



C & R Surveyors Ltd  
PO Box 564  
**OREWA, 0946**

16 February 2017

**Attention:** Mr C. Weck

**RE: PROPOSED RURAL SUBDIVISION FOR SH 16 LIMITED**  
**LOT 13, DP 79858, TAHEKEROA ROAD, MAKARAU**  
**Geotechnical Investigation of Building Sites on Lots 1 to 6**

## **1.0 INTRODUCTION**

This report presents the results of a geotechnical investigation for a proposed six lot rural subdivision and you have provided us with a copy of the scheme plan reference 2203-1 showing the proposed section layout.

The purpose of the investigation has been to identify stable building sites on the proposed Lots 1 to 6 and to assess the subsoil conditions and provide preliminary foundation and effluent disposal field recommendations.

## **2.0 SITE DESCRIPTION**

The land to be subdivided is a forestry block that has recently been cleared. The property is about 31.5 hectares in area and is situated on the south-eastern side of the road. The property is dissected by a deep gully and the recommended building sites are on the high ground on the southwestern side of the property.

The recommended building sites on Lots 1 to 4 are on the crest of knolls on the ridgeline and the Lots 5 and 6 sites on the southern side of the ridge on gently sloping terraces. The recommended sites have been positioned on land no steeper than 5H:1V and set back from the ridge side slopes and average 1000m<sup>2</sup> with the exception of the Lot 1 site, which is about 750m<sup>2</sup> in area. Access to the recommended building sites is via existing metalled logging roads. The approximate locations of the recommended building sites in relation to proposed lot boundaries are shown on a reduced copy of the scheme plan attached.

C & R Surveyors Ltd has located the positions of the boreholes and carried out a topographic survey in the vicinity of the recommended building sites, which are shown on Drawings 6045-1 to 4 attached.

## **3.0 FIELD WORK**

The fieldwork carried out during our investigation comprised a walk over inspection of the site by an Engineering Geologist to identify stable building sites and the drilling of a single hand auger borehole on each recommended building site (BH's 1 to 6). The boreholes extended to depths of between 1.3 (BH 2) and 5.0m (BH 4) and were 50 mm in diameter. The *in situ*, shear vane strengths of the subsoils were measured in the holes at regular intervals with a hand operated Pilcon type shear vane.



The locations of the boreholes in relation to the recommended building sites are shown on Drawings 6045-1 to 4 attached. Descriptions of the soils encountered in the boreholes along with measured shear vane strengths are presented on the attached log sheets (BH's 1 to 6).

#### **4.0 GROUND CONDITIONS AND STABILITY**

The IGNS geological map of the area Sheet Q10 Helensville shows that the area is underlain by interbedded sandstones and siltstones of the Paremoremo and Pakiri Formations, Waitemata Group.

The soils encountered in boreholes comprise very stiff silts and clays and in BH 1 below 1.4m moderately dense silty sands which we are residual soils of the Waitemata Group. Based on a visual inspection of the soils recovered from the boreholes we are of the opinion that the near surface residual soils are potentially expansive and moderately susceptible to seasonal soil shrinkage (Class M, AS 2870).

Measured shear vane strengths in the residual soils generally exceeds 125 kPa and in BH 2, 200 kPa. Strengths generally increase with depth and with the exception of BH 4 (Lot 5) the boreholes were terminated at depths of between 1.3 and 4.5m when the ground became too hard to auger.

Groundwater seepage was encountered in BH 4 and a water level measured at 4.4m depth on the day the hole was drilled. The remaining boreholes were dry.

No significant signs of instability were observed in the immediate vicinity of the recommended building sites, which are on the crests of ridges and spurs or on gently sloping land. Driveways have been formed to the building sites at an average gradient of no steeper than about 5H:1V.

Based on the results of the investigation we consider that the proposed development of the subdivision is not likely to adversely affect the stability of the land or on any other property subject to the recommendations given below.

#### **5.0 GEOTECHNICAL ASSESSMENT AND PRELIMINARY RECOMMENDATIONS**

Based on the results of the borehole investigation we are of the opinion that building foundations on the recommended building sites shall all be subject to specific investigation and foundation design based on the actual proposed development, building location and earthworks. However foundations may generally comprise conventional shallow footings, so long as the houses are set back by at least 10m from any land steeper than 1 vertical to 4 horizontal. If any significant filling is place to for the building platform (i.e. greater than 0.5m) the foundations would be subject to specific review by a geotechnical engineer.

Preliminary recommendations for site development are as follows:

- 1) Prior to finalising the design the foundation and earthworks plans for any dwelling on the building areas must be reviewed and approved by a Geotechnical Engineer to ensure that our recommendations have been correctly interpreted. Additional site specific investigations during the building consent stage may be necessary depending on the proposed development.

