



**K201046-1a**  
**10 August 2021**

**GEOTECHNICAL FEASIBILITY REPORT**  
**FUTURE RESIDENTIAL DEVELOPMENT THROUGH THE PROPOSED**  
**ZONE CHANGE PROPOSAL**  
**57 SCHNAPPER ROCK ROAD**  
**SCHNAPPER ROCK**

**Prepared For:**

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**KGA Geotechnical Group Limited**  
***Supporting the Construction Industry since 1990***

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## REPORT ISSUE AUTHORISATION

**Geotechnical Feasibility Report**  
**Future Residential Development Through The Proposed Zone Change Proposal**  
**57 Schnapper Rock Road**  
**Schnapper Rock**

**Prepared by:**



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### Attachments:

Sheet KGA 1	Site Plan
Sheet KGA 2	Development Zonation Plan

## **1. INTRODUCTION**

At the instruction of KBS Design Group Limited as our client, KGA Geotechnical Group Limited has carried out a feasibility investigation and assessment at 57 Schnapper Rock Road, Schnapper Rock, hereinafter referred to as the site. The scope of our assessment was to conduct a detailed site walkover inspection and investigate the subsurface conditions in specific locations using hand-operated equipment. This information has been used to provide an indication of the general ground conditions on-site, assess the feasibility of the site for future development and a zoning (plan) change, and provide preliminary development comments.

We highlight that this report has been prepared solely as a feasibility assessment, and in support of a proposed zoning (plan) change. This report is not considered suitable to support a Resource Consent application, and it should be understood that further investigation and assessment would be required to support a Resource Consent application.

## **2. SITE DESCRIPTION**

### **2.1 General Site Description**

The site is legally described as SECT 2 SO 555200 and is irregular in plan shape, with a total area of 3.9889ha. The site is located on the southeastern and southern side of Schnapper Rock Road and is bounded by large Lot residential properties to the southwest and southeast, and a storage yard for Pipeline and Civil Limited to the northeast as 57a Schnapper Rock Road. At the time of preparing this report, a portion of the site, approximately 20m back from the eastern site boundary is currently occupied by an earthwork development and is fenced off.

### **2.2 Topographic and Geomorphic Description**

As indicated on our site plan attached as Sheet KGA 1, the site topography is typically characterised by a south trending gully through the western portion of the site (Image 1), and a south trending overland flow path within the southern corner of the site. The side slopes of the western gully typically range in gradient between 1V:3H and 1V:4H, with an area of over steepened ground up to 1V:1.5H, near where the gully intercepts the western site boundary.

The ground within the southern corner of the site, surrounding the overland flow path typically falls with southerly aspect at gradients of between 1V:3H and 1V:6H.

There is also a broad gully present within the neighbouring property to the east at 55 Schnapper Rock Road. Within a portion of this gully is a large head scarp, which extends right up to the northeastern site boundary, over a length of approximately 70m. This head scarp is currently densely vegetated. The area directly upslope of the head scarp is currently being earth worked as part of the adjacent development; with a number of clay stockpiles present (Image 2).

The remainder of the site away from the above features (central and northern portions) generally comprises gently sloping to near level ground (Image 3 & 4).



**Image 1 (Top Left). Head of Western Gully looking North. Image 2 (Top Right) Vegetated Head Scarp along the eastern site boundary, with earthworks upslope looking Northeast. Images 3 and 4 (Bottom) Gently sloping ground within the central and northern portion of the site.**

### 3. PROPOSED DEVELOPMENT

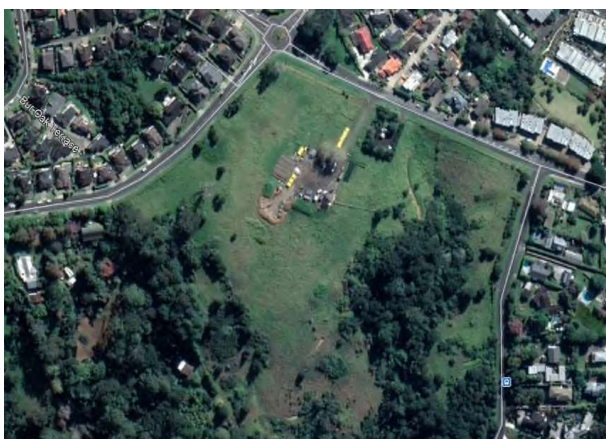
In carrying out this assessment, we have not been provided with a conceptual plan showing the proposed development. However, we have been informed that the future development will comprise the formation of a new residential subdivision. This subdivision will comprise a combination of mixed housing suburban, and single house zone Lots accessed from Schnapper Rock Road to the west.

At this stage, we have not been provided with any plans indicating proposed earthworks. However, based on the current site topography, we envision that some cut to fill earthworks would be required to form the finished Lot and road gradients.

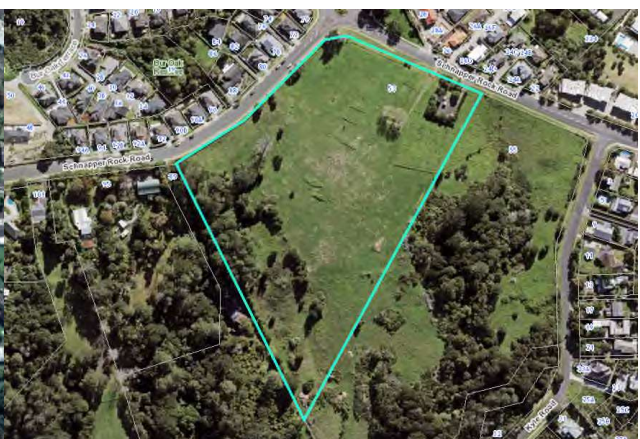
### 4. DESKTOP STUDY

#### 4.1 Historic Imagery

As part of our assessment, we have carried out a review of publically available data to identify any significant land changes since 1963. From our review of relevant historic aerial imagery, no significant land changes have occurred prior to 2019, apart from the removal of vegetation (notably a shelterbelt of trees through the central portion of the site) and the current earth worked area within the northeastern corner, and eastern portion of the site (not shown on the aerial imagery).



