Appendix C

Geotechnical Laboratory Test Results

Douglas Partners
Geotechnics · Environment · Groundwater

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Hunter Region Mail Centre NSW 2310
Australia

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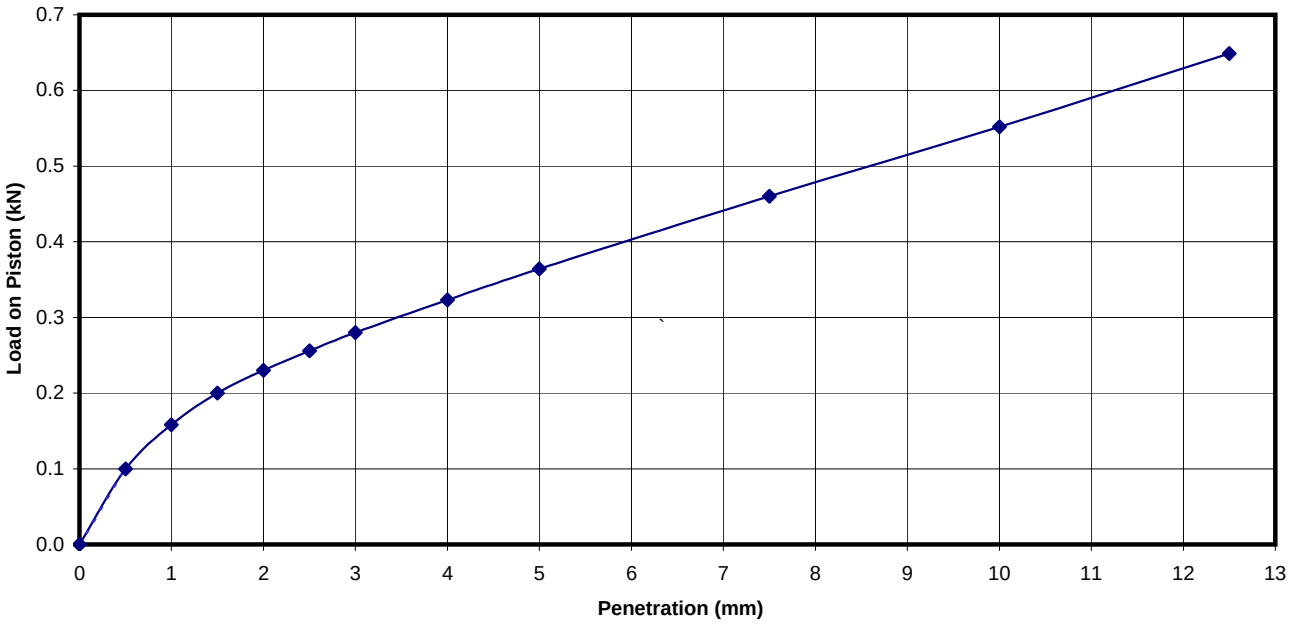
Phone (02) 4960 9600
Fax: (02) 4960 9601
newcastle@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179g
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
		Date Sampled :	6/08/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	8/09/2007
Test Location :	TP 36		
Depth / Layer :	0.1-1.0m	**Page:**	1 of 1



Description: Sandy CLAY - Dark brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001 **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 2.0%
MOISTURE RATIO: 100% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		25.4	1.49
After soaking		27.7	1.46
After test	Top 30mm of sample	32.6	-
	Remainder of sample	26.8	-
Field values		28.5	-
Standard Compaction		25.5	1.50

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**2.0**
	5.0 mm	**2.0**

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory:

Tested:	MG
Checked:	DM

Dave Millard
Laboratory Manager

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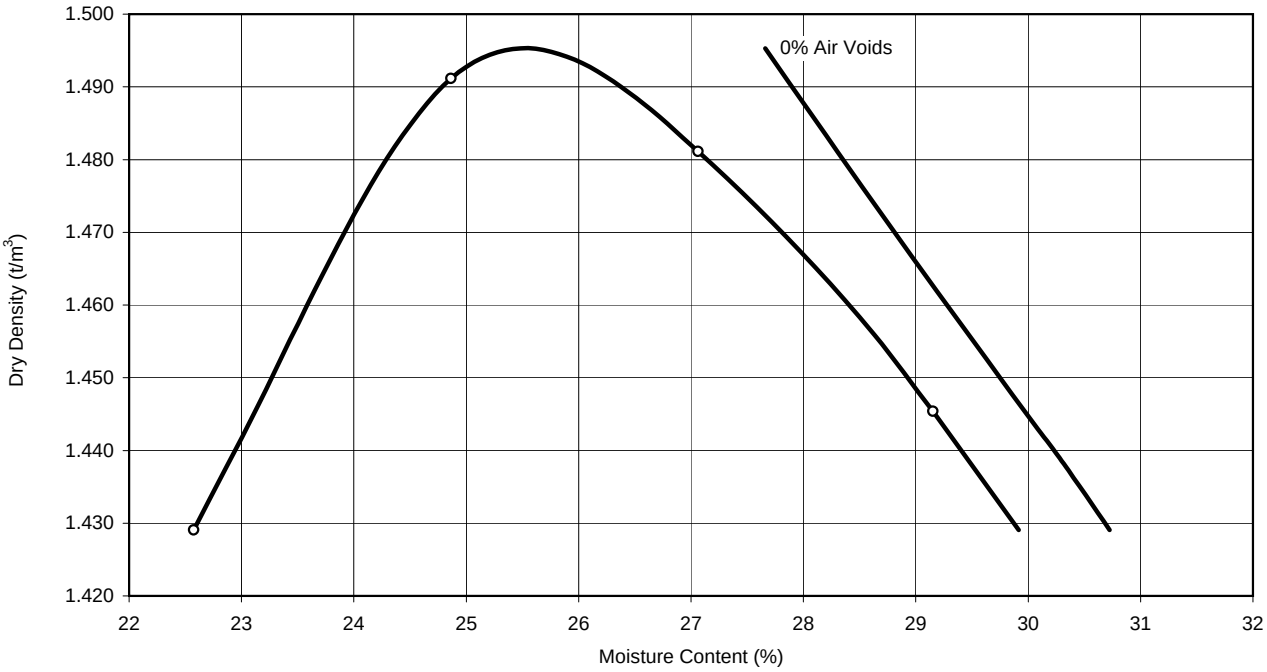
RESULTS OF COMPACTION TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179f
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	28/08/2007
		Page:	1 of 1



Sample Details **Location:** TP 36
Depth: 0.1-1.0m

Particles > 19mm: 0%

Description: Sandy CLAY - Dark brown

Maximum Dry Density:	**1.50 t/m^3**
Optimum Moisture Content:	**25.5 %**

Remarks:

Test Methods: AS 1289.5.1.1-2003 (STD), AS 1289.2.1.1-2005

Sampling Methods: AS 1289.1.1.1-1998, AS1289.1.2.1-2001

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	BB
Checked:	DM

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Laboratory Manager

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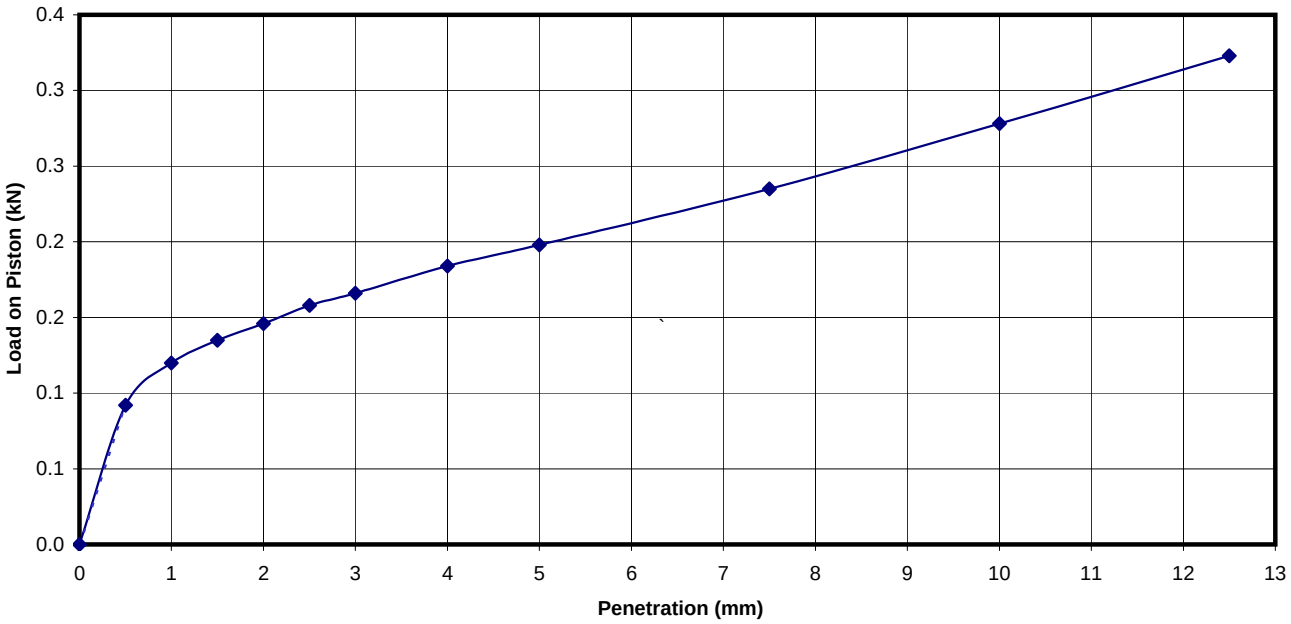
RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179e
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
		Date Sampled :	6/08/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	8/09/2007
Test Location :	TP 34		
Depth / Layer :	0.7-1.0m	**Page:**	1 of 1



Description: Silty CLAY - Dark grey/brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001 **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 4.0%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		34.2	1.32
After soaking		39.5	1.27
After test	Top 30mm of sample	48.4	-
	Remainder of sample	35.1	-
Field values		51.4	-
Standard Compaction		34.5	1.32

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**1.0**
	5.0 mm	**1.0**

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Checked:	DM

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Laboratory Manager

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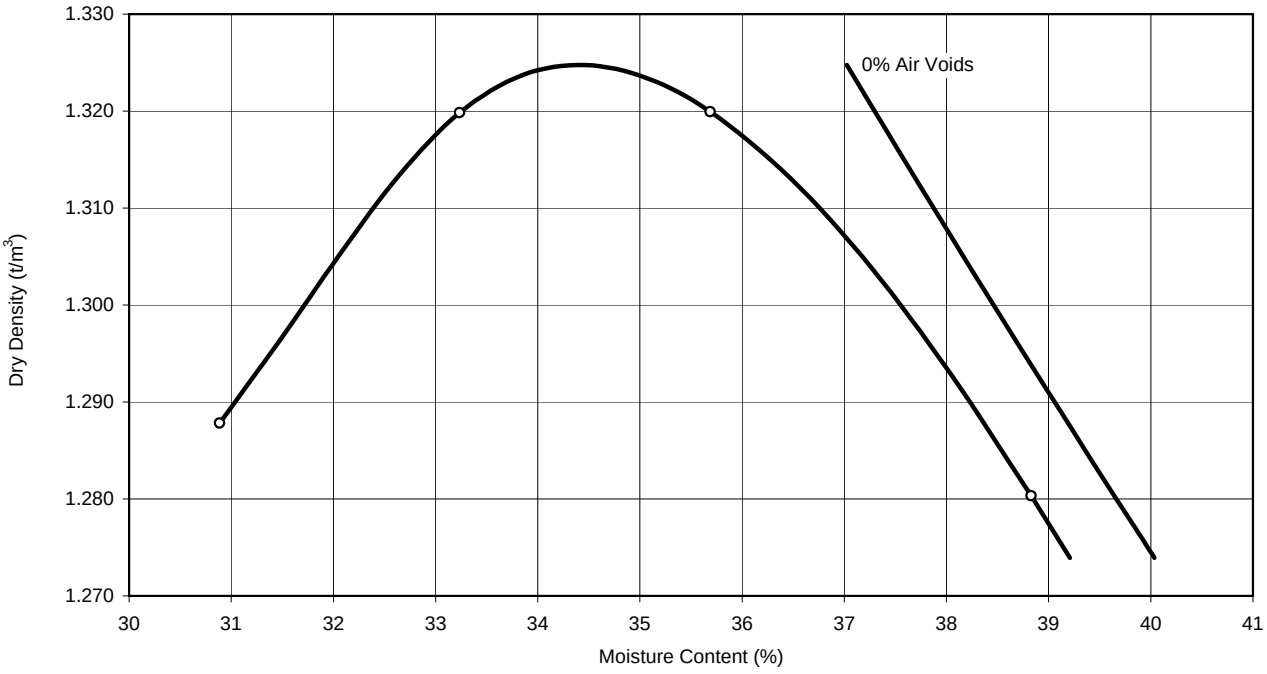
RESULTS OF COMPACTION TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179d
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	28/08/2007
		Page:	1 of 1



Sample Details **Location:** TP 34
Depth: 0.7-1.0m

Particles > 19mm: 0%

Description: Silty CLAY - Dark grey/brown

Maximum Dry Density:	**1.32 t/m^3**
Optimum Moisture Content:	**34.5 %**

Remarks:

Test Methods: AS 1289.5.1.1-2003 (STD), AS 1289.2.1.1-2005

Sampling Methods: AS 1289.1.1.1-1998, AS1289.1.2.1-2001

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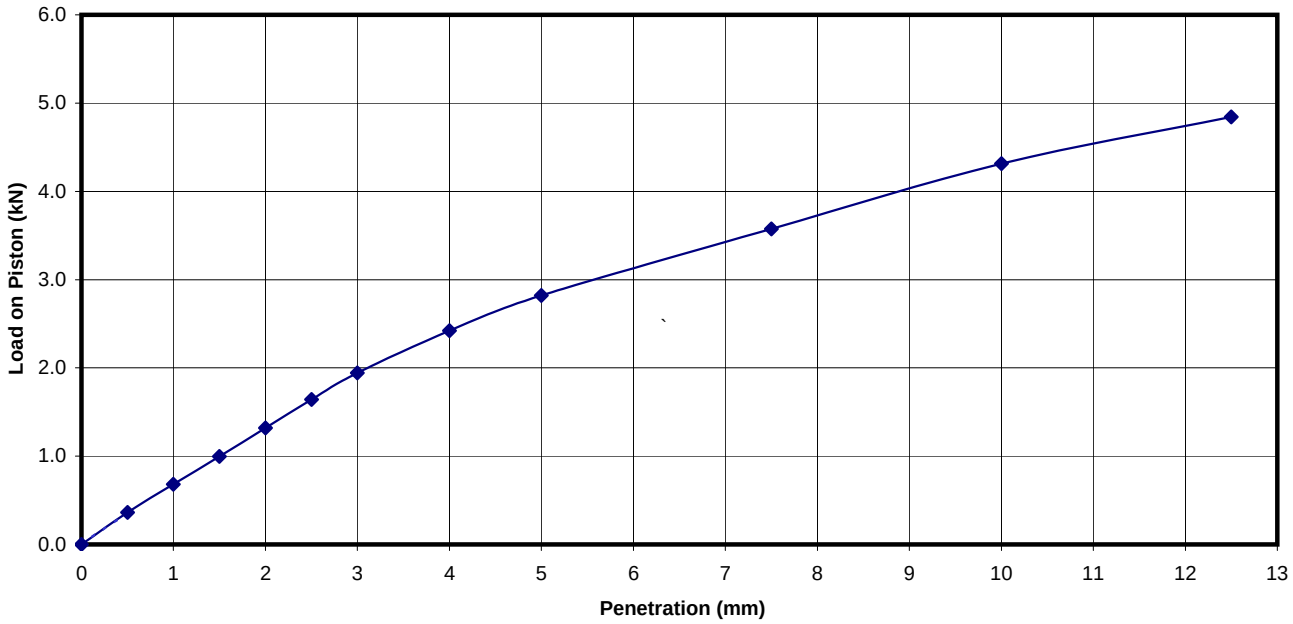
RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179c
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
		Date Sampled :	6/08/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	8/09/2007
Test Location :	TP 27		
Depth / Layer :	1.0-1.5m	**Page:**	1 of 1



Description: Gravelly CLAY - Dark grey (Coal Chitter)

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001 **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** -0.1%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		14.8	1.48
After soaking		16.1	1.48
After test	Top 30mm of sample	17.9	-
	Remainder of sample	15.1	-
Field values		20.7	-
Standard Compaction		15.0	1.48

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**12**
	5.0 mm	**14**

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	MG
Checked:	DM

Dave Millard
Laboratory Manager

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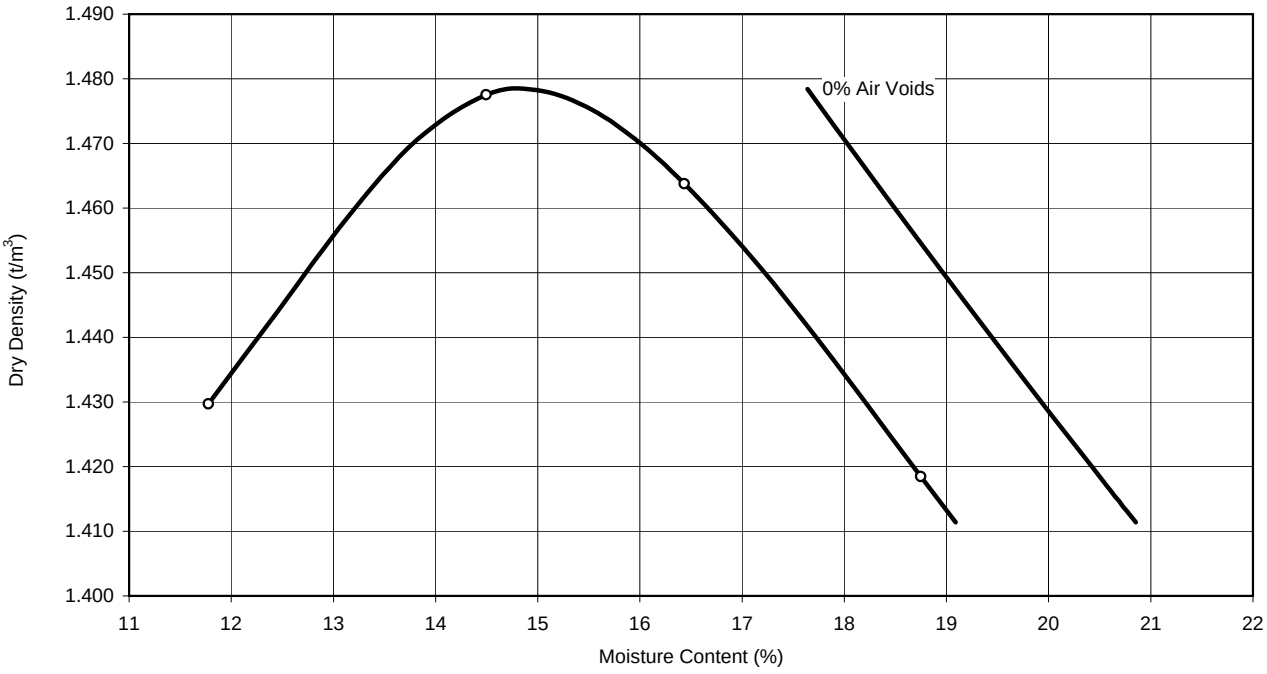
RESULTS OF COMPACTION TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179b
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	30/08/2007
		Page:	1 of 1



Sample Details **Location:** TP 27
Depth: 1.0-1.5m

Particles > 19mm: 15%

Description: Gravelly CLAY - Dark grey (Coal Chitter)

Maximum Dry Density:	**1.48 t/m^3**
Optimum Moisture Content:	**15.0 %**

Remarks:

Test Methods: AS 1289.5.1.1-2003 (STD), AS 1289.2.1.1-2005

Sampling Methods: AS 1289.1.1.1-1998, AS1289.1.2.1-2001

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	BB
Checked:	DM

Dave Millard
Laboratory Manager

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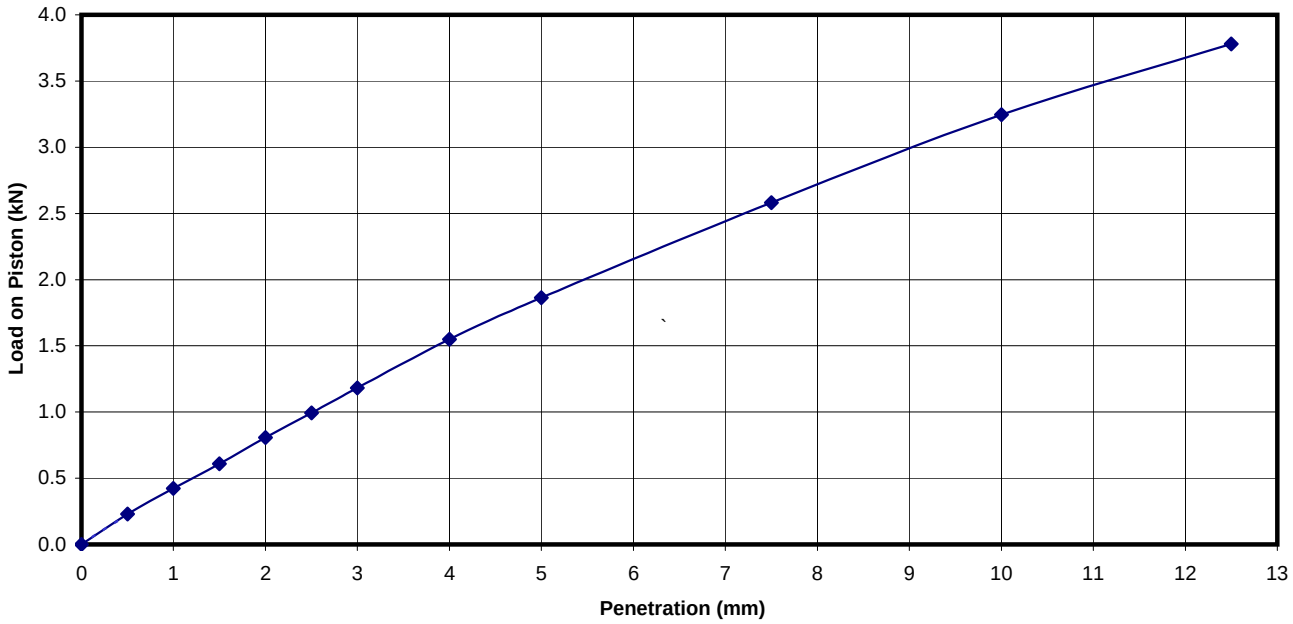
RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179a
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
		Date Sampled :	6/08/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	8/09/2007
Test Location :	TP 18		
Depth / Layer :	0.0-1.0m	**Page:**	1 of 1



Description: Coal Rejects

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001 **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** -0.1%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		13.4	1.58
After soaking		14.8	1.58
After test	Top 30mm of sample	16.3	-
	Remainder of sample	14.6	-
Field values		11.7	-
Standard Compaction		13.5	1.58

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**8**
	5.0 mm	**9**

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	MG
Checked:	DM

Dave Millard
Laboratory Manager

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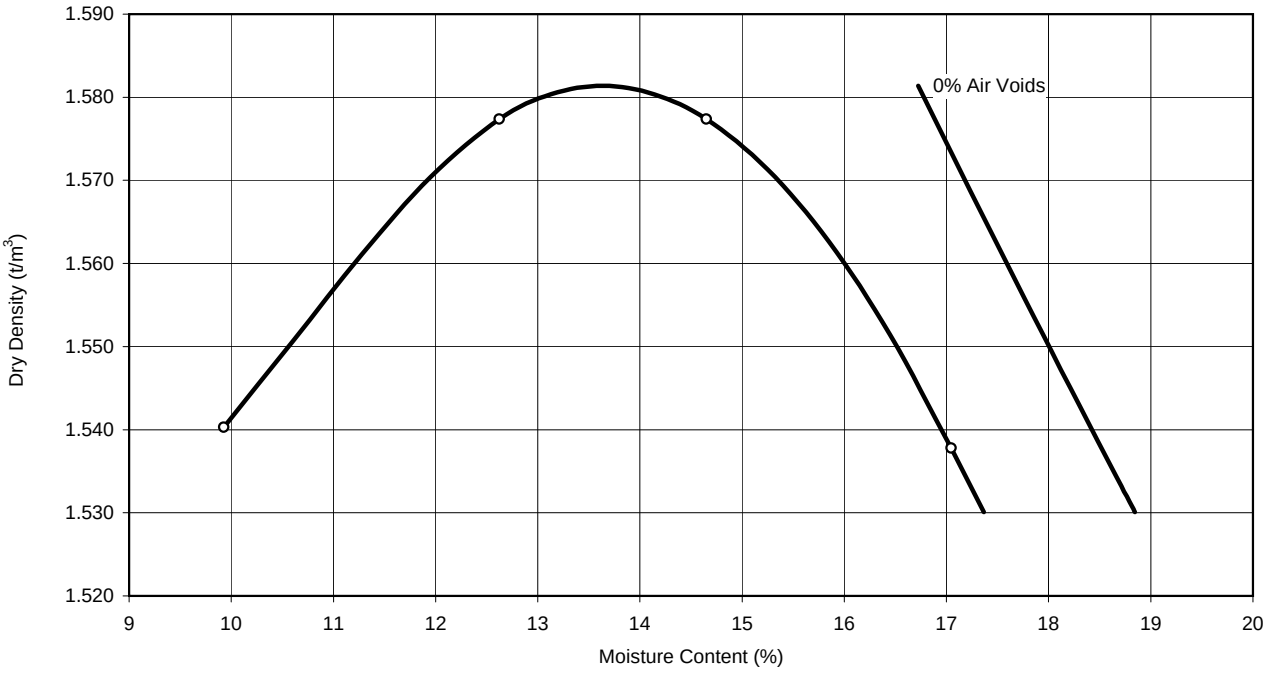
RESULTS OF COMPACTION TEST

Client :	Queensland Rail	**Project No. :**	39798
		Report No. :	N07-179
Project :	Preliminary Geotechnical Investigation	**Report Date :**	12/09/2007
Location :	Woodlands Close, Hexham	**Date of Test:**	27/08/2007
		Page:	1 of 1



Sample Details **Location:** TP 18
Depth: 0.0-1.0m

Particles > 19mm: 0%

Description: Coal Rejects

Maximum Dry Density:	**1.58 t/m^3**
Optimum Moisture Content:	**13.5 %**

Remarks:

