

Tauranga City Council
Private Bag 12022
Tauranga 3143

s 7(2)(f)(ii)

Dear s 7(2)(f)(ii)

Mauao Slip 5 - Bridge Foundation Options

1 Introduction

It is proposed to construct a footbridge with a span of 15.2 m at the location of Slip 5 on the Mauao Base Track. The proposed bridge layout and foundation details are shown on the attached drawings 851455-100 Rev A and 110 Rev A. The proposed bridge abutment locations have been chosen to ensure that the bridge abutments are well clear of the upslope slip area and to align the bridge as closely as possible to the existing track alignment.

The slope on the downslope side of the bridge abutments is approximately 7 m high and has a gradient of between 45 to 60 degrees to the horizontal. The proximity of the steep slope to the proposed bridge foundations presents some technical issues which are outlined below.

2 Ground Conditions

Examination of the face of the existing cutting on the upslope side of the track and the downslope face has indicated that the ground conditions consist of cemented sands with some very strong rock inclusions up to boulder size.

Trenching was undertaken to establish the continuity of the natural ground across the width of the track. The trench locations are shown on the survey plan in Appendix B. The trench logs are included in Appendix C.

In the investigation natural ground was generally encountered close to the ground surface. The trenching indicated that the natural ground dipped down to 1.5 m below ground level on the seaward side of Test Pit 2 (southern abutment location). At Test Pit 3 (northern abutment location) natural ground was encountered across the full width of the track.



3 Abutment Foundation Issues

The abutment foundations are to be located adjacent to a 7 m high steep slope. While the bearing capacity of the natural ground is likely to be relatively high, the long term stability of the slope is questionable. There is a risk that the shallow foundations may be undermined by slope instability within the 50 year design life of the bridge.

4 Foundation Proposals

4.1 Option 1: Piles

The preferred foundation option is to support the abutment on reinforced concrete piles which extend to below the area of possible instability. Ideally the piles should extend to 6m below ground level at the northern abutment and to 5 m below ground level at the southern abutment. Deeper piles are required at the north abutment due to the steeper slope in that area.

The current scheme (as outlined on drawings 851455-100 Rev A and 110 Rev A, which are attached in Appendix A), indicates 300 mm diameter piles. The use of 300 mm diameter piles is dictated by access constraints. Because of these access constraints the size of plant which can be used is limited. It is not considered feasible to use plant which can auger larger diameter holes.

If significant obstructions are encountered, it may not be possible to install the piles at the locations or to the depths required. This can only be established with certainty when the drilling of the holes is carried out. It is understood that the access issues relating to the drilling of the holes are currently under review.

4.2 Option 2: Spread Foundations

It would be possible to support the abutments on spread foundations. The spread foundations would potentially be vulnerable to instability on the downslope side and to localised bearing capacity failure close to the edge of the slope. The potential for instability would be slightly increased by the bridge loads. The risk of bearing capacity failure can be addressed by lowering the foundation level using mass concrete beneath the foundations close to the downslope edge. At the southern abutment the lowering of the foundation level will also be required because of the presence of loose fill in the outer section of the track, at this location.

An indicative detail showing the spread foundation, the proposed mass concrete and a shear key on the upslope side to resist lateral loads, is given on Sketch Sk1 in Appendix A.

The vulnerability of the foundation to the effects of downslope instability can be further reduced by ground anchors, which can be installed on the upslope side of the foundation to help counteract the overturning effect of instability on the downslope side. These are also shown on Sketch Sk1.

The use of spread foundations is a cost effective option, but this option cannot be certified for a design life of 50 years due to the risk of slope instability. The use of ground anchors will provide some protection against the effects of slope instability, though it needs to be appreciated that this risk will not be fully mitigated.

5 Overall Conclusion

The piled option provides the best technical solution, though its feasibility can only be finally established by attempting to drill the holes. The spread foundation option presents less construction challenges, but does not address the risk of potential instability as well as the piled option. If significant obstructions are encountered, it may not be possible to drill all or any of the piles to the

required depths. If this proves to be the case, a modified piled option may have to be developed or, in the worst case, it may be necessary to revert to the spread foundation option.

To determine the preferred option it is recommended that the council undertake an assessment of its acceptable level of risk, both in terms of the access required to construct the foundations and the long term stability of the foundations.

6 Applicability

This report has been prepared for the benefit of Tauranga City Council with respect to the particular brief given to us and it may not be relied upon in other contexts or for any other purpose without our prior review and agreement.

This opinion is not intended to be advice that is covered by the Financial Advisers Act 2010.