**Image 5. 2019**

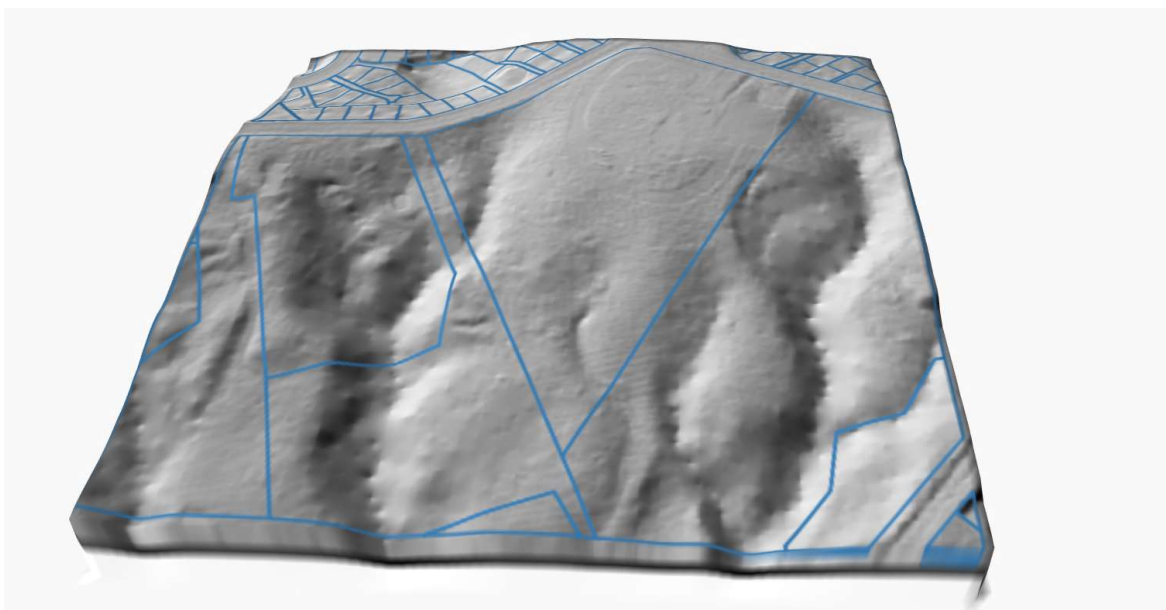


**Image 6. 2017**

**Image 7. 1996****Image 8. 1963**

## 4.2 GIS Interpretation

We have also carried out an interpretation of the freely available GIS information sourced from Land Information New Zealand (LINZ). Our interpretation of the GIS information generally confirmed our on-site observations. In particular, the data helped to confirm the presence and location of the large head scarp within the neighbouring property at 55 Schnapper Rock Road, which was largely covered by dense vegetation. A 3D perspective of the site using a hillshader algorithm applied to the Digital Elevation Model (DEM) of the site from the freely available LINZ data is presented in Image 9 below for perspective. The headscarp can be seen towards the top right corner, just past the site boundary.

**Image 9. 3D Perspective of the site elevations (data from LINZ). Looking from South to North**

### 4.3 Geologic Map

The geology of the site and surrounding area is given on the Geological Map of New Zealand, GNS Web Map, Scale 1:250,000 (Image 10 below). This shows the wider area around the site to be generally underlain by mudstone and graded sandstone of the East Coast Bays Formation, a subgroup of the Waitemata Group deposits.

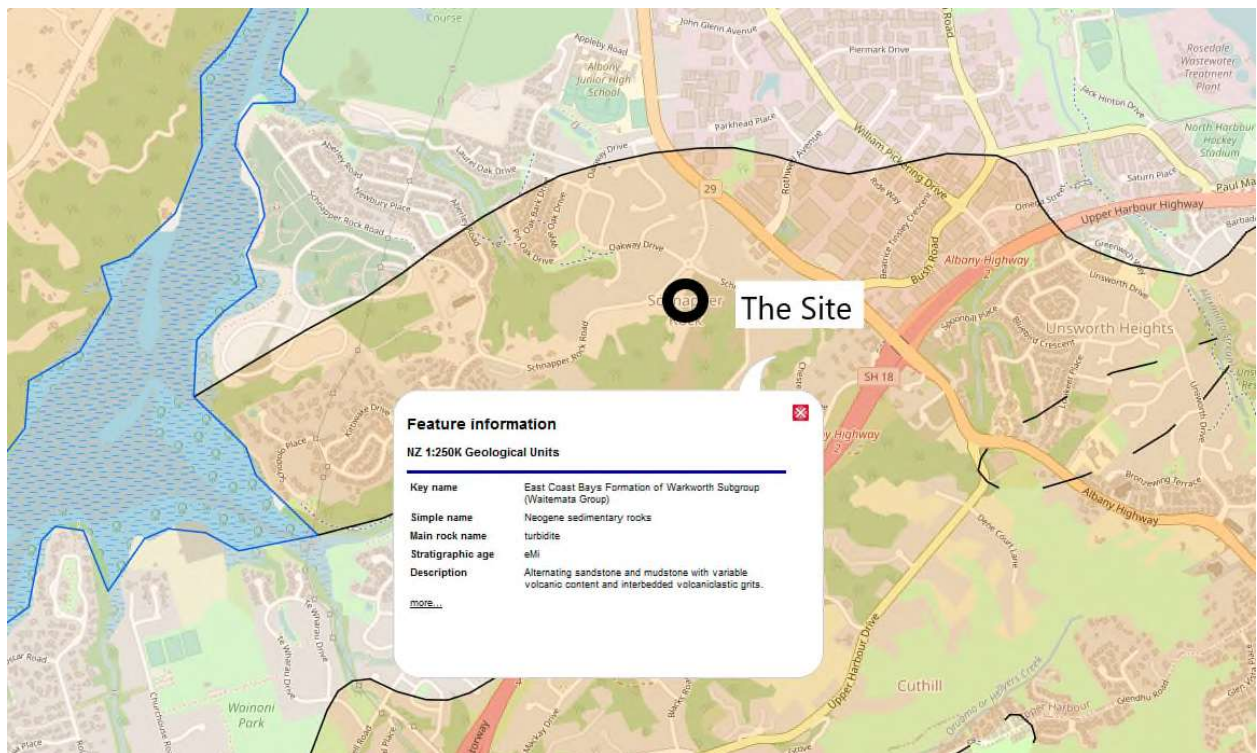


Image 10. Except from GNS Web Map (1:250,000 Scale)



## 5. FIELD EXPLORATION

To confirm the findings of our desktop study, the subsurface conditions on site were explored by drilling eight hand auger boreholes, designated AH1 to AH8 between the 5 and 11 of November 2020. The approximate borehole locations are shown on our attached site plan, Sheet KGA 1. The borehole locations were selected to provide a general indication of the subsurface ground conditions across site.

