Your Worksite is Our Laboratory.

Geotechnical Report
Level One Inspection and Testing

Summerhill Estate Stage 3
Cranbourne

Prepared for:

Streetworks Pty Ltd
4 Len Thomas Place
Narre Warren

Project 9821

16 February 2018

Prepared by:

TERRA FIRMA LABORATORIES
Geotechnical Inspection and Testing Authority

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Geotechnical Report Level One Inspection and Testing
Summerhill Estate Stage 3

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 Summerhill Stage 3. This work was conducted over the period of 23/08/2017 to 15/2/2018.

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 301, 306 to 310 and 324 to 325. 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 GPR Consulting 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:

- Pad Foot Roller
- Water Cart
- Excavator
- Trucks
- Dozer
- Dump Trucks

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

Test numbers 1, 3, 5, 6, 10 and 11 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 23/08/2017 or work completed after the 15/02/2018, may be certified as being compliant with the specification.

For and on behalf of
Terra Firma Laboratories,

Tom Seymour
Managing Director

Appendices

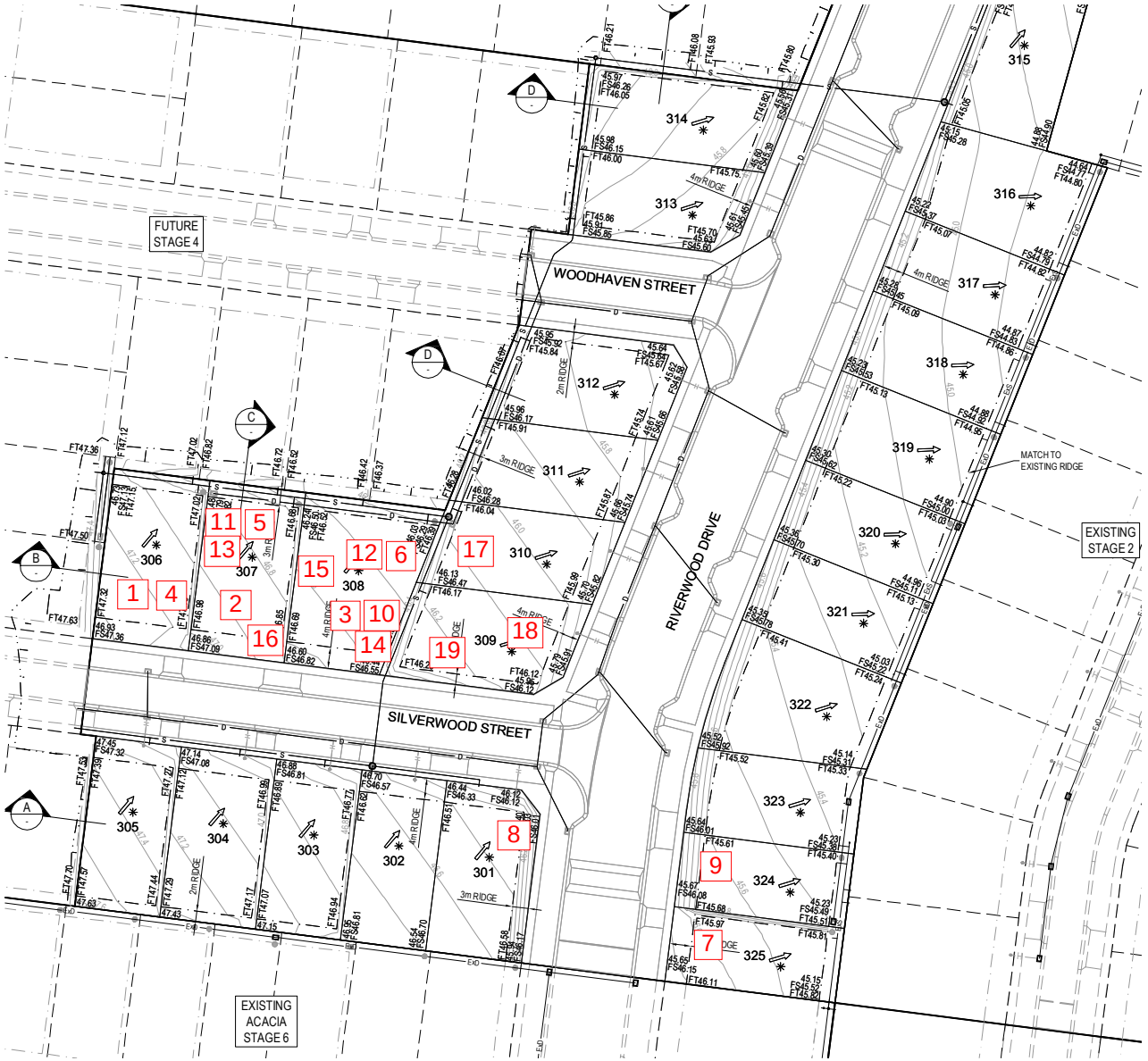
Appendix 1 Site Plan

Appendix 2 Test Summary

Appendix 3 Test Reports

Our Head Office
47 National Ave
Pakenham, VIC 3810

Our Laboratories
Pakenham 03 9769 5799
Deer Park 03 8348 5596
Bibra Lake 0481 227 980



terra firma laboratories

47 National Avenue
Pakenham VIC 3810

Test Location Plan

Client : Streetworks Pty Ltd

Project : Summerhill Stage 3

Scale NTS

Level One Test Summary Test Summary

Client: Streetworks Pty Ltd **Specification:** 95%
Project: Summerhill Stage 3 **Project No:** 9821

