



47 National Avenue,
Pakenham VIC 3810

ph: 03 9769 5799
fax: 03 9769 4799
mob: 0417 004 072
tseymour@terrafirmalabs.com.au

www.terrafirmalabs.com.au

ABN: 11 925 206 385

**Geotechnical Report
Level One Inspection and Testing
Version 2**

**Roses Estate Stage 5
Beaconsfield**

Prepared for:

**Streetworks Pty Ltd
4 Len Thomas Place
Narre Warren 3805**

Project 9278

17 May 2017.

Prepared by:

TERRA FIRMA LABORATORIES
Geotechnical Inspection and Testing Authority

47 National Avenue,
Pakenham VIC 3810
Phone: 03 9769 5799 Fax: 03 9769 4799
Email: tseymour@terrafirmalabs.com.au

Geotechnical Report Level One Inspection and Testing Roses Estate Stage 5 Version 2

1. Introduction

Terra Firma Laboratories was engaged by *Streetworks Pty Ltd* as the geotechnical inspection and testing authority to provide Level 1 supervision and testing works on the earthworks component for Roses Estate Stage 5. This work was conducted over the period of 16/12/2016 to 13/05/2017.

This report presents that the allotment earthworks was carried out in accordance with *AS3798-2007 Guidelines for Earthworks for Commercial and Residential Development* and in compliance with the compaction control specifications established by the contractor.

2. Scope of Works

2.1. Areas of work

The areas of work included lots 82, 84, 85, 86, 87 and 88. The site will be a residential estate.

The area on which fill was placed is shown on site plan (Appendix 1) based on drawings prepared by Banriar Investments Pty Ltd and provided by *Streetworks Pty Ltd*.

The supervision work by *Terra Firma Laboratories* involved both inspection of sub grade preparation work and full time inspection and testing of fill placement.

2.2. Specification

The placement of fill on the areas of work was to be carried out in accordance with *AS3798-2007 Guidelines for Earthworks for Commercial and Residential Development*, as directed by *Streetworks Pty Ltd*. At all times during placement of fill materials Terra Firma Laboratories maintained a Geotechnical Technician on site to perform the supervision and testing as required by AS3798-2007.

A technical specification for compaction control requirements was provided by Streetworks Pty Ltd and established that:

As referenced from AS3798-2007 (Section 5.2) establishes a specification requirement for a minimum density ratio of not less than 95% noting that soils containing more than 20% of particles coarser than 37.5mm cannot be tested for relative compaction using the procedures of AS1289.

Test Rolling is required for all layers of structural fill and materials within 150mm of permanent subgrade level so as to withstand test rolling without visible deformation or springing. Corrective action is required where unstable areas exceed 20% of the area being considered by test rolling.

3. Inspection and Testing

3.1. Sub-Grade Preparation

Subgrade preparation involved stripping the site down of topsoil and organic matter to a depth of approximately 200mm below existing levels detailed on the site plans. The sub-grade area was then proof-rolled to determine soft or otherwise unsuitable zones and such zones rectified as necessary. The sub-grade was watered and scarified prior to fill placement to aid layer bonding.

3.2. Fill materials

The materials used as fill were locally sourced and observed to generally consist of Silty Clay, sourced from stockpiled materials on site. No particles greater than 150mm were observed. The fill was nominated as clean fill by the contractor.

3.3. Fill Construction

The contractor had the following plant available on-site during the construction period for use in the fill placement:

- *Backhoe*
- *Padfoot Roller*
- *Dozer*
- *Water Truck*
- *Dump Truck*
- *Loader*
- *Grader*
- *Excavator*

All fill was placed in layers of thicknesses not exceeding 300mm. *The work area was typically a 2 or 3 lot area on any one particular day.* At the completion of a placed layer, compaction testing was performed to confirm appropriate compaction had been achieved and supported the observations made.

It was observed that finished levels were in accordance with levels marked on site by survey. These levels are shown on site plans attached in Appendix 1.

The final 300mm of fill placed across the site was placed as a topsoil layer/ growing medium and should be considered as non-structural, as it was placed in an uncontrolled manner, as allowed by specifications.

4. Compaction Control Testing

Testing comprised of a total of 13 in-situ density tests, with a summary of results included in Appendix 2. Test Reports are referenced in Appendix 3.

Test numbers 3, 4, 5, 6 and 7 originally failed to meet specification. Streetworks Pty Ltd were Notified and asked to rework the area appropriately. Upon adequate reworking *Terra Firma Laboratories* would perform a re-test.; this process would continue until a minimum compaction effort of 95% was achieved.