The subsurface conditions encountered during drilling were logged in general accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes', December 2005 as outlined by the NZ Geotechnical Society. All boreholes were designated to be drilled to a target depth of 5.0m below present ground level, or until effective refusal, whichever being encountered first.

A calibrated shear vane, used in accordance with New Zealand Geotechnical Society Guideline for Hand Held Shear Vane Test, 2001 was used at regular depths in the drilled holes to measure soil strengths, both in situ and remoulded. The vane shear strengths shown on the attached logs have been corrected in terms of BS 1377:1990.

Scala penetrometer testing was undertaken through the base of each borehole to establishing a general indication of soil resistance for a further 2m beyond the base of each borehole, or until effective refusal was encountered, whichever being encountered first.

The site was subsequently revisited on 12 November 2020 in order to check for standing groundwater within the boreholes after the effects of drilling had dissipated. Where encountered, the measured depths to standing groundwater level are marked on the relevant borehole logs and included in Table 1 below.

## **6. SUBSURFACE CONDITIONS**

The subsurface ground conditions encountered in the boreholes are summarised below and in Table 1. For a full detailed description of the materials encountered, reference should be made to the attached borehole logs. We wish to point out that, in order to generate a subsurface model of the site, the subsoil conditions encountered have been inferred between our borehole positions. It must be accepted that soil conditions can and do vary between each borehole location, particularly when the distance between boreholes is great.

### **Topsoil**

A veneer of topsoil was encountered from ground surface in all the boreholes up to a maximum thickness of around 300mm.

### **Fill**

Fill was encountered in AH1 to AH4 down to 0.5m depth. The fill generally comprised clayey silt and silt with varying amounts of gravel and organic material. Measured shear vane strengths generally ranged between 170kPa to greater than 200kPa.

### **Waitemata Group Residual Soils**

Residual soils derived from the in situ weathering of the parent Waitemata Group rock were encountered beneath the topsoil and fill in all the boreholes. The residual soils generally comprised clay silt, silt and silty clay, with occasional fine gravel. Measured shear vane strengths ranged between 60kPa to greater than 200kPa, with typical readings being above 100kPa.

### **Inferred Hard Stratum**

The Scala penetrometer testing conducted from the base of the boreholes encountered effective refusal in all the boreholes, apart from AH6. Refusal is inferred to be the contact with the underlying Waitemata Group Transitional Material.

### **Groundwater**

Groundwater seepage was encountered near surface in all the boreholes on the days of drilling, apart from AH7, where groundwater was not encountered. Groundwater levels were measured again on the 12 November 2020 once the effects of drilling had dissipated. Measured standing groundwater levels are shown in Table 1 below. Groundwater levels do fluctuate seasonally and it must be appreciated that higher groundwater levels may be encountered following periods of prolonged or heavy rainfall.

**Table 1. Summary of Subsurface Information.**

Borehole	Topsoil	Fill	Waitemata Group Residual Soils	Scala Penetrometer Depth	Ground Water Level (12-11-2020)
AH1	0.0 – 0.1	0.1 – 0.4	0.4 – 5.0 *	5.0 – 6.85	0.2
AH2	0.0 – 0.3	0.3 – 0.45	0.45 – 4.6*	4.60 – 5.70	0.0
AH3	0.0 – 0.1	0.1 – 0.4	0.4 – 5.0 *	5.0 – 6.45	0.2
AH4	0.0 – 0.1	0.1 – 0.5	0.5 – 4.8*	4.8 – 6.6	0.8
AH5	0.0 – 0.2	n/a	0.2 – 4.8 *	4.8 – 6.75	0.5
AH6	0.0 – 0.3	n/a	0.3 – 4.8 *	4.8 – 7.0	0.3
AH7	0.0 – 0.1	n/a	0.1 – 4.8*	4.8 – 6.7	Not Encountered
AH8	0.0 – 0.1	n/a	0.1 – 4.6*	4.6 – 6.8	0.75

Note, all depths indicated are in metres,

n/a = material not encountered

\* = end of borehole

## 7. SLOPE STABILITY AND FUTURE DEVELOPMENT.

As part of this assessment, we have carried out a qualitative assessment of the sites stability and general feasibility for future development. Based on our visual assessment undertaken on-site, along with a review of the desktop data, the site has been separated into three zones:

**Zone A:** Zone A comprises the relatively benign portions of the site, which should otherwise generally be suitable for future development, without specific slope stability assessment. Geotechnical investigation and associated considerations will still need to be given to the general formation works in this zone. Future development within these areas would mostly likely comprise conventional shallow foundations.

**Zone B:** Zone B comprises areas which we consider could generally be suitable for future development, providing that further development specific geotechnical investigation, slope stability analysis and design is carried out to prove the viability of building platforms here. These areas typically comprise ground steeper than 1V:4H (where Auckland Council requires quantitative slope stability analysis to be carried out), or areas directly adjacent to the existing overland flow path and western gully watercourse. Future development within these areas could require piled foundations.

**Zone C:** Zone C comprises the area directly upslope of the head scarp feature located along the eastern site boundary. This area would generally not be suitable for future development without specific geotechnical investigation and design, and potentially may not be suitable for intensive development at all. An in-ground palisade wall and/or alternative remedial options would be required to provide for stable building platforms within this area.