Tonkin & Taylor Ltd

Environmental and Engineering Consultants

Report prepared by:

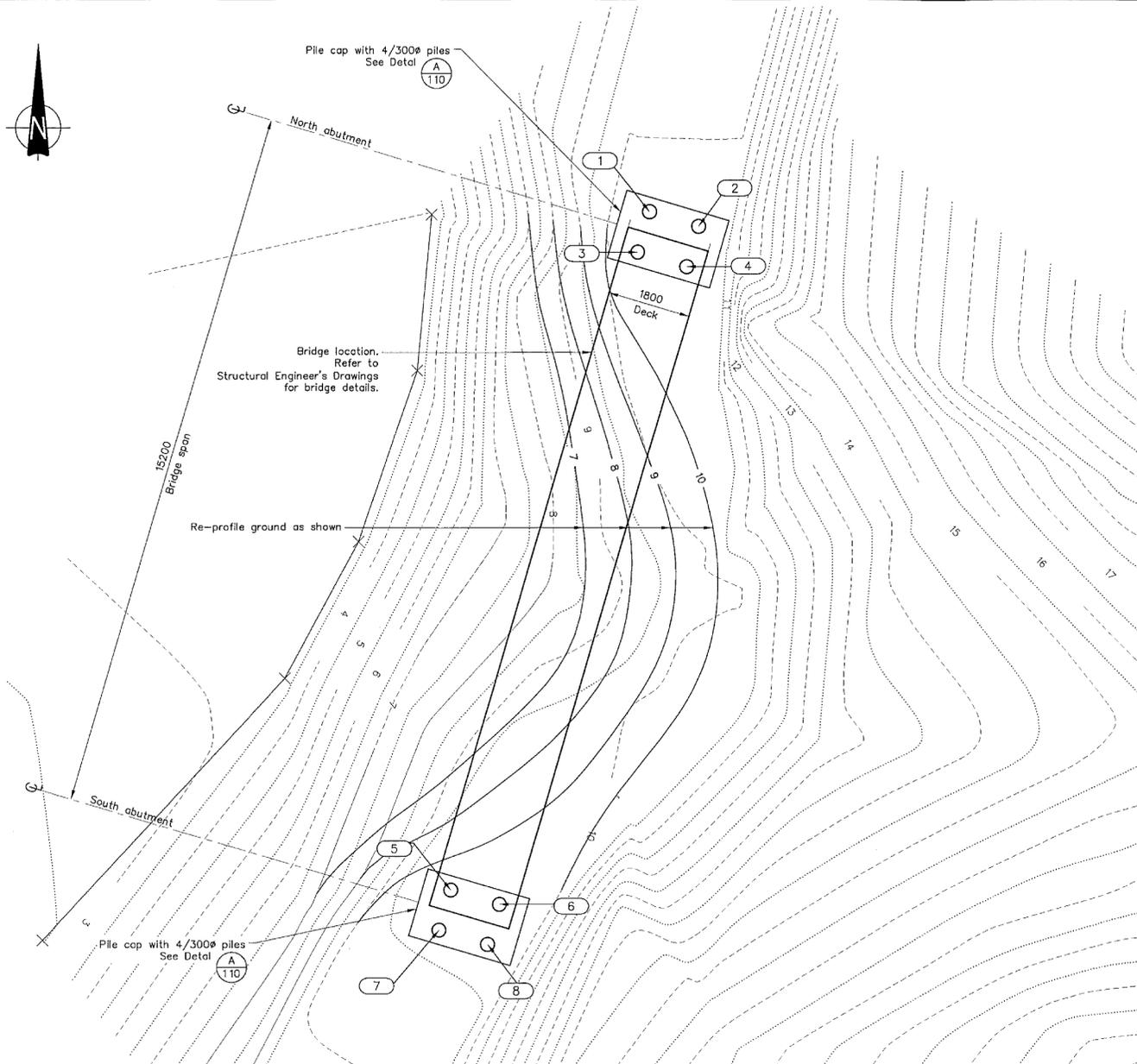
Authorised for Tonkin & Taylor Ltd by:



s 7(2)(a) ... Privacy

5-May-11
p:\851455\issueddocuments\20110503.mob.ltr.mauao.docx

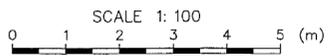
Appendix A: Preliminary Foundation Drawings



1	- 11.96 mN	-246.81 mE
2	- 12.27 mN	-245.76 mE
3	- 12.82 mN	-247.07 mE
4	- 13.13 mN	-246.01 mE
5	-26.54 mN	-251.10 mE
6	-26.85 mN	-250.05 mE
7	-27.40 mN	-251.36 mE
8	-27.71 mN	-250.30 mE

Coordinates to RPC survey reference point

	Design contours (1.0m)
	Existing contours



BRIDGE LAYOUT PLAN
SCALE 1: 100

CONSTRUCTION ISSUE
DRAWING STATUS: HOLE DRILLING ONLY

DESIGNED :	[Redacted]	Apr. 11
DRAWN :	[Redacted]	Apr. 11
DESIGN CHECKED :	[Redacted]	Apr. 11
DRAFTING CHECKED :	[Redacted]	Apr. 11
CADFILE :	85 1455 - 100.dwg	
s 7(2)(a) ... Privacy		
A Issued for Hole Drilling Only s 7(2)(a) This drawing is not to be used for construction purposes unless signed as approved		
REVISION DESCRIPTION	BY	DATE

NOTES :

- All dimensions are in metres unless noted otherwise.
- Site survey provided by RPC Consultants Ltd.