- 2) All shallow foundations and floor slabs for any dwelling and services into the dwelling must be designed for class M soils in terms of AS2870:2011 unless laboratory testing is carried out to confirm the reactive nature of the soil.
- 3) Earthworks should predominantly comprise cut with minimal filling to prevent surcharging on the slope. No fill greater than 0.5m should be placed within the building areas unless specifically approved by a geotechnical engineer. Spoil from excavations may be placed on site provided it is not placed adjacent to or over any steep slope (i.e. no steeper than 1V:4H) and is no more than 0.5m thick.
- 4) Building foundations on or immediately adjacent to sloping ground greater or equal to 1V:5H should be pile supported. The piles should be subject to specific investigation and foundation design. For preliminary design piles may consist of bored reinforced concrete or concrete encased timber piles designed by a Chartered Professional Engineer. Piles may be designed using Ultimate Limit State Design for a Dependable End Bearing of 450kPa (900kPa Ultimate) and a Dependable Skin Friction of 15kPa (30kPa Ultimate). Skin Friction to 0.6m depth, and through any fill, should be ignored. The piles should be founded in very stiff natural ground ( $C_u > 100\text{kPa}$ ), subject to inspection and confirmation by a Geotechnical Engineer or Engineering Geologist. In addition, the piles should be designed to resist soil creep pressure over the full depth of any fill and the top 1.5m of the natural ground, assuming the lateral pressure acts over a width of 3 pile hole diameters and using a lateral earth pressure coefficient of  $k = 0.7$ .
- 5) Foundations on level cut ground (i.e. cuts greater than 1.5m depth) or sloping ground less than 1V:5H and fill depth of more than 0.5m may comprise conventional strip/pad footings. Footings should be founded within very stiff ( $C_u > 100\text{ kPa}$ ) natural residual soils and may be designed for a dependable bearing pressure of 150 kPa (300 kPa ultimate). Footings should be taken down at least 0.6m below final cut ground levels as a precaution against settlement affects associated with seasonal soil shrinkage. Alternatively the foundations may comprise reinforced concrete raft foundations (e.g. ribraft). All shallow foundations must be designed as per recommendation 3 above. If weak soils or any fill are exposed in footing excavations deepening of the footings may be required or the foundations may need to be piled as per recommendation 5 above.
- 6) Floor slabs may be founded on grade on a layer of hardfill provided all topsoil, weak ground or pre-existing uncertified fill is removed below the slab. Slabs should be designed as per recommendation 2 above. Only good quality clean hardfill should be used as basecourse below floor slabs. Inferior hardfill such as lime rock or brown rock must not be used because of the increased risk of heave or settlement.
- 7) All cuts greater than 1m depth should be retained by Engineer designed retaining walls or battered back to a slope of no steeper than 1V:3H, subject to the advice and approval of a Geotechnical Engineer. No fill greater than 0.5m depth should be placed on site unless reviewed and approved by a Geotechnical Engineer. Any fill placed on site to form a building platform should be properly compacted and subject to monitoring, testing and certification by a Chartered Professional Engineer to ensure that it is placed to a satisfactory engineering standard. All topsoil, uncertified fill and weak natural soil must be removed from the subgrade prior to placing the fill and the subgrade must be benched to tie the fill into the slope. Soil fill should be compacted such that when tested with the hand shear vane test the average undrained shear strength is not less than 140kPa with no individual test under 110kPa. Air voids should not exceed 10%.

- 8) Retaining walls may be designed assuming the following soil parameters. Any retaining walls that are not part of a dwelling and located on sloping ground should be pile type cantilever walls (e.g. timber pole) and they should be engineer designed unless otherwise agreed by a Geotechnical Engineer.

Effective friction angle	= 30°
Effective cohesion	= 0
Unit weight of soil	= 18kN/m <sup>3</sup>
Coefficient of sliding resistance	= 0.36 (i.e. $\tan(\delta)$ )
Undrained shear strength (Ultimate)	= 50 kPa

A strength reduction factor of 0.5 should be applied to the passive resistance or undrained shear strength, depending on the wall design, and 0.8 for sliding resistance for a block wall. Any block type retaining walls with shallow foundations as part of a dwelling where the original ground surface was steeper than 1V:5H must be designed such that the designated sliding force is resisted by the dwelling structure and not sliding of the wall footing only.

The walls must be designed for any surcharge loads and taking into account the slope of the land above and below the walls which will increase the embedment depths using a 'Broms' type of analysis.

- 9) Care should be taken with disposal of stormwater to prevent any uncontrolled concentrated discharge of water over the slopes which could lead to erosion. Stormwater from the roof of any dwelling, tank overflows and any new driveway should be discharged well clear of the building areas.
- 10) The surficial soils on site generally consist of up to about 0.3m of organic silt (topsoil) underlain by clayey silt or silty clay to depths of at least 1.0m. The site appears to be moderately well drained. We assess the topsoil to be soil category 4 in terms of the definitions in TP58. We assess the underlying clayey silt and silty clay to 1.0m depth to be low permeability and correspond to soil category of 5 to 6 in terms of the definitions in TP58. Effluent disposal systems should be designed on this basis. Any effluent disposal for the building areas should be confined within the lot boundaries and well away from any steep slopes. The location of the effluent disposal should be confirmed as acceptable by a Geotechnical Engineer.
- 11) Any new driveway may be designed for a CBR of 3 provided all the weak and organic soils at the surface or any uncertified fill are removed prior to placing the basecourse and subject to inspection and approval by a Geotechnical Engineer following preparation of the subgrade.
- 12) The soils on the site are considered to be moderately susceptible to seasonal shrinkage and swelling. The effects of which can be exacerbated by trees (especially exotic varieties), hedges and plants having a high water demand, which, should not be planted near the building as they can withdraw moisture from the soil and cause any shallow foundations or ground bearing floor slabs to settle. Trees should be planted no closer to the building than 0.75 times the mature height of the tree.
- 13) All shallow foundations and floor slabs for any dwelling and services into the dwelling must be designed for class M soils in terms of AS2870:2011 unless laboratory testing is carried out to confirm the reactive nature of the soil.



Where Engineering Geology Ltd is required to carry out site inspections during construction and provide certification or a Producer Statement – Construction Review, it is requested that we be supplied a copy of the Building Consent Conditions. We request that a minimum notification of 24 hours be given for any site inspections and note that we will be unable to issue a Producer Statement without site inspections at the appropriate stages during construction.

## 6.0 LIMITATIONS

Recommendations and opinions in this report are based on a walkover inspection of the property and data from six hand auger boreholes. While the nature and continuity of the subsoil conditions away from the boreholes is inferred it is possible that actual conditions could vary from those assumed. Should variations in subsoil conditions from those described in this report, be found to exist, or the designated building sites are altered from that shown on Drawings 6045-1 to 4 and the scheme plan provided then it is essential that Engineering Geology Ltd be contacted as it may affect the recommendations given above and additional borehole investigation may be required.


This report has been prepared solely for the benefit of SH 16 Ltd, as our clients with respect to the brief for the purposes of subdivision of the land and Engineering Geology Ltd accept no liability to any other party in relation to this report. The reliance by other parties on the information or opinions contained in this report shall, without our prior review and agreement in writing, be at such parties' sole risk.