Date:	Test Number:	Layer:	Retest of:	Density:	Pass/Fail:	Lot No:	Report No:
23/08/2017	1	L1		90	Fail	306	9821-1
23/08/2017	2	L1		95	Pass	307	9821-1
23/08/2017	3	L1		91.5	Fail	308	9821-1
24/08/2017	4	L1	1	95	Pass	306	9821-2
24/08/2017	5	L2		87.5	Fail	307	9821-3
24/08/2017	6	L2		87	Fail	308	9821-3
27/09/2017	7	L2		104.5	Pass	325	9821-4
27/09/2017	8	L1		99.5	Pass	301	9821-4
27/09/2017	9	L1		101	Pass	324	9821-5
9/11/2017	10	L1	3	93	Fail	308	9821-6
9/11/2017	11	L2	5	90.5	Fail	307	9821-7
9/11/2017	12	L2	6	95.5	Pass	308	9821-6
25/11/2017	13	L2	11	97.5	Pass	307	9821-8
25/11/2017	14	L1	10	100	Pass	308	9821-8
15/02/2018	15	L1		101	Pass	308	9821-9
15/02/2018	16	L2		99	Pass	307	9821-9
15/02/2018	17	L1		97.5	Pass	310	9821-9
15/02/2018	18	L2		97	Pass	309	9821-9
15/02/2018	19	L2		99	Pass	309	9821-9

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

ph 03 5943 0980 www.terrafirmalabs.com.au

report No 9821-1

date of issue 28-Aug-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	SP
time	PM
date	23-Aug-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**1**	**2**	**3**			
location	Lot No	306	307	308			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1			
measurement depth	mm	275	275	275			
field wet density	t/m^3	1.91	1.92	1.86			
field dry density	t/m^3	1.59	1.61	1.53			
field moisture content	%	20.0	18.9	21.5			
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	2.12	2.02	2.03			
adjusted peak converted wet density	t/m^3	-	-	-			
moisture variation from OMC (-dry,+wet)%		3.5	1.0	3.5			
Moisture ratio	**%**	**121.0**	**106.0**	**120.5**			
Hilf density ratio (R_{HD})	**%**	**90.0**	**95.0**	**91.5**			

material description

Silty CLAY

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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