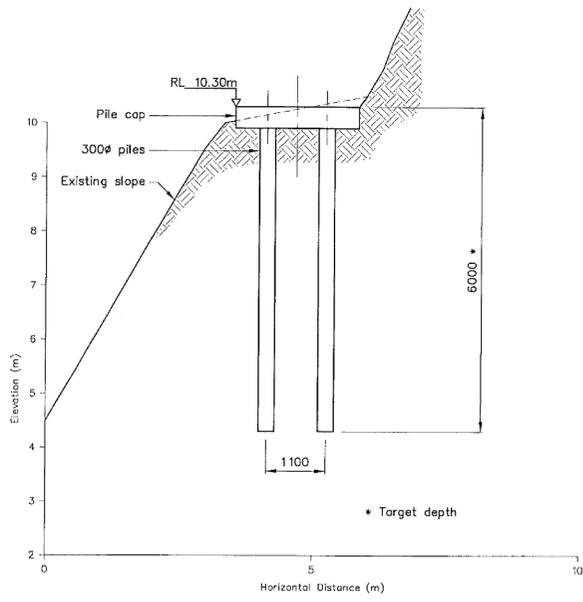
REFERENCE :

Tonkin & Taylor
Environmental and Engineering Consultants

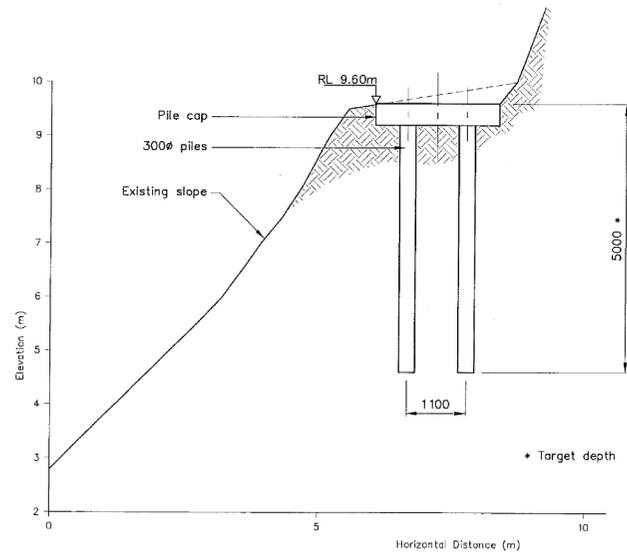
Level 1, 36 Grey Street, Tauranga
Tel. (07) 571 7360. Fax: (07) 571 7390
www.tonkin.co.nz

CLIENT PROJECT	TAURANGA CITY COUNCIL
TITLE	MAUAO SLIP 5 - FOOTBRIDGE DESIGN
TITLE	BRIDGE ABUTMENT
TITLE	Layout and Proposed Pre-drilling
SCALES (AT A3 SIZE)	1: 100
DWS. No.	85 1455- 100
REV.	A

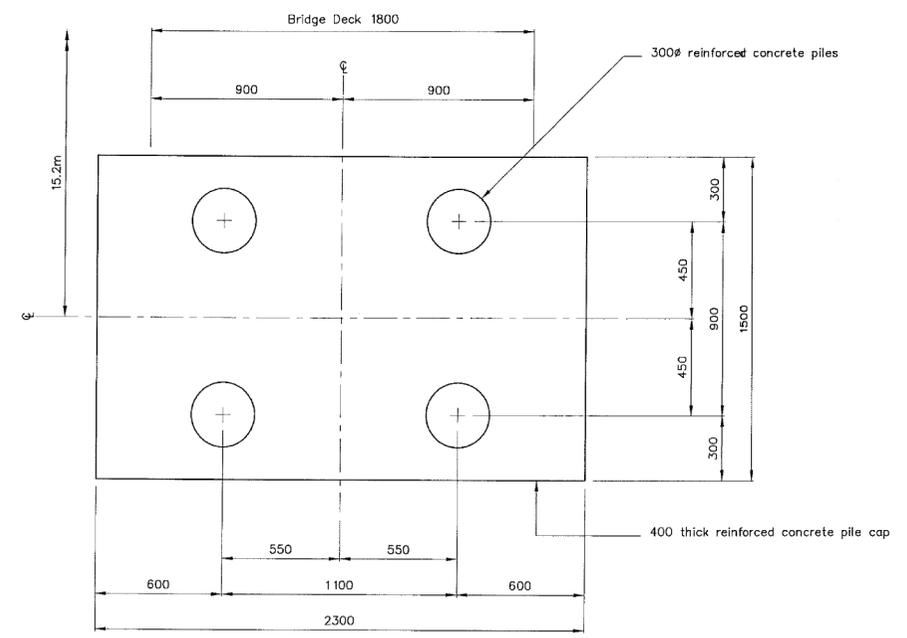
P:\851455\WorkingMaterial\CAD\851455-100.dwg, 100, 29/04/2011 3:36:32 p.m., dmm, 1:1



