

Riverwalk Estate Stage 21

GITA Inspection Verification Report

Prepared For: Excell Gray Bruni

Report Number 10293A V1

Version Release Date 5th September 2018

Report Released By Richard Schembri

Title Laboratory Manager

Signature



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1 Introduction

Terra Firma Laboratories was engaged by Excell Gray Bruni as the Geotechnical Inspection and Testing Authority (GITA) to provide Level 1 supervision and testing works on the earthworks component for Riverwalk Estate Stage 21. This work was conducted over the period of 30/04/2018 to 15/06/2018.

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 Work

2.1 Area of Work

The areas of work include lots 2107 and 2136 through to 2178. The site will be a residential estate.

The area on which fill was placed is shown on site plan (Appendix 1: *Test Location Plan*) based on drawings prepared by Dalton Consulting Engineers, Drawing Ref 10921FP01 and 10921FP02, and provided by Excell Gray Bruni.

The supervision work by the GITA involved both inspection of sub grade preparation work and full time inspection and testing of fill placement.

2.2 Specification

The technical specification (Drawing 10921FP01 and 10921FP02) for compaction control requirements was provided by Excell Gray Bruni and established that:

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.

Section 5.2 of 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 5.1.1 and AS1289 5.2.1.

In accordance with Table 8.1 (AS3798), for large scale operations, (greater than 1500m²), the minimum testing frequency is 1 test per layer per material type per 2500m² or 1 test per 500m³

distributed reasonable evenly throughout full depth and area or 3 tests per lot. AS3798 defines a lot as “an area of work that is essentially homogenous in relation to material type and moisture condition, rolling response and compaction technique, and which has been used for the assessment of the relative compaction of an area of work”. All three of these test frequencies must be achieved and this is typically confirmed to have been achieved when 3 tests per visit (day) have been completed.

2.3 Limitations

Terra Firma Laboratories cannot verify any works completed by others outside of the time period specified in the introduction. Uncontrolled works may include, but are not limited to trenching for services, cut and fill works for slab preparation or subsequent removal of vegetation and back fill of holes unless specified in section 2.1 of this report.

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

Verification of finished surface level to design levels is outside of the scope of the GITA report.

3 Construction Method

3.1 Subgrade Preparation

At the time of subgrade inspection the following was observed:

- Subgrade preparation involved stripping the site of topsoil, vegetation and organic matter to a depth of approximately 200mm below existing levels.
- The site was cleared of all trees and stumps to the extent necessary for the fill placement to proceed
- The roots of all trees and any debris was removed from site prior to any fill placement

The sub-grade area was then proof-rolled to confirm it was capable of withstanding test rolling without visible deformation or springing and any areas observed to be soft or otherwise unsuitable were rectified. The sub-grade was watered and scarified prior to fill placement to aid layer bonding.

3.2 Fill Placement

The contractor was observed to have suitable construction equipment and plant available on-site during the construction period for use in the fill placement.

All fill was placed in layers of thicknesses not exceeding 300mm . At the completion of a placed layer, compaction testing was performed to confirm appropriate compaction had been achieved and supported the observations made. It should be noted that the compaction tests are representative samples of the fill placed and support the visual assessment of the works completed. Each house lot does not necessarily require a compaction test to to have been conducted within the house allotment but may have been verified by testing conducted within up to a 2500m² area of the house lot.

Final fill placement levels were verified against design level by others. For the purposes of this report, it was observed that finished levels were in accordance with levels marked on site by survey markers.

The final 300mm of fill placed across the site was placed as a topsoil layer or growing medium and should be considered as non-structural, as it was placed in an uncontrolled manner, as allowed by specifications and placement of the final 300mm of fill was not observed by the GITA.

4 Construction Verification

Compaction Verification testing is summarized in a detailed test register with test certificates attached provided in Appendix 2: *Compaction Test Register and Test Certificates*. A test location plan (10293D1, Appendix 1) providing a schematic of test locations across the extent of scope of works for every placed layer of fill is also documented.

A total of 65 density tests (Hilf method in accordance with 1289 5.7.1) were undertaken with 2 failed results. The contractor was notified of any failed tests and the failed areas were ripped, watered, compacted and then re-tested to confirm compliance with the specification. The results summarised in the compaction test register (Appendix 2) confirm that for every layer of fill placed in a specific work area, satisfactory testing was completed.

