### Gleeson Quarries Ltd

Huntly Quarry Disposal Sites

# Huntly Quarry Disposal Sites – Geotechnical Assessment

Revision C Report Prepared By Gaia Engineers, 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand

#### **Revision History**

Revision No	Prepared By	Description	Date
А	МК	Draft for Comment	31 <sup>st</sup> July 2019
В	МК	Final for Issue	2 <sup>nd</sup> September 2019
С	МК	Peer Review	5 <sup>th</sup> November 2019

Prepared by:

Mht

Matthew Kernot Senior Engineering Geologist Gaia Engineers Ltd

Reviewed by:

Dr. Ka-Ching Cheung Director (Geotechnical) Gaia Engineers Ltd

Date: November 2019

Copyright: This document and its contents are the property of Gaia Engineers Ltd and Gleeson Quarries Ltd. Any unauthorised employment or reproduction in full or in part is forbidden.

2325-12-GQ-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

## Table of Contents

1	I	ntroduction	5
	1.1	Scope of Works	5
	1.2	Information Provided	5
2	C	Site Description	6
	2.1	Location	6
	2.2	Site Topography	6
	2.2.	1 Fill Site 2	6
	2.2	2 Fill Site 3	7
	2.2	.3 Fill Site 4	8
	2.2.	.4 Fill Site 5	9
	2.3	Geomorphology	.10
3	7	Fest Pit Investigation	.11
	3.1	Test Pit Shear Strength Summary	.11
4	(	Geology	.12
	4.1	Regional Geology and Structure	.12
	4.2	Local Stratigraphy	.13
	4.2	1 Existing Mining Overburden Fill	. 13
	4.2	2 Holocene Alluvial/Colluvial Materials	. 13
	4.2	.3 Puketoka Formation	. 13
	4.2	.4 Waikato Coal Measures	. 13
	4.2	5 Newcastle Group	. 13
	4.3	Geological Risks and Mitigation	.13
	4.3	1 Existing Mining Overburden Fill	.14
	4.3	2 Waikato Coal Measures Bedding	.14
	4.3	.3 Newcastle Group Greywacke	. 15
5	E	Existing Information Review	.16
	5.1	Pilbrow Surveying Topographic Models and Aerial Photography – April 2019	.16
	5.2	Geological and Resource Assessment of Huntly Quarry – 2006 (Terra Mining Ltd.)	.16
	5.3	Huntly Quarry Fill Assessment & Design – June 2019 (Terra Mining Ltd.)	.16

6 Co	ncept Fill Design	17
7 Slo	pe Stability Analysis	18
7.1	Geotechnical Parameters	18
7.2	Geological Models	18
7.2.1	Bedding Parallel Shears in the Waikato Coal Measures	
7.2.2	Seismic Loading	
7.3	Results	19
8 Pro	pposed Fill Recommendations	20
8.1	General Recommendations	20
8.1.1	Stripping	
8.1.2	Gully "Muck-Out" & Drainage	
8.1.3	Existing "Farm Dams"	
8.1.4	Haul Roads	
8.1.5	Sediment Control Ponds	
8.2	Site Specific Recommendations	21
8.2.1	Fill Site 2	
8.2.2	Fill Site 3	
8.2.3	Fill Site 4	
8.2.4	Fill Site 5	
8.3	Earthworks Recommendations	22
8.3.1	Engineered Containment Bunds	
8.3.2	Drainage Blankets	
8.3.3	"Bottom Up" Filling	
8.3.4	Fill Control	
8.3.5	Displacement Monitoring	
8.3.6	Pore-Water Pressure monitoring	
8.4	Scope for Modifications to the Concept Fill Designs	25
8.4.1	Fill Material Type	
8.4.2	Fill Site Footprints	
9 Co	nclusions	27
10 Lin	nitations	28
10.1	Specific Limitations	

## 2325-12-6Q-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

10.1	2 General Limitations	28
11	Risk and Mitigation	29
12	Safety in Design (SiD) Considerations	30

#### Appendices:

Appendix A – Drawings
Appendix B – Test Pit and Historic Borehole Logs
Appendix C – Slope Stability Outputs

#### Table of Tables:

Table 1: Summary of Measured Undrained Field Shear Strength (Su)	. 11
Table 2: Summary of Concept Fill Design Geometries (Extract from Terra Mining Consultants)	. 17
Table 3: Geotechnical Parameters used in SLIDE Models	. 18
Table 4: Compaction Control Criteria & Frequency of Testing – Cohesive Material	. 23
Table 5: Compaction Control Criteria & Frequency of Testing – Hardfill	. 24
Table 6: Compaction Control Criteria & Frequency of Testing - Non-Cohesive Fill (Brown Rock)Soft Pit Run	
(SPR 100)	. 24
Table 7: Potential Batter Gradients for Different Fill Materials	. 26
Table 8: Key Geotechnical Risk and Mitigation Strategy	. 29

#### Table of Figures

Figure 1: Oblique Image looking North-East at Fill Site 2 Showing Topographic Features	6
Figure 2: Oblique Image looking South at Fill Site 3 Showing Topographic Features	7
Figure 3: Oblique Image Looking South at Fill Site 4 Showing Topographic Features	8
Figure 4: Oblique Image looking North at Fill Site 5 Showing Topographic Features	9
Figure 5: Published Geological Map of the Huntly Quarry and Fill Sites	
Figure 6: Waikato Coal Measures Bedding Parallel Shears - Anisotropic Strength Model	

Drawing List:		
Drawing No:	Drawing Title:	Revision:
2325-12-01	Site Layout with Current Contours	В
2325-12-02	Site Layout with Proposed Contours	А
2325-12-03	Site Layout with Fill Thickness Contours	А
2325-12-04	Geological Map	А
2325-12-05	Fill 2 – Cross Section 1	А
2325-12-06	Fill 3 – Cross Section 1	А
2325-12-07	Fill 3 – Cross Section 2	А
2325-12-08	Fill 4 – Cross Section 1	А
2325-12-09	Fill 5 – Cross Section 1	А
2325-12-10	Typical Managed Fill and Containment Bund Detail	А
2325-12-11	Typical Drainage Details	А
2325-12-12	Concept Displacement Monitoring Layout – Fill 2 Area	А
2325-12-13	Concept Displacement Monitoring Layout – Fill 3 Area	А
2325-12-14	Concept Displacement Monitoring Layout – Fill 4 Area	A
2325-12-15	Concept Displacement Monitoring Layout – Fill 5 Area	A

2325-12-60-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

## EXECUTIVE SUMMARY

Gaia Engineers Ltd have been engaged by Gleeson Quarries Ltd to provide geotechnical design advice for four proposed fill sites located directly to the north of the existing Huntly Quarry. The purpose of this report is to provide support to the client and for a Resource Consent application.

Concept designs of the four fills have been provided by Terra Mining Consultants as referenced in the report Huntly Quarry Fill Assessment & Design dated June 2019. The fill profiles and extents provided in this report have formed the basis of our recommendations and advice.

The fill areas are proposed to accommodate overburden material produced from the expansion of the main quarry pit to the south as well as for the disposal of managed fill imported by the future paying customers.

Originally five fill sites were selected for investigation and design. However, the site known as Fill 1 is no longer being considered due to being situated within the proposed quarry expansion area. The remaining fill sites are still referred to as Fill 2 to Fill 5. Investigation for these sites was undertaken by Gaia Engineers from the 17<sup>th</sup> to the 20<sup>th</sup> of June 2019. The investigation consisted of a site walkover by an engineering geologist and the logging of machine excavated test pits to a maximum depth of 6.2m.

The results of this investigation provided information regarding the make-up of the soils immediately below the surface. Fill sites 2 and 4 are underlain by weathered soils belonging to the Te Kuiti Group (Waikato Coal Measures). Fill site 5 is underlain by weathered soils of the Newcastle Group (the local greywacke bedrock). Whilst Fill 3 is underlain by an unknown thickness of fill inferred to be overburden materials related to nearby historic coal mining operations.

Based on our experience with similar overburden and manged fill disposal areas we believe that the proposed fill site configurations are largely suitable. Specific recommendations on overall shape and size of fill batters as well as the necessity for containment bunds and similar stability improvement devices will be largely determined based on the composition of the fill material.

## 1 Introduction

Gaia Engineers Ltd. have been engaged by Gleeson Quarries Ltd. to provide a geotechnical assessment for four fill sites (as shown in drawing no.: 2325-12-01 included in Appendix A) intended to be used to place overburden from the Huntly Quarry as well as imported managed fill. This report presents our preliminary findings and geotechnical advice for the proposed fill project immediately north of the Huntly Quarry. This report is prepared and submitted in support of a Resource Consent Application.

### 1.1 Scope of Works

The scope of works for this project includes:

- a. A review of existing geological and geotechnical data;
- b. A detailed site walk over inspection of the five potential fill sites/or preferred fill site when known;
- c. Trial pit excavations in the foundations of the five potential fill sites (if required);
- d. Analysis of the structural, trial pit data and any other investigations deemed appropriate to complete geotechnical investigations
- e. Assess ground conditions, review stability and risks associated with the potential fill sites;
- f. Comments and recommendations on geotechnical matters relating to civil design and construction, including geotechnical constraints that will need to be considered as part of the detailed design phase.
- g. Preliminary engineering plans for the proposed overburden and managed fill areas.
- h. Provide a preliminary geotechnical assessment report suitable for the resource consent stage (level of detail for resource consent will be confirmed with Council)
- i. Detailed engineering drawings e.g. cross sections (if required by Council engineer)

### 1.2 Information Provided

The following data and reports were provided and reviewed in preparation of this report:

- Survey Data from Pilbrow Surveying Ltd. covering Fill Sites 2 to 5 as surveyed during April 2019 including:
  - o Topographic contours
  - o High resolution orthorectified aerial images
- Huntly Quarry Fill Assessment & Design by Terra Mining Consultants Ltd. dated June 2019.
- Geological and Resource Assessment of Huntly Quarry by Stevens & Associates and Terra Mining Consultants Ltd. dated July 2006.

## 2 Site Description

### 2.1 Location

The four proposed sites known as Fill sites 2 to 5 are located around the northern perimeter of the Huntly Quarry pit as shown in drawing No.: 2325-12-01. The sites are accessed from the Huntly Quarry located at 300 Riverview Road in the northern Waikato township of Huntly.

### 2.2 Site Topography

Fill Sites 2, 4 & 5 consist of relatively unmodified, broad gully systems. Fill Site 3 is inferred to originally have been a gully similar in shape to Fill Sites 2 & 4. Filling activities related to historic overburden stripping from nearby coal mines has resulted in the current broad flat area now present at the northern end of Fill Site 3. Descriptions of each fill site are presented in the sections below.

#### 2.2.1 Fill Site 2

Fill Site 2 is a broad gully network that trends in an east to west direction. The eastern end of the gully forms a large amphitheatre with a remnant central ridge running down the centre, separating two smaller gullies. A small dam has been constructed approximately 60m west of where the small gullies converge creating an area of ponded water.

Natural slopes within the existing gully at Fill Site 2 range between 2H:1V and 3H:1V within the main amphitheatre and on the southern flank. Gentler slopes of 5H:1V are present on the downstream northern flank.

The main watercourse beyond the dam flows within a relatively steeply incised channel before joining a larger watercourse at the western extent of the gully.



Figure 1: Oblique Image looking North-East at Fill Site 2 Showing Topographic Features

2325-12-6Q-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

#### www.gaia-engineers.co.nz

#### 2.2.2 Fill Site 3

Fill Site 3 is inferred to have been a similar gully in terms of size and shape to that of Fill Sites 2 and 4. Previous filling of the gully is inferred to be related to nearby historic mine overburden removal activities. Overburden placed as fill within the gully has created a large flat area that is present within the fill area and extends into the neighbouring property to the north. The remnants of the amphitheatre shaped gully head are still visible at the southern end of Fill Site 3 and indicate that the gully system trended in a general north-west direction.

The natural slopes still exposed at the gully head exhibit gradients of approximately 2.5H:1V. The average gradient of the filled flat area is approximately 50H:1V within the proposed fill site.



Figure 2: Oblique Image looking South at Fill Site 3 Showing Topographic Features

#### 2.2.3 Fill Site 4

Fill Site 4 is a similar broad gully network trending in a south-east to north-west direction. The gully head forms a large amphitheatre with two minor remnant ridges running down the centre, separating three smaller gullies. A larger farm dam of approximately 6 metres height is present near the base of the gully which has created an area of ponded water. A smaller dam structure comprised forestry slash and clay fill has been created approximately 100m upstream of the larger farm dam.



The natural slopes at the head of the gully range between 2H:1V and 3H:1V.

Figure 3: Oblique Image Looking South at Fill Site 4 Showing Topographic Features

#### 2.2.4 Fill Site 5

Fill Site 5 is a slightly narrower gully than other sites. This gully trends in a north-west to south-east direction and exits into the working floor of the quarry. The upper reaches of the gully exhibit signs of shallow instability in the form of small slump scarps as well as terracettes indicative of soil creep.

Electricity transmission pylons are present at the southern end and northern ends of the gully with the transmission lines crossing the gully head near the centre.



Figure 4: Oblique Image looking North at Fill Site 5 Showing Topographic Features

#### 2.3 Geomorphology

The geomorphology of the site is predominantly controlled by the underlying geology. The large amphitheatre valleys of Fill Sites 2, 3 (partially obscured by fill) and 4 are characteristic of the Waikato Coal Measures. The parent rock weathers at a relatively quick rate, loosing strength and becoming soils. Relict defects from the rock in the form of fine laminations and cross beds create planes of weakness that encourage rotational slumping of the soils. This process continues in the valley in a radiating pattern thus creating the valleys present today.

The broader ridge area present at the northern end of the Fill 5 Valley exhibits shallow slumping and relatively large creep terracettes. These features are characteristic of the comparatively weak underlying young ash derived soils. Seasonal wetting and drying of these soils cause the soils to creep downslope. At the boundary between the younger soils and the weathered Newcastle Group Greywacke the valley becomes noticeably narrower and steeper. The shape of the valley within this material is more controlled by erosion of the weathered soils and is less affected by slumping and the soil creep depth is much shallower.

## 3 Test Pit Investigation

Test pit site investigations were undertaken from the 17<sup>th</sup> to 20<sup>th</sup> of June 2019 and involved the excavation of 34 (No.) pits by means of a 30t excavator to a maximum depth of 6.2 metres. The soils exposed in the pit walls were logged generally in accordance with the NZGS Field description of soil and rock guidelines by a Gaia Engineers Ltd. engineering geologist. In addition, field shear vane readings were taken at regular intervals in the sidewalls of the excavated pits.

The locations of the test pits are shown on Drawing No.: 2325-12-01 included in Appendix A.

#### 3.1 Test Pit Shear Strength Summary

The following table presents a summary of the measured field vane shear strengths in each geological unit.

Geological Unit	Minimum Measured Shear Strength (kPa)	Maximum Measured Shear Strength (kPa)	Median Shear Strength (kPa)			
Existing Mine Overbuden Fill	55	>188	140			
Recent Alluvium and Colluvium	35	>188	67			
Puketoka Formation Material	170	>188	>188			
Residually Weathered Waikato Coal Measures Material	129	>188	>188			
Completely Weathered Waikato Coal Measures Material	136	>188	>188			
Residually Weathered Newcastle Group Material	136	>188	>188			
Completely Weathered Newcastle Group Material	>188	>188	>188			
Notes:	<ol> <li>188kPa is the maximum BS1377 corrected value for the dial used during the test-pit investigation</li> </ol>					

#### Table 1: Summary of Measured Undrained Field Shear Strength (Su)

Description of the lithologies encountered during the test pit investigation are discussed in Section 4.

## 4 Geology

#### 4.1 Regional Geology and Structure

Reference to GNS Science QMap 1:250,000 series shows that the proposed four fill sites are underlain by Newcastle Group Siltstone and Waikato Coal Measures of the Te Kuiti Group. The Huntly Area is situated on the north-western flank of the Hakarimata and Taupiri Ranges – a north-east to southwest tending mountain range.

The regional structural fabric of this range consists of similarly trending anticlinal and synclinal fold structures. One of the major synclinal fold features is mapped as running through the quarry area. A similar large north to south trending fault is present to the west of the quarry and fill sites

An annotated geological map from the GNS Science New Zealand Geology Web Map is presented below:



Figure 5: Published Geological Map of the Huntly Quarry and Fill Sites. *Modified from GNS Science Web Map Service Under Creative Commons Licence* 

2325-12-GQ-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

### 4.2 Local Stratigraphy

The following geological units have been observed or inferred within the project area:

### 4.2.1 Existing Mining Overburden Fill

The existing mining overburden fill was encountered in Fill Site 3 and is inferred to have originated from nearby coal mine stripping activities. The material consists intermixed layers of variably organic clays as well as crushed mudstone inferred to be Waikato Coal Measures material. No refuse or other visible signs of contamination were observed within the material encountered in the test pit investigation.

#### 4.2.2 Holocene Alluvial/Colluvial Materials

The material is observed in the invert of gullies and watercourses. This material consists of texturally disturbed, soft silts and clays with varying organic content and is locally saturated.

#### 4.2.3 Puketoka Formation

The material is inferred to be late Pleistocene to Holocene aged alluvial ash deposits. This material is present at the top of the highest ridges such as the ridge separating Fill 4 from Fill 5. It consists of predominantly white coloured pumiceous silts.

#### 4.2.4 Waikato Coal Measures

Late Eocene to Early Oligocene aged basal unit of the Te Kuiti Group. The Waikato Coal Measures unconformably overly the basement rock at the Huntly Quarry. This unit is typically weathered to soils up to a depth of approximately 5 to 6 metres. The soil consists of stiff, light coloured silts and clays with minor amounts of fine sand. Beyond this depth the unit typically presents as a very weak to weak mudstone and fine-grained sandstone. Carbonaceous and Coal beds were not observed in test-pits however are visible in overburden stripping cuts currently underway at the north-eastern edge of the quarry pit.

### 4.2.5 Newcastle Group

Late Triassic aged rocks of the Newcastle Group, part of the Murihiku terrane make up the basement bedrock material present at the subject site. Less weathered examples of this material are currently exploited as an aggregate resource at the Huntly Quarry. This unit has deeply weathered to soils as observed in the test pit investigation of Fill Site 5. The weathered soils are described as stiff silts with minor amounts of fine sand. The unweathered material is described as strong, jointed, dark grey siltstone and mudstone.

### 4.3 Geological Risks and Mitigation

The varied geological foundation conditions across the four proposed fill sites present different risks that will need to be accounted for during the design and subsequent construction of the individual fills. The following geotechnical risk and mitigation strategies are proposed for the three dominant foundation forming units:

#### 4.3.1 Existing Mining Overburden Fill

The historic mining fill that has been observed in Fill Site 3 has an unknown pedigree. No records of placement or surveys of the pre-existing surface are available. During the test-pit investigation undertaken for this report, the depth of the fill and the corresponding contact with the underlying formation was unable to be ascertained near the toe of the fill. Whilst the fill appeared to be competent and not inclusive of excessive deleterious material in the near surface, this could not be confirmed for the entire profile of the fill.

The fill was observed to be hydraulically conductive with numerous fast seepages observed in the sidewalls of the opened pits. High groundwater levels in the near surface could negatively impact the stability of new material placed above it.

During detailed investigation and design of Fill Site 3 it will be imperative that the investigation penetrates the historic fill in order to make conclusions as to the depth and composition of the fill as well as the underlying ground conditions. This will allow the structural bunds and toe keys (if required) to be specifically designed to ensure the stability of the proposed fill.

Deep counterfort drains will be required in the historic fill in order to draw-down the groundwater level present in the historic fill.

#### 4.3.2 Waikato Coal Measures Bedding

Planes of weakness that run parallel to the bedding of the Waikato Coal Measures mudstone are known to be associated with this unit. These planes are most commonly found beneath the residually weathered soil, near the interface with the relatively unweathered rock. Whilst slips involving the material above these weak planes are known to occur in this material type it should be noted that this mechanism has not been observed at the Huntly Quarry.

Bedding parallel weaknesses were not observed during the test pit investigation. Relatively uniform strength was observed within the residually weathered material followed by a gradual transition through weathering grades to moderately-slightly weathered material present in the base of the gullies.

However, the presence of bedding parallel weaknesses will be checked for during detailed investigation and design. In the absence of information regarding the bedding direction, the sensitivity of the fills to worst-cast bedding parallel weaknesses will be checked.

Mitigation options for the potential presence of bedding parallel weaknesses will typically consist of specifically designed shear-keys that penetrate the weak layer.

#### 4.3.3 Newcastle Group Greywacke

Only Fill Site 5 is anticipated to be founded directly on the local basement material. The depth to this material has not been confirmed at Fill Sites 2 to 4 and is inferred to be overlain by thick Waikato Coal Measures deposits.

Within Fill 5, the unweathered component of the basement bedrock is overlain by variably thick weathered horizons. The greatest weathering depth is present near the ridges whilst the depth to unweatherd material is less near the invert of the gullies. The strength of the material does decrease rapidly with increases in weathering, however even the more weathered members of this unit are considered to be sufficiently competent to found the proposed fill materials on.

Specific design of the basal layers and toe-bunds will be required in order to successfully to provide a stable platform to begin construction of the fill will be required.

## 5 Existing Information Review

The reports and data listed in Section 1.2 were reviewed in this project. A summary of material referenced is presented in the following sections:

### 5.1 Pilbrow Surveying Topographic Models and Aerial Photography – April 2019

Survey data provided by Pilbrow Surveying Ltd. has been used to develop a 3D surface model of the proposed fill sites using the software Eureka by Maptek. Test pit data collected during the site investigation undertaken as part of this report was input into the 3D model. Orthorectified aerial images provided by Pilbrow were then overlain on the surface models. These models along with field notes aided in the production of the engineering geological map which is included in Drawing 2325-12-04 in Appendix A.

### 5.2 Geological and Resource Assessment of Huntly Quarry – 2006 (Terra Mining Ltd.)

This report covered the geological assessment of the Huntly Quarry pit as well as the exploration and assessment of a potential resource block to the west of the existing pit. A series of deep boreholes were drilled around the perimeter of the existing pit and also in the proposed block to the west. A 3D geological model was created that covered the existing pit and extended towards the so called 35-year expansion line. Geological modelling and mapping did not extend into the currently proposed fill site areas.

Boreholes HQ006 and HQ007 (Location shown on drawing no.: 2325-12-01 shown in Appendix A and logs are shown in Appendix B) provide some information regarding the boundary between the Waikato Coal Measures and the Newcastle Group Greywacke. However, the projection of this boundary north into the proposed fill sites becomes increasingly uncertain and therefore unreliable. This geological boundary is not expected to be a governing factor regarding the stability and design of the proposed fill sites and will not be relied on for modelling.

#### 5.3 Huntly Quarry Fill Assessment & Design – June 2019 (Terra Mining Ltd.)

This report presented revised aggregate potential and required overburden stripping volumes as well as conceptual fill surfaces for the four proposed fill sites. These concept surfaces have been used as the basis of the investigation and reporting presented here.

It is noted that the fill footprints and designs presented in this report are conceptual and subject to geotechnical and civil specific design.

## 6 Concept Fill Design

Concept fill surface designs have been prepared by Terra Mining Consultants as presented in the report Huntly Quarry Fill Assessment & Design dated June 2019. The purpose of these models was to provide indicative storage volumes for each fill site.

The general geometries for the fill sites as presented by Terra Mining Consultants are summarised in Table 2 below:

Fill Site	Lowest Batter Gradient	Topography Constrained Batter Gradient	Unconstrained Batter Gradient	Inter-bench Height (m)	Proposed Berm/Bench Width (m)			
Fill Site 2	2H:1V	3H:1V	4H:1V	10	5			
Fill Site 3	3H:1V	4H:1V	3H:1V	10	5			
Fill Site 4	2H:1V	3H:1V	4H:1V	10	5			
Fill Site 5	2H:1V	3H:1V	4H:1V	10	5			
Notes:	<ol> <li>Topographically constrained refers to toe of fill being supported by sides of valley</li> <li>Unconstrained refers to the leading face of the fill that trends down the valley</li> <li>The top of the fill has a nominal 3°-5° crown</li> </ol>							

#### Table 2: Summary of Concept Fill Design Geometries (Extract from Terra Mining Consultants)

These fill design parameters were conservatively selected without geotechnical input in order to generate baseline calculations of potential fill volume at each site. Refer to Section 3 of the Terra Mining Consultants report for a full list of constraints that were considered in the design of the proposed fills.