NORTH ABUTMENT
SCALE 1: 100

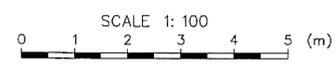


SOUTH ABUTMENT
SCALE 1: 100



DETAIL A PILE CAP LAYOUT
SCALE 1:25

NOTE: Pile holes to be temporarily covered with 700x700x10 steel plates



P:\851455\WorkingMaterial\CAD\851455-110.dwg, 110, 29/04/2011 3:35:38 p.m., dwm, 1:1

DESIGNED :	[Redacted]	Apr.11
DRAWN :	[Redacted]	Apr.11
DESIGN CHECKED :	[Redacted]	Apr.11
DRAFTING CHECKED :	[Redacted]	Apr.11
CADFILE :	\\851455-110.dwg	
s 7(2)(a) ... Privacy		
A. Issued for Hole Drilling Only s 7(2)(a)		
REVISION DESCRIPTION	BY	DATE

NOTES :

- All dimensions are in millimetres unless noted otherwise.

REFERENCE :

Tonkin & Taylor
Environmental and Engineering Consultants
Level 1, 36 Grey Street, Tauranga
Tel. (07) 571 7360. Fax: (07) 571 7390
www.tonkin.co.nz

CONSTRUCTION ISSUE
DRAWING STATUS: HOLE DRILLING ONLY

CLIENT, PROJECT
TAURANGA CITY COUNCIL
MAUAO SLIP 5 – FOOTBRIDGE DESIGN

TITLE
BRIDGE ABUTMENT
Sections and Detail

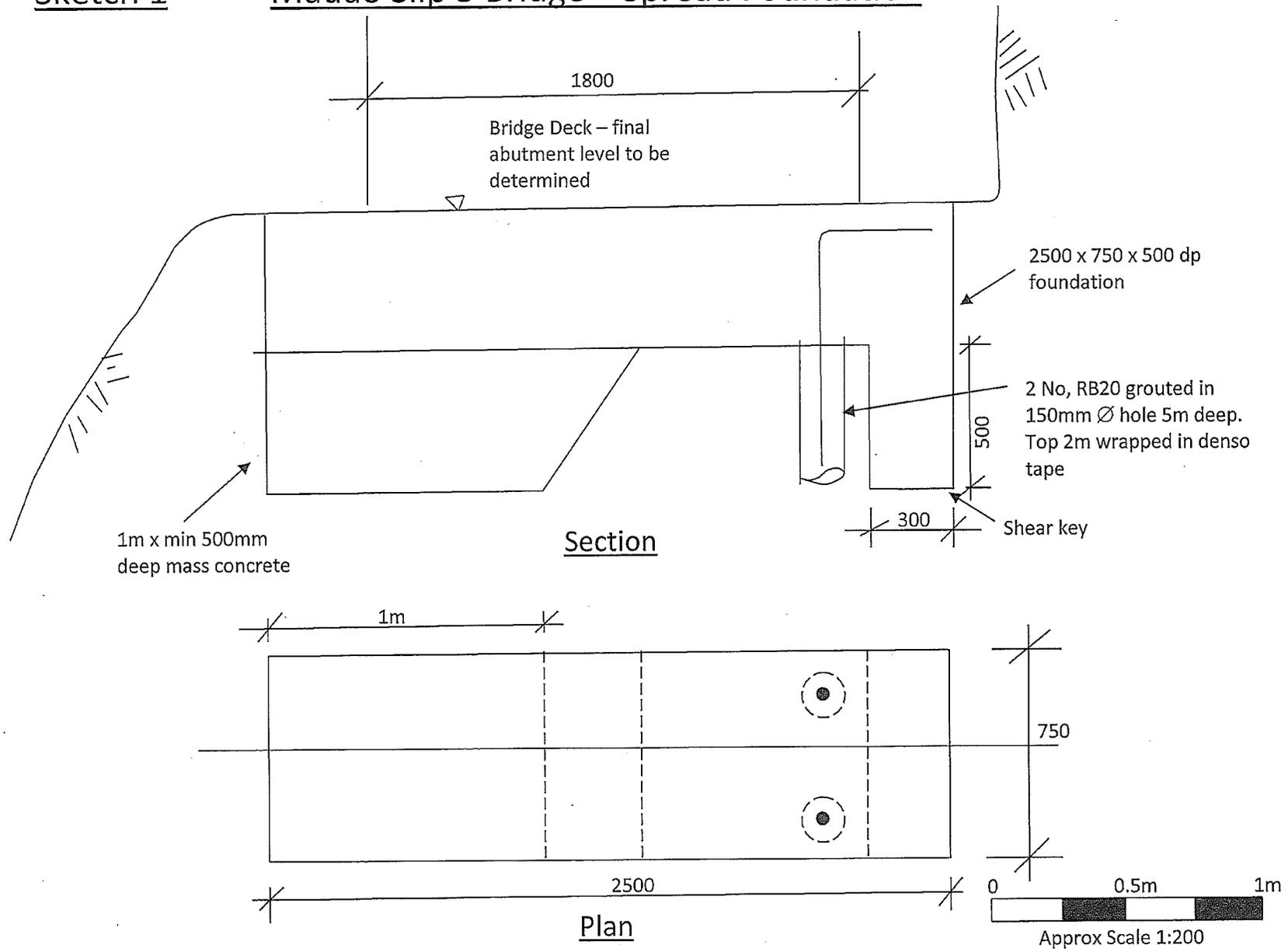
SCALES (AT A3 SIZE)
As Shown

DWG. No.
851455-110

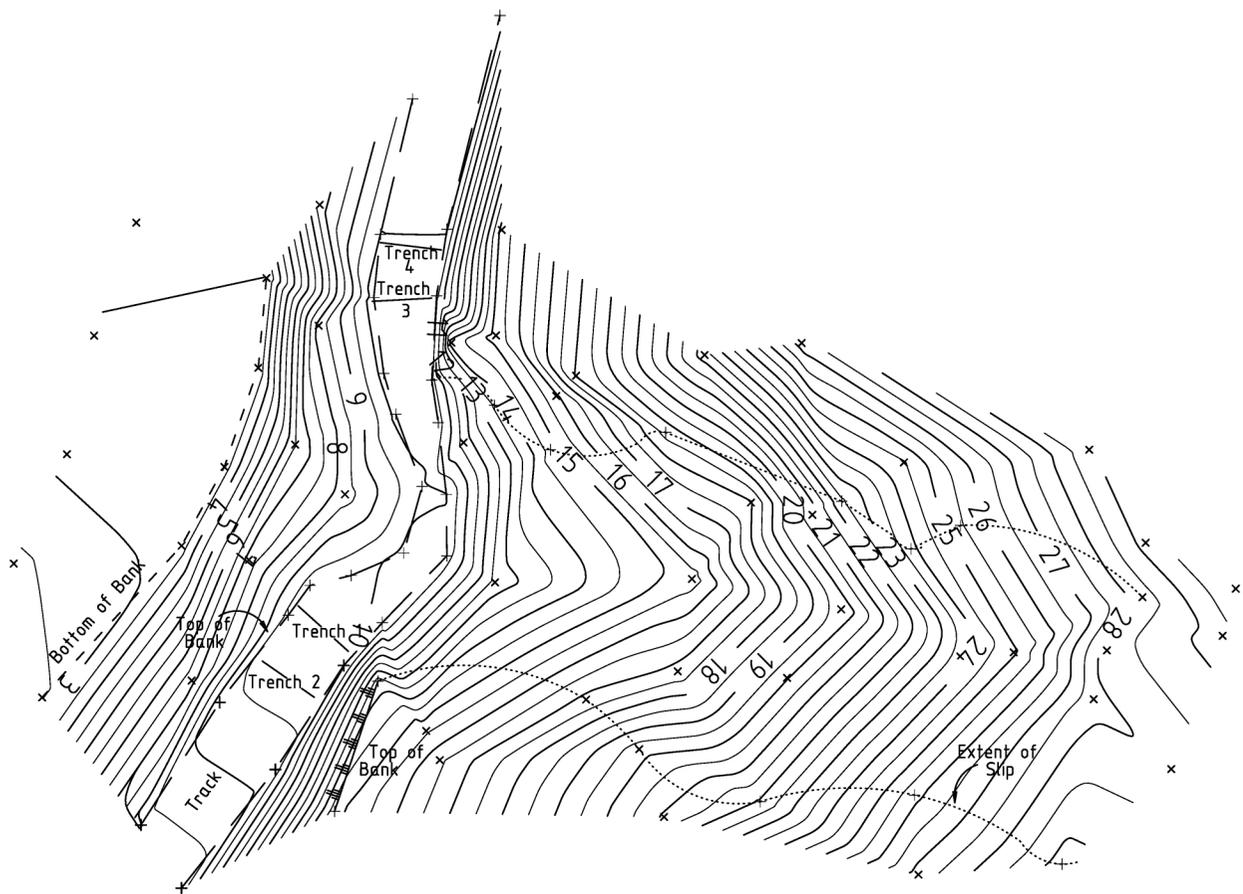
REV.
A

Sketch 1

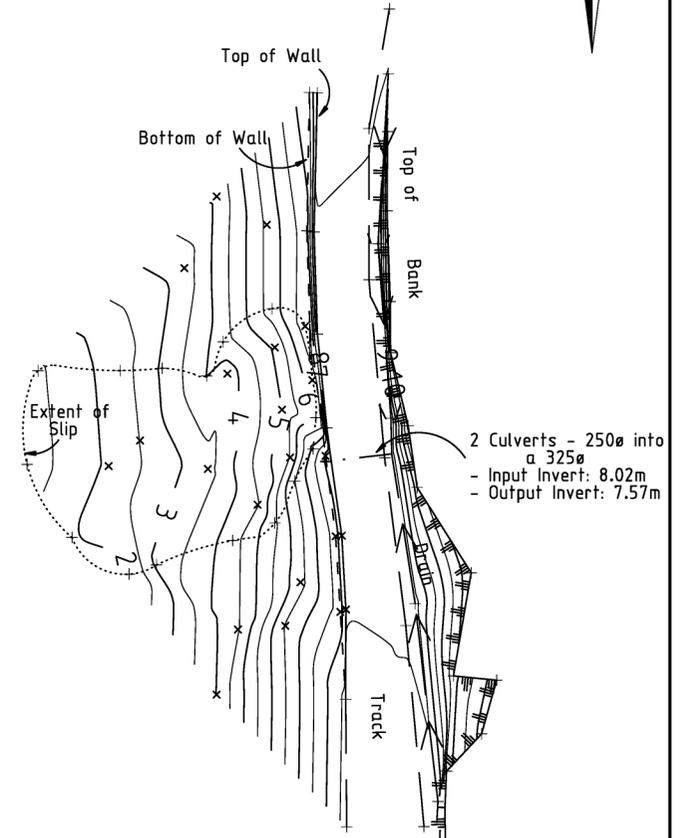
Mauao Slip 5 Bridge – Spread Foundation



Appendix B: Survey Drawing



Slip 5



Washout
(Rock Wall undermined)

NOTES: This plan is to be used by the named client only.
 Areas and dimensions are approximate only and are subject to final survey.
 Orientation is Assumed.
 Levels are in terms of Moturiki Datum.
 Origin of levels is: BM AB4Y RI. 3.4537m