Test Methods: AS 1289.5.1.1-2003 (STD), AS 1289.2.1.1-2005

Sampling Methods: AS 1289.1.1.1-1998, AS1289.1.2.1-2001

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	BB
Checked:	DM

Dave Millard
Laboratory Manager

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RESULTS OF MOISTURE CONTENT, PLASTICITY AND LINEAR SHRINKAGE TESTS

Client: **Queensland Rail**

Project: Preliminary Geotechnical Investigation

Location: Woodlands Close, Hexham

Project No: 39798
Report No: N07-179h
Report Date: 12/9/2007

Date Sampled: 6/8/2007
Date of Test: 6/9/2007
Page: 1 of 1

TEST LOCATION	DEPTH (m)	DESCRIPTION	CODE	W_F %	W_L %	W_P %	PI %	*LS %
TP 16	2.3	Silty CLAY - Dark brown	2,5	41.9	56	25	31	14.0 (CU)
TP 21	1.5-1.95	Silty CLAY - Brown	2,5	41.1	44	23	21	12.0
TP 37	3.9	Sandy SILT - Grey black	2,5	37.0	-	-	N/P	-

Legend:
W_F Field Moisture Content
W_L Liquid limit
W_P Plastic limit
PI Plasticity index
LS Linear shrinkage from liquid limit condition (Mould length 125mm)

Test Methods:
Moisture Content: AS 1289 2.1.1 - 2005
Liquid Limit: AS 1289 3.1.2 - 1995
Plastic Limit: AS 1289 3.2.1 - 1995
Plasticity Index: AS 1289 3.3.1 - 1995
Linear Shrinkage: AS 1289 3.4.1 - 1995

Code
Sample history for plasticity tests
1. Air dried
2. Low temperature (<50ºC) oven dried
3. Oven (105ºC) dried
4. Unknown

Method of preparation for plasticity tests
5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

Sampling Method(s): AS 1289.1.2.1-1998, AS 1289.1.1-2001

Remarks:

Approved Signatory:

Tested: LB
Checked: DM

D Millard
Laboratory Manager

NATA Accredited Laboratory Number: 828

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Appendix D

Analytical Laboratory Test Results
Chain of Custody Forms
Quality Assurance / Quality Control

Douglas Partners
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CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Hexham Preliminary Geotechnical Investigation
Project No: 39798 DP Order No: 67344
DP Contact Person: S McFarlane
Prior Storage: esky / fridge / shelved (circle) ... Freezer

To: ALS PTY LTD
5 Rosegum Close
Warabrook NSW 2304
Ph: (02) 4968 9433
Attn: Ken Reid

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: TPA	TAA	Scr											TCLP	Notes
1	14/2-4	6.08.07	S		✓	✓	✓												
2	16/3.0-3.45	6.08.07	S		↓	↓	↓												
3	27/1.5-1.95	6.08.07	S																
4	28/3.3	6.08.07	S																
5	30/0.4	6.08.07	S																
PQL (S)			mg/kg																
PQL (W)			mg/L																

Environmental Division
Brisbane
Work Order
EB0709130

Telephone : +61-7-3243 7222

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 14.08.07
Total number of samples in container: 5
Results required by:
TAT (Circle): (Standard) 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature: PETER DONAGHY ALS NEWCASTLE
Date: 15/8/07 Lab Ref:

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

Relinquished By: Kasey Watts of ALS Newcastle 15/8/07 at 4pm

ALS Environmental

QUALITY CONTROL REPORT

Client	:	**DOUGLAS PARTNERS PTY LTD**	**Laboratory**	:	Environmental Division Brisbane	**Page**	: **1 of 4**
Contact	:	MR SCOTT MCFARLANE	**Contact**	:	Tim Kilmister		
Address	:	PO BOX 324 HUNTER REGION MAIL CENTRE AUSTRALIA 2310	**Address**	:	32 Shand Street Stafford QLD Australia 4053	**Work order**	: **EB0709130**
						Amendment No.	:
Project	:	Hexham Preliminary Geotechnica	**Quote number**	:	EN/020/07	**Date received**	: **16 Aug 2007**
Order number	:	67344				**Date issued**	: **24 Aug 2007**
C-O-C number	:	- Not provided -					
Site	:	- Not provided -					
E-mail	:	mcfarlanes@douglaspartners.com.au	**E-mail**	:	Services.Brisbane@alsenviro.com	**No. of samples**	
Telephone	:	49609600	**Telephone**	:	+61-7-3243 7222	**Received**	: 5
Facsimile	:	49609601	**Facsimile**	:	+61-7-3243 7218	**Analysed**	: 5

This final report for the ALSE work order reference EB0709130 supersedes any previous reports with this reference.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- Laboratory Duplicates (DUP); Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Samples (LCS); Recovery and Acceptance Limits
- Matrix Spikes (MS); Recovery and Acceptance Limits

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory - 825

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Accredited for compliance with ISO/IED 17025

This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	Department
Lea-Ellen Catt	Inorganics - NATA 825 (818 - Brisbane)

Quality Control Report - Laboratory Duplicates (DUP)

The quality control term **Laboratory Duplicate** refers to an intralaboratory split sample randomly selected from the sample batch. Laboratory duplicates provide information on method precision and sample heterogeneity.
- Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** = *Limit of Reporting,* ***RPD*** = *Relative Percent Difference.*
* Indicates failed QC. The permitted ranges for the RPD of Laboratory Duplicates (relative percent deviation) are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting:- Result < 10 times LOR, no limit - Result between 10 and 20 times LOR, 0% - 50% - Result > 20 times LOR, 0% - 20%

Matrix Type: SOIL ***Laboratory Duplicates (DUP) Report***

Laboratory Sample ID	*Client Sample ID*	*Analyte name*	*LOR*	*Original Result*	*Duplicate Result*	*RPD*
EA026 : Chromium Reducible Sulphur						
EA026 : Chromium Reducible Sulphur - (QC Lot: 474407)				**%**	**%**	**%**
EB0709130-001	14/12.4	Chromium Reducible Sulphur	0.02 %	0.65	0.65	0.0
EA029-A: pH Measurements						
EA029-A: pH Measurements - (QC Lot: 474408)				**pH Unit**	**pH Unit**	**%**
EB0709130-001	14/12.4	pH OX (23B)	0.1 pH Unit	2.3	2.3	0.0
EA029-A: pH Measurements - (QC Lot: 474409)				**pH Unit**	**pH Unit**	**%**
EB0709130-001	14/12.4	pH KCl (23A)	0.1 pH Unit	5.6	5.6	0.0
EA029-B: Acidity Trail						
EA029-B: Acidity Trail - (QC Lot: 474408)				**mole H+ / t**	**mole H+ / t**	**%**
EB0709130-001	14/12.4	Titratable Peroxide Acidity (23G)	2 mole H+ / t	359	355	1.1
EA029-B: Acidity Trail - (QC Lot: 474409)				**mole H+ / t**	**mole H+ / t**	**%**
EB0709130-001	14/12.4	Titratable Actual Acidity (23F)	2 mole H+ / t	6	5	18.2

ALS Environmental

Quality Control Report - Method Blank (MB) and Laboratory Control Samples (LCS)

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC type is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a known, interference free matrix spiked with target analytes or certified reference material. The purpose of this QC type is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of actual laboratory data. Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. Abbreviations: LOR = Limit of reporting.

Matrix Type: SOIL

Method Blank (MB) and Laboratory Control Samples (LCS) Report

		Method blank result	*Actual Results*		*Recovery Limits*	
			Spike concentration	*Spike Recovery*	*Dynamic Recovery Limits*	
Analyte name	*LOR*			*LCS*	*Low*	*High*
EA026 : Chromium Reducible Sulphur						
EA026 : Chromium Reducible Sulphur - (QC Lot: 474407)		%	%	%	%	%
Chromium Reducible Sulphur	0.02 %	----	0.21	100	73.1	129
	0.02 %	<0.02	----	----	----	----
EA029-A: pH Measurements						
EA029-A: pH Measurements - (QC Lot: 474408)		pH Unit	pH Unit	%	%	%
pH OX (23B)	0.1 pH Unit	<0.1	----	----	----	----
EA029-A: pH Measurements - (QC Lot: 474409)		pH Unit	pH Unit	%	%	%
pH KCl (23A)	0.1 pH Unit	<0.1	----	----	----	----
EA029-B: Acidity Trail						
EA029-B: Acidity Trail - (QC Lot: 474408)		mole H+ / t	mole H+ / t	%	%	%
Titratable Peroxide Acidity (23G)	2 mole H+ / t	<2	2	----	----	----
EA029-B: Acidity Trail - (QC Lot: 474409)		mole H+ / t	mole H+ / t	%	%	%
Titratable Actual Acidity (23F)	2 mole H+ / t	<2	----	----	----	----

ALS Environmental

Quality Control Report - Matrix Spikes (MS)

The quality control term **Matrix Spike (MS)** refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC type is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQO's). 'Ideal' recovery ranges stated may be waived in the event of sample matrix interferences. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot. *Abbreviations:* ***LOR*** *= Limit of Reporting,* ***RPD*** *= Relative Percent Difference.*

* Indicates failed QC

Matrix Spike (MS) Report

					Actual Results		*Recovery Limits*	
					Sample Result	*Spike Recovery*	*Static Limits*	
Analyte name	*Laboratory Sample ID*	*Client Sample ID*	*LOR*	*Spike Concentration*		*MS*	*Low*	*High*
- (QC Lot:)						%	%	%
					----			

l **No Matrix Spike (MS) carried out on this Work Order.**

ALS Environmental

INTERPRETIVE QUALITY CONTROL REPORT

Client	:	**DOUGLAS PARTNERS PTY LTD**	**Laboratory**	:	Environmental Division Brisbane	**Page**	: **1 of 5**
Contact	:	MR SCOTT MCFARLANE	**Contact**	:	Tim Kilmister		
Address	:	PO BOX 324 HUNTER REGION MAIL CENTRE AUSTRALIA 2310	**Address**	:	32 Shand Street Stafford QLD Australia 4053	**Work order**	: **EB0709130**
						Amendment No.	:
Project	:	Hexham Preliminary Geotechnica	**Quote number**	:	EN/020/07	**Date received**	: 16 Aug 2007
Order number	:	67344				**Date issued**	: 24 Aug 2007
C-O-C number	:	- Not provided -					
Site	:	- Not provided -					
E-mail	:	mcfarlanes@douglaspartners.com.au	**E-mail**	:	Services.Brisbane@alsenviro.com	**No. of samples**	
Telephone	:	49609600	**Telephone**	:	+61-7-3243 7222	**Received**	: 5
Facsimile	:	49609601	**Facsimile**	:	+61-7-3243 7218	**Analysed**	: 5

This Interpretive Quality Control Report was issued on 24 Aug 2007 for the ALS work order reference EB0709130 and supersedes any previous reports with this reference.
This report contains the following information:

- Analysis Holding Time Compliance
- Quality Control Type Frequency Compliance
- Summary of all Quality Control Outliers
- Brief Method Summaries

Interpretive Quality Control Report - Analysis Holding Time

The following report summarises extraction / preparation and analysis times and compares with recommended holding times. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. Information is also provided re the sample container (preservative) from which the sample aliquot was taken. Elapsed time to analysis represents time from sampling where no extraction / digestion is involved or time from extraction / digestion where this is present. For composite samples, sampling date/time is taken as that of the oldest sample contributing to that composite. Sample date/time for laboratory produced leaches are taken from the completion date/time of the leaching process. Outliers for holding time are based on USEPA SW846, APHA, AS and NEPM (1999). Failed outliers, refer to the 'Summary of Outliers'.

Matrix Type: SOIL ***Analysis Holding Time and Preservation***

Method / **Container /** Client Sample ID(s)	**Date Sampled**	**Extraction / Preparation**			**Analysis**		
		Date extracted	Due for extraction	Pass?	Date analysed	Due for analysis	Pass?
EA026: Chromium Reducible Sulphur							
Snap Lock Bag - frozen 14/12.4, 16/3.0-3.45, 27/1.5-1.95, 28/3.3, 30/0.4	**6 Aug 2007**	**16 Aug 2007**	5 Aug 2008	Pass	**20 Aug 2007**	18 Nov 2007	Pass
EA029-TAA: Suspension Peroxide Oxidation-Combined Acidity and Sulphate							
Snap Lock Bag - frozen 14/12.4, 16/3.0-3.45, 27/1.5-1.95, 28/3.3, 30/0.4	**6 Aug 2007**	**16 Aug 2007**	5 Aug 2008	Pass	**20 Aug 2007**	18 Nov 2007	Pass
EA029-TPA: Suspension Peroxide Oxidation-Combined Acidity and Sulphate							
Snap Lock Bag - frozen 14/12.4, 16/3.0-3.45, 27/1.5-1.95, 28/3.3, 30/0.4	**6 Aug 2007**	**16 Aug 2007**	5 Aug 2008	Pass	**20 Aug 2007**	18 Nov 2007	Pass

Interpretive Quality Control Report - Frequency of Quality Control Samples

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which this work order was processed. Actual rate should be greater than or equal to the expected rate.

Matrix Type: SOIL ***Frequency of Quality Control Samples***

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
EA026: Chromium Reducible Sulphur	1	5	**20.0**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EA029-TAA: Suspension Peroxide Oxidation-Combined Acidity and Sulphate	1	5	**20.0**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EA029-TPA: Suspension Peroxide Oxidation-Combined Acidity and Sulphate	1	5	**20.0**	**10.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Laboratory Control Samples (LCS)					
EA026: Chromium Reducible Sulphur	1	5	**20.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
Method Blanks (MB)					
EA026: Chromium Reducible Sulphur	1	5	**20.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EA029-TAA: Suspension Peroxide Oxidation-Combined Acidity and Sulphate	1	5	**20.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement
EA029-TPA: Suspension Peroxide Oxidation-Combined Acidity and Sulphate	1	5	**20.0**	**5.0**	NEPM 1999 Schedule B(3) and ALSE QCS3 requirement

Interpretive Quality Control Report - Summary of Outliers

Outliers : Quality Control Samples

The following report highlights outliers flagged on the 'Quality Control Report'. Surrogate recovery limits are static and based on USEPA SW846 or ALS-QWI/EN/38 (in the absence of specific USEPA limits). Flagged outliers on control limits for inorganics tests may be within the NEPM specified data quality objective of recoveries in the range of 70 to 130%. Where this occurs, no corrective action is taken. - Anonymous - Client Sample IDs refer to samples which are not specifically part of this work order but formed part of the QC process lot.

Non-surrogates

- **For all matrices, no RPD recovery outliers occur for the duplicate analysis.**
- **For all matrices, no method blank result outliers occur.**
- **For all matrices, no laboratory spike recoveries breaches occur.**
- **For all matrices, no matrix spike recoveries breaches occur.**

Surrogates

- **For all matrices, no surrogate recovery outliers occur.**

Outliers : Analysis Holding Time

The following report highlights outliers within this 'Interpretive Quality Control Report - Analysis Holding Time'.

- **No holding time outliers occur.**

Outliers : Frequency of Quality Control Samples

The following report highlights outliers within this 'Interpretive Quality Control Report - Frequency of Quality Control Samples'.

- **No frequency outliers occur.**

Method Reference Summary

The analytical procedures used by ALS Environmental are based on established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house procedure are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

Matrix Type: SOIL ***Method Reference Summary***

Preparation Methods

EN020PR : Drying at 85 degrees, bagging and labelling (ASS) - In house

Analytical Methods

EA026 : Chromium Reducible Sulphur - Sullivan et al (1998) The CRS method converts reduced inorganic sulfur to H2S by CrCl2 solution ; the evolved H2S is trapped in a zinc acetate solution as ZnS which is quantified by iodometric titration.

EA029-TAA : Suspension Peroxide Oxidation-Combined Acidity and Sulphate - Ahern et al 2004 - a suspension peroxide oxidation method following the 'sulfur trail' by determining the level of 1M KCL extractable sulfur and the sulfur level after oxidation of soil sulphides. The 'acidity trail' is followed by measurement of TAA, TPA and TSA. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

EA029-TPA : Suspension Peroxide Oxidation-Combined Acidity and Sulphate - Ahern et al 2004 - a suspension peroxide oxidation method following the 'sulfur trail' by determining the level of 1M KCL extractable sulfur and the sulfur level after oxidation of soil sulphides. The 'acidity trail' is followed by measurement of TAA, TPA and TSA. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

ALS Environmental

CERTIFICATE OF ANALYSIS

Client	: **DOUGLAS PARTNERS PTY LTD**	*Laboratory*	: **Environmental Division Brisbane**	*Page*	: **1 of 4**
Contact	: **MR SCOTT MCFARLANE**	*Contact*	: **Tim Kilmister**	*Work Order*	: **EB0709130**
Address	: **PO BOX 324 HUNTER REGION MAIL CENTRE AUSTRALIA 2310**	*Address*	: **32 Shand Street Stafford QLD Australia 4053**		
E-mail	: **mcfarlanes@douglaspartners.com.au**	*E-mail*	: **Services.Brisbane@alsenviro.com**		
Telephone	: **49609600**	*Telephone*	: **+61-7-3243 7222**		
Facsimile	: **49609601**	*Facsimile*	: **+61-7-3243 7218**		
Project	: **Hexham Preliminary Geotechnica**	*Quote number*	: **EN/020/07**	*Date received*	: **16 Aug 2007**
Order number	: **67344**			*Date issued*	: **24 Aug 2007**
C-O-C number	: **- Not provided -**			*No. of samples*	- *Received* : **5**
Site	: **- Not provided -**				*Analysed* : **5**

ALSE - Excellence in Analytical Testing

NATA Accredited Laboratory 825

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This document has been electronically signed by those names that appear on this report and are the authorised signatories. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatory	*Position*	*Department*
Lea-Ellen Catt	**Laboratory Technician - Acid Sulphate Soils**	**Inorganics - NATA 825 (818 - Brisbane)**

ALS Environmental

Comments

This report for the ALSE reference EB0709130 supersedes any previous reports with this reference. Results apply to the samples as submitted. All pages of this report have been checked and approved for release.

This report contains the following information:

- **Analytical Results for Samples Submitted**
- **Surrogate Recovery Data**

The analytical procedures used by ALS Environmental have been developed from established internationally-recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported herein. Reference methods from which ALSE methods are based are provided in parenthesis.

When moisture determination has been performed, results are reported on a dry weight basis. When a reported 'less than' result is higher than the LOR, this may be due to primary sample extracts/digestion dilution and/or insuffient sample amount for analysis. Surrogate Recovery Limits are static and based on USEPA SW846 or ALS-QWI/EN38 (in the absence of specified USEPA limits). Where LOR of reported result differ from standard LOR, this may be due to high moisture, reduced sample amount or matrix interference. When date(s) and/or time(s) are shown bracketed, these have been assumed by the laboratory for process purposes. Abbreviations: CAS number = Chemical Abstract Services number, LOR = Limit of Reporting. * Indicates failed Surrogate Recoveries.

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Analytical Results

Analyte	CAS number	LOR	Units	Client Sample ID : 14/12.4	16/3.0-3.45	27/1.5-1.95	28/3.3	30/0.4
				Sample Matrix Type / Description : SOIL	SOIL	SOIL	SOIL	SOIL
				Sample Date / Time : 6 Aug 2007 15:00	6 Aug 2007 15:00	6 Aug 2007 15:00	6 Aug 2007 15:00	6 Aug 2007 15:00
				Laboratory Sample ID : EB0709130-001	EB0709130-002	EB0709130-003	EB0709130-004	EB0709130-005
EA026 : Chromium Reducible Sulphur								
Chromium Reducible Sulphur		0.02	%	0.65	0.08	<0.02	<0.02	0.04
EA029-A: pH Measurements								
pH KCl (23A)		0.1	pH Unit	5.6	6.8	5.5	5.9	5.4
pH OX (23B)		0.1	pH Unit	2.3	2.2	4.2	5.8	3.3
EA029-B: Acidity Trail								
Titratable Actual Acidity (23F)		2	mole H+ / t	6	<2	21	4	16
Titratable Peroxide Acidity (23G)		2	mole H+ / t	359	388	184	<2	230

ALS Environmental

Surrogate Control Limits

- **No surrogates present on this report.**

5180

Douglas Partners
Geotechnics · Environment · Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project Name: Hexham
Project No: 39798 DP Order No: 67339
DP Contact Person: Scott Macfarlane
Prior Storage: esky / fridge / shelved (circle)

To: SGS Australia PTY LTD
Unit 16/33 Maddox Street
ALEXANDRIA NSW 2015
Ph: (02) 8594 0400
Attn: Angela

	Sample ID	Date Sampled	Sample Type S-soil W-water	Lab ID	Analytes: TRH	BTEX	#Metals	PCB's	PAH's	OCP's	OPP's	Phenols	pH	Sulphate	Total Phosphorus	~~TCLP~~ Chloride	Notes
1	TP14/0.8	6/8/08	S		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
2	TP18/1.0	"	"		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	"Sample received labelled as TP18/0.9" (Angela 14/8/07)
3	TP28/0.1	"	"		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
4	TP28/1.0	"	"		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
5	TP29/0.4	"	"		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
6	D1	"	"		✓	✓	✓	✓	✓	✓	✓		✓	✓	✓	✓	
	PQL (S)		mg/kg														
	PQL (W)		mg/L														

SGS
Received 14/08/07
By Sam
Time 9am am/pm
Samples intact yes/no
Esky/Cooler Pack yes/no
5446

PQL = practical quantitation limit *As per Laboratory Method (Detection Limit)
# - Metals to Analyse (Please circle): As Cd Cr Cu Pb Zn Hg Ni Other
Date relinquished: 13/8/07
Total number of samples in container: 6
Results required by:
TAT (Circle): Standard 72 hr 48hr 24hr

SAMPLES RECEIVED
Please sign and date to acknowledge receipt of samples and return by fax
Signature: Sam
Date: 14/8/07 Lab Ref: 54461

Send results to:
Douglas Partners Pty Ltd
Address:
BOX 324 Hunter Region Mail Centre
NSW 2310
Fax: (02) 4960 9601

20 August 2007 **TEST REPORT**

Douglas Partners Pty Ltd
Box 324
Hunter Region Mail Centre
NSW 2310

Your Reference: 39798, Hexham
Report Number: 54461

Attention: Scott McFarlane

Dear Scott
The following samples were received from you on the date indicated.

Samples: Qty.	6 Soils
Date of Receipt of Samples:	14/08/07
Date of Receipt of Instructions:	14/08/07
Date Preliminary Report Emailed:	Not Issued

These samples were analysed in accordance with your written instructions.
A copy of the instructions is attached with the analytical report.

The results and associated quality control are contained in the following pages of this report.
Unless otherwise stated, solid samples are expressed on a dry weight basis (moisture has been supplied for your information only), air and liquid samples as received.

Should you have any queries regarding this report please contact the undersigned.

Yours faithfully
SGS ENVIRONMENTAL SERVICES

Ly Kim Ha
Senior Organic Chemist

Edward Ibrahim
Laboratory Services Manager

Alexandra Stenta
Key Account Representative

SGS Australia Pty Ltd | Environmental Services Unit 16, 33 Maddox Street, Alexandria Australia

BTEX in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
Benzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Total Xylenes	mg/kg	<1.5	<1.5	<1.5	<1.5	<1.5
BTEX Surrogate (%)	%	101	93	89	84	119

BTEX in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
Benzene	mg/kg	<0.5
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<0.5
Total Xylenes	mg/kg	<1.5
BTEX Surrogate (%)	%	90

TRH in soil with..C6-C9 by P/T						
Our Reference:	UNITS	54461-1	54461-2	54461-3	54461-4	54461-5
Your Reference	----------	TP14/0.8	TP18/1.0	TP28/0.1	TP28/1.0	TP29/0.4
Sample Type	----------	Soil	Soil	Soil	Soil	Soil
Date Sampled		6/08/2007	6/08/2007	6/08/2007	6/08/2007	6/08/2007
TRH C_6 - C_9 P&T	mg/kg	<20	<20	<20	<20	<20
TRH C_{10} - C_{14}	mg/kg	<20	<20	23	<20	110
TRH C_{15} - C_{28}	mg/kg	<50	100	290	<50	2,600
TRH C_{29} - C_{36}	mg/kg	<50	<50	170	<50	1,900

TRH in soil with..C6-C9 by P/T		
Our Reference:	UNITS	54461-6
Your Reference	----------	D1
Sample Type	----------	Soil
Date Sampled		6/08/2007
TRH C_6 - C_9 P&T	mg/kg	<20
TRH C_{10} - C_{14}	mg/kg	<20
TRH C_{15} - C_{28}	mg/kg	250
TRH C_{29} - C_{36}	mg/kg	170

PAHs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	1.0
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Phenanthrene	mg/kg	0.2	0.5	0.6	0.1	3.5
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.6
Fluoranthene	mg/kg	0.2	0.1	0.3	<0.1	2.0
Pyrene	mg/kg	0.1	0.1	0.3	<0.1	2.4
Benzo[*a*]anthracene	mg/kg	<0.1	0.1	0.2	<0.1	0.8
Chrysene	mg/kg	<0.1	<0.1	0.2	<0.1	0.8
Benzo[*b,k*]fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	0.8
Benzo[*a*]pyrene	mg/kg	0.07	0.06	0.09	<0.05	0.62
Indeno[*123-cd*]pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Dibenzo[*ah*]anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.1
Benzo[*ghi*]perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Total PAH's	mg/kg	<1.77	<1.96	<2.69	<1.55	<14.02
Nitrobenzene-d5	%	91	98	96	91	99
2-Fluorobiphenyl	%	90	96	96	89	97
p -Terphenyl-*d14*	%	101	108	109	104	105

PAHs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	0.6
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	0.3
Pyrene	mg/kg	0.3
Benzo[*a*]anthracene	mg/kg	0.2
Chrysene	mg/kg	0.2
Benzo[*b,k*]fluoranthene	mg/kg	<0.2
Benzo[*a*]pyrene	mg/kg	0.08
Indeno[*123-cd*]pyrene	mg/kg	<0.1
Dibenzo[*ah*]anthracene	mg/kg	<0.1
Benzo[*ghi*]perylene	mg/kg	<0.1
Total PAH's	mg/kg	<2.68
Nitrobenzene-d5	%	101
2-Fluorobiphenyl	%	101
p -Terphenyl-*d14*	%	112

OC Pesticides in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC (Lindane)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-Endosulfan	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
cis-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
trans-Nonachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
o,p'-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-Endosulfan	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
p,p'-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Ketone	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	111	103	115	108	102

OC Pesticides in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC (Lindane)	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
Aldrin	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
o,p'-DDE	mg/kg	<0.1
alpha-Endosulfan	mg/kg	<0.1
trans-Chlordane	mg/kg	<0.1
cis-Chlordane	mg/kg	<0.1
trans-Nonachlor	mg/kg	<0.1
p,p'-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
o,p'-DDD	mg/kg	<0.1
o,p'-DDT	mg/kg	<0.1
beta-Endosulfan	mg/kg	<0.1
p,p'-DDD	mg/kg	<0.1
p,p'-DDT	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Endrin Ketone	mg/kg	<0.1
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	106