In addition to the proposed fill sites, three sediment pond areas have been indicated at the base of Fill sites 2, 4 & 5. It is proposed that Fill Sites 3 and 4 share the ponding area at the base of Fill 4.

The exact footprint of the fills is not deemed to be controlled by geotechnical concerns but rather environmental and planning concerns. It is expected that the proposed fill footprint will be altered through an iterative process between the client, council and consultants. The footprint presented in the Terra Mining Consultants report and reproduced in the drawings in this report is subject to change.

www.gaia-engineers.co.nz

## 7 Slope Stability Analysis

Conceptual limit equilibrium slope stability analysis has been undertaken for Fill Sites 2 to 4 to gain an understanding of the likely stability of the concept fill sites as well as the mechanisms for instability likely to govern.

#### 7.1 Geotechnical Parameters

The geotechnical parameters presented in Table 3 below were used in the limit equilibrium slope stability analysis software SLIDE by Rocscience.

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Anisotropic Function	UCS (kPa)	GSI	mi	D	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface	Ни Туре	Hu	Ru
Proposed Structural Bund Fill		18	Mohr-Coulomb	5	30									None			0.1
Proposed Managed Fill		15	Mohr-Coulomb	3	23									None			0.1
Existing Historic Mining Fill		18	Mohr-Coulomb	3	30									Water Surface	Custom	1	
Residual Waikato Coal Measure Stiff Soil		17.5	Mohr-Coulomb	5	30									Water Surface	Custom	1	
Highly Weathered Waikato Coal Measures Mudstone - Hard Soil		18	Mohr-Coulomb	10	30									Water Surface	Custom	1	
Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone		20	Generalized Hoek-Brown					2500	30	7	0			Water Surface	Custom	1	
Waikato Coal Measures Bedding Parallel Shears		20	Anisotropic function				WCM Bedding Parallel Shears							Water Surface	Custom	1	
Proposed Managed Fill - Vertical Stress Ratio		15	Vertical Stress Ratio									0.3	35	None			0.1
Proposed Structural Bunds - Undrained		18	Undrained	150		Constant								None			0.1

Table 3: Geotechnical Parameters used in SLIDE Models

### 7.2 Geological Models

The geological models were adopted from the cross sections presented in drawing no.: 2325-12-05 to 08 as shown in Appendix A.

#### 7.2.1 Bedding Parallel Shears in the Waikato Coal Measures

In the absence of reliable bedding information for the Waikato Coal Measures near the toe of Fill Sites 2 and 4, a generalised anisotropic strength model which adopts a worst credible case of bedding parallel weaknesses dipping at a shallow angle downslope as represented as the orange sector in Figure 6 below:



Figure 6: Waikato Coal Measures Bedding Parallel Shears - Anisotropic Strength Model

2325-12-GQ-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

#### 7.2.2 Seismic Loading

A generic seismic loading has been adopted at the concept stability analysis stage. It is anticipated that seismic loading will likely represent the critical loading case. As such, fills will need to be carefully designed for acceptable performance under seismic loadings.

#### 7.3 Results

A copy of the SLIDE result outputs is included in Appendix C.

The analyses have indicated that the stability of the proposed fills is largely governed by the specific construction of the fills more so than the underlying geology. If unfavourable bedding direction is encountered during detailed investigation and design it is expected that this will be mitigated by the use of specifically designed toe-keys.

With specific design of the fills it is believed that the buttressing effect of the material placed will improve the stability of the natural slopes behind the fill.

The analyses presented are conceptual and preliminary in nature using existing information. Additional stability analyses will be required during detailed design of each fill site.

## 8 Proposed Fill Recommendations

Based on our review of existing geological/geotechnical information, walk-over inspection/mapping and test pit investigation, we are of the opinion that the selected sites are generally suitable for use as fill sites for placement of quarry overburden and managed fill.

At this stage of design, the specific composition of each fill site has yet to be finalised (overburden, imported managed fill, imported clean fill etc.). Specific design of each fill site will need to be undertaken based on the composition of the intended fill before filling commences.

The following sections outline our general recommendations followed by site specific and earthworks recommendations

#### 8.1 General Recommendations

#### 8.1.1 Stripping

Prior to commencement of filling – vegetation and topsoil along with soft and otherwise deleterious material should be removed to stockpile and to expose subgrade conditions. Subgrade conditions should be inspected by a suitably qualified geo-professional prior to commencement of filling.

#### 8.1.2 Gully "Muck-Out" & Drainage

The invert of all ephemeral and main watercourses should be mucked out of soft, organic and saturated material to allow the installation of drainage measures.

Proposed drainage measures are to include a graded drainage trench, lined with geotextile with a punched drainage coil wrapped in filter sock placed at the invert. The trench is to be backfilled to the surrounding grade with clean drainage aggregate. Additional and larger diameter coils will be used for areas with greater water production such as within the main watercourses.

Springs encountered during stripping and muck-out activities should be tapped with drainage trenches and coils and joined into the main drainage network.

Typical concept drainage details are included in Appendix A, Drawing No. 2325-12-11.

#### 8.1.3 Existing "Farm Dams"

Existing farm type dams are present in Fill Site 2 and Fill Site 4. It is recommended that these dams be deconstructed so that muck-out and installation of drainage can be undertaken as discussed in Section 8.1.2.

#### 8.1.4 Haul Roads

Haul roads to the toe of each fill will need to be established. Each fill area/valley is currently accessed by a network of farm and forestry tracks. It is expected that the network of existing roads and tracks will be upgraded as required for use as haul routes to the fill areas. Specific design of these roads will be undertaken during detailed design of each fill on an as needed basis. Comparatively more earthworks to construct a haul road for Fill Site 5 is anticipated, discussed further in Section 8.2.4.

#### 8.1.5 Sediment Control Ponds

Three indicative locations for stormwater ponds were presented in the Terra Mining Consultants report and have been carried over into this report as shown in Drawing No.: 2325-12-01. The proposed pond areas are considered suitable from a geotechnical perspective subject to the same recommendations provided for the proposed fill areas. Upon finalisation of the sediment pond locations, detailed geotechnical investigation and design should be undertaken for the ponds during detailed works for the corresponding fill site.

#### 8.2 Site Specific Recommendations

#### 8.2.1 Fill Site 2

Specifically designed drainage by a suitably qualified drainage engineering will be required in the base of the valley in order to convey the water from the existing stream beyond the proposed fill footprint.

It was noted whilst conducting the test pit investigation that a moderate amount of water was flowing from the ponded area despite limited recent rainfall. It is therefore recommended that the ponded water currently stored behind the existing farm dam be released as to ascertain whether or not the ponded water is entirely stormwater sourced and not being recharged by an obscured spring. The drainage could then be appropriately sized.

#### 8.2.2 Fill Site 3

Due to the uncontrolled nature of the historic fill present at Fill Site 3, it is recommended that additional deeper investigation be undertaken during detailed design in order to quantify the thickness of the fill and test the geotechnical properties of the existing fill.

### 8.2.3 Fill Site 4

Similarly to Fill Site 2, the presence (if any) of the groundwater regime at the existing pond will need to be quantified subsequent to releasing the farm dam structure. Specific design of the drainage from the ponded area will be required.

### 8.2.4 Fill Site 5

It is anticipated that due to the steeper and narrower nature of the valley that more extensive earthworks will be required in order to create haul routes for material to the fill area. We understand

that the preference for a haul route will include cutting a saddle into the western flank of the valley. Depending on the size and location of the cuts to create this road, stability checks will be required in order to confirm that the stability of the existing power transmission pylon present at the southern end of the fill is not compromised.

#### 8.3 Earthworks Recommendations

In order to maintain the stability of the existing and future fill slopes during filling activities the following methodologies are recommended:

#### 8.3.1 Engineered Containment Bunds

Imported managed fill and similar unsuitable fill materials can only support very shallow batter angles – typically flatter than 6H:1V. It is therefore recommended that to maximise the volume of imported managed fill that can be placed, engineered structural containment bunds be created so as to increase the maximum overall gradient of the fill.

The typical layout for this configuration is included in Appendix A, Drawing 2325-12-10.

Fill sites comprised overburden material and clean fill should also begin each lift by forming a containment bund that is compacted to structural fill standards. This will ensure that external batters are constructed to the design grade and surface water can be controlled during construction.

#### 8.3.2 Drainage Blankets

Drainage blankets will be required at the base of each lift. The blanket should consist of a nominal thickness of 0.4m of clean, large diameter (All Passing 100mm) aggregate. The drainage blanket should be continuous over the fill footprint and outlet beyond the previously discussed containment bunds. The purpose of the blankets is to relieve water pressure that may build up within the fills due to both stormwater infiltration and water released from managed fill during consolidation.

Drainage Blankets are shown in Appendix A, Drawing 2325-12-10.

#### 8.3.3 "Bottom Up" Filling

As noted in Section 2.3, the upper reaches of each valley are susceptible to slumping type failures. It is therefore recommended that the fills be constructed from the toe up. Fill should be transported to the base of the fill area and progressively built up in sub-horizontal layers.

It is not recommended that fill be end-tipped from the heads of the gully and pushed down the slopes. Doing so may overload the underlying soils and lead to failure – a potential risk to staff as well as filling progress.

#### 8.3.4 Fill Control

Monitoring of the fill placed during construction will be required. The monitoring methodology and specifications will be developed during detailed design of the fill areas. Typical engineered fill testing criteria and frequency for different types of fill material are included in Table 4, Table 5, and Table 6 below.

			Criteria	and Testing					
Fill Type	Water content (NZS 4402: Test 2.1) Frequency of Testing	Water Content Acceptance Criteria	Pilcon Vane Shear Frequency of Testing	Shearvane Acceptance Criteria (NZGS 2001 Guideline for Hand Held	Maximum Dry Density and Air Void Frequency of Testing	Maximum Dry Density and Air Void Acceptance Criteria (NZS4407 Test 4 2 1)			
Structural Fill	1 test per 500m <sup>3</sup> of source material cut with a min of 2 tests for each area worked each day	± 4%	1 set (3 points) per 500m3 placed with a min of 2 tests for each area worked each day and no more than every 0.5m thick of fill placed	Avg Su= 120kPa No single value less than 100kPa	1 set (3 points) per 500m3 placed with a min of 2 tests for each area worked each day and no more than every 0.5m thick of fill placed	≤ 8% Air Voids			
Managed Fill	Material is generally unsuitable for testing and compaction.								

#### Table 4: Compaction Control Criteria & Frequency of Testing – Cohesive Material

	Criteria and Testing				
Fill Type	Compaction Curves for MDD Test Frequency	Proof Roll Test Frequency	Grading Test Frequency & Acceptance Criteria	Density Acceptance Criteria (NZS4407:	Proof Roll Acceptance Criteria <sup>[1]</sup>
Collector Drain & Underfill Drain	N/A	N/A	3 test per source (NZS 4402:test 2.8.1)	N/A	N/A
Underfill Trench Drain	1 standard compaction test per 2000m <sup>3</sup> and at least 5 tests per source type	1 test per layer placed	3 test per source (NZS 4402:test 2.8.1)	85% of MDD	N/A
Drainage Blanket	1 plateau test per 2000m³ and at least 5 tests per source type	1 test per layer placed	Visual check each day. No particles greater than 100mm, no organic content, and minimal clay content	N/A	< 20mm <sup>(1)</sup>
Notes	(1) Acceptance criteria	based on pass with a 6T	roller (min).		

#### Table 5: Compaction Control Criteria & Frequency of Testing - Hardfill.

#### Table 6: Compaction Control Criteria & Frequency of Testing - Non-Cohesive Fill (Brown Rock)Soft Pit Run (SPR 100)

Fill Type	Grading Test Frequency & Acceptance Criteria	Proof Roll Frequency & Acceptance Criteria
Structural Fill	Visual check each day. No particles greater than 200mm. 1 test per 2000m <sup>3</sup> of compacted fill (NZS4402:test 2.8.1) Of particle passing 100mm sieve: - No organic content; and - <7% passing 75µm sieve.	<ul> <li>All layers. Visually confirm resultant impression at the surface shall be less than 5mm with a fully loaded ADT (min. 40 Tonne) or a standard axle vehicle (min. 10 Tonne).</li> <li>1 calibration tests <sup>[2]</sup> per 5,000m<sup>3</sup> of compacted fill and no more than every 1.5m thick of rock fill placed</li> </ul>

2325-12-6Q-01 (Huntly Quarry Disposal Sites - Geotechnical Assessment)\_Rev C 5 Carmont Place, Mt Wellington, Auckland 1060, New Zealand PO Box 51 295 Pakuranga, Auckland 2140

#### 8.3.5 Displacement Monitoring

It is recommended that displacement monitoring be established on the finished fills. Successive monitoring points should be established at each bench level with additional monitoring points installed on the finished surface. The monitoring points would nominally consist of a waratah fencing standard driven into the fill that can be checked periodically by a surveyor. The number and position of these monitoring points along with monitoring frequency and alert criteria will be determined for each fill during detailed design.

A concept monitoring point layout plan is included in Appendix A, drawing 2325-12-12 to 15

### 8.3.6 Pore-Water Pressure monitoring

If significant displacements and/or settlements are measured as part of the displacement monitoring recommended in Section 8.3.5, the installation of standpipe piezometers or similar within the fill will be required in order to monitor the pore-water pressure conditions. The rate of displacement and/or settlement that will trigger the installation of the piezometers will be determined during detailed design.

### 8.4 Scope for Modifications to the Concept Fill Designs

The concept fill designs have been created without geotechnical input for the primary purpose of indicative volume reporting. Based on our experience with similar projects, we believe there is scope for increasing the volume of the fills by means of steeping some of the proposed batter angles.

### 8.4.1 Fill Material Type

It is recommended that different fill materials be confined to specific fill sites. We believe that this is a good strategy in order to maximise the storage capacity of each site as different fill materials will have different requirements in terms of allowable gradients. Overburden fill and imported clean fill materials will not require containment bunds or similar stability improvement devices subject to specifically designed performance criteria. Compaction control and monitoring will be required in order to meet the designed performance criteria. Imported managed fill however will require specifically designed containment devices such as engineered bunds in order to maximise the managed fill volume and maintain an acceptable level of stability.

The table below summarises the potential batter angles that may be achievable for different fill types subject to specific design:

Fill Material Type	Maximum Face Batter Angles <sup>(1)</sup>	Maximum Topographically Constrained Batter Angles <sup>(2)</sup>	Containment Bund Required	Level of Fill Monitoring
Overburden Fill	3H:1V	2H:1V	No	High
Clean Fill <sup>(3)</sup>	3H:1V	2H:1V	No	High
Managed Fill	4H:1V	3H:1V	Yes	Low <sup>(4)</sup>
Notes:	4H:1V       3H:1V       Yes       Low <sup>(4)</sup> 1)       The Face batters refer to the leading edge of the fill that faces down the valley and is not constrained at the toe by topography.       2)       Topographically constrained batters refer to batters that end at the head or flanks of the valley.         3)       Imported clean fill will need to be subject to strict quality control inspections and must meet applicable structural fill testing requirements. Otherwise it will need to be treated as managed fill.         4)       Low level of fill monitoring refers to the managed fill component of the fill. Engineering structural bunds will require the same level of monitoring as for overburden and clean fill.         5)       The above recommended profiles shall be subjected to specific design after detailed			

#### Table 7: Potential Batter Gradients for Different Fill Materials

#### 8.4.2 Fill Site Footprints

It is anticipated that there may be some modification to the concept fill footprints due to operational requirements. These changes are not expected to be of significant geotechnical concern. Nevertheless, a recommended fill foot-print limit has been shown on the Drawing No.: 2325-12-01 included in Appendix A.

This limit approximately follows the gully ridgelines and covers an area that is considered to exhibit similar ground conditions to those encountered during investigation. It is important to note that all fill placed within the limit is still subject to detailed investigation and design.

## 9 Conclusions

The four fill sites presented are considered suitable for the proposed development. Proof of the concepts potential stability has been confirmed with preliminary slope stability analysis. Commencement of filling should be subject to detailed investigation and design not scoped as part of this report. The presence zones of weakness related to Waikato Coal Measures bedding is not considered to be of high risk to the proposed developments. However, this will need to be confirmed during detailed site investigations.

The final design of each fill area is highly dependent on the type of fill material intended to be used. Limiting each fill site to a particular type of fill material will maximise the amount of fill that can be placed for each type of fill.

The footprint of each fill is not considered to be geotechnically constrained. There is scope to increase or decrease the footprint of the fills subject to environmental, planning and other constraints not within the scope of this report. These constraints should be qualified and quantified before proceeding with detailed design to ensure that the fill footprint is suitable for the project. Any increase in the fill footprint beyond the limit shown in drawing no.: 2325-12-01 will require the review of the recommendations presented in this report as well as specific detailed investigation and design.

Subject to appropriate specific design and careful construction monitoring, it is expected that the proposed project will not unsatisfactorily impact the existing area in terms of land stability, subsidence and flooding.

## 10 Limitations

#### 10.1 Specific Limitations

The investigation and design scope for this report has been limited to the level considered necessary to support the application for Resource Consent. It is not intended that construction of the fills shown in the report be undertaken without additional detailed investigation (where needed) and design.

#### 10.2 General Limitations

This report is the property of our client – Gleeson Quarries Ltd.

The factual logs presenting descriptions of the soils and geology based on our observations of the samples recovered in the fieldwork and may not be truly representative of the underlying ground conditions.

To the maximum extent permitted by law, Gaia Engineers Ltd disclaims all liability and responsibility (in contract or tort, including negligence, or otherwise) for any loss or damage whatsoever which may be suffered as a result of any reliance by any third party on this report, whether that loss is caused by any fault or negligence on the part of Gaia Engineers Ltd or otherwise.

*Our interpretation of the geotechnical information is based on field investigations at discrete locations. Therefore, variation of ground conditions away from the investigations can be expected. No guarantee is expressed or implied as to the nature of the ground conditions between or beyond investigation conditions. This report covers the Fill Disposal Sites at the Huntly Quarry as described within and does not make any conclusion or recommendations regarding any other aspects of the quarry.* 

## 11 Risk and Mitigation

#### Table 8: Key Geotechnical Risk and Mitigation Strategy

Likely Risk	Mitigation Strategy
Ground Conditions: Position of Geological/Geotechnical Unit boundaries differs from design. Worse conditions than those designed for could lead to slope instability Presence of Bedding Parallel Shears and Weaknesses within the Waikato Coal Measures are encountered	Detailed design investigations to be undertaken in areas of geological uncertainty where the uncertainty could pose a risk to the design. Specific design of toe-keys to cut-off bedding parallel weaknesses. No permanent cuts that daylight bedding parallel weaknesses.
Groundwater Conditions: Groundwater table is higher than observed and/or groundwater springs are encountered.	Sufficient contingency in construction budget for additional drainage measures.
Land Slips: Slips within the weathered soils of the existing valleys during construction	Avoidance of placing undue load on the natural soil slopes by not end-tipping material from the gully head. Maintaining positive drainage across all active earthworks sites and shaping of finished ground. Not directing catchment stormwater flows onto active earthworks areas and conveying water to a safe discharge point

## 12 Safety in Design (SiD) Considerations

As this report presents a geotechnical appraisal and not a specific design, SiD considerations have not been developed. It is recommended that SiD considerations be developed with the client at the time of detailed design.

## APPENDIX A – Design Drawings

Drawing No:	Drawing Title:	Revision:
<u>2325-12-01</u>	Site Layout with Current Contours	В
2325-12-02	Site Layout with Proposed Contours	А
2325-12-03	Site Layout with Fill Thickness Contours	А
2325-12-04	Geological Map	А
2325-12-05	Fill 2 – Cross Section 1	А
2325-12-06	Fill 3 – Cross Section 1	А
2325-12-07	Fill 3 – Cross Section 2	А
2325-12-08	Fill 4 – Cross Section 1	А
2325-12-09	Fill 5 – Cross Section 1	А
2325-12-10	Typical Managed Fill and Containment Bund Detail	А
2325-12-11	Typical Drainage Details	А
2325-12-12	Concept Displacement Monitoring Layout – Fill 2 Area	А
2325-12-13	Concept Displacement Monitoring Layout – Fill 3 Area	А
2325-12-14	Concept Displacement Monitoring Layout – Fill 4 Area	A
2325-12-15	Concept Displacement Monitoring Layout – Fill 5 Area	А



M. KERNOT

Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022

A 02/09/19 DRAFT FOR COMMENT Rev. Date Revision Details





- PROPOSED FILL FOOTPRINT CONCEPT LIMIT (SUBJECT TO DETAILED DESIGN)
- SEDIMENT POND AREA (INDICATIVE ONLY)
- FILL 2 AREA
- FILL 4 AREA
- FILL 5 AREA
- TEST PIT (TP)
- HISTORIC BOREHOLE 2006 (HQ)

## REFERENCE: AERIAL IMAGERY + CONTOURS FROM PILBROW SURVEYING LTD. APRIL 2019

	INFORMATION
<sup>tt:</sup> UNTLY QUARRY ISPOSAL SITES	Project No. 2325/12
ing Title: ITE LAYOUT WITH CURRENT CONTOURS	Scale: AS SHOWN ORIGINAL SHEET SIZE: A3 Drawing No. 2325-12-01 B





LEGEND:

PROPOSED CONTOURS (2m INTERVAL)
SEDIMENT POND AREA (INDICATIVE ONLY)
FILL 2 AREA
FILL 3 AREA
FILL 4 AREA
FILL 5 AREA

	DRAFT
HUNTLY QUARRY DISPOSAL SITES	Project No. 2325/12
Drawing Title: SITE LAYOUT WITH	Scale: AS SHOWN ORIGINAL SHEET SIZE: A3 Drawing No. Rev.
PROPOSED CONTOURS	2325-12-02 A



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



LEGEND:	
<u> </u>	PROPOSED FILL CO
	FILL 2 AREA

ORIGINAL SHEET	SIZE:
awing No.	
2325-12-03	


Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022





# REFERENCE: AERIAL IMAGERY + CONTOURS FROM PILBROW SURVEYING LTD. APRIL 2019

Project: HUNTLY QUARRY DISPOSAL SITES Drawing Title: GEOLOGICAL MAP	DRAFT	DRA		
Drawing Title: GEOLOGICAL MAP	325/12	Project No. 2325/	UARRY . SITES	
GEOLOGICAL MAP	OWN NAL SHEET SIZE: A3	Scale: AS SHOWN ORIGINAL SHEE		
	-12-04 A	Drawing No. 2325-12-04	CAL MAP	





P O Box 51 295, Pakuranga Auckland 2140 5 Carmont Place, Mt Wellington Auckland 1060 New Zealand Tel: 09 276 5673 Mobile: 021 426 012 Email: info@gaia-engineers.co.nz A 02/09/19 DRAFT FOR COMMENT Rev. Date Revision Details Document Set ID: 3490863

Version: 1, Version Date: 14/04/2022

HISTORIC MINING OVERBURDEN FILL - FIRM TO VERY STIFF CLAY/SILT WITH CRUSHED MUDSTONE AND VARYING ORGANIC INCLUSIONS

RESIDUALLY WEATHERED WAIKATO COAL MEASURES -STIFF TO VERY STIFF CLAY/SILT

COMPLETELY WEATHERED WAIKATO COAL MEASURES -

# 0 1 2 3 4 5 0 1 2 3 4 5 0 1</td



PROPOSED FILL 3 SECTION 1 SCALE 1:2000 (A3)