5 Statement of Compliance

The intention of this report is to provide a description of the earthworks construction for Stage 21 at Riverwalk Estate Stage 21. For completed fill areas of greater than 300mm, and for works completed between 30/04/2018 and 15/06/2018, earthworks construction activities were conducted under the full time supervision of the Geotechnical Inspection and Testing Authority. 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. The earthworks construction for Stage 21 of Riverwalk Estate was observed to be constructed in compliance with the requirements of the Technical Specification.

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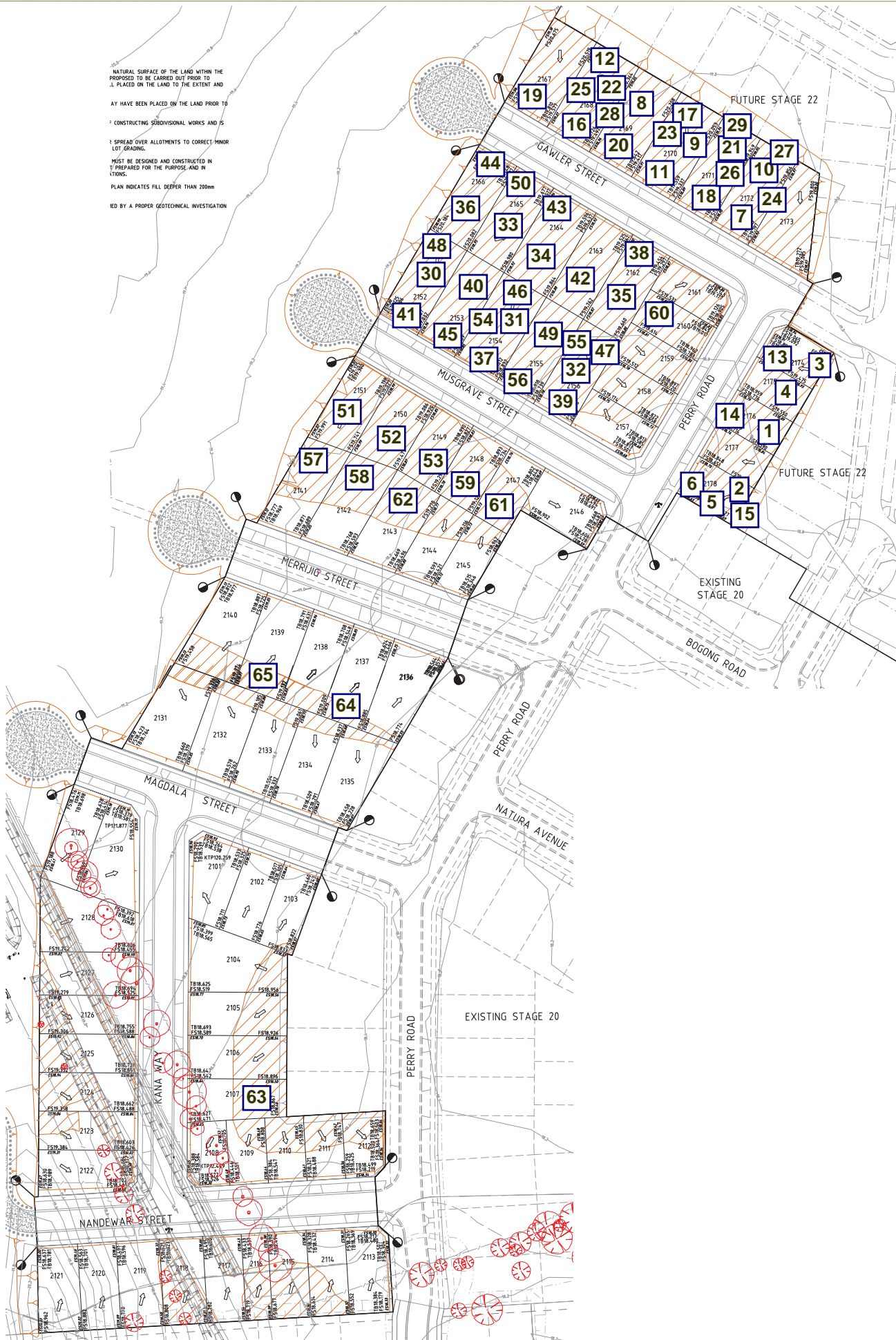
CONSTRUCTING SUBDIVISIONAL WORKS AND IS

SPREAD OVER ALLOTMENTS TO CORRECT MINOR LOT GRADING.

