ABN 31 105 704 078
13 Brock Street, Thomastown
Victoria 3074
(P) +61 3 9464 4617
(F) +61 3 9464 4618

LEVEL 1 INSPECTION & TESTING CORIDALE ESTATE – STAGE 2 LARA, VICTORIA

Prepared for Bitu-Mill Civil Pty Ltd

Report Reference: GS5211/2 AA

Date: 12 August 2020

ABN 31 105 704 078

13 Brock Street, Thomastown

Victoria 3074

(P) +61 3 9464 4617

(F) +61 3 9464 4618

PROJECT DETAILS

Project Reference	GS5211/2	Rev	AA
Project Title	Coridale Estate		
Project Location	Lara	State	VIC
Date	12 August 2020		

CLIENT DETAILS

Prepared For (Client)	Bitu-Mill Civil Pty Ltd
Client Address	133 Metrolink Circuit, Campbellfield VIC 3061

DISTRIBUTION

Original Held By	Ground Science Pty Ltd
One (1) Electronic Copy	Bitu-Mill Civil Pty Ltd

This document presents the results of the Level 1 Inspection and Testing performed by Ground Science for the aforementioned project, as the nominated project Geotechnical Inspection & Testing Authority (GITA). This report is detailed for the sole use of the intended recipient(s). Should you have any questions related to this report please do not hesitate to contact the undersigned.

AUTHOR:

Lee Maskell
Engineering Geologist

REVIEWED:

Gee Singh
Senior Geotechnical Engineer

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APPENDICES

1. INTRODUCTION

This report presents the results of inspection activities, compaction control and laboratory testing services performed by Ground Science Pty Ltd (Ground Science) for the construction of fill within Stage 2 of the Coridale Estate, located in Lara, Victoria (the site). Authorisation to proceed was provided by Bitu-Mill Civil Pty Ltd (the Client).

Level 1 Inspection & Testing, as defined in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments' provides for full time inspection of the construction of controlled fill and compaction testing in accordance with AS1289 'Methods of Testing Soils for Engineering Purposes'. Ground Science performed the role of the project Geotechnical Inspection & Testing Authority (GITA) with all Level 1 Inspection and Testing services described in this report undertaken by an experienced GITA site representative.

2. SCOPE OF WORK

2.1 AREAS OF WORK

Ground Science provided Level 1 Inspection and Testing of controlled fill placed within the proposed allotments at Stage 2 of the Coridale Estate. The areas of fill construction requiring Level 1 Inspection and Testing are shown on site plan (Figure 1) presented in Appendix A of this report, which is based on drawings prepared by Creo Consultants (Project No. 180014.2, Drawing No. R200, Revision 0, dated 23/04/20).

The placement of fill under Level 1 Inspection and Testing commenced on 15th May 2020 and was completed on 15th June 2020. The works included 14 full days of filling operations that were observed on a fulltime basis by Ground Science technicians.

2.2 PLACEMENT METHODOLOGY

A technical specification for the placement of fill was not provided by the Client and the following fill placement guidelines, based on the general requirements of AS3798 (2007) and the general notes detailed in Civil Drawings provided by the Client and prepared by Creo Consultants (Project No. 180014.2, Drawing No. R100, Revision 0, dated 23/04/20), were used as a basis for testing:

- Prior to filling, the area shall be stripped of topsoil, subsoil, soft material and vegetation to a firm base approved by the superintendent;
- Suitable fill material shall be placed in loose horizontal layers not exceeding 150mm in thickness after compaction;
- The fill is to be compacted to a Dry Density Ratio of at least 95% Standard for allotment subgrade soils (AS 1289: 5.1.1, 5.4.1 or 5.7.1);
- A target moisture ratio of 85% – 115% of standard compaction (AS 1289 5.1.1, 5.4.1, or 5.7.1) for compaction purposes was adopted for the project in the absence of a technical specification;
- The fill material should not contain greater than 20% by volume, of particles coarser than 37.5mm and no particle over two thirds layer thickness size in any dimension;
- The frequency of field density testing is to be in accordance with the guidelines in AS3798 (2007) for large scale developments (Type 1), which nominates a frequency of not less than:
    - 1 test per layer or 200mm per 2500m^2;
    - 1 test per 500m^3 distributed reasonably evenly throughout the full depth and area; or
    - 3 tests per site visit; whichever requires the most tests.

3. INSPECTION AND TESTING

3.1 SUBGRADE PREPARATION

A subgrade inspection for the site was undertaken by Ground Science prior to the commencement of filling works. It is understood that all areas were stripped with the use of an excavator and dozer and involved the removal of approximately 150mm of topsoil, vegetation, and unsuitable materials before a suitable base was achieved.

The above stripped subgrade was visually assessed using visual tactile methods described in AS1726 (2017) 'Geotechnical Site Investigations' and approved for subsequent fill placement by the GITA representative at the start the project. The subgrade soils were observed to comprise of CLAY, medium to high plasticity, dark brown, trace gravel and in a moist condition. A proof roll was undertaken with no surface deflection and/or soft spots observed, and the subgrade was considered suitable for subsequent fill placement. All areas were suitably ripped, and moisture conditioned (where required) prior to the placement of fill.