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



ASSOCIATION OF CONSULTING ENGINEERS NEW ZEALAND

0		4 5 															
	LEGEND: PROPOSED FILL HISTORIC MINING STIFF CLAY/SILT VARYING ORGAN RESIDUALLY WEA STIFF TO VERY ST COMPLETELY WEA VERY STIFF TO H	G OVERBURDEN FILL WITH CRUSHED MUD IC INCLUSIONS ATHERED WAIKATO CO TIFF CLAY/SILT ATHERED WAIKATO C ARD SILT	- FIRM TO VER STONE AND OAL MEASURES	Y 5 - 5 -							TP3 TP2 TP4			TP8	TPS	TP5	0 L L L L
		DATUM: 0.00m		3		2		2	;	- <u>?</u>	<u></u>	<del>?</del> ?_		?	3	- <u>-</u>	
	PI	ROPOSED LEVELS									69.57	76.00	81.24	86.23	92.41	96.49	98.00
	c: -	00000000000000000000000000000000000000	64.79	63 40	63.07	63.29	64.06	64.08	64.71	65.55	66.00	66.01	66.29	66.27	67.28	68.17	71.44
	C	UT/FILL DEPTHS									3.57	66.6	14.95	19.96	25.13	28.32	26.56
	C	HAINAGE O	20	40	60	80	100	120	140	160	180	200	220	240	260	280	300

PROPOSED FILL 3 SECTION 2 SCALE 1:1250 (A3)



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



	DRAFT
Project: HUNTLY QUARRY DISPOSAL SITES	Project No. 2325/12
Drawing Title:	Scale: AS SHOWN ORIGINAL SHEET SIZE: A3
SECTION 2	Drawing No. Rev. 2325-12-07 A



A 02/09/19 DRAFT FOR COMMENT Rev. Date Revision Details

Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



PROPOSED FILL 5 SECTION 1 SCALE 1:1000 (A3)

Client: K. C. CHEUNG Gaia Engineers P O Box 51 295, Pakuranga Auckland 2140 5 Carmont Place, Mt Wellington Auckland 106 New Zealand Tel: 09 276 5673 Mobile: 021 426 012 Email: info@gaia-engineers.co.nz M. KERNOT GAIA ENGINEERS Gleeson Quarries K. C. CHEUNG S. CHEN 
 A
 02/09/19
 DRAFT FOR COMMENT

 Rev.
 Date
 Revision Details
 rafting Check: M. KERNOT

Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022

ORIGINAL IN COLOU



	DRAFT
Project: Project No.	
HUNTLY QUARRY 23.	25/12
Drawing Title: Scale: AS SHOW	/N
PROPOSED FILL 5 SECTION 1	Rev. 12-09 A



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022

Rev. Date Revision Details





Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022







LEGEND: - 90 - PROPOSED CONTOURS (2m INTERVAL) DISPLACEMENT MONITORING POINT NOTES: NUMBER AND LOCATION OF DISPLACEMENT MONITORING POINTS TO BE DETERMINED DURING DETAILED DESIGN. - STEEL WARATAH FENCING STANDARD DRIVEN MIN 0.6m INTO GROUND - FINISHED FILL CONTAINMENT BUND SURFACE  $\underbrace{\text{TYPICAL DISPLACEMENT MONITORING POINT DETAIL}}_{\text{N. T. S.}}$ DRAFT roject Director: K. C. CHEUNG HUNTLY QUARRY DISPOSAL SITES 2325/12 M. KERNOT AS SHOWN ORIGINAL SHEET SIZE: A3 K. C. CHEUNG Prawing Title CONCEPT DISPLACEMENT MONITORING LAYOUT - FILL 2 AREA s. CHEN Drawing No 2325-12-12



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



ASSOCIATION OF CONSULTING

А







LEGEND: - 90 - PROPOSED CONTOURS (2m INTERVAL) DISPLACEMENT MONITORING POINT NOTES: NUMBER AND LOCATION OF DISPLACEMENT MONITORING POINTS TO BE DETERMINED DURING DETAILED DESIGN. - STEEL WARATAH FENCING STANDARD DRIVEN MIN 0.6m INTO GROUND - FINISHED FILL CONTAINMENT BUND SURFACE  $\underbrace{\text{TYPICAL DISPLACEMENT MONITORING POINT DETAIL}}_{\text{N. T. S.}}$ DRAFT K. C. CHEUNG HUNTLY QUARRY DISPOSAL SITES 2325/12 M. KERNOT AS SHOWN ORIGINAL SHEET SIZE: A3 K. C. CHEUNG Prawing Title CONCEPT DISPLACEMENT MONITORING LAYOUT - FILL 3 AREA s. CHEN rawing No 2325-12-13



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



ASSOCIATION OF CONSULTING

А



Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



ASSOCIATION OF CONSULTING

А

NOTES: NUMBER AND LOCATION OF DISPLACEMENT MONITOR POINTS TO BE DETERMINED DURING DETAILED DESIG	RING GN.
SURFACE	
ORING POINT DETAIL	
	DRAFT
Project: HUNTLY QUARRY DISPOSAL SITES	Project No. 2325/12
Drawing Title: CONCEPT DISPLACEMENT MONITORING LAYOUT - FILL 4 AREA	Scale: AS SHOWN ORIGINAL SHEET SIZE: A3 Drawing No. Re 2325-12-14

DISPLACEMENT MONITORING POINT

LEGEND: - 90 - PROPOSED CONTOURS (2m INTERVAL) DISPLACEMENT MONITORING POINT NOTES: NUMBER AND LOCATION OF DISPLACEMENT MONITORING POINTS TO BE DETERMINED DURING DETAILED DESIGN. 120 2.5m 0.6m - STEEL WARATAH FENCING STANDARD DRIVEN MIN 0.6m INTO GROUND - FINISHED FILL CONTAINMENT BUND SURFACE CONCEPT DISPLACEMENT MONITORING LAYOUT - FILL 5 AREA  $\underbrace{\text{TYPICAL DISPLACEMENT MONITORING POINT DETAIL}}_{\text{N. T. S.}}$ DRAFT ORIGINAL IN COLO Client K. C. CHEUNG Gaia Engineers HUNTLY QUARRY DISPOSAL SITES 2325/12 P O Box 51 295, Pakuranga Auckland 2140 5 Carmont Place, Mt Wellington Auckland 106 New Zealand Tel: 09 276 5673 Mobile: 021 426 012 Email: info@gaia-engineers.co.nz M. KERNOT GAIA AS SHOWN ORIGINAL SHEET SIZE: A3 Gleeson Quarries K. C. CHEUNG Prawing Title CONCEPT DISPLACEMENT MONITORING LAYOUT - FILL 5 AREA s. CHEN Drawing No 
 A
 02/09/19
 DRAFT FOR COMMENT

 Rev.
 Date
 Revision Details
 2325-12-15 M. KERNOT

Document Set ID: 3490863 Version: 1, Version Date: 14/04/2022



ASSOCIATION OF CONSULTING

А

# APPENDIX B – Test Pit & Historic Borehole Logs

Description	No. Sheets:
Test Pit Log Report Sheets	69
Historic Borehole Logs Sheets	12

GAIA			٦	res <sup>.</sup>	ΤF	ΝT	LO	G				TE 1::	EST 30	PIT ID. <b>T</b>	P20 Sheet	) <b>1</b> 1 of 1	
PROJECT:	Huntly Quarry Disp	osal Sites		CLIE	NT: (	Gleeson	Quarries	s Ltd.				JC	)B N	lo:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433597.7m N.721356.3m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 69.60m Auckland	00 Mt	Eden Ci al Datu	rcuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: HED: R:			19/0 19/0 Fine	)6/2019 )6/2019 ;			
	Soil	Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	2	(blows	Scala s/100	10 12	Sample ID	Sample Type	R.L (m)
0.00-0.20 m					-											0,	_
0.20-1.50 m Silty CLAY; light gre	ey and orange. Very s	tiff, moist, low to r	noderate plasticity, inser	nsitive.	- - - - - - - - - - - - -				134	68							
					- - - - - - - - - - - - - - - - - - -				188+						-		-
1.50-4.50 m Completely weathe	red, light grey with ora	ange streaks, MU	DSTONE; extremely we	ak	-	×			188+								- - - 68.0 —
[clayey SILT; Hard,	moist, non plastic].	5 / -			- 2		Aeasures		188+						-		-
							Waikato Coal N										
					- 												- - - - - - - - - -
					- - - - - - - - - - - - - - - - - - -										-		
	End	of Pit @ 4.5 m			-	× × × × × × × × ×											- - 65.0 — - -
					5												
					- - - - - - - 6												64.0 — - - -
Contractor: Glee	son Civil I td	Remarks <sup>.</sup>							Gro	undwa	l Iter i	notes					
Plant: Hitat Logged: MK Checked: KCC Approved: KCC	tch 30t Excavator	SV readings corre	ected to BS1377 - Dial N Logged in	lo. 1872 n accordar	nce with	n NZ Ge	eotechnic	al Soci	Grou ety (20	undwa	iter I uide	Not E	s. Enco	ountere	b		



TP201
PROJECT: Huntly Quarry Disposal Sites

s JOB No: 2325



	1		-	TES	ΤF	лт		Ç				TE	ST P	DI TID. <b>T</b>	P20	2	
GAL	A. RS				• •							1:3	0		Sheet	1 of 1	
PROJECT:	Huntly Quarry Dis	sposal Sites	1	CLIE	NT: (	Gleesor	Quarries	s Ltd.				JOE	B No	):	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433639.2m N.721326.0m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 60.20m Auckland	000 Mt d Vertic	Eden C cal Datu	rcuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		19 19 Fi	9/06 9/06 ine	/2019 /2019			
	Sc	bil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	(	Sc blows/	ala 100m 8 1	m) 10 12	Sample ID	Sample Type	R.L (m)
0.00-1.00 m Completely weath [clayey SILT; Hard	ered, light grey with o I, moist, non plastic].	range streaks, MU	DSTONE; extremely we	eak													60.0 -
1.00-4.50 m Highly weathered, weak, limonite and @ 1 0m - becomi	, light grey and orange d MnO staining on def	e with red streaks, fects [clayey SILT; ] ered to highly wea	sandy MUDSTONE; ext nard, moist, low plastici thered light grey and c	tremely ty].	- - - - - - - - - - - - - - - - - - -				188+								- 59.0
with red streaks.	Limonite and MnO sta	aining on joint surf	aces.				ſes		188+								-
					2		Waikato Coal Measu		188+								58.0 —
					3				188+								57.0
					- 4				188+								
	En	d of Pit @ 4.5 m							188+								56.0 —
					5												55.0 –
					6												-
Contractor: Gle	eson Civil Ltd	Remarks:							Gro	undwa	lter n	otes:					
Plant: Hita Logged: MK Checked: KC Approved: KC	atch 30t Excavator C C	SV readings corre	ected to BS1377 - Dial N	No. 1872 n accordar	nce wit	h NZ Ge	otechnic	al Soci	Gro ety (2	undwa	iter N	lot Er	ncou	intered	1		



TP202

PROJECT: Huntly Quarry Disposal Sites



GA			-	TES	ΤF	PIT	LO	G				T   1:	EST :30	PIT IC	). <b>ГР2(</b> Shee	<b>)3</b> t 1 of 1	
PROJECT:	Huntly Quarry [	Disposal Sites		CLIE	NT:	Gleesor	Quarries	s Ltd.				J(	OB	No:	2325		
LOCATION: COORDINATI	Huntly Quarry ES: E.433698.1m N.721335.1m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 63.70m Auckland	000 Mt d Vertic	Eden C cal Datu	ircuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: HED: R:			19/0 19/0 Fine	06/201 06/201 e	9	_	
		Soil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	2	(blow	Scala vs/100	a Dmm) 10 12	Sample ID	Sample Type	R.L (m)
0.00-1.00 m Clayey SILT; t sensitive [dist 1.00-1.50 m Completely to	prown-grey with orange urbed texture]. highly weathered, light	streaks. Very stiff, m grey with orange stre	oist, low plasticity, mode	erately	- - - - - - - - - - - - - - - - - - -		ŝ		129	41							
weak [clayey 1.50-3.00 m Moderately we	SILT; Very stiff, moist, lo eathered, light grey, san	w plasticity].	y weak; sheared fabric.				kato Coal Measure		UTP								
					2		Wai										
		End of Pit @ 3.0 m			3												61.0
															_		- - 60.0 — - -
					- - - - - - - - - - - - - - - - - - -												
Contractor: Plant: Logged: Checked:	Gleeson Civil Ltd. Hitatch 30t Excavator MK KCC	Remarks: SV readings corre Terminated Due t	ected to BS1377 - Dial N o Hard Digging	No. 1872	1		<u>.</u>	<u> </u>	Gro	undwa undwa	ater ater	note Not I	s: Enco	ounter	ed		
Approved:	КСС		Logged in	n accordar	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	guide	eline	s				



TP203

PROJECT: Huntly Quarry Disposal Sites



GAI	A		-	TES	T F	PIT	LO	G				TE 1:3	ST P	it id. <b>T</b>	P20 <sub>Sheet</sub>	<b>4</b> 1 of 1	
PROJECT:	Huntly Quarry Dis	sposal Sites		CLIE	NT:	Gleesor	n Quarrie	s Ltd.				JO	B No	:	2325		
LOCATION: COORDINATES	Huntly Quarry : E.433707.4m N.721316.3m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 64.00m Auckland	000 Mt d Vertio	Eden C cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		1 1 F	9/06/ 9/06/ ine	/2019 /2019			
	Sc	il/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	Si (blows)	cala /100mr 8 1	m) 0 12	Sample ID	Sample Type	R.L (m)
0.00-0.10 m TOPSOIL 0.10-0.50 m Silty CLAY; grey	and orange. Firm, mois	st, low plasticity.		/			Colluvium										-
0.50-3.00 m Silty CLAY with s saturated, low pl	some fibrous organics; asticity, moderately ser	grey-brown with bla sistive.	ack mottles; Firm, wet t	0				_	188+								
					- - - - -				45	16							- 63.0 — - -
							Alluvium		41	14							-
					2	x ale x x x ale x x x ale x x x x ale x x x x x x x x x x x x x x x x x x x											62.0 - - -
3.00-4.00 m Moderately weat	thered, light grey, mass	ive, sandy MUDST	ONE; very weak; shear	red fabric.	3	×2 ala ala ala	asures	-									- - 61.0 — -
							Waikato Coal Mea										
	En	d of Pit @ 4.0 m			- 4        												
					5												- 59.0 — - - -
					6												
Contractor: G	leeson Civil Ltd.	Remarks:			•	1		•	Gro	undwa	ater ı	notes	:				·
Plant: H Logged: M Checked: K Approved: K	itatch 30t Excavator IK CC CC	SV readings corre	ected to BS1377 - Dial I o Hard Digging Logged i	No. 1872	nce wit	h NZ G	eotechnie	cal Soci	Gro ety (2	undwa 005) <u>ເ</u>	ater I guide	Not E	ncoui	ntered			



TP204 PROJECT: Huntly Quarry Disposal Sites



	f <sup>2</sup>		TES	T F	PIT	LO	G				TE 1:3	ST F	DI TI T	P20 Sheet	<b>)5</b> 1 of 1	
PROJECT:	Huntly Quarry Disposal	Sites	CLIE	NT:	Gleeson	Quarries	s Ltd.				JO	B No	D:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433616.0m N.721282.6m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 73.70m Auckland	00 Mt d Vertic	Eden Ci cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	rted: Shed: R:		1 1 F	9/06 9/06 ine	5/2019 5/2019			
	Soil/Rock	Description		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	Si (blows	cala /100m 8	im) 10 12	Sample ID	Sample Type	R.L (m)
0.00-1.50 m Clayey SILT; light s	grey, orange and brown. Ve	ery stiff, moist, low plasticity.		- - - - - - - - - - - - - - - - - - -		FILL		188+								73.0
1.50-3.50 m Clayey SILT; light s	grey and dark orange. Very	stiff, moist, low plasticity.		- - - - - - - - - - - - - - - - - - -			-	188+								- - - 72.0 - - -
@3.0m - becomin	g light grey and orange wi	th pink streaks				Waikato Coal Measure		188+								
	End of P	it @ 3.5 m		- - - - - - - - - - - - - - - - - - -				188+								
				- - - - - - - - - - - - - - - - - - -												68.0 — - - - - - -
Contractor: Gle Plant: Hita Logged: MK Checked: KC0 Approved: KC0	eson Civil Ltd. Rem atch 30t Excavator SV ru C C	arks: eadings corrected to BS1377 - Dial Logged	No. 1872 in accordar	nce wit	h NZ Ge	eotechnic	al Soci	Gro Gro	undwa undwa 005) g	ater r ater N guide	notes Not E	: ncou	Intered	1 1	<u> </u>	1



TP205

PROJECT: Huntly Quarry Disposal Sites



	A.		CLIENT: Gleeson Quarries Ltd.									TEST PIT ID. TP20a (206) 1:30 Sheet 1 of 1						
PROJECT:	Huntly Quarry Dis	posal Sites	1	CLIE	NT: (	Gleesor	n Quarrie	s Ltd.				JOE	3 No:		2325			
LOCATION: COORDINATES:	Huntly Quarry E.433780.5m N.721399.4m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 96.00m Auckland	000 Mt d Vertic	Eden C al Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		20 20 Fi	)/06/2 )/06/2 ne	2019 2019				
	Soi	I/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	Sca (blows/1	ala 100mm) 8 10	12	Sample ID	Sample Type	R.L (m)	
0.00-0.10 m TOPSOIL 0.10-0.50 m Clayey SILT; brow	n. Firm, moist, modera	ate plasticity, finely	fissured.	/														
0.50-1.10 m Clayey SILT; light	grey, Stiff, moist, mode	erately plastic, fiss	ured.						UTP									
1.10-1.40 m Carbonaceous SII	T; black and purple-br	own. Stiff with har	d black inclusions, moist		- 1 - - - -	$\begin{array}{c} \times \times \\ \times \times \end{array}$			UTP								95.0 — - -	
1.40-2.30 m Highly weathered, spaced joints.	light brown, SILTSTO	NE; very weak; hig	ghly fissured, extremely c	closely			Coal Measure		UTP								-	
0.00.0.70					2	× ×	Waikato		UTP									
2.30-2.70 m Highly weatherd, t dry, sub-horizonta 2.70-3.50 m	black and dark grey, C Ily bedded, relict leaf ii	OAL with interbedon mpressions.	ded carbonaceous SILT;	weak,		× × × ×			UTP									
Moderately weath horizontally bedde	ered, light grey, SILTS d.	TONE; very weak,	dry, widely spaced joints	s, sub-	3	× × × × × × × × × × × × × × × × × × ×			UTP								- - 93.0 — - - -	
	Enc	d of Pit @ 3.5 m				****	× ×	-	UTP								-	
					4												92.0	
					5												- - - 91.0 —	
					6												- - - 90.0 —	
Contractor: Gle Plant: Hitz	eson Civil Ltd. atch 30t Excavator	Remarks: SV readings corre	ected to BS1377 - Dial No	o. 1872	1	1	1	1	Gro Gro	undwa undwa	i ater n ater N	iotes: Iot En	icount	tered			1	
Logged: PS Checked: KC Approved: KC	c c		Logged in	accordar	nce wit	h NZ G	eotechnic	al Soci	ety (2	005) g	juidel	lines						



TP20a (206)

PROJECT: Huntly Quarry Disposal Sites JOB No: 2325



GAIA		т	ES	ΤF	PIT	LO	G			TES 1:30		20° 20	20b (207) Sheet 1 of 1			
PROJECT:	Huntly Quarry Disposal Sites		CLIE	NT: (	Gleesor	Quarries	s Ltd.	.td.			JOB No:			2325		
LOCATION: COORDINATES:	Huntly Quarry E.433754.8m N.721264.5m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 87.00m Auckland	000 Mt d Vertic	Eden C al Datu	ircuit m 1946	PIT PIT WE	PIT STARTED: PIT FINISHED: WEATHER:			20 20 Fi	)/06/20 )/06/20 ne	019 019			
	Soil/Rock Description		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(t	Sca blows/1	ala 100mm) 8 10 1 1	12	Sample ID	Sample Type	R.L (m)	
0.00-0.20 m TOPSOIL		E												-		
0.20-0.50 m Clayey SILT; brown.	Very stiff, moist, moderate plasticity	finely fissured.		-												-
0.50-1.90 m Clayey SILT; light grey and minor grey-brown mottles; Very stiff, moderate plasticity, moist, highly fissured.								UTP								-
								UTP								86.0 - -
								UTP								-
1.90-2.10 m Highly weathered, gr sub-horizontal beddi 2 10-4 15 m	rey-brown/black carbonaceous SILT ng.	STONE/LIGNITE; very wea	ak; dry,	2		oal Measures		UTP								- 85.0 — -
Highly weathered, lig spaced joints	ght grey SILTSTONE; very weak; mo	vist, some Fe staining on cl	losely			Waikato C		UTP								
				3	× × × × × × × × × × × × × × × × × × ×			UTP								- 84.0 — - -
3.4 to 3.7m - carbon	naceous SILTSTONE beds commo	1						UTP								-
4.15-4.30 m Highly weathered, lic	ght brown, slightly carbonaceous SIL End of Pit @ 4.3 m	TSTONE; weak; dry.		4	× × × × × × × × × × × × × × × × × × ×		-	UTP								83.0
																- - - 82.0 —
																- -   -
				6												- - - 81.0 —
Contractor: Class									atos:							
Plant: Hitatc Logged: PS Checked: KCC Approved: KCC	th 30t Excavator SV readings co	rected to BS1377 - Dial No	o. 1872 accordar	nce wit	h NZ Ge	eotechnic	al Soci	Grou Grou ety (20	undwa undwa 005) d	iter N	otes: ot En	icount	ered			



GA	IA JEERS		TEST PIT LOG												P3C Sheet	<b>2301</b> Sheet 1 of 1										
PROJECT:	Huntly Quarry Di	sposal Sites	CLIENT: Gleeson Quarries Ltd.									JO	B No	:	2325											
LOCATION: COORDINATE	Huntly Quarry S: E.433564.9m N.721662.7m		SURVEY CIRCUIT:       NZGD2000 Mt Eden Circuit       PIT STARTE         GROUND R.L (m):       66.00m       PIT FINISHE         DATUM:       Auckland Vertical Datum 1946       WEATHER:									SURVEY CIRCUIT:     NZGD2000 Mt Eden Circuit     PIT STARTED       GROUND R.L (m):     66.00m     PIT FINISHED       DATUM:     Auckland Vertical Datum 1946     WEATHER:							JRVEY CIRCUIT:NZGD2000 Mt Eden CircuitPIT STARTED:ROUND R.L (m):66.00mPIT FINISHED:ATUM:Auckland Vertical Datum 1946WEATHER:							
	S	oil/Rock Description		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	Scala (blows/100mm)			Sample ID	ample Type	R.L (m)										
0.00-0.30 m TOPSOIL					-										-	0	-									
0.30-5.20 m Clayey SILT wi moist, low plas	th some organic inclusio ticity.	nd dark brown mottles. N	Very stiff,					188+								-										
@1.0m - beco	ming grey with less orga	anics			- - - - - - - - - - - - - - - - - - -		-		123	55																
					2				188+								- - - 64.0 - - -									
@2.5m - beco	ming stiff, dark grey with	n some inclusions (	of green-grey sandy SI	LT			Historic Mining F		188+																	
@3.0m - mottl plastic light gre	es of inferred Waikato C ey and orange, silty CLA	Coal Measures wea AY)	athered soils (moderate	e to highly	3		a - - - - - - -		75	41							63.0 — - - -									
@3.5m - beco	ming very stiff								188+																	
@4.0m - inclus	sions of inferred Waikat	o Coal Measures n	nudstone boulders and	coal	4				106	27							62.0 — - - -									
@4.8m - incre	ase in mudstone boulde	ers, fast seepage o	bserved				- - - - -	×	188+																	
	Er	nd of Pit @ 5.2 m			- 5		- - -		UTP								61.0 —									
																	-60.0									
Contractor: Gleeson Civil Ltd. Remarks:							I	I	Gro	undwa	ater r	notes:			ı	·	I									
Plant: Logged: Checked: Approved:	Hitatch 30t Excavator MK KCC KCC	SV readings corre	ected to BS1377 - Dial M	No. 1872 n accordar	nce wit	h NZ G	eotechnic	al Soci	Gro iety (2	undwa 005) g	ater I	Encou	untere	ed @ -	4.8m											