C Caulfield

COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

ph 03 5943 0980 www.terrafirmalabs.com.au

report No 9821-2

date of issue 22-Sep-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	SP
time	PM
date	24-Aug-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**4**					
location Lot No Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		306 Retest of 1					
depth from F.S.L.	m	Layer 1					
measurement depth	mm	275					
field wet density	t/m^3	1.96					
field dry density	t/m^3	1.63					
field moisture content	%	20.2					
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)%		3.5					
Moisture ratio	**%**	**121.0**					
Hilf density ratio (R_{HD})	**%**	**95.0**					

material description

Silty CLAY

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COMPACTION ASSESSMENT
BY NUCLEAR GAUGE METHOD

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

report No 9821-3
date of issue 22-Sep-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

chainage	Block Fill
Layer thickness (mm	300

tested by	SP
time:	PM
date:	24-Aug-2017
checked by	CC

test procedures AS1289.2.1.1 & 5.8.1

test No		**5**	**6**				
location Lot No		307	308				
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 2	Layer 2				
measurement depth	mm	275	275				
field wet density	t/m^3	1.92	1.89				
field dry density	t/m^3	1.55	1.52				
field moisture content	%	23.5	25.0				
laboratory compaction procedure AS1289.5.1.1 Standard Compaction							
standard maximum dry density	t/m^3	**1.77**	**1.74**				
standard optimum moisture content	%	**18.0**	**18.0**				
test procedure AS1289.5.4.1							
oversize material retained on AS sieve	mm	19.0	19.0				
percent of oversize material	wet	0	0				
percent of oversize material	dry	0	0				
adjusted standard maximum dry density	t/m^3	0.00	0.00				
adjusted standard optimum moisture content	%	0.0	0.0				
moisture variation (-dry,+wet)	%	5.5	7.0				
moisture ratio (R_m)	**%**	131.5	139.0				
dry density ratio (R_D)	**%**	**87.5**	**87.0**				

material description

Silty CLAY

compaction test details

date mat'l sampled	24-Aug-2017
material source	on site - On site
material stabilised	
time elapsed	

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BY NUCLEAR GAUGE METHOD

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47 National Avenue, Pakenham VIC 3810

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report No 9821-4

date of issue 02-Oct-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	SP
time	All Day
date	27-Sep-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**7**	**8**				
location	Lot No	325	301				
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 2	Layer 1				
measurement depth	mm	275	275				
field wet density	t/m^3	2.18	1.96				
field dry density	t/m^3	1.85	1.68				
field moisture content	%	17.9	17.0				
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	11	0				
peak converted wet density	t/m^3	-	1.97				
adjusted peak converted wet density	t/m^3	2.09	-				
moisture variation from OMC (-dry,+wet)%		-0.5	-3.0				
Moisture ratio	**%**	**98.0**	**84.0**				
Hilf density ratio (R_{HD})	**%**	**104.5**	**99.5**				

material description

Silty CLAY

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Approved Signature

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

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report No 9821-5

date of issue 05-Oct-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	MH
time	All Day
date	28-Sep-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**9**					
location Lot No		324					
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	2.06					
field dry density	t/m^3	1.81					
field moisture content	%	13.7					
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	2.04					
adjusted peak converted wet density	t/m^3	-					
moisture variation from OMC (-dry,+wet)%		-3.0					
Moisture ratio	**%**	**81.0**					
Hilf density ratio (R_{HD})	**%**	**101.0**					

material description

Silty CLAY

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

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report No 9821-6

date of issue 13-Nov-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	CC
time	03:00 PM
date	09-Nov-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**10**	**12**				
location Lot No		308 Retest of 3	308 Retest of 6				
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 2				
measurement depth	mm	275	275				
field wet density	t/m^3	1.99	1.99				
field dry density	t/m^3	1.72	1.75				
field moisture content	%	15.5	13.2				
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	2.08				
adjusted peak converted wet density	t/m^3	-	-				
moisture variation from OMC (-dry,+wet)%		0.5	-1.5				
Moisture ratio	**%**	**103.0**	**90.0**				
Hilf density ratio (R_{HD})	**%**	**93.0**	**95.5**				

material description

Silty CLAY

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Accredited for compliance with ISO/IEC 17025- Testing