3.2 CONSTRUCTION MATERIALS

Fill for the project is understood to have been sourced from both external sources and on-site stockpiles generated from current and previous stages of bulk earthworks. The on-site fill material was inspected using visual/tactile assessments and comprised of gravelly CLAY/silty CLAY/CLAY, medium to high plasticity, dark brown/brown-grey, dry of or close to the optimum moisture content (OMC).

Fill material from external sources was sourced from locations in Hoppers Crossing which was visually assessed to consist of gravelly CLAY/silty CLAY/CLAY, medium to high plasticity, brown-grey, and generally dry of or close to the OMC.

The fill material used in this project was nominated by the on-site contractor. Ground Science performed an assessment of the fill source to identify the following material characteristics:

- Material suitability as an engineering property;
- Cohesiveness;
- Free from building debris and vegetative matter;
- Oversize rock particles.

Visual assessments on the above-mentioned properties were conducted on-site and the fill material used was considered suitable for use as engineered fill. It should be noted that no chemical analysis was conducted on the fill material.

3.3 FILL CONSTRUCTION

The contractor had the following plant available on site during the earthworks phase:

- Excavator;
- Dozer;
- Water Cart;
- Dump Trucks;
- Grader;
- Moxies;
- Padfoot Roller.

The filling process was generally consistent throughout the project and involves the approved fill sources stockpiled by dump trucks and moxies adjacent to the fill placement zone. A dozer and grader and were used to spread the fill material into thin loose layers, and was moisture conditioned with the use of an on-site water cart, where required. The thin layers of fill were compacted to form a composite layer measuring approximately 200mm to 300mm thick, prior to undertaking the density tests. A sorting bucket was used to remove any oversized material from the fill matrix and any oversized particles observed exceeding 150mm in size was removed and/or pushed out by construction plants. The depth of fill comprised of up to 3 layers placed and compacted within the deepest sections of the site to achieve the required finished levels.

Throughout the filling process and/or at the completion of the day's production, compaction testing was performed to assess the achieved density ratio of each layer. Figure 1 (Appendix A) provide a guide to the areas of fill placement and the location of density tests performed. Any fill placed as part of drainage, sewer works or similar also does not form part of this Level 1 report.

3.4 RESULTS OF COMPACTION CONTROL TESTING

Level 1 Inspection and Testing was undertaken by experienced technicians from Ground Science who attended the site for the duration of the construction phase and nominated the location of the in-situ density tests. Testing comprised a total of 51 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289.5.8.1) together with 51 "Rapid HILF" Compaction tests (AS1289.5.7.1).

A summary of the field density tests performed for the project, including failed tests and re-tests, is presented in Appendix B of this report. Field density and compaction control testing report sheets are presented in Appendix C of this report. It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed.

All tests were noted to pass the required density ratio of 95% Standard Compaction with the exception of density tests #35. This area was reworked and retested as density test #36, which achieved a compliant density ratio. The moisture condition of the compacted fill material was noted to be generally within the recommended target moisture ratio of 85% - 115% of OMC. All laboratory testing was undertaken in our NATA accredited Thomastown laboratory.

3.5 FINAL SURFACE LEVELS

Observations were made by a Ground Science staff member that filling had been completed up to the nominated finished levels as per confirmation provided from the contractor's site foreman. The observed final levels are the constructed finished surface levels of the controlled fill. It should be noted that the overall fill depths are estimated using onsite visual methods and may not be a true representation of fill depths given that conditions on site may change over time. True fill depths should be obtained from the contractor's survey data.

4. COMPLIANCE

Ground Science staff have undertaken Level 1 Inspection and Testing services of the construction of the controlled fill in the areas designated on Figure 1. Ground Science field staff have also observed that the prepared subgrade provided an adequate base for the subsequent placement of controlled fill.

Based on observations made by Ground Science staff and the results of density tests, we consider that the controlled fill placed has been constructed in accordance with the stated general notes and AS3798 (2007) and is satisfactory for the intents and purposes of AS2870 (2011).

It should be noted that the final fill layers may be subjected to adverse weather conditions resulting in either surface softening or drying and cracking over time; regardless of the compactive efforts and moisture conditioning applied during the works. The integrity of the top 200mm to 300mm of the fill will deteriorate with time and should be taken into account by the foundation engineer prior to the construction of a dwelling. The levels nominated in this report are a guide to amounts of fill placed and do not necessarily reflect an accurate survey of the fill levels.

Level 1 Inspection & Testing requires full time inspection and testing of the fill placement undertaken on a site. Ground Science (project GITA), are notified daily (or at the completion of each day's work) by the project foreman where subsequent days of fill placement under Level 1 is to occur. On projects that rely upon the importation of a fill source, there can be delays in the receipt of sufficient materials to warrant fill placement works which may result in periods of time where a GITA representative is not required on site. It is the contractor's responsibility to notify the GITA when works proceed and their attendance on site is required again. A GITA relies upon the integrity of the contractor to advise when site attendance is required and makes all reasonable visual attempts to assess if the works are the same as the previous day's attendance.