An indication of the above areas are provided on our Zoning Plan attached as Drawing KGA 2.

## **8. SITE DEVELOPMENT CONSIDERATIONS**

We have not been provided with any plans indicating the level of earthworks proposed. However, based on the current site topography, we anticipate that cut to fill earthworks would be required to form finished Lot and road gradients. General recommendations and comments for future site development are provided below.

### **8.1 Undercut of Existing Non-Engineered Fill and Surficial Organic Material**

Existing fill was encountered within AH1 to AH5. As this fill is considered to be non-engineered, this would need to be undercut, along with any surficial organic and soft material during the site formation works. Any trees stumps and root masses would also need to be undercut. These may be prevalent in the location of the historic shelterbelt.

The quality and composition of all non-engineered fill material exposed by the site strip work ahead of any bulk filling would need to be inspected by a Geotechnical engineer. Where the existing non-engineered fill is identified as containing unsuitable materials, this would need to be removed from site. Otherwise, this material may potentially be re-worked and incorporated into the bulk filling operations.

## **8.2 Subsoil Drains**

Groundwater was encountered at shallow depths within the majority of boreholes drilled. In areas where filling is proposed, and within the existing overland flow paths, subsoil drainage would be required as part of the earthworks operations. These drains would need to be installed along the existing overland flow path channels, and any other area of seepage encountered during the site strip and discharge into the gully features.

## **8.3 Bulk Earthworks**

Based on the results of our subsurface investigation we consider that the in situ residual soils on site may generally be utilised for the proposed bulk fill earthworks. All earthworks on the site would need to be carried out in accordance with NZS4431:1989 Earth Fill for Residential Development.

In general, it is considered that minimal filling should occur upslope of the western gully, and especially upslope of the existing head scarp along the eastern site boundary.

## **9. FUTURE WORKS**

As mentioned in Section 1, this report has been prepared solely as a feasibility assessment and in support a proposed zoning (plan change). This report is not considered suitable to support a Resource Consent application. Once detailed development plans have been prepared, they must be reviewed by a geotechnical engineer, and further investigation and analysis carried out to support a future consent application.

## 10. LIMITATIONS

The conclusions made in this report are based upon the results of a desktop study, geomorphic site walkover, and hand auger holes spaced about the site as appeared appropriate at the time the field exploration was carried out. We also point out that the holes were extended as deep as reasonably possible with hand operated equipment but they could not and did not penetrate into the underlying slightly weathered materials. We are therefore not able to report on the potential of any deep-seated bedding plane defect or other adverse lithological feature in the underlying parent rock.

This report was prepared in the context defined in Section 1 above and must not be relied upon by any other party other than that for whom it was prepared and the relevant Territorial Authority. It has been compiled with respect to the brief given to us, and must not be relied upon in any other context or recreated for any other purpose.

## REFERENCES

Auckland Council. (2020). *GeoMaps (GIS viewer)*. Retrieved from <https://geomapspublic.aucklandcouncil.govt.nz/viewer/index.html>

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

New Zealand Geotechnical Society. (2001). *Guideline for Hand Held Shear Vane Test.*

New Zealand Geotechnical Society. (2005). *Field description of soil and rock - Guideline for the field classification and description of soil and rock for engineering purposes.*

Standards New Zealand. (1989). *Code of Practice for Earth Fill for Residential Development (NZS 4431: 1989)*. Wellington, NZ: Standards New Zealand.