TP301

PROJECT: Huntly Quarry Disposal Sites



GAL	Δ				TES	12											
	Huntly Quarry Dis	sposal Sites		CLIE	NT· (	Gleeson	Quarries	s I td				JOB No: 2325					
LOCATION: COORDINATES:	Huntly Quarry E.433608.1m N.721654.5m		SURVEY CIRCUIT:     NZGD2000 Mt Eden Circuit     PIT STARTED:       GROUND R.L (m):     66.10m     PIT FINISHED:       DATUM:     Auckland Vertical Datum 1946     WEATHER:									17/06/2019 17/06/2019 Fine					
	Sc	bil/Rock Description			)epth(m)	Graphic Log	Geologic Unit	Ground water	Vane She Strength (kPa)		(	Sc blows/	ala 100mm)		ample ID	mple Type	R.L (m)
0.00-0.10 m									Тр	Tr	2	4 6	8 10	12	ő	Sar	66.0 -
0.10-0.30 m Silty CLAY; orange and light grey; Very stiff, moist, low plasticity. 0.30-5.00 m Clayey SILT; dark grey and black with coal/carbonaceous inclusions @0.5m - becoming dark grey, broken moderately weathered mudstone									UTP								- - - -
					- - - - - - - - - - - - - - - - - - -				UTP								- - - 65.0 — -
									UTP								
					2		Ē		188+								- 64.0 — -
							Historic Mining		130	14							
@3.0m - becomi	ng stiff, blue-grey with	n some fine sand w	vith limonite and organ	ic staining	3				89	27							- - 63.0 — -
					-				68	27							
					4				75	27							- - 62.0 — -
									75	27							
	En	d of Pit @ 5.0 m			5			-	55	14							- - 61.0 — - -
					6												-
Contractor: Glo Plant: Hit Logged: Mi	actor: Gleeson Civil Ltd. Remarks: Hitatch 30t Excavator SV readings corrected to BS1377 - Dial No. 1872 ed: MK							<u>.</u>	Gro	undwa undwa	ater n ater N	otes: lot Er	ncount	ered			
Checked: KC Approved: KC			Logged i	in accordar	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	uidel	ines					



TP302

PROJECT: Huntly Quarry Disposal Sites



GAIA	Т	TEST PIT LOG												
PROJECT: Huntly Quarry Disposal Sit	tes	CLIENT:	Gleesor	n Quarrie:	s Ltd.	td.				JOB No:				
LOCATION: Huntly Quarry COORDINATES: E.433648.9m N.721662.2m	SURVEY CIRCUIT: N GROUND R.L (m): 6 DATUM: A	IZGD2000 M 5.70m uuckland Vert	: Eden C cal Datu	ircuit m 1946	PIT PIT WE	STARTED: FINISHED: ATHER:			1 1 F	7/06/2 7/06/2 ine	2019 2019			
Soil/Rock Des	cription	Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	Scala (blows/100mm)		1) 12	Sample ID	Sample Type	R.L (m)	
0.00-0.10 m <u>VOPSOIL</u> 0.10-0.30 m <u>Clayey SILT; red, orange and light grey. Very stiff</u> 0.30-1.50 m Clayey SILT with some carbonized wood fragme Very stiff, moist, low plasticity.	f, moist, low plasticity, insensitive. nts and mudstone boulders; dark gr	ey.				102 UTP	55							
<ul> <li>@1.2m - fast seepage encountered</li> <li>1.50-4.50 m</li> <li>Silty CLAY with trace organic staining; light blue-</li> </ul>	grey. Very stiff, wet, moderate plasti	city.		- - - - - -		UTP								- - - 64.0
@2.0m - becoming stiff		2		storic Mining Fill		95	55							
@3.0m - with trace fine sand and fine gravel sized white clasts				- <sup>2</sup> 		68	41							
		- 4		-		61	34							- 62.0 — - - - - -
End of Pit @	9 4.5 m	- 5	× ×		-	75	41							  61.0   
		6												60.0 — - - - - - -
Contractor: Gleeson Civil Ltd. Remark Plant: Hitatch 30t Excavator SV reac Logged: MK Checked: KCC Approved: KCC	is: lings corrected to BS1377 - Dial No. Logged in a	1872 ccordance w	th NZ G	eotechnic	al Soci	Gro Gro etv (2)	undwa undwa	ater n ater N	notes: Not El	: ncour	ntered		<u> </u>	J



TP303 PROJECT: Huntly Quarry Disposal Sites



GAIA		Т	TEST PIT LOG											<b>)4</b> 1 of 1				
ENGINEER PROJECT:	s Huntly Quarry Disposal Sites		CLIE	NT: (	Gleesor	Quarries	s Ltd.				JOB	No:	2325					
LOCATION: COORDINATES:	Huntly Quarry E.433693.2m N.721649.1m	SURVEY CIRCUIT: NZGD2000 Mt Ed GROUND R.L (m): 66.10m DATUM: Auckland Vertical			SURVEY CIRCUIT:       NZGD2000 Mt Eden Circuit       PIT STARTED:         SROUND R.L (m):       66.10m       PIT FINISHED:         DATUM:       Auckland Vertical Datum 1946       WEATHER:					CUIT: NZGD2000 Mt Eden Circuit PIT STARTED: (m): 66.10m PIT FINISHED: Auckland Vertical Datum 1946 WEATHER:				17/0 17/0 Fine	06/2019 06/2019 e	9		
	Soil/Rock Description	Graphic E C C C C C C C C C C C C C C C C C C	Geologic Unit	Ground water	Vane Stre (k	Vane Shear Strength (kPa)		Scala (blows/100mm) 2 4 6 8 10 12		Sample ID	ample Type	R.L (m)						
0.00-0.10 m ▼OPSOIL 0.10-0.50 m Clayey SILT; light b	orown-orange. Very stiff, moist, low pla	asticity	/										-	ω	66.0 -			
0.50-1.50 m Slightly weathered light grey mottles. H	MUDSTONE boulders in silty CLAY r Hard/tightly packed, moist.	natrix; dark grey with black	and	- - - - - - - - - - - - - - - - - - -	XPX 9X			188+					_		65.0 -			
1.50-5.00 m Silty CLAY; light blu	ue-grey. Stiff, moist, moderate plastici	ty.		-				82	41						-			
@2.0m - with som	e fine sand, remnant mudstone fabri	c visible		2		III		68	41						64.0 —			
				-		Historic Mining		75	41						-			
				3				68	41						63.0 —			
				4	×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×  ×			75	34						62.0 —			
	End of Pit @ 5.0 m			5				75	41				_		61.0			
Contractor: Glee Plant: Hita	eson Civil Ltd. Remarks: tch 30t Excavator SV readings co	rrected to BS1377 - Dial No	p. 1872					Gro Gro	undwa undwa	ter no ter No	tes: ot Enc	ountere	ed	<u> </u>				
Logged: MK Checked: KCC Approved: KCC		Logged in	accordar	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	uidelir	nes							



TP304 PROJECT: Huntly Quarry Disposal Sites



GAIA		т	TEST PIT LOG											TEST PIT ID. <b>TP305</b> 1:30 Sheet 1 of 1							
PROJECT:	Huntly Quarry Disposal Sites		CLIEN	NT: (	Gleeson	Quarrie	s Ltd.				JOB N	No:	2325								
LOCATION: COORDINATES:	Huntly Quarry E.433731.6m N.721574.8m	SURVEY CIRCUIT: I GROUND R.L (m): 0 DATUM: 0	NZGD200 67.60m Auckland	00 Mt Vertic	Eden Ci cal Datur	rcuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		17/0 17/0 Fine	)6/2019 )6/2019 9	1								
	Soil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	(blc	Scala ows/100	0mm) 10 12	Sample ID	Sample Type	R.L (m)						
0.00-0.10 m				-										o l	_						
0.10-1.00 m Clayey SILT; orange	e-brown. Very stiff, moist, low plasticit	/		-											-						
@0.5 to 1.0m - ver	y weak moderately weathered muds	one inclusions			<pre></pre>			188+							- 67.0 — -						
1.00-3.50 m Silty BOULDERS w Tightly packed; moi	ith some silty and clay; dark grey with st; slightly weathered mudstone; silt a	black and light grey mottle nd clay, low plasticity.	es.	- 				95	27				_		-						
@1.5m - mudstone	e inclusions becomes medium to coa	rse gravel sized.		- - - - - -		s Mining Fill		136	27						- 66.0 — -						
@2.0m - fast seep	age encountered			2		Historio	▾	82	30				_		-						
				- - - - - - -											- - 65.0						
				3				89	34				_								
	End of Pit @ 3.5 m		- - - - - - - - - - - - - - - - - - -	- - - - - - - - - - -	** 0 .0		-	95	27						- 64.0 - - -						
				— 4 - - - - - - - - - -											- - - - 63.0 —						
													-		-						
				- - - - - - -											- - 62.0 —						
				- 6																	
Contractor: Glee Plant: Hitat Logged: MK Checked: KCC	son Civil Ltd. Remarks: ch 30t Excavator SV readings cor Terminated Due	rected to BS1377 - Dial No to Pit Collapsing	o. 1872					Gro Gro	undwa undwa	ter not	es: counte	ered @	2.0m								
Approved: KCC		Logged in a	accordan	ce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) gi	uidelin	es										


TP305 PROJECT: Huntly Quarry Disposal Sites



GAIA		Т	ES	T F	PIT	LO	G			T 1	EST PI	т ір. <b>ТІ</b>	P30 <sub>Sheet</sub>	<b>6</b> 1 of 1	
PROJECT:	Huntly Quarry Disposal Sites		CLIE	NT: (	Gleeson	Quarrie	s Ltd.			J	OB No:		2325		
LOCATION: COORDINATES:	Huntly Quarry E.433680.9m N.721557.8m	SURVEY CIRCUIT: N GROUND R.L (m): 6 DATUM: A	ZGD20 7.50m Auckland	00 Mt d Vertic	Eden Ci al Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		17/06/2 17/06/2 Fine	2019 2019			
	Soil/Rock Description			Jepth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa)	(blov	Scala vs/100mm	ו)	ample ID	mple Type	R.L (m)
0.00-0.10 m				-				Тр	Tr		6 8 10	12	S	Sa	
TOPSOIL 0.10-0.60 m Clayey SILT with tra low plasticity	ce topsoil; dark orange, light grey and	grey mottles. Very stiff, mo	/					129	48						- - - 67.0 —
0.60-1.50 m Silty CLAY with som weathered mudston	ne cobbles; grey. Very stiff, moist, low p le, fractured.	plasticity; cobbles are mode	erately		× • • ×			LITD							
				- ' - - - - - - -	× 0 × 0 × 0 × 0 × 0 × 0 × 0 × 0 × 0 × 0										-
1.50-4.00 m Silty COBBLES with slightly weathered n	n some clay and boulders; brownish gr nudstone; silt and clay, low plasticity.	ey. Loosely packed; moist;				ning Fill		116	41						66.0 — - - -
@2.0m - mudstone	cobbles become fine to coarse grave	əl.		2		Historic Mi		109	41						-
				-											65.0 — - - -
				3				129	55						
	End of Pit @ 4.0 m			- - - - - - - - - - - - - -				143	41						
				- - - - - - -											- - - 63.0 —
				5											-
				- - - - - -											62.0 —
				- - - - - - - - - - - - - - - - - - -											
Contractor: Glee	son Civil Ltd. Remarks:							Gro	 undwa	l Iter note	s:				<u> </u>
Plant: Hitati Logged: MK Checked: KCC	ch 30t Excavator SV readings correction Terminated Due t	ected to BS1377 - Dial No. o Pit Collapsing	1872					Gro	undwa	iter Not	Encour	ntered			
Approved: KCC		Logged in a	ccordar	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	uideline	s				



TP306 PROJECT: Huntly Quarry Disposal Sites



	f		٦	res <sup>.</sup>	T F	ΡIT	LO	G				TE:	ST PIT 0	r id. Tf	⊃30 <sub>Sheet</sub>	<b>7</b> 1 of 1	
PROJECT:	Huntly Quarry Dispos	sal Sites		CLIE	NT: (	Gleeson	Quarries	s Ltd.				JOI	B No:		2325		
LOCATION: COORDINATES:	Huntly Quarry E.433638.0m N.721553.0m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 67.60m Auckland	000 Mt d Vertic	Eden C al Datu	ircuit m 1946	PIT PIT WE	STAR FINIS ATHE	TED: HED: R:		1 1 F	7/06/2 7/06/2 ine	019 019			
	Soil/Rc	ock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	2	Sc (blows/	ala 100mm) 8 10	12	Sample ID	Sample Type	R.L (m)
0.00-1.00 m Clayey SILT; light	brown-orange and brown	mottles. Stiff, r	noist, low plasticity.														
1.00-4.00 m Clayey SILT with s coarse, mudstone	some gravel; grey-brown.	Stiff, moist, low	/ plasticity; gravels are fi	ine to		x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2	storic Mining Fill										
					- 3		Ĩ										- - - 65.0 - - - - -
	End of	- Pit @ 4.0 m				x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2 x 2											
																	62.0 — - - - - - - - - - - - - - - - - - - -
Contractor: Cla	eson Civil I ta	marks.							Grav	Induce	l Iter ·	ntee					
Plant: Hita Logged: MK Checked: KC Approved: KC	atch 30t Excavator S	marks: / readings corre	ected to BS1377 - Dial N Logged in	lo. 1872	nce with	n NZ Ge	eotechnic	al Soci	Grou Grou ety (20	undwa	uer i iter i	Not Er	ncount	tered			



TP307 PROJECT: Huntly Quarry Disposal Sites



GA	IA		-	TES	ΤF	PIT	LO	G				TES 1:30	ST P	IT ID. T	P30 <sub>Sheet</sub>	<b>)8</b> 1 of 1	
PROJECT:	Huntly Quarry Dis	sposal Sites		CLIE	ENT: (	Gleeson	Quarries	s Ltd.				JOE	3 No	:	2325		
LOCATION: COORDINATE	Huntly Quarry S: E.433618.3m N.721587.7m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 67.00m Auckland	000 Mt d Vertic	Eden Ci al Datu	rcuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: SHED: R:		18 18 Fi	8/06/ 8/06/ ne	/2019 /2019			
	Sc	il/Rock Description	1		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(b	Sca blows/1	ala 100mr 8 1	m) 0 12	Sample ID	Sample Type	R.L (m)
0.00-0.10 m					, ,								T			0,	
0.10-0.50 m Clayey SILT; lig	ht brown-orange, grey a	nd brown mottles.	Very stiff, moist, low pla	sticity.													-
0.50-5.00 m Clayey SILT wit gravels are mo	th some gravel; grey and derately weathered mud	l brown mottles. Ve stone and coal frag	ery stiff, moist, low plasti gments.	city;		× × × ×			188+								-
					- - - - - -	8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8			188+								66.0 — - -
@1.5m - increa	ase in side of mudstone	gravel to cobbles	and boulders						188+								-
					2	×°×°			188+								65.0 —
						8 0 X 0 8 0	toric Mining Fill		188+								-
					- 3	× 0 × 0 × 0 × 0 × 0 × 0 × 0 × 0 × 0 × 0	His		188+								- - 64.0 —
						x     x		<b>•</b>	188+								63.0 -
@4.0m - fast s	eepage encountered					×   ×   ×   ×   ×   ×   ×   ×   ×   ×			188+								
	En	d of Pit @ 5.0 m			5	<u> </u>											62.0 —
																	-
					6												-61.0
Contractor: Plant: Logged:	Gleeson Civil Ltd. Hitatch 30t Excavator MK	Remarks: SV readings corre	ected to BS1377 - Dial N	No. 1872					Gro	undwa undwa	ter no ter Er	otes: ncoui	ntere	ed @ -	4.0m		
Checked:	ксс ксс		Logged ir	n accordai	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	uideli	nes					



TP308

PROJECT: Huntly Quarry Disposal Sites



GAIA			-	TES	T F	PIT	LO	G				TES 1:30	ST PIT	TF	P30	<b>9</b> 1 of 1	
PROJECT:	Huntly Quarry Disp	osal Sites	1	CLIE	NT: (	Gleeson	Quarries	s Ltd.				JOE	3 No:	2	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433628.6m N.721518.8m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 71.60m Auckland	000 Mt d Vertic	Eden Ci al Datu	ircuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: HED: R:		18 18 Fi	3/06/20 3/06/20 ne	019 019			
	Soil	Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(1	Sca blows/1	ala 100mm) 8 10	12	Sample ID	Sample Type	R.L (m)
0.00-0.20 m					-									Ħ		0)	_
0.20-1.20 m Silty CLAY; light gre	ey and orange. Very s	liff, moist, modera	te to high plasticity.						188+								71.0
1 20-4 00 m					- - - -				188+								
Completely weather [clayey SILT; Hard,	red, light grey with ora moist, non plastic].	ange streaks, MU	OSTONE; extremely we	eak					188+								- - 70.0 -
@2.0 to 2.5m - bec	coming brown orange	with red and pin	k streaks		2		ŷ		143	55							-
					- 3		Waikato Coal Measure		136	49							- 69.0 - - - -
																	- - - 68.0 - -
4.00-5.50 m Highly weathered, b [clayey SILT; hard, r	prown-orange with pin noist, non plastic]	k and red streaks	, MUDSTONE; extreme	ely weak	4				143	41							- - - 67.0 —
					5				188+								-
	End	of Pit @ 5.5 m			6												66.0 — - - -
Contractor: Ol	son Civil I to	Pomarka								Induc		otoci					
Plant: Hitat Logged: MK Checked: KCC Approved: KCC	ch 30t Excavator	Cernarks: SV readings corre	icted to BS1377 - Dial N Logged in	No. 1872 n accordar	nce wit	h NZ Ge	eotechnic	al Soci	Grou Grou ety (20	undwa undwa 005) g	ater N ater N juideli	ot En	counte	ered			



TP309

PROJECT: Huntly Quarry Disposal Sites



GA	IA		-	TES <sup>-</sup>	T F	PIT	LO	G				TE:	ST PI	IT ID. T	P31 <sub>Sheet</sub>	<b>0</b> 1 of 1	
PROJECT:	Huntly Quarry Dis	sposal Sites		CLIE	NT: (	Gleeson	Quarrie	s Ltd.				JOI	B No:	:	2325		
LOCATION: COORDINATE	Huntly Quarry S: E.433674.4m N.721530.7m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 70.00m Aucklanc	00 Mt I Vertic	Eden Ci cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	rted: Shed: R:		1) 1) F	8/06/: 8/06/: ïne	2019 2019			
	Se	il/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	Sc (blows/	cala 100mn 8 10	n) 0 12	Sample ID	Sample Type	R.L (m)
0.00-0.20 m TOPSOII					_											0,	
0.20-1.80 m Silty BOULDEF Tightly packed;	S with some silty and cl moist; slightly weathere	ay; dark grey with l d mudstone; silt an	plack and light grey mot d clay, low plasticity.	tles.	- - - - - - - - - - - - - - - - - - -		Historic Mining Fill		UTP								- - - - - - - - - - - - - - - - - - -
					- - - - - -	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~			UTP								-
1.80-3.00 m Silty CLAY; ora	nge and light grey. Very	stiff, moist, low pla	sticity.		2				188+								- - 68.0 —
3.00-4.50 m Completely wea weak [clayey S	athered, light grey and o ILT; Hard, moist, non pla	range with pink stre stic].	eaks, MUDSTONE; extr	emely	3		Waikato Coal Measures		188+								67.0 -
	En	d of Pit @ 4.5 m			- - - - - - - - - - - - - - - - - - -			-	188+								66.0 —
					5				188+								
Contractor:	Gleeson Civil Ltd. Hitatch 30t Excavator	Remarks: SV readings corre	ected to BS1377 - Dial N	No. 1872	6				Gro	undwa	ater n	notes:		ntered			-64.0 —
Logged: I Checked: I Approved: I	MAILEN OUL EXCAVATOR MK (CC (CC		Logged ir	n accordan	ice wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	Juide	lines	loour				



TP310

PROJECT: Huntly Quarry Disposal Sites



GAIA ENGINEER	s	-	TES	T F	PIT	LO	G				TE 1:3	ST F	םו דוי. <b>T</b>	P31 Sheet	<b>1</b> 1 of 1	
PROJECT:	Huntly Quarry Disposal Sites		CLIE	NT: (	Gleesor	Quarries	s Ltd.				JO	B No	D:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433737.7m N.721514.9m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 73.20m Auckland	00 Mt d Vertic	Eden C al Datu	rcuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: SHED: R:		1 1 F	8/06 8/06 ine	5/2019 5/2019			
	Soil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	2	Si (blows	cala /100m 8	im) 10 12	Sample ID	ample Type	R.L (m)
0.00-0.30 m TOPSOIL				-											0	- 73.0 —
0.30-1.00 m Silty CLAY; red, ligh	nt grey and orange-brown. Very stiff, n	noist, moderate plasticity.						143	55							
1.00-5.00 m Completely weathe [clayey SILT; Very s	red, light grey with orange streaks, Ml stiff, moist, non plastic]	JDSTONE; extremely we	eak	- 1 				140	48					-		
				2		to Coal Measures										
@3.0m - becoming	g light grey and pink with MnO stainir	g		3		Waika		188+						-		
				- - - - - - - - - - - - - - - - - - -	× 21× 21× 21× 21× 21× 21× 21× 21× 21× 21			188+						-		
	End of Pit @ 5.0 m			5				188+						-		- - - 68.0
				- - - - - - - - - - - - - - - - - - -												
Contractor: Glee Plant: Hitat Logged: MK	eson Civil Ltd. Remarks: tch 30t Excavator SV readings cor	rected to BS1377 - Dial N	No. 1872	1	<u> </u>		I	Gro	undwa undwa	ater n ater N	iotes lot E	: ncou	Intered	d	J	1
Checked: KCC Approved: KCC	2	Logged ir	n accordar	nce wit	h NZ Ge	otechnic	al Soci	ety (20	005) g	juidel	lines					



Image Not Available

GAIA				TES	T F	PIT	LO	G				TES 1:30	ST PIT	r id. TF	<b>P31</b> Sheet	<b>2</b> 1 of 1	
PROJECT:	Huntly Quarry Dis	sposal Sites		CLIE	NT: (	Gleeson	Quarries	s Ltd.				JOB	3 No:		2325		
LOCATION: COORDINATES:	Huntly Quarry E.433713.3m N.721479.4m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 87.80m Auckland	000 Mt d Vertic	Eden Ci al Datu	rcuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: HED: R:		18 18 Fii	3/06/2 3/06/2 ne	019 019			
	Sc	il/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(b	Sca lows/1	ala 100mm) 8 10	12	Sample ID	Sample Type	R.L (m)
0.00-0.20 m TOPSOII					-				-					Ť		0,	-
0.20-1.50 m Silty CLAY; brown-c	range. Very stiff, mo	oist, moderate plast	ticity.						188+								-  - 87.0
1.50-4.00 m Silty CLAY; light gre	y, red and orange. \	/ery stiff, moist, mo	derate plasticity.		- - - - - - - - - - - - - - - - - - -		es		188+								
					2		Waikato Coal Measur		188+								86.0 — - - - - - -
					3				188+								- - 85.0 — - - - -
	En	d of Pit @ 4.0 m			- - - - - - - - - - - - - - - - - - -				188+								
					6												- - 82.0 — - -
Contractor: Glee Plant: Hitat Logged: MK Checked: KCC Approved: KCC	son Civil Ltd. ch 30t Excavator	Remarks: SV readings corre	ected to BS1377 - Dial	No. 1872 in accordar	nce wit	n NZ Ge	eotechnic	al Soci	Gro Gro ety (20	undwa undwa 005) a	iter no iter No	otes: ot En nes	icount	tered			J