We would be pleased to provide any further advice you may require.

Yours faithfully

**ENGINEERING GEOLOGY LIMITED**

Prepared by:



J. Power/ P. Carter (CPEng)

Reviewed by:



J. Yeats (Director)

**Enclosure:** C& R Surveyors Limited Drawings Ref 2203  
Borelogs - BH's 1 to 6  
Drawings 6045-1 to 4



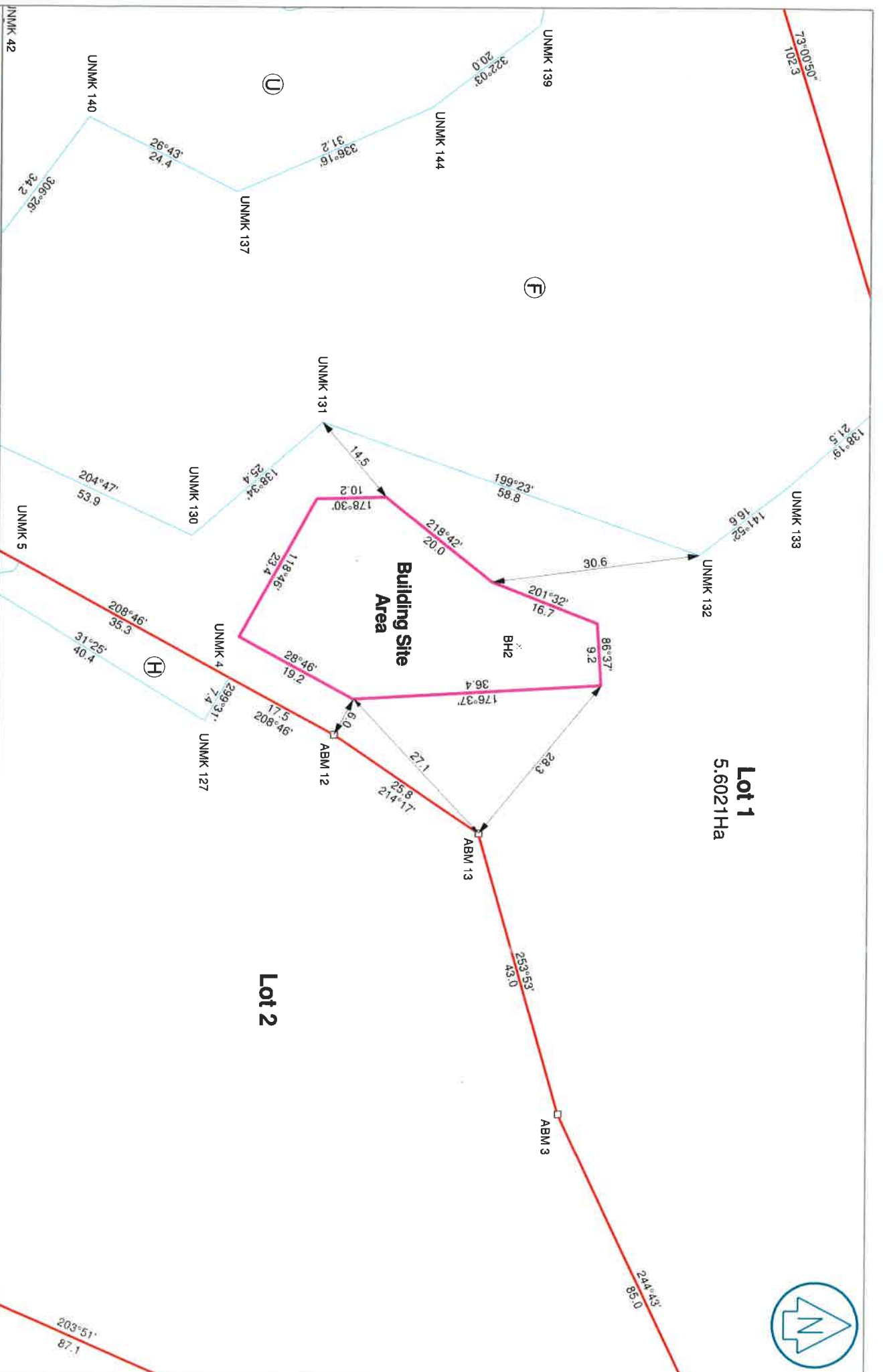
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**SH16 Limited**  
**Tahakeroa Road**  
**Makarau**