5. UNDERSTANDING LEVEL 1 INSPECTION & TESTING

The purpose of performing Level 1 Inspection and Testing is to ensure compliance of the fill with the specification. The engagement of a Geotechnical Inspection Testing Authority (GITA) allows the contractor to perform their role in the construction of the filling operation while the GITA monitors the quality control process of the fill placement. The visual observations of thorough processes and work practices by the contractor allows the GITA to approve the subsequent placement of fill without having to wait for the completion of testing and the extended time it takes to get a test result back. The GITA will however, carry out random spot checks of the filling operations throughout the day's production as confirmation that the placement procedures and the fill moisture content is appropriate. At the end of a day's production the GITA will sign off the completed works as satisfactory. Any failed tests will result in that particular area of operation requiring rectification in the following mornings activities. This may be as simple as extra rolling with compaction plant if moisture conditioning is suitable. Sometimes these areas may be retested if the GITA feels it is necessary.

While the code AS3798 2007 is a guideline on the minimum requirements of filling on commercial and residential developments, some projects require a more detailed project specification to deal with site specific issues. While moisture conditioning of fill sources aids in the ease with which compaction is achieved, it is not necessarily a physical characteristic that determines if the placed fill is acceptable. In some situations, the moisture requirement is an extremely important function of the final constructed product. In these situations, a specific project specification should apply to the project as detailed by the designing geotechnical engineer. These are typical of clay liners for wet lands, dams, landfill liners and caps and an array of other engineering situations. Creating a consolidated platform of which is similar to equivalent surrounding natural conditions is the primary aim of level one processes, preventing the occurrence of differential ground movements to footing structures.

For & on behalf of
Ground Science Pty Ltd

AUTHOR:

Lee Maskell
Engineering Geologist

REVIEWED:

Gee Singh
Senior Geotechnical Engineer

6. LIMITATIONS

This type of investigation (as per our commission) is not designed or capable of locating all soil conditions, (which can vary even over short distances). The advice given in this report is based on the assumption that the test results are representative of the overall soil conditions. However, it should be noted that actual conditions in some parts of the Site might differ from those found. If further sampling reveals soil conditions significantly different from those shown in our findings, Ground Science must be consulted. Maintenance and upkeep of finished fill placement must be regularly monitored as exposure to extended weather periods/other elements may cause surface drying which may lead to cracking. Conversely, excessive exposure to moisture may cause heaving/softening in the soils.

It is recognised that the passage of time affects the information and assessment provided in this document. Ground Science's assessment is based on information that existed at the time of the preparation of this document. It is understood that the services provided allowed Ground Science to form no more than an opinion of the actual site conditions observed during sampling and observations of the site visit and cannot be used to assess the effects of any subsequent changes in the quality of the site, or its surroundings, or any laws or regulations.

The scope and the period of Ground Science services are described in the proposal and are subject to restrictions and limitations. Ground Science did not perform a complete assessment of all possible conditions or circumstances that may exist at the Site. If a service is not expressly indicated, do not assume it has been provided. If a matter is not addressed, do not assume that any determination has been made by Ground Science in regards to it.

Where data has been supplied by the client or a third party, it is assumed that the information is correct unless otherwise stated. No responsibility is accepted by Ground Science for incomplete or inaccurate data supplied by others.

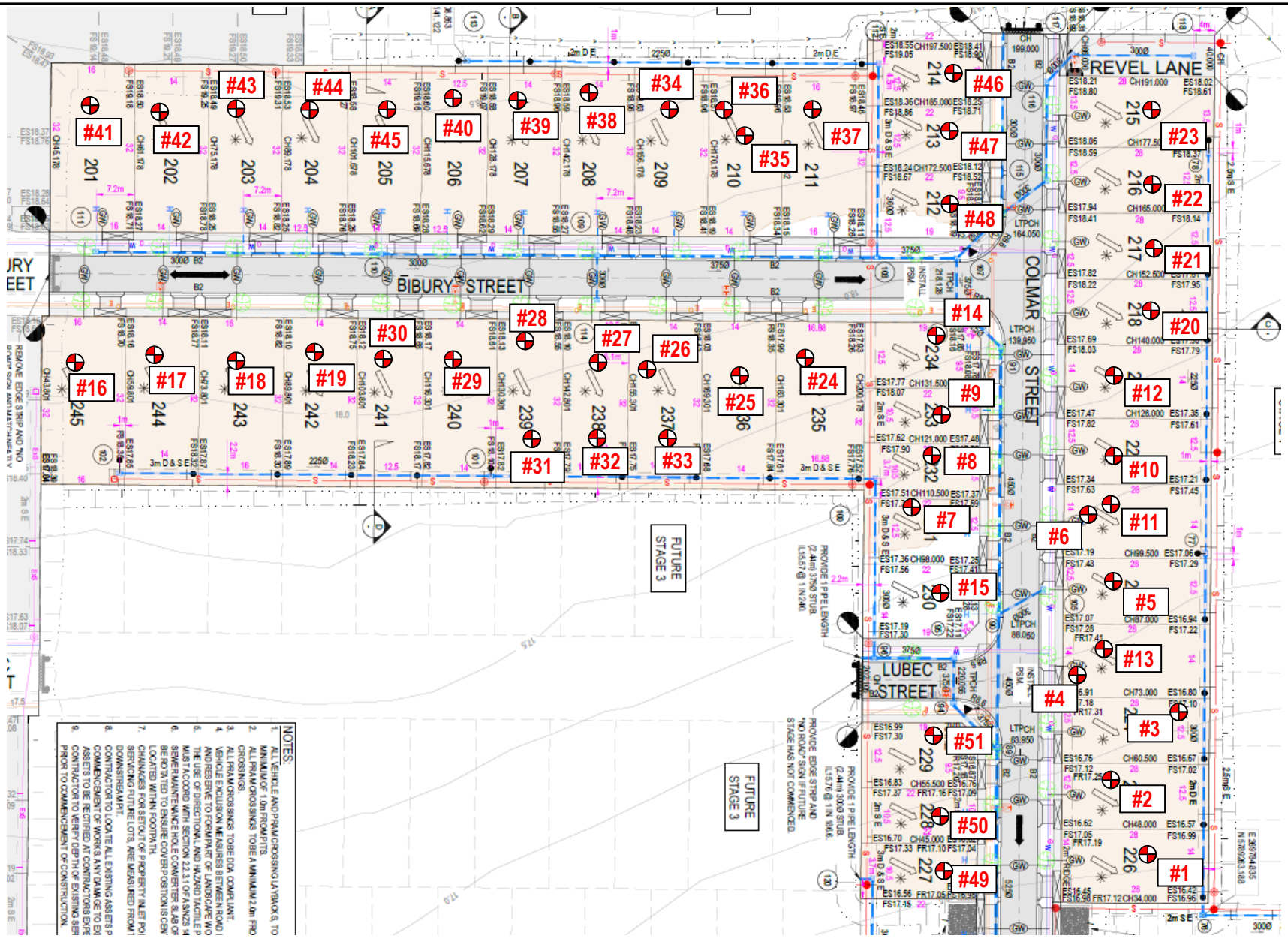
Any drawings or figures presented in this report should be considered only as pictorial evidence of our work. Therefore, unless otherwise stated, any dimensions should not be used for accurate calculations or dimensioning.