TP312

PROJECT: Huntly Quarry Disposal Sites



GAL	A		-	TES	ΤF	ΡIT	LO	G				TES		D. TP31 Shee	<b>3</b>	
PROJECT:	Huntly Quarry Dis	sposal Sites		CLIE	NT: (	Gleeson	Quarrie	s Ltd.				JOB	No:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433732.8m N.721668.8m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 67.90m Auckland	00 Mt I	Eden Ci al Datu	rcuit n 1946	PIT PIT WE	STAF FINIS ATHE	RTED: HED: R:		18 18 Fir	/06/201 /06/201 ne	9 9		
	Sc	il/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	(b	Sca plows/1	ila 00mm) 8 10 12	Sample ID	Sample Type	R.L (m)
0.00-1.10 m Clayey SILT; brov	wn-orange. Stiff, moist,	low plasticity.					Forrestry)		89	41						-
1.10-1.20 m	n				- - - - - - - - - - - - - - - - - - -		FILL (		143	68				_		- 67.0 — - -
1.20-4.00 m Clayey SILT; brov	n-orange. Very stiff, n	noist, low plasticity		/					188+							
					2		les		146	76						
					3		Waikato Col Measu		145	76						
@3.6m - becomi	ing light grey and oran	ge, trace rock fabi d of Pit @ 4.0 m	ric visible		- - - - - - - - - - - - - - - - - - -			-	143	82				_		
					5									_		
					6											
Contractor: Gle Plant: Hit Logged: Mł Checked: KC Approved: KC	eeson Civil Ltd. tatch 30t Excavator K CC CC	Remarks: SV readings corre	ected to BS1377 - Dial N	No. 1872 n accordar	ice with	n NZ Ge	otechnic	cal Soci	Gro Gro ety (2	undwa undwa 005) gi	ter no ter No uideli	otes: ot En nes	counter	ed		



TP313 PROJECT: Huntly Quarry Disposal Sites



GA	IA HEERS			TES	T F	PIT	LO	G				TEST 1:30	PIT ID	P40	<b>)1</b> : 1 of 1	
PROJECT:	Huntly Quarry Di	sposal Sites	_	CLIE	INT:	Gleesor	Quarries	s Ltd.				JOB I	No:	2325		
LOCATION: COORDINATE	Huntly Quarry S: E.433894.1m N.721653.8m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 58.00m Auckland	000 Mt d Vertio	Eden C cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS	RTED: SHED: R:		18/0 18/0 Fine	06/2019 06/2019 e	)		
	S	oil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa)	(bl	Scala ows/100	a Omm)	Sample ID	ample Type	R.L (m)
0.00-0.20 m					_				IP	Ir					ő	
0.20-1.00 m Clayey SILT; lig	ght grey and light brown-	orange. Very stiff, r	noist, low plasticity.													-
@0.5m - beco	ming light grey with orai	nge streaks and oc	ccasional red streaks						188+							
1.00-3.00 m Silty CLAY; ligh	nt grey and orange. Very	stiff, moist, low pla	sticity						188+					_		57.0 — -
							l Measures		188+							
					2		Waikato Coa		188+					_		- - 56.0 — -
							-									-
3.00-3.50 m Highly weather defects [clayey	red, light grey and orang v SILT; hard, moist, low p	e MUDSTONE; ext lasticity].	remely weak, limonite s	staining on	3		-		UTP					_		- - 55.0 — -
	Er	nd of Pit @ 3.5 m						-	UTP							-
					4									_		- 54.0 - -
					5											
																-
					6											- 52.0
Contractor: Plant: Logged: Checked:	Gleeson Civil Ltd. Hitatch 30t Excavator MK KCC	Remarks: SV readings corre	ected to BS1377 - Dial	No. 1872		<u>.</u>	·		Gro	undwa undwa	iter no iter No	tes: ot Enco	ountere	d		
Approved:	ксс		Logged	in accordar	nce wit	h NZ Ge	eotechnic	al Soci	iety (2	005) g	uidelir	nes				



TP401 PROJECT: Huntly Quarry Disposal Sites



GAIA ENGINEER	s		-	TES	T F	PIT	LO	G				TES 1:30	ST PIT	TID. TF	P40 Sheet	<b>2</b> 1 of 1	
PROJECT:	Huntly Quarry Dis	sposal Sites		CLIE	NT: (	Gleeson	Quarrie	s Ltd.				JOE	3 No:		2325		
LOCATION: COORDINATES:	Huntly Quarry E.433969.3m N.721536.3m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 61.70m Auckland	00 Mt I Vertic	Eden Ci cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	rted: Shed: R:		18 18 Fi	8/06/2 8/06/2 ine	019 019			
	Sc	il/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	Sci (blows/1	ala 100mm) 8 10	12	Sample ID	Sample Type	R.L (m)
0.00-0.10 m					-	<u> </u>								Ť			-
0.10-1.50 m Silty CLAY; light gre	ey and orange. Very	stiff, moist, low pla	sticity.	,		<pre></pre>	- (Forrestry)		188+								
					- - - - - - - - - -		E EIC		68	38							-
1.50-3.50 m Clayey SILT with so plasticity; organics	ome organic inclusion are rootlets, staining	ns; brown. Firm to and odor.	stiff, wet, low to modera	ate		$\begin{array}{c} \times \\ \times $	c c	-	65	30							- 60.0 
@2.0m - abundani	t decomposing wood	l and seepages				× shte × × shte × shte × × shte ×	Alluvium										
	En	d of Pit @ 3.5 m				× 306 × ( × × > 306 × ( × × > × 306 × ( × × > × 306 ×	4	-	48	38							
					- - - - - - - - - - - - - 5 - -												- - 57.0 — - - - -
					- - - - - - - - - - - - - - - - - - -												56.0
Contractor: Glee	eson Civil Ltd.	Remarks:	noted to PS1277 Di-L	No 1070					Gro	undwa	ater n	iotes:		orad			
Logged: MK Checked: KCC Approved: KCC	ICH JUT EXCAVATOR	Terminated Due t	ected to BS13/7 - Dial I o Pit Collapsing Logged i	no. 1872 n accordan	ce wit	h NZ Ge	eotechnic	al Soci	ety (2	undwa	uidel	NOT EN		ered			



TP402

PROJECT: Huntly Quarry Disposal Sites



	<b>A</b>	-	TES	T F	PIT	LO	G				TES 1:30	ST PIT	TID. TF	P40	<b>3</b> 1 of 1	
PROJECT:	Huntly Quarry Disposal Site	s	CLIE	NT: (	Gleeson	Quarries	s Ltd.				JOE	3 No:	2	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433981.1m N.721598.5m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 71.10m Auckland	000 Mt d Vertic	Eden Ci cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		18 18 Fi	3/06/2 3/06/2 ne	019 019			
	Soil/Rock Descri	iption		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	(t	Sca plows/1	ala 00mm) 8 10	12	Sample ID	Sample Type	R.L (m)
0.00-0.30 m TOPSOIL				-											0)	71.0
0.30-1.80 m Clayey SILT; light	brown-orange. Very stiff, moist, l	ow plasticity.		-				188+								-
				- - - - - - - -				188+								- - 70.0 — -
1.80-4.00 m				-		leasures		188+								-
Silty CLAY; light gi plasticity [inferred	rey with light brown-orange strea completely weathered mudstone	aks. Very stiff, moist, low to moc ə].	derate	2		Waikato Coal N		188+								- 69.0 — - - -
				3				188+								
	End of Pit @ 4	4.0 m					-	188+								- - - - - - - - - - - - - - - - - - -
				5												- 66.0 — - - - - -
Contractor: Gle	eson Civil Ltd Remarks			6				Gro	undwa		otes					-
Plant: Hita Logged: MK Checked: KC Approved: KC	atch 30t Excavator SV readir	ngs corrected to BS1377 - Dial I	No. 1872 in accordar	nce wit	h NZ Ge	eotechnic	al Soci	Gro iety (2	undwa	ater N	ot En	count	ered			



GAIA		ТІ	EST	ΓF	PIT	LO	G				TES 1:30	ST PIT	r id. Tf	P40 <sub>Sheet</sub>	<b>4</b> 1 of 1	
PROJECT:	Huntly Quarry Disposal Sites		CLIEN	IT: C	Gleeson	Quarries	s Ltd.				JOE	3 No:		2325		
LOCATION: COORDINATES:	Huntly Quarry E.434060.8m N.721454.0m	SURVEY CIRCUIT: N GROUND R.L (m): 83 DATUM: A	VZGD200 33.60m Auckland	0 Mt   Vertic	Eden Ci al Datur	rcuit n 1946	PIT PIT WE	STAR FINIS ATHE	RTED: SHED: R:		18 18 Fi	3/06/2 3/06/2 ne	019			
	Soil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(b	Sca blows/1	ala 00mm) 8 10	12	Sample ID	Sample Type	R.L (m)
0.00-0.30 m TOPSOIL			-													-
0.30-0.80 m Clayey SILT; light bro	wn-orange. Very stiff, moist, low plas	ticity.		-	X X X X X X X X X X X X X X X X X X X X			188+								- - 83.0 —
0.80-2.00 m Completely weathere weak; limonite stained	d, light grey with orange streaks, sar d defects [clayey SILT; Hard, moist, r	dy MUDSTONE; extremely oon plastic].	y -	- 1		Measures		188+								-
2 00-3 00 m				- 2	X X X X X X X  X  X  X  X  X  X  X  X	Waikato Coal I		UTP								- 82.0 — - - -
Highly weathered, light	ht grey, sandy MUDSTONE; very we	ak.		-												
	End of Pit @ 3.0 m			- 3 				UTP								
				- 5												
				- 6												
Contractor: Gleese Plant: Hitatch Logged: MK Checked: KCC	on Civil Ltd. Remarks: n 30t Excavator SV readings corr	ected to BS1377 - Dial No.	. 1872	e with	N7 Ge	otechnic	al Soci	Grou Grou	undwa undwa	ter no	otes: ot En	count	tered			



Image Not Available

	ł.	-		TEST PIT ID. <b>TP405</b> 1:30 Sheet 1 of 1														
PROJECT:	Huntly Quarry Dispo	osal Sites	CLIENT: Gleeson Quarries Ltd.										JOB No: 2325					
LOCATION: COORDINATES:	Huntly Quarry E.434061.9m N.721398.0m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 90.60m Aucklanc	000 Mt d Vertic	Eden Ci al Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	18 18 Fi	8/06/2 8/06/2 ine	2019 2019						
	Soil/F	Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Shear Strength (kPa) Tp Tr		Scala (blows/100mm)		)	Sample ID	Sample Type	R.L (m)		
0.00-0.30 m TOPSOIL					-												-	
0.30-1.20 m Silty CLAY; blue-g	rey and brown-orange.	Firm, moist, high	plasticity.				olluvium/Alluvium		34	14							- - 90.0 -	
					- - - -	× ×	ŭ		68	20							-	
1.20-2.00 m Silty CLAY; light gr	rey and orange. Stiff, mo	oist, high plastici	ty [disturbed texture].						440								-	
@1.5m - becomin	g very stiff								116	55							89.0	
2.00-4.00 m Clayey SILT with ti	race fine sand; light gre	y and orange. Ve	ery stiff, moist, low plast	ticity.	2		asures		157	68								
							Waikato Coal Me		188+								- 88.0 — - - -	
									164	20							87.0	
	End (	of Pit @ 4.0 m			4 			-									86.0	
					- 5 												85.0	
Contro -t C'		) and and										at-						
Plant: Hita Logged: MK Checked: KC Approved: KC	atch 30t Excavator	V readings corre	ected to BS1377 - Dial	No. 1872 in accordar	nce wit	h NZ Ge	eotechnic	al Soci	Gro Gro ety (2	undwa undwa 005) g	ater N ater N	lotes: lot Er	ncoun	tered				



TP405 PROJECT: Huntly Quarry Disposal Sites



GAIA		Т	T 1:	EST :30	ріт IC <b>Т</b>	<b>)6</b> 1 of 1										
PROJECT:	Huntly Quarry Disposal Sites		CLIEN	T: (	Gleeson	Quarries	Ltd.				J	OB N	lo:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.433938.5m N.721365.7m	SURVEY CIRCUIT: M GROUND R.L (m): S DATUM: A	NZGD2000 93.40m Auckland V	) Mt /ertic	Eden Ci al Datu	rcuit m 1946	PIT PIT WE	PIT STARTED: PIT FINISHED: WEATHER:					06/2019 06/2019	9		
	Soil/Rock Description	1		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Shear Strength (kPa) Tp Tr			(blow	Scala vs/100	mm)	Sample ID	Sample Type	R.L (m)
0.00-0.30 m TOPSOIL															0,	-
0.30-1.50 m Clayey SILT; orange	e-brown. Very stiff, moist, low plasticity.							188+								- 93.0 — - -
@1.2m - becoming	light grey and orange			- 1				188+								
1.50-5.00 m Completely weather [clayey SILT; Hard, ı	red, light grey with orange streaks, MU moist, non plastic].	DSTONE; extremely weak	k					188+								92.0 — - - -
				- 2	$\begin{array}{c} \times \\ \times $	Coal Measures		188+						_		
				- 3		Waikato		188+						_		
																90.0
				- 4				188+						_		- - - 89.0 — -
	End of Pit @ 5.0 m			- 5				188+						-		
				- 6												- 88.0  - - - -
				ō												
Contractor: Glees Plant: Hitato Logged: MK Checked: KCC Approved: KCC	son Civil Ltd. Remarks: ch 30t Excavator SV readings corre	ected to BS1377 - Dial No Logged in a	. 1872 accordance	e witl	h NZ Ge	otechnica	al Soci	Gro Gro ety (20	undwa undwa 005) g	ater ater	note Not I	s: Enco	ountere	d		



TP406

PROJECT: Huntly Quarry Disposal Sites



GAL	A		-	TEST PIT ID. <b>TP407</b> 1:30 Sheet 1 of 1													
PROJECT:	Huntly Quarry Dis	posal Sites		CLIE	NT:	Gleesor	Quarries	s Ltd.				JOE					
LOCATION: COORDINATES:	Huntly Quarry E.433908.1m N 721493.1m		SURVEY CIRCUIT: GROUND R.L (m): DATLIM:	STAF FINIS ATHF	RTED: SHED:		19 19 Fi	9/06/2 9/06/2	2019 2019								
	So			epth(m)	(L) H Graphic Geologic D Log Unit O				Shear ength Pa)	(	Sc: (blows/1	ala 100mm)	)	ample ID	nple Type	R.L (m)	
0.00-0.20 m					-				Тр	Tr	2	4 6	8 10	12	ŝ	Sar	
TOPSOIL					-												-
Clayey SILT; light	: orange-brown. Very st	liff, moist, low plast	ticity.		- - - - - - - - - - - - - - - - - - -				188+ 188+								
@1.5m - becomi	ng brown-orange with	red-brown and lig	ht grey streaks		2	X X  X  X  X  X  X  X  X  X  X  X  X  X	Waikato Coal Measures		188+								- - - - - - 78.0 — - - - -
3.00-3.50 m Completely weath [clayey SILT; Hard	hered, light grey with o d, moist, non plastic].	range streaks, MU	DSTONE; extremely we	eak	3	\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\* \$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`\$\*`			UTP								- - - - - - - - - - - - - - - - - - -
	En	d of Pit @ 3.5 m			4												- - - 76.0 — - - - - - - - - - - - - - - - - - - -
					5												- - 75.0 — - - - - - -
Contractor: Gi	eeson Civil Ltd.	Remarks:			6				Gro	undwa	ater n	notes:					-74.0
Plant: Hit Logged: Mł Checked: KC Approved: KC	tatch 30t Excavator	SV readings corre Terminated Due to	ected to BS1377 - Dial N o Hard Digging Logged in	No. 1872 n accordar	nce wit	h NZ Ge	eotechnic	al Soci	Gro ety (2	undwa 005) g	ater N Juidel	lines	icount	tered			



TP407

PROJECT: Huntly Quarry Disposal Sites JOB No: 2325



	A.	Т	ES	T F	PIT	LO	G				T 1	EST :30	T PIT	ID. TP4 She	<b>08</b> et 1 of 7	1
PROJECT:	Huntly Quarry Disposal Sites	3	CLIE	NT: (	Gleeson	Quarries	s Ltd.				J	ΟВ	No:	232	5	
LOCATION: COORDINATES:	Huntly Quarry E.433864.3m N.721587.3m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 57.10m Auckland	00 Mt d Vertic	Eden Ci al Datu	rcuit m 1946	PIT PIT WE	PIT STARTED: PIT FINISHED: WEATHER:					06/20 06/20	19 19		
	Soil/Rock Descrip	otion		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa)	2	(blov 2 4	Scala ws/10	a 10mm) 8 10 1	Sample ID	ample Type	R.L (m)
0.00-0.30 m TOPSOIL				-											0	57.0 -
0.30-1.00 m Clayey SILT and tr stiff, moist, low pla	race organics; light brown-orange sticity; organics are rootlets, slig	e and light grey with red mottles. htly disturbed texture.	Very	- - - - - - - - - - - - - - - - - - -				188+								
1.00-1.50 m Silty CLAY; light gr	rey and orange. Very stiff, moist,	moderate plasticity.		- 				130	71							
1.50-4.50 m Completely weath limonite staining o	ered, light grey with orange strea n defects [clayey SILT; Hard, moi	iks, MUDSTONE; extremely wea ist, low plasticity].	ık;					188+								
				- 2 - - - - - - - - -				188+								55.0
				3												- - 54.0 - -
				- - - - - - - - - - - - - - - - - - -				188+								53.0
	End of Pit @ 4	.5 m						188+								
																52.0
				6												
Contractor: Gle	eson Civil Ltd. Remarks:				1			Gro	l undwa	l ater	note	es:		1	1	
Plant: Hita Logged: MK Checked: KC Approved: KC	atch 30t Excavator SV reading C	gs corrected to BS1377 - Dial No	o. 1872 accordar	nce wit	h NZ Ge	otechnic	al Soci	Gro ety (2	undwa 005) g	ater guid	Not	Enc	counte	ered		



TP408 PROJECT: Huntly Quarry Disposal Sites



GAIA		-		TEST 1:30	) <b>1</b> 1 of 1										
ENGINEERS PROJECT:	s Huntly Quarry Disposal Sites		CLIE	ENT: (	Gleesor	Quarries	s Ltd.				JOB N	lo:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.434185.3m N.721166.3m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 75.30m Auckland	000 Mt d Vertic	Eden C al Datu	ircuit m 1946	PIT STARTED: PIT FINISHED: 6 WEATHER:		RTED: SHED: R:		20/06/201 20/06/201 Fine				
	Soil/Rock Description				Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(bl	Scala (blows/100		Sample ID	Sample Type	R.L (m)
0.00-0.50 m TOPSOIL (some cla	ay inclusions)														- - 75.0 —
0.50-1.00 m SILT with minor sar	nd; brown-orange. Very stiff, moist, low	plasticity						136	48						
1.00-2.00 m SILT with minor clar completely weather	y; light grey and orange. Very stiff, moi red greywacke].	st, low plasticity [inferred	d	- - - - - - - - - - -				188+							- - - 74.0 — -
2.00-5.00 m				2				188+							-
SILT with minor cla [inferred completely limonite and MnO c	y; dark orange with light grey and blac y to highly weathered greywacke, extre coating].	k. Very stiff, moist, non p mely closely spaced joir	olastic nts with			astle Group Materials									- 73.0 — - - -
@3.0m - increase	in limonite and MnO, some very weak	corestones present		3		Newo		188+							
				4				188+							- - - - - - 71.0 —
	End of Pit @ 5.0 m			- - - - - - - - - - - - - - - - - - -				188+							-
															70.0
				6											
Contractor: Glee Plant: Hitat Logged: MK/I Checked: KCC	eson Civil Ltd. Remarks: tch 30t Excavator SV readings corr PS	ected to BS1377 - Dial N	No. 1872	1	<u> </u>	<u>.</u>	I	Gro	undwa undwa	ater no ater No	tes: ot Enco	ountered	ـــــــــــــــــــــــــــــــــــــ	I	<u> </u>
Approved: KCC	>	Logged in	n accordai	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	juidelir	nes				



TP501

PROJECT: Huntly Quarry Disposal Sites



GAIA		T F	PIT	LO	G		TEST PIT ID. <b>TP502</b> 1:30 Sheet 1 of 1								
PROJECT:	Huntly Quarry Disposal Sites	CLIENT: Gleeson Quarries Ltd.											2325		
LOCATION: COORDINATES:	Huntly Quarry E.434190.3m N.721216.2m	SURVEY CIRCUIT: NZGD2000 Mt Eden Circuit PIT STARTED:   GROUND R.L (m): 84.00m PIT FINISHED:   DATUM: Auckland Vertical Datum 1946 WEATHER:									20, 20, Fir				
	Soil/Rock Description	1		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(b	Sca lows/10	la )0mm) 8 10 12	Sample ID	Sample Type	R.L (m)
0.00-0.20 m				_										0,	
0.20-0.70 m Clayey SILT; brown	orange. Very stiff, moist, low to moder	ate plasticity.		-				136	49						
0.70-4.60 m SILT with some clay weathered greywac	r; light grey with pink. Very stiff, moist, ke, closely spaced relict joints with Mn	low plasticity [inferred com O and Limonite coating].	pletely	- - - - - - - - -									_		- - 83.0 — -
				- - - - - - - - - - - -				180	27						
				2	× × × × × ×	istle Group Material		188+					_		- 82.0 — - - - -
@3.0m - becoming inclusions of highly	highly weathered, increase in MnO a plastic white clay.	and Limonite staining, rare		3		Newca		188+							81.0 — - - - - - - - -
				-            				188+							80.0 -
	End of Pit @ 4.6 m			-	$\left  \right\rangle$		-								-
				5									_		-  79.0 - - - -
Contractor: Glee	son Civil Ltd. Remarks:			- 				Gro	undwa		otes:				-78.0 —
Plant: Hitat Logged: MK/F Checked: KCC Approved: KCC	ch 30t Excavator SV readings corre	ected to BS1377 - Dial No. Logged in a	. 1872 Iccordan	ce wit	h NZ Ge	otechnic	al Soci	Grov ety (20	undwa 005) g	iter No	ot End	counter	ed		


## Test Pit Photographs

TP502 PROJECT: Huntly Quarry Disposal Sites

JOB No: 2325



GA	NEERS			TES	T F	PIT	LO	G				TES 1:30		D. TP50 Sheet	<b>)3</b> t 1 of 1	
PROJECT:	Huntly Quarry D	isposal Sites		CLIE	NT: (	Gleesor	Quarrie	s Ltd.				JOB	No:	2325		
LOCATION: COORDINATE	Huntly Quarry ES: E.434237.9m N.721207.8m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 89.00m Auckland	00 Mt d Vertic	Eden C cal Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	rted: Shed: R:		20 20 Fir	/06/20 <sup>-</sup> /06/20 <sup>-</sup> ne	19 19		
	S	Soil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	(b	Sca blows/10	la 00mm) 8 10 12	Sample ID	Sample Type	R.L (m)
0.00-0.40 m TOPSOIL (sor	ne colluvial gravel inclus	ions)			- - - -											
0.40-2.00 m Completely we joints, MnO co	eathered, brown orange ated [SILT with some cla	SILTSTONE (greyw ay, hard, non plastic	racke); extremely; close ]	ely spaced	- - - - - - - - - - - - - - - - - - -		stle Group Material									- 88.0
@1.5m - joints becoming closely spaced with 1 to 2mm aperture.																-
	E	nd of Pit @ 2.0 m			2	****	2							_		87.0 -
End of Pit @ 2.0 m																86.0
			- 4 - 4 											85.0		
			5											84.0 -		
					6											-83.0
Contractor: Plant: Logged: Checked:	Gleeson Civil Ltd. Hitatch 30t Excavator MK/PS KCC	Remarks: SV readings corre Existing Track Cu	ected to BS1377 - Dial	No. 1872	I		I		Gro	undwa undwa	ater no	otes: ot End	counter	red	<u> </u>	1
Approved:	KCC		Logged	in accordar	nce wit	h NZ Ge	eotechnic	al Soci	ety (2	005) g	guideli	nes				