MUST BE DESIGNED AND CONSTRUCTED IN T PREPARED FOR THE PURPOSE AND IN TIONS.

PLAN INDICATES FILL DEEPER THAN 200mm

ED BY A PROPER GEOTECHNICAL INVESTIGATION



Our Head Office
47 National Ave
Pakenham, VIC 3860

Our Laboratories
Pakenham 03 9769 5799
Deer Park 03 8348 5596
Bibra Lake 08 9395 7220

Test Location Plan

not to scale

Client: Excell Gray Bruni

Project: Riverwalk Estate, Stage 21

Reference: 10293 D1



Compaction Test Register

Client: Excell Gray Bruni **Project No:** 10293
Project: Riverwalk Estate Stage 21 **Specification:** 95%

Date:	Test No:	Layer:	Retest of:	Density:	Pass/Fail:	Lot No:	Report No:
30/04/2018	1	Layer 1		97.5	Pass	2176	10293-15
30/04/2018	2	Layer 1		97.5	Pass	2178	10293-15
30/04/2018	3	Layer 1		98	Pass	2174	10293-15
2/05/2018	4	Layer 2		97.5	Pass	2175	10293-16
2/05/2018	5	Layer 2		97	Pass	2178	10293-16
2/05/2018	6	Layer 2		96.5	Pass	2178	10293-16
2/05/2018	7	Layer 1		95.5	Pass	2172	10293-16
2/05/2018	8	Layer 1		98	Pass	2169	10293-16
2/05/2018	9	Layer 1		97	Pass	2170	10293-16
7/05/2018	10	Layer 3		102.5	Pass	2172	10293-17
7/05/2018	11	Layer 3		101	Pass	2170	10293-17
7/05/2018	12	Layer 3		100	Pass	2168	10293-17
8/05/2018	13	Layer 3		97	Pass	2174	10293-18
8/05/2018	14	Layer 3		95	Pass	2176	10293-18
8/05/2018	15	Layer 3		96	Pass	2178	10293-18
9/05/2018	16	Layer 4		98.5	Pass	2168	10293-19
9/05/2018	17	Layer 4		98	Pass	2170	10293-19
9/05/2018	18	Layer 4		98.5	Pass	2171	10293-19
14/05/2018	19	Layer 5		98.5	Pass	2167	10293-20
14/05/2018	20	Layer 5		98.5	Pass	2169	10293-20
14/05/2018	21	Layer 5		97.5	Pass	2171	10293-20
15/05/2018	22	-300		100	Pass	2168	10293-1
15/05/2018	23	-300		97	Pass	2170	10293-1
15/05/2018	24	-300		96	Pass	2172	10293-1
16/05/2018	25	FSL		91	Fail	2168	10293-2
16/05/2018	26	FSL		94.5	Fail	2171	10293-2
16/05/2018	27	FSL		95.5	Pass	2172	10293-2
22/05/2018	28	FSL	25	97	Pass	2168	10293-3
22/05/2018	29	FSL	26	97.5	Pass	2171	10293-3
23/05/2018	30	Layer 1		96	Pass	2152	10293-4
23/05/2018	31	Layer 1		95.5	Pass	2154	10293-4
23/05/2018	32	Layer 1		95.5	Pass	2156	10293-4
23/05/2018	33	Layer 1		96	Pass	2165	10293-4
23/05/2018	34	Layer 1		96	Pass	2164	10293-4
23/05/2018	35	Layer 1		97	Pass	2162	10293-4
24/05/2018	36	Layer 2		97.5	Pass	2166	10293-5
24/05/2018	37	Layer 2		97	Pass	2154	10293-5
24/05/2018	38	Layer 2		97	Pass	2162	10293-5
28/05/2018	39	Layer 3		96	Pass	2156	10293-6
28/05/2018	40	Layer 3		96.5	Pass	2153	10293-6
28/05/2018	41	Layer 3		96.5	Pass	2152	10293-6



Compaction Test Register

Client: Excell Gray Bruni **Project No:** 10293
Project: Riverwalk Estate Stage 21 **Specification:** 95%