OP Pesticides in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
Chlorpyrifos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromofos Ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
OP_Surrogate 1	%	111	103	115	108	102

OP Pesticides in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
Chlorpyrifos	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Bromofos Ethyl	mg/kg	<0.1
Ethion	mg/kg	<0.1
OP_Surrogate 1	%	106

PCBs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
Arochlor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1262	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Arochlor 1268	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total Positive PCB	mg/kg	<0.90	<0.90	<0.90	<0.90	<0.90
PCB_Surrogate 1	%	111	103	115	108	102

PCBs in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
Arochlor 1016	mg/kg	<0.1
Arochlor 1221	mg/kg	<0.1
Arochlor 1232	mg/kg	<0.1
Arochlor 1242	mg/kg	<0.1
Arochlor 1248	mg/kg	<0.1
Arochlor 1254	mg/kg	<0.1
Arochlor 1260	mg/kg	<0.1
Arochlor 1262	mg/kg	<0.1
Arochlor 1268	mg/kg	<0.1
Total Positive PCB	mg/kg	<0.90
PCB_Surrogate 1	%	106

Acid Extractable Metals in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
Arsenic	mg/kg	<3	20	7	<3	<3
Cadmium	mg/kg	<0.1	0.3	0.3	<0.1	0.2
Chromium	mg/kg	2.1	2.2	8.0	3.5	4.0
Copper	mg/kg	5.9	17	18	5.0	6.7
Lead	mg/kg	15	16	20	5	23
Mercury	mg/kg	<0.05	0.13	0.06	<0.05	<0.05
Nickel	mg/kg	3.5	3.5	13	3.8	8.0
Zinc	mg/kg	24	33	140	110	81

Acid Extractable Metals in Soil Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
Arsenic	mg/kg	4
Cadmium	mg/kg	0.1
Chromium	mg/kg	14
Copper	mg/kg	11
Lead	mg/kg	9
Mercury	mg/kg	0.05
Nickel	mg/kg	13
Zinc	mg/kg	36

Inorganics Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
pH 1:5 soil:water	pH Units	6.9	9.4	6.1	6.4	6.2
Sulphate, SO4 1:5 soil:water	mg/kg	270	210	21	27	250
Total Phosphorus	mg/kg	180	2,200	430	92	490
Chloride, Cl 1:5 soil:water	mg/kg	98	12	81	65	11

Inorganics Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
pH 1:5 soil:water	pH Units	7.1
Sulphate, SO4 1:5 soil:water	mg/kg	200
Total Phosphorus	mg/kg	360
Chloride, Cl 1:5 soil:water	mg/kg	580

Moisture Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-1 TP14/0.8 Soil 6/08/2007	54461-2 TP18/1.0 Soil 6/08/2007	54461-3 TP28/0.1 Soil 6/08/2007	54461-4 TP28/1.0 Soil 6/08/2007	54461-5 TP29/0.4 Soil 6/08/2007
Moisture	%	16	9	11	14	5

Moisture Our Reference: Your Reference Sample Type Date Sampled	UNITS ---------- ----------	54461-6 D1 Soil 6/08/2007
Moisture	%	23

Method ID	Methodology Summary
SEO-018	BTEX - Determination by purge and trap/ Gas Chromatography with MS Detection.
SEO-017	BTEX/TRH C6-C9 - Determination by Purge and Trap Gas Chromatography with Flame Ionisation Detection (FID) and Photo Ionisation Detection (PID). The surrogate spike used is aaa-trifluorotoluene.
SEO-020	TRH - Determination of Total Recoverable Hydrocarbons by gas chromatography following extraction with DCM/Acetone for solids and DCM for liquids.
SEO-030	PAHs by GC/MS - Determination of Polynuclear Aromatic Hydrocarbons (PAH's) by Gas Chromatography / Mass Spectrometry following extraction with dichloromethane or dichloromethane/acetone. The surrogate spike used is p-Terphenyl-d14.
SEO-005	OC/OP/PCB - Determination of a suite of Organchlorine Pesticides, Chlorinated Organo-phosphorus Pesticides and Polychlorinated Biphenyls (PCB's) by sonication extraction using dichloromethane for waters or acetone / hexane for soils followed by Gas Chromatographic separation with Electron Capture Detection (GC/ECD). The surrogate spike used is 2,4,5,6-Tetrachloro-m-xylene.
SEM-010	Metals - Determination of various metals by ICP-AES following aqua regia digest.
SEM-005	Mercury - Determination of Mercury by Cold Vapour Generation Atomic Absorption Spectroscopy.
AN101	pH - Measured using pH meter and electrode in accordance with APHA 20th ED, 4500-H+.
SEI-038	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA 20th ED, 4110-B.
AN002	Preparation of soils, sediments and sludges undergo analysis by either air drying, compositing, subsampling and 1:5 soil water extraction where required. Moisture content is determined by drying the sample at 105 ± 5°C.

QUALITY CONTROL BTEX in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Benzene	mg/kg	0.5	SEO-018	<0.5	54461-6	<0.5 || <0.5	LCS	76 || [N/T]
Toluene	mg/kg	0.5	SEO-018	<0.5	54461-6	<0.5 || <0.5	LCS	75 || [N/T]
Ethylbenzene	mg/kg	0.5	SEO-018	<0.5	54461-6	<0.5 || <0.5	LCS	79 || [N/T]
Total Xylenes	mg/kg	1.5	SEO-018	<1.5	54461-6	<1.5 || <1.5	LCS	82 || [N/T]
BTEX Surrogate (%)	%	0	SEO-018	92	54461-6	90 || 83 || RPD: 8	LCS	95 || [N/T]
QUALITY CONTROL TRH in soil with..C6-C9 by P/T	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
TRH C_6 - C_9 P&T	mg/kg	20	SEO-017	<20	54461-6	<20 || <20	LCS	92 || [N/T]
TRH C_{10} - C_{14}	mg/kg	20	SEO-020	<20	54461-6	<20 || <20	LCS	90 || [N/T]
TRH C_{15} - C_{28}	mg/kg	50	SEO-020	<50	54461-6	250 || 260 || RPD: 4	LCS	93 || [N/T]
TRH C_{29} - C_{36}	mg/kg	50	SEO-020	<50	54461-6	170 || 180 || RPD: 6	LCS	93 || [N/T]
QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Naphthalene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	LCS	88 || [N/T]
Acenaphthylene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	LCS	69 || [N/T]
Acenaphthene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	LCS	103 || [N/T]
Fluorene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Phenanthrene	mg/kg	0.1	SEO-030	<0.1	54461-6	0.6 || 0.6 || RPD: 0	LCS	94 || [N/T]
Anthracene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	LCS	92 || [N/T]
Fluoranthene	mg/kg	0.1	SEO-030	<0.1	54461-6	0.3 || 0.3 || RPD: 0	LCS	91 || [N/T]
Pyrene	mg/kg	0.1	SEO-030	<0.1	54461-6	0.3 || 0.3 || RPD: 0	LCS	90 || [N/T]
Benzo[a]anthracene	mg/kg	0.1	SEO-030	<0.1	54461-6	0.2 || 0.2 || RPD: 0	[NR]	[NR]
Chrysene	mg/kg	0.1	SEO-030	<0.1	54461-6	0.2 || 0.2 || RPD: 0	[NR]	[NR]
Benzo[*b,k*]fluoranthene	mg/kg	0.2	SEO-030	<0.2	54461-6	<0.2 || <0.2	[NR]	[NR]
Benzo[a]pyrene	mg/kg	0.05	SEO-030	<0.05	54461-6	0.08 || 0.09 || RPD: 12	LCS	101 || [N/T]
Indeno[*123-cd*]pyrene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Dibenzo[*ah*]anthracene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Benzo[*ghi*]perylene	mg/kg	0.1	SEO-030	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Total PAH's	mg/kg	1.55	SEO-030	1.55	54461-6	<2.68 || <2.69	[NR]	[NR]
Nitrobenzene-d5	%	0	SEO-030	92	54461-6	101 || 100 || RPD: 1	LCS	88 || [N/T]
2-Fluorobiphenyl	%	0	SEO-030	93	54461-6	101 || 100 || RPD: 1	LCS	91 || [N/T]
p -Terphenyl-*d* 14	%	0	SEO-030	101	54461-6	112 || 110 || RPD: 2	LCS	101 || [N/T]

QUALITY CONTROL OC Pesticides in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
HCB	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
gamma-BHC (Lindane)	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Heptachlor	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	83 || [N/T]
Aldrin	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	83 || [N/T]
beta-BHC	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
delta-BHC	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	80 || [N/T]
Heptachlor Epoxide	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
o,p'-DDE	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
alpha-Endosulfan	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
trans-Chlordane	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
cis-Chlordane	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
trans-Nonachlor	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
p,p'-DDE	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Dieldrin	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	85 || [N/T]
Endrin	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	88 || [N/T]
o,p'-DDD	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
o,p'-DDT	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
beta-Endosulfan	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
p,p'-DDD	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
p,p'-DDT	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	86 || [N/T]
Endosulfan Sulphate	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Methoxychlor	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Endrin Ketone	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
2,4,5,6-Tetrachloro-m-xylene *(Surrogate*	%	0	SEO-005	97	54461-6	106 || 107 || RPD: 1	LCS	96 || [N/T]

QUALITY CONTROL OP Pesticides in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Chlorpyrifos	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	92 || [N/T]
Fenitrothion	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Bromofos Ethyl	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
OP_Surrogate 1	%	0	SEO-005	97	54461-6	106 || 107 || RPD: 1	LCS	96 || [N/T]
QUALITY CONTROL PCBs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Arochlor 1016	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1221	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1232	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1242	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1248	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1254	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1260	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	LCS	112 || [N/T]
Arochlor 1262	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Arochlor 1268	mg/kg	0.1	SEO-005	<0.1	54461-6	<0.1 || <0.1	[NR]	[NR]
Total Positive PCB	mg/kg	0.9	SEO-005	0.90	54461-6	<0.90 || <0.90	LCS	0.9 || [N/T]
PCB_Surrogate 1	%	0	SEO-005	97	54461-6	106 || 107 || RPD: 1	LCS	97 || [N/T]
QUALITY CONTROL Acid Extractable Metals in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
Cadmium	mg/kg	0.1	SEM-010	<0.1	[NT]	[NT]	LCS	99 || [N/T]
Chromium	mg/kg	0.3	SEM-010	<0.3	[NT]	[NT]	LCS	97 || [N/T]
Copper	mg/kg	0.5	SEM-010	<0.5	[NT]	[NT]	LCS	100 || [N/T]
Lead	mg/kg	1	SEM-010	<1	[NT]	[NT]	LCS	99 || [N/T]
Mercury	mg/kg	0.05	SEM-005	<0.05	[NT]	[NT]	LCS	106 || [N/T]
Nickel	mg/kg	0.5	SEM-010	<0.5	[NT]	[NT]	LCS	99 || [N/T]
Zinc	mg/kg	0.3	SEM-010	<0.3	[NT]	[NT]	LCS	97 || [N/T]
QUALITY CONTROL Inorganics	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Matrix Spike % Recovery Duplicate + %RPD
pH 1:5 soil:water	pH Units		AN101	[NT]	54461-1	6.9 || 6.8 || RPD: 1	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	2	SEI-038	<2	54461-1	270 || 190 || RPD: 35	LCS	101 || [N/T]
Total Phosphorus	mg/kg	5	SEM-010	<5.0	54461-1	180 || [N/T]	LCS	105 || [N/T]
Chloride, Cl 1:5 soil:water	mg/kg	0.5	SEI-038	<0.5	54461-1	98 || 81 || RPD: 19	LCS	101 || [N/T]

QUALITY CONTROL Moisture	UNITS	PQL	METHOD	Blank
Moisture	%	1	AN002	<1

Result Codes

[INS]	:	Insufficient Sample for this test	[HBG]	:	Results not Reported due to High Background Interference
[NR]	:	Not Requested	*	:	Not part of NATA Accreditation
[NT]	:	Not tested	[N/A]	:	Not Applicable

Result Comments

Date Organics extraction commenced: 17/08/07
NATA Corporate Accreditation No. 2562, Site No 4354
Note: Test results are not corrected for recovery (excluding Dioxins/Furans* and PAH in XAD and PUF).
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Quality Control Protocol

Reagent Blank: Sample free reagents carried through the preparation/extraction/digestion procedure and analysed at the beginning of every sample batch analysis. For larger projects, a reagent blank is prepared and analysed with every 20 samples.
Duplicate: A separate portion of a sample being analysed which is treated the same as the other samples in the batch. A duplicate is prepared at least every 10 samples.
Matrix Spike Duplicates: Sample replicates spiked with identical concentrations of target analyte(s). The spiking occurs during the sample preparation and prior to the extraction/digestion procedure. They are used to document the precision and bias of a method in a given sample matrix. Where there is not enough sample available to prepare a spiked sample, another known soil/sand or water (or Milli-Q water) may be used. A duplicate spiked sample is prepared at least every 20 samples.
Surrogate Spike: Added to all samples requiring analysis for organics (where relevant) prior to extraction. Used to determine the extraction efficiency. They are organic compounds which are similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which are not normally found in environmental samples.
Internal Standard: Added to all samples requiring analysis for organics (where relevant) after the extraction process; the compounds serve to give a standard of retention time and response, which is invariant from run-to-run with the instruments.
Control Standards: Prepared from a source independent of the calibration standards. At least one control standard is included in each run to confirm calibration validity.
Additional QC Samples: A calibration standard and blank are run after every 20 samples of an instrumental analysis run to assess analytical drift.

SGS Environmental Services
Unit 16, 33 Maddox St. Alexandria NSW 2015
Telephone Number : (+61 2) 8594 0400
Fax Number : (+61 2) 8594 0499

SAMPLE RECEIPT CONFIRMATION

COMPANY	:	Douglas Partners Pty Ltd	FAX NO.	:	02 4960 9601
ATTENTION	:	Scott McFarlane	PAGES	:	1
FROM	:	Sample Receipt	DATE	:	15/08/07

This is to confirm that samples for Project **39798, Hexham** were received on **14/08/07** the results are expected to be ready on **21/08/2007** . Please quote SGS Reference: **54461** when making enquiries regarding this project. Please refer to below which details information about the integrity of the samples and other useful information.

Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples, unless otherwise instructed.

Samples received in good order:	YES
Samples received in correct containers:	YES
Samples received without headspace:	YES
Sufficient quantity supplied:	YES
Upon receipt sample temperature:	Cool
Cooling Method:	Ice
Sample containers provided by:	SGS
Samples Clearly Labelled:	NO
Turnaround time requested:	Standard
Completed documentation received:	YES

Comments:

Sample id on COC "TP18/1.0" was received on glass jar labelled "TP18/0.9"
Terms and conditions are available from www.au.sgs.com

The signed chain of custody will be returned to you with the original report.

Douglas Partners Pty Ltd
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Quality Assurance / Quality Control
Preliminary Geotechnical Investigation
Hexham

Quality Assurance (QA) was maintained by:

- Compliance with a Project Quality Plan written for the objectives of the study;
- Using qualified engineers to undertake the field supervision and sampling;
- Following the Douglas Partners Pty Ltd (DP) operating procedures for sampling, field testing and decontamination as presented in Table 1;
- Using NATA registered laboratories for sample testing, that generally utilise standard laboratory methods of the US EPA, the APHA and NSW EPA.

Table 1: Field Procedures

Abbreviation	Procedure Name
FPM LOG	Logging
FPM DECONT	Decontamination of Personnel and Equipment
FPM ENVID	Sample Identification, Handling, Transport and Storage of Contaminated Samples
FPM PIDETC	Operation of Field Analysers
FPM ENVSAMP	Sampling of Contaminated Soils

(from DP Field Procedures Manual)

Quality Control (QC) of the laboratory programme was achieved by the following means:

- Check replicate - a specific sample was split in the field, placed in separate containers and labelled with different sample numbers, and sent to the laboratory for analysis;
- Method blanks - the laboratory ran reagent blanks to confirm the equipment and standards used were uncontaminated;
- Laboratory replicates - the laboratory split samples internally and conducted tests on separate extracts;
- Laboratory spikes - samples were spiked by the laboratory with a known concentration of contaminants and subsequently tested for percent recovery;

DISCUSSION

A. Check Replicate

The Relative Percent Difference (RPD) between replicate results is used as a measure of laboratory reproducibility and is given by the following:

$$RPD = \frac{ABS(\text{Replicate result } 1 - \text{Replicate result } 2)}{(\text{Replicate result } 1 + \text{Replicate result } 2)/2} \times 100$$

The RPD can have a value between 0% and 200%. An RPD data quality objective of up to 50% is generally considered to be acceptable for organic analysis, and 35% for inorganics (i.e. Metals).

A summary of the results of the soil replicate QA/QC testing is provided in Table 2.

Table 2: Results of Quality Control Analysis

Analyte		Pit 28/0.1	D1	RPD (%)
Metals	As	7	4	55
	Cd	0.3	0.1	100
	Cr	8	14	55
	Cu	18	11	48
	Pb	20	9	76
	Hg	0.06	0.05	18
	Ni	13	13	0
	Zn	140	36	118
TRH	C_6 - C_9	<20	<20	N/A
	C_{10} - C_{14}	23	<20	N/A
	C_{15} - C_{28}	290	250	15
	C_{29} - C_{36}	170	170	0
BTEX	Benzene	<0.5	<0.5	N/A
	Toluene	<0.5	<0.5	N/A
	Ethyl Benzene	<0.5	<0.5	N/A
	Xylene	<1.5	<1.5	N/A
PAH	Total PAHs	1.69	1.68	1
	Benzo(a)pyrene	0.09	0.08	12
OCPs	Total OCPs	<PQL	<PQL	N/A
	Aldrin + Dieldrin	<PQL	<PQL	N/A
	Chlordane	<PQL	<PQL	N/A
	DDT	<PQL	<PQL	N/A
	Heptachlor	<PQL	<PQL	N/A
OPPs		<PQL	<PQL	N/A
PCBs		<PQL	<PQL	N/A
pH 1:5 soil:water		6.1	7.1	15
Sulphate, SO4		21	200	162
Total Phosphorus		430	360	18
Chloride, Cl		81	580	151

Notes to Table 2:

Results expressed in mg/kg on dry weight basis

PQL - Practical Quantitation Limit

N/A - Not Applicable

The average RPD's were generally within the acceptable limits. Some metals and nutrients in soil contained elevated RPD's (up to 162%). Slightly elevated RPD's were also found for some organic analytes. Elevated RPD's can be attributed to heterogeneity of the fill materials analysed, together with relatively low contaminant concentrations in soil for some analytes (ie. small differences in concentrations) resulting in high RPD's, The results of replicate analysis are therefore generally considered acceptable.

B. Method Blanks

All method blanks returned results lower than the laboratory detection limit, therefore are acceptable.

C. Laboratory Replicates

The average RPD for individual contaminants ranged from 0% to 35%, which is considered to be within acceptable limits.

D. Laboratory Spikes

Recoveries in the order of 70% to 130% are generally considered to be acceptable. The average percent recovery for individual organic contaminants ranged from 69% to 112% which is generally within the quality control objectives. The results should however be qualified and may slightly under-estimate or over-estimate contaminant concentrations in certain samples (i.e. biased low or high respectively).

Conclusions

In summary, it is noted that the magnitude of RPDs for field replicates (i.e. blind replicates) are generally higher than those for laboratory replicates. Field replicate results generally show greater variability than laboratory replicates, because they measure both field and laboratory reproducibility.

The accuracy and precision of the soil testing procedures, as inferred by the QA/QC data is generally considered to be of sufficient standard to allow the data reported to be used to interpret site contamination conditions.

Appendix E

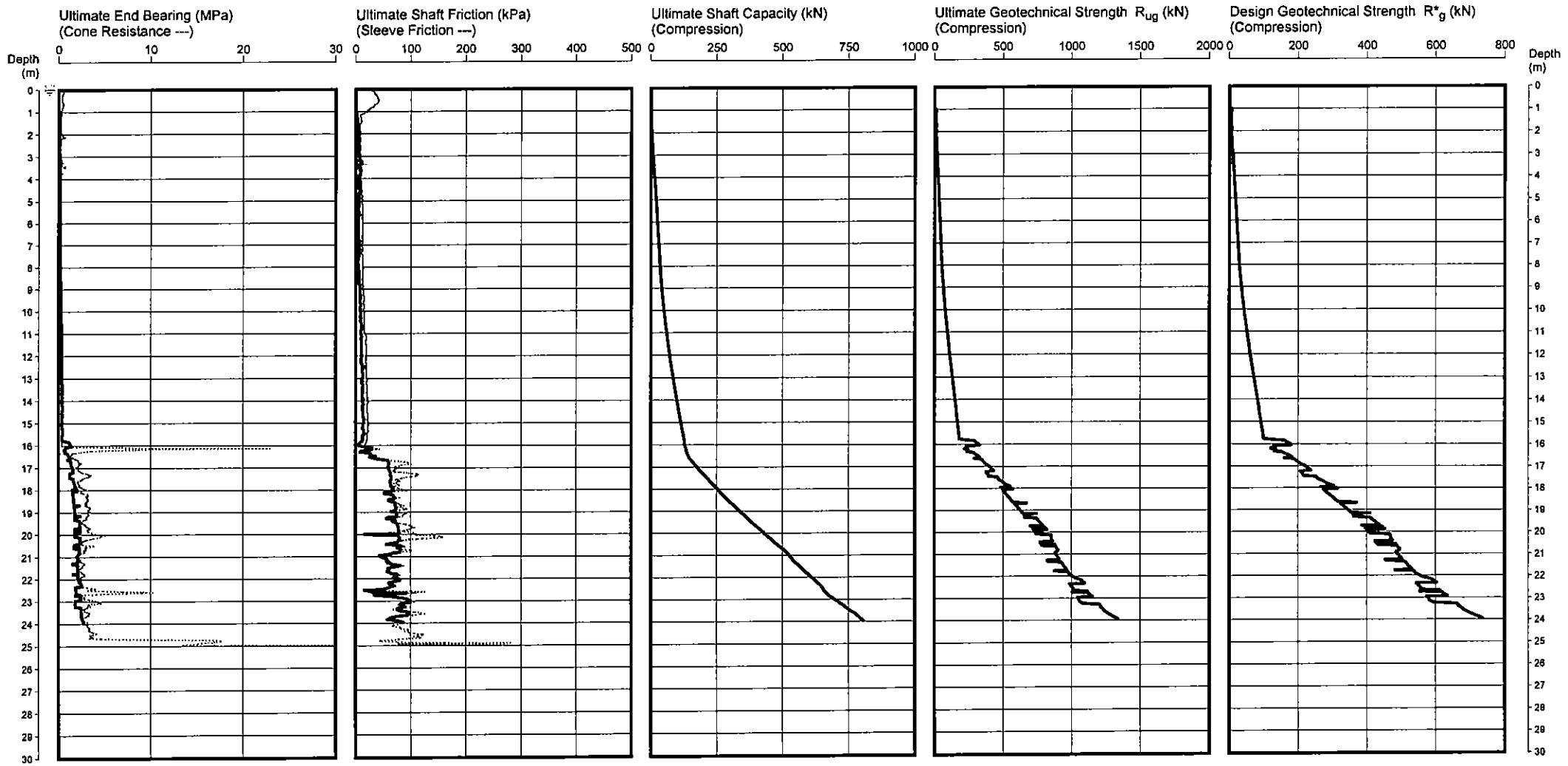
Pile Capacity Plots – CPT4 and CPT11

PILE CAPACITY ESTIMATE

PILE TYPE: Driven Timber S2 Hardwood
PILE SHAPE: Round Tapered
PILE SIZE: Toe Diameter = 0.25 Taper (mm/m) = 8.00
STRENGTH REDUCTION FACTOR ϕ_g: 0.55
CALCULATION METHOD: Dutch Method

PROJECT: PROPOSED MAINTENANCE FACILITY
LOCATION: WOODLANDS CLOSE, HEXHAM
CLIENT: QUEENSLAND RAIL

CPT 4
Page 1 of 1
DATE 20/08/2007
PROJECT No: 39798
SURFACE RL: 0.73 AHD



DISCLAIMER:
These capacities have been estimated using accepted static theory, and are a guide only. Suitable verification procedures should be adopted (refer to AS2159), and piling contractors should confirm pile suitability and capacities. Structural capacity should be checked, and due allowance made for inclined or eccentric loads, and possible corrosion effects.