Original Size:	A3
Original Scale:	1:500
Date:	17/01/2017
Job Number:	22



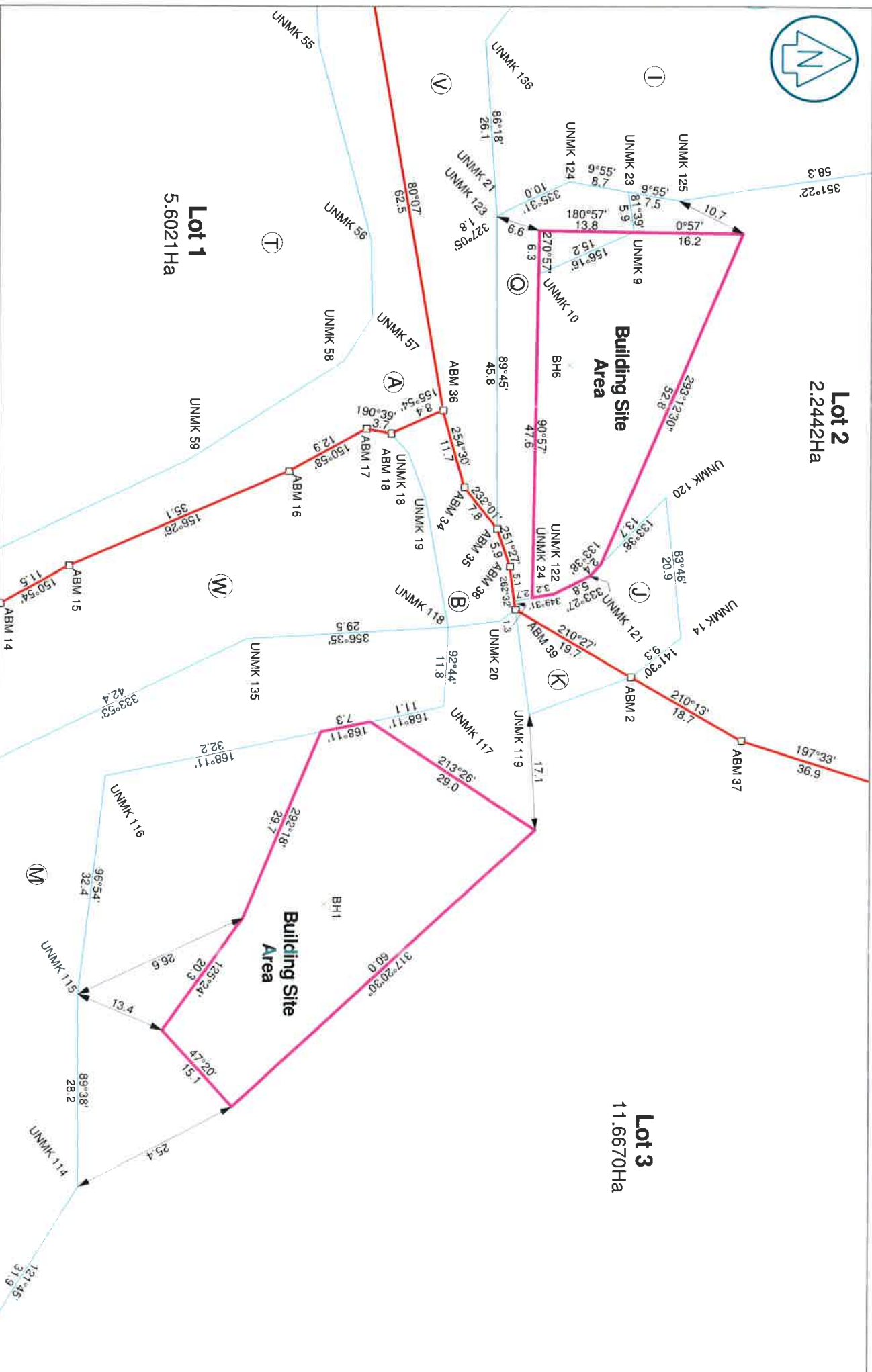


**Lot 2**  
2.2442Ha

**Lot 3**  
11.6670Ha

**Building Site Area**

**Building Site Area**



**C & R SURVEYORS LTD**

*Registered Professional  
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Client:

**SH16 Limited**  
**Tahakeroa Road**  
**Makarau**

Drawing Title:

**Proposed Building Site Areas**

**Lots 2 & 3 DP 486187**

Original Size:

A3

Original Scale:

1:500

Date:

17/01/2017

Job Number:

2203



UNMK 108

222°45'  
29.2

UNMK 107

186°51'  
36.4

202°07'  
23.6

17.8

22°07'  
25.4

10.0

144°01'  
38.5

**Lot 4**  
9.3421Ha

**Lot 5**

BH3

**Building Site Area**

(P)

181°56'  
24.4

335°30'  
42.1

170°19'  
59.4

300°03'40"  
94.3

28.6

65°30'  
13.2

Lot 2 DP 350133

300°03'40"  
39.0

28°43'30"  
399.4



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Client:

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**Tahakeroa Road**  
**Makarau**

Drawing Title:

**Proposed Building Site Area**

**Lot 4 DP 486187**

Original Size

A3

Original Scale

1:500

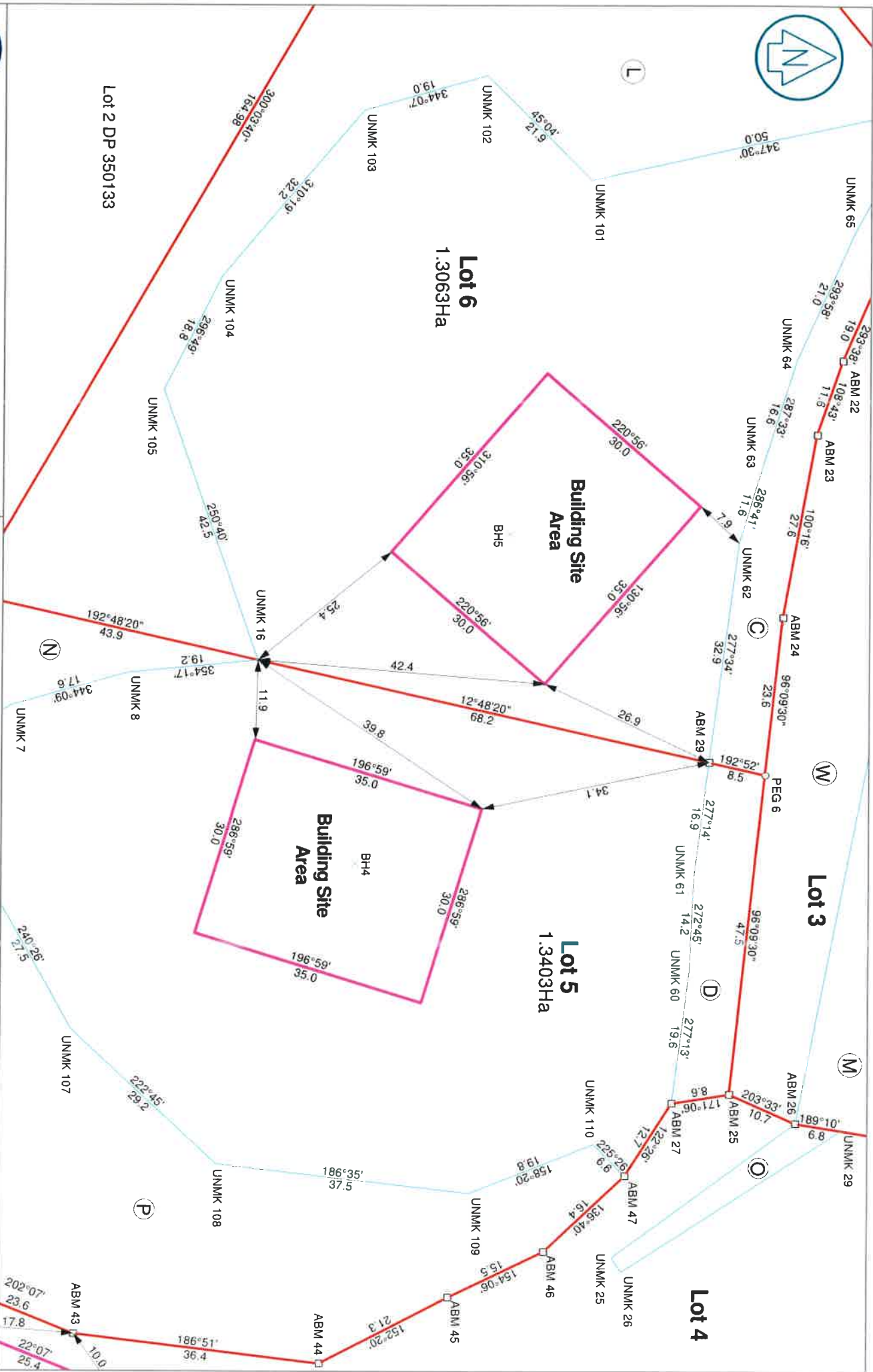
Date:

17/01/2017

Job Number

2203





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Client:  
**SH16 Limited**  
Takekeroa Road  
Makarau

Drawing Title:  
**Proposed Building Site Areas**  
Original Date: A3  
Original Scale: 1:500  
Date: 17/01/2017  
Job Number: 2203

# Engineering Geology Ltd

BOREHOLE No. 1

SITE: Lot 3, Tahekeroa Road, MAKARAU

REF: 6045

Sheet 1 of 1

REDUCED LEVEL STRATA	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%)	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa)									
							● Field vane (BS 1377)	○ Remoulded Field vane	50100150							
Waitemata Group	SILT; sl. clayey, moist, l/plastic, orange brown, grey mottles dry-moist, v. stiff, orange brown  tr. sand (f-m)  sl. sandy (m-c), sl. friable, orange brown, red brown mottles, limonite stains/nodules sandy (f-m), moist, friable, orange brown pink, orange brown, light grey		1											187 ●		
														194 ●		
														158 ●		
														120 ●		
	SAND (f-m); silty, no clay, moist, dense, orange brown, pink, grey mottles  dry  orange brown, occ. brown mottles		2												145 ●	
															158 ●	
															>200 ●	UTP
															148 ●	
															>200 ●	UTP
															>200 ●	UTP
	light grey, yellow brown  light grey, yellow brown, orange brown streaks gritty, limonite stains/nodules, orange brown	3												123 ●		
														>200 ●	UTP	
														>200 ●	UTP	
														>200 ●	UTP	
														>200 ●	UTP	
														>200 ●	UTP	
	E.O.B @ 4.1m (to hard to auger)		4													
			5													
NOTES							LOGGED BY: SP DATE DRILLED: 28-Jul-06 DRILL METHOD: 50mm Hand Auger									

# Engineering Geology Ltd

BOREHOLE No. 2

SITE: Lot 1, Tahekeroa Road, MAKARAU

REF: 6045

Sheet 1 of 1

REDUCED LEVEL STRATA	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%)	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa)	
Waitemata Group	SILT; sl. clayey, moist, l/plastic, orange brown, brown, grey hard		1			Dry 28/07/06	50 100 150	
	tr. clay, tr. sand (f), dry, friable, light grey, orange mottles sl. sandy (f), no clay limonite stains/nodules, orange brown weathered siltstone fragments (f) gritty (f), ground water seepage tr. clay, no sand or grit, light grey, orange brown streaks completely weathered siltstone fragments sandy (f), dry-moist, dense, light grey							UTP
	E.O.B @ 1.3m (to hard to auger)		2					UTP
			3					UTP
			4					
			5					

NOTES

LOGGED BY: SP  
DATE DRILLED: 28-Jul-06  
DRILL METHOD: 50mm Hand Auger

# Engineering Geology Ltd

BOREHOLE No. 3

SITE: Lot 4, Tahekeroa Road, MAKARAU

REF: 6045

Sheet 1 of 1

REDUCED LEVEL STRATA	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%)	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field vane (BS 1377) ○ Remoulded Field vane 50 100 150
Waitemata Group	SILT; sl. clayey, moist, l/plastic, grey						
	tr. sand (f), v. stiff, red pink, light grey streaks						152
	sl. sandy (f), tr. clay, dry, friable, orange brown, light grey						155
	tr. sand (f), red pink, light grey streaks						137
	sl. sandy (f), orange brown, light grey		1				135
	light grey, orange brown streaks						132
	sandy (f), no clay						132
	orange brown, light grey		2				113
	yellow brown						132
	tr. clay, tr. sand (f), sl. friable, light grey, pink streaks						116
	sandy (f-m), no clay, friable, orange brown, light grey						125
	moist		3				126
	wet, orange brown						132
	tr. clay, tr. sand (f), sl. friable, pink, light grey						121
	sl. sandy (m-c), limonite stains/nodules		4				125
	gritty (f-m), silt inclusions (m-c), orange brown						
	sandy (m-c), no grit						
	E.O.B @ 4.2m						
			5				