7. REFERENCES

- AS3798 (2007) Guidelines on Earthworks for Residential and Commercial Developments.
- AS1289 Methods of Testing Soils for Engineering Purposes.
- AS1726 (1993): Geotechnical Site Investigations.

APPENDIX A

Figures 1: Site Plan and Test Locations



Rev		Drawn	Date	Checked	Scale
0	Figure 1: Test Location Plan	LM	11.08.20	GS	NTS

Legend

Approximate Field Density Test Location

CORIDALE ESTATE STAGE 2
LARA, VICTORIA

Prepared For: Bitu-Mill Civil Pty Ltd

Job No: GS5211/2

GroundScience

APPENDIX B

Field Density Test Summary

LEVEL 1 - COMPACTION TEST SUMMARY

Client:	BITU-MILL PTY LTD	Job No:	GS5211/2
Project:	CORIDALE ESTATE - STAGE 2	Tech:	PRD / DVH
Location:	LARA		

Date	Test No.	Location	Layer No.	Density Ratio (%)	Moisture Ratio (%)	Moisture variation	(P) Pass (F) Fail	Comments
3/06/2020	31	N.E corner of Lot 239 / 5m South, 7m West	1	107.0	95.0	-1.0	P	
3/06/2020	32	N.E corner of Lot 238 / 6m South, 8m West	1	101.5	90.0	-2.5	P	
3/06/2020	33	N.E corner of Lot 237 / 7m South, 7m West	1	105.0	98.0	-0.5	P	
9/06/2020	34	N.E corner of Lot 209 / 6m South, 25m West	1	95.0	96.0	-1.0	P	
9/06/2020	35	N.E corner of Lot 210 / 7m South, 26m West	1	93.0	96.0	-1.0	F	
10/06/2020	36	Retest of #35	1	96.5	109.0	2.0	P	
10/06/2020	37	N.E corner of Lot 211 / 8m South, 27m West	1	100.5	102.0	0.5	P	
10/06/2020	38	N.E corner of Lot 208 / 6m South, 25m West	1	94.5	97.0	-0.5	P	
10/06/2020	39	N.E corner of Lot 207 / 5m South, 26m West	1	98.5	98.5	-2.0	P	
10/06/2020	40	N.E corner of Lot 206 / 5m South, 26m West	1	99.5	99.5	-0.5	P	
15/06/2020	41	N.E corner of Lot 201 / 8m South, 9m West	2	103.0	85.0	-3.0	P	
15/06/2020	42	N.E corner of Lot 202 / 7m South, 6m West	2	99.5	88.0	-2.5	P	
15/06/2020	43	N.E corner of Lot 203 / 9m South, 8m West	2	105.5	89.0	-2.5	P	
15/06/2020	44	N.E corner of Lot 204 / 6m South, 8m West	2	102.0	91.0	-2.0	P	
15/06/2020	45	N.E corner of Lot 205 / 6m South, 10m West	2	102.0	89.0	-2.5	P	
2/07/2020	46	N.E corner of Lot 214 / 7m South, 7m West	2	106.5	108.0	2.0	P	
2/07/2020	47	N.E corner of Lot 213 / 6m South, 6m West	2	109.5	89.0	-3.5	P	
2/07/2020	48	N.E corner of Lot 212 / 5m South, 7m West	2	106.0	90.0	-3.0	P	
2/07/2020	49	N.E corner of Lot 227 / 5m South, 5m West	1	109.0	99.0	-0.5	P	
2/07/2020	50	N.E corner of Lot 228 / 4m South, 5m West	1	108.0	102.0	0.5	P	
2/07/2020	51	N.E corner of Lot 229 / 5m South, 5m West	1	106.5	104.0	1.0	P	