55 SCHINA

SCHMAPPER ROCK ROAD

FUTURE WATERCARE SITE

HEAD SCARP

APPROXIMATE AREA CURRENTLY OCCUPIED BY OTHERS OR EARTHWORKS

AH1

AH3

AH4

AH5

AH2

AH6

SCHMAPPER ROCK ROAD

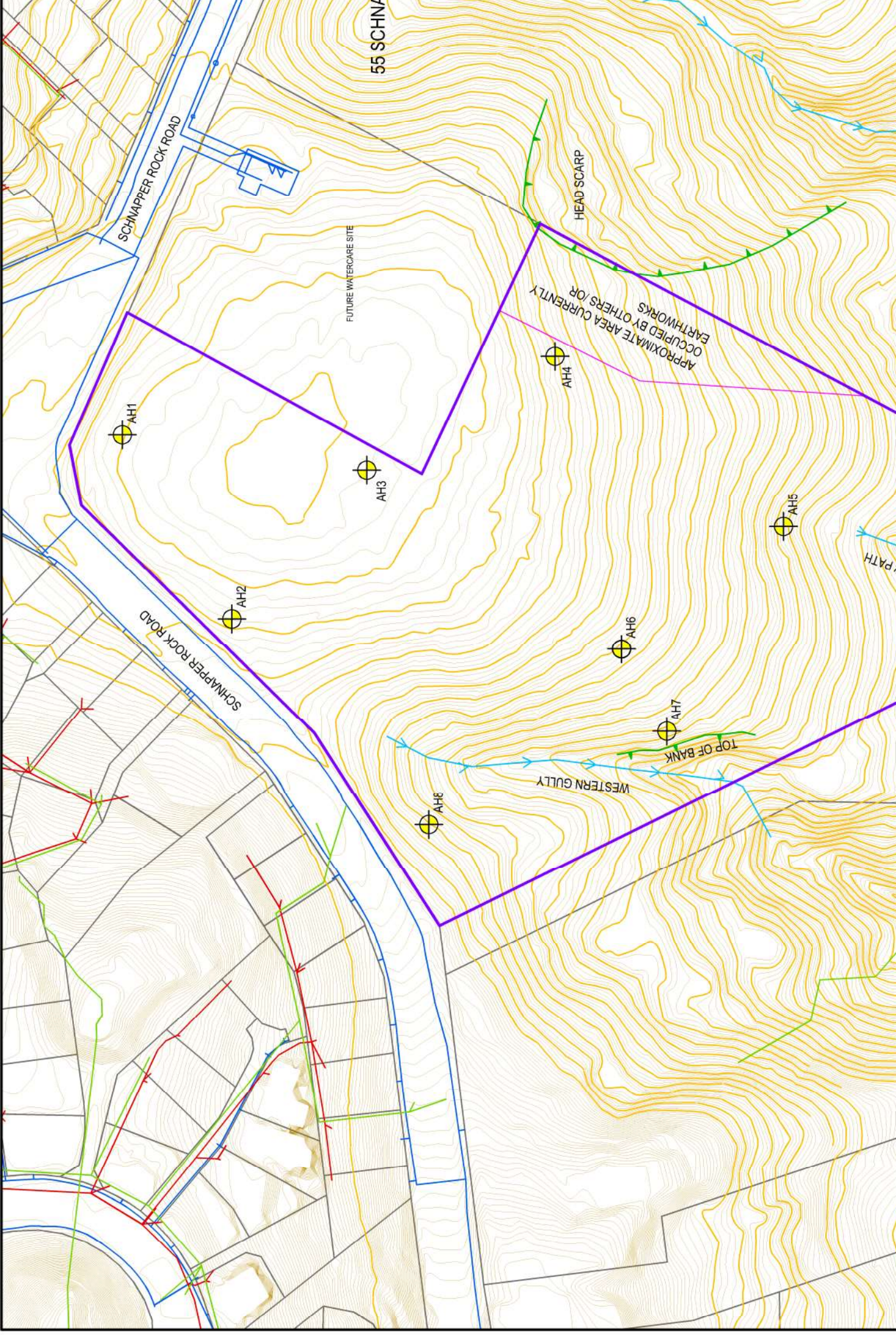
AH7

AH8

WESTERN GULLY

TOP OF BANK

PATH





55 SCHINA

SCHMAPPER ROCK ROAD

FUTURE WATERCARE SITE

HEAD SCARP

AH1

AH3

AH4

AH5

AH2

AH6

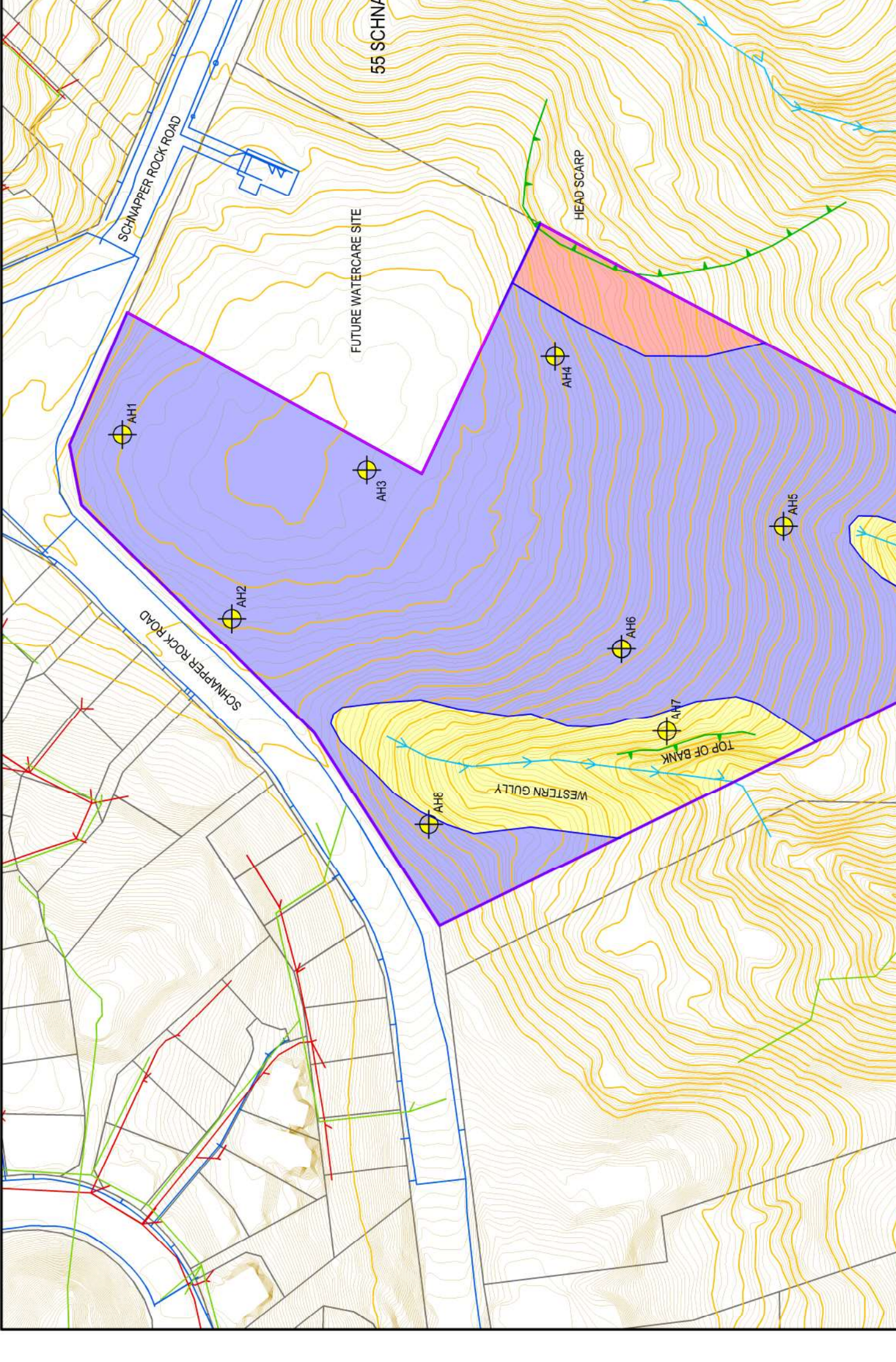
SCHMAPPER ROCK ROAD

TOP OF BANK

WESTERN GULLY

AH8

AH7



# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited

Hole No.: AH1

Project: Geotechnical Investigation

Date: 5/11/2020

Location: 57 Schnapper Rock Road, Schnapper Rock.