THIS PLAN HAS BEEN PREPARED BY AND COPYRIGHT TO



321 MAUNGANUI ROAD, PO BOX 5196, MOUNT MAUNGANUI 3150
 TEL (07) 575 4911 FAX. (07) 575 3041

Contour Plan of Mauao
 Slip 5 & Washout on NW base track

Mount Maunganui

Date:	22 March 2011
Scale:	1:200 (at A3)
Drawn by:	S 7(2)(a) - Pri
Client:	Tonkin & Taylor
	5504 (5)

Appendix C Test Pit Logs



GEOTECHNICS LTD

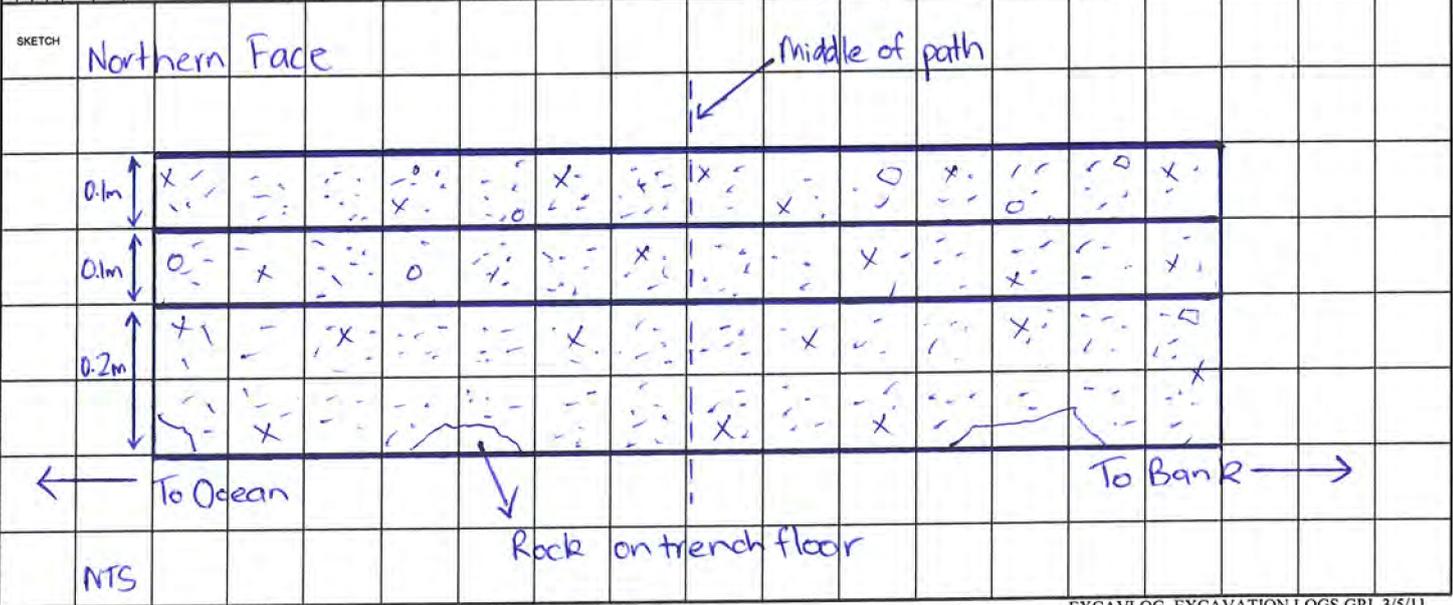
EXCAVATION LOG

EXCAVATION No: TP1
Location: ~6m S of centre

SHEET 1 OF 1

PROJECT: Mount Maunganui	LOCATION: Slip 5	JOB No: 851455
CO-ORDINATES:	EXPOSURE TYPE: Test Pit	EXCAV. STARTED: 16/3/11
R.L. m	EQUIPMENT: 1t Excavator	EXCAV FINISHED: 16/3/11
DATUM	OPERATOR: N/A	LOGGED BY: s 7(2)(a)
	DIMENSIONS:	CHECKED BY:

EXCAVATION TESTS			ENGINEERING DESCRIPTION				GEOLOGICAL							
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS		MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
								19	28					
							SPM	Silty, fine to coarse SAND with minor gravel and rootlets, brown. Dry to moist, loose, poorly graded. Gravel is fine to medium.	D-M	L				
							SPM	Silty, fine to coarse pumiceous SAND with trace gravel, light brown-orange. Moist, medium dense, poorly graded. Gravel is fine, highly weathered, subrounded to rounded.	M	MD				
							SPM	Silty, fine to medium pumiceous SAND, brown. Moist to wet, medium dense, poorly graded. Moderately sensitive, some sand broken down to silt under finger pressure.	M-W	MD				
					0.5			END OF TESTPIT AT 0.4mbgl.						



T:\T_DATA\TEMPLATE.GDT.rhb



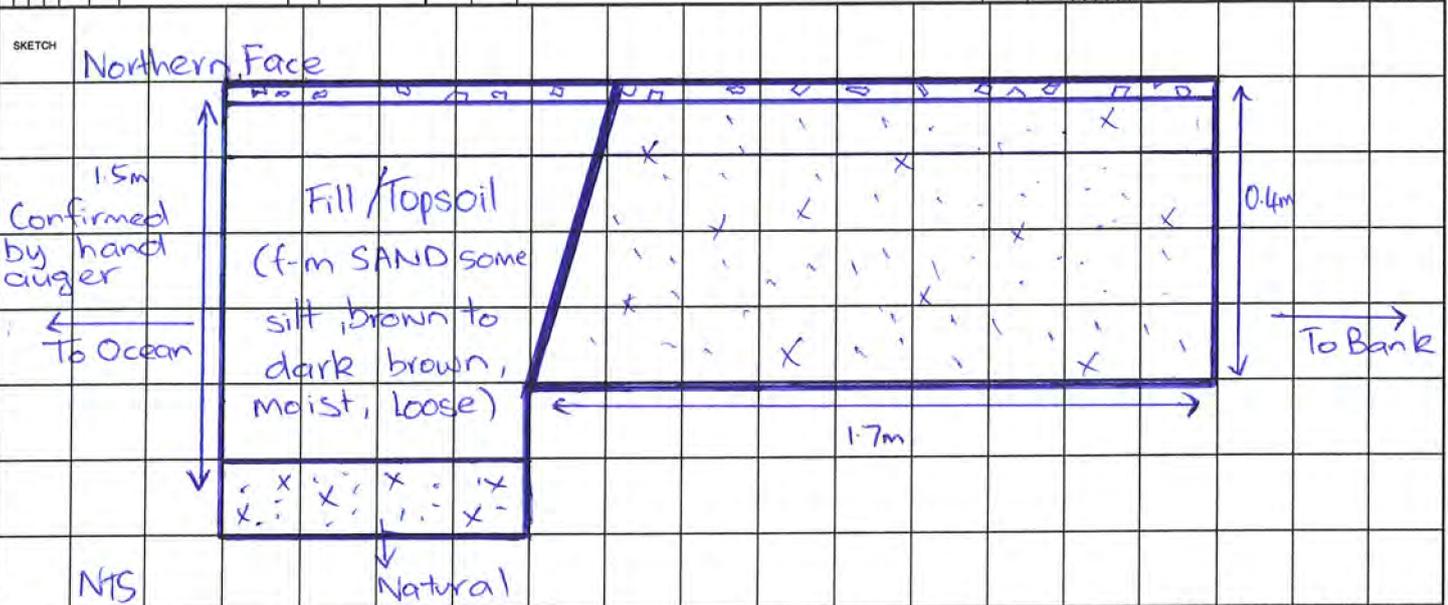
GEOTECHNICS LTD

EXCAVATION LOG

EXCAVATION No: TP2
Location: ~8m S of centre
SHEET 1 OF 1

PROJECT: Mount Maunganui	LOCATION: Slip 5	JOB No: 851455
CO-ORDINATES:	EXPOSURE TYPE: Test Pit	EXCAV. STARTED: 16/3/11
R.L. m	EQUIPMENT: 1t Excavator	EXCAV FINISHED: 16/3/11
DATUM	OPERATOR: N/A	LOGGED BY: s 7(2)(a) - Privacy
	DIMENSIONS:	CHECKED BY:

EXCAVATION TESTS			ENGINEERING DESCRIPTION				GEOLOGICAL					
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE CONDITION / WEATHERING	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT
						 G	Fine to medium GRAVEL, grey. Moist. (Seal/chip)	M				
						 SPM	Silty, fine to medium SAND, brown with some light brown mottling. Moist to wet, medium dense, poorly graded, pumiceous.	M-W	MD			
					0.5		END OF TEST PIT AT 0.4mbl.					