Dry 28/07/06

NOTES

LOGGED BY: SP  
DATE DRILLED: 28-Jul-06  
DRILL METHOD: 50mm Hand Auger



# Engineering Geology Ltd

BOREHOLE No. 4

SITE: Lot 5, Tahekeroa Road, MAKARAU

REF: 6045

Sheet 1 of 1

REDUCED LEVEL STRATA	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%)	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa)	
							● Field vane (BS 1377) ○ Remoulded Field vane 50   100   150	
Waitemata Group	TOPSOIL; silt, tr. clay, moist, grey brown							
	SILT; clayey, moist, mod. plastic, v. stiff, orange, light grey						● 175	
	CLAY; silty, moist, plastic, v. stiff, orange, light grey						● 152	
			1				● 143	
	SILT; clayey, moist, sl. plastic, v. stiff, orange brown, light grey						● 81	
	sl. clayey						● 172	
	tr. clay, non plastic, sl. friable, orange brown, light grey, red brown						● 31	
	no clay, mod. friable, red, orange, light grey		2				● 100	
	tr. sand (f)						● 176	
							● 151	
			3				● 159	
	sl. sandy (f)						● 143	
	tr. sand (f)						● 124	
	sl. sandy, MnO stains, yellow brown, grey, black						● 189	
	tr. sand (f)		4				● 194	
	sl. sandy (f)						● 150	
	sandy (f)						● 213	
	sl. sandy (f)							
	sandy (f)							
	hard							
	E.O.B. @ 5.0m		5					
NOTES					LOGGED BY: DM DATE DRILLED: 28-Jul-06 DRILL METHOD: 50 mm Hand Auger			

▼ 4.4m 28/07/2006



# Engineering Geology Ltd

BOREHOLE No. 5

SITE: Lot 6, Tahekeroa Road, MAKARAU

REF: 6045

Sheet 1 of 1

REDUCED LEVEL STRATA	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%)	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field vane (BS 1377) ○ Remoulded Field vane 50 100 150	
Waitemata Group	TOPSOIL; silt, moist, grey brown		0 - 1					
	SILT; tr. clay, moist, v. stiff, yellow brown							
	clayey, mod. plastic, yellow brown, orange						● 143	
	CLAY; silty, moist, plastic, v. stiff, yellow brown, orange, light grey						● 159	
	fine red brown silt layers						● 143	
	SILT; sl. clayey, MnO stains, moist, sl. plastic, sl. friable, v. stiff, red, black, orange, light grey						● 167	
	CLAY; silty, moist, plastic, v. stiff, orange, light grey						● 124	
	SILT; tr. clay, tr. sand (f-m), MnO stains, moist, mod. friable, hard, red, red brown, orange, black, light grey							
	sl. clayey, no sand, non friable		1 - 2					
	tr. sand (f), no clay, mod. friable							
	sl. sandy (f), v. stiff, orange, light grey		2 - 3					
	sl. clayey, no sand, non friable							
	MnO and limonite stains							
	tr. sand (f), no clay, hard, dark orange brown, black, light grey, pink							
	sandy (f), no limonite, orange brown		3 - 4					
			4 - 5					
			5 - 6					
			6 - 7					
			7 - 8					
			8 - 9					
			9 - 10					
			10 - 11					
			11 - 12					
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# Engineering Geology Ltd

BOREHOLE No. 6

SITE: Lot 2, Tahekeroa Road, MAKARAU

REF: 6045

Sheet 1 of 1

REDUCED LEVEL STRATA	DESCRIPTION OF SOIL	SOIL SYMBOL	DEPTH (m)	SAMPLE TYPE	WATER CONTENT (%)	WATER LEVEL	CORRECTED VANE SHEAR STRENGTH (kPa) ● Field vane (BS 1377) ○ Remoulded Field vane 50 100 150	
Waitemata Group	SILT; sl.sandy, v.stiff, moist, reddish/brown		1			Dry 17/08/2006	150	
	v.sandy						165	
							153	
							150	
							150	
							147	
	dark reddish brown		2				126	
	hard, highly weathered siltstone						>200	UTP
	E.O.B. at 2.4m (Too Hard to Auger)		3					
			4					
			5					
NOTES						LOGGED BY: JP DATE DRILLED: 17-Aug-06 DRILL METHOD: 50mm Hand Auger		



# ENGINEERING GEOLOGY LTD

## Borelog Terminology

### SOILS

Consistency (Cohesive Soils)		Relative Density (Non-cohesive Soils)			
Term	Undrain Shear Strength (KPa)	Term	'N' Valu (SPT)	Scala Blows/100 mm	Relative Density %
Very Soft	0 - 12.5	Very Loose	0 - 4	0 - 2	>20
Soft	12.5 - 25	Loose	4 - 10	2 - 5	20 - 33
Firm	25 - 50	Medium Dense	10 - 30	5 - 15	33 - 66
Stiff	50 - 100	Dense	30 - 50	15 - 25	66 - 90
Very Stiff	100 - 200	Very Dense	>50	>25	90 - 100
Hard	200 - 500				
( 1.5 x SPT 'N' )					
( SPT = Standard Penetrometer Test )					
( Scala = Scala Penetrometer Test )					

Sensitivity (Cohesive Soils)			Dilatancy
Term	Shear Strength Ratio	Undisturbed Remoulded	Reaction to shaking (silts & fine sands) varies from:
Insensitive, normal	>2		Non-dilatant - no reaction
Moderately Sensitive	2 - 4		to
Sensitive	4 - 8		highly dilatant - rapid appearance of water and complete loss of structure, sample 'flows' through fingers.
Extra Sensitive	8 - 16		
Quick	>16		

#### Soil Symbols



FILL



ORGANIC (TOPSOIL)



PEAT



CLAY



SILT



SAND



GRAVEL



Combinations e.g.  
Clay, silty, sl. sandy



TUFF

#### Sample Type



Bag Sample



Core Sample



Thin Wall Tube Sample (undisturbed)



Standard Penetration Test Sample  
Blow Counts per 150 mm or less  
as indicated

#### Tests



Water level in borehole at date shown



SPT blow counts per 300 mm



Moisture Content %



Bulk Density t/m3



Consolidation Test



Particle Size



Effective Stress (triaxial)