APPENDIX C

Field Density Test Report Sheets

Field Density Test Results

A C N 105 704 078

13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2 (LEVEL 1)**	Report No.	**AA**
Location:	**LARA**	Test date:	**18-May-20**

Test Number		1	2	3	4	5	6
Test location taken from		Lot 226	Lot 225	Lot 224	Lot 223	Lot 222	Lot 221
S.E corner of Lots		17m North 10m West	8m North 10m West	23m North 9m West	5m North 6m West	12m North 9m West	5m North 10m West
Layer Number		1	1	1	1	1	1
Time of tests		8:30:00	9:00:00	9:45:00	10:30:00	10:51:00	11:47:00
Depth of Layer	mm	200	200	200	200	200	200
Depth of Test	mm	175	175	175	175	175	175
Field Wet Density	t/m³	2.02	2.06	2.03	2.02	1.97	1.76
Field Dry Density	t/m³	1.73	1.77	1.79	1.78	1.68	1.48
Field Moisture Content	%	16.0	14.5	11.0	10.5	15.5	19.0
Oversize Material	Wet %	4	12	17	23	7	0
Sieve Size	mm	19.0	19.0	37.5	37.5	19.0	19.0
Peak Converted Wet Density	t/m³	1.98	1.97	2.10	-	1.98	1.95
Optimum Moisture Content	%	18.5	17.0	13.0	-	19.0	20.0
Compactive Effort Used	std / mod	STD	STD	STD	STD	STD	STD
Moisture Ratio	%	**87**	**86**	**85**	**-**	**82**	**95**
Moisture Variation	%	**-2.5**	**-2.5**	**-2.0**	**-**	**-3.5**	**-1.0**
Moisture Variation		**DRY**	**DRY**	**DRY**	**-**	**DRY**	**DRY**
Density Ratio	%	**102.0**	**104.5**	**97.0**	**Oversize**	**99.5**	**90.0**

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: gravelly CLAY, low to medium plasticity, mottled grey / white / brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards

Chris Senserrick
Approved Signatory
Date 21-May-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2 (LEVEL 1)**	Report No.	**AB**
Location:	**LARA**	Test date:	**19-May-20**

Test Number		7	8	9		
Test location taken from		Lot 231	Lot 232	Lot 233		
S.E corner of Lots		8m North 4m West	11m North 2m West	12m North 3m West		
Layer Number		1	1	1		
Time of tests		12:30:00	12:35:00	12:50:00		
Depth of Layer	mm	200	200	200		
Depth of Test	mm	175	175	175		
Field Wet Density	t/m³	1.90	1.89	1.90		
Field Dry Density	t/m³	1.57	1.52	1.55		
Field Moisture Content	%	21.5	23.5	22.0		
Oversize Material	Wet %	0	2	2		
Sieve Size	mm	19.0	19.0	19.0		
Peak Converted Wet Density	t/m³	1.93	1.97	1.93		
Optimum Moisture Content	%	23.5	23.0	23.5		
Compactive Effort Used	std / mod	STD	STD	STD		
Moisture Ratio	%	**92**	**102**	**94**		
Moisture Variation	%	**-2.0**	**0.5**	**-1.5**		
Moisture Variation		**DRY**	**WET**	**DRY**		
Density Ratio	%	**98.5**	**95.5**	**98.0**		

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: gravelly CLAY, medium plasticity, brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards

Chris Senserrick
Approved Signatory
Date 21-May-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2**	Report No.	**AC**
Location:	**LARA**	Test date:	**25-May-20**

Test Number		10	11	12	13		
Test location taken from N.E corner of each Lot		Lot 220 18m South 4m West	Retest of #6	Lot 219 21m South 5m West	Retest of #4		
Layer Number		1	1	1	1		
Time of tests		13:00:00	13:10:00	13:20:00	15:00:00		
Depth of Layer	mm	225	200	200	200		
Depth of Test	mm	200	175	175	175		
Field Wet Density	t/m³	2.03	2.12	1.98	2.00		
Field Dry Density	t/m³	1.69	1.79	1.67	1.58		
Field Moisture Content	%	18.0	17.0	17.0	25.5		
Oversize Material	Wet %	10	8	6	1		
Sieve Size	mm	19.0	19.0	19.0	19.0		
Peak Converted Wet Density	t/m³	2.08	2.07	2.01	1.98		
Optimum Moisture Content	%	18.5	17.5	17.5	25.0		
Compactive Effort Used	std / mod	STD	STD	STD	STD		
Moisture Ratio	%	**98**	**97**	**97**	**102**		
Moisture Variation	%	**-0.5**	**-0.5**	**-0.5**	**0.5**		
Moisture Variation		**DRY**	**DRY**	**DRY**	**WET**		
Density Ratio	%	**97.5**	**102.5**	**98.5**	**101.0**		

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: Tests #10 - 12: silty CLAY, medium to high plasticity, brown & grey

Test #13: CLAY, medium to high plasticity, yellow & brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards

E

Chris Senserrick
Approved Signatory
Date 27-May-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE (LEVEL 1)**	Report No.	**AD**
Location:	**LARA**	Test date:	**26-May-20**