TP503

PROJECT: Huntly Quarry Disposal Sites

JOB No: 2325



GAIA ENGINEERS			-	TES	T F	PIT	LO	G				TES 1:30	TPIT	D. TP5( Shee	<b>)4</b> t 1 of 1	
PROJECT:	Huntly Quarry Di	sposal Sites	1	CLIE	NT: (	Gleesor	Quarries	Ltd.				JOB	No:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.434232.2m N.721266.7m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 97.00m Auckland	00 Mt d Vertic	Eden C al Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:		20 20 Fir	/06/20 /06/20 ne	19 19		
	s	oil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	(b	Sca plows/1	Ia 00mm) 8 10 1	2 Sample ID	Sample Type	R.L (m)
0.00-1.00 m Disturbed covering s 1.00-5.00 m Completely weather closely spaced joints	soil - sample not rel red, brown orange S s, MnO coated	trieved GILTSTONE (greyw	acke); extremely to very	y weak;	- - - - - - - - - - - - - - - - - - -	× × × × × × × × × × × × × × × × × × ×										96.0
					3	X X X X X X X X X X X X X X X X X X X	Newcastle Group Material									95.0
	Er	nd of Pit @ 5.0 m			4	X X X X X X X X X X X X X X X X X X X										93.0
					6				1			- 1				91.0
Contractor: Glees	son Civil Ltd.	Remarks:				1			Gro	l undwa	l iter no	otes:				1
Plant: Hitato Logged: MK/P Checked: KCC Approved: KCC	ch 30t Excavator 2S	SV readings corre	ected to BS1377 - Dial M tting Logged in	No. 1872 n accordar	nce wit	h NZ Ge	eotechnic	al Soci	Gro ety (2	undwa 005) g	iter No	ot En	counte	red		



## TP504 Test Pit Photographs PROJECT: Huntly Quarry Disposal Sites JOB No: 2325



GAIA	s	-	TES	T F	PIT	LO	G				TES 1:30	T PIT	ID. TP5( Shee	<b>)5</b> t 1 of 1	
PROJECT:	Huntly Quarry Disposal Sites		CLIE	NT:	Gleesor	Quarries	s Ltd.				JOB	No:	2325		
LOCATION: COORDINATES:	Huntly Quarry E.434124.7m	SURVEY CIRCUIT: GROUND R.L (m):	NZGD20 96.00m	00 Mt	Eden C	ircuit	PIT PIT	STAF	RTED: SHED:		20 20	)/06/20 )/06/20	19 19		
	N.721188.7m	DATUM:	Auckland			m 1946			:R:	1	FI	ne		Φ	
	Soil/Rock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stro (k	ength Pa)	(t	Sca plows/1	ala 00mm) 8 10 1	Sample ID	Sample Typ	R.L (m)
0.00-0.20 m TOPSOIL				-											-
0.20-2.00 m Clayey SILT; orang	e-brown. Stiff, moist, low plasticity [di	sturbed texture]			X   x   x   x   x   x   x   x   x   x										95.0
2.00-5.00 m SILT with minor cla completely weather	y; light grey and orange. Very stiff, m red greywacke].	oist, non plastic [inferred i	residual to	2		astle Group Material		188+							94.0
				3	x x	Newc									
@4.0m - becoming defects	g hard soil to extremely weak rock, li	monite coating on joints	and	- 4	××× ××× ××× ××× ××× ××× ××× ××× ××× ××			UTP							
	End of Pit @ 5.0 m			5	$(\times \times \times)$								$\square$		91.0 —
				- 6											
Contractor: Glee Plant: Hitat	eson Civil Ltd. Remarks: tch 30t Excavator SV readings co	rrected to BS1377 - Dial I	No. 1872					Gro Gro	undwa	ater no	otes: ot En	counte	ered		
Logged: MK/I Checked: KCC Approved: KCC	PS	Logged i	n accordar	nce wit	h NZ Ge	eotechnic	cal Soci	iety (2	:005) g	juideli	ines				



## Test Pit Photographs

TP505 PROJECT: Huntly Quarry Disposal Sites

JOB No: 2325



ENGINEERS			[ES]	ΤF	ΡIΤ	LO	G				1:30	I	P50 Sheet	1 of 2	
PROJECT: H	Huntly Quarry Disposal Sites	1	CLIEI	NT: (	Gleeson	Quarries	s Ltd.				JOB I	No:	2325		
LOCATION: H COORDINATES: E	Huntly Quarry E.434122.9m N.721293.8m	SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 120.40m Auckland	00 Mt Vertic	Eden Ci al Datur	ircuit m 1946	PIT PIT WE	STAR FINIS ATHE	RTED: SHED: R:		20/0 20/0 Fine	06/2019 06/2019 e	9		
	Soil/Rock Description	l		Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (kl	Shear ength Pa) Tr	(bl	Scala lows/10(	1 0mm) 10 12	Sample ID	Sample Type	R.L (m)
0.00-0.20 m TOPSOII				-										0,	-
0.20-0.40 m	nd fine sand: light brown Firm moist	low plasticity		-											-
0.40-2.40 m SILT with some clay ar plasticity	nd trace fine sand; light grey and ora	ange mottles. Very stiff, r	noist, low	- - - - - - - - -				170	41						120.0 — - - -
				- - - - - - - - - - - - - - - - - - -				UTP							- - - 119.0 — -
2 40-4 40 m				2											- - - - - 118.0 —
Clayey SILT; light orang plasticity; rare weather	ige-brown with light grey streaks. Ve red gravels and mica flakes.	ry stiff, moist, low to mo	derate	3	× () × () × () × () × () × () × () × ()	Puketoka Formation		UTP							          
					<pre>xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;xi&gt;</pre>										
4.40-6.20 m SILT; light grey. Firm, n	noist, low plasticity														116.0 — - - - -
یر (@5.0m - light grey and	d orange mottles, some limonite le	nses, fissured.													- - - 115.0 - - - - -
				U											
Contractor: Gleesor Plant: Hitatch : Logged: PS Checked: KCC	n Civil Ltd. Remarks: 30t Excavator SV readings corre	ected to BS1377 - Dial N	lo. 1872		N7.0	oto ch-i		Gro	undwa	ter no ter No	tes: ot Enco	ountere	:d		

GAIA	L S			TES	ΤF	PIT	LO	G				Т 1	EST :30	PIT	ID. TP SI	<b>506</b> neet 2	<b>5</b> of 2	
PROJECT:	Huntly Quarry Dispo	sal Sites		CLIE	NT: (	Gleesor	Quarries	s Ltd.				J	OB	No:	23	325		
LOCATION: COORDINATES:	Huntly Quarry E.434122.9m N.721293.8m		SURVEY CIRCUIT: GROUND R.L (m): DATUM:	NZGD20 120.40m Auckland	00 Mt d Vertic	Eden C al Datu	ircuit m 1946	PIT PIT WE	STAF FINIS ATHE	RTED: SHED: R:			20/ 20/ Fine	06/20 06/20 e	19 19			
	Soil/R	ock Description			Depth(m)	Graphic Log	Geologic Unit	Ground water	Vane Stre (k	Shear ength Pa) Tr	2	(blov	Scala ws/10	a Omm) 3 1 <u>0</u> 1	2	Sample ID	ample Type	R.L (m)
SILT; light grey. Firm	n, moist, low plasticity				_	$\times \times \times$			19								S	
	End o	f Pit @ 6.2 m															1	- - 14.0 — - - -
					- - - - - - - - - - - - - - - - - - -												1	- - - 13.0 — - - -
					- - - - - - - - - - - - - - - - - - -												1	   12.0 - - - - -
					9												1	- - - - 11.0 — - - - -
					- - - - - - - - - - - - - - - - - - -												1	- - - - - 10.0 — - - -
					- - - - - - - - - - - - - - - - - - -												1	- - - 09.0 — - - -
					- 12													-
Contractor: Glee Plant: Hitat Logged: PS Checked: KCC Approved: KCC	eson Civil Ltd. R tch 30t Excavator S ;	emarks: / readings corr	ected to BS1377 - Dial	No. 1872 in accordar	nce with	n NZ Ge	eotechnic	al Soci	Gro Gro ety (2	undwa undwa 005) g	ater ater	note Not eline	es: Enc	ounte	ered			



	Hole	Name	:HQ006			Cl	ient: St	evens	sons R	esour	ces Li	imited	
Co	llar Coord	dinates (N	It. Eden Circuit):		(	Collar X : 269	9807.00	Co	llar Y :639	99179.00		Collar Z :	99.50
Dri	lling Com	pany: Bro	own Brothers Ltd	Ι.	D	rilled By: Ker	ry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segme	nt Start De	epth	n :0.00	Seç	gment Er	d Depth :	19.26		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weathering	g	Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
		ОВ	Red-brown	2 3 4 5	1								
	5	ОВ	Red-brown										
—2.5		ОВ	Orange-brown										97.09—
		ОВ	Mauve-black				1	999	bd,jt				
—5		ОВ	Mauve-black				Φ	999	bd,jt				94.67—
		ОВ	Mauve-black				Φ	100	bd,jt				
		ОВ	Mauve-black				12	999	bd,jt				
-7.5	Gs	ОВ	yellow grey										92.26—
		ОВ	yellow grey										
—10		ОВ	yellow grey										89.84—
		ОВ	yellow grey									white + green	
	Gs	ОВ	yellow grey				0	999	jt,bd,vn	P,U		(Poss smactite) clavs green	
—12.5		BR	yellow grey				37	70	jt,bd,vn	P,U	3,4	(Poss smactite) green	87.43—
		BR	yellow grey				10	60	jt,bd,vn	P,U	3,4	(Poss smectite) White class green	
—15		BR	yellow grey				33	60	jt,bd,vn	P,U	3,4	(Poss smactite) clavs green	85.01—
		BR	yellow grey				21	999	jt,bd,vn	P,U	3,4	(Poss smectite) clavs chi green (Poss	
	<u>^</u> -	BR	yellow grey				16	60	jt,bd,vn	P,U	3,4	(POSS Smectite) White + clavs chi green (Poss	
—17.5	φS	BR	yellow grey				φ	999	jt,bd,vn	P,U,S	2,3,4	smectite) cludbitecны green	82.60—
	Gs	BR	Green-grey Green-grey	עריין 1007 1007	n	04ω <mark>0</mark> -	92 60	30 <u>30</u>	t,bd,vn,r t,bd,vn,r	P,I,S P,U	2,3 <u>2,3</u>	(smectite) clays, chl, I, Fe-ox, so	
Geology Leger	nd	-					⊼ -		> >		Qua	rry Code Legend	
Core Loss	/Washout	Clay/Ash	Terti Carb Muds	ary onaceous stone	8 7 <b>8</b> 7	Tertiary Carbonaceous Sandstone	⊃ ⊃ eBas ⊃	altic Ash	> > Ba	isalt Flow		Brown/Soft Pit	Run
		-	=				<u>,                                     </u>		> 	6		Blue Brown	
Greywack	e Argillite	<ul> <li>Greywacl</li> <li>Conglom</li> </ul>	ke Grey erate Chip	wacke wacke		Greywacke Sandstone	Gre	ywacke Silts	tone Gr	eywacke		Blue	

	Hole	Name	:HQ006			C	lie	ent: St	tevens	sons R	esour	ces L	imited	
Cc	llar Coord	dinates (M	t. Eden Circuit):			Collar X : 26	998	307.00	Co	llar Y :639	99179.00		Collar Z :	99.50
Dri	lling Com	pany: Bro	wn Brothers Lto	l.	D	Drilled By: Ke	erry	/ Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start De	epth	n :19.26		Se	gment Er	d Depth :	38.51		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatherin	ng	Strength		RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	white + DiStରନ୍ମFill (smectite)	Elevation
—20		BR	Green-grey	ο 1 0 4 0 1 1 1	 ת			60	30	t,bd,vn,r	P,U	2,3	ciays, chi, Fe-ox, soft whaititee+	80.18
	Gs	BR	Green-grey					63	35	t,bd,vn,r	P,U	1,2,3	green (smectite) clavs <sub>e</sub> chl,	
		BR	Green-grey					35	45	t,bd,vn,r	P,U	1,2,3,4	green (smectite) clays,ehl,	
—22.5	Gs	BR	Green-grey						999	t,bd,vn,r	P,U,S	1,2,3,4,	green 5 (smectite) clays <sub>te</sub> chl,	77.77—
	Gs	BR	Green-grey					51	90	/n,jt,bd,r	P,U,S	1,2,3,4,	green 5 (smectite) लाक्षेप्रेड्,त्स्र, grev +	
—25		BB	Green-grey					64	60	vn,jt,bd	P,U,S	2,3,4	green (smectite) White, dk clave +	75.35—
		BB	Green-grey					25	60	vn,jt,bd	P,U,S	2,3,4	green (smectite) White, dk clave - the grev +	
		BB	Green-grey					30	60	vn,jt,bd	P,U,S	2,3,4	white (smectite) clave chi green	
—27.5		BB	Green-grey					0	85	vn,jt,bd	P,U,S	2,3,4	(smectite) clays, chl, Ca_trace	72.94—
	Če	BL	Green-grey					51	9		Ι, Ρ			
—30	43	BL	Green-grey					76	999	vn,fr,fx	Ι, Ρ	1,2	Ca, Cl, zeo, Py	70.52—
		BL	Green-grey					58	999	vn,fr,fx	Ι, Ρ	2,4	Ca, Cl, zeo, Py	
		BL	Green-grey					60	20	vn,fr,fx	I,P,	2,3	Ca, cl, zeo?, Py	
—32.5		BL	Green-grey					60	999	vn,fr,fx	I	3,2,5	Ca, cl, zeo, Py	68.11—
		BL	Green-grey					46	999	vn,fr,fx	I,U	2,3,4	ca,zeo,CI,P	
—35		BL	Green-grey					28	999	vn,fr,fx	I,U	2,3,4	Ca,zeo,CI,P	65.69—
		BL	Dk grey					47	999	vn,fr,fx	I,U	1,2,3,4	Ca, zeo, Cl, Py	
	Gs	BL	Light grey					23	999	vn,fr,fx	I	1,2,3,5	Ca, zeo, Cl, Py	
—37.5		BL	Grey	0 0 4 1	۲ ۵	ю <del>4</del> ю о с		78	999	vn,fx,fr	Ι, Ρ	2,3,4	white-clay, minor Pyrite	63.28—
Geology Logor	nd	BL	Green-grey					10	999	Fs?	I	2,3,5,4	Ca, Py	
Construction of the second sec	Allest		Terti	ary		Tertiary		5 T 2		>>	and file		Overburden	
Core Loss	/Washout	Clay/Ash	Carb — Mud	onaceous stone		Carbonaceou Sandstone	IS	A ∉Bas A ∣ ⊂ -	altic Ash	> > <sup>Ba</sup> > 1	asalt Flow		Brown/Soft Pi	t Run
Greywack	e Argillite	Greywack	e Grey	wacke		Greywacke Sandstone		Gre	ywacke Silts	tone Tu	uffaceous		Blue Brown	
		<ul> <li>Soligione</li> </ul>	• • • • • • • • • • • • • • • • • • •			Sanastone				N. G	_ <b>J</b>		Blue	

Collar Coordinates (ML Eden Circuit):         Collar X: 249907.00         Collar Y: 6399179.00         Collar X           Diffing Company: Brown Brothers Litt.         Diffied By: Kerry Brown         Eagenet Lind Depth -57.77         Scale /           Depth Al         Geology         Quar         Rock Colou         Weathering         Strangin         ROD         Discont		Hole	Name	:HQ006			C	lient: S	Stever	nsons R	esour	ces Li	mited	
Drilling Company. Browner Browner Start Depth 3: 00.00         Segment Start Depth 38.51         Segment End Depth 37.77         Scale           Begin Al         Green grey         Next Colum         Wattering         Singer         Place         Discont	Coll	llar Coord	linates (M	It. Eden Circuit):		Col	lar X :26	99807.00	С	ollar Y :63	99179.00		Collar Z :	99.50
$ \begin{tabular}{ c                                   $	Drilli	ling Com	pany: Bro	wn Brothers Lto	1.	Drill	ed By: K	erry Brown		Logged	By:		A Spar	go
Depth M     Code     Code     React Calour     Network     Strength     Part P     Par	Hole Le	ength : 1	00.00	Segmer	nt Start De	epth:3	8.51	S	egment E	and Depth :	57.77		Scale 1:	100
Image: Constraint of the second of	Depth At	Geology Code	Quarry Code	Rock Colour	Weatherin	ng Si	trength	RQD	Discont M	/ Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
Action         Bit         Grey         Action         Action <td></td> <th></th> <td>BL</td> <td>Green-grey</td> <td>0 4 W V</td> <td>ກ ທ.4</td> <td>        → 32 -1</td> <td>10</td> <td>999</td> <td>vn,Fr, Fs?</td> <td>I</td> <td>2,3,5,4</td> <td>Ca, Py</td> <td></td>			BL	Green-grey	0 4 W V	ກ ທ.4	 → 32 -1	10	999	vn,Fr, Fs?	I	2,3,5,4	Ca, Py	
34.         Grey-brown         42         999         vn, fr, fx         1         3.4.2         a.2.o.Cl,           -42.5         BL         Green-grey         BL         Grey         999         vn, fr, fx         1         3.2.4         Ca, Py           -42.5         BL         Grey         Grey         999         vn, fr, fx         1.9         3.2.4.5         Ca, Py           -42.5         BL         Grey         Grey         999         vn, fr, fx         1.9         3.2.4.5         Ca, Py           -45         BL         Grey         999         vn, fr, fx         1.9         3.2.4.5         Ca, Py           -47.5         BL         Grey         999         vn, fr, fx         1.9         2.3         Ca, Py           -47.5         BL         Grey         999         vn, fr, fx         1.5         2.3.4         Ca, Py           -47.5         BL         Grey         999         vn, fr, fx         1.5         2.3.4         Ca, Py           -47.5         BL         Grey         999         vn, fr, fx         1.5         2.3.4         Ca, Py           -56.         BL         Grey         999         vn, fr, fx         1.5<	-40	Gs	BL	Grey				35	999	Fr, vn,fx	I, S,	3,4,2	Ca,CI,zeo,P	60.86
-42.5       BL       Green-grey       Grey       999       vn, fr       1.       3,2.4       Ca, Py         -42.5       BL       Grey       999       vn, fr, k       1.5       3,2.4       Ca, Py         -45       BL       Grey       999       vn, fr, k       1.5       1.2,3.4       Ca, Py         -45       BL       Grey       999       vn, fr, k       1.5       1.2,3.4       Ca, Py         -47.5       BL       Grey       999       vn, fr, k       1.5       1.2,3.4       Ca, Py         -47.5       BL       Grey       999       vn, fr, k       1.5       1.2,3.4       Ca, Py         -47.5       BL       Grey       999       vn, fr, k       1.5       2.3,4.5       Ca, Py         -47.5       BL       Grey       999       vn, fr, k       1.5       2.3,4.5       Ca, Py         -64       999       vn, fr, k       1.5       2.3,4.5       Ca, Py         -55       Gs       BL       Grey       999       vn, fr, k       1.5       2.3,4.5       Ca, Py         -55       Gs       BL       Green-grey       54       999       vn, fr, kb       1.C.       3			BL	Grey-brown				42	999	vn, fr,fx	I	3,4,2	Ca,zeo,CI,P	
-42.5       BL       Grey			BL	Green-grey				62	999	vn, fr	Ι,	3,2,4	Ca, Py	
-45         BL         Grey         999         vn, fr,fx         1,P         3,2,4         Ca, Py           -45         BL         Grey         98         999         vn, fr,fx         1,S         1,2,3,4         Ca, Py           -47.5         BL         Grey         99         vn, fr,fx         1,L         2,3         Ca, Py           -47.5         BL         Grey         999         vn, fr,fx         1,L         2,3         Ca, Py           -47.5         BL         Grey         999         vn, fr,fx         1,L         2,3         Ca, Py           -47.5         BL         Grey         999         vn, fr,fx         1,L         2,3         Ca, Py           -47.5         BL         Grey         999         vn, fr,fx         1,S.U         2,3,4         Ca, Py           -50         Gs         BL         Grey         999         vn, fr,fx         1,L         2,3,4         Ca, Py           -52.5         Gs         BL         Green-grey         999         vn, fr,fx,b         1,C         2,3         a,zeo, cl, Py           -55.5         BL         Green-grey         999         n,fr,fx,b         1,C         3,4	-42.5		BL	Grey				0	999	vn fr fx	I	3,2,4,5	Ca, Py	58.45—
-45       BL       Grey       Grey       32       999       vn,fr,fx       I, S       1,2,3,4       Ca, Py         -47.5       BL       Grey       BL       Grey       32       999       vn,fr,fx       I       2,3       Ca, Py         -47.5       BL       Grey       BL       Grey       999       vn,fr,fx       I.S       2,3,4       Ca, Py         -47.5       BL       Grey       BL       Grey       64       999       vn,fr,fx       I.S       2,3,4       Ca, Py         -50       BL       Grey       Grey       64       999       vn,fr,fx       I.S       2,3,4,5       Ca, Py         -50       BL       Grey       64       999       vn,fr,fx       I.S       2,3,4,5       Ca, Py         -50       Gs       BL       Grey       64       999       vn,fr,fx       I       2,3,4,5       Ca, Py         -50       Gs       BL       Grey       64       999       vn,fr,fx       I       2,3,4,5       Ca, Py         -55       Gs       BL       Green-grey       64       999       n,fr,fx,b       I,C       2,3       a,zeo,cl,f         -55       <			BL	Grey				47	999	vn, fr,fx	I,P	3,2,4	Ca, Py	
Gs       BL       Grey       999       vn,fr,fx       1       2.3       Ca. Py         -47.5       BL       Grey       90       vn,fr,fx       1       2.3       Ca. Py         -47.5       BL       Grey       90       vn,fr,fx       1       2.3       Ca. Py         -47.5       BL       Grey       90       vn,fr,fx       1       2.3       Ca. Py         -47.5       BL       Grey       90       vn,fr,fx       1.5       2.3.4       Ca. Py         -50       Gs       BL       Grey       999       vn,fr,fx       1.5       2.3.4       Ca. Py         -50       Gs       BL       Grey       999       vn,fr,fx       1.5       2.3.4       Ca. Py         -50       Gs       BL       Grey       999       vn,fr,fx       1       2.3.4       Ca. Py         -52.5       Gs       BL       Green-grey       999       vn,fr,fx       1.2       3.4.5       St. cl         -55       Gs       BL       Grey       999       n,fr,fx,b       1.C       2.3       a.zeo,cl,f         -55       Gs       BL       Grey       999       n,fr,fx,b	-45		BL	Grey				98	999	vn,fr,fx	I, S	1,2,3,4	Ca, Py	56.03-
-47.5       BL       Grey		Gs BL Grey BL Grey						32	999	vn,fr,fx	I	2,3	Ca, Py	
-47.5 -4			BL	Grey				90	999	V,fr,fx	I	2,3	Са, ру	
-50       BL       Grey       Grey <t< td=""><td>-47.5</td><th></th><td>BL</td><td>Grey</td><td></td><td></td><td></td><td>68</td><td>999</td><td>vn,fr,fx</td><td>I,S</td><td>2,3,4</td><td>Ca, Py</td><td>53.62—</td></t<>	-47.5		BL	Grey				68	999	vn,fr,fx	I,S	2,3,4	Ca, Py	53.62—
-50       BL       Grey       32       999       vn,fr,fx       I       2,3,4,5       Ca, Py         Gs       BL       Grey       100       999       vn,fr,fx       I       2,3,4,5       Ca, Py         -52.5       Gs       BL       Green-grey       60       999       r,vn,fx,bi       I,P,C,U       3,4,5       Sst, cl         -52.5       Gs       BL       Green-grey       61       999       n,fr,fx,bi       I,C,U       3,4,5       Ca, zeo,Pi         -55       Gs       BL       Green-grey       61       999       n,fr,fx,bi       I,C       2,3       a,zeo,cl,Fi         -55       BL       Grey       61       999       n,fr,fx,bi       I,C       3,4       a,zeo,cl,Fi         -57.5       BL       Grey       67       999       n,fr,fx,bi       I,C       3,4       a,zeo,cl,Fi         -57.5       BL       Grey       NM + I       IN + I       IN + I       I,I			BL	Grey				64	999	vn,fr,fx	I,S,U	2,3,4,,1	Са	
OS       BL       Grey       Image: Constraint of the constrai	-50	Gs	BL	Grey				32	999	vn,fr,fx	I	2,3,4,5	Ca, Py	51 20
Gs       BL       Green-grey       60       999       r,vn,fx,bi       I,P,C,U       3,4,5       sst, cl         -52.5       Gs       BL       Green-grey       54       999       n,fr,fx,bi       I,C,U       3,4,5       Ca, zeo,P         Gs       BL       Green-grey       61       999       n,fr,fx,bi       I,C       2,3       ia,zeo,cl,F         -55       BL       Grey       69       999       n,fr,fx,bi       I,C       4,3,2       ia,zeo,cl,P         -57.5       Ge       BL       Grey       0       999       n,fr,fx,bi       I,C       3,4,4       ia,zeo,cl,P         -57.5       Ge       BL       Grey       0       999       n,fr,fx,bi       I,C       3,4       ia,zeo,cl,P         -57.5       Ge       BL       Grey       0       999       n,fr,fx,bi       I,C       3,4       ia,zeo,cl,P         -57.5       Ge       BL       Grey       0       999       n,fr,fx,bi       I,C       3,4       i,l,zeo,Py		Gs	BL	Grey				100	999	vn,fr,fx	I	2,3,4	Ca, Py	01120
$-52.5 \begin{bmatrix} \mathbf{Gs} \\ \mathbf{Gs} \\ \mathbf{Gs} \\ \mathbf{Gs} \\ \mathbf{BL} \\ \mathbf{Green-grey} \\ \mathbf{BL} \\ \mathbf{Grey} \\ \mathbf{Ce} $		Gs	BL	Green-grey				60	999	r,vn,fx,bo	I,P,C,U	3,4,5	sst, cl	
$-55$ $\begin{array}{c c c c c c c c c c c c c c c c c c c $	-52.5	Gs	BL	Green-grey				54	999	'n,fr,fx,bo	I,C,U	3,4,5	Ca, zeo,Py	48.79—
$-55 \qquad $		Gs	BL	Green-grey				61	999	'n,fr,fx,bo	I, C	2,3	ca,zeo,cl,Py	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	-55		BL	Grey				69	999	'n,fr,fx,bo	I,C	4,3,	Ca,zeo,cl,Py	46.37-
-57.5 BL Grey N™ → D D → M → D D → M → D D → M → D D → M → D → D		Gs	BL	Grey				57	999	'n,fr,fx,bo	I,C	3,4	a,zeo,cl,Py chl?	
			BL	Grey				73	999	'n,fr,fx,bo	I,C	3,4	l,cl,zeo,Py,	
	-57.5	Gs	BL	Grey	L       N 0 4 ⊓	ດ 	→ N 00 4	0	999	Fr,vn,fx?	I	4,3,2	open, cl,zeo,Py	43.96—
Geology Legend Ouerry Code Legend	ology Legend	d F.	5.	F_L.				5.5		> >		Quar	ry Code Legend Overburden	
Core Loss/Washout	Core Loss/W	Washout	Clay/Ash	Carb	ary ionaceous stone	-74	ertiary Carbonaceou Sandstone	s a s	Basaltic Ash	> ) > > <sup>Ba</sup>	asalt Flow		Brown/Soft Pit	Run
Greywacke Argillite Greywacke Conglomerate Chipwacke Sandstone Greywacke Siltstone Greywacke Siltstone	Greywacke	Argillite	Greywack	e Grey erate Chip	wacke wacke		Greywacke Gandstone		Greywacke Sil	Itstone	uffaceous reywacke		Blue Brown	

