	1070	395	108	5.5	61.6	64.4	117	49.8	47.5	47.3
Mercury	4,200	1	**0.45**	-	0.42	0.037	0.036	<0.025	0.025	0.42	0.15	0.28	0.14	0.19
Nickel	6000 [6]	105	**35**	320	**37.9**	16.9	15	1.9	11.8	4.4	2.1	1.8	1.6	1.4
Selenium	5800 [4]	-	**-**	-	2.4	0.65	1.3	0.66	0.69	2.4	1.6	0.66	1.3	0.47
Tin	700000 [4]	-	**4**	-	2.2	0.56	0.62	0.44	0.28	1.8	0.71	0.76	1.5	0.82
Vanadium	5800 [4]	-	**160**	-	60.9	35.1	37.4	27.9	11	8.9	15.1	58.9	10	60.9
Zinc	400000 [5]	400	**180**	400	91.1	52.6	46.6	21.1	91.1	7.47	4.2	21.4	9.44	47.7
Sulfur*	6000000 [4]	-	**2300**	-	**4100**	1600	**3,800**	<250	1,800	1700	**4100**	<250	720	<250
Fluoride*	47000 [4]	-	**-**	-	280	250	210	130	99	140	75	120	170	130
Total Organic Carbon	-	-	**0.6-14%**	-	**26.1**	0.23	0.48	<0.10	0.21	12	**26.1**	0.71	9.1	0.49
Allophane Indicator*	-	-	-	-	Moderate	Non- Reactive	Very Weak	Very Weak	Non - Reactive	Non - Reactive	Non - Reactive	Non - Reactive	Non - Reactive	Non - Reactive

Notes:
All values in mg/kg unless otherwise indicated
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Shaded values indicate that the results exceed typical managed fill criteria

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7 - Ridge Road Quarry Managed Fill Acceptance Criteria

Table E7: Summary table of analytical results of deep soil testing for Whenuapai Package 2

						Massey Connector - pH testing and testing of natural soils					Massey Connector - pH testing and testing of natural soils			
Sample Name						WSL-21-BH201	WSL-21-BH202	WSL-21-BH202	WSL-21-BH203	WSL-21-BH204	WSL-21-BH204	WSL-21-BH205	WSL-21-BH206	WSL-21-BH206
Sample Date						30/03/2021	30/03/2021	30/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021
QC Type						Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Depth	**NES Commercial / Industrial [1]**	**AUP Permitted Activity Criteria [2]**	**Published Auckland Background Levels (non-volcanic) [3]**	**Ridge Road managed fill accpetance criteria [7]**	**Maximum**	4-4.2m	14-14.2m	32-32.2m	25-25.2m	26-26.2m	36-36.2	22-22.2m	16-16.2m	24-24.2m
Testing suite						Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite	Full suite
Laboratory ID						21-14934-1	21-14934-2	21-14934-3	21-12125-1	21-12125-2	21-12125-3	21-12125-4	21-12125-5	21-12125-6
PID screening (field PPM)						-	-	-	-	-	-	-	-	-
pH screening (field)						7	7	7	7	7	7	7	7	7
pH*	-	-	-	-	7.6	4.1	4.1	5.2	5.9	6.2	7	4.4	4.1	5.5
Chloride*	-	-	-	-	20.4	8.7	4.5	20.4	6.1	3.3	4.9	<3	<3	<3.1
Sulfate-S*	-	-	-	-	107.4	<3.0	21.8	25.1	18.4	64.6	106.1	34	16	83.4
Arsenic	70	100	**12**	70	5.7	0.95	2.5	2.5	2.6	4.7	2.6	2.5	2.2	2.2
Barium	2000 [5]	-	**350**	-	**939**	29	**939**	266	**736**	117	211	133	**671**	**534**
Beryllium	220000 [4]	-	-	-	1.87	0.2	0.4	0.5	0.45	0.47	0.36	1.2	0.41	0.31
Boron	>10,000	-	**45**	-	5.8	4.5	5.7	5.5	4.8	4.4	3.9	2.8	3	2.9
Cadmium	1300	7.5	**0.65**	7.5	0.14	<0.0050	0.056	0.061	0.058	0.064	0.055	0.048	0.038	0.051
Chromium	6300	400	**55**	400	24.4	7.7	12.8	16.3	16	19.2	24.4	15.5	14.1	15.2
Cobalt	350 [4]	-	**35**	-	20.3	0.24	10.2	8.25	13.6	11	9.14	20.3	11.4	8.6
Copper	>10,000	325	**45**	325	32.6	8.96	15.9	24	26.9	32.5	19.9	20.5	16.4	18.5
Lead	3300	250	**65**	250	14	7.43	5.2	7.03	6.21	8.17	5.05	4.9	4.5	4.4
Manganese	26000 [4]	-	**2500**	-	1070	9.1	459	171	1070	186	493	132	294	1060
Mercury	4,200	1	**0.45**	-	0.42	<0.025	0.027	0.028	0.034	0.05	0.03	<0.025	<0.025	<0.025
Nickel	6000 [6]	105	**35**	320	**37.9**	0.8	15.9	14.8	21.9	19.7	16.3	**37.9**	19.2	14.7
Selenium	5800 [4]	-	-	-	2.4	<0.25	0.72	1.1	1.1	1.1	0.94	1.6	0.95	0.83
Tin	700000 [4]	-	**4**	-	2.2	2.2	0.75	0.68	0.48	0.53	0.4	0.41	0.33	0.33
Vanadium	5800 [4]	-	**160**	-	60.9	15.3	25.9	31.6	33.4	38.8	51	26.2	25.3	33.9
Zinc	400000 [5]	400	**180**	400	91.1	4.8	50.5	54.5	60.6	67.4	46.7	52.2	55.2	47.4
Sulfur*	6000000 [4]	-	**2300**	-	**4100**	<250	1400	1700	2100	**2700**	**3800**	1400	1600	1300
Fluoride*	47000 [4]	-	-	-	280	98	150	280	210	260	190	120	140	230
Total Organic Carbon	-	-	**0.6-14%**	-	**26.1**	0.08	0.19	0.27	0.26	0.36	0.14	0.15	0.14	0.29
Allophane Indicator*	-	-	-	-	Moderate	Very Weak	Non - Reactive	Non - Reactive	Non - Reactive	Non - Reactive	Moderate	Non - Reactive	Non - Reactive	Non - Reactive

Notes:
All values in mg/kg unless otherwise indicated
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Table E.8: TLCP Leachate Analysis

Sample Name	Maximum	Comp 1 (WSL-21-BH101-10-10.4, WSL-21-BH101-28-28.7)	Comp 1 (WSL-21-BH121-10m, WSL-21-BH121-25m)	Composite 1 (WSL-21-BH132-10m, WSL-21-BH132-15m)	Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)	Comp 2 (WSL-21-BH202-14-14.2, WSL-21-BH202-32-32.2)	Comp 3 (WSL-21-BH206-16-16.2, WSL-21-BH206-24-24.2)
Laboratory ID		21-18779-7	21-21579-3	21-24443-5	21-25085-3	21-18779-8	21-18779-9
Arsenic	<LOR	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Berylium	0.0002	-	-	0.0001	0.0002	-	-
Boron	1.4	-	-	1.4	1.3	-	-
Cadmium	<LOR	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Chromium	<LOR	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Copper	0.08	<0.05	<0.05	<0.05	<0.05	0.08	0.06
Lead	0.088	<0.010	0.033	0.088	0.018	0.013	<0.010
Mercury	<LOR	-	-	<0.001	<0.001	-	-
Nickel	0.078	0.078	0.019	0.025	<0.002	0.056	0.075
Zinc	3.6	<0.4	<0.4	3.6	2.1	<0.4	<0.4
Initial pH	5	5	5	4.9	4.9	5	5
Final pH	6.7	6.7	5	5	5	4.9	4.9

Table E.9: Summary table of groundwater testing Whenuapai Package 2

				14		16		10	12		17	
Sample Name	ANZECC Guidelines for the Protection of 95% of Freshwater Species [1]	**Background groundwater concentrations - Waitemata Bores [2]**	Maximum	BH122 Deep A	BH122 Shallow A	BH127 Deep B	BH127 Shallow A	BH110 A	BH115 shallow A	BH115 deep A	BH132 shallow A	BH132 deep A
Depth to groundwater (mbgl)				6.166	3.844	7.214	5.832	7.76	3.464	3.078	3.524	6.273
Screen depth (top-bottom)				11-15m	5-9m	21-24m	6.7-9.7m	21-27m	5-8m	16-19m	4-7m	13-16m
Soil profile				Fill material to 2.80m, Tauranga Group to 8.85m, East Coast Bays 8.85-30m		Fill material to 1.5m, Tauranga Group to 21.4m, East Coast Bays 21.4-25.5m		Fill material to 3.45m, Tauranga Group to 17.52m, East Coast Bays from 17.52-33m	Fill material to 3.0m, Tauranga Group to 9.4m, East Coast Bays from 9.4-19.5m		Fill material to 0.6m, Tauranga Group to 23.70m, East Coast Bays 23.70-33.13m	
Sample Date				8/07/2021	09/07/2021	8/07/2021	09/07/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021
QC Type				Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular	Regular
Testing suite				Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC	Metal, TPH, SVOC
Laboratory ID				21-30964	21-30964	21-30964	21-30964	21-48482-1	21-48482-5	21-48482-3	21-48482-7	21-48482-9
Metals												
Dissolved Arsenic	0.013	**0.0101**	0.0046	0.0013	0.0043	0.00085	0.0012	<0.00050	0.00059	<0.00050	0.0046	0.002
Dissolved Cadmium	0.0002	-	0.0002	<0.00002	0.0002	0.000021	0.000022	<0.000020	0.000083	<0.000020	0.000025	<0.000020
Dissolved Chromium	0.001	**<0.0005**	**0.0042**	**0.0011**	**0.0042**	<0.0002	<0.0002	<0.00020	0.00028	<0.00020	**0.0014**	**0.0009**
Dissolved Copper	0.0014	**0.001**	**0.011**	0.00024	**0.011**	<0.0002	<0.0002	<0.00020	**0.0047**	0.00058	**0.0087**	0.00061
Dissolved Lead	0.0034	**0.0008**	**0.0022**	<0.00005	**0.0017**	0.000055	<0.00005	<0.000050	<0.000050	<0.000050	**0.0022**	0.00029
Dissolved Mercury	0.0006	-	<LOR	<0.00008	<0.00008	<0.00008	<0.00008	<0.000080	<0.000080	<0.000080	<0.000080	<0.000080
Dissolved Nickel	0.011	**0.03**	**0.0415**	0.0018	**0.0415**	0.0053	0.0051	0.0046	0.011	0.0011	0.0075	0.0027
Dissolved Zinc	0.008	**0.055**	**0.351**	0.016	**0.351**	0.011	0.031	0.021	**0.134**	0.022	**0.066**	0.0047
Total Petroleum Hydrocarbons (TPH)			<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
Semi-volatile organic compounds (SVOC)			<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR	<LOR
4-Methylphenol	-	-	**0.001**	<0.0003	**0.001**	<0.0003	<0.0003	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Butyl benzyl phthalate	-	-	**0.0012**	<0.001	**0.0012**	<0.001	<0.001	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Benzyl alcohol	-	-	**0.0016**	<0.0003	**0.0016**	<0.0003	**0.00043**	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

Notes:

All concentrations in g/m^3 (ppm)

ID = Insufficent data to derive a reliable trigger value.

Red values indicate results above the ANZECC Guidelines for the Protection of 95% of Freshwater Species

Bold values indicate results above background groundwater concentrations

Shaded values indicate results above both background concnetrations and ANZECC 95% Freshwater trigger values

1 - ANZG 2000, Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. Available at www.waterquality.gov.au/anz-guidelines

2 - Auckland Regional Council (2007). State of the Environment Monitoring: Groundwater Quality Data Report 1998-2005. ARC Technical Publication 352. Auckland. 86 Pages

Appendix F Laboratory Transcripts

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
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Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-20712
Submitted by: Rebecca van der Krogt
Date Received: 07/05/2021
Testing Initiated: 7/05/2021
Date Completed: 12/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

			Client Sample ID	BH121-0.0m	BH121-0.5m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-20712-1	21-20712-2
Arsenic	mg/kg dry wt	*0.125*		3.3	2.1
Beryllium	mg/kg dry wt	*0.013*		0.32	0.19
Boron	mg/kg dry wt	*1.25*		1.9	2.2
Cadmium	mg/kg dry wt	*0.005*		0.047	0.048
Chromium	mg/kg dry wt	*0.125*		13.3	11
Copper	mg/kg dry wt	*0.075*		26.9	12.2
Lead	mg/kg dry wt	*0.25*		9.87	8.94
Mercury	mg/kg dry wt	*0.025*		0.086	0.086
Nickel	mg/kg dry wt	*0.05*		12.2	6.02
Zinc	mg/kg dry wt	*0.05*		29.4	24.0

Organochlorine Pesticides - Soil

			Client Sample ID	BH121-0.0m
			Date Sampled	
Analyte	Unit	*Reporting Limit*		21-20712-1
2,4'-DDD	mg/kg dry wt	*0.005*		<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*		<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*		<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*		<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*		<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*		<0.0050

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
This test report shall not be reproduced except in full, without the written permission of Analytica Laboratories.

Organochlorine Pesticides - Soil

			Client Sample ID	BH121-0.0m
			Date Sampled	
Total DDT	mg/kg dry wt	*0.02*	<0.020	
alpha-BHC	mg/kg dry wt	*0.005*	<0.0050	
Aldrin	mg/kg dry wt	*0.005*	<0.0050	
beta-BHC	mg/kg dry wt	*0.005*	<0.0050	
cis-Chlordane	mg/kg dry wt	*0.005*	<0.0050	
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.010	
delta-BHC	mg/kg dry wt	*0.005*	<0.0050	
Dieldrin	mg/kg dry wt	*0.05*	<0.050	
Endosulfan I	mg/kg dry wt	*0.005*	<0.0050	
Endosulfan II	mg/kg dry wt	*0.01*	<0.010	
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.0050	
Endrin	mg/kg dry wt	*0.05*	<0.050	
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.010	
Endrin ketone	mg/kg dry wt	*0.005*	<0.0050	
gamma-BHC	mg/kg dry wt	*0.005*	<0.0050	
Heptachlor	mg/kg dry wt	*0.005*	<0.0050	
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.0050	
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.0050	
Methoxychlor	mg/kg dry wt	*0.01*	<0.010	
trans-nonachlor	mg/kg dry wt	*0.01*	<0.010	
trans-Chlordane	mg/kg dry wt	*0.01*	<0.010	
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	
TCMX (Surrogate)	%	*1*	120	

Polycyclic Aromatic Hydrocarbons - Soil

		Client Sample ID	BH121-0.0m	BH121-0.5m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-20712-1	21-20712-2
1-Methylnaphthalene	mg/kg dry wt	*0.01*	<0.010	<0.010
2-Methylnaphthalene	mg/kg dry wt	*0.01*	<0.010	<0.010
Acenaphthene	mg/kg dry wt	*0.01*	<0.010	<0.010
Acenaphthylene	mg/kg dry wt	*0.01*	<0.010	<0.010
Anthracene	mg/kg dry wt	*0.01*	<0.010	<0.010
Benz[a]anthracene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[a]pyrene	mg/kg dry wt	*0.01*	<0.010	<0.010
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*	<0.010	<0.010
Chrysene	mg/kg dry wt	*0.01*	<0.010	<0.010
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*	<0.010	<0.010
Fluoranthene	mg/kg dry wt	*0.02*	<0.020	<0.020
Fluorene	mg/kg dry wt	*0.01*	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*	<0.010	<0.010
Naphthalene	mg/kg dry wt	*0.01*	<0.010	<0.010
Phenanthrene	mg/kg dry wt	*0.01*	<0.010	<0.010
Pyrene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*	0.030	0.030
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*	<0.010	<0.010
Anthracene-d10 (Surrogate)	%	*1*	87	86

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Total Petroleum Hydrocarbons - Soil

			Client Sample ID	BH121-0.0m	BH121-0.5m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-20712-1	21-20712-2
C7-C9	mg/kg dry wt	*10*		<10	<10
C10-C14	mg/kg dry wt	*15*		<15	<15
C15-C36	mg/kg dry wt	*25*		56	107
C7-C36 (Total)	mg/kg dry wt	*50*		56	107

Moisture Content

		Client Sample ID	BH121-0.0m	BH121-0.5m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-20712-1	21-20712-2
Moisture Content	%	*1*	22	21

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

OCP in Soil Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).

Total DDT Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

PAH in Soil Solvent extraction, silica cleanup, followed by GC-MS analysis.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).

TPH in Soil Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).

Moisture Moisture content is determined gravimetrically by drying at 103 °C.

Emily Hanna, B.Sc.
Trace Elements Team Leader

Rong Zhang
Technician

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Senior Technologist

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
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Attention: Lucy Hine
Phone: 027 304 0134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-31541
Submitted by: Rebecca van der Krogt
Date Received: 16/07/2021
Testing Initiated: 19/07/2021
Date Completed: 20/07/2021
Order Number:
Reference: 1015174

Sampling Site:
Description of Work: 1015174 Rebook 21-20712

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Asbestos in Soil (Qualitative)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
21-31541-1	BH121- 0.0m		Soil		20/07/2021

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled.

Laboratory ID	Client Sample ID	Fibre Types	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
	Units			
21-31541-1	BH121- 0.0m	Asbestos NOT Detected. Organic Fibres	Absent	Absent

Information in the above table supplied by the client: Client Sample ID.

Asbestos in Soil (Qualitative) Approver:

Cyrus Chao, B.Sc.
Technician

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Method Summary

Asbestos Fibres in Soil (Qualitative)	Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with AS4964-2004 Method for the qualitative identification of asbestos in bulk samples. Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques. Note 2: Trace asbestos is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present. Note 3: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised. Note 4: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
Auckland

Attention: Rebecca Van der Krogt
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-22644
Submitted by: Rebecca van der Krogt
Date Received: 19/05/2021
Testing Initiated: 19/05/2021
Date Completed: 26/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

			Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-22644-1	21-22644-2	21-22644-3
Arsenic	mg/kg dry wt	*0.125*		10	3.9	6.7
Beryllium	mg/kg dry wt	*0.013*		0.30	0.15	0.24
Boron	mg/kg dry wt	*1.25*		4.1	2.4	3.5
Cadmium	mg/kg dry wt	*0.005*		0.19	0.048	0.12
Chromium	mg/kg dry wt	*0.125*		23.2	16.4	16.0
Copper	mg/kg dry wt	*0.075*		18.4	16.6	17.9
Lead	mg/kg dry wt	*0.25*		24.7	19.1	22.5
Mercury	mg/kg dry wt	*0.025*		0.17	0.18	0.16
Nickel	mg/kg dry wt	*0.05*		13.4	13.8	13.1
Zinc	mg/kg dry wt	*0.05*		50.4	20.1	42.4

Organochlorine Pesticides - Soil

			Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-22644-1	21-22644-2	21-22644-3
2,4'-DDD	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*		<0.0030	<0.0030	<0.0030

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Organochlorine Pesticides - Soil

			Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
			Date Sampled			
4,4'-DDE	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*		82	88	90

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-22644-1	21-22644-2	21-22644-3
1-Methylnaphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
2-Methylnaphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Acenaphthene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Acenaphthylene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Anthracene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Benz[a]anthracene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
Benzo[a]pyrene	mg/kg dry wt	*0.01*		<0.010	<0.010	0.011
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Chrysene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Fluoranthene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
Fluorene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Naphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Phenanthrene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010
Pyrene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*		0.030	0.030	0.030

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Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
			Date Sampled			
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*		<0.010	<0.010	0.010
Anthracene-d10 (Surrogate)	%	*1*		110	110	110

Total Petroleum Hydrocarbons - Soil

			Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-22644-1	21-22644-2	21-22644-3
C7-C9	mg/kg dry wt	*10*		<10	<10	<10
C10-C14	mg/kg dry wt	*15*		<15	<15	<15
C15-C36	mg/kg dry wt	*25*		55	<25	<25
C7-C36 (Total)	mg/kg dry wt	*50*		55	<50	<50

ONOPs in Soil

			Client Sample ID	WSL-21-BH128-0.0m	Duplicate 6
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-22644-1	21-22644-3
3-Hydroxycarbofuran	mg/kg dry wt	*0.05*		<0.050	<0.050
Acephate	mg/kg dry wt	*0.05*		<0.050	<0.050
Acetochlor	mg/kg dry wt	*0.05*		<0.050	<0.050
Alachlor	mg/kg dry wt	*0.05*		<0.050	<0.050
Aldicarb	mg/kg dry wt	*0.05*		<0.050	<0.050
Aldicarb sulfone	mg/kg dry wt	*0.05*		<0.050	<0.050
Aldicarb sulfoxide	mg/kg dry wt	*0.05*		<0.050	<0.050
Ametryn	mg/kg dry wt	*0.05*		<0.050	<0.050
Atrazine	mg/kg dry wt	*0.05*		<0.050	<0.050
Atrazine-desethyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Atrazine-desisopropyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Avermectin B1a	mg/kg dry wt	*0.05*		<0.050	<0.050
Azaconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Azinphos-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Azoxystrobin	mg/kg dry wt	*0.05*		<0.050	<0.050
Benalaxyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Bendiocarb	mg/kg dry wt	*0.05*		<0.050	<0.050
Bitertanol	mg/kg dry wt	*0.05*		<0.050	<0.050
Bromacil	mg/kg dry wt	*0.05*		<0.050	<0.050
Bupirimate	mg/kg dry wt	*0.05*		<0.050	<0.050
Buprofezin	mg/kg dry wt	*0.05*		<0.050	<0.050
Butachlor	mg/kg dry wt	*0.05*		<0.050	<0.050
Carbaryl	mg/kg dry wt	*0.05*		<0.050	<0.050
Carbendazim	mg/kg dry wt	*0.05*		<0.050	<0.050
Carbofuran	mg/kg dry wt	*0.05*		<0.050	<0.050
Chlorfluazuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Chlorpyrifos	mg/kg dry wt	*0.05*		<0.050	<0.050
Chlorpyriphos-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Chlorotoluron	mg/kg dry wt	*0.05*		<0.050	<0.050
Cyanazine	mg/kg dry wt	*0.05*		<0.050	<0.050

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ONOPs in Soil

			Client Sample ID	WSL-21-BH128-0.0m	Duplicate 6
			Date Sampled		
Cyfluthrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Cyhalothrin (lambda)	mg/kg dry wt	*0.05*		<0.050	<0.050
Cypermethrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Cyproconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Cyprodinil	mg/kg dry wt	*0.05*		<0.050	<0.050
Deltamethrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Diazinon	mg/kg dry wt	*0.05*		<0.050	<0.050
Dichlofluanid	mg/kg dry wt	*0.05*		<0.050	<0.050
Dichlorvos	mg/kg dry wt	*0.05*		<0.050	<0.050
Difenoconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Dimethoate	mg/kg dry wt	*0.05*		<0.050	<0.050
Diuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Emamectin B1a	mg/kg dry wt	*0.05*		<0.050	<0.050
Fenarimol	mg/kg dry wt	*0.05*		<0.050	<0.050
Fenpropimorph	mg/kg dry wt	*0.05*		<0.050	<0.050
Fenpyroximate	mg/kg dry wt	*0.05*		<0.050	<0.050
Fenvalerate	mg/kg dry wt	*0.05*		<0.050	<0.050
Fluazifop-butyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Fluometuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Flusilazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Fluvalinate (tau)	mg/kg dry wt	*0.05*		<0.050	<0.050
Furalaxyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Haloxyfop-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Hexaconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Hexazinone	mg/kg dry wt	*0.05*		<0.050	<0.050
Imazalil	mg/kg dry wt	*0.05*		<0.050	<0.050
Imidacloprid	mg/kg dry wt	*0.05*		<0.050	<0.050
Indoxacarb	mg/kg dry wt	*0.05*		<0.050	<0.050
IPBC	mg/kg dry wt	*0.05*		<0.050	<0.050
Iprodione	mg/kg dry wt	*0.05*		<0.050	<0.050
Kresoxim-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Linuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Lufenuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Malathion	mg/kg dry wt	*0.05*		<0.050	<0.050
Metalaxyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Methamidophos	mg/kg dry wt	*0.05*		<0.050	<0.050
Methiocarb	mg/kg dry wt	*0.05*		<0.050	<0.050
Methomyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Metolachlor	mg/kg dry wt	*0.05*		<0.050	<0.050
Metribuzin	mg/kg dry wt	*0.05*		<0.050	<0.050
Mevinphos	mg/kg dry wt	*0.05*		<0.050	<0.050
Molinate	mg/kg dry wt	*0.05*		<0.050	<0.050
Monocrotophos	mg/kg dry wt	*0.05*		<0.050	<0.050
Myclobutanil	mg/kg dry wt	*0.05*		<0.050	<0.050
Naled	mg/kg dry wt	*0.05*		<0.050	<0.050
Norfluazuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Omethoate	mg/kg dry wt	*0.05*		<0.050	<0.050
Oxyflurofen	mg/kg dry wt	*0.05*		<0.050	<0.050
Paclobutrazol	mg/kg dry wt	*0.05*		<0.050	<0.050
Parathion-ethyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Pendimethalin	mg/kg dry wt	*0.05*		<0.050	<0.050
Permethrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Pirimicarb	mg/kg dry wt	*0.05*		<0.050	<0.050