Test Number		14	15				
Test location taken from		Lot 234	Lot 230				
N.E corner of each Lot		7m South	5m South				
		4m West	7m West				
Layer Number		1	1				
Time of tests		9:25:00	9:35:00				
Depth of Layer	mm	200	200				
Depth of Test	mm	175	175				
Field Wet Density	t/m³	1.98	2.00				
Field Dry Density	t/m³	1.67	1.63				
Field Moisture Content	%	19.0	22.5				
Oversize Material	Wet %	0	0				
Sieve Size	mm	19.0	19.0				
Peak Converted Wet Density	t/m³	2.02	1.94				
Optimum Moisture Content	%	19.0	23.0				
Compactive Effort Used	std / mod	STD	STD				
Moisture Ratio	%	**100**	**98**				
Moisture Variation	%	**0.0**	**-0.5**				
Moisture Variation		**-**	**DRY**				
Density Ratio	%	**98.0**	**103.0**				

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: silty CLAY, medium to high plasticity, grey & brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA Accredited Laboratory No. 15055
Accredited for compliance with ISO/IEC 17025 - Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards

Tim Senserrick
Approved Signatory
Date 28-May-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2**	Report No.	**AE**
Location:	**LARA**	Test date:	**27-May-20**

Test Number		16	17	18	19		
Test location taken from		Lot 245	Lot 244	Lot 243	Lot 242		
N.E corner of each Lot		8m South 29m West	7m South 28m West	8m South 22m West	8m South 26m West		
Layer Number		2	2	2	2		
Time of tests		9:10:00	9:15:00	9:45:00	9:55:00		
Depth of Layer	mm	200	200	200	200		
Depth of Test	mm	175	175	175	175		
Field Wet Density	t/m³	1.99	1.94	2.00	2.01		
Field Dry Density	t/m³	1.59	1.58	1.58	1.61		
Field Moisture Content	%	25.5	22.5	25.0	24.0		
Oversize Material	Wet %	0	3	4	3		
Sieve Size	mm	19.0	19.0	19.0	19.0		
Peak Converted Wet Density	t/m³	1.90	1.94	1.89	1.87		
Optimum Moisture Content	%	26.0	23.0	25.0	26.0		
Compactive Effort Used	std / mod	STD	STD	STD	STD		
Moisture Ratio	%	**98**	**98**	**100**	**93**		
Moisture Variation	%	**-0.5**	**-0.5**	**0.0**	**-2.0**		
Moisture Variation		**DRY**	**DRY**	**-**	**DRY**		
Density Ratio	%	**105.0**	**100.5**	**105.5**	**107.0**		

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: silty CLAY, medium to high plasticity, brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA Accredited Laboratory No. 15055
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Tim Senserrick
Approved Signatory
Date 29-May-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2**	Report No.	**AF**
Location:	**LARA**	Test date:	**27-May-20**

Test Number		20	21	22	23		
Test location taken from		Lot 218	Lot 217	Lot 216	Lot 215		
N.E corner of each Lot		12m South 6m West	12m South 7m West	12m South 5m West	13m South 2m West		
Layer Number		2	2	1	1		
Time of tests		13:10:00	13:20:00	13:30:00	13:40:00		
Depth of Layer	mm	200	200	200	200		
Depth of Test	mm	175	175	175	175		
Field Wet Density	t/m³	2.10	2.03	2.09	2.07		
Field Dry Density	t/m³	1.74	1.70	1.73	1.72		
Field Moisture Content	%	19.5	18.0	19.0	17.0		
Oversize Material	Wet %	7	4	8	13		
Sieve Size	mm	19.0	19.0	19.0	19.0		
Peak Converted Wet Density	t/m³	2.03	2.08	2.08	2.09		
Optimum Moisture Content	%	19.0	16.5	18.5	16.5		
Compactive Effort Used	std / mod	STD	STD	STD	STD		
Moisture Ratio	%	**103**	**109**	**103**	**103**		
Moisture Variation	%	**0.5**	**1.5**	**0.5**	**0.5**		
Moisture Variation		**WET**	**WET**	**WET**	**WET**		
Density Ratio	%	**103.0**	**97.5**	**100.5**	**99.0**		

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: gravelly CLAY, medium to high plasticity, brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

NATA ACCREDITED FOR TECHNICAL COMPETENCE

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Tim Senserrick
Approved Signatory
Date 29-May-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2**	Report No.	**AG**
Location:	**LARA**	Test date:	**28-May-20**

Test Number		24	25	26	27		
Test location taken from		Lot 235	Lot 236	Lot 237	Lot 238		
N.E corner of each Lot		7m South 25m West	6m South 24m West	9m South 24m West	3m South 23m West		
Layer Number		1	1	1	1		
Time of tests		14:40:00	14:50:00	15:00:00	15:10:00		
Depth of Layer	mm	200	200	200	200		
Depth of Test	mm	175	175	175	175		
Field Wet Density	t/m³	1.99	1.96	2.12	1.97		
Field Dry Density	t/m³	1.67	1.60	1.82	1.75		
Field Moisture Content	%	19.0	22.5	16.0	12.0		
Oversize Material	Wet %	0	1	4	2		
Sieve Size	mm	19.0	19.0	19.0	19.0		
Peak Converted Wet Density	t/m³	1.94	1.94	2.00	1.96		
Optimum Moisture Content	%	21.0	24.5	18.0	14.0		
Compactive Effort Used	std / mod	STD	STD	STD	STD		
Moisture Ratio	%	**91**	**92**	**89**	**86**		
Moisture Variation	%	**-2.0**	**-2.0**	**-2.0**	**-2.0**		
Moisture Variation		**DRY**	**DRY**	**DRY**	**DRY**		
Density Ratio	%	**102.5**	**101.5**	**106.0**	**100.5**		