Date 11/07
Plotted
Checked

Water depth after test: 0.00m depth

File: P:\39798\Field\CP5 files\CPT04.CP5
Cone ID: IGS **Type:** 5 Piezocone

ConePile Version 5.6.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Driven Concrete
PILE SHAPE: Square
PILE SIZE: Width = 0.35
STRENGTH REDUCTION FACTOR $\emptyset_g$: 0.55
CALCULATION METHOD: Dutch Method

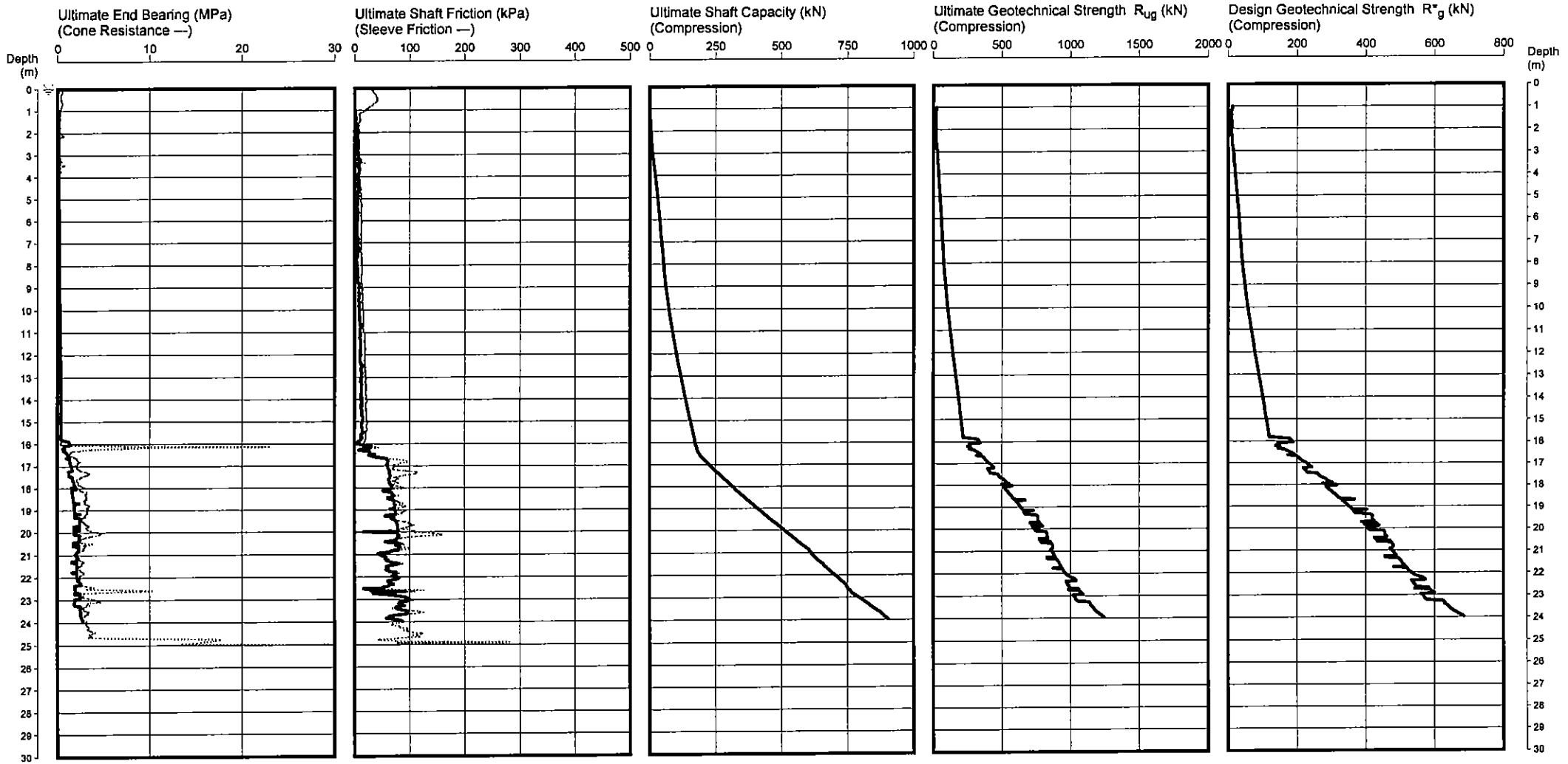
PROJECT: PROPOSED MAINTENANCE FACILITY

LOCATION: WOODLANDS CLOSE, HEXHAM

CLIENT: QUEENSLAND RAIL

CPT 4
Page 1 of 1

DATE 20/08/2007
PROJECT No: 39798
SURFACE RL: 0.73 AHD



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Date 11/07
Plotted
Checked

Water depth after test: 0.00m depth

File: P:\39798\Field\CP5 files\CPT04.CP5
Cone ID: IGS **Type:** 5 Piezocone

ConePile Version 5.6.1

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PILE CAPACITY ESTIMATE

PILE TYPE: Driven Concrete
PILE SHAPE: Square
PILE SIZE: Width = 0.35
STRENGTH REDUCTION FACTOR $Ø_g$: 0.55
CALCULATION METHOD: Dutch Method

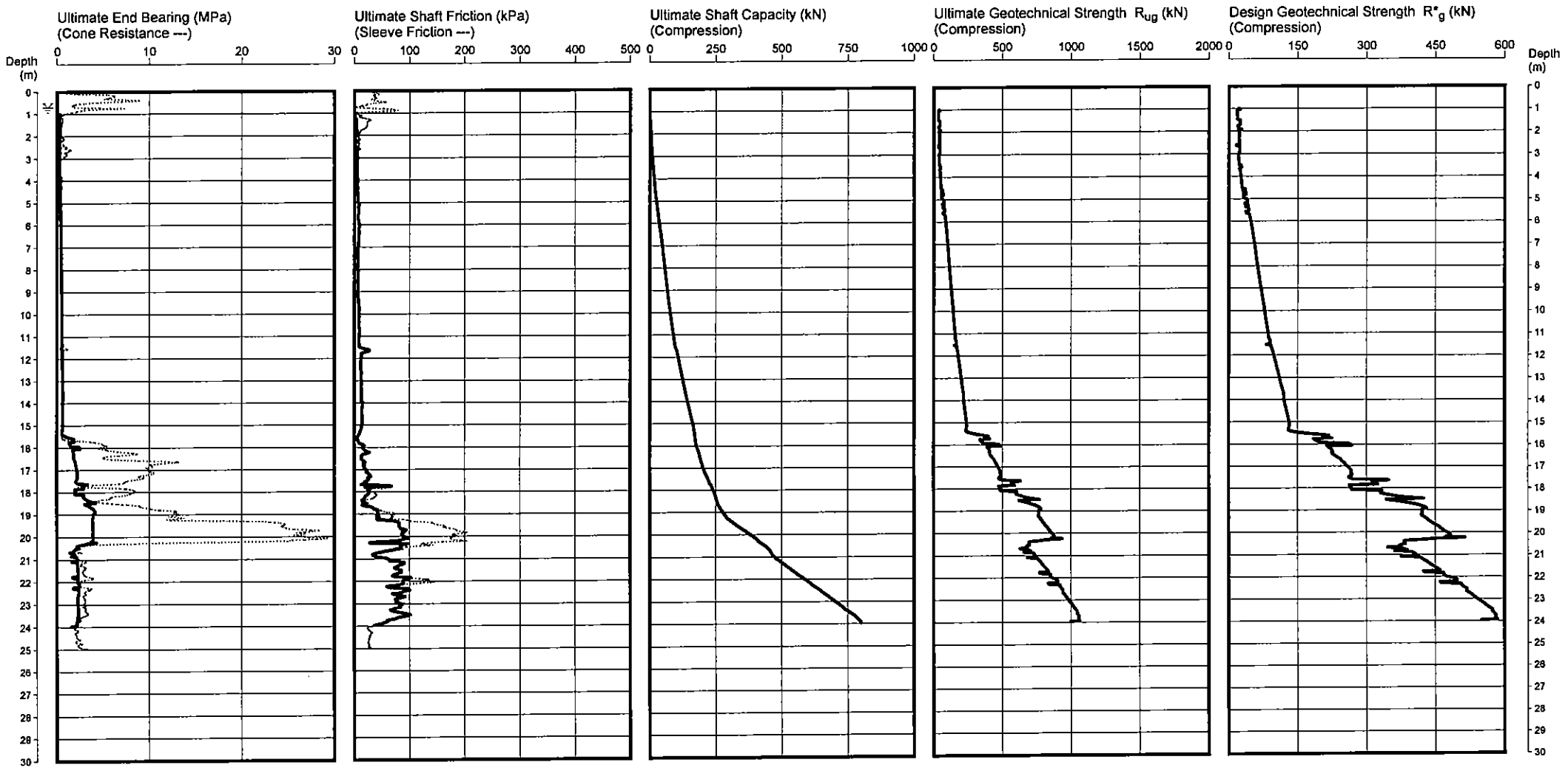
PROJECT: PROPOSED MAINTENANCE FACILITY

LOCATION: WOODLANDS CLOSE, HEXHAM

CLIENT: QUEENSLAND RAIL

CPT 11
Page 1 of 1

DATE 30/07/2007
PROJECT No: 39798
SURFACE RL: 1.53 AHD



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Date 11/07
Plotted
Checked

Water depth after test: 0.70m depth

File: P:\39798\Field\CP5 files\CPT11.CP5
Cone ID: 400 **Type:** 2 Standard

ConePile Version 5.8.1

Douglas Partners
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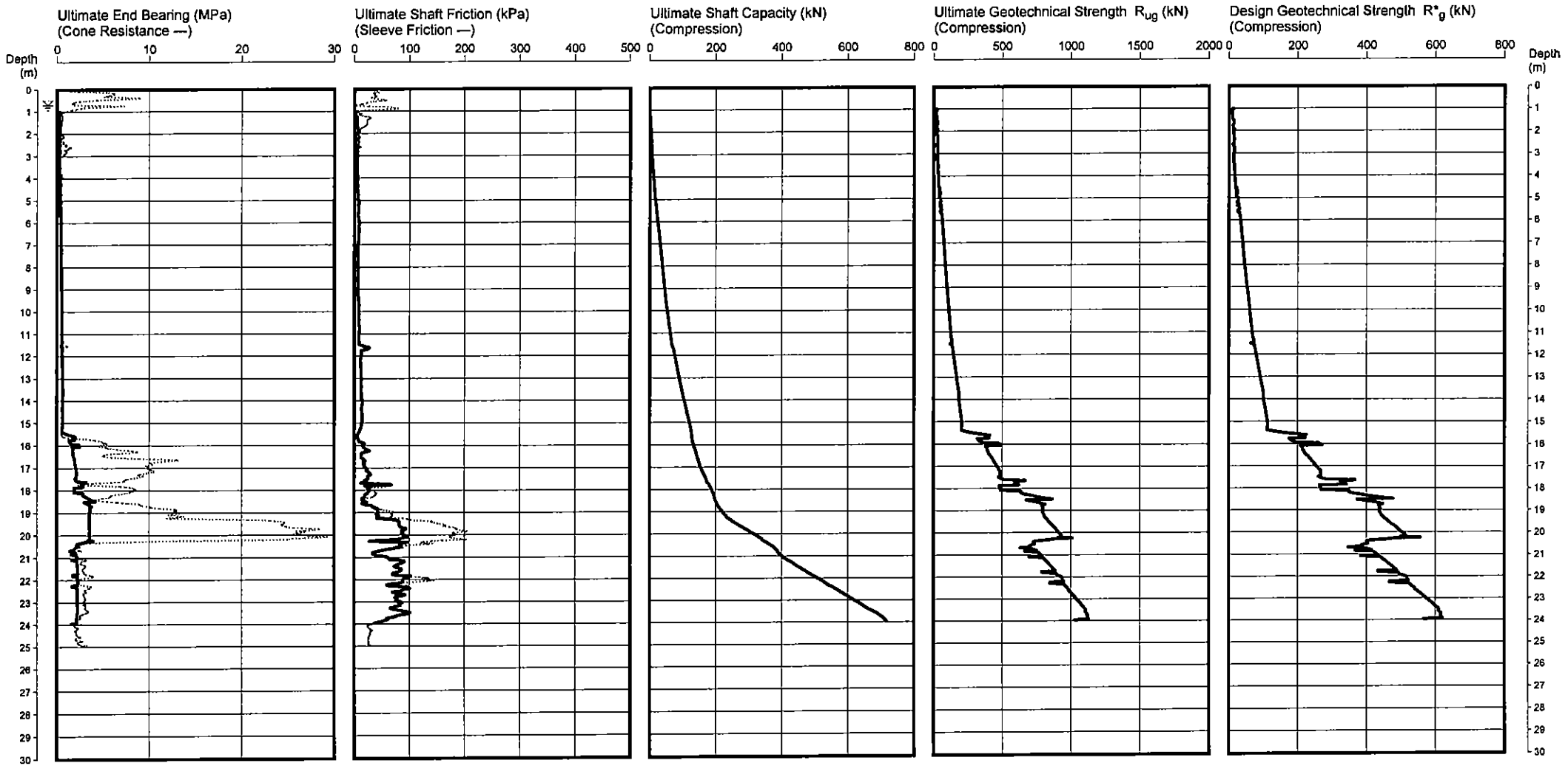
PILE CAPACITY ESTIMATE

PILE TYPE: Driven Timber S2 Hardwood
PILE SHAPE: Round Tapered
PILE SIZE: Toe Diameter = 0.25 Taper (mm/m) = 8.00
STRENGTH REDUCTION FACTOR $\emptyset_g$: 0.55
CALCULATION METHOD: Dutch Method

PROJECT: PROPOSED MAINTENANCE FACILITY
LOCATION: WOODLANDS CLOSE, HEXHAM
CLIENT: QUEENSLAND RAIL

CPT 11

DATE 30/07/2007
PROJECT No: 39798
SURFACE RL: 1.53 AHD



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Date 11/07
Plotted
Checked

Water depth after test: 0.70m depth

File: P:\39798\Field\CP5 files\CPT11.CP5
Cone ID: 400 **Type:** 2 Standard

ConePile Version 5.8.1

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Appendix F

Douglas Partners Report – Geotechnical Assessment

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Project 39798.08
15 May 2012
SAM:sm
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Appendix F

Geotechnical Assessment of Embankment Settlement and Stability
Train Support Facility
Hexham

1. Introduction

This report presents the results of a geotechnical assessment for a proposed rail siding and provisioning and maintenance facility situated off Woodlands Close, Hexham. The work was undertaken at the request of QR National.

This report supersedes the report on the geotechnical assessment, ref 39798.01, 19 March 2008, prepared for Queensland Rail.

It is understood that the first stage of the development will include the construction of the following:

- Temporary provisioning and fuelling facility;
- Two new rail embankments from Ch 177241 m to Ch 179917 m.

At this stage, it is understood that the rail embankments will be constructed and allowed to settle for a period of about six months to one year. Following the initial settlement, the rail track and ballast will be installed and the subsequent settlement will be accommodated by periodic re-levelling of the rail track, as required.

The purpose of this assessment was to provide the following:

- Estimation of the initial settlement over a period of six months to one year based on the long section (cut and fill depths) provided;
- Estimation of the long term (residual) settlement following construction of the rail track;
- Stability analysis of the rail embankment.

This report was prepared on the basis of geotechnical data presented in the Report on Preliminary Geotechnical Investigation, ref 39798, October 2007 which is now superseded by the Report on Preliminary Geotechnical Investigation, ref 39798.08 May 2012.

2. Rail Embankment Loads

The formation levels of the proposed rail embankment were provided in a long-section by the client. The formation level along the majority of the rail siding is RL 2.65 AHD but reduces in elevation at each end of the alignment to tie into the Great Northern Railway (RL 1.4 m AHD southern end and 1.46 m AHD northern end).

It is understood that the rail level will be an additional 0.65 m above the formation level and that the proposed buildings will be at rail level (ie 3.3 AHD). The additional pressure associated with the ballast / rail is about 10 kPa to the top of the formation level; this load has been ignored in the analysis to account for some of the preconsolidation pressure of the underlying clays.

The load applied by the trains onto the formation has not been considered in this assessment as the load is considered as a transient load and will not stress the underlying compressible clays for sufficient time to allow significant consolidation. Cyclic creep from repeated load by the trains has also been ignored in the analysis. It is considered that strain associated with cyclic creep would be within the order of accuracy of the settlement estimates associated with consolidation of the underlying clays.

It has also been assumed that the existing filling associated with the former coal preparation plant has consolidated the underlying clays. The bulk of the filling has been in place for a period of greater than 30 years. There is a possibility that creep settlement may still be occurring but compared to the settlement associated with the remaining parts of the site, the residual settlements are likely to be minor. In this regard the strength of the underlying clays in areas where existing fill is situated show strength gain has occurred which confirms that primary settlement has also occurred.

The weight of the proposed filling embankment has been based on a compacted unit weight 20 kN/m^3.

The settlement along the rail embankment was estimated generally at 100 m intervals. It should be noted that the testing undertaken for the preliminary assessment was not undertaken at this frequency. The settlement analysis was based on interpolation between data points and is therefore considered approximate.

Based on the above, settlement analysis at each location along the rail embankment was based on the following relationships:

- Load on foundation = (Top of Formation level – Current Surface Level) x 20 kN/m^3.

3. Settlement of Unimproved Site

The settlements of an unimproved site (ie site not subject to ground improvement works) under the above loads were estimated for the centrelines of the rail embankment as indicated on the long-section provided by the client. The settlements were estimated using conventional 1-D consolidation theory, with soil compressibility values derived from CPT q_c values, and previous laboratory test results.

The settlement is caused by consolidation of the clay, which generally occurs in three phases:

- Initial undrained elastic settlement;
- Primary consolidation - a volume decrease associated with dissipation of load-induced excess pore water pressures, in low permeability soils (ie clays). This process can take some time, and the rate is very dependent on the length of the drainage path;
- Secondary consolidation - involving rearrangement of the soil particles, without excess pore pressure, and is less dependent on the magnitude of load; also referred to as creep.

There are differing opinions on when creep commences: at the same time as primary consolidation, at some point during primary consolidation, or following substantial completion of primary consolidation. The analyses in this report assume that creep commences at about 90% of primary consolidation.

One dimensional consolidation estimates from CPT data were based on correlations between cone tip resistance (q_c or q_t) and constrained modulus (M):

$M = \alpha.q_c = 1 / m_v$, where m_v is the coefficient of volume compressibility.

The following values of α were adopted (Refs 1 and 2):

Clay with q_c < 0.5 MPa: $\alpha = 3$
Clay with q_c > 0.5 MPa: $\alpha = 4$
Sand: $\alpha = 6$

The following consolidation parameters were also adopted and are based on previous laboratory test results at this site and adjacent sites.

Table 1: Summary of Adopted Soil Parameters

Property	Upper Silty Sandy Clay /Clayey Sand	Clay/Silty Clay	Clay
Bulk Density γ_b (kN/m^3)	18	17	17
Strength Ratio s_u/p'_o	0.20	0.25	0.25
Creep rate C_α(%)	1	1.5	1.5
c_v Before Preload (m^2/yr)	5	2.5	2.5

At each CPT location a time-settlement plot was determined for an unimproved site. Figure 1 shows the settlement estimates at 0.5 years and 1 year following placement of filling and are compared to the total estimated settlement over 25 years.

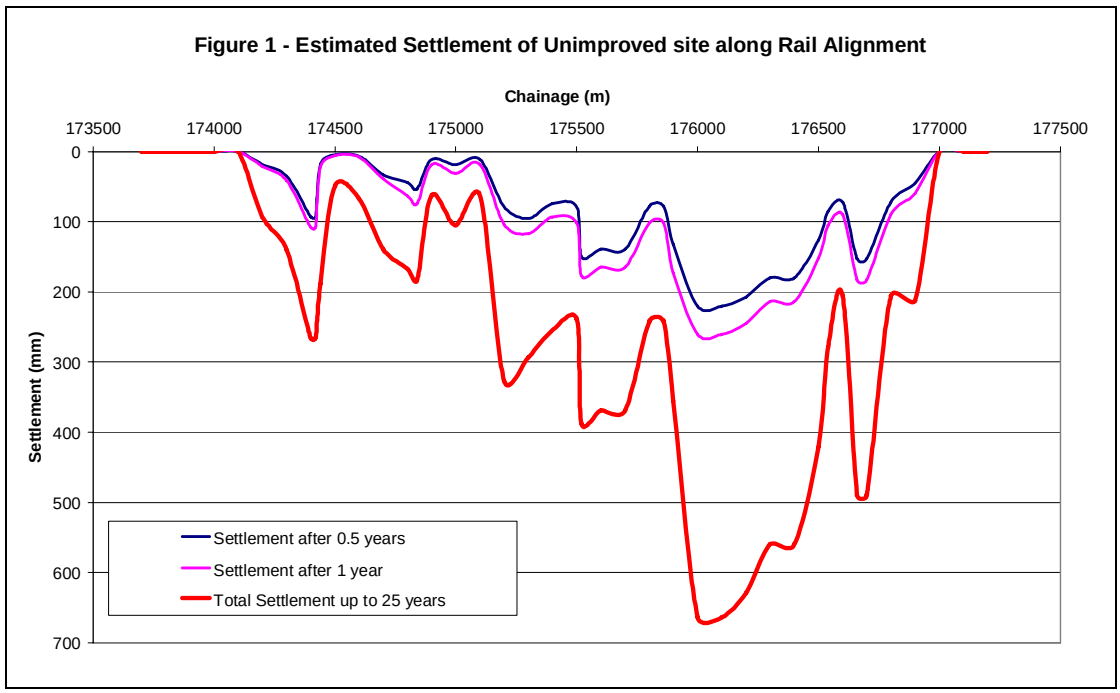
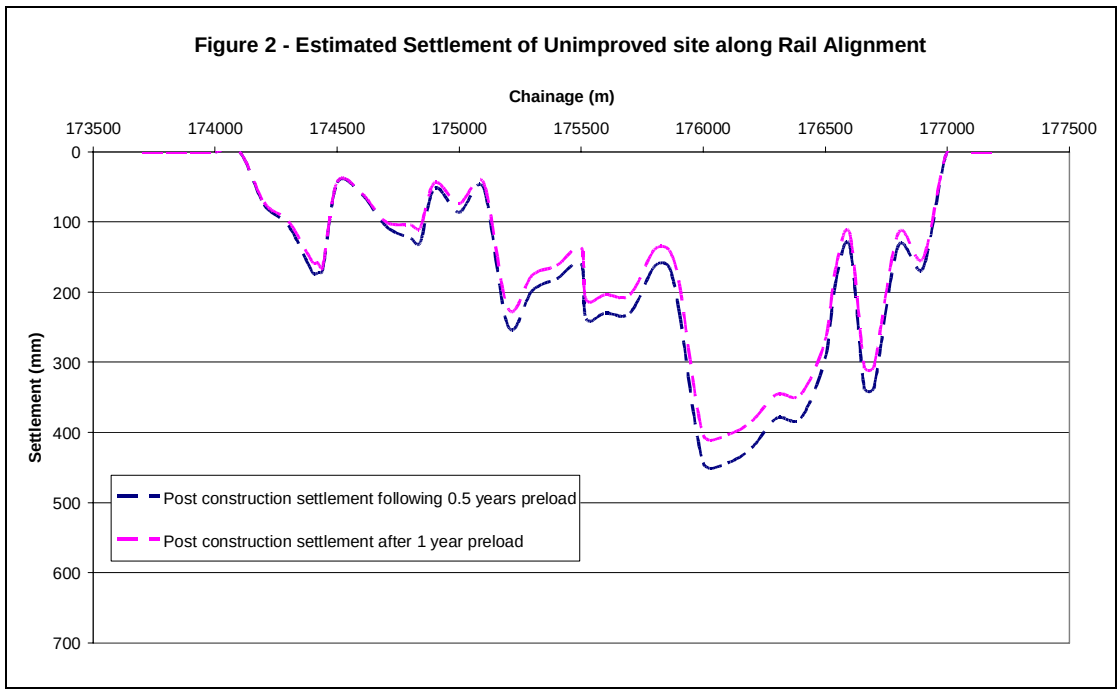


Figure 2 shows the post construction (residual) settlement of the rail embankment up to 25 years after the initial settlement



Based on the above plots, the largest expected settlement along the rail alignment will be between Ch 176000 m and 176700 m. This area correlates to the area where pre-existing filling has not been placed and the proposed fill height is greatest. This area is also situated in the area where the underlying clays are weaker in strength.

The magnitude and rates of settlements are estimates only. It is essential that the preload performance be monitored by geotechnical instrumentation installed prior to placing the fill and preload. These instruments would comprise settlement monitoring plates (SMP) installed on a regular grid. The SMPs would require survey levelling by registered surveyors at the time of installation and at selected time intervals during filling operations. SMPs generally provide valuable data on the magnitude and rate of settlement, which then help to refine post-construction settlement estimates.

4. Stability Assessment

The geometry of the embankment is controlled by the required height of the embankment, water level and the batter slopes required to provide acceptable factors of safety against slope instability.

The slope stability is controlled by the upper soft clay, which varies in strength and thickness across the site. For the purposes of the stability assessment, the stability of the rail embankment was assessed in the area where the clays were weakest and the height of the embankment is greatest (ie between Ch 176000 m and 176700 m).

The soil parameters adopted for initial conditions are presented in Table 2 below.

Table 2: Initial Soil Parameters used for Stability Analyses

Material	Bulk Density (kN/m^3)	Friction Ratio, ϕ (^{o})	Undrained Shear Strength, s_u (kPa)	Comments
Embankment Material	18	32	-	Fill material not known – assume granular fill
Upper Crust of Natural Material	18	-	25	Up to 1 m below ground
Lower Soft Clay	17	-	5	Greater than 1 m Strength increases with depth by 1.8 kPa/m

The geometry and load applied to the fill embankment was based on the following:

- Fill height – 2.0 m;
- Batter slope – 2.5 H:1V.

The slope stability assessment was undertaken using the program Slope/W Ver 2007.

The results of the analysis are shown in Figure 3 below and indicate that the factor of safety against slope failure during preload is 1.5 which is considered satisfactory for no load at crest.

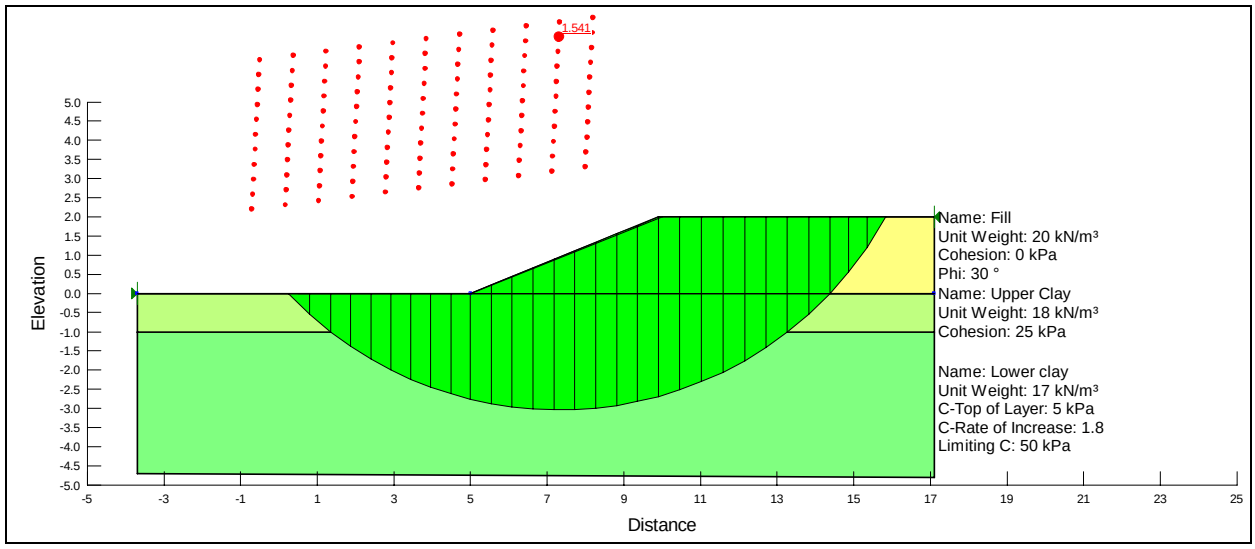


Figure 3: Results of Stability Analysis (no ground improvement, no load at crest)

The stability of the embankment following preload was estimated. The stability of the embankment (with train loads) will be a function of the amount of strength gain the underlying clays have achieved during the partial preload.