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ONOPs in Soil

			Client Sample ID	WSL-21-BH128-0.0m	Duplicate 6
			Date Sampled		
Pirimiphos-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Prochloraz	mg/kg dry wt	*0.05*		<0.050	<0.050
Procymidone	mg/kg dry wt	*0.05*		<0.050	<0.050
Prometryn	mg/kg dry wt	*0.05*		<0.050	<0.050
Propachlor	mg/kg dry wt	*0.05*		<0.050	<0.050
Propanil	mg/kg dry wt	*0.05*		<0.050	<0.050
Propazine	mg/kg dry wt	*0.05*		<0.050	<0.050
Propiconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Pyrimethanil	mg/kg dry wt	*0.05*		<0.050	<0.050
Pyriproxyfen	mg/kg dry wt	*0.05*		<0.050	<0.050
Quizalofop-ethyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Simazine	mg/kg dry wt	*0.05*		<0.050	<0.050
Simetryn	mg/kg dry wt	*0.05*		<0.050	<0.050
Sulfentrazone	mg/kg dry wt	*0.05*		<0.050	<0.050
TCMTB	mg/kg dry wt	*0.05*		<0.050	<0.050
Tebuconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Terbufos	mg/kg dry wt	*0.05*		<0.050	<0.050
Terbumeton	mg/kg dry wt	*0.05*		<0.050	<0.050
Terbuthylazine	mg/kg dry wt	*0.05*		<0.050	<0.050
Terbuthylazine-desethyl	mg/kg dry wt	*0.05*		<0.050	<0.050
Terbutryn	mg/kg dry wt	*0.05*		<0.050	<0.050
Tetrachlorvinphos	mg/kg dry wt	*0.05*		<0.050	<0.050
Tetraconazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Thiabendazole	mg/kg dry wt	*0.05*		<0.050	<0.050
Thiacloprid	mg/kg dry wt	*0.05*		<0.050	<0.050
Thiobencarb	mg/kg dry wt	*0.05*		<0.050	<0.050
Tolylfluanid	mg/kg dry wt	*0.05*		<0.050	<0.050
Triazophos	mg/kg dry wt	*0.05*		<0.050	<0.050
Triflumuron	mg/kg dry wt	*0.05*		<0.050	<0.050
Triphenylphosphate (Surrogate)	%	*1*		86	90

Moisture Content

		Client Sample ID	WSL-21-BH128-0.0m	WSL-21-BH128-0.5m	Duplicate 6
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-22644-1	21-22644-2	21-22644-3
Moisture Content	%	*1*	33	21	33

Method Summary

Elements in Soil	Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.
OCP in Soil	Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).
Total DDT	Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

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Method Summary

PAH in Soil	Solvent extraction, silica cleanup, followed by GC-MS analysis. **Benzo[a]pyrene TEQ (LOR)**: The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH. **Benzo[a]pyrene TEQ (Zero)**: The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation. Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).
TPH in Soil	Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).
ONOPs in Soil	Fresh soil is extracted in acetonitrile and analysed by GC-MS/MS and LC-MS/MS. (In accordance with in-house procedure).
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

Sharelle Frank, B.Sc. (Tech)
Technologist

Yuri Zubenko, Ph.D.
Senior Technologist

Rong Zhang
Technician

Terry Cooney, Ph.D.
Signatory

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TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2616296 SPv1
Contact:	Rebecca van der Krogt C/- Tonkin & Taylor PO Box 5271 Auckland 1141	**Date Received:**	20-May-2021
		Date Reported:	27-May-2021
		Quote No:	80842
		Order No:	1015174
		Client Reference:	1015174
		Submitted By:	Rebecca van der Krogt

Sample Type: Soil

		Sample Name:	WSL-21-BH128 - 0.0m Split 17-May-2021				
		Lab Number:	2616296.1				
Individual Tests							
Dry Matter	g/100g as rcvd		72	-	-	-	-
Total Recoverable Beryllium	mg/kg dry wt		0.2	-	-	-	-
Total Recoverable Boron	mg/kg dry wt		< 20	-	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		6	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		0.11	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt		14	-	-	-	-
Total Recoverable Copper	mg/kg dry wt		16	-	-	-	-
Total Recoverable Lead	mg/kg dry wt		21	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt		0.17	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt		9	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt		33	-	-	-	-
Organochlorine Pesticides Screening in Soil							
Aldrin	mg/kg dry wt		< 0.014	-	-	-	-
alpha-BHC	mg/kg dry wt		< 0.014	-	-	-	-
beta-BHC	mg/kg dry wt		< 0.014	-	-	-	-
delta-BHC	mg/kg dry wt		< 0.014	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt		< 0.014	-	-	-	-
cis-Chlordane	mg/kg dry wt		< 0.014	-	-	-	-
trans-Chlordane	mg/kg dry wt		< 0.014	-	-	-	-
2,4'-DDD	mg/kg dry wt		< 0.014	-	-	-	-
4,4'-DDD	mg/kg dry wt		< 0.014	-	-	-	-
2,4'-DDE	mg/kg dry wt		< 0.014	-	-	-	-
4,4'-DDE	mg/kg dry wt		< 0.014	-	-	-	-
2,4'-DDT	mg/kg dry wt		< 0.014	-	-	-	-
4,4'-DDT	mg/kg dry wt		< 0.014	-	-	-	-
Total DDT Isomers	mg/kg dry wt		< 0.09	-	-	-	-
Dieldrin	mg/kg dry wt		< 0.014	-	-	-	-
Endosulfan I	mg/kg dry wt		< 0.014	-	-	-	-
Endosulfan II	mg/kg dry wt		< 0.014	-	-	-	-
Endosulfan sulphate	mg/kg dry wt		< 0.014	-	-	-	-
Endrin	mg/kg dry wt		< 0.014	-	-	-	-
Endrin aldehyde	mg/kg dry wt		< 0.014	-	-	-	-
Endrin ketone	mg/kg dry wt		< 0.014	-	-	-	-
Heptachlor	mg/kg dry wt		< 0.014	-	-	-	-
Heptachlor epoxide	mg/kg dry wt		< 0.014	-	-	-	-
Hexachlorobenzene	mg/kg dry wt		< 0.014	-	-	-	-

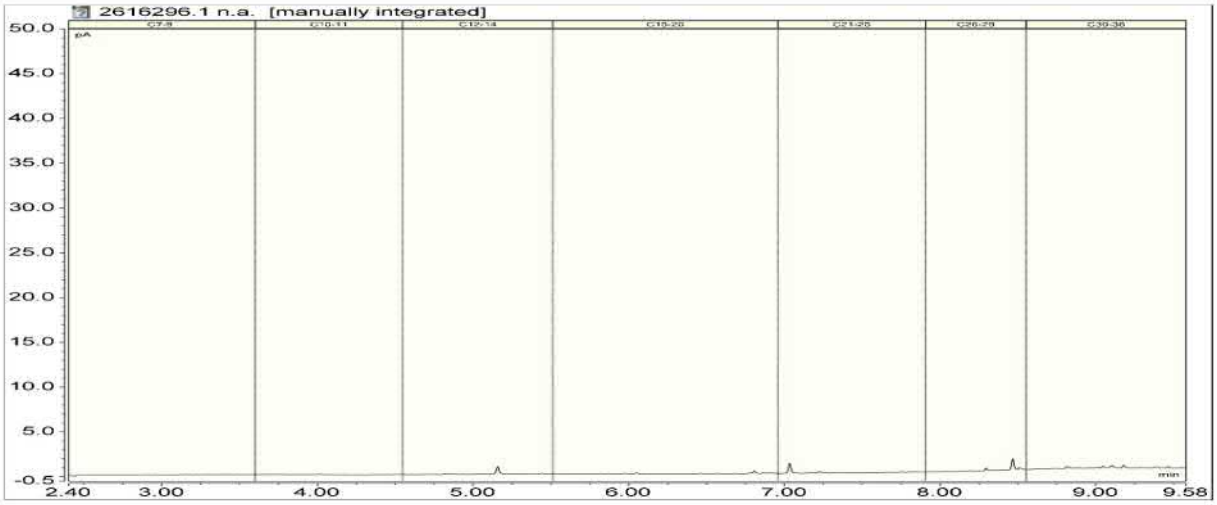
This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Sample Type: Soil						
Sample Name:		WSL-21-BH128 - 0.0m Split 17-May-2021				
Lab Number:		2616296.1				
Organochlorine Pesticides Screening in Soil						
Methoxychlor	mg/kg dry wt	< 0.014	-	-	-	-
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg dry wt	< 0.07	-	-	-	-
Alachlor	mg/kg dry wt	< 0.05	-	-	-	-
Atrazine	mg/kg dry wt	< 0.07	-	-	-	-
Atrazine-desethyl	mg/kg dry wt	< 0.07	-	-	-	-
Atrazine-desisopropyl	mg/kg dry wt	< 0.13	-	-	-	-
Azaconazole	mg/kg dry wt	< 0.04	-	-	-	-
Azinphos-methyl	mg/kg dry wt	< 0.13	-	-	-	-
Benalaxyl	mg/kg dry wt	< 0.04	-	-	-	-
Bitertanol	mg/kg dry wt	< 0.13	-	-	-	-
Bromacil	mg/kg dry wt	< 0.07	-	-	-	-
Bromopropylate	mg/kg dry wt	< 0.07	-	-	-	-
Butachlor	mg/kg dry wt	< 0.07	-	-	-	-
Captan	mg/kg dry wt	< 0.13	-	-	-	-
Carbaryl	mg/kg dry wt	< 0.07	-	-	-	-
Carbofuran	mg/kg dry wt	< 0.07	-	-	-	-
Chlorfluazuron	mg/kg dry wt	< 0.07	-	-	-	-
Chlorothalonil	mg/kg dry wt	< 0.07	-	-	-	-
Chlorpyrifos	mg/kg dry wt	< 0.07	-	-	-	-
Chlorpyrifos-methyl	mg/kg dry wt	< 0.07	-	-	-	-
Chlortoluron	mg/kg dry wt	< 0.13	-	-	-	-
Cyanazine	mg/kg dry wt	< 0.07	-	-	-	-
Cyfluthrin	mg/kg dry wt	< 0.08	-	-	-	-
Cyhalothrin	mg/kg dry wt	< 0.07	-	-	-	-
Cypermethrin	mg/kg dry wt	< 0.16	-	-	-	-
Deltamethrin (including Tralomethrin)	mg/kg dry wt	< 0.07	-	-	-	-
Diazinon	mg/kg dry wt	< 0.04	-	-	-	-
Dichlofluanid	mg/kg dry wt	< 0.07	-	-	-	-
Dichloran	mg/kg dry wt	< 0.2	-	-	-	-
Dichlorvos	mg/kg dry wt	< 0.09	-	-	-	-
Difenoconazole	mg/kg dry wt	< 0.10	-	-	-	-
Dimethoate	mg/kg dry wt	< 0.13	-	-	-	-
Diphenylamine	mg/kg dry wt	< 0.13	-	-	-	-
Diuron	mg/kg dry wt	< 0.07	-	-	-	-
Fenpropimorph	mg/kg dry wt	< 0.07	-	-	-	-
Fluazifop-butyl	mg/kg dry wt	< 0.07	-	-	-	-
Fluometuron	mg/kg dry wt	< 0.07	-	-	-	-
Flusilazole	mg/kg dry wt	< 0.07	-	-	-	-
Fluvalinate	mg/kg dry wt	< 0.05	-	-	-	-
Furalaxyl	mg/kg dry wt	< 0.04	-	-	-	-
Haloxyfop-methyl	mg/kg dry wt	< 0.07	-	-	-	-
Hexaconazole	mg/kg dry wt	< 0.07	-	-	-	-
Hexazinone	mg/kg dry wt	< 0.04	-	-	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.4	-	-	-	-
Kresoxim-methyl	mg/kg dry wt	< 0.04	-	-	-	-
Linuron	mg/kg dry wt	< 0.07	-	-	-	-
Malathion	mg/kg dry wt	< 0.07	-	-	-	-
Metalaxyl	mg/kg dry wt	< 0.07	-	-	-	-
Methamidophos	mg/kg dry wt	< 0.4	-	-	-	-
Metolachlor	mg/kg dry wt	< 0.05	-	-	-	-
Metribuzin	mg/kg dry wt	< 0.07	-	-	-	-
Molinate	mg/kg dry wt	< 0.13	-	-	-	-

Sample Type: Soil						
Sample Name:		WSL-21-BH128 - 0.0m Split 17-May-2021				
Lab Number:		2616296.1				
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Myclobutanil	mg/kg dry wt	< 0.07	-	-	-	-
Naled	mg/kg dry wt	< 0.4	-	-	-	-
Norflurazon	mg/kg dry wt	< 0.13	-	-	-	-
Oxadiazon	mg/kg dry wt	< 0.07	-	-	-	-
Oxyfluorfen	mg/kg dry wt	< 0.04	-	-	-	-
Paclobutrazol	mg/kg dry wt	< 0.07	-	-	-	-
Parathion-ethyl	mg/kg dry wt	< 0.07	-	-	-	-
Parathion-methyl	mg/kg dry wt	< 0.07	-	-	-	-
Pendimethalin	mg/kg dry wt	< 0.07	-	-	-	-
Permethrin	mg/kg dry wt	< 0.03	-	-	-	-
Pirimicarb	mg/kg dry wt	< 0.07	-	-	-	-
Pirimiphos-methyl	mg/kg dry wt	< 0.07	-	-	-	-
Prochloraz	mg/kg dry wt	< 0.4	-	-	-	-
Procymidone	mg/kg dry wt	< 0.07	-	-	-	-
Prometryn	mg/kg dry wt	< 0.04	-	-	-	-
Propachlor	mg/kg dry wt	< 0.07	-	-	-	-
Propanil	mg/kg dry wt	< 0.2	-	-	-	-
Propazine	mg/kg dry wt	< 0.04	-	-	-	-
Propiconazole	mg/kg dry wt	< 0.05	-	-	-	-
Pyriproxyfen	mg/kg dry wt	< 0.07	-	-	-	-
Quizalofop-ethyl	mg/kg dry wt	< 0.07	-	-	-	-
Simazine	mg/kg dry wt	< 0.07	-	-	-	-
Simetryn	mg/kg dry wt	< 0.07	-	-	-	-
Sulfentrazone	mg/kg dry wt	< 0.4	-	-	-	-
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.13	-	-	-	-
Tebuconazole	mg/kg dry wt	< 0.07	-	-	-	-
Terbacil	mg/kg dry wt	< 0.07	-	-	-	-
Terbufos	mg/kg dry wt	< 0.07	-	-	-	-
Terbumeton	mg/kg dry wt	< 0.07	-	-	-	-
Terbuthylazine	mg/kg dry wt	< 0.04	-	-	-	-
Terbuthylazine-desethyl	mg/kg dry wt	< 0.07	-	-	-	-
Terbutryn	mg/kg dry wt	< 0.07	-	-	-	-
Thiabendazole	mg/kg dry wt	< 0.4	-	-	-	-
Thiobencarb	mg/kg dry wt	< 0.07	-	-	-	-
Tolylfluanid	mg/kg dry wt	< 0.04	-	-	-	-
Triazophos	mg/kg dry wt	< 0.07	-	-	-	-
Trifluralin	mg/kg dry wt	< 0.07	-	-	-	-
Vinclozolin	mg/kg dry wt	< 0.07	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	-	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.014	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.014	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.014	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.014	-	-	-	-
Anthracene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.014	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.014	-	-	-	-

Sample Type: Soil							
Sample Name:		WSL-21-BH128 - 0.0m Split 17-May-2021					
Lab Number:		2616296.1					
Polycyclic Aromatic Hydrocarbons Screening in Soil*							
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.014	-	-	-	-	
Benzo[k]fluoranthene	mg/kg dry wt	< 0.014	-	-	-	-	
Chrysene	mg/kg dry wt	< 0.014	-	-	-	-	
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.014	-	-	-	-	
Fluoranthene	mg/kg dry wt	< 0.014	-	-	-	-	
Fluorene	mg/kg dry wt	< 0.014	-	-	-	-	
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.014	-	-	-	-	
Naphthalene	mg/kg dry wt	< 0.07	-	-	-	-	
Perylene	mg/kg dry wt	< 0.014	-	-	-	-	
Phenanthrene	mg/kg dry wt	< 0.014	-	-	-	-	
Pyrene	mg/kg dry wt	< 0.014	-	-	-	-	
Total Petroleum Hydrocarbons in Soil							
C7 - C9	mg/kg dry wt	< 9	-	-	-	-	
C10 - C14	mg/kg dry wt	< 20	-	-	-	-	
C15 - C36	mg/kg dry wt	152	-	-	-	-	
Total hydrocarbons (C7 - C36)	mg/kg dry wt	163	-	-	-	-	

2616296.1
WSL-21-BH128 - 0.0m Split 17-May-2021
Client Chromatogram for TPH by FID



Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	1
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	1
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	1
Total Recoverable Beryllium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.2 mg/kg dry wt	1

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Recoverable Boron	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	20 mg/kg dry wt	1
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	1
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	1
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	1
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1
Organochlorine/nitro&phosphorus Pest.s Screen in Soils, GCMS	Sonication extraction, GC-ECD and GC-MS analysis. In-house based on US EPA 8081 and US EPA 8270.	0.010 - 0.2 mg/kg dry wt	1
Total Petroleum Hydrocarbons in Soil			
Client Chromatogram for TPH by FID	Small peaks associated with QC compounds may be visible in chromatograms with low TPH concentrations. QC peaks are as follows: one peak in the C12 - 14 band, the C21 - 25 band and the C30 - 36 band. All QC peaks are corrected for in the reported TPH concentrations.	-	1
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	8 mg/kg dry wt	1
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	1
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	1
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 24-May-2021 and 27-May-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

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Certificate of Analysis

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105 Carlton Gore Road, Newmarket
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Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-27853
Submitted by: Rebecca van der Krogt
Date Received: 22/06/2021
Testing Initiated: 22/06/2021
Date Completed: 5/07/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

AMENDED REPORT. This report replaces in full a previous version R01 sent on 28/06/2021. Added Be, B and Hg results.

Heavy Metals in Soil

	Client Sample ID		WSL-21-BH108-0.0m 0	WSL-21-BH108-0.5m 0.5	Duplicate 10	Duplicate 11
	Date Sampled					
Analyte	Unit	*Reporting Limit*	21-27853-1	21-27853-2	21-27853-3	21-27853-4
Arsenic	mg/kg dry wt	*0.125*	0.91	0.91	1.3	1.8
Boron	mg/kg dry wt	*1.25*	<1.3	<1.3	<1.3	1.4
Beryllium	mg/kg dry wt	*0.013*	0.64	0.47	0.39	0.45
Cadmium	mg/kg dry wt	*0.005*	0.056	0.071	0.060	0.055
Chromium	mg/kg dry wt	*0.125*	7.5	8.3	8.0	8.7
Copper	mg/kg dry wt	*0.075*	2.7	5.4	4.4	7.3
Lead	mg/kg dry wt	*0.25*	11.6	7.09	8.11	6.42
Mercury	mg/kg dry wt	*0.025*	0.085	0.067	0.081	0.053
Nickel	mg/kg dry wt	*0.05*	2.3	2.5	2.8	3.2
Zinc	mg/kg dry wt	*0.05*	10.5	8.92	9.60	12.1

Organochlorine Pesticides - Soil

	Client Sample ID		WSL-21-BH108-0.0m 0	Duplicate 10
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-27853-1	21-27853-3
2,4'-DDD	mg/kg dry wt	*0.005*	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*	<0.0030	<0.0030

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Organochlorine Pesticides - Soil

			Client Sample ID	WSL-21-BH108-0.0m 0	Duplicate 10
			Date Sampled		
4,4'-DDE	mg/kg dry wt	*0.005*		0.0076	0.020
4,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*		<0.020	0.020
alpha-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*		<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*		<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*		<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*		<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*		<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*		<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*		<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*		<0.020	<0.020
TCMX (Surrogate)	%	*1*		110	100

Total Petroleum Hydrocarbons - Soil

			Client Sample ID	WSL-21-BH108-0.0m 0	WSL-21-BH108-0.5m 0.5	Duplicate 10	Duplicate 11
			Date Sampled				
Analyte	Unit	*Reporting Limit*		21-27853-1	21-27853-2	21-27853-3	21-27853-4
C7-C9	mg/kg dry wt	*10*		<10	<10	<10	<10
C10-C14	mg/kg dry wt	*15*		<15	<15	<15	<15
C15-C36	mg/kg dry wt	*25*		67	46	52	39
C7-C36 (Total)	mg/kg dry wt	*50*		67	<50	52	<50

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	WSL-21-BH108-0.0m 0	WSL-21-BH108-0.5m 0.5	Duplicate 10	Duplicate 11
			Date Sampled				
Analyte	Unit	*Reporting Limit*		21-27853-1	21-27853-2	21-27853-3	21-27853-4
1-Methylnaphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
2-Methylnaphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Acenaphthene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Acenaphthylene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Anthracene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Benz[a]anthracene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020
Benzo[a]pyrene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020

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Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	WSL-21-BH108-0.0m 0	WSL-21-BH108-0.5m 0.5	Duplicate 10	Duplicate 11
			Date Sampled				
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Chrysene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Fluoranthene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020
Fluorene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Naphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Phenanthrene	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Pyrene	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*		0.030	0.030	0.030	0.030
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010
Anthracene-d10 (Surrogate)	%	*1*		110	110	110	110

Moisture Content

		Client Sample ID	WSL-21-BH108-0.0m 0	WSL-21-BH108-0.5m 0.5	Duplicate 10	Duplicate 11
		Date Sampled				
Analyte	Unit	*Reporting Limit*	21-27853-1	21-27853-2	21-27853-3	21-27853-4
Moisture Content	%	*1*	27	20	20	20

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

OCP in Soil Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).

Total DDT Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

TPH in Soil Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).

PAH in Soil Solvent extraction, silica cleanup, followed by GC-MS analysis.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).

Moisture Moisture content is determined gravimetrically by drying at 103 °C.

Emily Hanna, B.Sc.
Trace Elements Team Leader

Rong Zhang
Technician

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Certificate of Analysis

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Attention: Lucy Hine
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Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-27865
Submitted by: Rebecca van der Krogt
Date Received: 22/06/2021
Testing Initiated: 23/06/2021
Date Completed: 28/06/2021
Order Number:
Reference: 1015174

Sampling Site:
Description of Work: 1015174

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Asbestos in Soil (Semi-Quantitative)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
21-27865-1	WSL-21-BH108-0.0m		Soil		28/06/2021

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled

Analysis Results (Summary)

Laboratory ID	Client Sample ID	Fibre Types	Sample Weight as Received	Moisture Content	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
Units			g	%		
21-27865-1	WSL-21-BH108-0.0m	Asbestos NOT Detected.	449.5	29.3	Absent	Absent

Information in the above table supplied by the client: Client Sample ID

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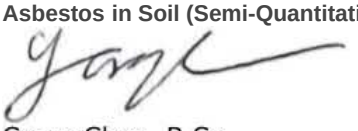
Analysis Results (Size Fraction Breakdown)

Laboratory ID	Client Sample ID	Fraction Size	Fraction Weight*	AF/FA Weight*	ACM Weight*	ACM Content*	Asbestos Matrix	Asbestos Weight*	W/W% Asbestos*
Units *Reporting Limit*			g 0	g 0	g 0	%		g 0	W/W% 0.001
21-27865-1	WSL-21-BH108-0.0m	>10mm	65.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	154.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	
		<2mm	98.00	0.0000	-	-	No Asbestos Detected	0.0000	

Information in the above table supplied by the client: Client Sample ID

Asbestos in Soil (Semi-Quantitative) Approver:



Cyrus Chao, B.Sc.
Technician

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Method Summary

Asbestos Fibres in Soil (Semi-Quantitative)	Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with AS4964-2004 Method for the qualitative identification of asbestos in soil samples. Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques. Note 2: Trace asbestos is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present. Note 3: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised. Note 4: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.