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: silty CLAY, medium to high plasticity, grey and brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Tim Senserrick
Approved Signatory
Date 01-Jun-20

Field Density Test Results

A C N 105 704 078

13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2**	Report No.	**AH**
Location:	**LARA**	Test date:	**29-May-20**

Test Number		28	29	30			
Test location taken from N.E corner of each Lot		Lot 239 7m South 27m West	Lot 240 6m South 25m West	Lot 241 4m South 26m West			
Layer Number		2	2	2			
Time of tests		14:05:00	14:20:00	14:30:00			
Depth of Layer	mm	200	200	200			
Depth of Test	mm	175	175	175			
Field Wet Density	t/m³	2.00	1.99	2.15			
Field Dry Density	t/m³	1.73	1.73	1.85			
Field Moisture Content	%	15.0	15.0	13.0			
Oversize Material	Wet %	0	0	18			
Sieve Size	mm	19.0	19.0	19.0			
Peak Converted Wet Density	t/m³	1.94	1.97	2.07			
Optimum Moisture Content	%	18.0	18.0	14.5			
Compactive Effort Used	std / mod	STD	STD	STD			
Moisture Ratio	%	**84**	**84**	**90**			
Moisture Variation	%	**-3.0**	**-3.0**	**-1.5**			
Moisture Variation		**DRY**	**DRY**	**DRY**			
Density Ratio	%	**102.5**	**100.5**	**103.5**			

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: Test #28 - 29: silty CLAY, medium to high plasticity, grey & brown

Test #30: silty CLAY, medium to high plasticity, grey & brown with gravel

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Chris Senserrick
Approved Signatory
Date 02-Jun-20

Field Density Test Results

A C N 105 704 078

13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE (LEVEL 1)**	Report No.	**AI**
Location:	**LARA**	Test date:	**3-Jun-20**

Test Number		31	32	33			
Test location taken from		Lot 239	Lot 238	Lot 237			
N.E corner of each Lot		5m South 7m West	6m South 8m West	7m South 7m West			
Layer Number		1	1	1			
Time of tests		14:50:00	15:00:00	15:10:00			
Depth of Layer	mm	200	200	200			
Depth of Test	mm	175	175	175			
Field Wet Density	t/m³	2.12	1.91	2.09			
Field Dry Density	t/m³	1.74	1.57	1.74			
Field Moisture Content	%	19.0	22.0	18.0			
Oversize Material	Wet %	14	0	10			
Sieve Size	mm	19.0	19.0	19.0			
Peak Converted Wet Density	t/m³	1.98	1.88	1.99			
Optimum Moisture Content	%	20.0	24.5	18.5			
Compactive Effort Used	std / mod	STD	STD	STD			
Moisture Ratio	%	**95**	**90**	**98**			
Moisture Variation	%	**-1.0**	**-2.5**	**-0.5**			
Moisture Variation		**DRY**	**DRY**	**DRY**			
Density Ratio	%	**107.0**	**101.5**	**105.0**			

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: silty CLAY, medium to high plasticity, grey / brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Chris Senserrick
Approved Signatory
Date 18-Jun-20

Field Density Test Results

A C N 105 704 078
13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE (LEVEL 1)**	Report No.	**AJ**
Location:	**LARA**	Test date:	**9-Jun-20**

Test Number		34	35				
Test location taken from N.E corner of each Lot		Lot 209 6m South 25m West	Lot 210 7m South 26m West				
Layer Number		1	1				
Time of tests		15:10:00	15:25:00				
Depth of Layer	mm	200	200				
Depth of Test	mm	175	175				
Field Wet Density	t/m³	1.81	1.75				
Field Dry Density	t/m³	1.44	1.40				
Field Moisture Content	%	23.5	23.0				
Oversize Material	Wet %	7	7				
Sieve Size	mm	19.0	19.0				
Peak Converted Wet Density	t/m³	1.91	1.88				
Optimum Moisture Content	%	24.5	24.0				
Compactive Effort Used	std / mod	STD	STD				
Moisture Ratio	%	**96**	**96**				
Moisture Variation	%	**-1.0**	**-1.0**				
Moisture Variation		**DRY**	**DRY**				
Density Ratio	%	**95.0**	**93.0**				

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: silty CLAY, medium to high plasticity, brown with gravel

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Chris Senserrick
Approved Signatory
Date 18-Jun-20

Field Density Test Results

A C N 105 704 078

13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2 (LEVEL ONE)**	Report No.	**AK**
Location:	**LARA**	Test date:	**10-Jun-20**