Date:	Test No:	Layer:	Retest of:	Density:	Pass/Fail:	Lot No:	Report No:
29/05/2018	42	Layer 4		98	Pass	2163	10293-7
29/05/2018	43	Layer 4		98.5	Pass	2164	10293-7
29/05/2018	44	Layer 4		98.5	Pass	2166	10293-7
30/05/2018	45	Layer 4		97.5	Pass	2153	10293-8
30/05/2018	46	Layer 4		98.5	Pass	2154	10293-8
30/05/2018	47	Layer 4		99	Pass	2156	10293-8
31/05/2018	48	Layer 5		98	Pass	2152	10293-9
31/05/2018	49	Layer 5		97.5	Pass	2155	10293-9
31/05/2018	50	Layer 5		98.5	Pass	2165	10293-9
4/06/2018	51	Layer 1		98.5	Pass	2151	10293-10
4/06/2018	52	Layer 1		98.5	Pass	2150	10293-10
4/06/2018	53	Layer 1		97	Pass	2149	10293-10
5/06/2018	54	Layer 5		96.5	Pass	2154	10293-11
5/06/2018	55	Layer 5		96.5	Pass	2156	10293-11
5/06/2018	56	Layer 5		97.5	Pass	2155	10293-11
7/06/2018	57	Layer 2		99.5	Pass	2141	10293-12
7/06/2018	58	Layer 2		100	Pass	2142	10293-12
7/06/2018	59	Layer 2		99.5	Pass	2148	10293-12
8/06/2018	60	Layer 5		98.5	Pass	2160	10293-13
8/06/2018	61	Layer 2		98	Pass	2147	10293-13
8/06/2018	62	Layer 2		98	Pass	2143	10293-13
15/06/2018	63	Layer 1		99	Pass	2107	10293-14
15/06/2018	64	Layer 1		97	Pass	2137	10293-14
15/06/2018	65	Layer 1		98	Pass	2139	10293-14



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-1
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF,NB
 time ALL DAY
 date 15-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		22	23	24		
location	Lot No	2168	2170	2172		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	-300	-300	-300		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.89	1.90	1.90		
field dry density	t/m ³	1.74	1.74	1.73		
field moisture content	%	8.4	9.3	9.6		

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	1.89	1.96	1.98		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-2.0	-1.5	-1.5		
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Moisture ratio	%	84.0	85.0	85.5		
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Hilf density ratio (R_{HD})	%	100.0	97.0	96.0		
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material description

Silty CLAY



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LABORATORY ACCREDITATION No 15357

Approved Signature
 R Schembri



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-2
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF,NB
 time ALL DAY
 date 16-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		25	26	27		
location	Lot No	2168	2171	2172		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	FSL	FSL	FSL		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.86	1.88	1.89		
field dry density	t/m ³	1.69	1.72	1.73		
field moisture content	%	10.1	9.2	9.3		

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	2.04	1.99	1.985		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-3.5	-3.5	-3.5		
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Moisture ratio	%	73.0	72.5	72.5		
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Hilf density ratio (R_{HD})	%	91.0	94.5	95.5		
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material description

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Approved Signature
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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-3
 date of issue 12-Jun-2018

Client	Excell Gray Bruni
Client address	12 Allied Drive, Tullamarine, 3043
Project	Riverwalk Estate Stage 21 Level One
Location	Werribee

Location	Lot Fill
Layer thickness (mm)	300

tested by	RF,NB
time	ALL DAY
date	22-May-2018
checked by	RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		28	29			
location	Lot No	Re- Test of 25	Re- Test of 26			
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)		2168	2171			
depth from F.S.L.	m	FSL	FSL			
measurement depth	mm	275	275			
field wet density	t/m ³	1.92	1.91			
field dry density	t/m ³	1.75	1.75			
field moisture content	%	9.9	9.6			