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Certificate of Analysis

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Attention: Lucy Hine
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Lab Reference: 21-17935
Submitted by: Rebecca van der Krogt
Date Received: 21/04/2021
Testing Initiated: 21/04/2021
Date Completed: 3/05/2021
Order Number: COC1007354
Reference: 1015174.0000

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

	Client Sample ID		HDD entry_0.00m-0.10m	HDD entry_0.50m-1.00m	HDD exit_0.00m-0.10m	HDD exit_0.40m-1.00m	Shaft 8_0.00m-0.10m
	Date Sampled		19/04/2021	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*	21-17935-1	21-17935-2	21-17935-3	21-17935-4	21-17935-5
Arsenic	mg/kg dry wt	*0.125*	2.2	1.3	1.7	4.0	5.0
Beryllium	mg/kg dry wt	*0.013*	0.052	0.10	0.060	0.082	0.24
Boron	mg/kg dry wt	*1.25*	<1.3	1.4	2.1	<1.3	4.1
Cadmium	mg/kg dry wt	*0.005*	0.062	0.023	0.38	0.028	0.061
Chromium	mg/kg dry wt	*0.125*	3.6	4.6	4.7	6.0	12
Copper	mg/kg dry wt	*0.075*	2.3	1.2	6.4	4.8	19.6
Lead	mg/kg dry wt	*0.25*	4.4	8.67	6.19	6.93	6.83
Mercury	mg/kg dry wt	*0.025*	0.063	0.21	0.060	0.12	<0.025
Nickel	mg/kg dry wt	*0.05*	1.1	2.1	2.2	3.0	16.5
Zinc	mg/kg dry wt	*0.05*	7.88	5.25	30.0	5.48	50.0

Heavy Metals in Soil

	Client Sample ID		Shaft 8_0.30m-1.00m	Duplicate 3
	Date Sampled		19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*	21-17935-7	21-17935-8
Arsenic	mg/kg dry wt	*0.125*	4.1	5.4
Beryllium	mg/kg dry wt	*0.013*	0.18	0.22
Boron	mg/kg dry wt	*1.25*	<1.3	3.9
Cadmium	mg/kg dry wt	*0.005*	0.016	0.092

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Heavy Metals in Soil

			Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021
Chromium	mg/kg dry wt	*0.125*		14.7	12.6
Copper	mg/kg dry wt	*0.075*		8.08	20.1
Lead	mg/kg dry wt	*0.25*		6.35	11.9
Mercury	mg/kg dry wt	*0.025*		0.11	0.049
Nickel	mg/kg dry wt	*0.05*		0.98	16.9
Zinc	mg/kg dry wt	*0.05*		7.33	39.9

Organochlorine Pesticides - Soil

			Client Sample ID	HDD entry_0.00m-0.10m	HDD entry_0.50m-1.00m	HDD exit_0.00m-0.10m	HDD exit_0.40m-1.00m	Shaft 8_0.00m-0.10m
			Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*		21-17935-1	21-17935-2	21-17935-3	21-17935-4	21-17935-5
2,4'-DDD	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*		<0.0030	<0.0030	<0.0030	<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*		<0.010	<0.010	<0.010	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*		<0.020	<0.020	<0.020	<0.020	<0.020
TCMX (Surrogate)	%	*1*		99	94	97	98	96

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Organochlorine Pesticides - Soil

		Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
		Date Sampled	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*	21-17935-7	21-17935-8
2,4'-DDD	mg/kg dry wt	*0.005*	<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*	<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*	<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Total DDT	mg/kg dry wt	*0.02*	<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*	<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*	<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*	<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*	<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*	<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*	<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*	<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*	<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*	<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*	<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*	<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*	<0.020	<0.020
TCMX (Surrogate)	%	*1*	97	95

Total Petroleum Hydrocarbons - Soil

		Client Sample ID	HDD entry_0.00m-0.10m	HDD entry_0.50m-1.00m	HDD exit_0.00m-0.10m	HDD exit_0.40m-1.00m	Shaft 8_0.00m-0.10m
		Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*	21-17935-1	21-17935-2	21-17935-3	21-17935-4	21-17935-5
C7-C9	mg/kg dry wt	*10*	<10	<10	<10	<10	<10
C10-C14	mg/kg dry wt	*15*	<15	<15	<15	<15	<15
C15-C36	mg/kg dry wt	*25*	<25	<25	29	<25	<25
C7-C36 (Total)	mg/kg dry wt	*50*	<50	<50	<50	<50	<50

Total Petroleum Hydrocarbons - Soil

		Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
		Date Sampled	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*	21-17935-7	21-17935-8
C7-C9	mg/kg dry wt	*10*	<10	<10
C10-C14	mg/kg dry wt	*15*	<15	<15

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Total Petroleum Hydrocarbons - Soil

			Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021
C15-C36	mg/kg dry wt	*25*		<25	27
C7-C36 (Total)	mg/kg dry wt	*50*		<50	<50

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	HDD entry_0.00m-0.10m	HDD entry_0.50m-1.00m	HDD exit_0.00m-0.10m	HDD exit_0.40m-1.00m	Shaft 8_0.00m-0.10m
			Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Analyte		Unit	*Reporting Limit*	21-17935-1	21-17935-2	21-17935-3	21-17935-4	21-17935-5
1-Methylnaphthalene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
2-Methylnaphthalene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphthene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Acenaphthylene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Anthracene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Benz[a]anthracene		mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
Benzo[a]pyrene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Benzo[b]&[j] fluoranthene		mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
Benzo[g,h,i]perylene		mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
Benzo[k]fluoranthene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Chrysene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Dibenz(a,h)anthracene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Fluoranthene		mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
Fluorene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Indeno(1,2,3-cd)pyrene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Naphthalene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Phenanthrene		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Pyrene		mg/kg dry wt	*0.02*	<0.020	<0.020	<0.020	<0.020	<0.020
Benzo[a]pyrene TEQ (LOR)		mg/kg dry wt	*0.03*	0.030	0.030	0.030	0.030	0.030
Benzo[a]pyrene TEQ (Zero)		mg/kg dry wt	*0.01*	<0.010	<0.010	<0.010	<0.010	<0.010
Anthracene-d10 (Surrogate)		%	*1*	120	120	110	120	120

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021
Analyte		Unit	*Reporting Limit*	21-17935-7	21-17935-8
1-Methylnaphthalene		mg/kg dry wt	*0.01*	<0.010	<0.010
2-Methylnaphthalene		mg/kg dry wt	*0.01*	<0.010	<0.010
Acenaphthene		mg/kg dry wt	*0.01*	<0.010	<0.010
Acenaphthylene		mg/kg dry wt	*0.01*	<0.010	<0.010
Anthracene		mg/kg dry wt	*0.01*	<0.010	<0.010
Benz[a]anthracene		mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[a]pyrene		mg/kg dry wt	*0.01*	<0.010	<0.010
Benzo[b]&[j] fluoranthene		mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[g,h,i]perylene		mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[k]fluoranthene		mg/kg dry wt	*0.01*	<0.010	<0.010

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Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021
Chrysene	mg/kg dry wt	*0.01*		<0.010	<0.010
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*		<0.010	<0.010
Fluoranthene	mg/kg dry wt	*0.02*		<0.020	<0.020
Fluorene	mg/kg dry wt	*0.01*		<0.010	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*		<0.010	<0.010
Naphthalene	mg/kg dry wt	*0.01*		<0.010	<0.010
Phenanthrene	mg/kg dry wt	*0.01*		<0.010	<0.010
Pyrene	mg/kg dry wt	*0.02*		<0.020	<0.020
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*		0.030	0.030
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*		<0.010	<0.010
Anthracene-d10 (Surrogate)	%	*1*		120	120

ONOPs in Soil

			Client Sample ID	HDD entry_0.00m-0.10m	HDD exit_0.00m-0.10m	Shaft 8_0.00m-0.10m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*		21-17935-1	21-17935-3	21-17935-5	21-17935-8
3-Hydroxycarbofuran	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Acephate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Acetochlor	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Alachlor	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Aldicarb	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Aldicarb sulfone	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Aldicarb sulfoxide	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Ametryn	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Atrazine	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Atrazine-desethyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Atrazine-desisopropyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Avermectin B1a	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Azaconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Azinphos-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Azoxystrobin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Benalaxyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Bendiocarb	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Bitertanol	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Bromacil	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Bupirimate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Buprofezin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Butachlor	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Carbaryl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Carbendazim	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Carbofuran	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Chlorfluazuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Chlorpyrifos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Chlorpyriphos-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Chlorotoluron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Cyanazine	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Cyfluthrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050

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ONOPs in Soil

			Client Sample ID	HDD entry_0.00m-0.10 m	HDD exit_0.00m-0.10m	Shaft 8_0.00m-0.10m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Cyhalothrin (lambda)	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Cypermethrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Cyproconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Cyprodinil	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Deltamethrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Diazinon	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Dichlofluanid	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Dichlorvos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Difenoconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Dimethoate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Diuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Emamectin B1a	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fenarimol	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fenpropimorph	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fenpyroximate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fenvalerate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fluazifop-butyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fluometuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Flusilazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Fluvalinate (tau)	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Furalaxyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Haloxyfop-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Hexaconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Hexazinone	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Imazalil	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Imidacloprid	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Indoxacarb	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
IPBC	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Iprodione	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Kresoxim-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Linuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Lufenuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Malathion	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Metalaxyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Methamidophos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Methiocarb	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Methomyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Metolachlor	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Metribuzin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Mevinphos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Molinate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Monocrotophos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Myclobutanil	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Naled	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Norfluazuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Omethoate	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Oxyflurofen	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Paclobutrazol	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Parathion-ethyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Pendimethalin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Permethrin	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Pirimicarb	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Pirimiphos-methyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050

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ONOPs in Soil

			Client Sample ID	HDD entry_0.00m-0.10m	HDD exit_0.00m-0.10m	Shaft 8_0.00m-0.10m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Prochloraz	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Procymidone	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Prometryn	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Propachlor	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Propanil	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Propazine	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Propiconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Pyrimethanil	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Pyriproxyfen	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Quizalofop-ethyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Simazine	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Simetryn	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Sulfentrazone	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
TCMTB	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Tebuconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Terbufos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Terbumeton	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Terbuthylazine	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Terbuthylazine-desethyl	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Terbutryn	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Tetrachlorvinphos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Tetraconazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Thiabendazole	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Thiacloprid	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Thiobencarb	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Tolylfluanid	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Triazophos	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Triflumuron	mg/kg dry wt	*0.05*		<0.050	<0.050	<0.050	<0.050
Triphenylphosphate (Surrogate)	%	*1*		94	96	100	96

Moisture Content

			Client Sample ID	HDD entry_0.00m-0.10m	HDD entry_0.50m-1.00m	HDD exit_0.00m-0.10m	HDD exit_0.40m-1.00m	Shaft 8_0.00m-0.10m
			Date Sampled	19/04/2021	19/04/2021	19/04/2021	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*		21-17935-1	21-17935-2	21-17935-3	21-17935-4	21-17935-5
Moisture Content	%	*1*		20	25	29	29	19

Moisture Content

			Client Sample ID	Shaft 8_0.30m-1.00m	Duplicate 3
			Date Sampled	19/04/2021	19/04/2021
Analyte	Unit	*Reporting Limit*		21-17935-7	21-17935-8
Moisture Content	%	*1*		28	21

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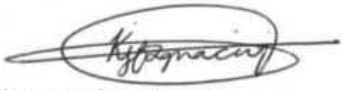
Method Summary

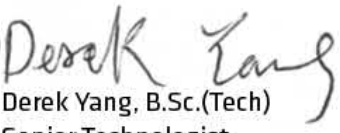
Elements in Soil	Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.
OCP in Soil	Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).
Total DDT	Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)
TPH in Soil	Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).
PAH in Soil	Solvent extraction, silica cleanup, followed by GC-MS analysis. **Benzo[a]pyrene TEQ (LOR)**: The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH. **Benzo[a]pyrene TEQ (Zero)**: The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation. Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).
ONOPs in Soil	Fresh soil is extracted in acetonitrile and analysed by GC-MS/MS and LC-MS/MS. (In accordance with in-house procedure).
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

Sharelle Frank, B.Sc. (Tech)
Technologist



Kimmy Ignacio, B.Sc.
Technician

Yuri Zubenko, Ph.D.
Senior Technologist



Derek Yang, B.Sc.(Tech)
Senior Technologist

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Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2590821 A2Pv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:**	21-Apr-2021
		Date Reported:	27-Apr-2021
		Quote No:	80842
		Order No:	1015174.0000
		Client Reference:	1015174.0000
		Add. Client Ref:	COC1007354
		Submitted By:	Rebecca van der Krogt

Sample Type: Soil

Sample Name:		HDD entry_0.00m-0.10m 19-Apr-2021 4:20 pm	HDD exit_0.00m-0.10m 19-Apr-2021 5:16 pm	Shaft 8_0.00m-0.10m 19-Apr-2021 2:51 pm		
Lab Number:		2590821.1	2590821.3	2590821.5		
Asbestos Presence / Absence		Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	-	-
Description of Asbestos Form		-	-	-	-	-
Asbestos in ACM as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	-	-
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	-	-
Asbestos as Fibrous Asbestos as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	-	-
Asbestos as Asbestos Fines as % of Total Sample*	% w/w	< 0.001	< 0.001	< 0.001	-	-
As Received Weight	g	661.3	648.1	757.9	-	-
Dry Weight	g	526.7	453.3	624.5	-	-
Moisture	%	20	30	18	-	-
Sample Fraction >10mm	g dry wt	< 0.1	< 0.1	129.1	-	-
Sample Fraction <10mm to >2mm	g dry wt	67.0	< 0.1	247.2	-	-
Sample Fraction <2mm	g dry wt	458.5	452.6	247.7	-	-
<2mm Subsample Weight	g dry wt	55.5	59.5	52.6	-	-
Weight of Asbestos in ACM (Non-Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	-	-
Weight of Asbestos as Fibrous Asbestos (Friable)	g dry wt	< 0.00001	< 0.00001	< 0.00001	-	-
Weight of Asbestos as Asbestos Fines (Friable)*	g dry wt	< 0.00001	< 0.00001	< 0.00001	-	-

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked * or any comments and interpretations, which are not accredited.

Glossary of Terms
• Loose fibres (Minor) - One or two fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• Loose fibres (Major) - Three or more fibres/fibre bundles identified during analysis by stereo microscope/PLM.
• ACM Debris (Minor) - One or two small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• ACM Debris (Major) - Large (>2mm) piece, or more than three small (<2mm) pieces of material attached to fibres identified during analysis by stereo microscope/PLM.
• Unknown Mineral Fibres - Mineral fibres of unknown type detected by polarised light microscopy including dispersion staining. The fibres detected may or may not be asbestos fibres. To confirm the identities, another independent analytical technique may be required.
• Trace - Trace levels of asbestos, as defined by AS4964-2004.
For further details, please contact the Asbestos Team.

Please refer to the BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil.
https://www.branz.co.nz/asbestos

The following assumptions have been made:

1. Asbestos Fines in the <2mm fraction, after homogenisation, is evenly distributed throughout the fraction
2. The weight of asbestos in the sample is unaffected by the ashing process.

Results are representative of the sample provided to Hill Laboratories only.

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Wgt of Asbestos as Asbestos Fines in <10mm >2mm Fraction*	Measurement on analytical balance, from the <10mm >2mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g dry wt	1, 3, 5
New Zealand Guidelines Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3, 5
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1, 3, 5
Moisture	Sample dried at 100 to 105°C. Calculation = (As received weight - Dry weight) / as received weight x 100.	1 %	1, 3, 5
Sample Fraction >10mm	Sample dried at 100 to 105°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1, 3, 5
Sample Fraction <10mm to >2mm	Sample dried at 100 to 105°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1, 3, 5
Sample Fraction <2mm	Sample dried at 100 to 105°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g dry wt	1, 3, 5
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	0.01%	1, 3, 5
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1, 3, 5
Weight of Asbestos in ACM (Non-Friable)	Measurement on analytical balance, from the >10mm Fraction. Weight of asbestos based on assessment of ACM form. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1, 3, 5
Asbestos in ACM as % of Total Sample*	Calculated from weight of asbestos in ACM and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3, 5
Weight of Asbestos as Fibrous Asbestos (Friable)	Measurement on analytical balance, from the >10mm Fraction. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1, 3, 5
Asbestos as Fibrous Asbestos as % of Total Sample*	Calculated from weight of fibrous asbestos and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3, 5
Weight of Asbestos as Asbestos Fines (Friable)*	Measurement on analytical balance, from the <10mm Fractions. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.00001 g dry wt	1, 3, 5

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Asbestos as Asbestos Fines as % of Total Sample*	Calculated from weight of asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3, 5
Combined Fibrous Asbestos + Asbestos Fines as % of Total Sample*	Calculated from weight of fibrous asbestos plus asbestos fines and sample dry weight. New Zealand Guidelines for Assessing and Managing Asbestos in Soil, November 2017.	0.001 % w/w	1, 3, 5

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed on 27-Apr-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

This certificate of analysis must not be reproduced, except in full, without the written consent of the signatory.

Rhodri Williams BSc (Hons)
Technical Manager - Asbestos

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Certificate of Analysis

Client:	Tonkin & Taylor	**Lab No:**	2590343	SPv1
Contact:	Lucy Hine C/- Tonkin & Taylor PO Box 13055 Christchurch 8141	**Date Received:** **Date Reported:** **Quote No:** **Order No:** **Client Reference:** **Submitted By:**	21-Apr-2021 27-Apr-2021 80842 1015174 1015174 Rebecca van der Krogt	

Sample Type: Soil

		Sample Name:	Split HDD Entry 0.0-0.1m 19-Apr-2021				
		Lab Number:	2590343.2				
Individual Tests							
Dry Matter	g/100g as rcvd		79	-	-	-	-
Total Recoverable Beryllium	mg/kg dry wt		< 0.2	-	-	-	-
Total Recoverable Boron	mg/kg dry wt		< 20	-	-	-	-
Heavy Metals with Mercury, Screen Level							
Total Recoverable Arsenic	mg/kg dry wt		2	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt		< 0.10	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt		3	-	-	-	-
Total Recoverable Copper	mg/kg dry wt		2	-	-	-	-
Total Recoverable Lead	mg/kg dry wt		4.0	-	-	-	-
Total Recoverable Mercury	mg/kg dry wt		< 0.10	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt		< 2	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt		8	-	-	-	-
Organochlorine Pesticides Screening in Soil							
Aldrin	mg/kg dry wt		< 0.013	-	-	-	-
alpha-BHC	mg/kg dry wt		< 0.013	-	-	-	-
beta-BHC	mg/kg dry wt		< 0.013	-	-	-	-
delta-BHC	mg/kg dry wt		< 0.013	-	-	-	-
gamma-BHC (Lindane)	mg/kg dry wt		< 0.013	-	-	-	-
cis-Chlordane	mg/kg dry wt		< 0.013	-	-	-	-
trans-Chlordane	mg/kg dry wt		< 0.013	-	-	-	-
2,4'-DDD	mg/kg dry wt		< 0.013	-	-	-	-
4,4'-DDD	mg/kg dry wt		< 0.013	-	-	-	-
2,4'-DDE	mg/kg dry wt		< 0.013	-	-	-	-
4,4'-DDE	mg/kg dry wt		< 0.013	-	-	-	-
2,4'-DDT	mg/kg dry wt		< 0.013	-	-	-	-
4,4'-DDT	mg/kg dry wt		< 0.013	-	-	-	-
Total DDT Isomers	mg/kg dry wt		< 0.08	-	-	-	-
Dieldrin	mg/kg dry wt		< 0.013	-	-	-	-
Endosulfan I	mg/kg dry wt		< 0.013	-	-	-	-
Endosulfan II	mg/kg dry wt		< 0.013	-	-	-	-
Endosulfan sulphate	mg/kg dry wt		< 0.013	-	-	-	-
Endrin	mg/kg dry wt		< 0.013	-	-	-	-
Endrin aldehyde	mg/kg dry wt		< 0.013	-	-	-	-
Endrin ketone	mg/kg dry wt		< 0.013	-	-	-	-
Heptachlor	mg/kg dry wt		< 0.013	-	-	-	-
Heptachlor epoxide	mg/kg dry wt		< 0.013	-	-	-	-
Hexachlorobenzene	mg/kg dry wt		< 0.013	-	-	-	-

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Sample Type: Soil						
Sample Name:		Split HDD Entry 0.0-0.1m 19-Apr-2021				
Lab Number:		2590343.2				
Organochlorine Pesticides Screening in Soil						
Methoxychlor	mg/kg dry wt	< 0.013	-	-	-	-
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Acetochlor	mg/kg	< 0.06	-	-	-	-
Alachlor	mg/kg	< 0.05	-	-	-	-
Atrazine	mg/kg	< 0.06	-	-	-	-
Atrazine-desethyl	mg/kg	< 0.06	-	-	-	-
Atrazine-desisopropyl	mg/kg	< 0.12	-	-	-	-
Azaconazole	mg/kg	< 0.03	-	-	-	-
Azinphos-methyl	mg/kg	< 0.12	-	-	-	-
Benalaxyl	mg/kg	< 0.03	-	-	-	-
Bitertanol	mg/kg	< 0.12	-	-	-	-
Bromacil	mg/kg	< 0.06	-	-	-	-
Bromopropylate	mg/kg	< 0.06	-	-	-	-
Butachlor	mg/kg	< 0.06	-	-	-	-
Captan	mg/kg	< 0.12	-	-	-	-
Carbaryl	mg/kg	< 0.06	-	-	-	-
Carbofuran	mg/kg	< 0.06	-	-	-	-
Chlorfluazuron	mg/kg	< 0.06	-	-	-	-
Chlorothalonil	mg/kg	< 0.06	-	-	-	-
Chlorpyrifos	mg/kg	< 0.06	-	-	-	-
Chlorpyrifos-methyl	mg/kg	< 0.06	-	-	-	-
Chlortoluron	mg/kg	< 0.12	-	-	-	-
Cyanazine	mg/kg	< 0.06	-	-	-	-
Cyfluthrin	mg/kg	< 0.08	-	-	-	-
Cyhalothrin	mg/kg	< 0.06	-	-	-	-
Cypermethrin	mg/kg	< 0.15	-	-	-	-
Deltamethrin (including Tralomethrin)	mg/kg	< 0.06	-	-	-	-
Diazinon	mg/kg	< 0.03	-	-	-	-
Dichlofluanid	mg/kg	< 0.06	-	-	-	-
Dichloran	mg/kg	< 0.2	-	-	-	-
Dichlorvos	mg/kg	< 0.09	-	-	-	-
Difenoconazole	mg/kg	< 0.09	-	-	-	-
Dimethoate	mg/kg	< 0.12	-	-	-	-
Diphenylamine	mg/kg	< 0.12	-	-	-	-
Diuron	mg/kg	< 0.06	-	-	-	-
Fenpropimorph	mg/kg	< 0.06	-	-	-	-
Fluazifop-butyl	mg/kg	< 0.06	-	-	-	-
Fluometuron	mg/kg	< 0.06	-	-	-	-
Flusilazole	mg/kg	< 0.06	-	-	-	-
Fluvalinate	mg/kg	< 0.05	-	-	-	-
Furalaxyl	mg/kg	< 0.03	-	-	-	-
Haloxyfop-methyl	mg/kg	< 0.06	-	-	-	-
Hexaconazole	mg/kg	< 0.06	-	-	-	-
Hexazinone	mg/kg	< 0.03	-	-	-	-
IPBC (3-Iodo-2-propynyl-n-butylcarbamate)	mg/kg dry wt	< 0.3	-	-	-	-
Kresoxim-methyl	mg/kg	< 0.03	-	-	-	-
Linuron	mg/kg	< 0.06	-	-	-	-
Malathion	mg/kg	< 0.06	-	-	-	-
Metalaxyl (Mefenoxam)	mg/kg	< 0.06	-	-	-	-
Methamidophos	mg/kg	< 0.3	-	-	-	-
Metolachlor	mg/kg	< 0.05	-	-	-	-
Metribuzin	mg/kg	< 0.06	-	-	-	-
Molinate	mg/kg	< 0.12	-	-	-	-

Sample Type: Soil						
Sample Name:		Split HDD Entry 0.0-0.1m 19-Apr-2021				
Lab Number:		2590343.2				
Organonitro&phosphorus Pesticides Screen in Soil by GCMS						
Myclobutanil	mg/kg	< 0.06	-	-	-	-
Naled	mg/kg	< 0.3	-	-	-	-
Norflurazon	mg/kg	< 0.12	-	-	-	-
Oxadiazon	mg/kg	< 0.06	-	-	-	-
Oxyfluorfen	mg/kg	< 0.03	-	-	-	-
Paclobutrazol	mg/kg	< 0.06	-	-	-	-
Parathion-ethyl	mg/kg	< 0.06	-	-	-	-
Parathion-methyl	mg/kg	< 0.06	-	-	-	-
Pendimethalin	mg/kg	< 0.06	-	-	-	-
Permethrin	mg/kg	< 0.03	-	-	-	-
Pirimicarb	mg/kg	< 0.06	-	-	-	-
Pirimiphos-methyl	mg/kg	< 0.06	-	-	-	-
Prochloraz	mg/kg	< 0.3	-	-	-	-
Procymidone	mg/kg	< 0.06	-	-	-	-
Prometryn	mg/kg	< 0.03	-	-	-	-
Propachlor	mg/kg	< 0.06	-	-	-	-
Propanil	mg/kg	< 0.2	-	-	-	-
Propazine	mg/kg	< 0.03	-	-	-	-
Propiconazole	mg/kg	< 0.05	-	-	-	-
Pyriproxyfen	mg/kg	< 0.06	-	-	-	-
Quizalofop-ethyl	mg/kg	< 0.06	-	-	-	-
Simazine	mg/kg	< 0.06	-	-	-	-
Simetryn	mg/kg	< 0.06	-	-	-	-
Sulfentrazone	mg/kg	< 0.3	-	-	-	-
TCMTB [2-(thiocyanomethylthio) benzothiazole,Busan]	mg/kg dry wt	< 0.12	-	-	-	-
Tebuconazole	mg/kg	< 0.06	-	-	-	-
Terbacil	mg/kg	< 0.06	-	-	-	-
Terbufos	mg/kg	< 0.06	-	-	-	-
Terbumeton	mg/kg	< 0.06	-	-	-	-
Terbuthylazine	mg/kg	< 0.03	-	-	-	-
Terbuthylazine-desethyl	mg/kg	< 0.06	-	-	-	-
Terbutryn	mg/kg	< 0.06	-	-	-	-
Thiabendazole	mg/kg	< 0.3	-	-	-	-
Thiobencarb	mg/kg	< 0.06	-	-	-	-
Tolylfluanid	mg/kg	< 0.03	-	-	-	-
Triazophos	mg/kg	< 0.06	-	-	-	-
Trifluralin	mg/kg	< 0.06	-	-	-	-
Vinclozolin	mg/kg	< 0.06	-	-	-	-
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Total of Reported PAHs in Soil	mg/kg dry wt	< 0.4	-	-	-	-
1-Methylnaphthalene	mg/kg dry wt	< 0.013	-	-	-	-
2-Methylnaphthalene	mg/kg dry wt	< 0.013	-	-	-	-
Acenaphthylene	mg/kg dry wt	< 0.013	-	-	-	-
Acenaphthene	mg/kg dry wt	< 0.013	-	-	-	-
Anthracene	mg/kg dry wt	< 0.013	-	-	-	-
Benzo[a]anthracene	mg/kg dry wt	< 0.013	-	-	-	-
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.013	-	-	-	-
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	mg/kg dry wt	< 0.04	-	-	-	-
Benzo[a]pyrene Toxic Equivalence (TEF)*	mg/kg dry wt	< 0.04	-	-	-	-
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.013	-	-	-	-
Benzo[e]pyrene	mg/kg dry wt	< 0.013	-	-	-	-

Sample Type: Soil						
Sample Name:		Split HDD Entry 0.0-0.1m 19-Apr-2021				
Lab Number:		2590343.2				
Polycyclic Aromatic Hydrocarbons Screening in Soil*						
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.013	-	-	-	-
Benzo[k]fluoranthene	mg/kg dry wt	< 0.013	-	-	-	-
Chrysene	mg/kg dry wt	< 0.013	-	-	-	-
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.013	-	-	-	-
Fluoranthene	mg/kg dry wt	< 0.013	-	-	-	-
Fluorene	mg/kg dry wt	< 0.013	-	-	-	-
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.013	-	-	-	-
Naphthalene	mg/kg dry wt	< 0.07	-	-	-	-
Perylene	mg/kg dry wt	< 0.013	-	-	-	-
Phenanthrene	mg/kg dry wt	< 0.013	-	-	-	-
Pyrene	mg/kg dry wt	< 0.013	-	-	-	-
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	-	-	-	-
C10 - C14	mg/kg dry wt	< 20	-	-	-	-
C15 - C36	mg/kg dry wt	< 40	-	-	-	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	-	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively simple matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis. A detection limit range indicates the lowest and highest detection limits in the associated suite of analytes. A full listing of compounds and detection limits are available from the laboratory upon request. Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Individual Tests			
Environmental Solids Sample Drying*	Air dried at 35°C Used for sample preparation. May contain a residual moisture content of 2-5%.	-	2
Total of Reported PAHs in Soil	Sonication extraction, GC-MS analysis. In-house based on US EPA 8270.	0.03 mg/kg dry wt	2
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. (Free water removed before analysis, non-soil objects such as sticks, leaves, grass and stones also removed). US EPA 3550.	0.10 g/100g as rcvd	2
Total Recoverable Beryllium	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	0.2 mg/kg dry wt	2
Total Recoverable Boron	Dried sample, sieved as specified (if required). Nitric/Hydrochloric acid digestion, ICP-MS, screen level. US EPA 200.2.	20 mg/kg dry wt	2
Benzo[a]pyrene Potency Equivalency Factor (PEF) NES*	BaP Potency Equivalence calculated from; Benzo(a)anthracene x 0.1 + Benzo(b)fluoranthene x 0.1 + Benzo(j)fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Benzo(a)pyrene x 1.0 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Fluoranthene x 0.01 + Indeno(1,2,3-c,d)pyrene x 0.1. Ministry for the Environment. 2011. Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment.	0.002 mg/kg dry wt	2
Benzo[a]pyrene Toxic Equivalence (TEF)*	Benzo[a]pyrene Toxic Equivalence (TEF) calculated from; Benzo[a]pyrene x 1.0 + Benzo(a)anthracene x 0.1 + Benzo(b) fluoranthene x 0.1 + Benzo(k)fluoranthene x 0.1 + Chrysene x 0.01 + Dibenzo(a,h)anthracene x 1.0 + Indeno(1,2,3-c,d)pyrene x 0.1. Guidelines for assessing and managing contaminated gasworks sites in New Zealand (GMG) (MfE, 1997).	0.002 mg/kg dry wt	2
TPH Oil Industry Profile + PAHscreen	Sonication extraction, GC-FID and GC-MS analysis. Tested on as received sample. In-house based on US EPA 8015 and US EPA 8270.	0.002 - 70 mg/kg dry wt	2
Heavy Metals with Mercury, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	2
Organochlorine/nitro&phosphorus Pest.s Screen in Soils, GCMS	Sonication extraction, GC-ECD and GC-MS analysis. In-house based on US EPA 8081 and US EPA 8270.	-	2

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Petroleum Hydrocarbons in Soil			
C7 - C9	Solvent extraction, GC-FID analysis. In-house based on US EPA 8015.	8 mg/kg dry wt	2
C10 - C14	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	20 mg/kg dry wt	2
C15 - C36	Solvent extraction, GC-FID analysis. Tested on as received sample. In-house based on US EPA 8015.	40 mg/kg dry wt	2
Total hydrocarbons (C7 - C36)	Calculation: Sum of carbon bands from C7 to C36. In-house based on US EPA 8015.	70 mg/kg dry wt	2

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Testing was completed between 23-Apr-2021 and 27-Apr-2021. For completion dates of individual analyses please contact the laboratory.