It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed. Each lot does not necessarily require a compaction test to comply. The compaction control testing indicated that the engineered fill on all lots complied with the technical specification.

5. Uncontrolled Works

Terra Firma Laboratories cannot verify any works completed by others after the final date specified in the introduction. Uncontrolled works may include, but not limited to trenching for services, cut and fill works for slab preparation or subsequent removal of vegetation and back fill of holes.

6. Clean Fill

Terra Firma Laboratories cannot guarantee that the material used as a filling medium is free from chemical or other contamination.

7. Statement of Compliance

Inspections and testing of the fill areas at this site indicate that both sub grade preparation and fill placement have been conducted in accordance with the specification and that the completed fill areas of greater than 300mm, as shown on the site plan attached, and not any preceding the 16/12/2016 or work completed after the 13/04/2017, may be certified as being compliant with the specification.

For and on behalf of
Terra Firma Laboratories,



Tom Seymour
Lab Manager



47 National Avenue,
Pakenham VIC 3810

ph: 03 9769 5799
fax: 03 9769 4799
mob: 0417 004 072
tseymour@terrafirmalabs.com.au

www.terrafirmalabs.com.au

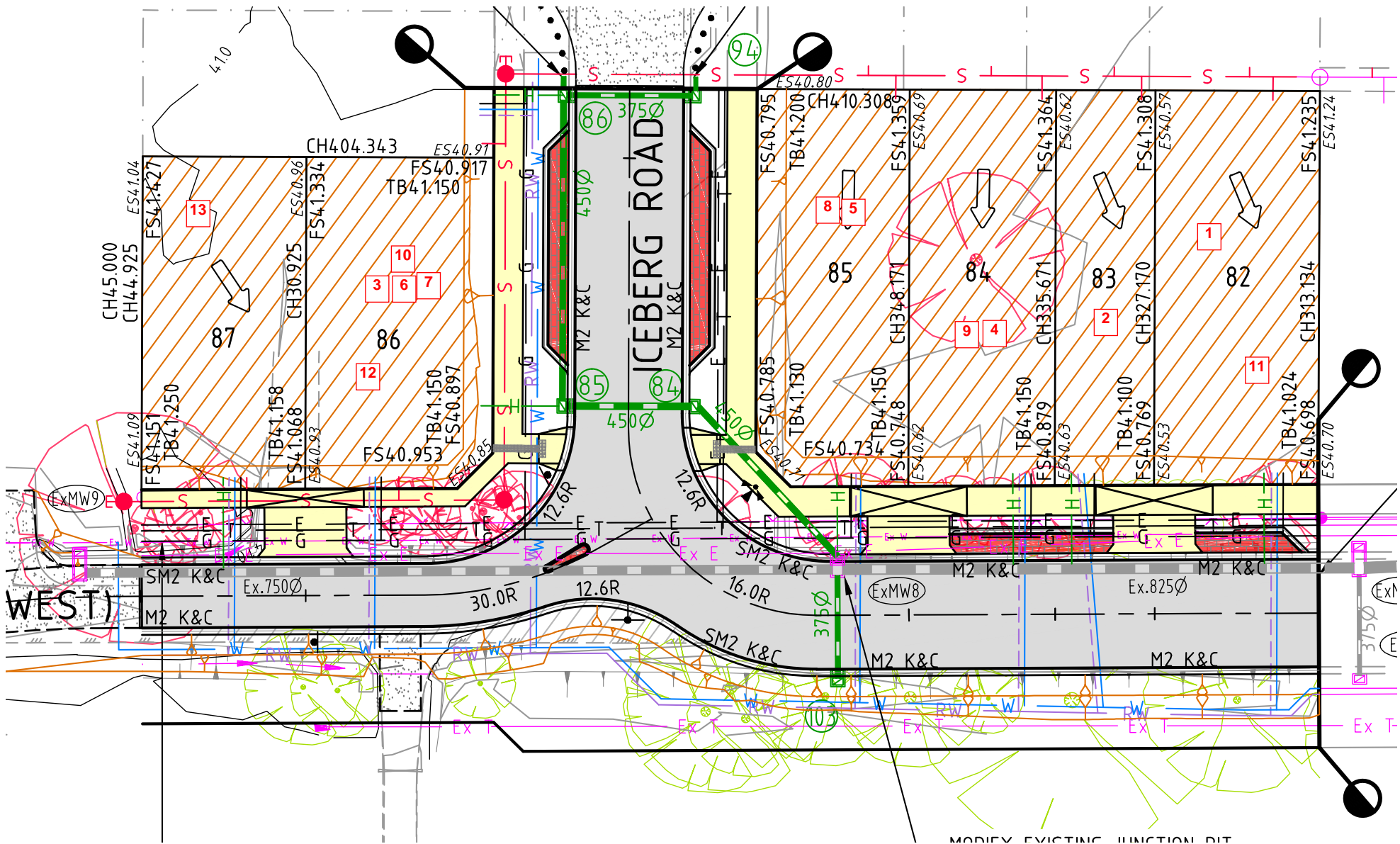
ABN: 11 925 206 385

APPENDICES

Appendix 1: Site Plans

Appendix 2: Test Summary

Appendix 3: Test Reports



MODEX EXISTING JUNCTION DET



12 Enterprise Ave
Berwick
Vic 3806

Test Location Plan

Client : Streetworks Pty Ltd

Project : Roses Estate Stage 5

Scale
NTS



Level One Test Summary

Client: Streetworks Pty Ltd **Specification:** 95%
Project: Roses Estate St 5 **Project No:** 9278

Date:	Test Number:	Layer:	Retest of:	Density:	Pass/Fail:	Lot No:	Report No:
16/12/2016	1	L1		96.5	PASS	82	9278-1
16/12/2016	2	L1		96	PASS	88	9278-1
19/12/2016	3	L1		92.5	FAIL	86	9278-2
19/12/2016	4	L2		93	FAIL	84	9278-3
19/12/2016	5	L2		91.5	FAIL	85	9278-3
19/12/2016	6	L1	3	93.5	FAIL	86	9278-3
20/12/2016	7	L1	6	94	FAIL	86	9278-5
20/12/2016	8	L2	5	97	PASS	82	9278-4
20/12/2016	9	L2	4	97	PASS	84	9287-4
20/12/2016	10	L1	7	99.5	PASS	86	9278-4
20/12/2016	11	L3		98.5	PASS	82	9278-6
13/04/2017	12	L1		97	PASS	86	9278-7
13/04/2017	13	L1		96	PASS	87	9278-7