	Hole	Name	:HQ006		С	lient: St	evens	sons R	esour	ces Li	imited	
Co	ollar Coord	dinates (N	1t. Eden Circuit)	:	Collar X : 26	99807.00	Со	llar Y : 639	99179.00		Collar Z :	99.50
Dri	illing Com	pany: Bro	own Brothers Lto	ł.	Drilled By: Ke	erry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start De	epth : 57.77	Seg	gment Er	d Depth :	77.02		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatherin	ng Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
		BL	Grey	0 4 ω <b>Δ</b>	 σ_ <mark>4 τυ</mark>	Φ.	999	Fr,vn,fx?	<u> </u>	4,3,2	en, cl,zeo,	
	Gs		Grey			39	999	r,vn,fx,bo	I,C	3,4	CI,zeo,Py	
60	ر الله ال		Grey			31	999	r,vn,fx,bo	I,P,C	2,3,4,5	open, sz,cl,zeo	41.54—
	Gs		Grey			27	999	n,fr,fx,bo	I,P	2,3,4	cl,zeo	
			Grey			0	999	/n,bd,fr,f	I,P,	2,3,4,5	open,cl,zec	
—62.5			Grey			23	999	n,bd,fr,f	I,P	2,3,4,5	cl,zeo,Py	39.13—
	Gs		Grey			34	999	)d,fr,fx,∨i	I,P	3,4,5	open,cl,zec	
			Grey			26	999	8d,vn,fr,f:	I,P	3,4,5	open,cl,Py	0/ 71
-65			Grey			34	999	Bd,fr,vn	I,P	3,4,5	open, cl,zeo	30.71
	Gs		Grey			10	999	od,fr,vn,fi	I,P	3,4,5	open,cl,zec	
—67.5			Grey			10	999	n,bd,fr,f	I,C,P	3,4,5	cl,zeo,open	34.30—
	Gs		Grey			0	999	Fr,bd,vn	I,P	3,4	n,cl,zeo,Py,	
—70			Grey			55	999	fr,vn,bd	I,P	3,4	open,cl,zec	31.89—
	Gs		Grey			24	999	8d,vn,fr,f:	I,P	3,4	,zeo,open,:	
	Gs		Grey			50	999	r,vn,fx,b	I,P	3,4	pen,cl,zeo,s	
-72.5			Dk Grey			60	999	r,fx,vn,b	I,P	3,4	open, Fe oxides, cl,	29.47—
	Gs		Dk Grey			10	999	r,vn,bd,f	I	3,4,5	open, cl, zeo, chl	
	- - - - - - - - - - - - - - - - - - -		Dk Grey			0	999	n,fr,fx,bo	I	3,4,5	open,zeo?, cl, chl?	27.06
			Dk Grey			23	999	r,vn,fx,b	I,U	3,4,5	oxides, Py,Cal	
	us		Dk Grey	0 m 4 L	0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	55	999 000	/n,fr,fx,b	I,U	3,4,5	,zeo?,Cal,c	
Geology Leger	nd	2	Tort	ary	Tortiary	5		> >		Qua	rry Code Legend Overburden	
Core Loss	/Washout	Clay/Ash		onaceous stone	Carbonaceou Sandstone	s 🍐 Basa	altic Ash	Ba	salt Flow		Brown/Soft Pi	Run
		Greywark	(e Grev	wacke	Greywacke			N. Tu	ffaceous		Blue Brown	
Greywack	e Argillite	<ul> <li>Conglome</li> </ul>	erate Chip	wacke	Sandstone	Gre	ywacke Silts	tone Gr	eywacke		Blue	

	Hole	Name	:HQ006		С	lient: Si	teven	sons R	esour	ces Li	imited	
Co	llar Coord	dinates (M	t. Eden Circuit)	:	Collar X : 26	99807.00	Co	llar Y :639	99179.00		Collar Z :	99.50
Dri	lling Com	pany: Bro	wn Brothers Lto	1.	Drilled By: Ke	erry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start De	pth : 77.02	Se	gment Er	nd Depth :	96.28		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weathering	g Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
-77.5	Gs	BL	Dk Grey	2345		57	999	'n,fx,fr,bi	I,S	3,4	al,zeo?,Py, oxides	24.64—
	Gs Gs	BL	Dk Grey			69	999	n,fr,fx,bd	I,C,S	3,4,5	l,Cal,cl,zeo Py,Chl	
80	<u> </u>	BL	Dk Grey			70	999	n,fr,fx,bo	I,P,U	2,3,4,5	zeo,cl,cal	22.23-
	Gs	BL	Dk Grey			56	999	n,fr,fx,bo	I,S	3,4,5	;I,zeo,cal,P	-
	3333	BL	Dk Grey			62	999	fx, sz, Vn, Fr	I,U,S	3,4,5	al,zeo?,cl,s	
-82.5		BL	Dk Grey			59	999	n,fx,fr,bo	I,S,	3,4	cl,cal,zeo?	19.81—
		BB	Dk Grey			61	999	vn,fx	Р	3,4	zeo,cal,cl	
—85		BB	Dk Grey			20	999	vn, Jt,	Р	3,4	zeo	17.40
		BB	Dk Grey			23	999	vn,jt	P,I	3,4	zeo	
		BL	Dk Grey			0	999	vn,jt	P,i	3,4	cal,zeo	
-87.5		BL	Dk Grey			10	999	vn,jt	P,i	3,4	zeo, cal	14.98—
		BL	Dk Grey			27	999	vn,jt	P,i	3,4	cal,zeo	
—90		BL	Dk Grey			13	999	vn,jt	P,i	3,4	zeo,cal,Py	12.57—
		BL	Dk Grey			0	100	vn,jt	P,i	3,4	zeo,cal,Py	
	Gs	BL	Dk Grey			28	100	vn,jt	P,i	3,4		
-92.5		BL	Dk Grey			38			P,i	3,4		10.15—
		BL	Dk Grey			67			P,i	3,4		
95		BB	Dk Grey			38			P,i	3,4		7.74—
		BB	Dk Grey Dk Grey	 2 ю 4 с 	0 4 6 0 <del>-</del>	37 ¢			P,i P,i	3,4 3,4		
Geology Leger	nd	÷.				5.5		> >		Qua	rry Code Legend	
Core Loss	/Washout	Clay/Ash	Carb Mud	ary onaceous stone	Carbonaceous	s 斗 Bas	altic Ash	> > Ba	isalt Flow		Brown/Soft Pi	t Run
		e Ground		wacko	Crownelia			N.	ffaccourc		Blue Brown	
Greywack	e Argillite	<ul> <li>Greywack</li> <li>Conglome</li> </ul>	e Grey rate Chip	wacke	Greywacke Sandstone	Gre	ywacke Silts	tone Gr	eywacke		Blue	

	Hole	Name	:HQ006			(	Client: S	tevens	sons R	esour	ces L	imited	
Cc	llar Coord	dinates (M	lt. Eden Circuit)	:		Collar X : 26	599807.00	Co	llar Y :63	99179.00		Collar Z :	99.50
Dri	lling Com	pany: Bro	wn Brothers Lto	d.	0	Drilled By: K	erry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start De	epth	n :96.28	Seg	gment End	d Depth :	115.54		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatherin	ng	Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
		BB	Dk Grey	2	 л 	- σ 4 ω	Φ			P,i	3,4		
97.5		BL	Dk Grey				39			P,i	3,4		5.32—
	Gs	BL	Dk Grey				59			P,i	3,4		
		BL	Dk Grey				14			P,i	3,4		
													2.91
—102.5													0.49—
—105													-1.92—
—107.5													-4.34—
—110													-6.75
—112.5													-9.17—
—115				0 0 4 U	 ດ 								-11.58
Geology Leger	nd	5			-		5.5		> >		Qu	overburden	
Core Loss	/Washout	Clay/Ash	= Tert = Carb _ Mud	iary conaceous stone		Carbonaceou Sandstone	us 🔺 Ba	saltic Ash	> > > Ba	asalt Flow		Brown/Soft Pi	t Run
È		<ul> <li>Greywach</li> </ul>	ie Gro	wacke	ſ	Greywacko	<u> </u>		N T	Iffaceous		Blue Brown	
Greywack	e Argillite	<ul> <li>Conglome</li> </ul>	erate Chip	wacke		Sandstone	Gr	eywacke Silts	tone G	reywacke		Blue	

	Hole	Name	:HQ007		CI	ient: St	evens	sons R	esour	ces Li	imited	
Co	ollar Coord	dinates (N	It. Eden Circuit):		Collar X : 270	0093.00	Col	lar Y :639	99219.00		Collar Z : 1	07.50
Dri	illing Com	pany: Bro	own Brothers Ltd		Drilled By: Ker	ry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segme	nt Start De	pth :0.00	Seg	gment En	d Depth :	19.26		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weathering	g Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
		ОВ	Orange-brown	2		Φ						
	क्ष	ОВ	Orange-brown			Φ						
-2.5		ОВ	Orange-brown			Φ						105.09
		ОВ	Light yellow			47	100	Jt	Р		open	
—5		ОВ	Light yellow			20	100	Jt	P,I		open	102.67—
		ОВ	Pink-yellow			44	100	Jt	Р		open	
		ОВ	Pink-orange			28	100	Jt	Р		open	
-7.5		ОВ	Orange-yellow			Φ						100.26—
		OB	Orange-brown			Φ	100	Jt	Р		open	
—10	Gs	ОВ	Orange-brown			Φ	100	Jt	P		open	97.84
		ОВ	Orange-brown			Φ						
10 F		ОВ	Pink-brown			0						05.42
-12.5							100	1+	DI		open	95.43
		ОВ	Yellow arev			0	100	Jt	Р		open	
—15		ОВ	Orange-grey			φ						93.01—
	Gs	ОВ	Orange-grey			Φ	100	Jt	Р		open	
—17.5		ОВ	Orange-brown			12	100	Jt	Р		open, Lm	90.60
		ов	Orange-brown	ი ო ძ ი ი ძ ო ს	Δ 7 0 7 <del>-</del>	10	100	jt,vn	Р		open, Fe oxides, Lm?	
Geology Leger	nd	OB	Urange-brown			0	100	Jt	Р	Qua	I. Fe oxides,	
Core Loss	/Washout	Clay/Ash	Terti Carb	ary onaceous	Tertiary Carbonaceous	S - Bas	altic Ash	>> >> >Ba	asalt Flow		Overburden	Pun
		-						> :			Blue Brown	. KUH
Greywack	e Argillite	Greywac Conglom	ke Grey erate Chip	wacke wacke	Greywacke Sandstone	Gre	ywacke Siltst	tone Gr	iffaceous eywacke		Blue	

	Hole	Name	:HQ007			C	lient: S	tevens	sons R	esour	ces L	imited	
Cc	llar Coor	dinates (N	It. Eden Circuit):			Collar X : 27	00093.00	Col	lar Y :63	99219.00		Collar Z : 1	07.50
Dri	lling Com	ipany: Bro	own Brothers Lto	l.		Drilled By: K	erry Brown		Logged	By:		A Spar	go
Hole	Length : 1	100.00	Segmer	nt Start D	ept	h :19.26	Se	gment En	d Depth :	38.51		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatheri	ng	Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
	Gs	ОВ	Orange-brown		 ת		0	100	Jt	Р		open, Fe oxides, 1 m?	00 10
-20		ОВ	Light yellow grey				17	100	jt	Ρ		open, Fe oxides, Lm	00.10
		BR	Light yellow grey				0	100	Jt	Ρ		Fe oxides, Lm? open	
—22.5	Gs	BR	Light yellow grey				0	999	Jt	Р		oPn, Fe oxides, Lm?	85.77—
		BR	Yellow grey				Φ	999	jt	Р		open,Fe oxides, Lm?	
—25		BR	Yellow grey				30	100	Jt	Р		open,Fe oxides, Lm?	83.35—
-		вв	Orange-grey				10	100	jt	Р		open, Fe oxides, Lm?	
		вв	Orange-grey				10	100	Jt,vn	Р		Fe oxides, open,zeo	
—27.5		вв	Orange-grey				32	100	Jt, vn	Р		open,Fe ox, zeo	80.94—
			Grey				ο	100	Jt,vn	Р		zeo,cl?,Fe oxides	
—30			Grey				0	100	Jt	Р		Fe ox	78.52—
			Grey				42	30	Jt	Р		Fe ox, zeo cl?	
	Gs		Grey				25	70	Vn,jt	P,I		Fe ox	
—32.5			Dk grey				15	100	jt	Р		Fe ox	76.11—
			Dk grey				Φ	100	jt	Р		Fe ox	
—35			Dk grey				Φ	100	Jt,vn	Р		Fe ox,zeo	73.69—
			Dk grey				26	50	Jt,vn	Р		Fe oxides, zeo	
			Dk grey				36	30	Jt,vn	Р		Fe oxides, zeo, cal	
—37.5			Dk grey	0 0 4 1	2	Ω4 m O F	43	20	Jt,vn	Р		Fe ox, zeo, Py, cl?	71.28—
Geology Leger	nd	BL	Dk grey				30	30	Jt	Р	Qu	zeo, Pv?	
Core Loss	/Washout	Clay/Ash	Terti	ary onaceous		Tertiary Carbonaceou	IS S Ba	saltic Ash	> > >   Ba	asalt Flow		Overburden	
		•		stone		Sandstone	2)00		>>			Brown/Soft Pit	t Run
Greywack	e Argillite	Greywack	ke Grey erate Chip	wacke wacke		Greywacke Sandstone	Gr	eywacke Silts	tone Tu Gi	iffaceous eywacke		Blue Brown Blue	

	Hole	Name	:HQ007			C	lient: St	tevens	sons R	esour	ces L	imited	
Cc	Ilar Coord	dinates (N	It. Eden Circuit):			Collar X : 27	00093.00	Co	llar Y : 639	99219.00		Collar Z : 1	07.50
Dri	lling Com	pany: Bro	own Brothers Lto	l.	I	Drilled By: Ke	erry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start D	eptl	h :38.51	Se	gment En	d Depth :	57.77		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatherii	ng	Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
	Gs		Dk grey	 μως	 л		30	30	Jt	Р		Fe ox, zeo. Pv?	
10			Dk grey				40	15	Jt	Р		open,zeo,Py	60.06
40			Dk grey				26	30	Jt,vn	Ρ		en,cal,zeo,	08.80
			Dk grey				100	25	vn,jt	Р	2,3	ıl,zeo,chl?,I	
—42.5	Gs		Dk grey				100	40	Vn,jt	Р		Cal,zeo,Py	66.45—
			Dk grey				100	50	vn,fx,jt	Р		Cal,zeo,Py	
			Dk grey				80	50	vn,jt	Р		Cal,zeo,Py	64 03
-10			Dk grey				Φ	30	jt,vn,bd	Р		open,fe ox, cl?,zeo?	01.00
			Dk grey				12	50	jt,vn	P,I	3,5	zeo,cal	
—47.5	Ĝs		Dk grey				10	50	Jt	Р		en,cal,zeo,	61.62—
			Dk grey				0	999	jt	Р		en,cal,zeo,	
50			Dk grey				10	50	jt	Р		en,cal,zeo,	59.20
			Dk grey				47	50	Jt	Р		open	
			Dk grey				38	25	vn,jt	Р		cal,zeo,Py	
52.5			Dk grey				64	20	vn,jt	Р		cal,zeo,Py	56.79—
	Gs		Dk grey				100	50	vn,bd	Р		zeo,cal	
			Dk grey				75	25	vn,jt,bd	Р		cal,zeo,Py	54.37—
			Dk grey				46	25	Jt	Р		zeo,cal,Py	
			Dk grey				57	20	jt,vn	Р		al,zeo,Py,c	
-57.5		BL	Dk grey	0.041	2 	0400F	37	25	jt,vn	Р		cal,zeo	51.96
Geology Leger	id	5.					5.5		> >		Qua	orry Code Legend	
Core Loss	/Washout	Clay/Ash	Carb Mud	ary onaceous stone		Tertiary Carbonaceous Sandstone	ceous Basaltic Ash Basalt Flow Brown/So						Run
-		-	-				<u></u>		8-1 N 1-			Blue Brown	
Greywack	e Argillite	<ul> <li>Greywack</li> <li>Conglome</li> </ul>	erate Grey Chip	wacke wacke		Sandstone	Gre	ywacke Silts	tone Gr	eywacke		Blue	

	Hole	Name	:HQ007		C	lient: St	tevens	sons R	esour	ces Li	imited	
Co	llar Coord	dinates (N	It. Eden Circuit):	:	Collar X : 27	00093.00	Co	llar Y :639	99219.00		Collar Z : 1	07.50
Dri	lling Com	pany: Bro	wn Brothers Lto	l.	Drilled By: K	erry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start Dep	oth :57.77	Seg	gment Er	d Depth :	77.02		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weathering	Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
			Dk grey			37	25	jt,vn	P		cal,zeo	
			Dk grey			50	50	jt	Р		cal,zeo	
			Dk grey			50	12	jt,vn	Р		cal,zeo	49 54
00	Ğs		Dk grey			84	45	fx,vn	Р		cal,zeo	+7.5+
			Dk grey			0	45	vn,jt	Р		cal,zeo,Py	
-62.5			Dk grey			10	50	Jt,vn	Р		cal,zeo,Py	47.13—
			Dk grey			18	35	Jt	Р		cal,zeo,Py	
65			Dk grey			22	40	jt	Р		cal,zeo,Py	44.71—
			Dk grey			39	33	jt,vn	Р		cal,zeo,Py	
	Gs		Dk grey			1	100	jt	Р		cal,zeo,Py	
-67.5			Dk grey			0	100	jt	Р		cal,zeo,Py	42.30—
			Dk grey			50	25	Jt	Р		cal,zeo	
—70			Dk grey			0	42	jt,vn,	Р		cal,zeo	39.89—
			Dk grey			71	40	vn,jt	P,I	3,4	cal,zeo, Py	
			Dk grey			70	18	vn,jt	Р		cal,zeo,Py	
—72.5			Dk grey			33	40	vn,jt	Р		cal,zeo,Py	37.47—
	Gs		Dk grey			74	25	jt,vn	Р		cal,zeo	
75			Dk grey			66	60	sz,vn,jt	Р	3,4	cal,zeo,Py	35.06
			Dk grey			15	45	jt,vn	Р		cal,zeo,Py	
		BL	Dk grey	 თო4თ		43	50 25	vn,jt it vn	P		cal,zeo, chl?	
Geology Leger	nd	÷.	Terti	ary	Tertiary	5.5		>_>		Qua	Overburden	
Core Loss,	/Washout	Clay/Ash	Carb Mud	onaceous stone	Carbonaceou Sandstone	is A Bas	altic Ash	s s <mark>Ba</mark>	isalt Flow		Brown/Soft Pi	Run
-		Greywack	(e Grov	wacke	Greywacke	<u> </u>		N. T.	Iffaceous		Blue Brown	
Greywack	e Argillite	<ul> <li>Conglome</li> </ul>	erate Chip	wacke	Sandstone	Gre	ywacke Silts	tone Gr	eywacke		Blue	

	Hole	Name	:HQ007		Client: Stevensons Resources Limited								
Co	llar Coord	dinates (M	t. Eden Circuit):	:		Collar X : 270	0093.00	Co	llar Y :639	99219.00		Collar Z : 1	07.50
Dri	lling Com	pany: Bro	wn Brothers Lto	1.	D	Drilled By: Ke	rry Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmer	nt Start De	epth	n : 77.02	Se	gment Er	nd Depth :	96.28		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatherir	ng	Strength	RQD	Discont / M	Discont Type	Discont Shape	Discont Rough	Discont Fill	Elevation
-77.5	Gs	BL	Dk grey	2340	 л 	- 4 σ - 4 σ - 4 σ	89	35	jt,vn	Р		cal,zeo	32.64—
		BL	Dk grey				52	59	jt,vn	Р		cal,zeo,Py	
80		BL	Dk grey				10	50	jt,vn	Р	0,10,60,	8 cal,zeo,Py	30.23—
		BL	Dk grey				13	40	jt,vn	Р		cal,zeo,Py	
		BL	Dk grey				26	100	jt,sz,vn	Р		cal,zeo,Py	
-82.5	Gs	BL	Dk grey				0	999	sz,fx,jt,vr	Р		al,zeo,qz?,F	27.81—
		BL	Dk grey				23	90	vn,jt	P,I	3,4,5	cal,zeo	
		BL	Dk grey				76	100	vn,jt	Р		cal,zeo	25.40
		BL	Dk grey				34	90	vn,jt	Р		cal,zeo	
		BL	Dk grey				40	100	vn,jt	Р		cal,zeo	
87.5	Gs	BL	Dk grey				25	999	fx,vn,jt	Р		cal,zeo,fxbi	22.98—
		BL	Dk grey				20	100	vn,jt	Р		cal,zeo	
—90	Gs	BL	Dk grey				Φ	999	vn,jt,fx	Р		cal,zeo	20.57—
		BL	Dk grey				34	100	/n,jt,fx,sz	P,I		cal,zeo	
		BL	Dk grey				25	50	vn,jt	Р		en,cal,zeo,	
-92.5		BL	Dk grey				47	40	vn,jt	Р	3,5	oPe,cal,zec	18.15—
	Gs	BL	Dk grey				55	20	jt,vn	Р		pen,cal,ze	
95		BL	Dk grey				Φ	100	jt,vn	Р		zeo,cal,Py	15.74—
		BL	Dk grey	  0041 	 ג 	υ <del>4 ю 0 Г</del>	0	60 50	jt it vo	P	3,4,5	cal,zeo,Py	
Geology Leger	nd						<u>_</u>	00	jt, vii	Γ,Ι	Qua	rry Code Legend	
Core Loss	/Washout	Clay/Ash	E Terti	ary onaceous stone		Tertiary Carbonaceous Sandstone	S Basaltic Ash Basalt Flow						
		•	=				<u></u>		> :	6		Blue Brown	
Greywack	e Argillite	<ul> <li>Greywacke</li> <li>Conglome</li> </ul>	e Grey rate Chip	wacke wacke	1.1.1.1	Greywacke Sandstone	Gr	eywacke Silts	stone Gr	rraceous eywacke		Blue	