Samples are held at the laboratory after reporting for a length of time based on the stability of the samples and analytes being tested (considering any preservation used), and the storage space available. Once the storage period is completed, the samples are discarded unless otherwise agreed with the customer. Extended storage times may incur additional charges.

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Certificate of Analysis

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Attention: Rebecca Van der Krogt
Phone: 027 304 0134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-43661
Submitted by: Rebecca van der Krogt
Date Received: 16/10/2021
Testing Initiated: 18/10/2021
Date Completed: 22/10/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

			Client Sample ID	BH114-0.1m	BH114-0.5m
			Date Sampled	07/10/2021	07/10/2021
Analyte	Unit	*Reporting Limit*		21-43661-1	21-43661-2
Arsenic	mg/kg dry wt	*0.125*		1.3	0.99
Beryllium	mg/kg dry wt	*0.013*		0.20	0.23
Boron	mg/kg dry wt	*1.25*		1.4	<1.3
Cadmium	mg/kg dry wt	*0.005*		0.026	0.019
Chromium	mg/kg dry wt	*0.125*		8.9	9.2
Copper	mg/kg dry wt	*0.075*		4.2	3.9
Lead	mg/kg dry wt	*0.25*		13.0	9.64
Mercury	mg/kg dry wt	*0.025*		0.11	0.10
Nickel	mg/kg dry wt	*0.05*		4.2	3.0
Zinc	mg/kg dry wt	*0.05*		12.1	7.50

Organochlorine Pesticides - Soil

			Client Sample ID	BH114-0.1m	BH114-0.5m
			Date Sampled	07/10/2021	07/10/2021
Analyte	Unit	*Reporting Limit*		21-43661-1	21-43661-2
2,4'-DDD	mg/kg dry wt	*0.005*		<0.0050	<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*		<0.0050	<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*		<0.0030	<0.0030
4,4'-DDE	mg/kg dry wt	*0.005*		<0.0050	<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*		<0.0050	<0.0050

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Organochlorine Pesticides - Soil

			Client Sample ID	BH114-0.1m	BH114-0.5m
			Date Sampled	07/10/2021	07/10/2021
Total DDT	mg/kg dry wt	*0.02*		<0.020	<0.020
alpha-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Aldrin	mg/kg dry wt	*0.005*		<0.0050	<0.0050
beta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*		<0.0050	<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010
delta-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Dieldrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Endosulfan I	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Endosulfan II	mg/kg dry wt	*0.01*		<0.010	<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Endrin	mg/kg dry wt	*0.05*		<0.050	<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*		<0.010	<0.010
Endrin ketone	mg/kg dry wt	*0.005*		<0.0050	<0.0050
gamma-BHC	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Heptachlor	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*		<0.0050	<0.0050
Methoxychlor	mg/kg dry wt	*0.01*		<0.010	<0.010
trans-nonachlor	mg/kg dry wt	*0.01*		<0.010	<0.010
trans-Chlordane	mg/kg dry wt	*0.01*		<0.010	<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*		<0.020	<0.020
TCMX (Surrogate)	%	*1*		79	84

Polycyclic Aromatic Hydrocarbons - Soil

		Client Sample ID	BH114-0.1m	BH114-0.5m
		Date Sampled	07/10/2021	07/10/2021
Analyte	Unit	*Reporting Limit*	21-43661-1	21-43661-2
1-Methylnaphthalene	mg/kg dry wt	*0.01*	<0.010	<0.010
2-Methylnaphthalene	mg/kg dry wt	*0.01*	<0.010	<0.010
Acenaphthene	mg/kg dry wt	*0.01*	<0.010	<0.010
Acenaphthylene	mg/kg dry wt	*0.01*	<0.010	<0.010
Anthracene	mg/kg dry wt	*0.01*	<0.010	<0.010
Benz[a]anthracene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[a]pyrene	mg/kg dry wt	*0.01*	<0.010	<0.010
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*	<0.010	<0.010
Chrysene	mg/kg dry wt	*0.01*	<0.010	<0.010
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*	<0.010	<0.010
Fluoranthene	mg/kg dry wt	*0.02*	<0.020	<0.020
Fluorene	mg/kg dry wt	*0.01*	<0.010	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*	<0.010	<0.010
Naphthalene	mg/kg dry wt	*0.01*	<0.010	<0.010
Phenanthrene	mg/kg dry wt	*0.01*	<0.010	<0.010
Pyrene	mg/kg dry wt	*0.02*	<0.020	<0.020
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*	0.030	0.030
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*	<0.010	<0.010
Anthracene-d10 (Surrogate)	%	*1*	110	110

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Total Petroleum Hydrocarbons - Soil

			Client Sample ID	BH114-0.1m	BH114-0.5m
			Date Sampled	07/10/2021	07/10/2021
Analyte		Unit	*Reporting Limit*	21-43661-1	21-43661-2
C7-C9		mg/kg dry wt	*10*	<10	<10
C10-C14		mg/kg dry wt	*15*	<15	<15
C15-C36		mg/kg dry wt	*25*	<25	<25
C7-C36 (Total)		mg/kg dry wt	*50*	<50	<50

ONOPs in Soil

		Client Sample ID	BH114-0.1m
		Date Sampled	07/10/2021
Analyte	Unit	*Reporting Limit*	21-43661-1
3-Hydroxycarbofuran	mg/kg dry wt	*0.05*	<0.050
Acephate	mg/kg dry wt	*0.05*	<0.050
Acetochlor	mg/kg dry wt	*0.05*	<0.050
Alachlor	mg/kg dry wt	*0.05*	<0.050
Aldicarb	mg/kg dry wt	*0.05*	<0.050
Aldicarb sulfone	mg/kg dry wt	*0.05*	<0.050
Aldicarb sulfoxide	mg/kg dry wt	*0.05*	<0.050
Ametryn	mg/kg dry wt	*0.05*	<0.050
Atrazine	mg/kg dry wt	*0.05*	<0.050
Atrazine-desethyl	mg/kg dry wt	*0.05*	<0.050
Atrazine-desisopropyl	mg/kg dry wt	*0.05*	<0.050
Avermectin B1a	mg/kg dry wt	*0.05*	<0.050
Azaconazole	mg/kg dry wt	*0.05*	<0.050
Azinphos-methyl	mg/kg dry wt	*0.05*	<0.050
Azoxystrobin	mg/kg dry wt	*0.05*	<0.050
Benalaxyl	mg/kg dry wt	*0.05*	<0.050
Bendiocarb	mg/kg dry wt	*0.05*	<0.050
Bitertanol	mg/kg dry wt	*0.05*	<0.050
Bromacil	mg/kg dry wt	*0.05*	<0.050
Bupirimate	mg/kg dry wt	*0.05*	<0.050
Buprofezin	mg/kg dry wt	*0.05*	<0.050
Butachlor	mg/kg dry wt	*0.05*	<0.050
Carbaryl	mg/kg dry wt	*0.05*	<0.050
Carbendazim	mg/kg dry wt	*0.05*	<0.050
Carbofuran	mg/kg dry wt	*0.05*	<0.050
Chlorfluazuron	mg/kg dry wt	*0.05*	<0.050
Chlorpyrifos	mg/kg dry wt	*0.05*	<0.050
Chlorpyriphos-methyl	mg/kg dry wt	*0.05*	<0.050
Chlorotoluron	mg/kg dry wt	*0.05*	<0.050
Cyanazine	mg/kg dry wt	*0.05*	<0.050
Cyfluthrin	mg/kg dry wt	*0.05*	<0.050
Cyhalothrin (lambda)	mg/kg dry wt	*0.05*	<0.050
Cypermethrin	mg/kg dry wt	*0.05*	<0.050
Cyproconazole	mg/kg dry wt	*0.05*	<0.050
Cyprodinil	mg/kg dry wt	*0.05*	<0.050
Deltamethrin	mg/kg dry wt	*0.05*	<0.050
Diazinon	mg/kg dry wt	*0.05*	<0.050
Dichlofluanid	mg/kg dry wt	*0.05*	<0.050
Dichlorvos	mg/kg dry wt	*0.05*	<0.050
Difenoconazole	mg/kg dry wt	*0.05*	<0.050

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ONOPs in Soil

			Client Sample ID	BH114-0.1m
			Date Sampled	07/10/2021
Dimethoate	mg/kg dry wt	*0.05*	<0.050
Diuron	mg/kg dry wt	*0.05*	<0.050
Emamectin B1a	mg/kg dry wt	*0.05*	<0.050
Fenarimol	mg/kg dry wt	*0.05*	<0.050
Fenpropimorph	mg/kg dry wt	*0.05*	<0.050
Fenpyroximate	mg/kg dry wt	*0.05*	<0.050
Fenvalerate	mg/kg dry wt	*0.05*	<0.050
Fluazifop-butyl	mg/kg dry wt	*0.05*	<0.050
Fluometuron	mg/kg dry wt	*0.05*	<0.050
Flusilazole	mg/kg dry wt	*0.05*	<0.050
Fluvalinate (tau)	mg/kg dry wt	*0.05*	<0.050
Furalaxyl	mg/kg dry wt	*0.05*	<0.050
Haloxyfop-methyl	mg/kg dry wt	*0.05*	<0.050
Hexaconazole	mg/kg dry wt	*0.05*	<0.050
Hexazinone	mg/kg dry wt	*0.05*	<0.050
Imazalil	mg/kg dry wt	*0.05*	<0.050
Imidacloprid	mg/kg dry wt	*0.05*	<0.050
Indoxacarb	mg/kg dry wt	*0.05*	<0.050
IPBC	mg/kg dry wt	*0.05*	<0.050
Iprodione	mg/kg dry wt	*0.05*	<0.050
Kresoxim-methyl	mg/kg dry wt	*0.05*	<0.050
Linuron	mg/kg dry wt	*0.05*	<0.050
Lufenuron	mg/kg dry wt	*0.05*	<0.050
Malathion	mg/kg dry wt	*0.05*	<0.050
Metalaxyl	mg/kg dry wt	*0.05*	<0.050
Methamidophos	mg/kg dry wt	*0.05*	<0.050
Methiocarb	mg/kg dry wt	*0.05*	<0.050
Methomyl	mg/kg dry wt	*0.05*	<0.050
Metolachlor	mg/kg dry wt	*0.05*	<0.050
Metribuzin	mg/kg dry wt	*0.05*	<0.050
Mevinphos	mg/kg dry wt	*0.05*	<0.050
Molinate	mg/kg dry wt	*0.05*	<0.050
Monocrotophos	mg/kg dry wt	*0.05*	<0.050
Myclobutanil	mg/kg dry wt	*0.05*	<0.050
Naled	mg/kg dry wt	*0.05*	<0.050
Norfluazuron	mg/kg dry wt	*0.05*	<0.050
Omethoate	mg/kg dry wt	*0.05*	<0.050
Oxyflurofen	mg/kg dry wt	*0.05*	<0.050
Paclobutrazol	mg/kg dry wt	*0.05*	<0.050
Parathion-ethyl	mg/kg dry wt	*0.05*	<0.050
Pendimethalin	mg/kg dry wt	*0.05*	<0.050
Permethrin	mg/kg dry wt	*0.05*	<0.050
Pirimicarb	mg/kg dry wt	*0.05*	<0.050
Pirimiphos-methyl	mg/kg dry wt	*0.05*	<0.050
Prochloraz	mg/kg dry wt	*0.05*	<0.050
Procymidone	mg/kg dry wt	*0.05*	<0.050
Prometryn	mg/kg dry wt	*0.05*	<0.050
Propachlor	mg/kg dry wt	*0.05*	<0.050
Propanil	mg/kg dry wt	*0.05*	<0.050
Propazine	mg/kg dry wt	*0.05*	<0.050
Propiconazole	mg/kg dry wt	*0.05*	<0.050
Pyrimethanil	mg/kg dry wt	*0.05*	<0.050
Pyriproxyfen	mg/kg dry wt	*0.05*	<0.050
Quizalofop-ethyl	mg/kg dry wt	*0.05*	<0.050

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ONOPs in Soil

			Client Sample ID	BH114-0.1m
			Date Sampled	07/10/2021
Simazine	mg/kg dry wt	*0.05*	<0.050
Simetryn	mg/kg dry wt	*0.05*	<0.050
Sulfentrazone	mg/kg dry wt	*0.05*	<0.050
TCMTB	mg/kg dry wt	*0.05*	<0.050
Tebuconazole	mg/kg dry wt	*0.05*	<0.050
Terbufos	mg/kg dry wt	*0.05*	<0.050
Terbumeton	mg/kg dry wt	*0.05*	<0.050
Terbuthylazine	mg/kg dry wt	*0.05*	<0.050
Terbuthylazine-desethyl	mg/kg dry wt	*0.05*	<0.050
Terbutryn	mg/kg dry wt	*0.05*	<0.050
Tetrachlorvinphos	mg/kg dry wt	*0.05*	<0.050
Tetraconazole	mg/kg dry wt	*0.05*	<0.050
Thiabendazole	mg/kg dry wt	*0.05*	<0.050
Thiacloprid	mg/kg dry wt	*0.05*	<0.050
Thiobencarb	mg/kg dry wt	*0.05*	<0.050
Tolylfluanid	mg/kg dry wt	*0.05*	<0.050
Triazophos	mg/kg dry wt	*0.05*	<0.050
Triflumuron	mg/kg dry wt	*0.05*	<0.050
Triphenylphosphate (Surrogate)	%	*1*	89

Moisture Content

		Client Sample ID	BH114-0.1m	BH114-0.5m
		Date Sampled	07/10/2021	07/10/2021
Analyte	Unit	*Reporting Limit*	21-43661-1	21-43661-2
Moisture Content	%	*1*	23	21

Method Summary

Elements in Soil
Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

OCP in Soil
Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS.
(Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).

Total DDT
Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

PAH in Soil
Solvent extraction, silica cleanup, followed by GC-MS analysis.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).

TPH in Soil
Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).

ONOPs in Soil
Fresh soil is extracted in acetonitrile and analysed by GC-MS/MS and LC-MS/MS. (In accordance with in-house procedure).

Moisture
Moisture content is determined gravimetrically by drying at 103 °C.

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Certificate of Analysis

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Attention: Lucy Hine
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Lab Reference: 21-24630
Submitted by: Rebecca van der Krogt
Date Received: 01/06/2021
Testing Initiated: 1/06/2021
Date Completed: 16/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0	WSL-21-BH133-0.50mm 0.5
			Date Sampled	28/05/2021	28/05/2021
Analyte	Unit	*Reporting Limit*		21-24630-1	21-24630-2
Arsenic	mg/kg dry wt	*0.125*		1.8	2.2
Beryllium	mg/kg dry wt	*0.013*		0.23	0.18
Boron	mg/kg dry wt	*1.25*		2.1	1.7
Cadmium	mg/kg dry wt	*0.005*		0.048	0.045
Chromium	mg/kg dry wt	*0.125*		8.9	8.8
Copper	mg/kg dry wt	*0.075*		7.2	8.83
Lead	mg/kg dry wt	*0.25*		9.17	15.3
Mercury	mg/kg dry wt	*0.025*		0.080	0.087
Nickel	mg/kg dry wt	*0.05*		6.71	6.23
Zinc	mg/kg dry wt	*0.05*		16.0	23.1

Organochlorine Pesticides - Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0
			Date Sampled	28/05/2021
Analyte	Unit	*Reporting Limit*		21-24630-1
2,4'-DDD	mg/kg dry wt	*0.005*		<0.0050
2,4'-DDE	mg/kg dry wt	*0.005*		<0.0050
2,4'-DDT	mg/kg dry wt	*0.005*		<0.0050
4,4'-DDD	mg/kg dry wt	*0.003*		<0.0030

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Organochlorine Pesticides - Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0
			Date Sampled	28/05/2021
4,4'-DDE	mg/kg dry wt	*0.005*		<0.0050
4,4'-DDT	mg/kg dry wt	*0.005*		<0.0050
Total DDT	mg/kg dry wt	*0.02*		<0.020
alpha-BHC	mg/kg dry wt	*0.005*		<0.0050
Aldrin	mg/kg dry wt	*0.005*		<0.0050
beta-BHC	mg/kg dry wt	*0.005*		<0.0050
cis-Chlordane	mg/kg dry wt	*0.005*		<0.0050
cis-Nonachlor	mg/kg dry wt	*0.01*		<0.010
delta-BHC	mg/kg dry wt	*0.005*		<0.0050
Dieldrin	mg/kg dry wt	*0.05*		<0.050
Endosulfan I	mg/kg dry wt	*0.005*		<0.0050
Endosulfan II	mg/kg dry wt	*0.01*		<0.010
Endosulfan sulfate	mg/kg dry wt	*0.005*		<0.0050
Endrin	mg/kg dry wt	*0.05*		<0.050
Endrin aldehyde	mg/kg dry wt	*0.01*		<0.010
Endrin ketone	mg/kg dry wt	*0.005*		<0.0050
gamma-BHC	mg/kg dry wt	*0.005*		<0.0050
Heptachlor	mg/kg dry wt	*0.005*		<0.0050
Heptachlor epoxide	mg/kg dry wt	*0.005*		<0.0050
Hexachlorobenzene	mg/kg dry wt	*0.005*		<0.0050
Methoxychlor	mg/kg dry wt	*0.01*		<0.010
trans-nonachlor	mg/kg dry wt	*0.01*		<0.010
trans-Chlordane	mg/kg dry wt	*0.01*		<0.010
Chlordane (sum)	mg/kg dry wt	*0.02*		<0.020
TCMX (Surrogate)	%	*1*		100

PFAS in Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0
			Date Sampled	28/05/2021
Analyte	Unit	*Reporting Limit*		21-24630-1
Perfluorinated Sulfonic Acids (PFSA)				
PFPrS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFBS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFPeS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFHxS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFHxS (mono-branched)	mg/kg dry wt	*0.0010*		<0.0010
PFHxS (di-branched)	mg/kg dry wt	*0.001*		<0.0010
PFHxS (Total)	mg/kg dry wt	*0.0010*		<0.0010
PFHpS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFOS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFOS (mono-branched)	mg/kg dry wt	*0.0010*		<0.0010
PFOS (di-branched)	mg/kg dry wt	*0.001*		<0.0010
PFOS (Total)	mg/kg dry wt	*0.0010*		<0.0010
PFNS (linear)	mg/kg dry wt	*0.0010*		<0.0010
PFDS (linear)	mg/kg dry wt	*0.0010*		<0.0010
Perfluoroalkyl carboxylic Acids				
PFBA	mg/kg dry wt	*0.0010*		<0.0010
PFPeA	mg/kg dry wt	*0.0010*		<0.0010

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PFAS in Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0
			Date Sampled	28/05/2021
PFHxA	mg/kg dry wt	*0.0010*	<0.0010
PFHpA	mg/kg dry wt	*0.0010*	<0.0010
PFOA	mg/kg dry wt	*0.0010*	<0.0010
PFNA	mg/kg dry wt	*0.0010*	<0.0010
PFDA	mg/kg dry wt	*0.0010*	<0.0010
PFUnDA	mg/kg dry wt	*0.0010*	<0.0010
PFDoDA	mg/kg dry wt	*0.0010*	<0.0010
PFTrDA	mg/kg dry wt	*0.0010*	<0.0010
PFTeDA	mg/kg dry wt	*0.0010*	<0.0010
Perfluorinated Sulfonamides			
PFOSA	mg/kg dry wt	*0.0010*	<0.0010
N-EtFOSA	mg/kg dry wt	*0.0010*	<0.0010
N-MeFOSA	mg/kg dry wt	*0.0010*	<0.0010
Perfluorinated sulfonamidoacetic acids			
PFOSAA	mg/kg dry wt	*0.0010*	<0.0010
N-EtFOSAA	mg/kg dry wt	*0.0010*	<0.0010
N-MeFOSAA	mg/kg dry wt	*0.0010*	<0.0010
Perfluoroalkyl sulfonamidoethanols			
N-EtFOSE	mg/kg dry wt	*0.0010*	<0.0010
N-MeFOSE	mg/kg dry wt	*0.0010*	<0.0010
Fluorotelomer Sulfonates			
4:2 FTS	mg/kg dry wt	*0.0010*	<0.0010
6:2 FTS	mg/kg dry wt	*0.0050*	<0.0050
8:2 FTS	mg/kg dry wt	*0.0010*	<0.0010
Other			
HFPO-DA	mg/kg dry wt	*0.0010*	<0.0010
Internal Standards / Surrogates			
13C4-PFOS-Na	%	*1*	120
13C4-PFOA	%	*1*	120
13C3-PFBS-Na	%	*1*	96
13C3-PFHxS-Na	%	*1*	100
13C8-PFOS-Na	%	*1*	95
13C4-PFBA	%	*1*	96
13C5-PFPeA	%	*1*	96
13C5-PFHxA	%	*1*	96
13C4-PFHpA	%	*1*	95
13C8-PFOA	%	*1*	93
13C9-PFNA	%	*1*	98
13C6-PFDA	%	*1*	98
13C7-PFUdA	%	*1*	94
13C2-PFDoDA	%	*1*	89
13C2-PFTeDA	%	*1*	91
13C8-FOSA	%	*1*	94
D5-N-EtFOSA-M	%	*1*	92
D3-N-MeFOSA-M	%	*1*	90
D5-N-EtFOSAA	%	*1*	92
D3-N-MeFOSAA	%	*1*	97
D9-N-EtFOSE-M	%	*1*	95
D7-N-MeFOSE-M	%	*1*	90

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PFAS in Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0
			Date Sampled	28/05/2021
13C2-4:2 FTS-Na	%	*1*		99
13C2-6:2 FTS-Na	%	*1*		92
13C2-8:2 FTS-Na	%	*1*		94
13C3-HFPO-DA	%	*1*		92

Total Petroleum Hydrocarbons - Soil

		Client Sample ID	WSL-21-BH133-0.00mm 0	WSL-21-BH133-0.50mm 0.5
		Date Sampled	28/05/2021	28/05/2021
Analyte	Unit	*Reporting Limit*	21-24630-1	21-24630-2
C7-C9	mg/kg dry wt	*10*	<10	<10
C10-C14	mg/kg dry wt	*15*	<15	<15
C15-C36	mg/kg dry wt	*25*	37	29
C7-C36 (Total)	mg/kg dry wt	*50*	<50	<50

