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

Prepared for Bitu-Mill Civil Pty Ltd

Report Reference: GS5211/1 AA

Date: 6 August 2020

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PROJECT DETAILS

Project Reference	GS5211/1	Rev	AA
Project Title	Coridale Estate		
Project Location	Lara	State	VIC
Date	6 August 2020		

CLIENT DETAILS

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

DISTRIBUTION

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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.

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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 1 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, footpaths, and roads at Stage 1 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. 180014.1, Drawing No. R200, Revision 1, dated 15/04/20).

The placement of fill under Level 1 Inspection and Testing commenced on 28th April 2020 and was completed on 14th July 2020. The works included 11 full days and 1 half day 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. 180014.1, Drawing No. R100, Revision 1, dated 17/03/20), 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 subgrade soils and 98% Standard for subgrade soils under driveways, footpaths, and roads (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 2500m²;
 - 1 test per 500m³ 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 a grader 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 boulders 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 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, medium to high plasticity, dark brown, dry or close to the optimum moisture content (OMC). It should be noted that some of the on-site stockpiles were observed to consist a high volume of gravel. The GITA site representative provided advice on the potential heterogenous nature of the materials if used as fill, however the material was used at the discretion of the project foreman.

Fill material was also sourced from offsite locations located in Hoppers Crossing and Geelong which was visually assessed to consist of gravelly CLAY/CLAY/silty CLAY/sandy CLAY, medium to high plasticity, dark brown/orange, dark brown, mottled brown-grey, and generally dry 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:

- 815 Compactor;
- Dozer;
- Water Cart;
- Dump Trucks;
- Grader;
- Moxies;
- Excavator.

During fill placement, the weather conditions were generally cool, windy and sunny with typical temperature conditions ranging from 10 to 20 degrees Celsius. Occasional rainfall events occurred during filling works with no adverse effects on fill material and placement observed.

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, grader and an 815 compactor with a spreader attachment were used to spread the fill material into thin loose layers, and was moisture conditioned with the use of an on-site water cart. The thin layers of fill were compacted to form a composite layer measuring approximately 200mm to 250mm 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 of fill 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% and/or 98% (where required) Standard Compaction with the exception of density tests #31 and #32. These areas were reworked and retested as density tests #33 and #34, all achieving 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. Test areas that were dry of the recommended moisture ratio were moisture conditioned and reworked. 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 days 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:



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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.

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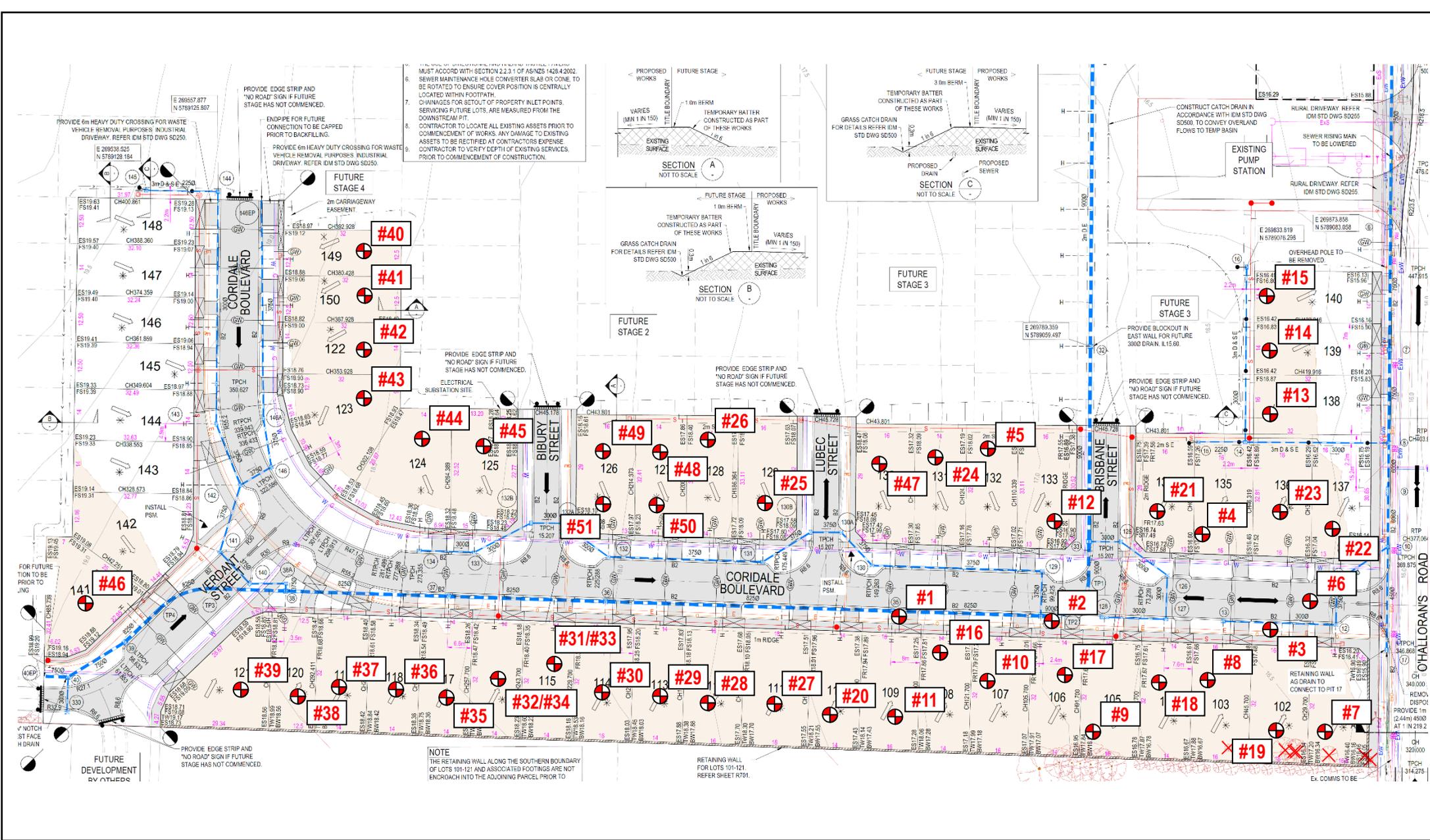