LABORATORY ACCREDITATION No **15357**

Approved Signature

C Caulfield

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COMPACTION ASSESSMENT
BY NUCLEAR GAUGE METHOD

report No 9821-7
date of issue 13-Nov-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

chainage	Refer to Locations
Layer thickness (mm	300

tested by	CC
time:	03:00 PM
date:	09-Nov-2017
checked by	CC

test procedures AS1289.2.1.1 & 5.8.1

test No		**11**					
location Lot No		307 Retest of 5					
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 2					
measurement depth	mm	275					
field wet density	t/m^3	1.98					
field dry density	t/m^3	1.68					
field moisture content	%	18.0					
laboratory compaction procedure AS1289.5.1.1 Standard Compaction							
standard maximum dry density	t/m^3	**1.85**					
standard optimum moisture content	%	**14.0**					
test procedure AS1289.5.4.1							
oversize material retained on AS sieve	mm	19.0					
percent of oversize material	wet	0					
percent of oversize material	dry	0					
adjusted standard maximum dry density	t/m^3	0.00					
adjusted standard optimum moisture content	%	0.0					
moisture variation (-dry,+wet)	%	4.0					
moisture ratio (R_m)	**%**	128.5					
dry density ratio (R_D)	**%**	**91.0**					

material description

Silty CLAY

compaction test details

date mat'l sampled	09-Nov-2017
material source	on site - On site
material stabilised	
time elapsed	

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Approved Signature
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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

terra firma laboratories

47 National Avenue, Pakenham VIC 3810

ph 03 5943 0980 www.terrafirmalabs.com.au

report No 9821-8

date of issue 20-Dec-2017

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Block Fill
Layer thickness (mm)	300

tested by	BM
time	09:00 AM
date	25-Nov-2017
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**13**	**14**				
location Lot No		307 Retest of 11	308 Retest of 10				
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 2	Layer 1				
measurement depth	mm	275	275				
field wet density	t/m^3	2.09	2.12				
field dry density	t/m^3	1.81	1.83				
field moisture content	%	15.6	15.4				
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	2.14	2.12				
adjusted peak converted wet density	t/m^3	-	-				
moisture variation from OMC (-dry,+wet)%		0.5	0.5				
Moisture ratio	**%**	**104.5**	**103.0**				
Hilf density ratio (R_{HD})	**%**	**97.5**	**100.0**				

material description

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47 National Avenue, Pakenham VIC 3810

ph 03 5943 0980 www.terrafirmalabs.com.au

report No 9821-9

date of issue 16-Feb-2018

Client	Streetworks
Client address	4 Len Thomas Place, Narre Warren, 3805
Project	Summerhill Stage 3
Location	Cranbourne

Feature	Blcok Fill
Layer thickness (mm)	300

tested by	MH
time	All Day
date	15-Feb-2018
checked by	CC

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		**15**	**16**	**17**	**18**	**19**	
location Lot No		308	307	310	309	309	
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 2	Layer 1	Layer 2	Layer 2	
measurement depth	mm	275	275	275	275	275	
field wet density	t/m^3	2.09	2.11	1.94	1.93	1.93	
field dry density	t/m^3	1.77	1.80	1.55	1.59	1.57	
field moisture content	%	18.0	17.1	24.6	21.3	23.3	
laboratory compaction procedure AS1289 5.7.1							
compactive effort		standard	standard	standard	standard	standard	
oversize material retained on AS sieve	mm	19.0	19.0	19.0	19.0	19.0	
percent of oversize material	wet	0	0	0	0	0	
peak converted wet density	t/m^3	2.07	2.13	1.98	1.99	1.95	
adjusted peak converted wet density	t/m^3	-	-	-	-	-	
moisture variation from OMC (-dry,+wet)%		3.0	1.5	1.5	1.0	0.5	
Moisture ratio	**%**	**119.5**	**110.0**	**106.5**	**104.0**	**102.5**	
Hilf density ratio (R_{HD})	**%**	**101.0**	**99.0**	**97.5**	**97.0**	**99.0**	

material description

Silty CLAY

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