Semivolatile Organic Compounds - Soil

		Client Sample ID	WSL-21-BH133-0.00mm 0	WSL-21-BH133-0.50mm 0.5
		Date Sampled	28/05/2021	28/05/2021
Analyte	Unit	*Reporting Limit*	21-24630-1	21-24630-2
Phenol	mg/kg dry wt	*0.3*	<0.30	<0.30
2-Chlorophenol	mg/kg dry wt	*0.3*	<0.30	<0.30
2-Methylphenol	mg/kg dry wt	*0.3*	<0.30	<0.30
2-Nitrophenol	mg/kg dry wt	*1.0*	<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*	<0.30	<0.30
2,4-Dichlorophenol	mg/kg dry wt	*0.3*	<0.30	<0.30
2,6-Dichlorophenol	mg/kg dry wt	*0.3*	<0.30	<0.30
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*	<0.30	<0.30
2,4,5-Trichlorophenol	mg/kg dry wt	*5*	<5.0	<5.0
2,4,6-Trichlorophenol	mg/kg dry wt	*5*	<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*	<5.0	<5.0
4-Methylphenol	mg/kg dry wt	*0.3*	<0.30	<0.30
4-Nitrophenol	mg/kg dry wt	*5*	<5.0	<5.0
Naphthalene	mg/kg dry wt	*0.1*	<0.10	<0.10
2-Methylnaphthalene	mg/kg dry wt	*0.1*	<0.10	<0.10
2-Chloronaphthalene	mg/kg dry wt	*0.3*	<0.30	<0.30
Acenaphthene	mg/kg dry wt	*0.1*	<0.10	<0.10
Acenaphthylene	mg/kg dry wt	*0.1*	<0.10	<0.10
Fluorene	mg/kg dry wt	*0.1*	<0.10	<0.10
Phenanthrene	mg/kg dry wt	*0.1*	<0.10	<0.10
Anthracene	mg/kg dry wt	*0.1*	<0.10	<0.10
2-Phenylphenol	mg/kg dry wt	*0.5*	<0.50	<0.50
Fluoranthene	mg/kg dry wt	*0.1*	<0.10	<0.10
Benzo[a]anthracene	mg/kg dry wt	*0.1*	<0.10	<0.10
Chrysene	mg/kg dry wt	*0.1*	<0.10	<0.10
Bis(2-ethylhexyl) adipate	mg/kg dry wt	*0.5*	<0.50	<0.50
Benzo[b]fluoranthene	mg/kg dry wt	*0.1*	<0.10	<0.10

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Semivolatile Organic Compounds - Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0	WSL-21-BH133-0.50mm 0.5
			Date Sampled	28/05/2021	28/05/2021
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*		<0.10	<0.10
Benzo[a]pyrene	mg/kg dry wt	*0.1*		<0.10	<0.10
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*		<0.10	<0.10
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*		<0.10	<0.10
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*		<0.10	<0.10
Pyrene	mg/kg dry wt	*0.2*		<0.20	<0.20
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.2*		0.20	0.20
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		<0.10	<0.10
4,4'-DDD	mg/kg dry wt	*0.3*		<0.30	<0.30
4,4'-DDE	mg/kg dry wt	*0.3*		<0.30	<0.30
4,4'-DDT	mg/kg dry wt	*0.5*		<0.50	<0.50
alpha-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
beta-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
gamma-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
delta-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
Aldrin	mg/kg dry wt	*0.3*		<0.30	<0.30
cis-Chlordane	mg/kg dry wt	*0.3*		<0.30	<0.30
trans-Chlordane	mg/kg dry wt	*0.3*		<0.30	<0.30
Dieldrin	mg/kg dry wt	*0.5*		<0.50	<0.50
Endosulfan I	mg/kg dry wt	*0.3*		<0.30	<0.30
Endosulfan II	mg/kg dry wt	*0.5*		<0.50	<0.50
Endosulfan sulfate	mg/kg dry wt	*0.5*		<0.50	<0.50
Endrin	mg/kg dry wt	*0.5*		<0.50	<0.50
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.50	<0.50
Endrin ketone	mg/kg dry wt	*0.5*		<0.50	<0.50
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
Heptachlor	mg/kg dry wt	*0.3*		<0.30	<0.30
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.30	<0.30
Methoxychlor	mg/kg dry wt	*0.5*		<0.50	<0.50
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		<0.50	<0.50
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.50	<0.50
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1.0	<1.0
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.50	<0.50
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.30	<0.30
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.30	<0.30
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.30	<0.30
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.30	<0.30
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.30	<0.30
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.30	<0.30
Azobenzene	mg/kg dry wt	*0.5*		<0.50	<0.50
Isophorone	mg/kg dry wt	*0.5*		<0.50	<0.50
Nitrobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.30	<0.30
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.30	<0.30
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.30	<0.30
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.30	<0.30
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30

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Semivolatile Organic Compounds - Soil

			Client Sample ID	WSL-21-BH133-0.00mm 0	WSL-21-BH133-0.50mm 0.5
			Date Sampled	28/05/2021	28/05/2021
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.30	<0.30
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.30	<0.30
Hexachloroethane	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.30	<0.30
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.50	<0.50
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.50	<0.50
Dibenzofuran	mg/kg dry wt	*0.3*		<0.30	<0.30
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1.0	<1.0
Benzyl alcohol	mg/kg dry wt	*1*		<1.0	<1.0
Phenol-d5 (Surrogate)	%	*1*		99	100
2-Fluorophenol (Surrogate)	%	*1*		100	110
2-Fluorobiphenyl (Surrogate)	%	*1*		93	100
2,4,6-Tribromophenol (Surrogate)	%	*1*		76	120
p-Terphenyl-d14 (Surrogate)	%	*1*		110	100
Nitrobenzene-d5 (Surrogate)	%	*1*		100	100

Moisture Content

		Client Sample ID	WSL-21-BH133-0.00mm 0	WSL-21-BH133-0.50mm 0.5
		Date Sampled	28/05/2021	28/05/2021
Analyte	Unit	*Reporting Limit*	21-24630-1	21-24630-2
Moisture Content	%	*1*	17	16

Method Summary

Elements in Soil	Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.
OCP in Soil	Samples are extracted with hexane, pre-concetrated then analysed by GC-MSMS. (Chlordane (sum) is calculated from the main actives in technical Chlordane: Chlordane, Nonachlor and Heptachlor). (In accordance with in-house procedure).
Total DDT	Sum of DDT, DDD and DDE (4,4' and 2,4 isomers)

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Method Summary

Poly- and Perfluorinated Alkyl Substances in Soil

The extraction method is based on a weak basic ammonia solution in methanol using sonication to improve extraction followed by graphite carbon black SPE clean up. Heavily labelled internal standards are included to allow an internal standardisation calibration protocol. Final analysis of the extracts is performed by LCMSMS. In accordance with in-house procedure based on ASTM Method D7968-17a (2017).

Short-hand Name	Full name
PFPrS (linear)	Perfluoro-1-propanesulfonic acid
PFBS (linear)	Perfluoro-1-butanesulfonic acid
PFPeS (linear)	Perfluoro-1-pentanesulfonic acid
PFHxS (linear)	Perfluoro-1-hexanesulfonic acid
PFHxS (mono-branched)	Trifluoromethylperfluoropentanesulfonic acid
PFHxS (di-branched)	Di(trifluoromethyl)perfluorobutanesulfonic acid
PFHxS (total)	*Sum of linear, mono-branched and di-branched*
PFHpS (linear)	Perfluoro-1-heptanesulfonic acid
PFOS (linear)	Perfluoro-1-octanesulfonic acid
PFOS (mono-branched)	Trifluoromethylperfluoroheptanesulfonic acid
PFOS (di-branched)	Di(trifluoromethyl)perfluorohexanesulfonic acid
PFOS (total)	*Sum of linear, mono-branched and di-branched*
PFNS (linear)	Perfluoro-1-nonanesulfonic acid
PFDS (linear)	Perfluoro-1-decanesulfonic acid
PFBA	Perfluoro-n-butanoic acid
PFPeA	Perfluoro-n-pentanoic acid
PFHxA	Perfluoro-n-hexanoic acid
PFHpA	Perfluoro-n-heptanoic acid
PFOA	Perfluoro-n-octanoic acid
PFNA	Perfluoro-n-nonanoic acid
PFDA	Perfluoro-n-decanoic acid
PFUdA	Perfluoro-n-undecanoic acid
PFDoA	Perfluoro-n-dodecanoic acid
PFTrDA	Perfluoro-n-tridecanoic acid
PFTeDA	Perfluoro-n-tetradecanoic acid
PFOSA	Perfluoro-1-octanesulfonamide
N-EtFOSA	N-ethylperfluoro-1-octanesulfonamide
N-MeFOSA	N-methylperfluoro-1-octansulfonamide
PFOSAA	Perfluoro-1-octanesulfonamidoacetic acid
N-EtFOSAA	N-ethylperfluoro-1-octanesulfonamidoacetic acid
N-MeFOSAA	N-methylperfluoro-1-octanesulfonamidoacetic acid
N-EtFOSE	2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol
N-MeFOSE	2-(N-methylperfluoro-1-octanesulfonamido)-ethanol
4:2 FTS	1H,1H,2H,2H-perfluoro-1-hexanesulfonic acid
6:2 FTS	1H,1H,2H,2H-perfluoro-1-octanesulfonic acid
8:2 FTS	1H,1H,2H,2H-perfluoro-1-decanesulfonic acid
HFPO-DA	Tetrafluoro-2-heptafluoropropoxy-propanoic acid

TPH in Soil

Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).

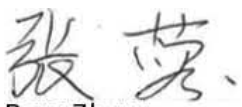
SVOC in Soil

Solvent extraction, followed by GC-MS analysis.(In-house based on US EPA 8270).

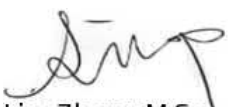
Moisture

Moisture content is determined gravimetrically by drying at 103 °C.

Emily Hanna, B.Sc.
Trace Elements Team Leader



Rong Zhang
Technician



Lisa Zheng, M.Sc.
Senior Technologist

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Certificate of Analysis

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Attention: Lucy Hine
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Lab Reference: 21-24627
Submitted by: Rebecca van der Krogt
Date Received: 01/06/2021
Testing Initiated: 2/06/2021
Date Completed: 3/06/2021
Order Number:
Reference: 1015714

Sampling Site:
Description of Work: 1015174

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Asbestos in Soil (Semi-Quantitative)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
21-24627-1	WSL-21-BH133-0.0mm		Soil	28/05/2021	03/06/2021
21-24627-2	WSL-21-BH133-0.50mm		Soil	28/05/2021	03/06/2021

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled

Analysis Results (Summary)

Laboratory ID	Client Sample ID	Fibre Types	Sample Weight as Received	Moisture Content	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
Units			g	%		
21-24627-1	WSL-21-BH133-0.0mm	Organic Fibres Asbestos NOT Detected.	629.0	17.2	Absent	Absent
21-24627-2	WSL-21-BH133-0.50mm	Organic Fibres Asbestos NOT Detected.	610.0	17.5	Absent	Absent

Information in the above table supplied by the client: Client Sample ID

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Analysis Results (Size Fraction Breakdown)

Laboratory ID	Client Sample ID	Fraction Size	Fraction Weight*	AF/FA Weight*	ACM Weight*	ACM Content*	Asbestos Matrix	Asbestos Weight*	W/W% Asbestos*
Units *Reporting Limit*			g 0	g 0	g 0	% 		g 0	W/W% 0.001
21-24627-1	WSL-21-BH133-0.0mm	>10mm	144.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	209.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	
		<2mm	166.50	0.0000	-	-	No Asbestos Detected	0.0000	
21-24627-2	WSL-21-BH133-0.50mm	>10mm	97.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	175.00	0.0000	0.0000	0	No Asbestos Detected	0.0000	
		<2mm	230.50	0.0000	-	-	No Asbestos Detected	0.0000	

Information in the above table supplied by the client: Client Sample ID

Asbestos in Soil (Semi-Quantitative) Approver:

Emma Kirk, NZCS.
Dunedin Lab Coordinator

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Method Summary

Asbestos Fibres in Soil (Semi-Quantitative)	Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with AS4964-2004 Method for the qualitative identification of asbestos in soil samples. Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques. Note 2: Trace asbestos is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present. Note 3: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised. Note 4: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
Auckland

Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-16211
Submitted by: Rebecca van der Krogt
Date Received: 19/04/2021
Testing Initiated: 20/04/2021
Date Completed: 12/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Please note variance was observed on replicate samples for Chloride which may indicate sample heterogeneity.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH101-10-10.4m	WSL-21-BH101-28-28.7m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-16211-1	21-16211-2
pH*	pH	*1*		7.5	7.6
Chloride*	mg/kg dry wt	*3*		9.8	3.8
Sulfate-S*	mg/kg dry wt	*3*		67.5	78.8

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH101-10-10.4m	WSL-21-BH101-28-28.7m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-16211-1	21-16211-2
Arsenic	mg/kg dry wt	*0.125*		5.3	5.7
Barium	mg/kg dry wt	*0.025*		138	357
Beryllium	mg/kg dry wt	*0.013*		0.30	0.44
Boron	mg/kg dry wt	*1.25*		3.7	5.5
Cadmium	mg/kg dry wt	*0.005*		0.033	0.073
Chromium	mg/kg dry wt	*0.125*		24.3	20.1
Cobalt	mg/kg dry wt	*0.025*		8.32	9.88
Copper	mg/kg dry wt	*0.075*		13.1	22.1
Lead	mg/kg dry wt	*0.25*		4.8	8.99
Manganese	mg/kg dry wt	*0.125*		180	423
Mercury	mg/kg dry wt	*0.025*		0.032	0.050

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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH101-10-10.4m	WSL-21-BH101-28-28.7m
			Date Sampled		
Nickel	mg/kg dry wt	*0.05*		15.9	19.4
Selenium	mg/kg dry wt	*0.25*		0.88	1.5
Tin	mg/kg dry wt	*0.25*		0.43	0.57
Vanadium	mg/kg dry wt	*0.125*		44.4	49.0
Zinc	mg/kg dry wt	*0.05*		40.2	55.6
Sulfur*	mg/kg dry wt	*250*		1,800	3,300

Fluoride in Soil (Subcontracted - ARL)

			Client Sample ID	WSL-21-BH101-10-10.4m	WSL-21-BH101-28-28.7m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-16211-1	21-16211-2
Fluoride*	mg/kg dry wt			170	230

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

			Client Sample ID	WSL-21-BH101-10-10.4m	WSL-21-BH101-28-28.7m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-16211-1	21-16211-2
Total Organic Carbon	g/100g dry wt	*0.05*		12.10	0.99

Allophane Indicator

			Client Sample ID	WSL-21-BH101-10-10.4m	WSL-21-BH101-28-28.7m
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-16211-1	21-16211-2
Allophane Indicator*				Very Weak	Moderate

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

Total Organic Carbon	Subcontracted to Hill Laboratories - Air dried at 35°C and sieved, <2mm fraction. May contain a residual moisture content of 2-5%. Acid pretreatment to remove carbonates present followed by Catalytic Combustion at (900°C, O_2), separation, Thermal Conductivity Detector (Elementar Analyser).

Sharelle Frank, B.Sc. (Tech)
Technologist

Karam Wadi, B.E. (Hons)
Technologist

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
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Attention: Lucy Hine
Phone: 027 304 0134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-25541
Submitted by: Rebecca van der Krogt
Date Received: 05/06/2021
Testing Initiated: 8/06/2021
Date Completed: 22/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH104-12m	Duplicate 7
			Date Sampled	03/06/2021	03/06/2021
Analyte	Unit	*Reporting Limit*		21-25541-1	21-25541-3
pH*	pH	*1*		4.8	4.7
Chloride*	mg/kg dry wt	*3*		3.4	3.7
Sulfate-S*	mg/kg dry wt	*3*		9.1	9.3

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH104-12m	Duplicate 7
			Date Sampled	03/06/2021	03/06/2021
Analyte	Unit	*Reporting Limit*		21-25541-1	21-25541-3
Arsenic	mg/kg dry wt	*0.125*		0.30	0.36
Barium	mg/kg dry wt	*0.025*		41.7	41.5
Beryllium	mg/kg dry wt	*0.013*		0.62	0.66
Boron	mg/kg dry wt	*1.25*		2.2	2.3
Cadmium	mg/kg dry wt	*0.005*		0.015	0.018
Chromium	mg/kg dry wt	*0.125*		14.2	19.0
Cobalt	mg/kg dry wt	*0.025*		0.71	0.85
Copper	mg/kg dry wt	*0.075*		32.6	29.4
Lead	mg/kg dry wt	*0.25*		6.19	6.58
Manganese	mg/kg dry wt	*0.125*		23.8	28.5
Mercury	mg/kg dry wt	*0.025*		0.032	0.035

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Elements in Soil (Comp)

			WSL-21-BH104-12m	Duplicate 7
		Date Sampled	03/06/2021	03/06/2021
Nickel	mg/kg dry wt	*0.05*	1.6	1.8
Selenium	mg/kg dry wt	*0.25*	1.2	1.1
Tin	mg/kg dry wt	*0.25*	0.43	0.45
Vanadium	mg/kg dry wt	*0.125*	34.6	38.3
Zinc	mg/kg dry wt	*0.05*	13.7	21.1
Sulfur*	mg/kg dry wt	*250*	<250	<250

Allophane Indicator

		WSL-21-BH104-12m	Duplicate 7
	Date Sampled	03/06/2021	03/06/2021
Analyte	*Reporting Limit*	21-25541-1	21-25541-3
Allophane Indicator*		Weak	Weak

Fluoride in Soil (Subcontracted - ARL)

			WSL-21-BH104-12m	Duplicate 7
		Date Sampled	03/06/2021	03/06/2021
Analyte	Unit	*Reporting Limit*	21-25541-1	21-25541-3
Fluoride*	mg/kg dry wt		110	110

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

			WSL-21-BH104-12m	Duplicate 7
		Date Sampled	03/06/2021	03/06/2021
Analyte	Unit	*Reporting Limit*	21-25541-1	21-25541-3
Total Organic Carbon*	g/100g dry wt	*0.1*	0.13	0.26

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Sharelle Frank, B.Sc. (Tech)
Technologist

Emily Hanna, B.Sc.
Trace Elements Team Leader

Matthew Counsell, B.Sc.
Inorganics Team Leader

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
Auckland

Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-26998
Submitted by: Rebecca van der Krogt
Date Received: 16/06/2021
Testing Initiated: 16/06/2021
Date Completed: 16/07/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH106-21m	WSL-21-BH118-22m	Duplicate 9
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-26998-2	21-26998-4	21-26998-6
pH*	pH	*1*		5.1	4.4	4.4
Chloride*	mg/kg dry wt	*3*		<3.0	3.8	3.8
Sulfate-S*	mg/kg dry wt	*3*		25.5	11.2	18.0

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH106-21m	WSL-21-BH118-22m	Duplicate 9
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-26998-2	21-26998-4	21-26998-6
Arsenic	mg/kg dry wt	*0.125*		1.4	2.0	3.0
Barium	mg/kg dry wt	*0.025*		729	275	215
Beryllium	mg/kg dry wt	*0.013*		0.31	0.32	0.33
Boron	mg/kg dry wt	*1.25*		2.0	2.8	2.5
Cadmium	mg/kg dry wt	*0.005*		0.054	0.044	0.034
Chromium	mg/kg dry wt	*0.125*		17.2	14.9	14.0
Cobalt	mg/kg dry wt	*0.025*		9.41	6.22	7.06
Copper	mg/kg dry wt	*0.075*		14.1	12.5	13.5
Lead	mg/kg dry wt	*0.25*		4.3	4.6	5.31
Manganese	mg/kg dry wt	*0.125*		146	777	391
Mercury	mg/kg dry wt	*0.025*		<0.025	<0.025	0.027

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH106-21m	WSL-21-BH118-22m	Duplicate 9
			Date Sampled			
Nickel	mg/kg dry wt	*0.05*		15.9	11.2	14.2
Selenium	mg/kg dry wt	*0.25*		0.41	0.42	0.70
Tin	mg/kg dry wt	*0.25*		0.39	0.32	0.35
Zinc	mg/kg dry wt	*0.05*		56.4	38.3	40.2
Vanadium	mg/kg dry wt	*0.125*		34.8	26.2	23.4
Sulfur*	mg/kg dry wt	*250*		1,700	1,500	1,600

Allophane Indicator

		Client Sample ID	WSL-21-BH106-21m	WSL-21-BH118-22m	Duplicate 9
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-26998-2	21-26998-4	21-26998-6
Allophane Indicator*			Moderate	Moderate	Moderate

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH106-21m	WSL-21-BH118-22m	Duplicate 9
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-26998-2	21-26998-4	21-26998-6
Total Organic Carbon*	g/100g dry wt	*0.1*	0.23	0.58	0.57

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH106-21m	WSL-21-BH118-22m	Duplicate 9
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-26998-2	21-26998-4	21-26998-6
Fluoride*	mg/kg dry wt		99.0	170	200

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

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Method Summary

Fluoride in Soil	Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

Matthew Counsell, B.Sc.
Inorganics Team Leader

Emily Hanna, B.Sc.
Trace Elements Team Leader

Sharelle Frank, B.Sc. (Tech)
Technologist

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Attention: Lucy Hine
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Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-29124
Submitted by: Rebecca van der Krogt
Date Received: 30/06/2021
Testing Initiated: 30/06/2021
Date Completed: 16/07/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH112-24m
			Date Sampled	18/06/2021
Analyte		Unit	*Reporting Limit*	21-29124-2
pH*		pH	*1*	3.2
Chloride*		mg/kg dry wt	*3*	5.5
Sulfate-S*		mg/kg dry wt	*3*	<3.0

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH112-24m
			Date Sampled	18/06/2021
Analyte		Unit	*Reporting Limit*	21-29124-2
Arsenic		mg/kg dry wt	*0.125*	<0.13
Barium		mg/kg dry wt	*0.025*	41.1
Beryllium		mg/kg dry wt	*0.013*	0.74
Boron		mg/kg dry wt	*1.25*	1.9
Cadmium		mg/kg dry wt	*0.005*	<0.0050
Chromium		mg/kg dry wt	*0.125*	12
Cobalt		mg/kg dry wt	*0.025*	2.1
Copper		mg/kg dry wt	*0.075*	11.0
Lead		mg/kg dry wt	*0.25*	4.5
Manganese		mg/kg dry wt	*0.125*	55.0
Mercury		mg/kg dry wt	*0.025*	<0.025

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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH112-24m
			Date Sampled	18/06/2021
Nickel	mg/kg dry wt	*0.05*		4.4
Selenium	mg/kg dry wt	*0.25*		2.1
Tin	mg/kg dry wt	*0.25*		0.33
Vanadium	mg/kg dry wt	*0.125*		23.7
Zinc	mg/kg dry wt	*0.05*		23.5
Sulfur*	mg/kg dry wt	*250*		<250

Allophane Indicator

		Client Sample ID	WSL-21-BH112-24m
		Date Sampled	18/06/2021
Analyte	Unit	*Reporting Limit*	21-29124-2
Allophane Indicator*			Very Weak

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH112-24m
		Date Sampled	18/06/2021
Analyte	Unit	*Reporting Limit*	21-29124-2
Fluoride*	mg/kg dry wt		120

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH112-24m
		Date Sampled	18/06/2021
Analyte	Unit	*Reporting Limit*	21-29124-2
Total Organic Carbon*	g/100g dry wt	*0.1*	<0.10

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Matthew Counsell, B.Sc.
Inorganics Team Leader

Emily Hanna, B.Sc.
Trace Elements Team Leader

Sharelle Frank, B.Sc. (Tech)
Technologist

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Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-21579
Submitted by: Rebbecca van der Krogt
Date Received: 12/05/2021
Testing Initiated: 13/05/2021
Date Completed: 28/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Custom Job

	Client Sample ID		WSL-21-BH121-10m	WSL-21-BH121-25m
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Custom Job			Complete	Complete

Soil Aggregate Properties and Nutrients

	Client Sample ID		WSL-21-BH121-10m	WSL-21-BH121-25m
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
pH*	pH	*1*	3.9	5.9
Chloride*	mg/kg dry wt	*3*	<3.0	14.5
Sulfate-S*	mg/kg dry wt	*3*	16.4	34.5

Elements in Soil (Comp)

	Client Sample ID		WSL-21-BH121-10m	WSL-21-BH121-25m
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Arsenic	mg/kg dry wt	*0.125*	2.8	2.8
Barium	mg/kg dry wt	*0.025*	109	427

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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
			Date Sampled		
Beryllium	mg/kg dry wt	*0.013*		0.59	0.43
Boron	mg/kg dry wt	*1.25*		2.6	5.8
Cadmium	mg/kg dry wt	*0.005*		0.048	0.048
Chromium	mg/kg dry wt	*0.125*		13.1	20.8
Cobalt	mg/kg dry wt	*0.025*		8.05	10.0
Copper	mg/kg dry wt	*0.075*		18.5	17.9
Lead	mg/kg dry wt	*0.25*		5.88	5.56
Manganese	mg/kg dry wt	*0.125*		99.9	395
Mercury	mg/kg dry wt	*0.025*		0.044	0.037
Nickel	mg/kg dry wt	*0.05*		14.9	16.9
Selenium	mg/kg dry wt	*0.25*		0.88	0.65
Tin	mg/kg dry wt	*0.25*		0.46	0.56
Vanadium	mg/kg dry wt	*0.125*		17.8	35.1
Zinc	mg/kg dry wt	*0.05*		54.0	52.6
Sulfur*	mg/kg dry wt	*250*		1,900	1,600

Allophane Indicator

		Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Allophane Indicator*			Non - Reactive	Non - Reactive

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Fluoride*	mg/kg dry wt		130	250

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

		Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Total Organic Carbon	g/100g dry wt	*0.05*	0.23	0.23

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Heavy Metals by TCLP

			Comp 1 (WSL-21-BH121-10m, WSL-21-BH121-25m)
	Client Sample ID		
	Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-3
Arsenic	g/m^3	*0.005*	<0.005
Cadmium	g/m^3	*0.0005*	<0.0005
Chromium	g/m^3	*0.005*	<0.005
Copper	g/m^3	*0.05*	<0.05
Lead	g/m^3	*0.01*	0.033
Nickel	g/m^3	*0.002*	0.019
Zinc	g/m^3	*0.4*	<0.4

TCLP Extraction

			Comp 1 (WSL-21-BH121-10m, WSL-21-BH121-25m)
	Client Sample ID		
	Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-3
Extractant Used			# 1
Initial pH	pH	*1*	5.0
Final pH	pH	*1*	5.0

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

Total Organic Carbon Subcontracted to Hill Laboratories - Air dried at 35°C and sieved, <2mm fraction. May contain a residual moisture content of 2-5%. Acid pretreatment to remove carbonates present followed by Catalytic Combustion at (900°C, O_2), separation, Thermal Conductivity Detector (Elementar Analyser).