T-T. DATATEMPLATE.GDT.rth



GEOTECHNICS LTD

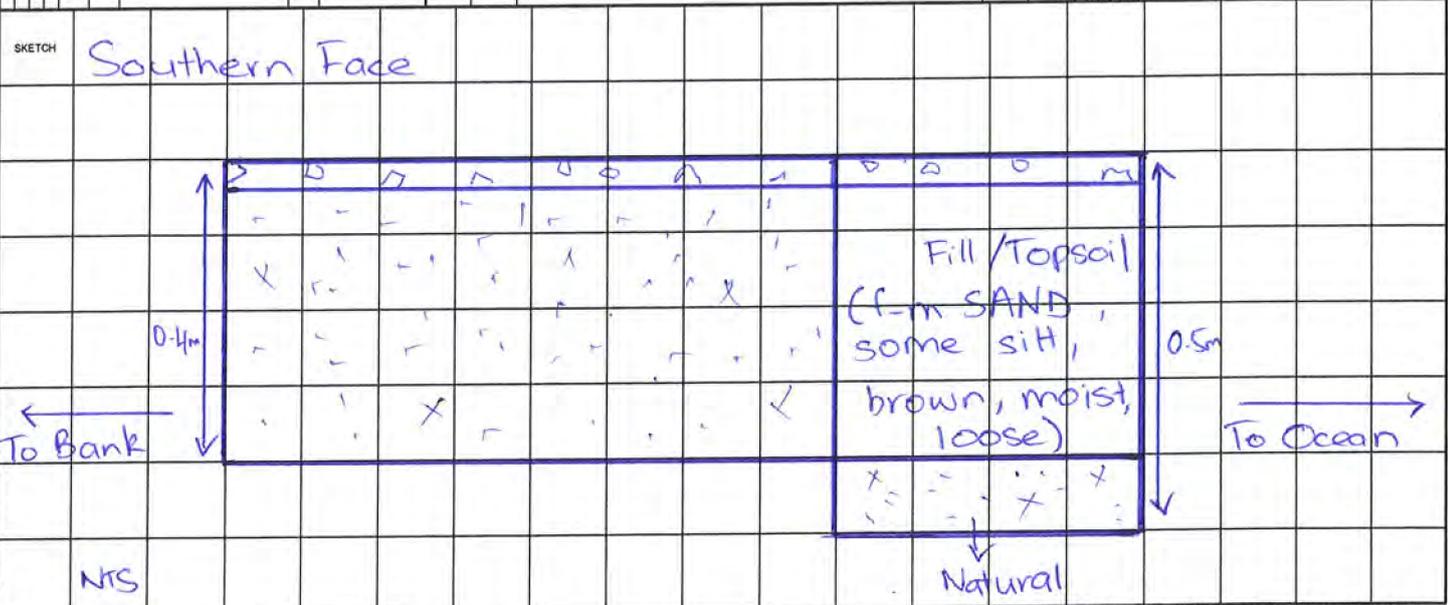
EXCAVATION LOG

EXCAVATION No: TP4
Location: ~10m N of centre

SHEET 1 OF 1

PROJECT: Mount Maunganui	LOCATION: Slip 5	JOB No: 851455
CO-ORDINATES:	EXPOSURE TYPE: Test Pit	EXCAV. STARTED: 16/3/11
R.L. m	EQUIPMENT: 2.5t Excavator	EXCAV FINISHED: 16/3/11
DATUM	OPERATOR: N/A	LOGGED BY: s 7(2)(a)
	DIMENSIONS:	CHECKED BY:

EXCAVATION TESTS			ENGINEERING DESCRIPTION				GEOLOGICAL							
PENETRATION 1 2 3	SUPPORT	WATER	SAMPLES, TESTS	R.L. (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	SOIL NAME, PLASTICITY OR PARTICLE SIZE CHARACTERISTICS, COLOUR, SECONDARY AND MINOR COMPONENTS	MOISTURE / WEATHERING CONDITION	STRENGTH / DENSITY CLASSIFICATION	ESTIMATED SHEAR STRENGTH (kPa)	ORIGIN TYPE, MINERAL COMPOSITION, DEFECTS, STRUCTURE	UNIT	
														20
							G	Fine to medium GRAVEL, grey. Moist. (Seal/Chip)	M					
							SP	Fine to medium SAND with trace silt, light brown and white. Moist, dense, poorly graded, pumiceous.	M	D				
					0.5			END OF TEST PIT AT 0.4mbgl.						



T+T DATATEMPLATE.GDT.rdb