The consolidation and hence strength gain of the upper clay profile (critical for the stability assessment) was based on methods presented by Lambe & Whitman (1969) and the parameters presented in Table 1. Based on the results of the analysis, the degree of consolidation of the upper 3 m of soft clay after a period of 1 year was estimated to be about 50%.

The strength gain in the clay after full consolidation was calculated based on the following relationship between effective overburden stress and undrained shear strength:

$$s_u = 0.25\sigma_v'$$

Based on the above relationship and 50% strength gain within the soft clay after a period of 1 year, the strength of the upper 3 m of the soft clay due to a fill height of 2 m was estimated to be about 10 kPa.

The factor of safety was reassessed after a period of one year when the clays have partially consolidated and using a shear strength of 10 kPa. The analysis was also based on additional load applied at the crest of the embankment due to the load of a train. In this regard, without details on train loads, a value of 60 kPa (positioned at least 1 m from the shoulder of the embankment) was assumed in the analysis for the stress applied by the train loads onto the fill embankment.

The results of the stability analysis are presented in Figure 4 and indicate that the factor of safety following 1 year preload is about 1.3.

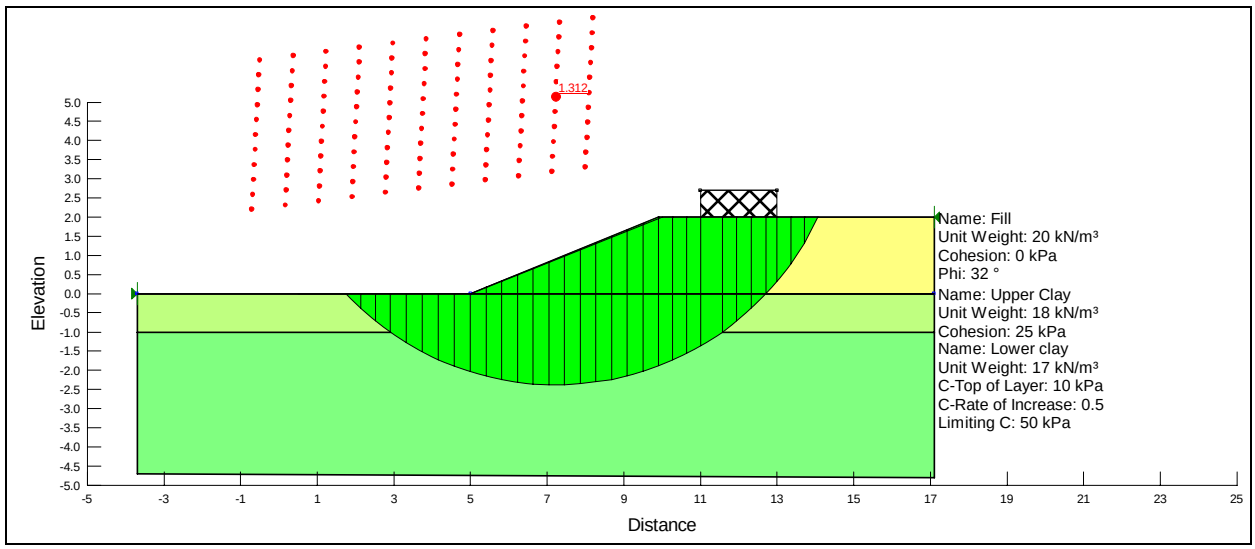


Figure 4: Results of Stability Analysis (following 1 year preload)

A factor of safety against slope failure of greater than 1.5 is generally considered the minimum acceptable for long term structures. The results of the above analysis suggest that a factor of safety of only 1.3 will be achievable following partial preload after 1 year and less if the preload is in place for a period of only 6 months. The factor of safety will increase over time to about 1.5 after the clay fully consolidates.

There are several options QR National can take with regard to the lower factor of safety; these are discussed below:

1. Do nothing – Accept the lower factor of safety and higher risk associated with slope instability until the upper clays have consolidated and sufficient strength gain has been achieved (ie about 5 to 8 years).
2. Placement of an additional 1 m to 2 m surcharge onto the fill embankment to increase the strength gain in the upper clays at the completion of partial preload and improve the long-term factor of safety. The short term factor of safety (ie during preload) will reduce to about 1.1 to 1.2 until strength gain is achieved. Careful monitoring of the fill embankment (via inclinometers) would be required to ensure slope failure does not occur during construction.
3. Install wick drains in the upper 5 m to 6 m of the clay profile to increase the consolidation rate and strength gain within the clay. The installation of wick drains will also aid with reducing long term settlement of the fill embankment. Further analysis would be required to optimise the depth and spacing of the wick drains if this option is considered.

4. Provide berm adjacent to rail embankment – Placement of a stabilising berm at the toe of the proposed embankment could be undertaken to improve the factor of safety against slope instability. The stabilising berm should be about 1 m high and 3 m wide at the toe of the embankment. The factor of safety against slope instability would increase to 1.4 in the short term which may be considered marginally acceptable.
5. Ground improvement options such as those presented in the DP report on the Preliminary Geotechnical Investigation, ref 39798.08 May 2012, ie deep soil mixing, stone columns or vacuum consolidation will increase the factor of safety against slope failure. Further analysis will be required if these options are considered.

The percentage of consolidation and thus strength gain can be gauged from pore pressure monitoring, however it is recommended that cone penetration testing be undertaken following preload, to confirm the predicted strength gain prior to allowing trains to use the rail embankment.

5. References

1. Lunne T, Robertson P K & Powell J J M (1997), "Cone Penetration Testing in Geotechnical Practice", Blackie Academic & Professional, First Edition 1997.
2. Jones S R (1995). "Engineering Properties of Alluvial Soils in Newcastle using Cone Penetration Testing", Proc Conference on Engineering Geology of the Newcastle-Gosford Region, The University of Newcastle, 5 - 7 February 1995, Australian Geomechanics Society.
3. Lambe, T W and Whitman, R V (1969) “Soil Mechanics”, Pub. John Wiley, New York.

Yours faithfully
Douglas Partners Pty Ltd Reviewed by

Scott McFarlane **John Harvey**
Senior Associate Principal

Appendix G

Douglas Partners Report – Geotechnical Investigation – Upgrade of Tarro Interchange

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17 May 2012
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Appendix G

Preliminary Geotechnical Investigation
Upgrade of Tarro Interchange
New England Highway, Tarro / Hexham

1. Introduction

This report presents the results of a geotechnical investigation for a proposed new road embankment between the Tarro interchange and Woodlands Close, Tarro, NSW. The work was carried out at the request of QR National.

It is understood that a new access road is proposed to connect the existing Tarro interchange with the QR National Train Support Facility (TSF).

A geotechnical investigation is required to assess subsurface conditions and to provide advice on the following:

- Settlement of the proposed embankment;
- Stability of the proposed embankment;
- Comments on ground improvement options to reduce construction time, instability of the batters and long-term settlement.

The investigation consisted of test bores and cone penetration tests (CPTs), in situ soil sampling and strength testing together with laboratory testing and engineering analysis. The results are presented in the report, together with geotechnical advice on design and construction.

The field investigations were undertaken along an alignment that has since been changed. This report is based on the testing results from the superseded alignment and, therefore, the comments are preliminary.

For the purpose of the investigation, the client supplied a current general arrangement plan, longitudinal and cross-sections of the proposed alignment (Ref ENG-0389-101 by Engenicom Pty Ltd / QR National) dated 26 April 2012.

2. Site Description

The site is located on the southern side of the New England Highway between Tarro and Hexham and covers the following areas:

Existing Tarro Interchange

The existing Tarro interchange comprised a concrete bridge spanning over the New England Highway with an earth-filled embankment on either end. The site of the geotechnical investigation is situated at the southern abutment (Figure 1). The earth filled embankment is about 8 m high and has grassed batters of between 2.5H:1V to 3H:1V. A row of semi mature trees is located at the eastern toe of the fill embankment.

The site was accessed via a temporary access road which comprised rubber tyres filled with gravel "Ecopave".

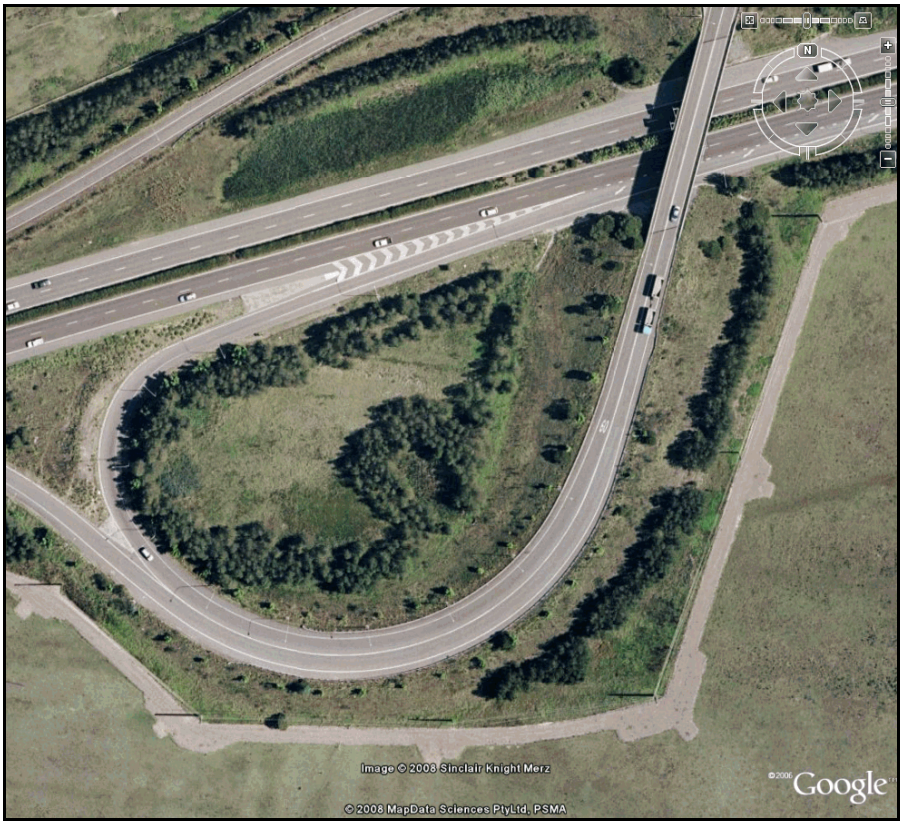


Figure 1: Southern Abutment of Tarro Interchange

Figure 2: Road leading off the southern embankment of the interchange Between Tarro Interchange and Woodlands Close

The area situated between the interchange and Woodlands Close comprises relatively flat grassed paddocks. The surface was saturated at the time of the investigation resulting in difficulties gaining access to test locations with rubber tyred vehicles. The Chichester pipeline bisects the access road in a north-south direction.

Figure 3: Area between gravel access road and the eastern side of the interchange embankment

Figure 4: Low lying grassed paddock between the Interchange and Woodlands Close (Old Maitland Road)

The 1:100000 scale Newcastle Coalfield Regional Geology map (Sheet 9321), published by the Department of Mineral Resources, indicates that the site is underlain by Quaternary Alluvium. The alluvium typically comprises unconsolidated sediments deposited in a fluvial or estuarine environment, and includes gravel, sand, silt and clay.

3. Field Work

3.1 Methods

General

The field work for the investigation was undertaken between 15 July 2007 and 18 July 2007, and comprised hand auger bores, drilling of bores and cone penetration tests (CPT).

The CPTs were set out at locations which were accessible to the truck mounted rig. Two additional CPTs were proposed but due to poor access, hand augers, together with hand shear vane and dynamic penetrometer testing were undertaken.

The tests were set out from existing site features such as boundary fences. The test locations are presented on Drawing 1-2, Appendix H. The position of the bores and pits were based on the development that was proposed in 2007.

An underground service locator was engaged to check test locations for potential underground services. The main services in the area included high pressure gas, Telstra, water (Chichester pipe line) and major optic (Telstra and Optus).

Cone Penetration Testing

A total of five CPTs were carried out to depths ranging from 2 m to 7.2 m, and were terminated upon.

The tests were carried out using a custom-built, truck-mounted CPT rig, with centrally located hydraulic rams. The cones were advanced at a constant rate of approximately 20 mm/second and a digital data acquisition system recorded cone tip resistance, friction sleeve resistance, inclination from vertical and encoded depth at measurement intervals of 20 mm.

Test Bores

A total of five bores (Bores 501 to 505) were drilled along Woodlands Close to assess the thickness of the existing pavement and subgrade conditions. The bores were drilled using a bobcat with 225 mm diameter auger attachment to depths of about 1.2 m.

Hand Augers

A total of eight hand-augur test bores (Bores 401, 404, 405 and 501b, to 505b) were drilled in areas where the drilling rig could not gain access due to wet and boggy conditions.

Bore 401 was drilled on the western site of the existing embankment at the Tarro interchange, Bores 404 and 405 were drilled within a grass paddock along the proposed road alignment between Woodlands Close and Tarro Interchange. Bores 501b to 505b were drilled near the toe of the existing road embankment along Woodlands Close

The bores were drilled to depths ranging between 1.2 m and 1.9 m.

3.2 Results

The subsurface conditions encountered are presented in detail in the attached borehole logs and CPT charts. The CPT charts show the measured parameters, together with an inferred strata description, based on published correlations. The charts and bores should be read in conjunction with the notes in Appendix A, which explain the descriptive terms and classification methods used in the logs.

The following is a summary of the subsurface conditions encountered in the bores / CPT. The summary of the subsurface conditions has been divided into two areas as presented below:

Woodlands Close (Bores 501 to 505 and 501b to 505b)

Bore 501 to 505 were drilled near the centre of Woodlands Close through the existing pavement.

The pavement profile along Woodlands Close generally comprised a spray seal wearing course overlying brown or black silty sandy gravel (basecourse) to depths of 0.18 m to 0.3 m. Clayey gravel comprising slag was encountered beneath the basecourse to depths of between 0.55 m and 0.8 m and was generally overlying natural clay or silty clay. Clay filling however, was encountered to 1.2 m depth at Bore 501.

Based on the results of the dynamic penetrometer and pocket penetrometer tests the underlying clay was firm to stiff to the depth of investigation (about 1.2 m). Some organics were encountered beneath the filling at Bores 501 and 505.

Bores 501b to 505b were drilled at the toe of the fill embankment along Woodlands Close.

Subsurface conditions in Bores 501b to 505b comprised topsoil to a depth of about 0.1 m overlying a firm to stiff clay / sandy clay which reduced in strength to generally firm below depths of about 0.4 m to 0.8 m at a similar level to the groundwater measurements. Soft clay was encountered in Bore 505b below depths of 1.6 m.

Groundwater was encountered in Bores 501b to 505b at depths of between 0.5 m to 0.9 m but the groundwater level rose to 0.28 m in Bore 502b after a period of about 15 minutes.

Proposed Embankment (Bore 401, 404 and 405, CPT 402, 403, 406, 407 and 407A)

The subsurface conditions at the bores and CPTs along the that was proposed in 2007 alignment comprised a thin layer of filling (CPT 402, 403, 406, 407 and 407A) to a depth of 0.3 m to 0.7 m. Topsoil was encountered in Bores 401, 404 and 405. The natural profile beneath the filling and topsoil comprised generally firm, firm to stiff or stiff clay to depths of between 1 m and 1.9 m. Very stiff to hard clay was encountered beneath the firm to stiff clay and continued to the depth of investigation where refusal was encountered at each location suggesting weathered bedrock. A summary of the results are presented in Table 1 below:

Table 1: Summary of Subsurface Conditions

Test Location	Depth of Filling / Topsoil (m)	Thickness of Firm to Stiff Clay (m)	Depth of CPT or DPT Refusal (m)	Groundwater Observations
Bore 401	Topsoil to 0.05 m	0.95	1.65	Not observed
CPT 402	Granular Filling to 0.4 m	1.2	4.78	Hole Collapse at surface
CPT 403	Granular filling to 0.4 m	0.8	7.22	0.5 m
Bore 404	Topsoil to 0.05 m	1.2	1.95	0.28 m
Bore 405	Topsoil to 0.05 m	1.4	1.95	0.4 m
CPT 406	Filling to 0.8 m	1.2	5.78	0.7 m
CPT 407	Filling to 0.3 m	1.5	2.0	0.2 m
CPT 407A	Filling to 0.4 m	1.2	2.16	0.2 m

The regional groundwater level is typically shallow relative to the natural ground surface. The data indicates that ground water levels are typically around 0 m to about 1 m below ground level. The groundwater measurements however may not represent a standing groundwater level as measurements are typically made upon the completion of testing and in low permeability soils there is insufficient time for water to enter the borehole, CPT hole prior to backfilling/collapse. In order to obtain accurate water levels, standpipes or piezometers installed in boreholes are required and should be monitored once levels have had sufficient time to stabilise.

Due to the above features, and with climatic variations, water levels within the site will be transient and also vary across the site.

4. Laboratory Results

Samples were submitted to the Douglas Partners Newcastle laboratory for California bearing ratio (CBR) and standard compaction testing. Detailed results are attached and are summarised in Table 2.

Table 2: Results of Laboratory Testing

Test Location	Depth (m)	Description	FMC (%)	MDD (t/m^3)	OMC (%)	CBR (%)
503b	0.2 - 0.5	Clay – Grey Brown	43.2	1.36	31.0	2.0
505	0.75 - 1.2	Clay – brown trace sand/gravel	59.1	1.27	36.5	6

Notes to Table 2:
FMC – Field Moisture Content
OMC – Optimum Moisture Content
MDD – Maximum Dry Density
CBR – California Bearing Ratio

Significant features to note with the laboratory testing is that field moisture contents are 12.2% (Bore 503B) and 22.6% (Bore 505) greater than optimum moisture content.

5. Comments

5.1 Road Embankment Loads

Analysis was carried out for the data obtained in 2007 for the road alignment proposed at that time. The analysis described in the following sections refers to the superseded alignment.

The finished surface level of the proposed road embankment was provided in a long-section by Engenicom. The surface level at the Tarro intersection is about RL 10.5 to 11 AHD and reduces in elevation to 1.8 AHD over a distance of about 200 m. From Ch 170 m to Ch 1580 the surface level of the finished road embankment is about RL 1.8 AHD (i.e. 0.6 m to 1.7 m above current ground levels).

The load applied by the vehicular loads onto the formation has not been considered in the settlement analysis as the load is considered as a transient load and will not stress the underlying compressible clays for sufficient time to allow significant consolidation. The traffic loads, however, have been considered in the short term stability analysis. A surcharge load of 20 kPa was adopted for the short term stability analysis.

The settlement along the road embankment was estimated generally at 40 m intervals between Ch 0 and Ch 200. The settlement analysis was based on interpolation between data points and is therefore considered approximate.

The weight of the proposed filling embankment has been based on a compacted unit weight 20 kN/m^3. The settlement analysis at each location along the road embankment was therefore determined as:
Load on foundation = (Finished Surface level – Current Surface Level) x 20 kN/m^3.

5.2 Settlement of Road Embankment

The settlement of an unimproved site under the above loads were estimated for the centrelines of the rail embankment as indicated on the long-section provided by the client. The settlements were estimated using conventional 1-D consolidation theory, with soil compressibility values derived from CPT q_c values, and previous laboratory test results. The layer thicknesses from the bores were also used in the analysis.

The settlement is caused by consolidation of the clay, which generally occurs in three phases:

- Initial undrained elastic settlement;
- Primary consolidation - a volume decrease associated with dissipation of load-induced excess pore water pressures, in low permeability soils (i.e. clays). This process can take some time, and the rate is very dependent on the length of the drainage path;
- Secondary consolidation - involving rearrangement of the soil particles, without excess pore pressure, and is less dependent on the magnitude of load; also referred to as creep. The stiffness of the clay that was encountered at each test location (Tests 401 to 405) suggests that secondary consolidation is likely to be minor.

One dimensional consolidation estimates from CPT data were based on correlations between cone tip resistance (q_c or q_t) and constrained modulus (M):

$M = \alpha.q_c = 1/m_v$, where m_v is the coefficient of volume compressibility.

The following values of α were adopted:

Clay with $q_c < 0.5$ MPa: $\alpha = 3$
Clay with $q_c > 0.5$ MPa: $\alpha = 4$
Sand: $\alpha = 6$

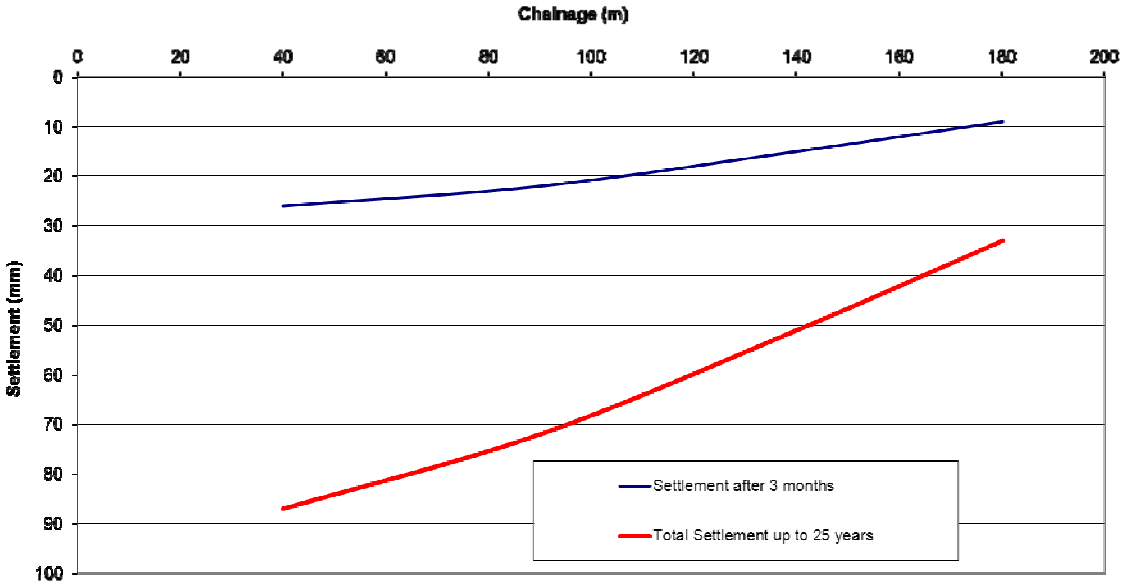
The following consolidation parameters were also adopted based on previous laboratory test results at this site and adjacent sites.

Table 3: Summary of Adopted Soil Parameters

Property	Clay – Firm to Stiff	Clay/Sandy Clay – Very Stiff to Hard
Bulk Density γ_b (kN/m^3)	17	21
Creep rate $C_{\alpha\varepsilon}$(%)	0.1	0.0
Coefficient of Vertical consolidation c_v (m^2/yr)	2.0	2.0

At each CPT location a time-settlement plot was determined for an unimproved site. Figure 1 shows the settlement estimates at 3 months and following placement of filling and are compared to the total estimated settlement over 25 years and the total post construction settlement following 3 months.

Figure 1 - Estimated Settlement of Unimproved site along Road Alignment



Based on the above plot, the largest expected settlement along the road embankment will be between Ch 35 m and 80 m. This area correlates to the area where the depth of proposed filling is greatest (about 10 m high) which would subject a load of about 200 kPa onto the foundation soils.

Based on thickness of clay encountered at Bore 401 and CPT 402/403, it is considered that the natural clay beneath the existing Tarro interchange has already consolidated due to the load applied by the existing embankment. Accordingly, any additional settlement of the existing embankment will only be associated with the placement of additional filling over the existing batters of the embankment. The thickness of the fill on the batters therefore reduces toward the centre of the existing embankment and therefore settlement will reduce.

Based on the results presented in Figure 1, it is expected that post construction settlements of up to 30 mm to 40 mm can be accommodated and ground improvement is unlikely to be required for the proposed road.

5.3 Stability of Road Embankment

The geometry of the embankment is controlled by the required height of the embankment, water level and the batter slopes required to provide acceptable factors of safety against slope instability. The slope stability is controlled by the upper firm or firm to stiff clay. For the purposes of the assessment, the stability of the road embankment was assessed in the area where the clays were weakest and the height of the embankment is greatest (i.e. between Ch 35 and 80 m).

The soil parameters adopted for initial conditions are presented in Table 4 below.

Table 4: Initial Soil Parameters used for Stability Analyses

Material	Bulk Density (kN/m^3)	Internal Friction ϕ (^{o})	Undrained Shear Strength, s_u (kPa)	Comments
Embankment Material	22	34^o	-	Fill material not known – assume granular fill such quarry overburden
Upper Firm to Stiff Clay	19	-	35	Up to 1.5 m below natural ground
Lower Hard Clay	21	-	400	Greater than 1.5 m

The geometry and load applied to the fill embankment was based on the following:

- Fill height – 10.0 m;
- Batter slope – 2.5 H:1V.

The slope stability assessment was undertaken using the program Slope/W Ver 2007.

The results of the analysis indicate that the factor of safety against slope failure is 1.40 which is slightly below the normally accepted factor of safety of 1.5 for long – term structures. The factor of safety increases to greater than 1.5 for embankment heights of less than 6 m.

The stability was reanalysed for a batter slope 3H:1V. The results of the analysis indicated a factor of safety of 1.6, as shown in Figure 2, which was considered acceptable.