Test Number		36	37	38	39	40	
Test location taken from		Lot 210	Lot 211	Lot 208	Lot 207	Lot 206	
N.E Corner of each lot		10m South	8m South	6m South	5m South	5m South	
Offset (m)		26m West	27m West	25m West	26m West	26m West	
		Retest of #35					
Layer Number		1	1	1	1	1	
Time of tests		11:30:00	11:40:00	11:55:00	12:15:00	12:30:00	
Depth of Layer	mm	200	200	200	200	200	
Depth of Test	mm	175	175	175	175	175	
Field Wet Density	t/m³	1.93	1.99	1.93	1.96	1.97	
Field Dry Density	t/m³	1.48	1.53	1.68	1.69	1.62	
Field Moisture Content	%	25.0	24.0	15.0	15.5	20.5	
Oversize Material	Wet %	18	19	1	2	3	
Sieve Size	mm	19.0	19.0	19.0	19.0	19.0	
Peak Converted Wet Density	t/m³	1.99	1.97	2.04	1.98	1.98	
Optimum Moisture Content	%	23.0	23.5	15.5	17.5	21.0	
Compactive Effort Used	std / mod	STD	STD	STD	STD	STD	
Moisture Ratio	%	**109**	**102**	**97**	**89**	**98**	
Moisture Variation	%	**2.0**	**0.5**	**-0.5**	**-2.0**	**-0.5**	
Moisture Variation		**WET**	**WET**	**DRY**	**DRY**	**DRY**	
Density Ratio	%	**96.5**	**100.5**	**94.5**	**98.5**	**99.5**	

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: #36 - #37: Gravelly silty CLAY, medium to high plasticity, brown.

#38 - #40: Silty CLAY, medium to high plasticity, brown.

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Chris Senserrick
Approved Signatory
Date 18-Jun-20

Field Density Test Results

A C N 105 704 078

13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE (LEVEL 1)**	Report No.	**AL**
Location:	**LARA**	Test date:	**15-Jun-20**

Test Number		41	42	43	44	45	
Test location taken from N.E corner of each Lot		Lot 201 8m South 9m West	Lot 202 7m South 6m West	Lot 203 9m South 8m West	Lot 204 6m South 8m West	Lot 205 6m South 10m West	
Layer Number		2	2	2	2	2	
Time of tests		11:10:00	11:25:00	11:55:00	12:10:00	12:25:00	
Depth of Layer	mm	200	200	200	200	200	
Depth of Test	mm	175	175	175	175	175	
Field Wet Density	t/m³	1.94	1.92	2.05	1.96	1.94	
Field Dry Density	t/m³	1.63	1.60	1.70	1.63	1.62	
Field Moisture Content	%	16.5	18.5	19.5	19.5	19.0	
Oversize Material	Wet %	13	7	6	3	4	
Sieve Size	mm	19.0	19.0	19.0	19.0	19.0	
Peak Converted Wet Density	t/m³	1.88	1.93	1.95	1.92	1.90	
Optimum Moisture Content	%	19.5	21.0	22.0	21.5	21.5	
Compactive Effort Used	std / mod	STD	STD	STD	STD	STD	
Moisture Ratio	%	**85**	**88**	**89**	**91**	**89**	
Moisture Variation	%	**-3.0**	**-2.5**	**-2.5**	**-2.0**	**-2.5**	
Moisture Variation		**DRY**	**DRY**	**DRY**	**DRY**	**DRY**	
Density Ratio	%	**103.0**	**99.5**	**105.5**	**102.0**	**102.0**	

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: gravelly CLAY, medium to high plasticity, brown / grey

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Chris Senserrick
Approved Signatory
Date 18-Jun-20

Field Density Test Results

A C N 105 704 078

13 Brock Street Thomastown Vic, **P** 03 9464 4617 **Email** reception@groundscience.com.au

Client:	**BITU-MILL (CAMPBELLFIELD)**	Job No:	**GS5211/2**
Project:	**CORIDALE ESTATE - STAGE 2**	Report No.	**AM**
Location:	**LARA**	Test date:	**2-Jul-20**

Test Number		46	47	48	49	50	51
Test location taken from		Lot 214	Lot 213	Lot 212	Lot 227	Lot 228	Lot 229
N.E corner of each Lot		7m South 7m West	6m South 6m West	5m South 7m West	5m South 5m West	4m South 5m West	5m South 5m West
Layer Number		2	2	2	1	1	1
Time of tests		13:40:00	13:50:00	14:00:00	14:25:00	14:35:00	14:45:00
Depth of Layer	mm	200	200	200	200	200	200
Depth of Test	mm	175	175	175	175	175	175
Field Wet Density	t/m³	1.94	1.95	1.93	1.96	2.08	1.94
Field Dry Density	t/m³	1.51	1.53	1.55	1.49	1.63	1.49
Field Moisture Content	%	27.0	27.0	25.0	31.0	26.5	30.0
Oversize Material	Wet %	2	0	0	0	5	0
Sieve Size	mm	19.0	19.0	19.0	19.0	19.0	19.0
Peak Converted Wet Density	t/m³	1.81	1.77	1.82	1.80	1.93	1.82
Optimum Moisture Content	%	25.0	30.5	28.0	31.5	26.0	29.0
Compactive Effort Used	std / mod	STD	STD	STD	STD	STD	STD
Moisture Ratio	%	**108**	**89**	**90**	**99**	**102**	**104**
Moisture Variation	%	**2.0**	**-3.5**	**-3.0**	**-0.5**	**0.5**	**1.0**
Moisture Variation		**WET**	**DRY**	**DRY**	**DRY**	**WET**	**WET**
Density Ratio	%	**106.5**	**109.5**	**106.0**	**109.0**	**108.0**	**106.5**

Specification Requirements: 95% Standard compaction

Notes: Moisture Variation: (-) indicates dry; (+) indicates wet

Material description: silty CLAY, medium to high plasticity, brown

Test Methods: AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Chris Senserrick
Approved Signatory
Date 06-Jul-20