	Hole	Name	:HQ007				C	Clie	ent: S	tevens	sons R	ces L			
Co	llar Coord	dinates (M	t. Eden Circuit)	:		Collar	X : 27	7000	093.00	Col	llar Y :63	99219.00		Collar Z : 1	07.50
Dri	lling Com	pany: Bro	wn Brothers Lto	d.	[	Drilled	By: K	erry	y Brown		Logged	By:		A Spar	go
Hole	Length : 1	00.00	Segmei	nt Start De	epth	n:96.2	28		Seg	gment End	d Depth :	115.54		Scale 1:	100
Depth At	Geology Code	Quarry Code	Rock Colour	Weatherin	ng	Strer	ngth		RQD	Discont / M	Discont Type	Discont Shape	Discon Rough	t Discont Fill	Elevation
		BL	Dk grey	2 -	 ח ו	μ μ μ μ	- č -		37	50	jt,vn	P,I		cal,zeo,Py	
<del></del> 97.5		BL	Dk grey						74	50	vn,jt	Ρ		cal,zeo	13.32—
	Gs	BL	Dk grey						82	25	Vn,jt	P,I		zeo,cal	
		BL	Dk grey						75	50	vn,jt	P,I		cal,zeo	
<del></del>															- <del>10.91</del>
															8.49—
—105															6.08—
107 5															2.44
-107.5															3.66
—110															1.25—
—112.5															-1.17—
—115				- - - - - - - - - -	ი 	<u> </u>	-15°								-3.58
Geology Leger	nd	5		iary		Tort	iary		5.5		> >			uarry Code Legend Overburden	
Core Loss	/Washout	Clay/Ash	Carb Mud	onaceous stone		Carb Carb Sand	onaceou distone	JS	Ba:	saltic Ash	> > > > Bi	asalt Flow		Brown/Soft Pi	t Run
È		<ul> <li>Greywack</li> </ul>		wacke	1	Gree	warke		5		N. T.	Iffaceous		Blue Brown	
Greywack	e Argillite	<ul> <li>Conglome</li> </ul>	rate Chip	wacke		Sand	dstone		Gre	eywacke Silts	tone G	reywacke		Blue	

## APPENDIX C – Slope Stability Analysis Outputs

Description	No. Sheets:
Slope Stability Ana	25











200			,									1	l 0.19 /
120	0.869				Results Bishop s Search M Divisions Circles p Number Divisions Number Minimum Minimum Minimum Minimum Every av 0.760 Factor of Axis Loc	implified Method:Au a along sla er divisio of iteratio to vertice Elevatio Depth:N Area:No Weight:1 ailable su Safety: ( ation: 115	to Refin ope:50 n:10 ns:5 next iter s per sur n:Not De to Defined Jot Defin rface .760 .156, 28	e Search ation:50% face:12 fined d ed 2.395					
- - - - - - - - - - - - - - - - - 				~	Right Slip	Surface E	Endpoint: Endpoin	81.660, 76 t: 243.460	0.359 , 110.292				
											o		
	Material Name	Color Unit Weight (kN/m3)	Strength Type	Cohesion P (kPa) (d	thi Cohesion Type	UCS (kPa) G	51 mi C	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface	о Ни Туре	Hu Ru	
	Material Name Residual Waikato Coal Measure Stiff Soil	Color Unit Weight (kN/m3)	Strength Type Mohr-Coulomb	Cohesion P (kPa) (d 5 3	rhi Cohesion reg) Type 30	UCS (kPa)	51 mi E	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface	Hu Type Custom	Hu Ru 1	
	Material Name Residual Waikato Coal Measure Stiff Soil Highly Weathered Waikato Coal Measures Mudstone - Hard Soil	Color Unit Weight (kN/m3) 17.5 18	Strength Type Mohr-Coulomb Mohr-Coulomb	Cohesion         P           (kPa)         (d           5         2           10         2	Phi Cohesion rype 30 30	UCS (kPa) G	51 mi C	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface           Water Surface           Water Surface	<ul> <li>Hu Type</li> <li>Custom</li> </ul>	Hu Ru 1 1	
	Material Name         Residual Waikato Coal Measures Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone	Color         Unit Weight (kN/m3)           17.5         18           20         20	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown	Cohesion P (kPa) (d 5 2 10 2	Phi Cohesion Type 30 30	UCS (kPa) G 2500 3	51 mi C	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom	Hu Ru 1 1 1 1	
	Material Name         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Proposed Managed Fill - Vertical Stress Ratio	Color         Unit Weight (kN/m3)           17.5         18           20         15	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Vertical Stress Ratio	Cohesion         P           (kPa)         (d           5         2           10         2	thi Cohesion rype 30 30	UCS (kPa) G 2500 3	SI mi E	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface Water Surface Water Surface Water Surface None	Hu Type Custom Custom Custom	Hu Ru 1 1 1 1 1 1 1 0.1	
	Material Name         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Proposed Managed Fill - Vertical Stress Ratio         Proposed Structural Bunds - Undrained	Color         Unit Weight (kN/m3)           17.5         18           20         15           18         18	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Vertical Stress Ratio Undrained	Cohesion         P           (kPa)         (d)           5         3           10         3           10         1           150         1	Phi     Cohesion       rgg     Type       30	UCS (kPa) G 2500 3	SI mi C J	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface           Water Surface           Water Surface           Water Surface           None	Hu Type       Custom       Custom       Custom       I	Hu         Ru           1	
	Material Name         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Proposed Managed Fill - Vertical Stress Ratio         Proposed Structural Bunds - Undrained         100       150	Color         Unit Weight (kN/m3)           17.5         18           20         15           18         18	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Vertical Stress Ratio Undrained	Cohesion         P           (kPa)         (d)           5         2           10         2           150         1	Phi     Cohesion       eg)     Type       30	UCS (kPa) G 2500 3	51 mi E 0 7 C	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface       Water Surface       Water Surface       Water Surface       Water Surface       None       None	Hu Type Custom Custom Custom	Hu         Ru           1	
	Material Name         Residual Waikato Coal Measures Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Proposed Managed Fill - Vertical Stress Ratio         Proposed Structural Bunds - Undrained         100       150         Project	Color         Unit Weight (kN/m3)           17.5         18           20         15           18         18	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Vertical Stress Ratio Undrained 200 Huntly Quarry -	Cohesion P (kPa) d 5 3 10 3 150 1 150 1	thi Cohesion eg) Type 30 30 Constant 250 Sposal Si	UCS (kPa) 3 2500 3 2500 1 1	51 mi E	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface         Water Surface         Water Surface         Water Surface         None         None	Hu Type Custom Custom Custom 350	Hu Ru 1 1 1 1 1 1 0.1 0.1	
GAI	Material Name         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Proposed Managed Fill - Vertical Stress Ratio         Proposed Managed Fill - Vertical Stress Ratio         Proposed Structural Bunds - Undrained         100       150         Project         Analysis Description	Color         Unit Weight (kN/m3)           17.5         18           20         15           18         18           19         18           Fill Site 2 -         10	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Vertical Stress Ratio Undrained 200 Huntly Quarry - Cross Section 1,	Cohesion P (kPa) (d 5 2 10 2 150 1 Fill Dis Propose	thi Cohesion Type 30 20 20 20 20 20 20 20 20 20 20 20 20 20	UCS (kPa) G 2500 3 2500 3 1 1 1 1 1	51 mi E 0 7 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface         Water Surface         Water Surface         Water Surface         None         None	Hu Type Custom Custom Custom 350	Hu         Ru           1	
Contraction of the second seco	Material Name         Material Name         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Proposed Managed Fill - Vertical Stress Ratio         Proposed Structural Bunds - Undrained         100       150         Project         Analysis Description         Drawn By       MK	Color         Unit Weight (kN/m3)           17.5         18           20         15           13         18           14         18           15         18           16         18           17.5         18           17.5         18           18         18           18         18           5         18           5         5           5         5           5         5	Strength Type Mohr-Coulomb Generalized Hoek-Brown Vertical Stress Ratio Undrained 200 Huntly Quarry - Cross Section 1, 1:1500	Cohesion P (kPa) d 5 = 10 = 150 150 Fill Dis Propose Company	thi Cohesion eg) Type 30 30 Constant 250 constant sposal Si cd Fill - Se	UCS (kPa) G 2500 3 2500 3 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	si mi c 0 7 0 1	Vertical Strength Ratio	Minimum Shear Strength (kPa)	Water Surface Water Surface Water Surface Water Surface Water Surface None None Ltd.	Hu Type Custom Custom Custom 350	Hu         Ru           1	

	1.022			Results Bishop simplified Search Method:Auto Refi Divisions along slope:50 Circles per division:10 Number of iterations:5 Divisions to use in next it Number of vertices per su Minimum Belevation:Not Defin Minimum Weight:Not Defin Minimum Weight:Not Defin Minimum Weight:Not Defin Surface Endpoin Right Slip Surface Endpoin Right Slip Surface Endpoin	ne Search eration:50º Irface:12 edined d ned 25.871 t: 82.743, int: 241.56	% 70.716 0,110.319 → ↔								
	Material Name	Color	Unit Weight	Strength Type	Cohesion (kPa)	Phi Cohesion	UCS (kPa)	GSI	mi D	Vertical Strength	Ainimum Shear Strength (kPa)	Water Surface	Hu Type Hu	Ru
	Residual Waikato Coal Measure Stiff Soil		17.5	Mohr-Coulomb	5	30	, -/			Ratio		Water Surface	Custom 1	
	Highly Weathered Waikato Coal Measures Mudstone - Hard Soil		18	Mohr-Coulomb	10	30				+		Water Surface	Custom 1	-
	Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone		20	Generalized Hoek-Brown			2500	30	7 0			Water Surface	Custom 1	
	Proposed Managed Fill - Vertical Stress Ratio		15	Vertical Stress Ratio						0.22	35	None		0.1
	Proposed Structural Bunds - Undrained		18	Undrained	150	Constant						None		0.1
	· · · · · · · · · · · · · · · · · · ·							1						
0 50	100150			200		250				300			350	
GAI	Analysis Description	Fil	l Sito 7	Huntly Quarry	- Fill		Sites	S	od (	<b>`</b> ase				
	Drawn By	1.11	Scale	1,1500	Com	pany	Jilu	all			nainaa			
ENGINE	ERS	0		1:1200	File	Name		<b></b>	C'1.		ingineers		-1	
SLIDEINTERPRET 8.021	Oct 201	9			1 1/2	iunic		Fill :	Site	2 - Cono	cept Stab	olity Calcs.	simd	

50 100 150 200	Results Bishop simplified Search Method:Auto Refine Search Divisions along slope:50 Circles per division:10 Number of iteration:50 Divisions to use in next iteration:50% Aumber of vertices per surface:12 Minimum Revation:Not Defined Minimum Verght:Not Defined Minimum Weight:Not Defined Minimum Weight:Not Defined 1.509 Rot of Safety: 1.505 Avis Location: 550.762, 128.258 Left Slip Surface Endpoint: 551.841, 96.099 Right Slip Surface Endpoint: 576.205, 108.559									1.505
	Material Name	Color Unit Weight	Strength Tupo	Cohesion Phi	UCS	SI mi	D. Water Surface	Hu Tuno	Hu	
	Material Name Existing Historic Mining Fill	Color Unit Weight (kN/m3)	Strength Type Mohr-Coulomb	Cohesion Phi (kPa) (deg	UCS (kPa)	iSI mi	D Water Surface	Hu Type	Hu	
	Material Name Existing Historic Mining Fill Residual Waikato Coal Measure Stiff Soil	Color     Unit Weight (kN/m3)       1     18       1     17.5	Strength Type Mohr-Coulomb Mohr-Coulomb	Cohesion (kPa)         Phi (deg 30           3         30           5         30	UCS (kPa)	iSI mi	D Water Surface Water Surface Water Surface	Hu Type Custom Custom	Hu 1	
	Material Name Existing Historic Mining Fill Residual Waikato Coal Measure Stiff Soil Highly Weathered Waikato Coal Measures Mudstone - Hard Soil	Color         Unit Weight (kN/m3)           1         18           1         17.5           1         18	Strength Type Mohr-Coulomb Mohr-Coulomb Mohr-Coulomb	Cohesion (kPa)         Phi (deg)           3         30           5         30           10         30	UCS (kPa) G	iSI mi	D Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom	Hu 1 1 1	
	Material Name Existing Historic Mining Fill Residual Waikato Coal Measure Stiff Soil Highly Weathered Waikato Coal Measures Mudstone - Hard Soil Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone	Color     Unit Weight (kN/m3)       Image: Color in the second sec	Strength Type Mohr-Coulomb Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown	Cohesion (kPa)         Phi (deg)           3         30           5         30           10         30	UCS (kPa) G (kPa) G 	<ul> <li>isi mi</li> <li>i</li> <li>i<!--</th--><th>D     Water Surface       Water Surface     Water Surface       Water Surface     Water Surface       Water Surface     Water Surface</th><th>Hu Type Custom Custom Custom Custom</th><th>Hu 1 1 1 1</th><th></th></li></ul>	D     Water Surface       Water Surface     Water Surface       Water Surface     Water Surface       Water Surface     Water Surface	Hu Type Custom Custom Custom Custom	Hu 1 1 1 1	
	Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone	ColorUnit Weight (kN/m3)Image: Color18Image: Color17.5Image: Color18Image: Color18Image: Color20	Strength Type Mohr-Coulomb Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown	Cohesion (kPa)         Phi (deg)           3         30           5         30           10         30           10         30	UCS (kPa) G	351 mi 	D     Water Surface       Water Surface     Water Surface       Water Surface     Water Surface       0     Water Surface	Hu Type Custom Custom Custom	Hu 1 1 1	
	Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         150       200         250	Color     Unit Weight (kN/m3)       Image: Color (kn/m3)     18       Image: Color (kn/m3)     18       Image: Color (kn/m3)     18       Image: Color (kn/m3)     20	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown	Cohesion (kPa)         Phi (deg)           3         30           5         30           10         30	UCS (kPa) G	450 mi	D Water Surface Water Surface Water Surface 0 Water Surface 0 Water Surface	Hu Type Custom Custom Custom Custom 500	Hu 1 1 1 1	
<sup>e</sup> <sup>e</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup> <sup>o</sup>	Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measures Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         150       200       250         Project         Analysis Description	Color       Unit Weight (kN/m3)         18       18         19       17.5         10       18         20       20         300       Huntly         Site 3, Cross Set	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown 350 Quarry - Fill Dis ection 1, Existing S	Cohesion (kPa)       Phi (deg         3       30         5       30         10       30         10       30         400       30         sposal Site         Slope - Mas	UCS (KPa) G 2500 3 2500 3 2500 3 S ter Sce	isi mi 	D Water Surface Water Surface Water Surface 0 Water Surface 0 Water Surface	Hu Type Custom Custom Custom Custom SOO	Hu 1 1 1 1	
0 0 0 0 0 0 0 0 0 0 0 0 0 0	Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Highly Weathered Waikato Coal Measures Mudstone - Hard Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         150 200 250         Project         Analysis Description         Fill S         Drawn By         MK	Color       Unit Weight (kN/m3)         18       18         10       17.5         18       20         300       Huntly         Site 3, Cross Set       Scale         Scale       1:22	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Generalized Hoek-Brown	Cohesion (kPa)     Phi (deg 3       3     30       5     30       10     30       10     30       400       sposal Site       Slope - Mas	UCS (kPa) G 2500 3 2500 3	isi mi 	D Water Surface Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom Custom 500	Hu 1 1 1 1	

0 100 150 200 200		Results Bishop simplified Search Method:Auto Refine Search Divisions along slope:50 Wimber of iterations:5 Divisions to use in next iteration:50% Number of vertices per surface:12 Minimum Flevation:Not Defined Minimum Area:Not Defined Minimum Area:Not Defined Minimum Area:Not Defined Minimum Area:Not Defined Minimum Area:Not Defined Minimum Area:Not Defined Every available surface 1.356 Factor of Safety: 1.356 Axis Location: 524.5141, 4for.919 Left Slip Surface Endpoint: 579.384, 10 Minimum Surface Endpoint: 579.384, 10 Minimum Area:Not Safety Safet	7.640 109.264									1.35	56	
2														
0		Material Name	Color U	nit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Anisotropic Function	UCS (kPa)	GSI	mi D	Water Surface	Ни Туре	Hu
0		Material Name Existing Historic Mining Fill	Color U	nit Weight (kN/m3) 18	Strength Type Mohr-Coulomb	Cohesion (kPa) 3	Phi (deg) 30	Anisotropic Function	UCS (kPa)	GSI	mi D	Water Surface	Hu Type Custom	<b>Hu</b> 1
- 2 		Material Name Existing Historic Mining Fill Residual Waikato Coal Measure Stiff Soil	Color V	Init Weight (kN/m3) 18 17.5	Strength Type Mohr-Coulomb Mohr-Coulomb	Cohesion (kPa) 3 5	Phi (deg)	Anisotropic Function	UCS (kPa)	GSI	mi D	Water Surface Water Surface Water Surface	Hu Type Custom Custom	Hu 1 1
- 2 		Material Name           Existing Historic Mining Fill           Residual Waikato Coal Measure Stiff Soil           Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstoned	color U III Ne	Init Weight (kN/m3) 18 17.5 20	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown	Cohesion (kPa) 3 5	Phi (deg) 30 30	Anisotropic Function	UCS (kPa) 2500	<b>GSI</b> 30	mi D 7 0	Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom	Hu 1 1 1
20		Material Name           Existing Historic Mining Fill           Residual Waikato Coal Measure Stiff Soil           Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone           Waikato Coal Measures Bedding Parallel Shears	Color U Color U ne III I Ne IIII I NE III I NE IIIII I NE III I NE III I NE III I NE III I NE III I NE II	nit Weight (kN/m3) 18 17.5 20 20	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Anisotropic function	Cohesion (kPa) 3 5	Phi (deg)	Anisotropic Function	UCS (kPa) 2500	<b>GSI</b> 30	mi D 7 0	Water Surface Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom Custom	Hu 1 1 1 1
		Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Waikato Coal Measures Bedding Parallel Shears         100       150       200       23         Project	Color         U           ■         ■           ne         ■           ■         ■           1         ■ </td <td>nit Weight (kN/m3) 18 17.5 20 20 20</td> <td>Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Anisotropic function</td> <td>Cohesion (kPa) 3 5</td> <td>Phi (deg)           30           30           400</td> <td>Anisotropic Function</td> <td>UCS (kPa)</td> <td><b>GSI</b> 30</td> <td>mi D 7 0 500</td> <td>Water Surface Water Surface Water Surface Water Surface</td> <td>Hu Type Custom Custom Custom Custom 550</td> <td>Hu 1 1 1</td>	nit Weight (kN/m3) 18 17.5 20 20 20	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Anisotropic function	Cohesion (kPa) 3 5	Phi (deg)           30           30           400	Anisotropic Function	UCS (kPa)	<b>GSI</b> 30	mi D 7 0 500	Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom Custom 550	Hu 1 1 1
		Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Waikato Coal Measures Bedding Parallel Shears         100       150       200       23         Project         Instruction Description	Color U ■ 10 10 10 10 10 10 10 10 10 10	nit Weight (kN/m3) 18 17.5 20 20 20 20 20 20	Strength Type Mohr-Coulomb Generalized Hoek-Brown Anisotropic function 4.000000000000000000000000000000000000	Cohesion (kPa) 3 5	Phi (deg)	Anisotropic Function	UCS (kPa)	<b>GSI</b> 30	mi D 7 0 500	Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom Custom 550	Hu 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
	0 50 GA	Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudston         Waikato Coal Measures Bedding Parallel Shears         100       150       200       2:         Index       Project         Analysis Description	color U e Ne S	nit Weight (kN/m3) 18 17.5 20 20 20 20 20 20 20 20 20 20 20 20 20	Strength Type Mohr-Coulomb Generalized Hoek-Brown Anisotropic function 4	Cohesion (kPa) 3 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Phi (deg) 30 30 400 tability	Anisotropic Function	UCS (kPa)	GSI 30	mi D 7 0 500	Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom Custom 550	Hu 1 1 1 1 1 1 1 1
	0 50 GA	Material Name         Existing Historic Mining Fill         Residual Waikato Coal Measure Stiff Soil         Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone         Waikato Coal Measures Bedding Parallel Shears         100       150       200       24         100       150       200       24         IANA       Analysis Description       Drawn By       Drawn By	Color U ■ 10 10 10 10 10 10 10 10 10 10	nit Weight (kN/m3) 18 17.5 20 20 20 20 20 20 20 20 20 20 20 20 20	Strength Type Mohr-Coulomb Mohr-Coulomb Generalized Hoek-Brown Anisotropic function Anisotropic function	Cohesion (kPa) 3 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Phi (deg) 30 30 30 wc 400 tability rallel She	Anisotropic Function	UCS (kPa)	GSI 30	mi D 7 0 500	Water Surface Water Surface Water Surface Water Surface	Hu Type Custom Custom Custom Custom	Hu 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1


















50 1.150 Results Bishop simplified Search Method:Auto Refine Search Divisions along slope:50 Circles per division:10 Number of iterations:5 Divisions to use in next iteration:50% Number of vertices per surface:12 90 Minimum Elevation:Not Defined Minimum Depth:Not Defined Minimum Area:Not Defined Minimum Weight:Not Defined Every available surface 1.150 Factor of Safety: 1.150 Axis Location: 230.634, 137.661 Left Slip Surface Endpoint: 204.521, 76.000 Right Slip Surface Endpoint: 283.652, 96.757 W 50 Vertical UCS Unit Weight Cohesion Phi Cohesion linimum Shear Material Name Color Strength Type Strength Water Surface Hu Type Hu Ru GSI mi (kN/m3) (kPa) (deg) Туре (kPa) Strength (kPa) Ratio Existing Historic Mining Fill 18 Mohr-Coulomb 3 30 Water Surface Custom 0 17.5 5 30 Residual Waikato Coal Measure Stiff Soil Mohr-Coulomb Water Surface Custom 1 30 Highly Weathered Waikato Coal Measures Mudstone - Hard Soil 18 Mohr-Coulomb 10 Water Surface Custom 2500 30 7 0 Moderately to Slightly Weathered Waikato Coal Measures - Very Weak Mudstone 20 Generalized Hoek-Brown Water Surface Custom 0.1 18 150 Proposed Structural Bund - Undrained Undrained Constant None 0.1 0.22 Proposed Managed Fill - Vertical Stress Ratio 15 Vertical Stress Ratio 35 None 250 300 50 100 150 200 350 0 Project Huntly Quarry - Fill Disposal Sites Analysis Description Fill Site 3 - Cross Section 2, Proposed Fill - Undrained Case Drawn By Scale Company ENGINEERS MK 1:1500 Gaia Engineers Date File Name Oct 2019 Fill Site 3 Cross Section 2.slmd