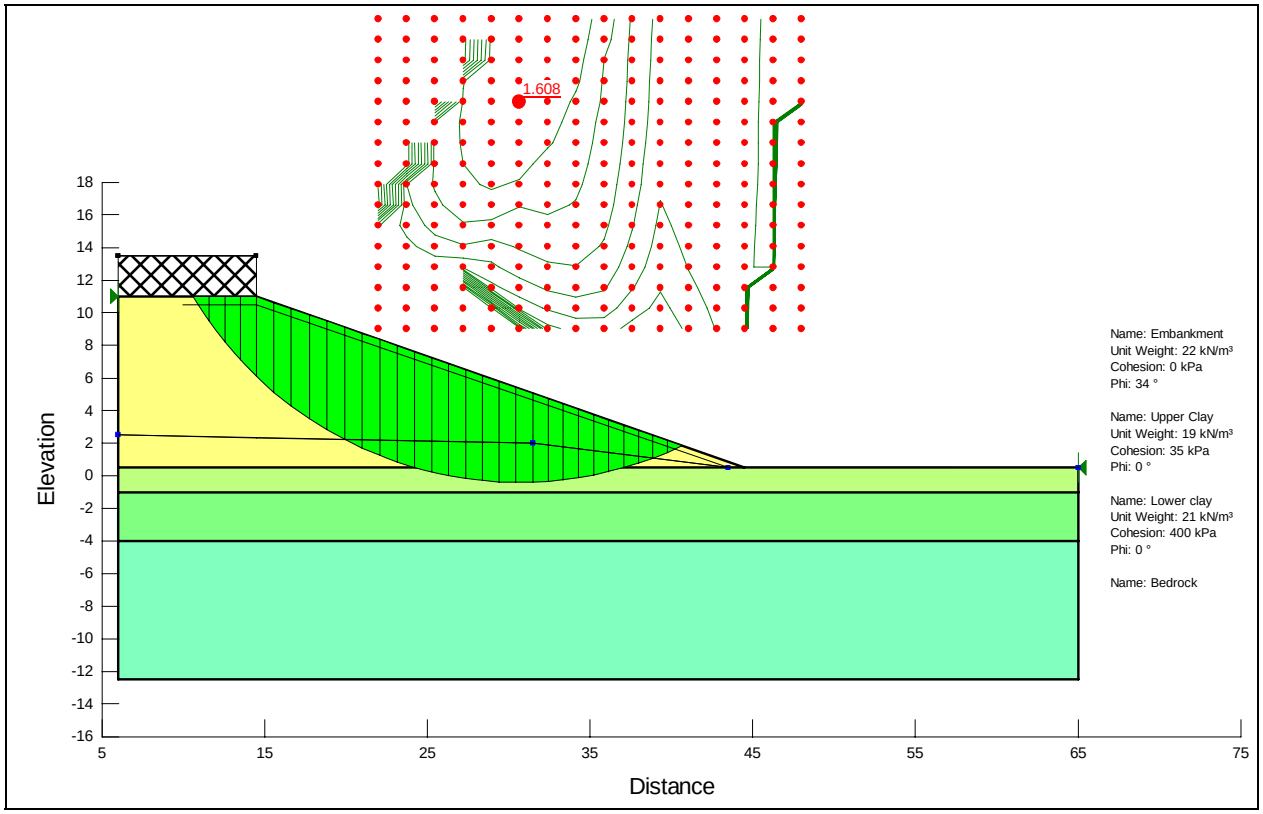


Figure 2: Results of Stability Analysis (3H:1V batters)

In summary, the results of the analysis indicate that for embankments greater than 6 m in height, the batter slope should be no steeper than 3H:1V and for embankments less than 6 m in height, batters should be no steeper than 2.5H:1V.

Yours faithfully
Douglas Partners Pty Ltd Reviewed by

Scott McFarlane **John Harvey**
Senior Associate Principal

Attachments: Borehole Lots (Bore 401, 404, 405, 501 to 505, 501b to 505b)
CPT Plots (CPT 402, 403, 406, 407 and 407A)
Results of Dynamic Penetrometer Tests
Laboratory Test Results

BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: 1.2m AHD*
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 401
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.05	TOPSOIL: Generally comprising dark brown/black silty clay, M>Wp							
		CLAY: Stiff grey mottled orange clay, M>Wp		SV	0.5		Peak = 66kPa Residual = 4.5kPa		
1	1.0	SILTY CLAY/CLAYEY SILT: Very stiff light grey mottled orange silty clay/clayey silt, M<Wp		SV	1.05		Peak = 160kPa Residual = 12kPa		
	1.2	Bore discontinued at 1.2m, due to refusal							
2									

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Hand tools
DRILLER: Foote/Cowan
LOGGED: Foote/Cowan
CASING: Nil

TYPE OF BORING: Hand Auger
WATER OBSERVATIONS: No free groundwater observed
REMARKS: Interpolated from survey plan

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: 0.9m AHD*
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 404
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.05	TOPSOIL: Soft dark brown silty clay topsoil, saturated, rootlets							
		CLAY: Stiff dark grey clay, some orange mottling (iron staining?), M>Wp		SV A	0.5		Peak=78kPa Residual=4kPa		
		From 0.8m, slightly sandy clay, grades to clay. Sand is fine to medium grained							
	1			SV	1.0		Peak=70kPa Residual=4kPa		
		From 1.2m, very stiff							
	1.9	Bore discontinued at 1.9m, due to refusal							
	2								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: Hand tools **DRILLER:** Foote/Cowan **LOGGED:** Foote/Cowan **CASING:** Nil

TYPE OF BORING: Hand Auger

WATER OBSERVATIONS: Free groundwater observed at 0.08m

REMARKS: Interpolated from long-section

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: 0.8m AHD*
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 405
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.05	TOPSOIL: Soft dark brown silty clay topsoil, saturated, rootlets							
		CLAY: Firm dark brown clay, M>Wp							
	0.3	CLAY: Stiff grey mottled orange (ferric staining?) clay, W_L>M>Wp						▼	
		From 0.5m, grey in colour		SV	0.5		Peak=78kPa Residual=3.4kPa		
	0.9	SANDY CLAY: Stiff grey sandy clay, sand is fine to medium grained, grades to slightly sandy clay, W_L>M>Wp		SV A	1.0		Peak=90kPa Residual=11kPa		
1	1.25	From 1.2m, brown in colour							1
		SHELLY CLAY: Stiff grey shelly clay, some patches of orange, fine grained clayey sand, W_L>M>Wp		A	1.3				
		From 1.4m, very stiff							
	1.8	Bore discontinued at 1.8m, due to refusal							
2									2

RIG: Hand tools **DRILLER:** Foote/Cowan **LOGGED:** Foote/Cowan **CASING:** Nil

TYPE OF BORING: Hand Auger

WATER OBSERVATIONS: Free groundwater observed at 0.4m

REMARKS: Interpolated from long-section

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 501
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
	0.03	FILLING - Spray seal							
		FILLING - Generally comprising brown silty sandy fine to medium grained subrounded gravel		A	0.1				
	0.18	FILLING - Generally comprising silty clayey gravel and slag		A	0.4				
	0.75	FILLING - Generally comprising clay, silty clay and gravel		A	0.8				1
	1.2	CLAY - Firm brown clay, organics M>Wp		A	1.2				
	1.25	Bore discontinued at 1.25m, limit of investigation							
	2								2

RIG: 247 Bobcat
DRILLER: J. Ahern
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Solid Flight Auger - 200mm Ø
WATER OBSERVATIONS: No free groundwater observed
REMARKS: On centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 501b
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL - Brown clay, trace silt with rootlets, M>Wp							
		CLAY - Firm brown clay, trace silt. M>Wp. Silt content decreasing with depth		A,pp	0.2		90-100 kPa		
		From 0.35m orange grey		A,pp	0.4		70-80 kPa		
				pp	0.55		60-90 kPa	▼	
	0.8	SANDY CLAY - Firm grey fine grained sandy clay, M>>Wp							
	1			A	1.0				1
	1.5	Bore discontinued at 1.5m, limit of investigation							
	2								2

5 10 15 20

RIG:
DRILLER: Benson
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Hand Auger
WATER OBSERVATIONS: Free groundwater observed at 0.77m
REMARKS: 13m south of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 502
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
	0.03	FILLING - Spray seal							
		FILLING - Generally comprising brown silty sandy fine to medium grained subrounded gravel		A	0.2				
	0.26	FILLING - Generally comprising grey brown silty clayey fine grained gravel and slag (20-80mm)		A	0.4				
	0.65	CLAY - Soft to firm grey brown clay, trace silt, M>>Wp		A	0.8				
	1.2	Bore discontinued at 1.2m, limit of investigation							

RIG: 247 Bobcat **DRILLER:** J. Ahern **LOGGED:** Benson **CASING:** Nil
TYPE OF BORING: Solid Flight Auger - 200mm Ø
WATER OBSERVATIONS: No free groundwater observed
REMARKS: 0.5m north of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 15/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 502b
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL - Brown clay, trace silt, rootlets, M>Wp							
		CLAY - Firm, brown clay, M>Wp		A,pp	0.3		90-120 kPa		
		From 0.35m orange/grey		pp	0.5		50-90 kPa		
		From 0.65m mottled orange grey						▼	
	0.75	SANDY CLAY - Firm grey fine grained sandy clay, saturated		A	0.8				
	1.5	Bore discontinued at 1.5m, limit of investigation							

RIG:
DRILLER: Benson
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Hand Auger
WATER OBSERVATIONS: Free groundwater observed at 0.65m (0.28m by time packed up)
REMARKS: 14m south of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 503
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.03	FILLING - Spray seal							
		FILLING - Generally comprising brown silty clayey sandy fine to coarse subrounded to subangular gravel		A	0.2				
	0.25	FILLING - Generally comprising slag (20-80mm) and silty sandy clayey fine to medium grained gravel		A	0.4				
	0.55	CLAY - Firm grey brown clay trace fine grained gravel, M>Wp		A	0.8				
	1.2	Bore discontinued at 1.2m, limit of investigation							

RIG: 247 Bobcat
DRILLER: J. Ahern
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Solid Flight Auger - 200mm Ø
WATER OBSERVATIONS: No free groundwater observed
REMARKS: On centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 503b
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.2	TOPSOIL - Brown clay, trace silt, rootlets, M<Wp							
		CLAY - Firm to stiff grey brown clay, M>Wp		B,pp	0.2		100-150 kPa		
	0.55	CLAYEY SAND/SANDY CLAY - Firm orange/brown clayey sand/sandy clay, damp		A	0.5 0.8			▼	
	1.7	Bore discontinued at 1.7m, limit of investigation							

RIG:
DRILLER: Benson
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Shovel to 0.5m. Hand Auger to TBD
WATER OBSERVATIONS: Free groundwater observed at 0.9m
REMARKS: 12m south of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 17/7/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 504
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
	0.03	FILLING - Spray seal							
		FILLING - Generally comprising black silty sandy subrounded gravel		A	0.1				
	0.25	FILLING - Generally comprising silty clayey medium to coarse subrounded-angular gravel (slag) - clay content increasing with depth		A	0.4				
	0.8	CLAY - Firm brown clay, trace silt, M>Wp		A	0.9				1
	1.2	Bore discontinued at 1.2m, limit of investigation							
	1								
	2								2

RIG: 247 Bobcat **DRILLER:** J. Ahern **LOGGED:** Benson **CASING:** Nil

TYPE OF BORING: Solid Flight Auger - 200mm Ø

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Auger tip bolt snapped - 650mm - hole on centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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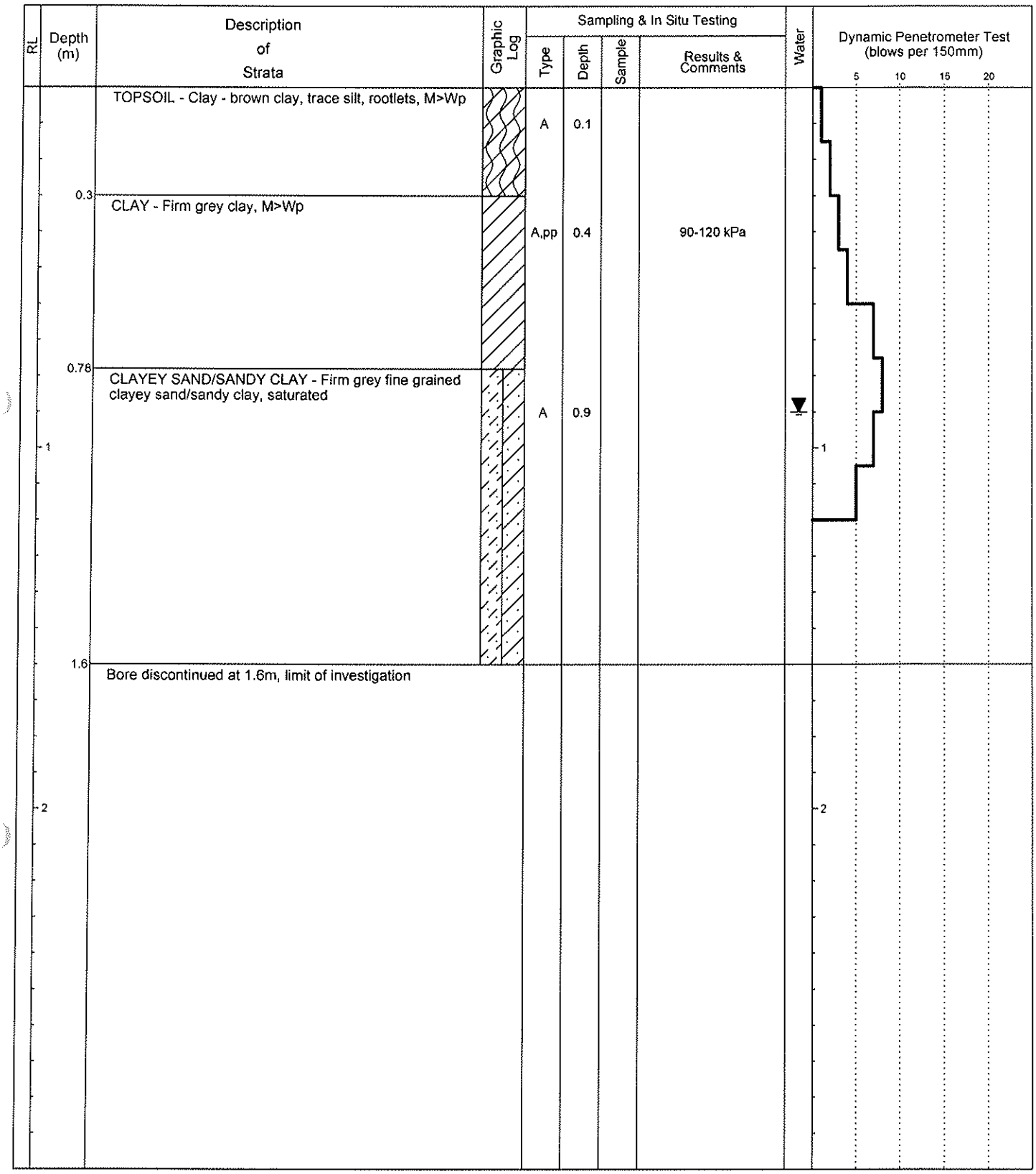
BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 504b
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1



RIG:
DRILLER: Benson
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Hand Auger
WATER OBSERVATIONS: Free groundwater observed at 0.9m
REMARKS: 14m south of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/8/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 505
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.03	FILLING - Spray seal							
		FILLING - Generally comprising black silty gravel subrounded-angular		A	0.2				
	0.3	FILLING - Generally comprising brown/grey silty medium to coarse gravel (slag) - some coal		A	0.4				
	0.7	ORGANICS		A	0.7				
	0.75	CLAY - Soft brown clay trace silt, trace fine grained sand, trace fine grained gravel		B,pp	0.75		20-50 kPa		
	1.2	Bore discontinued at 1.2m, limit of investigation			1.2				

RIG: 247 Bobcat **DRILLER:** J. Ahern **LOGGED:** Benson **CASING:** Nil

TYPE OF BORING: Solid Flight Auger - 200mm Ø

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Approximately 500mm south of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 16/08

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BOREHOLE LOG

CLIENT: Queensland Rail
PROJECT: Tarro Interchange - Option 3
LOCATION: New England Highway 1, Woodlands Close, Tarro/Hexham

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 505b
PROJECT No: 39798.03
DATE: 17 Jul 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL - Brown silty clay							
	0.1	CLAY - Firm brown silty clay, M>Wp, trace silt, trace sand		A,pp	0.2		100 kPa		
		From 0.5m mottled orange brown From 0.55m mottled orange/grey. Saturated from 0.55m		A	0.65			▼	
		From 0.8m grey-dark grey		pp	0.85		50-60 kPa		
	1	From 1.1m soft							1
	1.6	Bore discontinued at 1.6m, limit of investigation							
	2								2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG:
DRILLER: Benson
LOGGED: Benson
CASING: Nil

TYPE OF BORING: Hand Auger
WATER OBSERVATIONS: Free groundwater observed at 0.6m
REMARKS: Approximately 11m south of centre line

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U,	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date: 10/08

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CONE PENETRATION TEST

CLIENT: QUEENSLAND RAIL

PROJECT: TARRO INTERCHANGE

LOCATION: NEW ENGLAND HIGHWAY, TARRO/ HEXHAM

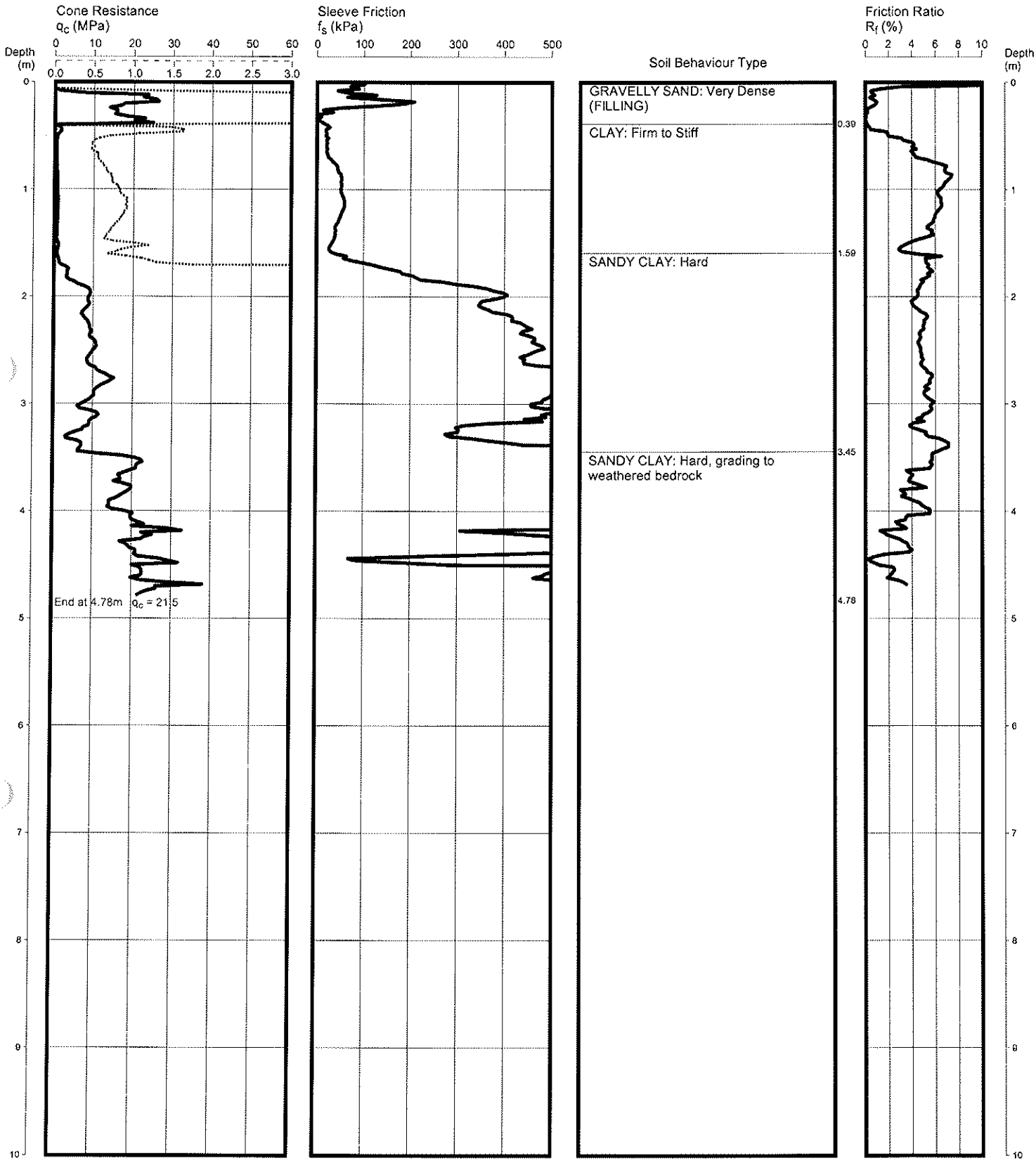
PROJECT No: 39798.03

CPT 402

Page 1 of 1

DATE 15/07/2008

SURFACE RL: 1.1



REMARKS: HOLE COLLAPSED AT 0.2m AFTER WITHDRAWAL OF RODS
SURFACE LEVEL INTERPOLATED FROM LONG-SECTION BY WPWATER LEVEL ASSUMED

Date Plotted 16/7/08
Checked

File: P:\39798.03\Field\39798402.CP5
Cone ID: 413 Type: 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT: QUEENSLAND RAIL

PROJECT: UPGRADE AT TARRO INTERCHANGE

LOCATION: NEW ENGLAND HIGHWAY, TARRO / HEXHAM

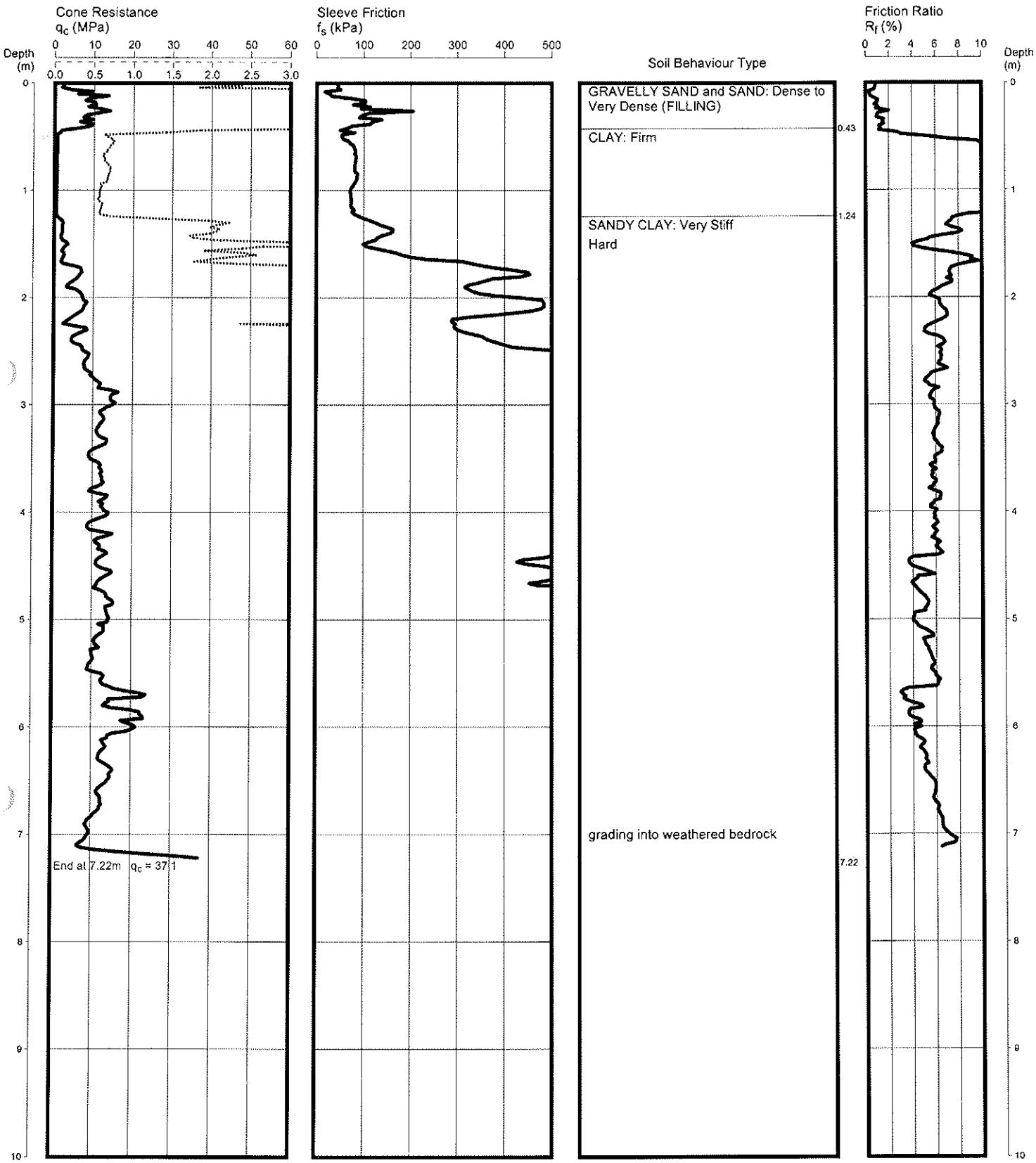
PROJECT No: 39798.03

CPT 403

Page 1 of 1

DATE 15/07/2008

SURFACE RL: 1.1



REMARKS: HOLE COLLAPSED AT 0.2 m AFTER WITHDRAWAL OF RODS
SURFACE LEVEL INTERPOLATED BY LONG-SECTION BY WPWATER LEVEL ASSUMED

Date Plotted 13/8/08
Checked

File: P:\39798.03\Field\39798403.CP5
Cone ID: CONE-HH3 Type: 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT: QUEENSLAND RAIL