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	1.975	1.96			
adjusted peak converted wet density	t/m ³	-	-			

moisture variation from OMC (-dry,+wet)%		-3.5	-3.5			
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Moisture ratio	%	73.0	72.5			
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Hilf density ratio (R_{HD})	%	97.0	97.5			
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-4
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF, NB
 time ALL DAY
 date 23-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		30	31	32	33	34	35
location	Lot No	2152	2154	2156	2165	2164	2162
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 1	Layer 1	Layer 1	Layer 1	Layer 1	Layer 1
measurement depth	mm	275	275	275	275	275	275
field wet density	t/m ³	1.89	1.90	1.91	1.89	1.90	1.90
field dry density	t/m ³	1.76	1.75	1.73	1.70	1.71	1.72
field moisture content	%	7.7	8.1	10.4	10.6	10.8	10.8

laboratory compaction procedure AS1289 5.7.1

compactive effort		standard	standard	standard	standard	standard	standard
oversize material retained on AS sieve	mm	19.0	19.0	19.0	19.0	19.0	19.0
percent of oversize material	wet	0	0	0	0	0	0
peak converted wet density	t/m ³	1.97	1.99	2	1.96	1.98	1.96
adjusted peak converted wet density	t/m ³	-	-	-	-	-	-

moisture variation from OMC (-dry,+wet)%		-3.5	-3.5	-3.5	-3.5	-1.5	-3.5
--	--	------	------	------	------	------	------

Moisture ratio	%	70.5	71.5	76.0	76.0	86.5	76.5
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Hilf density ratio (R_{HD})	%	96.0	95.5	95.5	96.0	96.0	97.0
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-5
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time ALL DAY
 date 24-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		36	37	38		
location	Lot No	2166	2154	2162		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 2	Layer 2	Layer 2		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.97	1.95	1.97		
field dry density	t/m ³	1.74	1.72	1.74		
field moisture content	%	12.9	13.4	13.2		

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	2.02	2.011	2.025		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-1.5	-1.5	-1.5		
--	--	------	------	------	--	--

Moisture ratio	%	88.5	89.5	90.5		
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Hilf density ratio (R_{HD})	%	97.5	97.0	97.0		
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-6
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time ALL DAY
 date 28-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		39	40	41		
location	Lot No	2156	2153	2152		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 3	Layer 3	Layer 3		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.94	1.94	1.93		
field dry density	t/m ³	1.75	1.74	1.74		
field moisture content	%	11.3	11.5	11.1		

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	2.02	2.01	2		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-1.5	-1.5	-1.5		
--	--	------	------	------	--	--

Moisture ratio	%	87.0	87.5	87.0		
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Hilf density ratio (R_{HD})	%	96.0	96.5	96.5		
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material description

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The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards requirements.
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LABORATORY ACCREDITATION No 15357

Approved Signature
 R Schembri



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-7
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time ALL DAY
 date 29-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		42	43	44		
location	Lot No	2163	2164	2166		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 4	Layer 4	Layer 4		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.96	1.96	1.98		
field dry density	t/m ³	1.79	1.78	1.80		
field moisture content	%	9.8	9.6	9.7		

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	1.985	2.01		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-3.5	-3.5	-3.5		
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Moisture ratio	%	73.5	73.5	73.0		
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Hilf density ratio (R_{HD})	%	98.0	98.5	98.5		
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material description

Silty CLAY



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 Approved Signature
 R Schembri



COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-8
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time ALL DAY
 date 30-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		45	46	47		
location	Lot No	2153	2154	2156		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 4	Layer 4	Layer 4		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.98	1.97	1.96		
field dry density	t/m ³	1.80	1.79	1.78		
field moisture content	%	10.2	10.1	10.5		

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	2.03	2	1.978		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-4.0	-3.5	-4.0		
--	--	------	------	------	--	--

Moisture ratio	%	73.0	73.5	73.5		
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Hilf density ratio (R_{HD})	%	97.5	98.5	99.0		
--	----------	-------------	-------------	-------------	--	--

material description

Silty CLAY



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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-9
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time ALL DAY
 date 31-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		48	49	50		
location	Lot No	2152	2155	2165		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 5	Layer 5	Layer 5		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.96	1.96	1.95		
field dry density	t/m ³	1.72	1.73	1.72		
field moisture content	%	13.8	13.3	13.6		

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	2.015	1.98		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-4.0	-4.0	-4.0		
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Moisture ratio	%	78.0	77.0	78.0		
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Hilf density ratio (R_{HD})	%	98.0	97.5	98.5		
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material description

Silty CLAY



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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-10
 date of issue 12-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 275

tested by NB
 time ALL DAY
 date 04-Jun-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		51	52	53		
location	Lot No	2151	2150	2149		
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	250	250	250		
field wet density	t/m ³	1.94	1.92	1.94		
field dry density	t/m ³	1.75	1.74	1.76		
field moisture content	%	10.7	10.4	10.4		