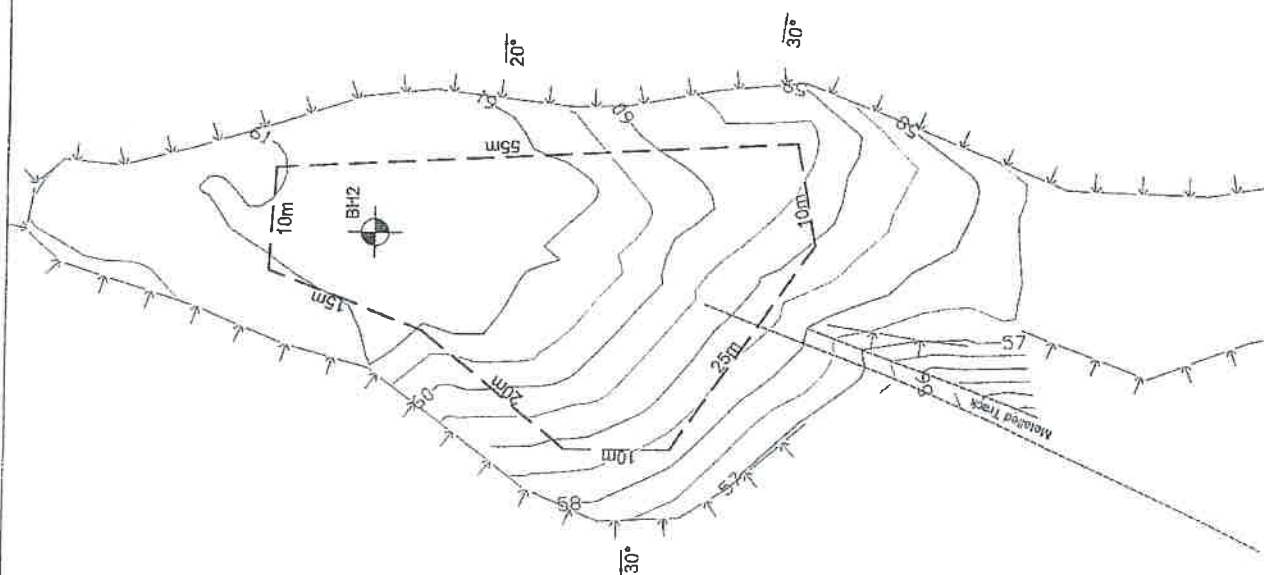


Unconfined Compression





Lot 1



Legend

- BH17
- Recommended Building Site
- Contours (m)  
0.5m interval
- Top of Steep slope
- Slope Angle & Direction

Drawing No. 6045-1  
Date: August 2006  
Drawn: RB  
Scale: 1:500 (A3)  
Filename: 6045

Lot 1, Tahekaroa Road, MAKARAU  
Borehole Location Plan

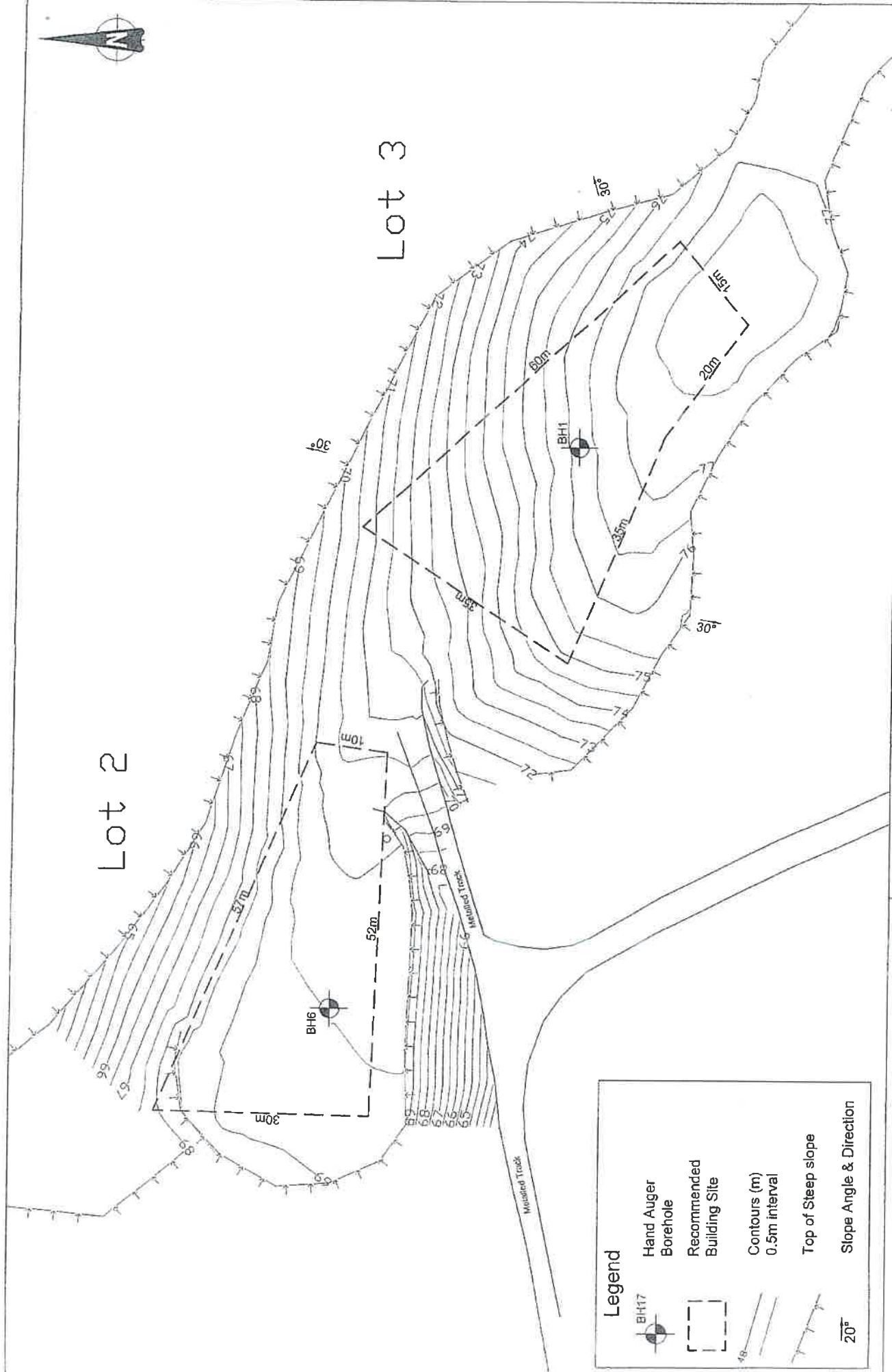
**ENGINEERING GEOLOGY LTD**  
Unit 7C, 331 Rosedale Rd, PO Box 301054, Albany  
Ph (09)486-2546, Fax (09)486-2556