PROJECT: TARRO INTERCHANGE

LOCATION: NEW ENGLAND HIGHWAY, TARRO / HEXHAM

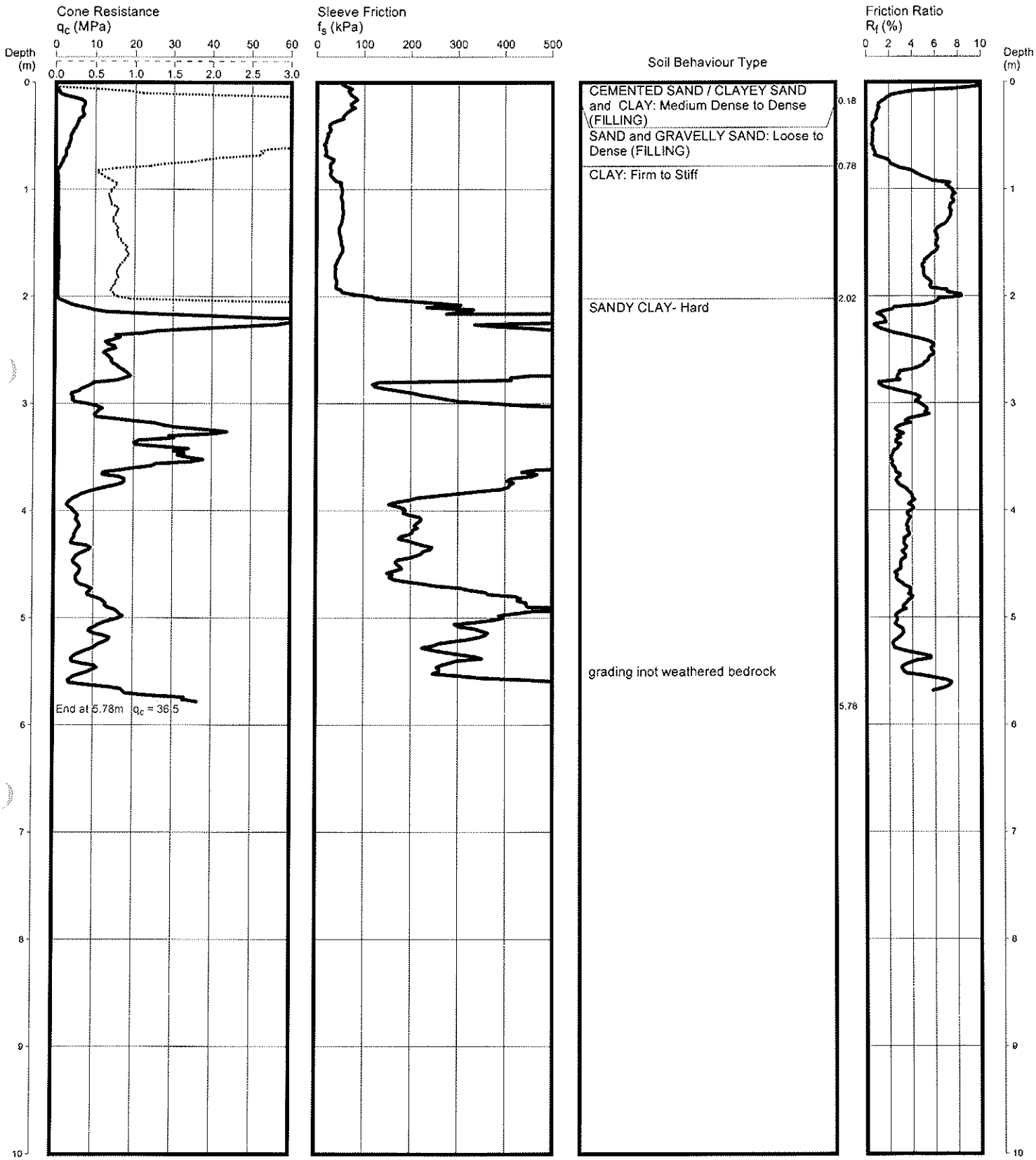
PROJECT No: 39798.03

CPT 406

Page 1 of 1

DATE 15/07/2008

SURFACE RL: 1.2 AHD



REMARKS: WATER DEPTH AT COMPLETION OF TEST:0.7m
SURFACE LEVEL INTERPOLATED FROM LONG-SECTION BY WP

Date Plotted 10/08
Checked

File: P:\39798.03\Field\39798406.CP5
Cone ID: CONE-HH3 Type: 2 Standard

ConePlot Version 5.6.1

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CONE PENETRATION TEST

CLIENT: QUEENSLAND RAIL

PROJECT: TARRO INTERCHANGE

LOCATION: NEW ENGLAND HIGHWAY, TARRO / HEXHAM

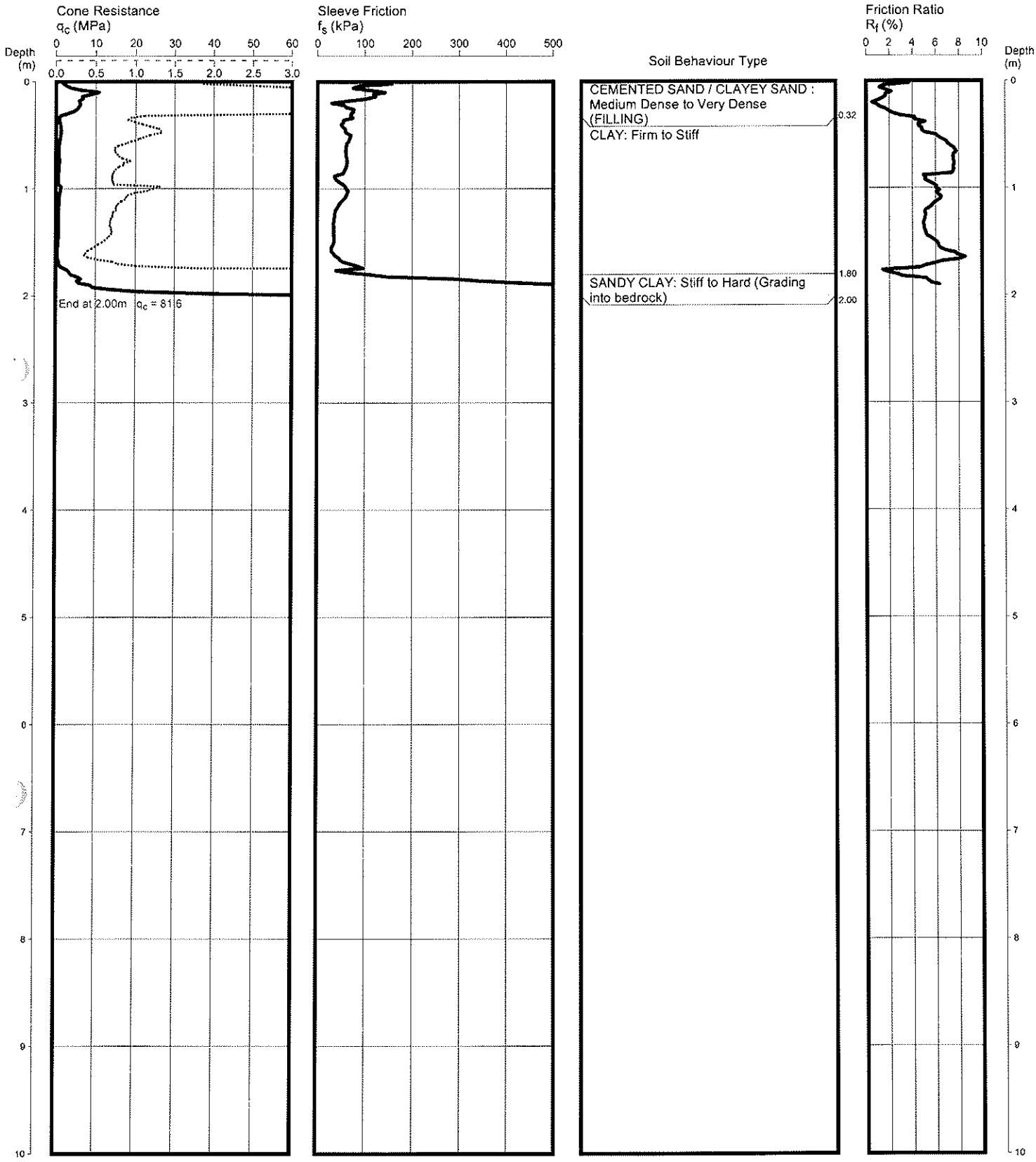
PROJECT No: 39798.03

CPT 407

Page 1 of 1

DATE 15/07/2008

SURFACE RL: 1.0 AHD



REMARKS: WATER DEPTH AT COMPLETION OF TESTING: 0.2 m
SURFACE LEVEL INTERPOLATED FROM LONG-SECTION BY WP

Date Plotted 30/7/08
Checked

File: P:\39798.03\Field\39798407.CP5
Cone ID: CONE-HH3 Type: 2 Standard

ConePlot Version 5.8.1

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CONE PENETRATION TEST

CLIENT: QUEENSLAND RAIL

PROJECT: HEXHAM RAIL FACILITY

LOCATION: NEW ENGLAND HIGHWAY, TARRO

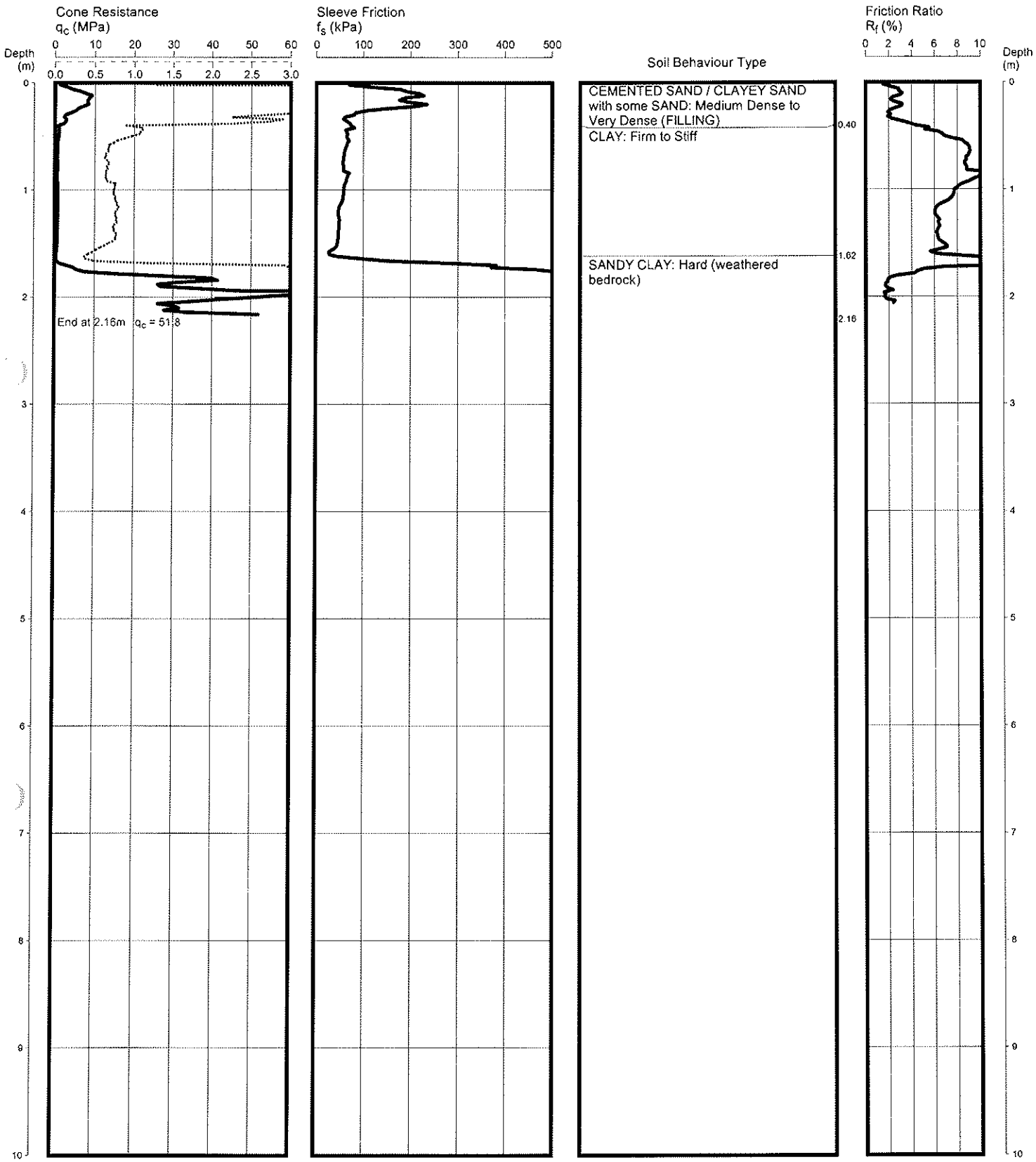
PROJECT No: 39798.03

CPT 407A

Page 1 of 1

DATE 15/07/2008

SURFACE RL: 1.1



REMARKS: HOLE COLLAPSED AT 0.2 m AFTER WITHDRAWAL OF RODS
SURFACE LEVEL INTERPOLATED FROM LONG-SECTION BY WPWATER LEVEL ASSUMED

Date Plotted 10/08

Checked

File: P:\39798.03\Field\39798407A.CP5
Cone ID: CONE-HH3 Type: 2 Standard

ConePlot Version 5.8.1

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RESULTS OF DYNAMIC PENETROMETER TESTS

CLIENT	Queensland Rail	DATE	18.07.08
PROJECT	Tarro Interchange – Option 3	PROJECT NO	39798.03
LOCATION	New England Highway/Woodlands Close, Tarro/Hexham	PAGE NO	Page 1 of 2

TEST LOCATIONS	401	404	405							
RL OF TEST										
DEPTH m	PENETRATION RESISTANCE BLOWS/150mm									
0.00 - 0.15	0	0	1							
0.15 - 0.30	1	2	1							
0.30 - 0.45	2	4	2							
0.45 - 0.60	3	6	5							
0.60 - 0.75	5	10	8							
0.75 - 0.90	8	13	11							
0.90 - 1.05	13	17	14							
1.05 - 1.20	21	18	14							
1.20 - 1.35	28	21	15							
1.35 - 1.50	31	24	21							
1.50 - 1.65	37	28	27							
1.65 - 1.80		30	31							
1.80 - 1.95		34	35							
1.95 - 2.10										
2.10 - 2.25										
2.25 - 2.40										
2.40 - 2.55										
2.55 - 2.70										
2.70 - 2.85										
2.85 - 3.00										

TEST METHOD AS 1289.6.3.2, CONE PENETROMETER ☑
AS 1289.6.3.3, FLAT END PENETROMETER ☐

TESTED BY: JMF
CHECKED BY:

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RESULTS OF DYNAMIC PENETROMETER TESTS

CLIENT	Queensland Rail	DATE	17/7/08
PROJECT	Tarro Interchange – Option 3	PROJECT NO	39798.03
LOCATION	New England Highway/Woodlands Close, Tarro/Hexham	PAGE NO	Page 2 of 2

TEST LOCATIONS	501	501b	502	502b	503	503b	504	504b	505	
RL OF TEST										
DEPTH m	PENETRATION RESISTANCE BLOWS/150mm									
0.00 - 0.15		2		2		3		1		
0.15 - 0.30		2		2		3		2		
0.30 - 0.45		4		5		6		3		
0.45 - 0.60		8		7		7		4		
0.60 - 0.75		9	2	9	2	10		7		
0.75 - 0.90	2	8	2	9	2	8		8	0	
0.90 - 1.05	7	10	1	10	3	8	2	7	0	
1.05 - 1.20	7	9	3	10	3	8	2	5	0	
1.20 - 1.35										
1.35 - 1.50										
1.50 - 1.65										
1.65 - 1.80										
1.80 - 1.95										
1.95 - 2.10										
2.10 - 2.25										
2.25 - 2.40										
2.40 - 2.55										
2.55 - 2.70										
2.70 - 2.85										
2.85 - 3.00										

TEST METHOD AS 1289.6.3.2, CONE PENETROMETER ☑
AS 1289.6.3.3, FLAT END PENETROMETER ☐

TESTED BY: IDB
CHECKED BY:

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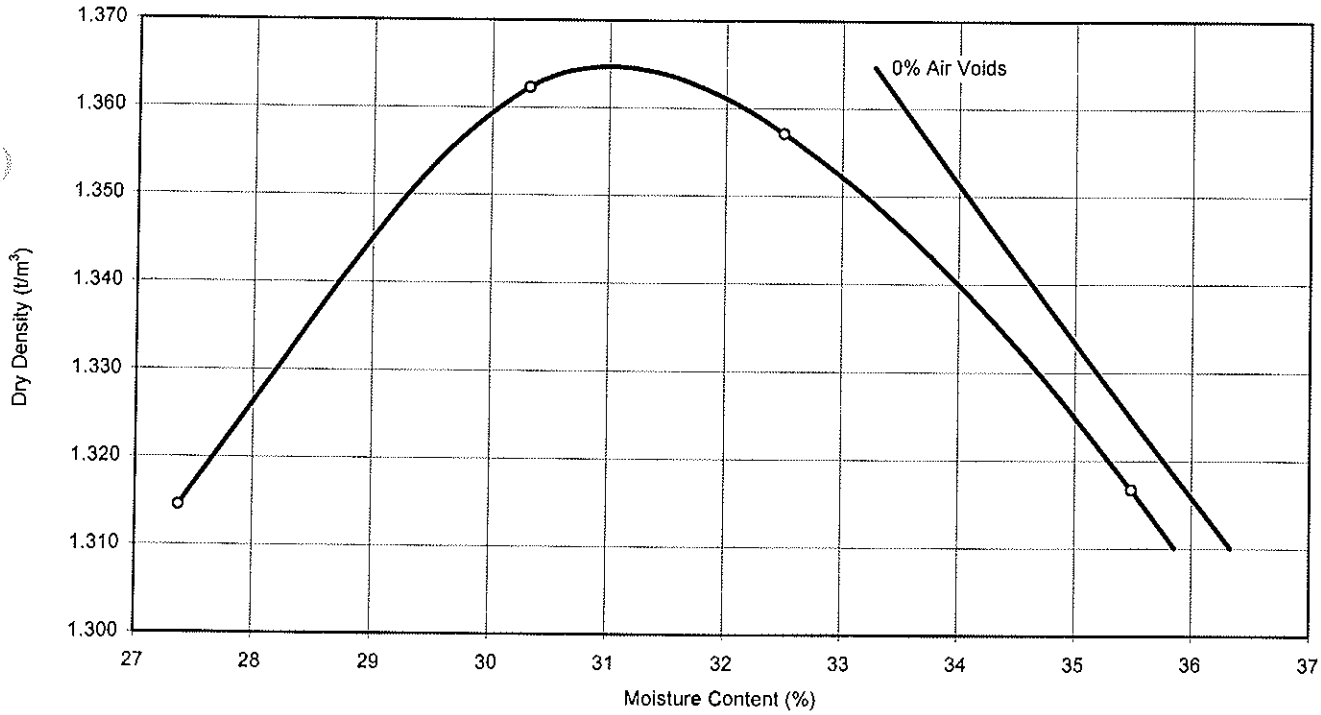
Warabrook NSW 2304
Phone (02) 4960 9600
Fax: (02) 4960 9601
newcastle@douglaspartners.com.au

RESULTS OF COMPACTION TEST

Client :	Queensland Rail	**Project No. :**	39798.03
		Report No. :	N08-207
Project :	Proposed Tarro Interchange - Option 3	**Report Date :**	4/09/2008
Location :	Tarro/Hexham	**Date of Test:**	25/08/2008
		Page:	1 of 1



Sample Details **Location:** Bore 503B
Depth: 0.20-0.50m

Particles > 19mm: 0%

Description: CLAY - Grey/brown

Maximum Dry Density:	**1.36 t/m^3**
Optimum Moisture Content:	**31.0 %**

Remarks:

Test Methods: AS 1289.5.1.1-2003 (STD), AS 1289.2.1.1-2005

Sampling Methods: Sampled by DP engineers

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NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	DR
Checked:	DM

Dave Millard
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

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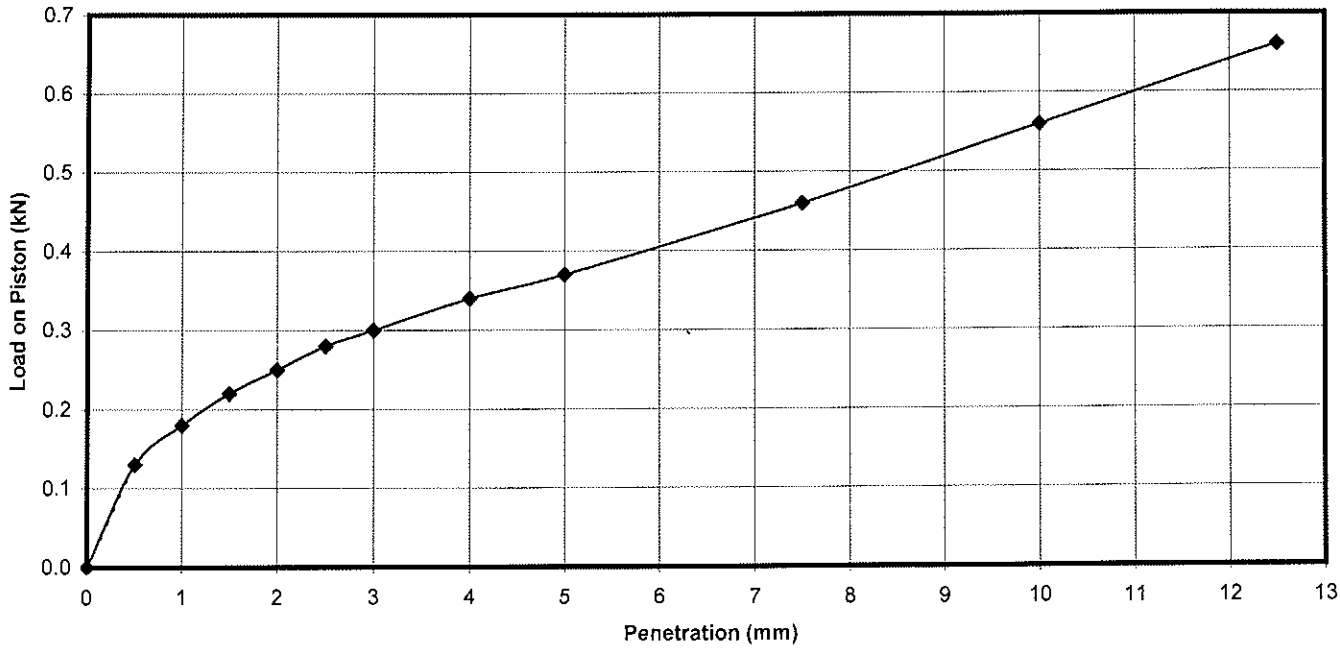
RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Queensland Rail	**Project No. :**	39798.03
		Report No. :	N08-207a
Project :	Proposed Tarro Interchange - Option 3	**Report Date :**	4/09/2008
		Date Sampled :	17/07/2008
Location :	Tarro/Hexham	**Date of Test:**	2/09/2008
Test Location :	Bore 503B		
Depth / Layer :	0.20-0.50m	**Page:**	1 of 1



Description: CLAY - Grey/brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): Sampled by DP engineers

Percentage > 19mm: 0.0%

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 100% of STD OMC
SURCHARGE: 9 kg
SOAKING PERIOD: 4 days
SWELL: 3.1%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		31.0	1.36
After soaking		35.2	1.32
After test	Top 30mm of sample	43.8	-
	Remainder of sample	31.8	-
Field values		43.2	-
Standard Compaction		31.0	1.36

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	2.5 mm	2.0
	5.0 mm	2.0

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Approved Signatory:

Tested:	LB
Checked:	DM

Dave Millard
Laboratory Manager

Douglas Partners
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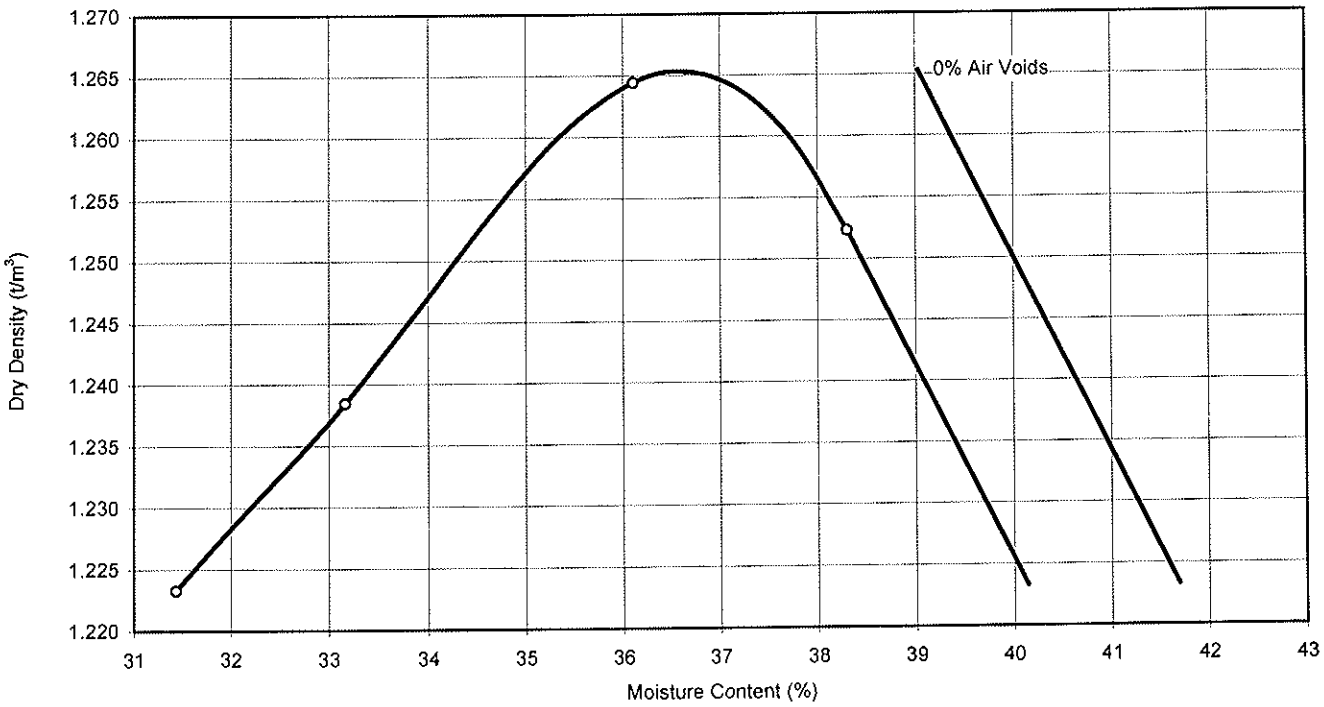
RESULTS OF COMPACTION TEST

Client :	Queensland Rail	**Project No. :**	39798.03
		Report No. :	N08-207b
Project :	Proposed Tarro Interchange - Option 3	**Report Date :**	4/09/2008
Location :	Tarro/Hexham	**Date of Test:**	25/08/2008
		Page:	1 of 1



Sample Details **Location:** Bore 505
Depth: 0.75-1.20m

Particles > 19mm: 0%

Description: CLAY - Brown, trace silt, sand and gravel

Maximum Dry Density:	**1.27 t/m^3**
Optimum Moisture Content:	**36.5 %**

Remarks:

Test Methods: AS 1289.5.1.1-2003 (STD), AS 1289.2.1.1-2005

Sampling Methods: Sampled by DP engineers

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Approved Signatory:

Tested:	DR
Checked:	DM

Dave Millard
Laboratory Manager

Douglas Partners
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Phone (02) 4960 9600
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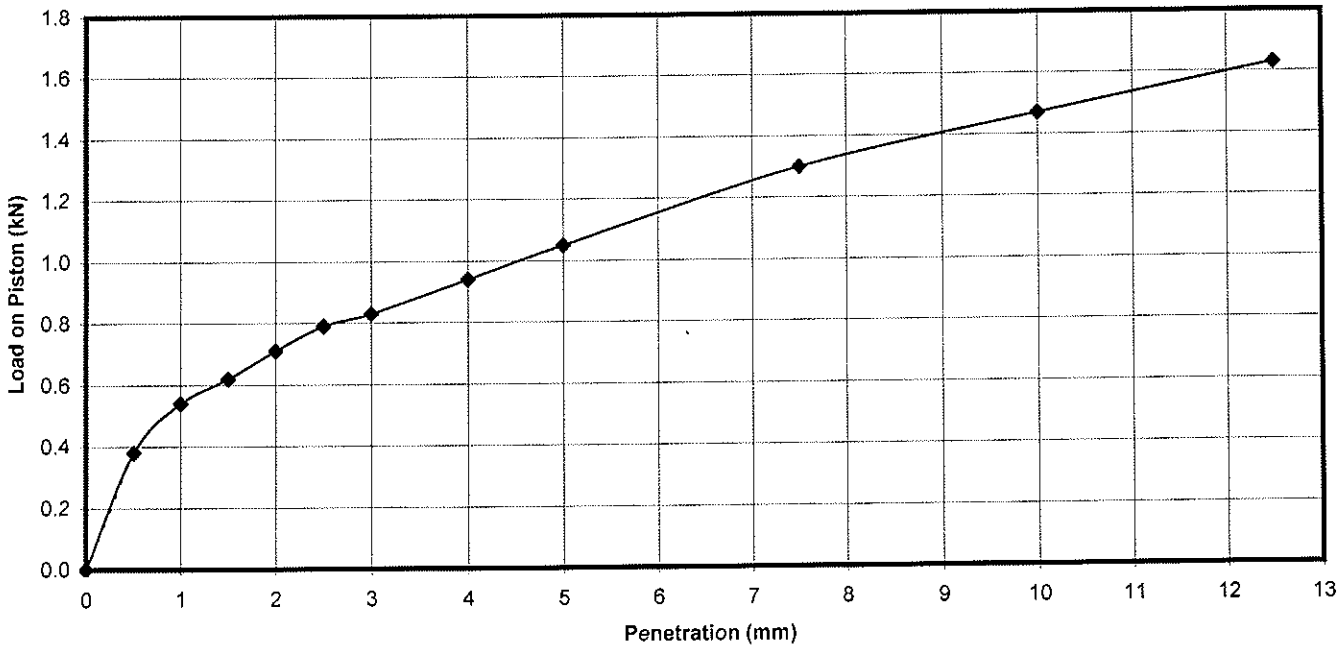
newcastle@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Queensland Rail	**Project No. :**	39798.03
		Report No. :	N08-207c
Project :	Proposed Tarro Interchange - Option 3	**Report Date :**	4/09/2008
		Date Sampled :	17/07/2008
Location :	Tarro/Hexham	**Date of Test:**	2/09/2008
Test Location :	Bore 505		
Depth / Layer :	0.75-1.20m	**Page:**	1 of 1



Description: CLAY - Brown, trace silt, sand and gravel

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): Sampled by DP engineers

Percentage > 19mm: 0.0%

LEVEL OF COMPACTION: 100% of STD MDD
MOISTURE RATIO: 101% of STD OMC
SURCHARGE: 9 kg
SOAKING PERIOD: 4 days
SWELL: 1.4%

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		36.9	1.27
After soaking		40.9	1.26
After test	Top 30mm of sample	38.9	-
	Remainder of sample	36.9	-
Field values		59.1	-
Standard Compaction		36.5	1.27

RESULTS		
TYPE	PENETRATION	CBR (%)
TOP	2.5 mm	6
	5.0 mm	5

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Approved Signatory:

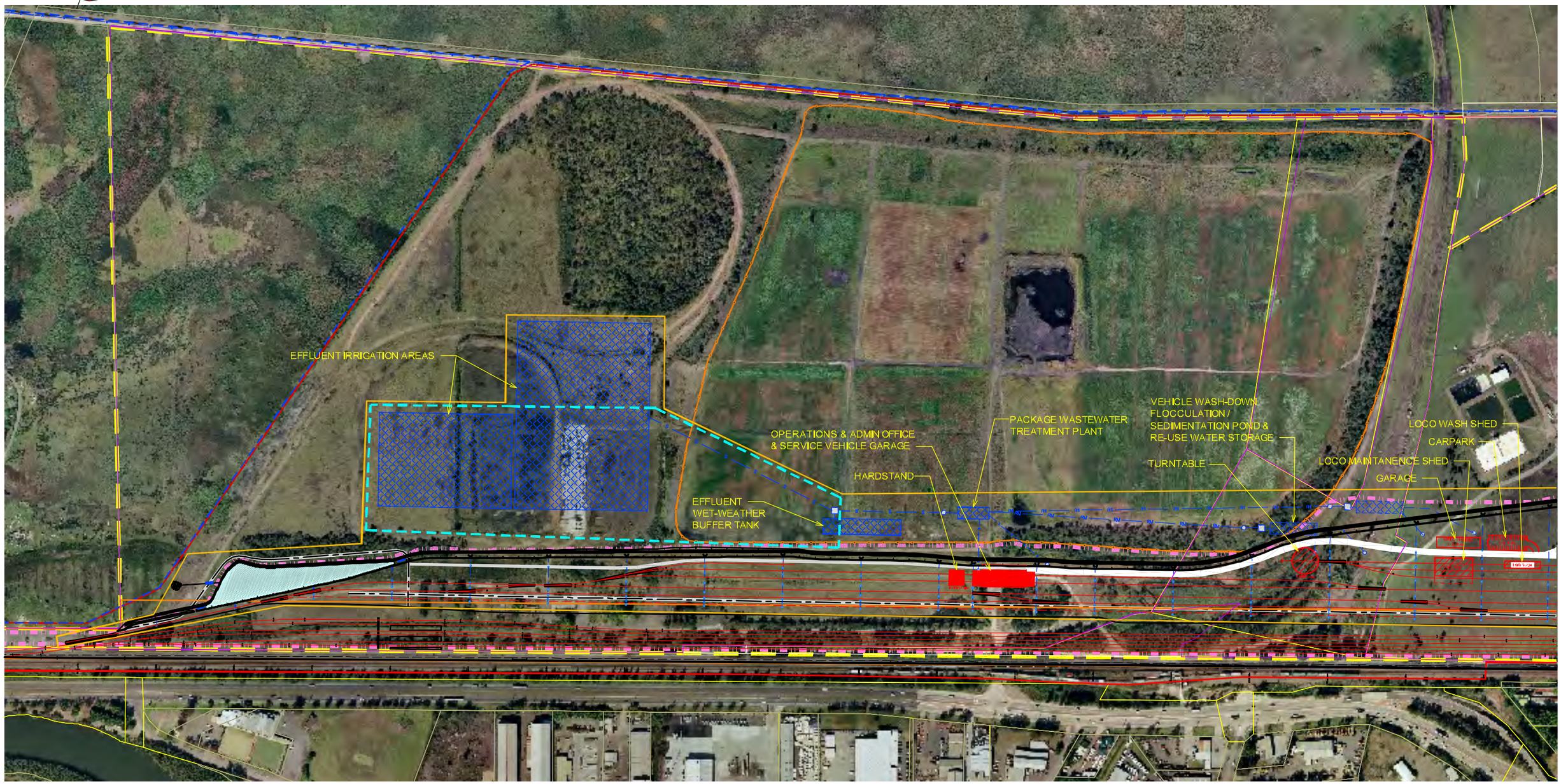
Tested:	LB
Checked:	DM

Dave Millard
Laboratory Manager

Appendix H

Figure 2 – Proposed Arrangement – Train Support Facility (WorleyParsons) (Sheet 1 of 2 and Sheet 2 of 2)
Drawing 1-1 – Location of Previous Investigations
Drawing 1-2 – Test Location Plan
Drawing 1- 3 – Section A-A
Areas of Disturbance Cut – Drawings 2216395-16-FIG-C0002 (GHD) – Rev 4 – 10 October 2012
Areas of Disturbance of Fill – Drawings 2216395-16-FIG-C0003 (GHD) – Rev 2 – 26 September 2012

FIGURE 2



LEGEND

- TRAIN SUPPORT FACILITY BOUNDARY
- PROPERTY BOUNDARY
- WATER RECYCLING & WASTEWATER TREATMENT SYSTEM
- HWC PROPOSED WATER MAIN
- EXISTING WATER MAIN
- PROPOSED ARTC RELIEF ROADS (TRACKS)
- TSF ROADS (TRACKS)
- STORMWATER DRAINAGE NETWORK
- COAL TAILINGS STOCKPILE EXTENTS
- PROPOSED CESS DRAIN
- PROPOSED WASTEWATER DRAINAGE LINE
- PROPOSED RISING MAIN

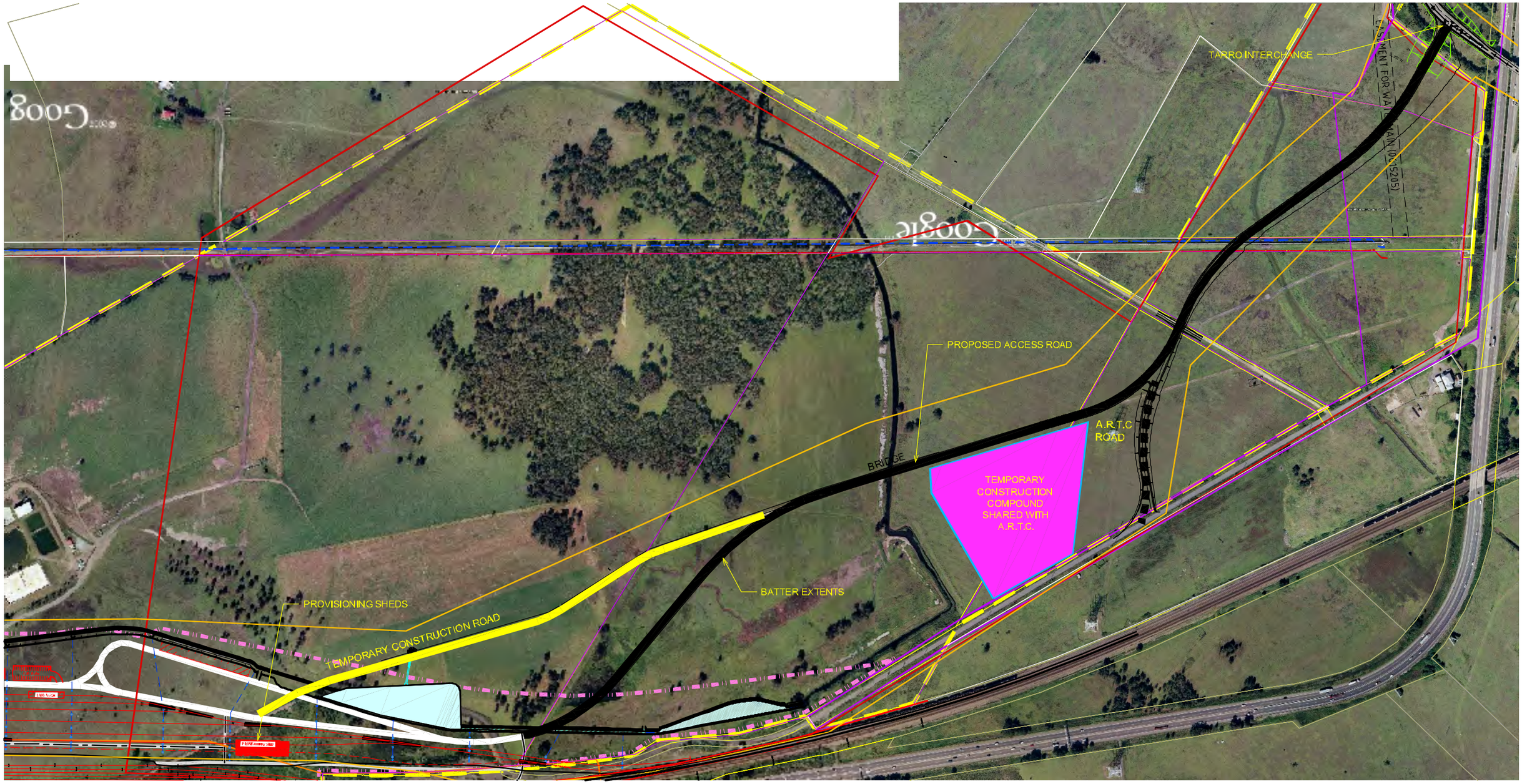
WorleyParsons
resources & energy

0 200m
1:5000

PROPOSED ARRANGEMENT TRAIN SUPPORT FACILITY SHEET 1 OF 2

O:\301020\03465 – QR TSF (GS)\12.0 Drawings\12.01 Civil Infrastructure\CAD\STORMWATER FIGURES\FIG 2-1_2-2_PROPOSED ARRANGEMENT.dwg 23/08/2012

FIGURE 2



LEGEND

- TRAIN SUPPORT FACILITY BOUNDARY
- PROPOSED CESS DRAIN
- PROPERTY BOUNDARY
- WATER RECYCLING & WASTEWATER TREATMENT SYSTEM
- TRUCK SHAKEDOWN AND WASHDOWN BAY (IF REQUIRED)

0 200m

1:5000

WorleyParsons
resources & energy

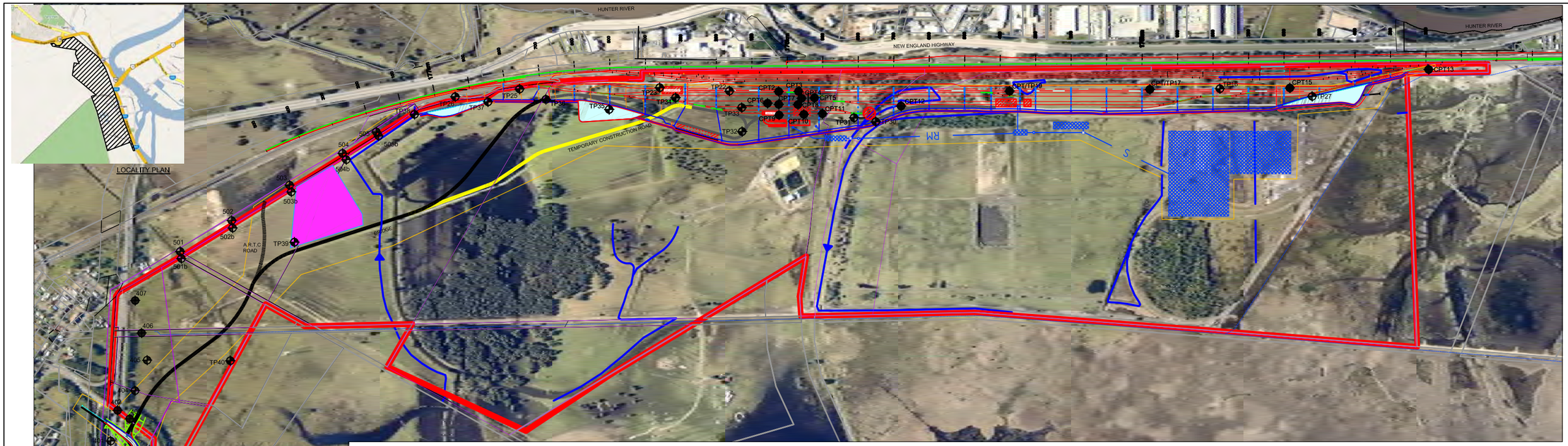
PROPOSED ARRANGEMENT
TRAIN SUPPORT FACILITY
SHEET 2 OF 2

O:\301020\03465 – QR TSF (GS)\12.0 Drawings\12.01 Civil Infrastructure\CAD\STORMWATER FIGURES\FIG 2-1_2-2_PROPOSED ARRANGEMENT.dwg 23/08/2012

DRAWING ADAPTED FROM iPLAN PLANNING PORTAL

Ref:P:/39798.08/Drawings/39798.08 Drawing 1-1

Douglas Partners Geotechnics | Environment | Groundwater	**Location of Previous Investigation Data** **Preliminary Geotechnical Investigation** **Proposed Train Support Facility** **Woodland Close, Hexham**	PROJECT No: 39798.08 DRAWING No: 1-1 REVISION: 1
	CLIENT: QR National	DATE: 14.05.2012



LEGEND

- Site Boundary
- Approximate Borehole Location (Project 39798 and 39798.03-October 2007)
- Approximate CPT Location (Project 39798-October 2007)
- Approximate Creek/Drainage Channels and Direction Flow
- Water Quality Control Pond
- Temporary Construction Compound
- Effluent Irrigation Areas

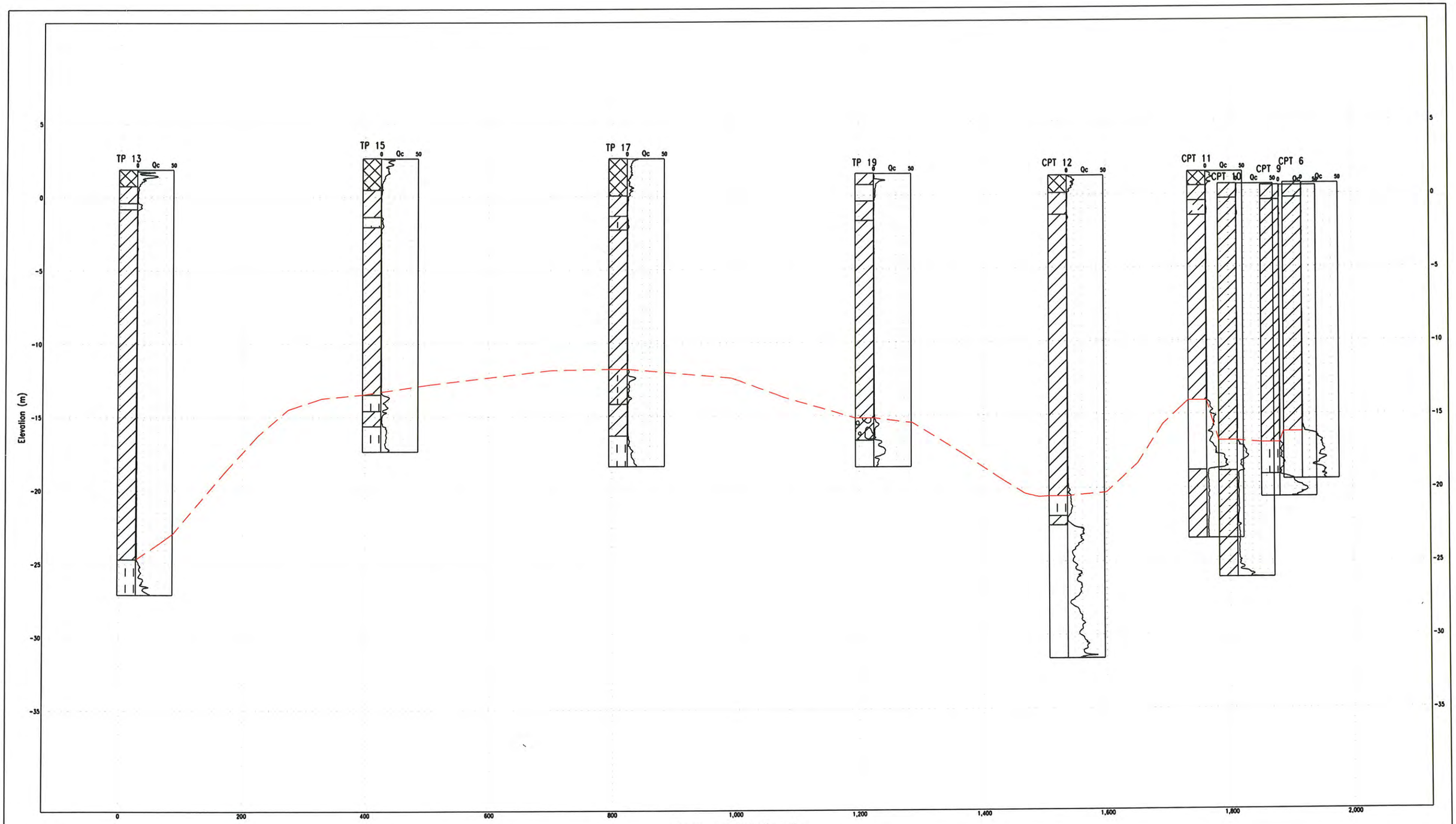
Drawing adapted from plan supplied by client, File Ref SKETCH120829 Site Masterplan-Final.dwg provided 30.08.2012 and NearMap Image dated 25 June 2011

0 50 100 150 200 300 400 500m

1:5000 @ A1

Douglas Partners
Geotechnics | Environment | Groundwater

CLIENT: QR National		TITLE: Test Location Plan Proposed Train Support Facility Woodlands Close, Hexham	PROJECT No: 39798.08
OFFICE: Newcastle	DRAWN BY: PLH		DRAWING No: 1-2
SCALE: 1:5000@A1	DATE: 13.09.2012		REVISION: 1



LEGEND

- Filling
- Clay
- Silty Sand
- Sand
- Clayey Sand
- Silty Clay
- Clayey Gravel
- Q_c Cone Resistance (MPa)
- — — Approximate Base of Soft Clay Layer

NOTES:

1. Refer Drawing 1–2 "Test Location Plan" for location of section
2. Reference should be made to detailed CPTs for detailed descriptions
3. Layer boundaries have been estimated from discrete test locations and has involved interpolation between data points.

Ref:P:/39798.08/Drawings/39798.08 Drawing 1-3

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: QR National		TITLE: **Geological Section A-A'**	PROJECT No: 39798.08
OFFICE: Newcastle	DRAWN BY: PLH	**Proposed Train Support Facility**	DRAWING No: 1-3
SCALE: As shown	DATE: 16.05.2012	**Woodlands Close, Hexham**	REVISION: 0

1:10,000 Paper Size A3

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

Areas Of Disturbance Cut mm

- 300
- 800
- 1000
- 1500
- 1600
- 2600

- Cadastral Site Boundary
- Roads
- ARTC HRR Rail centrline
- QRN Rail Centreline

GHD

CLIENTS | PEOPLE | PERFORMANCE

QR National Pty
NSW Long Term Train Support Facility

Job Number 22-16395
Revision 4
Date 10 Oct 2012

Areas of Disturbance Cut

2216395-16-FIG-C0002

G:\22\16395\GIS\Maps\Deliverables\Internal\General\2216395-16-FIG-C0002(4).mxd

Data source: LPMA: DTDB - 2007; Nearmap: Aerials - 2012; Engenicom: Design Data - 2012. Created by:mabarnier

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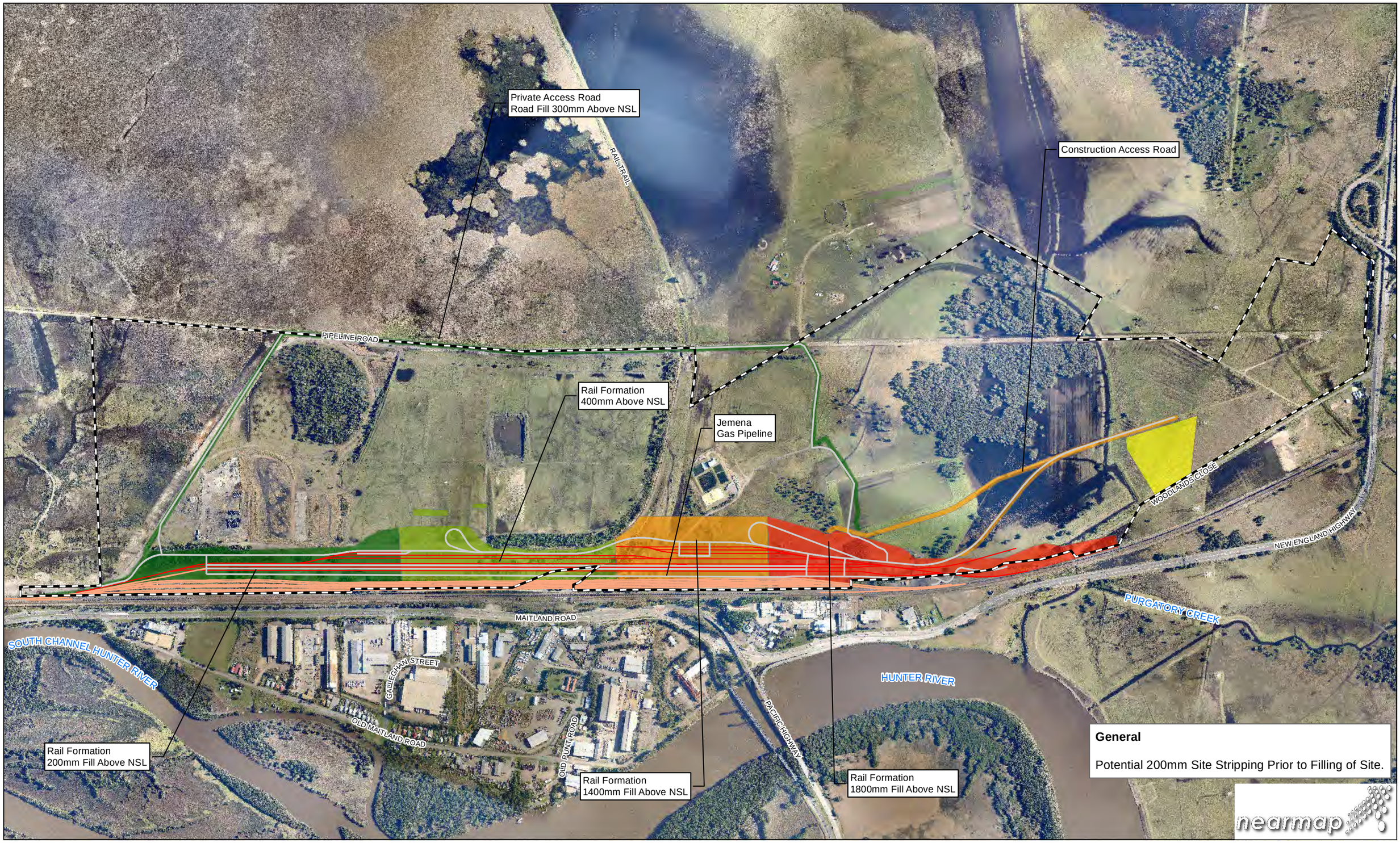

1:10,000 Paper Size A3

0 50 100 200 300 400

Metres

Map Projection: Transverse Mercator
Horizontal Datum: GDA 1994
Grid: GDA 1994 MGA Zone 56

N

LEGEND

Areas Of Disturbance Fill mm

- 0-200
- 200-400
- 500
- 1400
- 1800
- Cadastral Site Boundary
- Roads
- ARTC HRR Rail centrline
- QRN Rail Centreline

GHD

CLIENTS|PEOPLE|PERFORMANCE

QR National Pty Ltd
NSW Long Term Train Support Facility

Job Number	22-16395
Revision	2
Date	26 Sep 2012

Areas of Disturbance Fill

2216395-16-FIG-C0003

G:\22\16395\GIS\Maps\Deliverables\Internal\General\2216395-16-FIG-C0003(2).mxd

Data source: LPMA: DTDB - 2007; Nearmap: Aerial - 2012; Engenicom: Design Data - 2012. Created by:mabarnier

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