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	1.97	1.95	2		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-1.5	-1.5	-3.0		
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Moisture ratio	%	86.5	86.5	79.0		
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Hilf density ratio (R_{HD})	%	98.5	98.5	97.0		
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-11
 date of issue 12-Jun-2018

Client	Excell Gray Bruni
Client address	12 Allied Drive, Tullamarine, 3043
Project	Riverwalk Estate Stage 21 Level One
Location	Werribee

Location	Lot Fill
Layer thickness (mm)	300

tested by	NNB
time	ALL DAY
date	05-Jun-2018
checked by	RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		54	55	56		
location	Lot No	2154	2156	2155		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 5	Layer 5	Layer 5		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.94	1.95	1.94		
field dry density	t/m ³	1.64	1.64	1.63		
field moisture content	%	18.0	19.1	18.9		

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	2.005	2.015	1.99		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-0.5	-0.5	-0.5		
--	--	------	------	------	--	--

Moisture ratio	%	97.0	97.0	96.5		
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Hilf density ratio (R_{HD})	%	96.5	96.5	97.5		
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-12
 date of issue 12-Jun-2018

Client	Excell Gray Bruni
Client address	12 Allied Drive, Tullamarine, 3043
Project	Riverwalk Estate Stage 21 Level One
Location	Werribee

Location	Lot Fill
Layer thickness (mm)	300

tested by	NB
time	ALL DAY
date	07-Jun-2018
checked by	RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		57	58	59		
location	Lot No	2141	2142	2148		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 2	Layer 2	Layer 2		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.95	1.96	1.96		
field dry density	t/m ³	1.71	1.71	1.72		
field moisture content	%	14.0	14.2	14.1		

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	1.96	1.96	1.97		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-1.5	-1.5	-1.0		
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Moisture ratio	%	89.0	89.0	92.5		
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Hilf density ratio (R_{HD})	%	99.5	100.0	99.5		
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-13
 date of issue 13-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time ALL DAY
 date 08-Jun-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		60	61	62		
location	Lot No	2160	2147	2143		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 5	Layer 2	Layer 2		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.97	1.95	1.94		
field dry density	t/m ³	2.14	1.77	1.77		
field moisture content	%	-7.9	9.9	9.8		

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	1.991	1.987	1.981		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-4.0	-3.5	-3.5		
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Moisture ratio	%	165.5	74.0	73.5		
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Hilf density ratio (R_{HD})	%	98.5	98.0	98.0		
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terrafirma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-14
 date of issue 26-Jun-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Estate Stage 21 Level One
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by NB
 time All Day
 date 15-Jun-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		63	64	65		
location	Lot No	2107	2137	2139		
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	1.97	1.96	1.95		
field dry density	t/m ³	1.72	1.72	1.71		
field moisture content	%	14.4	14.0	14.2		

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	1.99	2.015	1.995		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-1.5	-1.5	-1.5		
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Moisture ratio	%	90.0	89.5	90.5		
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Hilf density ratio (R_{HD})	%	99.0	97.0	98.0		
--	----------	-------------	-------------	-------------	--	--

material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terra Firma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-15
 date of issue 24-May-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Stage 21 Level 1
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by EH/RF
 time All Day
 date 30-Apr-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		1	2	3		
location	Lot No	2176	2178	2174		
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	1.96	1.99	1.99		
field dry density	t/m ³	1.76	1.78	1.78		
field moisture content	%	11.5	11.9	11.9		

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	2.01	2.04	2.03		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-2.0	-2.0	-2.0		
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Moisture ratio	%	86.0	87.0	86.0		
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Hilf density ratio (R_{HD})	%	97.5	97.5	98.0		
--	----------	-------------	-------------	-------------	--	--

material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-16
 date of issue 24-May-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Stage 21 Level 1
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF/WF
 time 15:00 PM
 date 02-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		4	5	6	7	8	9
location	Lot No	2175	2178	2178	2172	2169	2170
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)							
depth from F.S.L.	m	Layer 2	Layer 2	Layer 2	Layer 1	Layer 1	Layer 1
measurement depth	mm	275	275	275	275	275	275
field wet density	t/m ³	1.82	1.85	1.87	1.90	1.89	1.90
field dry density	t/m ³	1.57	1.56	1.65	1.60	1.56	1.62
field moisture content	%	15.7	18.8	13.6	18.9	21.0	17.5