Lot 2

Lot 3



**Legend**

Hand Auger  
Borehole



Recommended  
Building Site



Contours (m)  
0.5m interval



Top of Steep slope



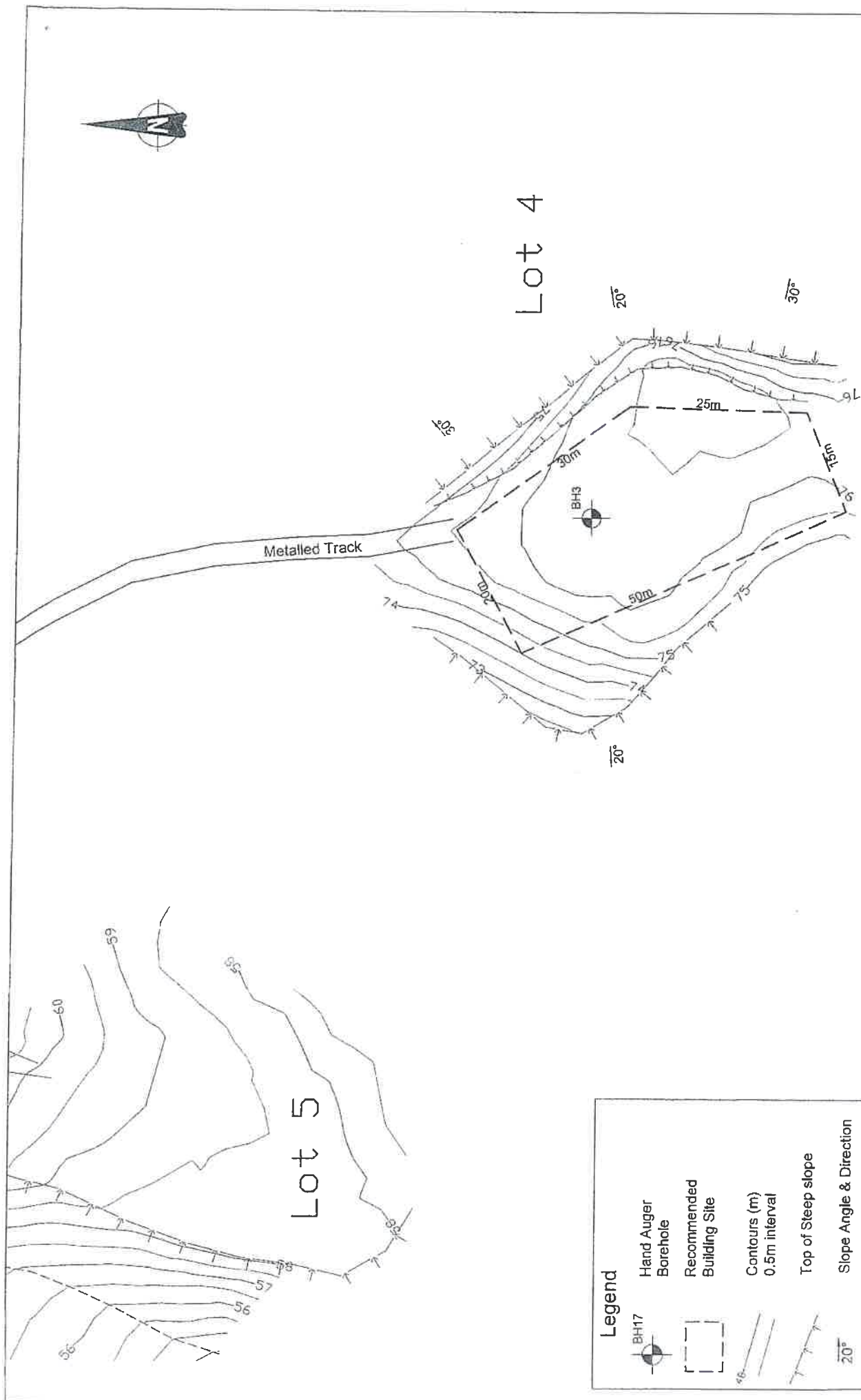
Slope Angle & Direction



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**Lot 2 & 3, Tahekaroa Road, MAKARAU**  
**Borehole Location Plan**

Drawing No. 6045-2  
Date: August 2006  
Drawn: RB  
Scale: 1:500 (A3)  
Filename: 6045



# Legend



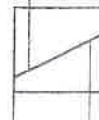
Hand Auger  
Borehole

Recommended  
Building Site

Contours (m)  
0.5m interval

Top of Steep slope

Slope Angle & Direction



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Lot 4, Tahekaroa Road, MAKARAU  
Borehole Location Plan

Drawing No. 6045-3  
Date: August 2006  
Drawn: RB  
Scale: 1:500 (@A3)  
Filename: 6045



Mettled Track

Lot 5

Lot 6

Legend

- BH17
- Recommended Building Site
- Contours (m)  
0.5m interval
- Top of Slope
- Bottom of Slope
- Slope Angle & Direction  
20°

Drawing No. 6045-4  
Date: August 2006  
Drawn: RB  
Scale: 1:500 (A3)  
Filename: 6045

Lot 5 & 6, Tahekaroa Road, MAKARAU  
Borehole Location Plan

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