TCLP Elements TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).

TCLP Extraction TCLP was performed according to US-EPA method 1311.

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Sharelle Frank, B.Sc. (Tech)
Technologist

Emily Hanna, B.Sc.
Trace Elements Team Leader

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
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Attention: Lucy Hine
Phone: 027 304 0134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-25082
Submitted by: Rebecca van der Krogt
Date Received: 03/06/2021
Testing Initiated: 3/06/2021
Date Completed: 14/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH130-16m 16m
			Date Sampled	01/06/2021
Analyte		Unit	*Reporting Limit*	21-25082-2
Arsenic		mg/kg dry wt	*0.125*	2.4
Barium		mg/kg dry wt	*0.025*	30.1
Beryllium		mg/kg dry wt	*0.013*	0.48
Boron		mg/kg dry wt	*1.25*	2.3
Cadmium		mg/kg dry wt	*0.005*	0.091
Chromium		mg/kg dry wt	*0.125*	7.1
Cobalt		mg/kg dry wt	*0.025*	7.64
Copper		mg/kg dry wt	*0.075*	11.7
Lead		mg/kg dry wt	*0.25*	5.0
Manganese		mg/kg dry wt	*0.125*	61.6
Mercury		mg/kg dry wt	*0.025*	0.025
Nickel		mg/kg dry wt	*0.05*	11.8
Selenium		mg/kg dry wt	*0.25*	0.69
Tin		mg/kg dry wt	*0.25*	0.28
Vanadium		mg/kg dry wt	*0.125*	11
Zinc		mg/kg dry wt	*0.05*	91.1
Sulfur*		mg/kg dry wt	*250*	1,800

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH130-16m 16m
			Date Sampled	01/06/2021
Analyte		Unit	*Reporting Limit*	21-25082-2
Chloride*		mg/kg dry wt	*3*	<3.0
pH*		pH	*1*	3.7
Sulfate-S*		mg/kg dry wt	*3*	16.3

Allophane Indicator

			Client Sample ID	WSL-21-BH130-16m 16m
			Date Sampled	01/06/2021
Analyte		Unit	*Reporting Limit*	21-25082-2
Allophane Indicator*				Non - Reactive

Fluoride in Soil (Subcontracted - ARL)

			Client Sample ID	WSL-21-BH130-16m 16m
			Date Sampled	01/06/2021
Analyte		Unit	*Reporting Limit*	21-25082-2
Fluoride*		mg/kg dry wt		99.0

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

			Client Sample ID	WSL-21-BH130-16m 16m
			Date Sampled	01/06/2021
Analyte		Unit	*Reporting Limit*	21-25082-2
Total Organic Carbon*		g/100g dry wt	*0.1*	0.21

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Emily Hanna, B.Sc.
Trace Elements Team Leader

Matthew Counsell, B.Sc.
Inorganics Team Leader

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Certificate of Analysis

Tonkin and Taylor Ltd
105 Carlton Gore Road, Newmarket
Auckland

Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-24443
Submitted by: Rebecca van der Krogt
Date Received: 29/05/2021
Testing Initiated: 31/05/2021
Date Completed: 11/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
pH*	pH	*1*		4.8	4.3
Chloride*	mg/kg dry wt	*3*		16.6	5.3
Sulfate-S*	mg/kg dry wt	*3*		3.5	<3.1

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
Arsenic	mg/kg dry wt	*0.125*		0.98	0.39
Barium	mg/kg dry wt	*0.025*		181	40.2
Beryllium	mg/kg dry wt	*0.013*		0.95	0.28
Boron	mg/kg dry wt	*1.25*		2.9	<1.3
Cadmium	mg/kg dry wt	*0.005*		0.038	0.011
Chromium	mg/kg dry wt	*0.125*		12	18.8
Cobalt	mg/kg dry wt	*0.025*		1.8	0.37
Copper	mg/kg dry wt	*0.075*		2.8	5.3
Lead	mg/kg dry wt	*0.25*		4.3	10.2
Manganese	mg/kg dry wt	*0.125*		117	49.8
Mercury	mg/kg dry wt	*0.025*		0.15	0.28

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Elements in Soil (Comp)

Client Sample ID			WSL-21-BH132-10M	WSL-21-BH132-15M
Date Sampled				
Nickel	mg/kg dry wt	*0.05*	2.1	1.8
Selenium	mg/kg dry wt	*0.25*	1.6	0.66
Tin	mg/kg dry wt	*0.25*	0.71	0.76
Vanadium	mg/kg dry wt	*0.125*	15.1	58.9
Zinc	mg/kg dry wt	*0.05*	4.2	21.4
Sulfur*	mg/kg dry wt	*250*	4,100	<250

Heavy Metals by TCLP

Client Sample ID			Composite 1 (WSL-21-BH132-10M, WSL-21-BH132-15M)
Date Sampled			
Analyte	Unit	*Reporting Limit*	21-24443-5
Arsenic	g/m^3	*0.005*	<0.005
Beryllium	g/m^3	*0.0001*	0.0001
Boron	g/m^3	*0.5*	1.4
Cadmium	g/m^3	*0.0005*	<0.0005
Chromium	g/m^3	*0.005*	<0.005
Copper	g/m^3	*0.05*	<0.05
Lead	g/m^3	*0.01*	0.088
Mercury	g/m^3	*0.001*	<0.001
Nickel	g/m^3	*0.002*	0.025
Zinc	g/m^3	*0.4*	3.6

TCLP Extraction

Client Sample ID			Composite 1 (WSL-21-BH132-10M, WSL-21-BH132-15M)
Date Sampled			
Analyte	Unit	*Reporting Limit*	21-24443-5
Extractant Used			# 1
Initial pH	pH	*1*	4.9
Final pH	pH	*1*	5.0

Fluoride in Soil (Subcontracted - ARL)

Client Sample ID			WSL-21-BH132-10M	WSL-21-BH132-15M
Date Sampled				
Analyte	Unit	*Reporting Limit*	21-24443-1	21-24443-2
Fluoride*	mg/kg dry wt		75.0	120

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Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
Total Organic Carbon*	g/100g dry wt	*0.1*		26.1	0.71

Allophane Indicator

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
Allophane Indicator*				Non - Reactive	Non - Reactive

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TCLP Elements TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).

TCLP Extraction TCLP was performed according to US-EPA method 1311.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Matthew Counsell, B.Sc.
Inorganics Team Leader

Emily Hanna, B.Sc.
Trace Elements Team Leader

Sharelle Frank, B.Sc. (Tech)
Technologist

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Certificate of Analysis

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Attention: Lucy Hine
Phone: 027 304 0134
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Lab Reference: 21-25085
Submitted by: Rebecca van der Krogt
Date Received: 03/06/2021
Testing Initiated: 3/06/2021
Date Completed: 21/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
Client Sample ID				
Date Sampled			31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
pH*	pH	*1*	4.3	3.8
Chloride*	mg/kg dry wt	*3*	11.1	5.4
Sulfate-S*	mg/kg dry wt	*3*	4.3	<3.0

Elements in Soil (Comp)

			WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
Client Sample ID				
Date Sampled			31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Arsenic	mg/kg dry wt	*0.125*	1.3	0.36
Barium	mg/kg dry wt	*0.025*	124	52.5
Beryllium	mg/kg dry wt	*0.013*	0.80	0.17
Boron	mg/kg dry wt	*1.25*	1.6	<1.3
Cadmium	mg/kg dry wt	*0.005*	0.14	0.016
Chromium	mg/kg dry wt	*0.125*	6.1	16.4
Cobalt	mg/kg dry wt	*0.025*	0.55	0.40
Copper	mg/kg dry wt	*0.075*	1.4	6.3
Lead	mg/kg dry wt	*0.25*	12.3	14.0
Manganese	mg/kg dry wt	*0.125*	47.5	47.3
Mercury	mg/kg dry wt	*0.025*	0.14	0.19

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
			Date Sampled	31/05/2021	31/05/2021
Nickel	mg/kg dry wt	*0.05*		1.6	1.4
Selenium	mg/kg dry wt	*0.25*		1.3	0.47
Tin	mg/kg dry wt	*0.25*		1.5	0.82
Vanadium	mg/kg dry wt	*0.125*		10	60.9
Zinc	mg/kg dry wt	*0.05*		9.44	47.7
Sulfur*	mg/kg dry wt	*250*		720	<250

Allophane Indicator

		Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
		Date Sampled	31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Allophane Indicator*			Non - Reactive	Non - Reactive

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
		Date Sampled	31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Total Organic Carbon*	g/100g dry wt	*0.1*	9.1	0.49

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
		Date Sampled	31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Fluoride*	mg/kg dry wt		170	130

Heavy Metals by TCLP

		Client Sample ID	Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)
		Date Sampled	
Analyte	Unit	*Reporting Limit*	21-25085-3
Arsenic	g/m^3	*0.005*	<0.005
Beryllium	g/m^3	*0.0001*	0.0002
Boron	g/m^3	*0.5*	1.3
Cadmium	g/m^3	*0.0005*	<0.0005
Chromium	g/m^3	*0.005*	<0.005
Copper	g/m^3	*0.05*	<0.05
Lead	g/m^3	*0.01*	0.018
Mercury	g/m^3	*0.001*	<0.001
Nickel	g/m^3	*0.002*	<0.002

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Heavy Metals by TCLP

			Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)
Client Sample ID			
Date Sampled			
Zinc	g/m^3	*0.4*	2.1

TCLP Extraction

			Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)
Client Sample ID			
Date Sampled			
Analyte	Unit	*Reporting Limit*	21-25085-3
Extractant Used			# 1
Initial pH	pH	*1*	4.9
Final pH	pH	*1*	5.0

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

TCLP Elements TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).

TCLP Extraction TCLP was performed according to US-EPA method 1311.

Matthew Counsell, B.Sc.
Inorganics Team Leader

Emily Hanna, B.Sc.
Trace Elements Team Leader

Sharelle Frank, B.Sc. (Tech)
Technologist

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Certificate of Analysis

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Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-14934
Submitted by: Rebecca van der Krogt
Date Received: 01/04/2021
Testing Initiated: 13/04/2021
Date Completed: 29/04/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Please note variance was observed on replicate samples for metals in soil which may indicate sample heterogeneity.

Soil Aggregate Properties and Nutrients

			WSL-21-BH201-4-4.2m	WSL-21-BH202-14-14.2m	WSL-21-BH202-32-32.2m
Client Sample ID					
Date Sampled			30/03/2021	30/03/2021	30/03/2021
Analyte	Unit	*Reporting Limit*	21-14934-1	21-14934-2	21-14934-3
pH*	pH	*1*	4.1	4.1	5.2
Chloride*	mg/kg dry wt	*3*	8.7	4.5	20.4
Sulfate-S*	mg/kg dry wt	*3*	<3.0	21.8	25.1

Elements in Soil (Comp)

			WSL-21-BH201-4-4.2m	WSL-21-BH202-14-14.2m	WSL-21-BH202-32-32.2m
Client Sample ID					
Date Sampled			30/03/2021	30/03/2021	30/03/2021
Analyte	Unit	*Reporting Limit*	21-14934-1	21-14934-2	21-14934-3
Arsenic	mg/kg dry wt	*0.125*	0.95	2.5	2.5
Barium	mg/kg dry wt	*0.025*	29.0	939	266
Beryllium	mg/kg dry wt	*0.013*	0.20	0.40	0.50
Boron	mg/kg dry wt	*1.25*	4.5	5.7	5.5
Cadmium	mg/kg dry wt	*0.005*	<0.0050	0.056	0.061
Chromium	mg/kg dry wt	*0.125*	7.7	12.8	16.3
Cobalt	mg/kg dry wt	*0.025*	0.24	10.2	8.25
Copper	mg/kg dry wt	*0.075*	8.96	15.9	24.0
Lead	mg/kg dry wt	*0.25*	7.43	5.20	7.03
Manganese	mg/kg dry wt	*0.125*	9.1	459	171
Mercury	mg/kg dry wt	*0.025*	<0.025	0.027	0.028

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH201-4-4.2m	WSL-21-BH202-14-14.2m	WSL-21-BH202-32-32.2m
			Date Sampled	30/03/2021	30/03/2021	30/03/2021
Nickel	mg/kg dry wt	*0.05*		0.80	15.9	14.8
Selenium	mg/kg dry wt	*0.25*		<0.25	0.72	1.1
Tin	mg/kg dry wt	*0.25*		2.2	0.75	0.68
Vanadium	mg/kg dry wt	*0.125*		15.3	25.9	31.6
Zinc	mg/kg dry wt	*0.05*		4.8	50.5	54.5
Sulfur*	mg/kg dry wt	*250*		<250	1,400	1,700

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH201-4-4.2m	WSL-21-BH202-14-14.2m	WSL-21-BH202-32-32.2m
		Date Sampled	30/03/2021	30/03/2021	30/03/2021
Analyte	Unit	*Reporting Limit*	21-14934-1	21-14934-2	21-14934-3
Fluoride*	mg/kg dry wt		98.0	150	280

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

		Client Sample ID	WSL-21-BH201-4-4.2m	WSL-21-BH202-14-14.2m	WSL-21-BH202-32-32.2m
		Date Sampled	30/03/2021	30/03/2021	30/03/2021
Analyte	Unit	*Reporting Limit*	21-14934-1	21-14934-2	21-14934-3
Total Organic Carbon	g/100g dry wt	*0.05*	0.08	0.19	0.27

Allophane Indicator

		Client Sample ID	WSL-21-BH201-4-4.2m	WSL-21-BH202-14-14.2m	WSL-21-BH202-32-32.2m
		Date Sampled	30/03/2021	30/03/2021	30/03/2021
Analyte	Unit	*Reporting Limit*	21-14934-1	21-14934-2	21-14934-3
Allophane Indicator*			Very Weak	Non - Reactive	Non - Reactive

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

Total Organic Carbon	Subcontracted to Hill Laboratories - Air dried at 35°C and sieved, <2mm fraction. May contain a residual moisture content of 2-5%. Acid pretreatment to remove carbonates present followed by Catalytic Combustion at (900°C, O_2), separation, Thermal Conductivity Detector (Elementar Analyser).

Sharelle Frank, B.Sc. (Tech)
Technologist

Emily Hanna, B.Sc.
Trace Elements Team Leader

Karam Wadi, B.E. (Hons)
Technologist

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Certificate of Analysis

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Lab Reference: 21-12125
Submitted by: Rebecca van der Krogt
Date Received: 17/03/2021
Testing Initiated: 19/03/2021
Date Completed: 19/04/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH203-25-25.2m	WSL-21-BH204-26-26.2m	WSL-21-BH204-36-36.2m	WSL-21-BH205-22-22.2m	WSL-21-BH206-16-16.2m
			Date Sampled	16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021
Analyte	Unit	*Reporting Limit*		21-12125-1	21-12125-2	21-12125-3	21-12125-4	21-12125-5
pH*	pH	*1*		5.9	6.2	7.0	4.4	4.1
Chloride*	mg/kg dry wt	*3*		6.1	3.3	4.9	<3.0	<3.0
Sulfate-S*	mg/kg dry wt	*3*		18.4	64.6	106.1	34.0	16.0

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH206-24-24.2m
			Date Sampled	16/03/2021
Analyte	Unit	*Reporting Limit*		21-12125-6
pH*	pH	*1*		5.5
Chloride*	mg/kg dry wt	*3*		<3.1
Sulfate-S*	mg/kg dry wt	*3*		83.4

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Elements in Soil (Comp)

Client Sample ID			WSL-21-BH203-25-25.2m	WSL-21-BH204-26-26.2m	WSL-21-BH204-36-36.2m	WSL-21-BH205-22-22.2m	WSL-21-BH206-16-16.2m
Date Sampled			16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-1	21-12125-2	21-12125-3	21-12125-4	21-12125-5
Arsenic	mg/kg dry wt	*0.125*	2.6	4.7	2.6	2.5	2.2
Barium	mg/kg dry wt	*0.025*	736	117	211	133	671
Beryllium	mg/kg dry wt	*0.013*	0.45	0.47	0.36	1.2	0.41
Boron	mg/kg dry wt	*1.25*	4.8	4.4	3.9	2.8	3.0
Cadmium	mg/kg dry wt	*0.005*	0.058	0.064	0.055	0.048	0.038
Chromium	mg/kg dry wt	*0.125*	16.0	19.2	24.4	15.5	14.1
Cobalt	mg/kg dry wt	*0.025*	13.6	11.0	9.14	20.3	11.4
Copper	mg/kg dry wt	*0.075*	26.9	32.5	19.9	20.5	16.4
Lead	mg/kg dry wt	*0.25*	6.21	8.17	5.05	4.9	4.5
Manganese	mg/kg dry wt	*0.125*	1,070	186	493	132	294
Mercury	mg/kg dry wt	*0.025*	0.034	0.050	0.030	<0.025	<0.025
Nickel	mg/kg dry wt	*0.05*	21.9	19.7	16.3	37.9	19.2
Selenium	mg/kg dry wt	*0.25*	1.1	1.1	0.94	1.6	0.95
Tin	mg/kg dry wt	*0.25*	0.48	0.53	0.40	0.41	0.33
Vanadium	mg/kg dry wt	*0.125*	33.4	38.8	51.0	26.2	25.3
Zinc	mg/kg dry wt	*0.05*	60.6	67.4	46.7	52.2	55.2
Sulfur*	mg/kg dry wt	*250*	2,100	2,700	3,800	1,400	1,600

Elements in Soil (Comp)

Client Sample ID			WSL-21-BH206-24-24.2m
Date Sampled			16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-6
Arsenic	mg/kg dry wt	*0.125*	2.2
Barium	mg/kg dry wt	*0.025*	534
Beryllium	mg/kg dry wt	*0.013*	0.31
Boron	mg/kg dry wt	*1.25*	2.9
Cadmium	mg/kg dry wt	*0.005*	0.051
Chromium	mg/kg dry wt	*0.125*	15.2
Cobalt	mg/kg dry wt	*0.025*	8.60
Copper	mg/kg dry wt	*0.075*	18.5
Lead	mg/kg dry wt	*0.25*	4.4
Manganese	mg/kg dry wt	*0.125*	1,060
Mercury	mg/kg dry wt	*0.025*	<0.025
Nickel	mg/kg dry wt	*0.05*	14.7
Selenium	mg/kg dry wt	*0.25*	0.83
Tin	mg/kg dry wt	*0.25*	0.33
Vanadium	mg/kg dry wt	*0.125*	33.9
Zinc	mg/kg dry wt	*0.05*	47.4
Sulfur*	mg/kg dry wt	*250*	1,300

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Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH203-25-25.2m	WSL-21-BH204-26-26.2m	WSL-21-BH204-36-36.2m	WSL-21-BH205-22-22.2m	WSL-21-BH206-16-16.2m
		Date Sampled	16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-1	21-12125-2	21-12125-3	21-12125-4	21-12125-5
Fluoride*	mg/kg dry wt		210	260	190	120	140

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH206-24-24.2m
		Date Sampled	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-6
Fluoride*	mg/kg dry wt		230

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

		Client Sample ID	WSL-21-BH203-25-25.2m	WSL-21-BH204-26-26.2m	WSL-21-BH204-36-36.2m	WSL-21-BH205-22-22.2m	WSL-21-BH206-16-16.2m
		Date Sampled	16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-1	21-12125-2	21-12125-3	21-12125-4	21-12125-5
Total Organic Carbon	g/100g dry wt	*0.05*	0.26	0.36	0.14	0.15	0.14

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

		Client Sample ID	WSL-21-BH206-24-24.2m
		Date Sampled	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-6
Total Organic Carbon	g/100g dry wt	*0.05*	0.29

Allophane Indicator

		Client Sample ID	WSL-21-BH203-25-25.2m	WSL-21-BH204-26-26.2m	WSL-21-BH204-36-36.2m	WSL-21-BH205-22-22.2m	WSL-21-BH206-16-16.2m
		Date Sampled	16/03/2021	16/03/2021	16/03/2021	16/03/2021	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-1	21-12125-2	21-12125-3	21-12125-4	21-12125-5
Allophane Indicator*			Non - Reactive	Non - Reactive	Moderate	Non - Reactive	Non - Reactive

Allophane Indicator

		Client Sample ID	WSL-21-BH206-24-24.2m
		Date Sampled	16/03/2021
Analyte	Unit	*Reporting Limit*	21-12125-6
Allophane Indicator*			Non - Reactive

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Method Summary

pH in Soil	1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).
Chloride in Soil	1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).
Sulfate-S in Soils	1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).
Elements in Soil	Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.
Fluoride in Soil	Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".
Total Organic Carbon	Subcontracted to Hill Laboratories - Air dried at 35°C and sieved, <2mm fraction. May contain a residual moisture content of 2-5%. Acid pretreatment to remove carbonates present followed by Catalytic Combustion at (900°C, O_2), separation, Thermal Conductivity Detector (Elementar Analyser).

Matthew Counsell, B.Sc.
Inorganics Team Leader

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Trace Elements Team Leader

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Certificate of Analysis

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Lab Reference: 21-21601
Submitted by: Rebbecca van der Krogt
Date Received: 13/05/2021
Testing Initiated: 13/05/2021
Date Completed: 28/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH207-5.4m
			Date Sampled	
Analyte		Unit	*Reporting Limit*	21-21601-1
pH*		pH	*1*	3.8
Chloride*		mg/kg dry wt	*3*	<3.1
Sulfate-S*		mg/kg dry wt	*3*	22.0

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH207-5.4m
			Date Sampled	
Analyte		Unit	*Reporting Limit*	21-21601-1
Arsenic		mg/kg dry wt	*0.125*	0.71
Barium		mg/kg dry wt	*0.025*	19.4
Beryllium		mg/kg dry wt	*0.013*	0.27
Boron		mg/kg dry wt	*1.25*	1.7
Cadmium		mg/kg dry wt	*0.005*	0.045
Chromium		mg/kg dry wt	*0.125*	12
Cobalt		mg/kg dry wt	*0.025*	0.77
Copper		mg/kg dry wt	*0.075*	2.3
Lead		mg/kg dry wt	*0.25*	4.4
Manganese		mg/kg dry wt	*0.125*	46.0
Mercury		mg/kg dry wt	*0.025*	0.036

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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH207-5.4m
			Date Sampled	
Nickel	mg/kg dry wt	*0.05*		1.1
Selenium	mg/kg dry wt	*0.25*		0.27
Tin	mg/kg dry wt	*0.25*		0.54
Vanadium	mg/kg dry wt	*0.125*		45.6
Zinc	mg/kg dry wt	*0.05*		6.01
Sulfur*	mg/kg dry wt	*250*		500

Allophane Indicator

		Client Sample ID	WSL-21-BH207-5.4m
		Date Sampled	
Analyte	Unit	*Reporting Limit*	21-21601-1
Allophane Indicator*			Very Weak

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH207-5.4m
		Date Sampled	
Analyte	Unit	*Reporting Limit*	21-21601-1
Fluoride*	mg/kg dry wt		130

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

		Client Sample ID	WSL-21-BH207-5.4m
		Date Sampled	
Analyte	Unit	*Reporting Limit*	21-21601-1
Total Organic Carbon	g/100g dry wt	*0.05*	1.63

Method Summary

pH in Soil	1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).
Chloride in Soil	1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).
Sulfate-S in Soils	1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).
Elements in Soil	Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.
Fluoride in Soil	Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

Total Organic Carbon	Subcontracted to Hill Laboratories - Air dried at 35°C and sieved, <2mm fraction. May contain a residual moisture content of 2-5%. Acid pretreatment to remove carbonates present followed by Catalytic Combustion at (900°C, O_2), separation, Thermal Conductivity Detector (Elementar Analyser).