laboratory compaction procedure AS1289 5.7.1

compactive effort		standard	standard	standard	standard	standard	standard
oversize material retained on AS sieve	mm	19.0	19.0	19.0	19.0	19.0	19.0
percent of oversize material	wet	0	0	0	0	0	0
peak converted wet density	t/m ³	1.87	1.91	1.935	1.99	1.925	1.96
adjusted peak converted wet density	t/m ³	-	-	-	-	-	-

moisture variation from OMC (-dry,+wet)%		-4.0	-4.0	-3.5	-3.5	-4.0	-3.5
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Moisture ratio	%	80.0	82.5	78.5	83.0	83.0	82.0
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Hilf density ratio (R_{HD})	%	97.5	97.0	96.5	95.5	98.0	97.0
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terra Firma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-17
 date of issue 24-May-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Stage 21 Level 1
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF/PD
 time ALL DAY
 date 07-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		10	11	12		
location	Lot No	2172	2170	2168		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 3	Layer 3	Layer 3		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.95	1.98	1.99		
field dry density	t/m ³	1.68	1.71	1.69		
field moisture content	%	16.2	15.7	18.0		

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	1.9	1.96	1.99		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-3.5	-3.5	-4.0		
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Moisture ratio	%	81.5	81.0	81.0		
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Hilf density ratio (R_{HD})	%	102.5	101.0	100.0		
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material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terra Firma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-18
 date of issue 24-May-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Stage 21 Level 1
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF/PD
 time 12:30 PM
 date 08-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		13	14	15		
location	Lot No	2174	2176	2178		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 3	Layer 3	Layer 3		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.90	1.92	1.94		
field dry density	t/m ³	1.64	1.66	1.68		
field moisture content	%	15.6	15.8	15.9		

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	1.96	2.016	2.02		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-3.5	-1.5	-1.5		
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Moisture ratio	%	81.0	90.5	90.0		
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Hilf density ratio (R_{HD})	%	97.0	95.0	96.0		
--	----------	-------------	-------------	-------------	--	--

material description

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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terra Firma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-19
 date of issue 24-May-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Stage 21 Level 1
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF
 time ALL DAY
 date 09-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		16	17	18		
location	Lot No	2168	2170	2171		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 4	Layer 4	Layer 4		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.90	1.92	1.90		
field dry density	t/m ³	1.62	1.66	1.64		
field moisture content	%	17.0	15.7	16.0		

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	1.93	1.95	1.93		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-4.0	-4.0	-4.0		
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Moisture ratio	%	80.5	79.5	80.0		
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Hilf density ratio (R_{HD})	%	98.5	98.0	98.5		
--	----------	-------------	-------------	-------------	--	--

material description

Silty CLAY



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COMPACTION ASSESSMENT

BY NUCLEAR GAUGE METHOD

Terraforma Laboratories - Deer Park Laboratory
 Factory 6 / 22-24 Westwood Drive, Deer Park Phone No: 8348 5596

report No 10293-20
 date of issue 24-May-2018

Client Excell Gray Bruni
 Client address 12 Allied Drive, Tullamarine, 3043
 Project Riverwalk Stage 21 Level 1
 Location Werribee

Location Lot Fill
 Layer thickness (mm) 300

tested by RF/PD
 time 15:00 PM
 date 14-May-2018
 checked by RS

Field density test procedure AS1289.2.1.1 and 5.8.1

Test No		19	20	21		
location	Lot No	2167	2169	2171		
Sampling procedures AS1289.1.1,1.2.1-Clause 6.4(b)						
depth from F.S.L.	m	Layer 5	Layer 5	Layer 5		
measurement depth	mm	275	275	275		
field wet density	t/m ³	1.89	1.90	1.92		
field dry density	t/m ³	1.64	1.67	1.66		
field moisture content	%	15.2	13.8	15.1		

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	1.915	1.93	1.96		
adjusted peak converted wet density	t/m ³	-	-	-		

moisture variation from OMC (-dry,+wet)%		-3.5	-3.5	-4.0		
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Moisture ratio	%	80.5	79.5	79.5		
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Hilf density ratio (R_{HD})	%	98.5	98.5	97.5		
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material description

Silty CLAY



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

Approved Signature
 R Schembri