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

47 National Avenue, Pakenham VIC 3810
 ph 03 5943 0980 www.terrafirmalabs.com.au

report No 9278-1
 date of issue 20-Dec-2016

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	TR
time	All Day
date	16-Dec-2016
checked by	DB

Field density test procedure AS1289.2.1.1 and 5.8.1							
Test No		1	2				
location	Lot No	82	83				
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	L1	L1				
measurement depth	mm	275	275				
field wet density	t/m ³	2.06	2.03				
field dry density	t/m ³	1.80	1.73				
field moisture content	%	14.6	17.3				
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard				
oversize material retained on AS sieve	mm	19.0	19.0				
percent of oversize material	wet	0	0				
peak converted wet density	t/m ³	2.13	2.11				
adjusted peak converted wet density	t/m ³	-	-				
moisture variation from OMC (-dry,+wet)%		0.5	1.0				
Moisture ratio	%	103.0	106.5				
Hilf density ratio (R_{HD})	%	96.5	96.0				
material description							
Silty CLAY							



The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards.
 Accredited for compliance with ISO/IEC 17025- Testing

LABORATORY ACCREDITATION No 15357

Approved Signature

D Burgess



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

47 National Avenue, Pakenham VIC 3810
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report No 9278-2
 date of issue 20-Dec-2016

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	BM
time	All Day
date	19-Dec-2016
checked by	DB

Field density test procedure AS1289.2.1.1 and 5.8.1							
Test No		3					
location	Lot No	86					
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1					
measurement depth	mm	275					
field wet density	t/m ³	1.92					
field dry density	t/m ³	1.58					
field moisture content	%	21.4					
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard					
oversize material retained on AS sieve	mm	19.0					
percent of oversize material	wet	0					
peak converted wet density	t/m ³	2.07					
adjusted peak converted wet density	t/m ³	-					
moisture variation from OMC (-dry,+wet)%		1.5					
Moisture ratio	%	106.5					
Hilf density ratio (R_{HD})	%	92.5					
material description							
Silty CLAY							



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report No 9278-3
 date of issue 21-Dec-2016

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	MW
time	All Day
date	19-Dec-2016
checked by	DB