Matthew Counsell, B.Sc.
Inorganics Team Leader

Sharelle Frank, B.Sc. (Tech)
Technologist

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Certificate of Analysis

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Lab Reference: 21-31081
Submitted by: Rebecca van der Krogt
Date Received: 14/07/2021
Testing Initiated: 14/07/2021
Date Completed: 29/07/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH110-20m	WSL-21-BH120-20m	WSL-21-BH131-10m
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-31081-1	21-31081-2	21-31081-3
Sulfate-S*	mg/kg dry wt	*3*		29.2	107.4	12.1
pH*	pH	*1*		4.1	3.9	4.3
Chloride*	mg/kg dry wt	*3*		10.9	6.1	14.6

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH110-20m	WSL-21-BH120-20m	WSL-21-BH131-10m
			Date Sampled			
Analyte	Unit	*Reporting Limit*		21-31081-1	21-31081-2	21-31081-3
Arsenic	mg/kg dry wt	*0.125*		1.9	4.1	0.77
Barium	mg/kg dry wt	*0.025*		117	101	206
Beryllium	mg/kg dry wt	*0.013*		0.88	0.46	0.62
Boron	mg/kg dry wt	*1.25*		2.2	2.0	1.5
Cadmium	mg/kg dry wt	*0.005*		0.047	0.015	0.039
Chromium	mg/kg dry wt	*0.125*		14.0	13.1	7.6
Cobalt	mg/kg dry wt	*0.025*		13.2	10.5	0.89
Copper	mg/kg dry wt	*0.075*		16.9	13.4	6.7
Lead	mg/kg dry wt	*0.25*		4.7	6.37	8.97
Manganese	mg/kg dry wt	*0.125*		96.3	100	64.4
Mercury	mg/kg dry wt	*0.025*		<0.025	0.028	0.42

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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH110-20m	WSL-21-BH120-20m	WSL-21-BH131-10m
			Date Sampled			
Nickel	mg/kg dry wt	*0.05*		21.9	19.7	4.4
Selenium	mg/kg dry wt	*0.25*		0.72	0.65	2.4
Tin	mg/kg dry wt	*0.25*		0.65	0.43	1.8
Vanadium	mg/kg dry wt	*0.125*		24.7	17.1	8.9
Sulfur*	mg/kg dry wt	*250*		1,200	2,900	1,700
Zinc	mg/kg dry wt	*0.05*		50.6	22.5	7.47

Allophane Indicator

		Client Sample ID	WSL-21-BH110-20m	WSL-21-BH120-20m	WSL-21-BH131-10m
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-31081-1	21-31081-2	21-31081-3
Allophane Indicator*			Very Weak	Non - Reactive	Non - Reactive

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH110-20m	WSL-21-BH120-20m	WSL-21-BH131-10m
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-31081-1	21-31081-2	21-31081-3
Total Organic Carbon*	g/100g dry wt	*0.1*	0.22	0.25	12.0

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH110-20m	WSL-21-BH120-20m	WSL-21-BH131-10m
		Date Sampled			
Analyte	Unit	*Reporting Limit*	21-31081-1	21-31081-2	21-31081-3
Fluoride*	mg/kg dry wt		100	110	140

Method Summary

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

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Method Summary

Fluoride in Soil	Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

Sharelle Frank, B.Sc. (Tech)
Technologist

Matthew Counsell, B.Sc.
Inorganics Team Leader

Emily Hanna, B.Sc.
Trace Elements Team Leader

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Certificate of Analysis

Tonkin and Taylor
105 Carlton Gore Road, Newmarket
Auckland

Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-47139
Submitted by: Rebecca van der Krogt
Date Received: 11/11/2021
Testing Initiated: 11/11/2021
Date Completed: 25/11/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH116-13m
			Date Sampled	09/11/2021
Analyte		Unit	*Reporting Limit*	21-47139-1
Arsenic		mg/kg dry wt	*0.125*	5.8
Barium		mg/kg dry wt	*0.025*	315
Beryllium		mg/kg dry wt	*0.013*	0.37
Boron		mg/kg dry wt	*1.25*	3.5
Cadmium		mg/kg dry wt	*0.005*	0.17
Chromium		mg/kg dry wt	*0.125*	17.5
Cobalt		mg/kg dry wt	*0.025*	21.7
Copper		mg/kg dry wt	*0.075*	17.6
Lead		mg/kg dry wt	*0.25*	5.0
Manganese		mg/kg dry wt	*0.125*	192
Mercury		mg/kg dry wt	*0.025*	0.061
Nickel		mg/kg dry wt	*0.05*	36.5
Selenium		mg/kg dry wt	*0.25*	0.79
Tin		mg/kg dry wt	*0.25*	0.38
Vanadium		mg/kg dry wt	*0.125*	36.2
Zinc		mg/kg dry wt	*0.05*	79.6
Sulfur*		mg/kg dry wt	*250*	18,000

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Soil Aggregate Properties and Nutrients

		Client Sample ID	WSL-21-BH116-13m
		Date Sampled	09/11/2021
Analyte	Unit	*Reporting Limit*	21-47139-1
pH*	pH	*1*	4.2
Chloride*	mg/kg dry wt	*3*	<3.0
Sulfate-S*	mg/kg dry wt	*3*	2,588.0

Allophane Indicator

		Client Sample ID	WSL-21-BH116-13m
		Date Sampled	09/11/2021
Analyte	Unit	*Reporting Limit*	21-47139-1
Allophane Indicator*			Non - Reactive

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH116-13m
		Date Sampled	09/11/2021
Analyte	Unit	*Reporting Limit*	21-47139-1
Fluoride*	mg/kg dry wt		170

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH116-13m
		Date Sampled	09/11/2021
Analyte	Unit	*Reporting Limit*	21-47139-1
Total Organic Carbon*	g/100g dry wt	*0.1*	1.3

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

TOC/TC/TN in Soil	Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Sharelle Frank, B.Sc. (Tech)
Technologist

Matthew Counsell, B.Sc.
Inorganics Team Leader

Alini Goundar, B. Sc.
Microbiology Team Leader

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Tonkin and Taylor
105 Carlton Gore Road, Newmarket
Auckland

Attention: Rebecca Van der Krogt
Phone: 273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-45159
Submitted by: Rebecca van der Krogt
Date Received: 28/10/2021
Testing Initiated: 28/10/2021
Date Completed: 9/11/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Elements in Soil (Comp)

			Client Sample ID	WSL_21-BH125-23mm	WSL_21-BH126-17mm
			Date Sampled	21/10/2021	20/10/2021
Analyte	Unit	*Reporting Limit*		21-45159-2	21-45159-3
Arsenic	mg/kg dry wt	*0.125*		2.4	0.54
Barium	mg/kg dry wt	*0.025*		90.4	31.9
Beryllium	mg/kg dry wt	*0.013*		1.87	0.30
Boron	mg/kg dry wt	*1.25*		3.0	1.5
Cadmium	mg/kg dry wt	*0.005*		0.022	<0.0050
Chromium	mg/kg dry wt	*0.125*		13.2	13.3
Cobalt	mg/kg dry wt	*0.025*		8.59	0.88
Copper	mg/kg dry wt	*0.075*		31.1	19.8
Lead	mg/kg dry wt	*0.25*		7.20	4.7
Manganese	mg/kg dry wt	*0.125*		108	5.5
Mercury	mg/kg dry wt	*0.025*		0.036	<0.025
Nickel	mg/kg dry wt	*0.05*		15.0	1.9
Selenium	mg/kg dry wt	*0.25*		1.3	0.66
Tin	mg/kg dry wt	*0.25*		0.62	0.44
Vanadium	mg/kg dry wt	*0.125*		37.4	27.9
Zinc	mg/kg dry wt	*0.05*		46.6	21.1
Sulfur*	mg/kg dry wt	*250*		3,800	<250

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL_21-BH125-23mm	WSL_21-BH126-17mm
			Date Sampled	21/10/2021	20/10/2021
Analyte	Unit	*Reporting Limit*		21-45159-2	21-45159-3
pH*	pH	*1*		3.8	4.0
Chloride*	mg/kg dry wt	*3*		5.3	19.1
Sulfate-S*	mg/kg dry wt	*3*		6.7	<3.0

Allophane Indicator

		Client Sample ID	WSL_21-BH125-23mm	WSL_21-BH126-17mm
		Date Sampled	21/10/2021	20/10/2021
Analyte	Unit	*Reporting Limit*	21-45159-2	21-45159-3
Allophane Indicator*			Very Weak	Very Weak

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL_21-BH125-23mm	WSL_21-BH126-17mm
		Date Sampled	21/10/2021	20/10/2021
Analyte	Unit	*Reporting Limit*	21-45159-2	21-45159-3
Fluoride*	mg/kg dry wt		210	130

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL_21-BH125-23mm	WSL_21-BH126-17mm
		Date Sampled	21/10/2021	20/10/2021
Analyte	Unit	*Reporting Limit*	21-45159-2	21-45159-3
Total Organic Carbon*	g/100g dry wt	*0.1*	0.48	<0.10

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

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Method Summary

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Sharelle Frank, B.Sc. (Tech)
Technologist

Matthew Counsell, B.Sc.
Inorganics Team Leader

Yuri Zubenko, Ph.D.
Senior Technologist

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105 Carlton Gore Road, Newmarket
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Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-18779
Submitted by: Rebecca van der Kroggt
Date Received: 24/04/2021
Testing Initiated: 27/04/2021
Date Completed: 7/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

AMENDED REPORT. This report replaces in full a previous version [R00] sent on 07/05/2021. Sample IDs amended.

Aggregate Properties and Nutrients by TCLP

			Comp 1 (WSL-21-BH101-10-10.4, WSL-21-BH101-28-28.7)	Comp 2 (WSL-21-BH202-14-14.2, WSL-21-BH202-32-	Comp 3 (WSL-21-BH206-16-16.2, WSL-21-BH206-24-24.2)
Client Sample ID					
Date Sampled					
Analyte	Unit	*Reporting Limit*	21-18779-7	21-18779-8	21-18779-9
Chromium(VI)*	g/m^3	*0.02*	<0.020	<0.020	<0.020

Heavy Metals by TCLP

			Comp 1 (WSL-21-BH101-10-10.4, WSL-21-BH101-28-28.7)	Comp 2 (WSL-21-BH202-14-14.2, WSL-21-BH202-32-	Comp 3 (WSL-21-BH206-16-16.2, WSL-21-BH206-24-24.2)
Client Sample ID					
Date Sampled					
Analyte	Unit	*Reporting Limit*	21-18779-7	21-18779-8	21-18779-9
Arsenic	g/m^3	*0.005*	<0.0050	<0.0050	<0.0050
Cadmium	g/m^3	*0.0005*	<0.00050	<0.00050	<0.00050
Chromium	g/m^3	*0.005*	<0.005	<0.005	<0.005
Copper	g/m^3	*0.05*	<0.050	0.081	0.060
Lead	g/m^3	*0.01*	<0.010	0.013	<0.010
Nickel	g/m^3	*0.002*	0.078	0.056	0.075
Zinc	g/m^3	*0.4*	<0.40	<0.40	<0.40

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Polycyclic Aromatic Hydrocarbons - TCLP

Client Sample ID			Comp 1 (WSL-21-BH101-10-10.4, WSL-21-BH101-28-28.7)	Comp 2 (WSL-21-BH202-14-14.2, WSL-21-BH202-32-	Comp 3 (WSL-21-BH206-16-16.2, WSL-21-BH206-24-24.2)
Date Sampled					
Analyte	Unit	*Reporting Limit*	21-18779-7	21-18779-8	21-18779-9
1-Methylnaphthalene	g/m^3	*0.00024*	<0.00024	<0.00024	<0.00024
2-Methylnaphthalene	g/m^3	*0.00024*	<0.00024	<0.00024	<0.00024
Acenaphthene	g/m^3	*0.00008*	0.00069	<0.000081	<0.000081
Acenaphthylene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Anthracene	g/m^3	*0.00008*	0.0025	<0.000081	<0.000081
Benz[a]anthracene	g/m^3	*0.00012*	<0.00013	<0.00013	<0.00013
Benzo[a]pyrene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Benzo[b]&[j]fluoranthene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Benzo[g,h,i]perylene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Benzo[k]fluoranthene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Chrysene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Dibenz[a,h]anthracene	g/m^3	*0.00008*	<0.000081	<0.000081	<0.000081
Fluoranthene	g/m^3	*0.00008*	0.0020	<0.000081	<0.000081
Fluorene	g/m^3	*0.00008*	0.0024	<0.000081	<0.000081
Indeno[1,2,3-cd]pyrene	g/m^3	*0.00012*	<0.00013	<0.00013	<0.00013
Naphthalene	g/m^3	*0.0025*	<0.0025	<0.0025	<0.0025
Phenanthrene	g/m^3	*0.00012*	0.012	<0.00013	<0.00013
Pyrene	g/m^3	*0.00008*	0.0015	<0.000081	<0.000081
Benzo[a]pyrene TEQ (LOR)	g/m^3	*0.0002*	0.00023	0.00021	0.00021
Benzo[a]pyrene TEQ (Zero)	g/m^3	*0.00008*	<0.000080	<0.000080	<0.000080
Anthracene-d10 (Surrogate)	%	*4*	120	150	140

TCLP Extraction

Client Sample ID			Comp 1 (WSL-21-BH101-10-10.4, WSL-21-BH101-28-28.7)	Comp 2 (WSL-21-BH202-14-14.2, WSL-21-BH202-32-	Comp 3 (WSL-21-BH206-16-16.2, WSL-21-BH206-24-24.2)
Date Sampled					
Analyte	Unit	*Reporting Limit*	21-18779-7	21-18779-8	21-18779-9
Extractant Used			# 1	# 1	# 1
Initial pH	pH	*1*	5.0	5.0	5.0
Final pH	pH	*1*	6.7	4.9	4.9

Custom Job

Client Sample ID			Comp 1 (WSL-21-BH101-10-10.4, WSL-21-BH101-28-28.7)	Comp 2 (WSL-21-BH202-14-14.2, WSL-21-BH202-32-	Comp 3 (WSL-21-BH206-16-16.2, WSL-21-BH206-24-24.2)
Date Sampled					
Analyte	Unit	*Reporting Limit*	21-18779-7	21-18779-8	21-18779-9
Custom Job			Complete	Complete	Complete
Moisture Content	%	*1*	15	13	15

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Method Summary

TCLP Cr6+	TCLP extracts analysed colourimetrically. (APHA 3500-Cr6+ B - Modified - Discrete Analyser - Online edition).
TCLP Elements	TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).
TCLP PAH	Liquid-liquid extraction with hexane, florisil cleanup with analysis by GC-MS. **Benzo[a]pyrene TEQ (LOR)**: The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH. **Benzo[a]pyrene TEQ (Zero)**: The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation. Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. In accordance with in-house procedure.
PAH in Water	Liquid-liquid extraction with hexane, florisil cleanup with analysis by GC-MS. **Benzo[a]pyrene TEQ (LOR)**: The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH. **Benzo[a]pyrene TEQ (Zero)**: The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation. Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. In accordance with in-house procedure.
TCLP Extraction	TCLP was performed according to US-EPA method 1311.
Moisture	Moisture content is determined gravimetrically by drying at 103 °C.

Sharelle Frank, B.Sc. (Tech)
Technologist

Rong Zhang
Technician

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Attention: Lucy Hine
Phone: 0273040134
Email: rvanderkrogt@tonkintaylor.co.nz

Lab Reference: 21-21579
Submitted by: Rebbecca van der Krogt
Date Received: 12/05/2021
Testing Initiated: 13/05/2021
Date Completed: 28/05/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Custom Job

	Client Sample ID		WSL-21-BH121-10m	WSL-21-BH121-25m
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Custom Job			Complete	Complete

Soil Aggregate Properties and Nutrients

	Client Sample ID		WSL-21-BH121-10m	WSL-21-BH121-25m
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
pH*	pH	*1*	3.9	5.9
Chloride*	mg/kg dry wt	*3*	<3.0	14.5
Sulfate-S*	mg/kg dry wt	*3*	16.4	34.5

Elements in Soil (Comp)

	Client Sample ID		WSL-21-BH121-10m	WSL-21-BH121-25m
	Date Sampled			
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Arsenic	mg/kg dry wt	*0.125*	2.8	2.8
Barium	mg/kg dry wt	*0.025*	109	427

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
			Date Sampled		
Beryllium	mg/kg dry wt	*0.013*		0.59	0.43
Boron	mg/kg dry wt	*1.25*		2.6	5.8
Cadmium	mg/kg dry wt	*0.005*		0.048	0.048
Chromium	mg/kg dry wt	*0.125*		13.1	20.8
Cobalt	mg/kg dry wt	*0.025*		8.05	10.0
Copper	mg/kg dry wt	*0.075*		18.5	17.9
Lead	mg/kg dry wt	*0.25*		5.88	5.56
Manganese	mg/kg dry wt	*0.125*		99.9	395
Mercury	mg/kg dry wt	*0.025*		0.044	0.037
Nickel	mg/kg dry wt	*0.05*		14.9	16.9
Selenium	mg/kg dry wt	*0.25*		0.88	0.65
Tin	mg/kg dry wt	*0.25*		0.46	0.56
Vanadium	mg/kg dry wt	*0.125*		17.8	35.1
Zinc	mg/kg dry wt	*0.05*		54.0	52.6
Sulfur*	mg/kg dry wt	*250*		1,900	1,600

Allophane Indicator

		Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Allophane Indicator*			Non - Reactive	Non - Reactive

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Fluoride*	mg/kg dry wt		130	250

Total Carbon and Nitrogen in Soil (Subcontracted - Hill Laboratories)

		Client Sample ID	WSL-21-BH121-10m	WSL-21-BH121-25m
		Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-1	21-21579-2
Total Organic Carbon	g/100g dry wt	*0.05*	0.23	0.23

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Heavy Metals by TCLP

			Comp 1 (WSL-21-BH121-10m, WSL-21-BH121-25m)
	Client Sample ID		
	Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-3
Arsenic	g/m^3	*0.005*	<0.005
Cadmium	g/m^3	*0.0005*	<0.0005
Chromium	g/m^3	*0.005*	<0.005
Copper	g/m^3	*0.05*	<0.05
Lead	g/m^3	*0.01*	0.033
Nickel	g/m^3	*0.002*	0.019
Zinc	g/m^3	*0.4*	<0.4

TCLP Extraction

			Comp 1 (WSL-21-BH121-10m, WSL-21-BH121-25m)
	Client Sample ID		
	Date Sampled		
Analyte	Unit	*Reporting Limit*	21-21579-3
Extractant Used			# 1
Initial pH	pH	*1*	5.0
Final pH	pH	*1*	5.0

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

Total Organic Carbon Subcontracted to Hill Laboratories - Air dried at 35°C and sieved, <2mm fraction. May contain a residual moisture content of 2-5%. Acid pretreatment to remove carbonates present followed by Catalytic Combustion at (900°C, O_2), separation, Thermal Conductivity Detector (Elementar Analyser).

TCLP Elements TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).

TCLP Extraction TCLP was performed according to US-EPA method 1311.

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Sharelle Frank, B.Sc. (Tech)
Technologist

Emily Hanna, B.Sc.
Trace Elements Team Leader

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Certificate of Analysis

Tonkin and Taylor Ltd
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Attention: Lucy Hine
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Lab Reference: 21-24443
Submitted by: Rebecca van der Krogt
Date Received: 29/05/2021
Testing Initiated: 31/05/2021
Date Completed: 11/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
pH*	pH	*1*		4.8	4.3
Chloride*	mg/kg dry wt	*3*		16.6	5.3
Sulfate-S*	mg/kg dry wt	*3*		3.5	<3.1

Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
Arsenic	mg/kg dry wt	*0.125*		0.98	0.39
Barium	mg/kg dry wt	*0.025*		181	40.2
Beryllium	mg/kg dry wt	*0.013*		0.95	0.28
Boron	mg/kg dry wt	*1.25*		2.9	<1.3
Cadmium	mg/kg dry wt	*0.005*		0.038	0.011
Chromium	mg/kg dry wt	*0.125*		12	18.8
Cobalt	mg/kg dry wt	*0.025*		1.8	0.37
Copper	mg/kg dry wt	*0.075*		2.8	5.3
Lead	mg/kg dry wt	*0.25*		4.3	10.2
Manganese	mg/kg dry wt	*0.125*		117	49.8
Mercury	mg/kg dry wt	*0.025*		0.15	0.28

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Elements in Soil (Comp)

Client Sample ID			WSL-21-BH132-10M	WSL-21-BH132-15M
Date Sampled				
Nickel	mg/kg dry wt	*0.05*	2.1	1.8
Selenium	mg/kg dry wt	*0.25*	1.6	0.66
Tin	mg/kg dry wt	*0.25*	0.71	0.76
Vanadium	mg/kg dry wt	*0.125*	15.1	58.9
Zinc	mg/kg dry wt	*0.05*	4.2	21.4
Sulfur*	mg/kg dry wt	*250*	4,100	<250

Heavy Metals by TCLP

Client Sample ID			Composite 1 (WSL-21-BH132-10M, WSL-21-BH132-15M)
Date Sampled			
Analyte	Unit	*Reporting Limit*	21-24443-5
Arsenic	g/m^3	*0.005*	<0.005
Beryllium	g/m^3	*0.0001*	0.0001
Boron	g/m^3	*0.5*	1.4
Cadmium	g/m^3	*0.0005*	<0.0005
Chromium	g/m^3	*0.005*	<0.005
Copper	g/m^3	*0.05*	<0.05
Lead	g/m^3	*0.01*	0.088
Mercury	g/m^3	*0.001*	<0.001
Nickel	g/m^3	*0.002*	0.025
Zinc	g/m^3	*0.4*	3.6

TCLP Extraction

Client Sample ID			Composite 1 (WSL-21-BH132-10M, WSL-21-BH132-15M)
Date Sampled			
Analyte	Unit	*Reporting Limit*	21-24443-5
Extractant Used			# 1
Initial pH	pH	*1*	4.9
Final pH	pH	*1*	5.0

Fluoride in Soil (Subcontracted - ARL)

Client Sample ID			WSL-21-BH132-10M	WSL-21-BH132-15M
Date Sampled				
Analyte	Unit	*Reporting Limit*	21-24443-1	21-24443-2
Fluoride*	mg/kg dry wt		75.0	120

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Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
Total Organic Carbon*	g/100g dry wt	*0.1*		26.1	0.71

Allophane Indicator

			Client Sample ID	WSL-21-BH132-10M	WSL-21-BH132-15M
			Date Sampled		
Analyte	Unit	*Reporting Limit*		21-24443-1	21-24443-2
Allophane Indicator*				Non - Reactive	Non - Reactive

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TCLP Elements TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).

TCLP Extraction TCLP was performed according to US-EPA method 1311.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Matthew Counsell, B.Sc.
Inorganics Team Leader

Emily Hanna, B.Sc.
Trace Elements Team Leader

Sharelle Frank, B.Sc. (Tech)
Technologist

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Certificate of Analysis

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Lab Reference: 21-25085
Submitted by: Rebecca van der Krogt
Date Received: 03/06/2021
Testing Initiated: 3/06/2021
Date Completed: 21/06/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soil Aggregate Properties and Nutrients

			WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
Client Sample ID				
Date Sampled			31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
pH*	pH	*1*	4.3	3.8
Chloride*	mg/kg dry wt	*3*	11.1	5.4
Sulfate-S*	mg/kg dry wt	*3*	4.3	<3.0

Elements in Soil (Comp)

			WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
Client Sample ID				
Date Sampled			31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Arsenic	mg/kg dry wt	*0.125*	1.3	0.36
Barium	mg/kg dry wt	*0.025*	124	52.5
Beryllium	mg/kg dry wt	*0.013*	0.80	0.17
Boron	mg/kg dry wt	*1.25*	1.6	<1.3
Cadmium	mg/kg dry wt	*0.005*	0.14	0.016
Chromium	mg/kg dry wt	*0.125*	6.1	16.4
Cobalt	mg/kg dry wt	*0.025*	0.55	0.40
Copper	mg/kg dry wt	*0.075*	1.4	6.3
Lead	mg/kg dry wt	*0.25*	12.3	14.0
Manganese	mg/kg dry wt	*0.125*	47.5	47.3
Mercury	mg/kg dry wt	*0.025*	0.14	0.19

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Elements in Soil (Comp)

			Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
			Date Sampled	31/05/2021	31/05/2021
Nickel	mg/kg dry wt	*0.05*		1.6	1.4
Selenium	mg/kg dry wt	*0.25*		1.3	0.47
Tin	mg/kg dry wt	*0.25*		1.5	0.82
Vanadium	mg/kg dry wt	*0.125*		10	60.9
Zinc	mg/kg dry wt	*0.05*		9.44	47.7
Sulfur*	mg/kg dry wt	*250*		720	<250

Allophane Indicator

		Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
		Date Sampled	31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Allophane Indicator*			Non - Reactive	Non - Reactive

Total Carbon and Nitrogen in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
		Date Sampled	31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Total Organic Carbon*	g/100g dry wt	*0.1*	9.1	0.49

Fluoride in Soil (Subcontracted - ARL)

		Client Sample ID	WSL-21-BH133-10m 10m	WSL-21-BH133-15m 15m
		Date Sampled	31/05/2021	31/05/2021
Analyte	Unit	*Reporting Limit*	21-25085-1	21-25085-2
Fluoride*	mg/kg dry wt		170	130

Heavy Metals by TCLP

		Client Sample ID	Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)
		Date Sampled	
Analyte	Unit	*Reporting Limit*	21-25085-3
Arsenic	g/m^3	*0.005*	<0.005
Beryllium	g/m^3	*0.0001*	0.0002
Boron	g/m^3	*0.5*	1.3
Cadmium	g/m^3	*0.0005*	<0.0005
Chromium	g/m^3	*0.005*	<0.005
Copper	g/m^3	*0.05*	<0.05
Lead	g/m^3	*0.01*	0.018
Mercury	g/m^3	*0.001*	<0.001
Nickel	g/m^3	*0.002*	<0.002

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Heavy Metals by TCLP

			Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)
Client Sample ID			
Date Sampled			
Zinc	g/m^3	*0.4*	2.1

TCLP Extraction

			Composite 1 (WSL-21-BH133-10m, WSL-21-BH133-15m)
Client Sample ID			
Date Sampled			
Analyte	Unit	*Reporting Limit*	21-25085-3
Extractant Used			# 1
Initial pH	pH	*1*	4.9
Final pH	pH	*1*	5.0

Method Summary

pH in Soil 1:2.5 extraction with 0.1M calcium chloride followed by pH probe determination.(Department of Sustainable Natural Resources).

Chloride in Soil 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by filtration and Ion Exchange Chromatography analysis - (APHA 4110 B Online Edition).

Sulfate-S in Soils 1:5 water extraction (NEPM, Schedule B3, Laboratory Analysis of Potentially Contaminated Soil, 2011) followed by Ion Exchange Chromatography analysis (APHA 4110 B - Online Edition).

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TOC/TC/TN in Soil Sample prepared at Analytica Laboratories, analysis subcontracted to Analytical Research Laboratories (ARL) - Samples are air-dried and sieved to <2mm then analysed by Dumas combustion analysis with Infrared detection, based on ISO 10694:1995, IDT. Total organic carbon is measured after first removing carbonates by hydrochloric acid treatment of the air dried sample.

Fluoride in Soil Subcontracted to Analytical Research Laboratories Ltd (ARL) - Soil is fused with NaOH at 600°C for 3 hours whereafter the content is transferred to 100ml tubes, pH adjusted to 12.5, TISAB buffer added and F read with an ISE probe. (Soil Science Society of America and American Agronomy Society, Methods of soil analysis, Part 3, Chemical methods). Note: detection limit for method is under development, results will be reported uncensored and can't be reported as "less than".

TCLP Elements TCLP extraction of soils followed by acid digestion and analysis of TCLP extracts by ICP-MS (In house procedure based on US EPA method 200.8).

TCLP Extraction TCLP was performed according to US-EPA method 1311.