Logged By: KT

Coordinates: ,

Ground Level: -

Sheet: 1 of 1

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)				Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows
		TOPSOIL [TOPSOIL]		T							5.05	1.0
		Clayey SILT with trace gravels (medium); light grey and orange. Very stiff; dry, low plasticity. [FILL]	12/11/2020	S							5.10	2.0
				FILL						170	5.15	3.0
										64	5.20	2.0
											5.25	3.0
0.5		CLAY with some silt; orange and light grey. Very stiff; moist, high plasticity. [WAITEMATA GROUP SOILS]									5.30	4.0
										124	5.35	3.0
										45	5.40	4.0
											5.45	6.0
										127	5.50	5.0
										64	5.55	5.0
											5.60	6.0
											5.65	6.0
										146	5.70	6.0
		Clayey SILT; light grey and orange. Very stiff; moist, moderate plasticity. [WAITEMATA GROUP SOILS]								70	5.75	6.0
											5.80	6.0
										143	5.85	6.0
										48	5.90	7.0
											5.95	6.0
											6.00	6.0
										143	6.05	7.0
										48	6.10	7.0
											6.15	7.0
2.0		SILT with trace clay; orange and light brown. Very stiff; dry to moist, no to low plasticity. [WAITEMATA GROUP SOILS]	05/11/2020								6.20	7.0
										165	6.25	8.0
										35	6.30	7.0
											6.35	8.0
										60	6.40	9.0
		SILT with some sand (fine) and trace clay; orange. Stiff; wet, no to low plasticity. [WAITEMATA GROUP SOILS]								40	6.45	8.0
											6.50	8.0
										140	6.55	9.0
										48	6.60	10.0
											6.65	9.0
		Silty CLAY; light grey, mottled orange. Very stiff; wet, moderate to high plasticity. [WAITEMATA GROUP SOILS]								200	6.70	11.0
										64	6.75	10.0
											6.80	12.0
											6.85	11.0
		SILT with some clay; orange, mottled light brown. Very stiff; wet, low plasticity. [WAITEMATA GROUP SOILS]								UTP	-	-
		Clayey SILT; light grey, mottled pinkish orange. Very stiff; dry, low plasticity. [WAITEMATA GROUP SOILS]								UTP	-	-
		SILT with some sand (fine); light grey. Hard; moist to wet, no plasticity. [WAITEMATA GROUP SOILS]								127	48	
											153	41
											143	48
4.5		Clayey SILT; light grey, mottled orange and pinkish orange. Very stiff; dry to moist, low plasticity. [WAITEMATA GROUP SOILS]										
		SILT; pinkish orange. Very stiff; moist to wet, no plasticity. [WAITEMATA GROUP SOILS]										
5.0												

### Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	
▽ Water Level At Time Of Drilling	Vane No.:522	
↔ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited  
 Project: Geotechnical Investigation  
 Location: 57 Schnapper Rock Road, Schnapper Rock.  
 Coordinates: ,

Hole No.: AH2  
 Date: 9/11/2020  
 Logged By: CB  
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)				Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows
		TOPSOIL [TOPSOIL]	▼	TS	TS						4.60	2.0
		Hardfill [FILL]		FIL L	FIL L						4.65	3.0
0.5		Silty CLAY; tan with dark orange and light grey mottling. Very stiff, wet, moderate to high plasticity. [WAITEMATA GROUP SOILS]	12/11/2020								4.70	3.0
											4.75	3.0
											4.80	4.0
											4.85	4.0
											4.90	5.0
											4.95	5.0
											5.00	5.0
										112	5.05	5.0
1.0										44	5.10	4.0
											5.15	4.0
											5.20	5.0
											5.25	5.0
										107	5.30	7.0
										41	5.35	7.0
											5.40	8.0
1.5										137	5.45	10.0
										66	5.50	12.0
											5.55	13.0
										142	5.60	11.0
										58	5.65	10.0
2.0											5.70	10.0
		2.2m - 2.3m: Pink sandy SILT mottling.								192+	-	-
										192+	-	-
2.5										192+	-	-
										192+	-	-
										192+	-	-
3.0										192+	-	-
										192+	-	-
										192+	-	-
3.5										192+	-	-
										192+	-	-
										192+	-	-
4.0										UTP	-	-
										UTP	-	-
		4.1m: Dark orange fine to medium gravels of oxidized silt followed by a colour change to orange.								UTP	-	-
4.5										UTP	-	-

**Notes & Abbreviations**

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited

Hole No.: AH4

Project: Geotechnical Investigation

Date: 9/11/2020

Location: 57 Schnapper Rock Road, Schnapper Rock.

Logged By: KT

Coordinates: ,

Ground Level: -

Sheet: 1 of 1

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)				Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows
0.5		Organic SILT [TOPSOIL]		T S							4.85	2.0
		SILT, some clay; orange and light grey with intermixed topsoil. Very stiff, dry-moist, low plasticity. [FILL]		FILL						200+	4.90	3.0
1.0		Silty CLAY; orange with mottled dark orange. Very stiff, dry-moist, moderate plasticity. [WAITEMATA GROUP]	12/11/2020	Waitemata Group						178	4.95	1.0
		orange and light grey [WAITEMATA GROUP]								64	5.00	2.0
		stiff, saturated [WAITEMATA GROUP]	09/11/2020							191	5.05	2.0
		SILT; light grey with mottled pink and orange. Stiff, saturated, low plasticity [WAITEMATA GROUP]								73	5.10	3.0
		some coarse sand and fine gravels; orange [WAITEMATA GROUP]								95	5.15	4.0
		dark pink [WAITEMATA GROUP]								29	5.20	4.0
		light grey with mottled pink and orange [WAITEMATA GROUP]								95	5.25	4.0
		some medium to coarse sand; orange with some light grey and pink mottles [WAITEMATA GROUP]								124	5.30	5.0
		clayey; light grey with pink and orange mottles, moderate plasticity [WAITEMATA GROUP]								32	5.35	4.0
		some clay [WAITEMATA GROUP]								80	5.40	5.0
2.0		Silty CLAY; light grey and pink. Very stiff, saturated, moderate plasticity. [WAITEMATA GROUP]								111	5.45	5.0
		Coarse sandy SILT with some fine gravel; orange and dark orange. Hard, saturated, low plasticity. [WAITEMATA GROUP]								40	5.50	6.0
								111	5.55	6.0		
								32	5.60	6.0		
								111	5.65	5.0		
								32	5.70	7.0		
								86	5.75	7.0		
								32	5.80	7.0		
								111	5.85	6.0		
								38	5.90	8.0		
4.5										118	6.00	9.0
										45	6.05	8.0
										143	6.10	8.0
										48	6.15	7.0
										140	6.20	8.0
										48	6.25	8.0
										140	6.30	8.0
										48	6.35	8.0
										143	6.40	8.0
										48	6.45	10.0
										140	6.50	11.0
										48	6.55	11.0
										UTP	6.60	10.0