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		4	5	6		
location	Lot No	84	85	86		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)				Retest of Test 3		
depth from F.S.L.	m	L2	L2	L1		
measurement depth	mm	275	275	275		
field wet density	t/m ³	2.00	1.97	1.96		
field dry density	t/m ³	1.75	1.72	1.70		
field moisture content	%	14.5	14.3	15.3		

laboratory compaction procedure AS1289 5.7.1

compactive effort		standard	standard	standard		
oversize material retained on AS sieve	mm	19.0	19.0	19.0		
percent of oversize material	wet	0	0	0		
peak converted wet density	t/m ³	2.15	2.16	2.10		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		1.5	2.0	1.0		
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Moisture ratio	%	111.5	118.0	105.5		
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Hilf density ratio (R_{HD})	%	93.0	91.5	93.5		
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material description

Silty CLAY



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report No 9278-4
 date of issue 21-Dec-2016

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	MW
time	All Day
date	20-Dec-2016
checked by	DB

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		8	9	10		
location	Lot No	85	84	86		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Retest of Test 5	Retest of Test 4	Retest of Test 7		
depth from F.S.L.	m	Layer 2	Layer 2	Layer 1		
measurement depth	mm	275	275	275		
field wet density	t/m ³	2.03	2.03	2.00		
field dry density	t/m ³	1.72	1.72	1.62		
field moisture content	%	18.1	18.1	23.4		

laboratory compaction procedure AS1289 5.7.1

compactive effort		standard	standard	standard		
oversize material retained on AS sieve	mm	19.0	19.0	19.0		
percent of oversize material	wet	0	0	0		
peak converted wet density	t/m ³	2.09	2.09	2.01		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		3.5	1.0	2.0		
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Moisture ratio	%	123.5	105.0	110.0		
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Hilf density ratio (R_{HD})	%	97.0	97.0	99.5		
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material description

Silty CLAY



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47 National Avenue, Pakenham VIC 3810
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report No 9278-5
 date of issue 21-Dec-2016

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	BM
time	All Day
date	20-Dec-2016
checked by	DB

Field density test procedure AS1289.2.1.1 and 5.8.1							
Test No		7					
location	Lot No	86					
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		Retest of Test 6					
depth from F.S.L.	m	Layer 1					
measurement depth	mm	275					
field wet density	t/m ³	1.97					
field dry density	t/m ³	1.73					
field moisture content	%	13.8					
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard					
oversize material retained on AS sieve	mm	19.0					
percent of oversize material	wet	0					
peak converted wet density	t/m ³	2.09					
adjusted peak converted wet density	t/m ³	-					
moisture variation from OMC (-dry,+wet)%		2.0					
Moisture ratio	%	118.5					
Hilf density ratio (R_{HD})	%	94.0					
material description							
Silty CLAY							



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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

47 National Avenue, Pakenham VIC 3810
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report No 9278-6
 date of issue 22-Dec-2016

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	BM
time	All Day
date	20-Dec-2016
checked by	DB

Field density test procedure AS1289.2.1.1 and 5.8.1							
Test No		11					
location	Lot No	82					
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 3					
measurement depth	mm	275					
field wet density	t/m ³	2.07					
field dry density	t/m ³	1.81					
field moisture content	%	14.5					
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard					
oversize material retained on AS sieve	mm	19.0					
percent of oversize material	wet	0					
peak converted wet density	t/m ³	2.10					
adjusted peak converted wet density	t/m ³	-					
moisture variation from OMC (-dry,+wet)%		0.5					
Moisture ratio	%	104.0					
Hilf density ratio (R_{HD})	%	98.5					
material description							
Silty CLAY							



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 D Burgess



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

47 National Avenue, Pakenham VIC 3810
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report No 9278-7
 date of issue 18-Apr-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Roses Estate Stage 5
Location	Beaconsfield

Feature	Block Fill
Layer thickness (mm)	300

tested by	AA
time	All Day
date	13-Apr-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		12	13			
location	Lot No	86	87			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 1	Layer 1			
measurement depth	mm	275	275			
field wet density	t/m ³	2.06	2.03			
field dry density	t/m ³	1.74	1.71			
field moisture content	%	18.0	18.7			

laboratory compaction procedure AS1289 5.7.1

compactive effort		standard	standard			
oversize material retained on AS sieve	mm	19.0	19.0			
percent of oversize material	wet	0	0			
peak converted wet density	t/m ³	2.12	2.11			
adjusted peak converted wet density	t/m ³	-	-			

moisture variation from OMC (-dry,+wet)%		0.5	1.0			
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Moisture ratio	%	103.5	104.5			
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Hilf density ratio (R_{HD})	%	97.0	96.0			
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material description

Sandy Silty CLAY



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Approved Signature

C Caulfield