Matthew Counsell, B.Sc.
Inorganics Team Leader

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Trace Elements Team Leader

Sharelle Frank, B.Sc. (Tech)
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Phone: 027 304 0134
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Lab Reference: 21-30964
Submitted by: Rebecca van der Krogt
Date Received: 13/07/2021
Testing Initiated: 14/07/2021
Date Completed: 19/07/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soluble Heavy Metals in Water

	Client Sample ID		BH122 Deep A	BH122 Shallow A	BH127 Deep B	BH127 Shallow A	Duplicate 01
	Date Sampled		08/07/2021	09/07/2021	08/07/2021	09/07/2021	08/07/2021
Analyte	Unit	*Reporting Limit*	21-30964-1	21-30964-3	21-30964-6	21-30964-7	21-30964-9
Arsenic	g/m³	*0.0005*	0.0013	0.0043	0.00085	0.0012	0.0012
Cadmium	g/m³	*0.00002*	<0.000020	0.00020	0.000021	0.000022	<0.000020
Chromium	g/m³	*0.0002*	0.0011	0.0042	<0.00020	<0.00020	0.0012
Copper	g/m³	*0.0002*	0.00024	0.011	<0.00020	<0.00020	0.00037
Lead	g/m³	*0.00005*	<0.000050	0.0017	0.000055	<0.000050	0.000071
Mercury	g/m³	*0.00008*	<0.000080	<0.000080	<0.000080	<0.000080	<0.000080
Nickel	g/m³	*0.0002*	0.0018	0.0415	0.0053	0.0051	0.0019
Zinc	g/m³	*0.001*	0.016	0.351	0.011	0.031	0.017

Soluble Heavy Metals in Water

	Client Sample ID		Trip Blank	Rinsate	Field Blank	Rinsate
	Date Sampled		08/07/2021	08/07/2021	09/07/2021	09/07/2021
Analyte	Unit	*Reporting Limit*	21-30964-10	21-30964-12	21-30964-13	21-30964-14
Arsenic	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
Cadmium	g/m³	*0.00002*	<0.000020	<0.000020	<0.000020	<0.000020
Chromium	g/m³	*0.0002*	<0.00020	<0.00020	<0.00020	<0.00020
Copper	g/m³	*0.0002*	<0.00020	<0.00020	<0.00020	<0.00020
Lead	g/m³	*0.00005*	<0.000050	<0.000050	<0.000050	<0.000050
Mercury	g/m³	*0.00008*	<0.000080	<0.000080	<0.000080	<0.000080
Nickel	g/m³	*0.0002*	<0.00020	0.00052	<0.00020	<0.00020
Zinc	g/m³	*0.001*	<0.0010	<0.0010	<0.0010	<0.0010

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Total Petroleum Hydrocarbons - Water

	Client Sample ID		BH122 Deep A	BH122 Shallow A	BH127 Deep B	BH127 Shallow A	Duplicate 01
	Date Sampled		08/07/2021	09/07/2021	08/07/2021	09/07/2021	08/07/2021
Analyte	Unit	*Reporting Limit*	21-30964-1	21-30964-3	21-30964-6	21-30964-7	21-30964-9
C7-C9	g/m³	*0.2*	<0.23	<0.21	<0.21	<0.22	<0.21
C10-C14	g/m³	*0.2*	<0.23	<0.21	<0.21	<0.22	<0.21
C15-C36	g/m³	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
C7-C36 (Total)	g/m³	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5

Total Petroleum Hydrocarbons - Water

	Client Sample ID		Trip Blank	Rinsate	Field Blank	Rinsate
	Date Sampled		08/07/2021	08/07/2021	09/07/2021	09/07/2021
Analyte	Unit	*Reporting Limit*	21-30964-10	21-30964-12	21-30964-13	21-30964-14
C7-C9	g/m³	*0.2*	<0.2	<0.2	<0.2	<0.21
C10-C14	g/m³	*0.2*	<0.2	<0.2	<0.2	<0.21
C15-C36	g/m³	*0.3*	<0.3	<0.3	<0.3	<0.3
C7-C36 (Total)	g/m³	*0.5*	<0.5	<0.5	<0.5	<0.5

Semivolatile Organic Compounds - Water

	Client Sample ID		BH122 Deep A	BH122 Shallow A	BH127 Deep B	BH127 Shallow A	Duplicate 01
	Date Sampled		08/07/2021	09/07/2021	08/07/2021	09/07/2021	08/07/2021
Analyte	Unit	*Reporting Limit*	21-30964-1	21-30964-3	21-30964-6	21-30964-7	21-30964-9
Phenol	g/m³	*0.002*	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
2-Chlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Nitrophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,4-Dimethylphenol	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,4-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2,6-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Chloro-3-methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2,4,5-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,4,6-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,3,4,6-Tetrachlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Methylphenol	g/m³	*0.0003*	<0.00030	0.0010	<0.00030	<0.00030	<0.00030
Naphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Methylnaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Chloronaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Acenaphthylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Acenaphthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Fluorene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Phenanthrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Phenylphenol	g/m³	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo[a]anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Chrysene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) adipate	g/m³	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo[b]fluoranthene	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Benzo[k]fluoranthene	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050

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Semivolatile Organic Compounds - Water

	Client Sample ID		BH122 Deep A	BH122 Shallow A	BH127 Deep B	BH127 Shallow A	Duplicate 01
	Date Sampled		08/07/2021	09/07/2021	08/07/2021	09/07/2021	08/07/2021
Benzo[a]pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Indeno(1,2,3-c,d)pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dibenzo[a,h]anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo[g,h,i]perylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo[a]pyrene TEQ (LOR)	g/m³	*0.0008*	0.00080	0.00080	0.00080	0.00080	0.00080
Benzo[a]pyrene TEQ (Zero)	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4,4'-DDD	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
4,4'-DDE	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4,4'-DDT	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
alpha-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
beta-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
gamma-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
delta-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Aldrin	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cis-Chlordane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
trans-Chlordane	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dieldrin	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Endosulfan I	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Endosulfan II	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Endosulfan sulfate	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Endrin	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Endrin aldehyde	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Endrin ketone	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Heptachlor	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Heptachlor epoxide	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Methoxychlor	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) phthalate	g/m³	*0.010*	<0.010	<0.010	<0.010	<0.010	<0.010
Butyl benzyl phthalate	g/m³	*0.0010*	<0.0010	0.0012	<0.0010	<0.0010	<0.0010
Di-n-butyl phthalate	g/m³	*0.010*	<0.010	<0.010	<0.010	<0.010	<0.010
Di-n-octyl phthalate	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Diethyl phthalate	g/m³	*0.0020*	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dimethyl phthalate	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
N-Nitrosodiphenylamine	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
N-Nitrosodi-n-propylamine	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2,4-Dinitrotoluene	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,6-Dinitrotoluene	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Azobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Isophorone	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Nitrobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Bromophenyl phenyl ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Chlorophenyl phenyl ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloroethyl) ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloro-1-methylethyl) ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloroethoxy) methane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,2-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,3-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

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Semivolatile Organic Compounds - Water

			Client Sample ID	BH122 Deep A	BH122 Shallow A	BH127 Deep B	BH127 Shallow A	Duplicate 01
			Date Sampled	08/07/2021	09/07/2021	08/07/2021	09/07/2021	08/07/2021
1,4-Dichlorobenzene	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorobutadiene	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorocylopentadiene	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachloroethane	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Chloroaniline	g/m³	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2-Nitroaniline	g/m³	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
3-Nitroaniline	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
3,3'-Dichlorobenzidine	g/m³	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dibenzofuran	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Methyl methanesulfonate	g/m³	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Ethyl methanesulfonate	g/m³	*0.010*		<0.010	<0.010	<0.010	<0.010	<0.010
Benzyl alcohol	g/m³	*0.0003*		<0.00030	0.0016	<0.00030	0.00043	<0.00030
Phenol-d5 (Surrogate)	%	*1*		88	81	82	70	81
2-Fluorophenol (Surrogate)	%	*1*		92	90	89	78	98
2-Fluorobiphenyl (Surrogate)	%	*1*		88	88	91	93	93
2,4,6-Tribromophenol (Surrogate)	%	*1*		73	57	46	76	43
p-Terphenyl-d14 (Surrogate)	%	*1*		130	180	190	110	180
Nitrobenzene-d5 (Surrogate)	%	*1*		190	190	180	190	190

Semivolatile Organic Compounds - Water

		Client Sample ID	Trip Blank	Rinsate	Field Blank	Rinsate
		Date Sampled	08/07/2021	08/07/2021	09/07/2021	09/07/2021
Analyte	Unit	*Reporting Limit*	21-30964-10	21-30964-12	21-30964-13	21-30964-14
Phenol	g/m³	*0.002*	<0.0020	0.0024	<0.0020	<0.0020
2-Chlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2-Methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2-Nitrophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
2,4-Dimethylphenol	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010
2,4-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2,6-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
4-Chloro-3-methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2,4,5-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
2,4,6-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
2,3,4,6-Tetrachlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
4-Methylphenol	g/m³	*0.0003*	0.00061	<0.00030	<0.00030	<0.00030
Naphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2-Methylnaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2-Chloronaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Acenaphthylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Acenaphthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Fluorene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Phenanthrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
2-Phenylphenol	g/m³	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030

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Semivolatile Organic Compounds - Water

			Client Sample ID	Trip Blank	Rinsate	Field Blank	Rinsate
			Date Sampled	08/07/2021	08/07/2021	09/07/2021	09/07/2021
Benzo[a]anthracene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Chrysene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) adipate	g/m^3	*0.005*		<0.0050	<0.0050	<0.0050	<0.0050
Benzo[b]fluoranthene	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
Benzo[k]fluoranthene	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
Benzo[a]pyrene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Indeno(1,2,3-c,d)pyrene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Dibenzo[a,h]anthracene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Benzo[g,h,i]perylene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Pyrene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Benzo[a]pyrene TEQ (LOR)	g/m^3	*0.0008*		0.00080	0.00080	0.00080	0.00080
Benzo[a]pyrene TEQ (Zero)	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
4,4'-DDD	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
4,4'-DDE	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
4,4'-DDT	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010	<0.0010
alpha-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
beta-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
gamma-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
delta-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Aldrin	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
cis-Chlordane	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
trans-Chlordane	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
Dieldrin	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
Endosulfan I	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010	<0.0010
Endosulfan II	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010	<0.0010
Endosulfan sulfate	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
Endrin	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010	<0.0010
Endrin aldehyde	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Endrin ketone	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Heptachlor	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Heptachlor epoxide	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Methoxychlor	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) phthalate	g/m^3	*0.010*		<0.010	<0.010	<0.010	<0.010
Butyl benzyl phthalate	g/m^3	*0.0010*		<0.0010	0.0012	<0.0010	<0.0010
Di-n-butyl phthalate	g/m^3	*0.010*		<0.010	<0.010	<0.010	<0.010
Di-n-octyl phthalate	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050	<0.00050
Diethyl phthalate	g/m^3	*0.0020*		<0.0020	<0.0020	<0.0020	<0.0020
Dimethyl phthalate	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
N-Nitrosodiphenylamine	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
N-Nitrosodi-n-propylamine	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
2,4-Dinitrotoluene	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010	<0.0010
2,6-Dinitrotoluene	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010	<0.0010
Azobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Isophorone	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Nitrobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
4-Bromophenyl phenyl ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
4-Chlorophenyl phenyl ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloroethyl) ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030	<0.00030

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Semivolatile Organic Compounds - Water

	Client Sample ID		Trip Blank	Rinsate	Field Blank	Rinsate
	Date Sampled		08/07/2021	08/07/2021	09/07/2021	09/07/2021
Bis(2-Chloro-1-methylethyl) ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloroethoxy) methane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
1,2-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
1,3-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
1,4-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorobutadiene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorocylopentadiene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Hexachloroethane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
4-Chloroaniline	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
2-Nitroaniline	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
3-Nitroaniline	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
3,3'-Dichlorobenzidine	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050
Dibenzofuran	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Methyl methanesulfonate	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030
Ethyl methanesulfonate	g/m³	*0.010*	<0.010	<0.010	<0.010	<0.010
Benzyl alcohol	g/m³	*0.0003*	<0.00030	0.0041	<0.00030	0.0011
Phenol-d5 (Surrogate)	%	*1*	100	84	120	100
2-Fluorophenol (Surrogate)	%	*1*	120	92	140	110
2-Fluorobiphenyl (Surrogate)	%	*1*	85	90	84	85
2,4,6-Tribromophenol (Surrogate)	%	*1*	51	78	44	64
p-Terphenyl-d14 (Surrogate)	%	*1*	150	270	190	150
Nitrobenzene-d5 (Surrogate)	%	*1*	180	170	200	200

Method Summary

Soluble Trace Elements Samples were analysed as received by the laboratory using ICP-MS following a 0.45µm membrane filtration (except when field filtered). In house procedure based on US EPA 200.8.

TPH in Water Solvent extraction, silica cleanup, followed by GC-FID analysis (C7-C36). MFE Petroleum Industry Guidelines. (In accordance with in-house procedure based on US EPA 8015).

SVOC in Water Dichloromethane extraction followed by GC-MS analysis. (In-house method based on US-EPA 8270).

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Trace Elements Team Leader

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Technician

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Certificate of Analysis

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Lab Reference: 21-48482
Submitted by: Rebecca van der Krogt
Date Received: 20/11/2021
Testing Initiated: 22/11/2021
Date Completed: 25/11/2021
Order Number:
Reference: 1015174

Sampling Site:

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Soluble Heavy Metals in Water

	Client Sample ID		BH110A	BH115 deep A	BH115 shallow A	BH132 shallow A	BH132 deep A
	Date Sampled		18/11/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021
Analyte	Unit	*Reporting Limit*	21-48482-1	21-48482-3	21-48482-5	21-48482-7	21-48482-9
Arsenic	g/m³	*0.0005*	<0.00050	<0.00050	0.00059	0.0046	0.0020
Beryllium	g/m³	*0.00001*	<0.000010	0.000023	0.000038	0.00014	0.000050
Boron	g/m³	*0.01*	0.13	0.018	0.14	0.028	0.030
Cadmium	g/m³	*0.00002*	<0.000020	<0.000020	0.000083	0.000025	<0.000020
Chromium	g/m³	*0.0002*	<0.00020	<0.00020	0.00028	0.0014	0.00090
Copper	g/m³	*0.0002*	<0.00020	0.00058	0.0047	0.0087	0.00061
Lead	g/m³	*0.00005*	<0.000050	<0.000050	<0.000050	0.0022	0.00029
Mercury	g/m³	*0.00008*	<0.000080	<0.000080	<0.000080	<0.000080	<0.000080
Nickel	g/m³	*0.0002*	0.0046	0.0011	0.011	0.0075	0.0027
Zinc	g/m³	*0.001*	0.021	0.022	0.134	0.066	0.0047

Soluble Heavy Metals in Water

	Client Sample ID		Rinsate 1	Trip Blank	Duplicate 1
	Date Sampled		18/11/2021	18/11/2021	18/11/2021
Analyte	Unit	*Reporting Limit*	21-48482-11	21-48482-12	21-48482-14
Arsenic	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050
Beryllium	g/m³	*0.00001*	<0.000010	<0.000010	<0.000010
Boron	g/m³	*0.01*	<0.010	<0.010	0.13
Cadmium	g/m³	*0.00002*	<0.000020	<0.000020	<0.000020
Chromium	g/m³	*0.0002*	<0.00020	<0.00020	<0.00020
Copper	g/m³	*0.0002*	<0.00020	0.00038	<0.00020

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation with the exception of tests marked *, which are not accredited.
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Soluble Heavy Metals in Water

	Client Sample ID		Rinsate 1	Trip Blank	Duplicate 1
	Date Sampled		18/11/2021	18/11/2021	18/11/2021
Lead	g/m³	*0.00005*	<0.000050	<0.000050	<0.000050
Mercury	g/m³	*0.00008*	<0.000080	<0.000080	<0.000080
Nickel	g/m³	*0.0002*	<0.00020	<0.00020	0.0046
Zinc	g/m³	*0.001*	<0.0010	0.0051	0.021

Semivolatile Organic Compounds - Water

	Client Sample ID		BH110A	BH115 deep A	BH115 shallow A	BH132 shallow A	BH132 deep A
	Date Sampled		18/11/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021
Analyte	Unit	*Reporting Limit*	21-48482-1	21-48482-3	21-48482-5	21-48482-7	21-48482-9
Phenol	g/m³	*0.002*	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
2-Chlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Methylphenol (o-Cresol)	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Nitrophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,4-Dimethylphenol	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,4-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2,6-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Chloro-3-methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2,4,5-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,4,6-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2,3,4,6-Tetrachlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Naphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Methylnaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Chloronaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Acenaphthylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Acenaphthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Fluorene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Phenanthrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2-Phenylphenol	g/m³	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Fluoranthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo[a]anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Chrysene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) adipate	g/m³	*0.005*	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Benzo[b and J]fluoranthene	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Benzo[k]fluoranthene	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Benzo[a]pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Indeno(1,2,3-c,d)pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Dibenzo[a,h]anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo[g,h,i]perylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Benzo[a]pyrene TEQ (LOR)	g/m³	*0.0008*	0.00080	0.00080	0.00080	0.00080	0.00080
Benzo[a]pyrene TEQ (Zero)	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4,4'-DDD	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
4,4'-DDE	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4,4'-DDT	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
alpha-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030

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Semivolatile Organic Compounds - Water

	Client Sample ID		BH110A	BH115 deep A	BH115 shallow A	BH132 shallow A	BH132 deep A
	Date Sampled		18/11/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021
beta-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
gamma-BHC (Lindane)	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
delta-BHC	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Aldrin	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
cis-Chlordane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
trans-Chlordane	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dieldrin	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Endosulfan I	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Endosulfan II	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Endosulfan sulfate	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Endrin	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Endrin aldehyde	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Endrin ketone	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Heptachlor	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Heptachlor epoxide	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Methoxychlor	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) phthalate	g/m³	*0.010*	<0.010	<0.010	<0.010	<0.010	<0.010
Butyl benzyl phthalate	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Di-n-butyl phthalate	g/m³	*0.010*	<0.010	<0.010	<0.010	<0.010	<0.010
Di-n-octyl phthalate	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Diethyl phthalate	g/m³	*0.0020*	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Dimethyl phthalate	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
N-Nitrosodiphenylamine	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
N-Nitrosodi-n-propylamine	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
2,4-Dinitrotoluene	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
2,6-Dinitrotoluene	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Azobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Isophorone	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Nitrobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Bromophenyl phenyl ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Chlorophenyl phenyl ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloroethyl) ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloro-1-methylethyl) ether	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Bis(2-Chloroethoxy) methane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,2-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,3-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
1,4-Dichlorobenzene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorobutadiene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachlorocylopentadiene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Hexachloroethane	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
4-Chloroaniline	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
2-Nitroaniline	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
3-Nitroaniline	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
3,3'-Dichlorobenzidine	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050
Dibenzofuran	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Methyl methanesulfonate	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Ethyl methanesulfonate	g/m³	*0.010*	<0.010	<0.010	<0.010	<0.010	<0.010

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Semivolatile Organic Compounds - Water

		Client Sample ID	BH110A	BH115 deep A	BH115 shallow A	BH132 shallow A	BH132 deep A
		Date Sampled	18/11/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021
Benzyl alcohol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030	<0.00030	<0.00030
Phenol-d5 (Surrogate)	%	*1*	81	77	82	71	77
2-Fluorophenol (Surrogate)	%	*1*	73	72	74	66	71
2-Fluorobiphenyl (Surrogate)	%	*1*	89	92	90	96	93
2,4,6-Tribromophenol (Surrogate)	%	*1*	120	98	130	100	120
p-Terphenyl-d14 (Surrogate)	%	*1*	120	100	110	120	120
Nitrobenzene-d5 (Surrogate)	%	*1*	80	96	100	95	90

Semivolatile Organic Compounds - Water

		Client Sample ID	Rinsate 1	Trip Blank	Duplicate 1
		Date Sampled	18/11/2021	18/11/2021	18/11/2021
Analyte	Unit	*Reporting Limit*	21-48482-11	21-48482-12	21-48482-14
Phenol	g/m³	*0.002*	<0.0020	<0.0020	<0.0020
2-Chlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2-Methylphenol (o-Cresol)	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2-Nitrophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050
2,4-Dimethylphenol	g/m³	*0.0010*	<0.0010	<0.0010	<0.0010
2,4-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2,6-Dichlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
4-Chloro-3-methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2,4,5-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050
2,4,6-Trichlorophenol	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050
2,3,4,6-Tetrachlorophenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
4-Methylphenol	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Naphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2-Methylnaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2-Chloronaphthalene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Acenaphthylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Acenaphthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Fluorene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Phenanthrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
2-Phenylphenol	g/m³	*0.005*	<0.0050	<0.0050	<0.0050
Fluoranthene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Benzo[a]anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Chrysene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) adipate	g/m³	*0.005*	<0.0050	<0.0050	<0.0050
Benzo[b and J]fluoranthene	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050
Benzo[k]fluoranthene	g/m³	*0.0005*	<0.00050	<0.00050	<0.00050
Benzo[a]pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Indeno(1,2,3-c,d)pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Dibenzo[a,h]anthracene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Benzo[g,h,i]perylene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030
Pyrene	g/m³	*0.0003*	<0.00030	<0.00030	<0.00030

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Semivolatile Organic Compounds - Water

			Client Sample ID	Rinsate 1	Trip Blank	Duplicate 1
			Date Sampled	18/11/2021	18/11/2021	18/11/2021
Benzo[a]pyrene TEQ (LOR)	g/m^3	*0.0008*		0.00080	0.00080	0.00080
Benzo[a]pyrene TEQ (Zero)	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
4,4'-DDD	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
4,4'-DDE	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
4,4'-DDT	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
alpha-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
beta-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
gamma-BHC (Lindane)	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
delta-BHC	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Aldrin	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
cis-Chlordane	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
trans-Chlordane	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
Dieldrin	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
Endosulfan I	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
Endosulfan II	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
Endosulfan sulfate	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
Endrin	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
Endrin aldehyde	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Endrin ketone	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Hexachlorobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Heptachlor	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Heptachlor epoxide	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Methoxychlor	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Bis(2-ethylhexyl) phthalate	g/m^3	*0.010*		<0.010	<0.010	<0.010
Butyl benzyl phthalate	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
Di-n-butyl phthalate	g/m^3	*0.010*		<0.010	<0.010	<0.010
Di-n-octyl phthalate	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
Diethyl phthalate	g/m^3	*0.0020*		<0.0020	<0.0020	<0.0020
Dimethyl phthalate	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
N-Nitrosodiphenylamine	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
N-Nitrosodi-n-propylamine	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
2,4-Dinitrotoluene	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
2,6-Dinitrotoluene	g/m^3	*0.0010*		<0.0010	<0.0010	<0.0010
Azobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Isophorone	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Nitrobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
4-Bromophenyl phenyl ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
4-Chlorophenyl phenyl ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Bis(2-Chloroethyl) ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Bis(2-Chloro-1-methylethyl) ether	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Bis(2-Chloroethoxy) methane	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
1,2-Dichlorobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
1,3-Dichlorobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
1,4-Dichlorobenzene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Hexachlorobutadiene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Hexachlorocylopentadiene	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Hexachloroethane	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
4-Chloroaniline	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050

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Semivolatile Organic Compounds - Water

			Client Sample ID	Rinsate 1	Trip Blank	Duplicate 1
			Date Sampled	18/11/2021	18/11/2021	18/11/2021
2-Nitroaniline	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
3-Nitroaniline	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
3,3'-Dichlorobenzidine	g/m^3	*0.0005*		<0.00050	<0.00050	<0.00050
Dibenzofuran	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Methyl methanesulfonate	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Ethyl methanesulfonate	g/m^3	*0.010*		<0.010	<0.010	<0.010
Benzyl alcohol	g/m^3	*0.0003*		<0.00030	<0.00030	<0.00030
Phenol-d5 (Surrogate)	%	*1*		110	66	78
2-Fluorophenol (Surrogate)	%	*1*		120	69	76
2-Fluorobiphenyl (Surrogate)	%	*1*		84	91	93
2,4,6-Tribromophenol (Surrogate)	%	*1*		99	97	110
p-Terphenyl-d14 (Surrogate)	%	*1*		150	160	110
Nitrobenzene-d5 (Surrogate)	%	*1*		110	90	99

Total Petroleum Hydrocarbons - Water

		Client Sample ID	BH110A	BH115 deep A	BH115 shallow A	BH132 shallow A	BH132 deep A
		Date Sampled	18/11/2021	18/11/2021	18/11/2021	18/11/2021	18/11/2021
Analyte	Unit	*Reporting Limit*	21-48482-1	21-48482-3	21-48482-5	21-48482-7	21-48482-9
C7-C9	g/m^3	*0.2*	<0.2	<0.2	<0.2	<0.2	<0.2
C10-C14	g/m^3	*0.2*	<0.2	<0.2	<0.2	<0.2	<0.2
C15-C36	g/m^3	*0.3*	<0.3	<0.3	<0.3	<0.3	<0.3
C7-C36 (Total)	g/m^3	*0.5*	<0.5	<0.5	<0.5	<0.5	<0.5

Total Petroleum Hydrocarbons - Water

		Client Sample ID	Rinsate 1	Trip Blank	Duplicate 1
		Date Sampled	18/11/2021	18/11/2021	18/11/2021
Analyte	Unit	*Reporting Limit*	21-48482-11	21-48482-12	21-48482-14
C7-C9	g/m^3	*0.2*	<0.2	<0.2	<0.2
C10-C14	g/m^3	*0.2*	<0.2	<0.2	<0.2
C15-C36	g/m^3	*0.3*	<0.3	<0.3	<0.3
C7-C36 (Total)	g/m^3	*0.5*	<0.5	<0.5	<0.5

Method Summary

Soluble Trace Elements	Samples were analysed as received by the laboratory using ICP-MS following a 0.45µm membrane filtration (except when field filtered). In house procedure based on US EPA 200.8.
SVOC in Water	Dichloromethane extraction followed by GC-MS analysis. (In-house method based on US-EPA 8270).
TPH in Water	Solvent extraction, followed by GC-FID analysis (C7-C36). MFE Petroleum Industry Guidelines. (In accordance with in-house procedure based on US EPA 8015).

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