**Notes & Abbreviations**

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited  
 Project: Geotechnical Investigation  
 Location: 57 Schnapper Rock Road, Schnapper Rock.  
 Coordinates: ,

Hole No.: AH5

Date: 11/11/2020

Logged By: CB

Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)				Scala Penetrometer (blows / 50mm)				
						50	100	150	200	Values	Depth (m)	Blows		
0.0		TOPSOIL [TOPSOIL]		TS							4.85	2.0		
0.2		SILT; dark brown with dark grey mottling. Hard, wet, no plasticity. [WAITEMATA GROUP SOILS]	▼	WAITEMATA GROUP SOILS						UTP	4.90	2.0		
0.4			12/11/2020									-	4.95	2.0
0.6			11/11/2020									-	5.00	2.0
0.8												200+	5.05	2.0
1.0		Clayey SILT; dark brownish grey with tan mottling. Hard, wet, moderate plasticity. [WAITEMATA GROUP SOILS]										-	5.10	3.0
1.2												-	5.15	3.0
1.4												200+	5.20	3.0
1.6												-	5.25	4.0
1.8												177	5.30	4.0
2.0		SILT with some clay; light grey with tan mottling. Very stiff, saturated, low plasticity. [WAITEMATA GROUP SOILS]										119	5.35	4.0
2.2												-	5.40	5.0
2.4												164	5.45	5.0
2.6												93	5.50	6.0
2.8												-	5.55	6.0
3.0												164	5.60	6.0
3.2												87	5.65	6.0
3.4												-	5.70	7.0
3.6												158	5.75	8.0
3.8										87	5.80	7.0		
4.0		Clayey SILT; orange with light grey mottling. Very stiff, saturated, low to moderate plasticity. [WAITEMATA GROUP SOILS]								158	5.85	6.0		
4.2										-	5.90	8.0		
4.4		SILT; pink. Very stiff, saturated, no plasticity. [WAITEMATA GROUP SOILS]								87	5.95	8.0		
4.6										-	6.00	8.0		
4.8										145	6.05	8.0		
5.0										84	6.10	9.0		
5.2										-	6.15	9.0		
5.4										155	6.20	10.0		
5.6										84	6.25	9.0		
5.8										-	6.30	10.0		
6.0										84	6.35	9.0		
6.2										164	6.40	9.0		
6.4										90	6.45	10.0		
6.6										-	6.50	8.0		
6.8										177	6.55	8.0		
7.0										96	6.60	10.0		
7.2										-	6.65	11.0		
7.4										148	6.70	11.0		
7.6										87	6.75	16.0		
7.8										-				
8.0										148				
8.2										93				
8.4										142				
8.6										100				
8.8										135				
9.0										48				
9.2										155				
9.4										93				
9.6										148				
9.8										87				

**Notes & Abbreviations**

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	
▽ Water Level At Time Of Drilling	Vane No.:522	
↶ Out Flow ↷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited  
 Project: Geotechnical Investigation  
 Location: 57 Schnapper Rock Road, Schnapper Rock.  
 Coordinates: ,

Hole No.: AH6  
 Date: 11/11/2020  
 Logged By: CB  
 Sheet: 1 of 1

Ground Level: -

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)				Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows
0.5  1.0  1.5  2.0  2.5  3.0  3.5  4.0  4.5		Organic SILT [TOPSOIL]		TS							4.85	2.0
		Clayey SILT; orange with light grey and black specks. Very stiff, saturated, moderate plasticity. [WAITEMATA GROUP]	11/11/2020							164	4.90	2.0
		CLAY, some silt; orange with light grey and light brown streaks. Very stiff, saturated, high plasticity. [WAITEMATA GROUP]								42	4.95	3.0
										171	5.00	3.0
		silty, trace fine sand, moderate to high plasticity [WAITEMATA GROUP]								89	5.05	5.0
										178	5.10	4.0
		some silt; light grey with light pink streaks, high plasticity [WAITEMATA GROUP]								95	5.15	5.0
										178	5.20	5.0
		SILT, some fine sand and clay; bright orange with light grey specks. Very stiff, saturated, low plasticity [WAITEMATA GROUP]								95	5.25	5.0
										184	5.30	3.0
		light grey with some pink and tan mottling [WAITEMATA GROUP]								110	5.35	4.0
										110	5.40	5.0
		some coarse sand; light pink with some orange mottles [WAITEMATA GROUP]								200+	5.45	4.0
										124	5.50	5.0
		light grey with light pink mottles [WAITEMATA GROUP]								124	5.55	6.0
										124	5.60	6.0
		light pink with some light grey streaks [WAITEMATA GROUP]								156	5.65	6.0
										69	5.70	7.0
		orange and pink [WAITEMATA GROUP]								124	5.75	7.0
										71	5.80	7.0
	light grey with some tan and pink mottles [WAITEMATA GROUP]								71	5.85	7.0	
									129	5.90	7.0	
									82	5.95	5.0	
									142	6.00	5.0	
									62	6.05	7.0	
									77	6.10	7.0	
									77	6.15	7.0	
									124	6.20	7.0	
									71	6.25	7.0	
									71	6.30	8.0	
									71	6.35	8.0	
									129	6.40	8.0	
									82	6.45	7.0	
									82	6.50	6.0	
									142	6.55	5.0	
									62	6.60	6.0	
									62	6.65	6.0	
									138	6.70	7.0	
									77	6.75	6.0	
									77	6.80	7.0	
									138	6.85	7.0	
									74	6.90	8.0	
									74	6.95	5.0	
									152	7.00	5.0	
									85			
									177			
									94			
									179			
									99			
									194			
									105			

**Notes & Abbreviations**

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	
▽ Water Level At Time Of Drilling	Vane No.: 1984	
↔ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited

Hole No.: AH7

Project: Geotechnical Investigation

Date: 11/11/2020

Location: 57 Schnapper Rock Road, Schnapper Rock.

Logged By: JW

Coordinates: ,

Ground Level: -

Sheet: 1 of 1

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)				Scala Penetrometer (blows / 50mm)		
						50	100	150	200	Values	Depth (m)	Blows
0.5		Organic Silt [TOPSOIL]	Groundwater Not Encountered	Waitemata Group							4.85	2.0
		Clayey silt; light brown and orange. Hard, dry, low to moderate plasticity [WAITEMATA GROUP]				200+		4.90	2.0			
							4.95	2.0				
							5.00	2.0				
							5.05	2.0				
		minor clay; orange with light grey streaks and specks, low plasticity [WAITEMATA GROUP]						5.10	2.0			
								5.15	3.0			
								5.20	3.0			
								5.25	3.0			
								5.30	3.0			
		trace sand; orange with light grey specks, very stiff [WAITEMATA GROUP]						124	5.35	3.0		
								27	5.40	3.0		
									5.45	3.0		
								124	5.50	3.0		
								35	5.55	4.0		
									5.60	4.0		
		mottled dark orange with some limonitic gravels, dry-moist [WAITEMATA GROUP]						192	5.65	4.0		
								48	5.70	4.0		
		minor clay, and fine sand; light grey, hard, moist [WAITEMATA GROUP]							5.75	4.0		
								192	5.85	3.0		
								82	5.90	3.0		
		light pink streaks, very stiff [WAITEMATA GROUP]							6.00	3.0		
								179	6.10	5.0		
								82	6.15	7.0		
						6.20	8.0					
						6.25	8.0					
		orange [WAITEMATA GROUP]			137	6.30	5.0					
					39	6.35	5.0					
						6.40	4.0					
						6.45	4.0					
						6.50	6.0					
						6.55	6.0					
		Silty CLAY; light grey and orange. Very stiff, moist, moderate plasticity [WAITEMATA GROUP]				6.60	8.0					
					151	6.65	16.0					
		SILT, some clay; light grey with light pink streaks. Very stiff, moist, low-moderate plasticity [WAITEMATA GROUP]				6.60	8.0					
					66	6.70	20.0					
		Clayey, moderate plasticity [WAITEMATA GROUP]				151						
						36						
		some fine sand and trace clay; orange, dry, low plasticity [WAITEMATA GROUP]				148						
						65						
						200+						
						59						
						165						
						68						
		light grey and orange, hard [WAITEMATA GROUP]				UTP						
						-						
		light grey [WAITEMATA GROUP]				UTP						
						-						

**Notes & Abbreviations**

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
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# HAND AUGER LOG

Job No.: K200880

Client: Snapper Trap Investments Limited

Hole No.: AH8

Project: Geotechnical Investigation

Date: 5/11/2020

Location: 57 Schnapper Rock Road, Schnapper Rock.

Logged By: KT

Coordinates: ,

Ground Level: -

Sheet: 1 of 1

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)				Scala Penetrometer (blows / 50mm)				
						50	100	150	200	Values	Depth (m)	Blows		
		TOPSOIL [TOPSOIL]		T S							4.65	1.0		
		Silty CLAY; brown, mottled orange with intermixed topsoil. Very stiff; moist, low to moderate plasticity. [WAITEMATA GROUP]		Waitemata Group						143	4.70	0.5		
												64	4.75	0.5
													4.80	1.0
													4.85	1.0
0.5		CLAY with some silt; orange, some mottled light grey and dark orange. Very stiff; moist, moderate to high plasticity. Occasional rootlets and organic silt layers up to 1.0m. [WAITEMATA GROUP]											4.90	1.0
													4.95	1.0
													5.00	1.0
													5.05	2.0
													5.10	1.0
													5.15	2.0
													5.20	1.0
													5.25	3.0
		1.1m: Becomes moist to wet, high plasticity.											5.30	4.0
													5.35	5.0
													5.40	8.0
											5.45	6.0		
											5.50	4.0		
											5.55	5.0		
											5.60	6.0		
											5.65	4.0		
											5.70	5.0		
											5.75	4.0		
											5.80	4.0		
		2.0m: Trace sand (fine to coarse) with some rootlets.									5.85	5.0		
											5.90	6.0		
											5.95	8.0		
											6.00	8.0		
											6.05	7.0		
		Clayey SILT; light grey, mottled orange. Stiff; moist to wet, low plasticity. [WAITEMATA GROUP]									6.10	8.0		
											6.15	7.0		
											6.20	7.0		
											6.25	7.0		
											6.30	7.0		
											6.35	8.0		
											6.40	7.0		
											6.45	8.0		
											6.50	6.0		
											6.55	8.0		
											6.60	9.0		
											6.65	10.0		
											6.70	10.0		
											6.75	10.0		
											6.80	10.0		
		SILT with trace sand (fine to medium) and clay; orange, mottled light grey. Stiff; wet, no to low plasticity. [WAITEMATA GROUP]									86			
		Gravelly sandy SILT; light grey, mottled orange. Stiff; wet, no plasticity. [WAITEMATA GROUP]									32			
		SILT with trace clay and sand (fine); orange and pinkish orange, mottled light grey. Stiff; wet, no plasticity. [WAITEMATA GROUP]									137			
											52			
		Gravelly SILT with some sand (fine to coarse); orange. Very stiff; wet, no plasticity. [WAITEMATA GROUP]												

### Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

#### Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

#### Shear Vane

- Corrected as per NZGS Guidelines
- Vane No.:2537
- UTP = Unable To Penetrate
- + = Peak Exceeded
- = No Result

#### Other Comments

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