7. REFERENCES

- 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	Legend
0	SE	6.08.20	GS	NTS	 Approximate Field Density Test Location

CORIDALE ESTATE STAGE 1 LARA, VICTORIA

Prepared For: Bitu-Mill Civil Pty Ltd

Job No: GS5211/1



APPENDIX B

Field Density Test Summary



LEVEL 1 - COMPACTION TEST SUMMARY

Client:	BITU-MILL CIVIL PTY LTD	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1	Tech:	PRD / DVH
Location:	LARA		

Date	Test No.	Location	Layer No.	Density Ratio (%)	Moisture Ratio (%)	Moisture variation	(P) Pass (F) Fail	Comments
28/04/2020	1	Coridale Blvd, verge Southern Side / Ch: 145, centreline of verge	1	104.0	91.0	-3.0	P	
28/04/2020	2	Coridale Blvd, verge Southern Side / Ch: 90, centreline of verge	1	100.5	91.0	-3.5	P	
28/04/2020	3	Coridale Blvd, verge Southern Side / Ch: 35, centreline of verge	2	101.0	95.0	-2.0	P	
5/05/2020	4	Lot 135 / S.E corner of Lots: 6m North, 12m West	1	98.5	111.0	1.5	P	
5/05/2020	5	Lot 132 / S.E corner of Lots: 25m North, 7.5m West	1	99.0	100.0	0.0	P	
5/05/2020	6	Coridale Blvd / S.E corner of Lots, Ch: 90, 5m North	1	100.5	94.0	-1.0	P	
6/05/2020	7	S.E corner of Lot 101 / 10m North, 13m West	1	102.5	97.0	-0.5	P	
6/05/2020	8	S.E corner of Lot 103 / 24m North, 11m West	1	99.0	100.0	0.0	P	
6/05/2020	9	S.E corner of Lot 105 / 8m North, 15m West	1	103.0	100.0	0.0	P	
6/05/2020	10	S.E corner of Lot 107 / 19m North, 14m West	1	101.0	94.0	-1.0	P	
6/05/2020	11	S.E corner of Lot 109 / 6m North, 8m West	1	101.5	90.0	-1.5	P	
6/05/2020	12	S.E corner of Lot 133 / 10m North, 6m West	1	100.0	96.0	-0.5	P	
7/05/2020	13	S.E corner of Lot 138 / 5m North, 28m West	1	97.0	68.0	-4.0	P	
7/05/2020	14	S.E corner of Lot 139 / 8m North, 29m West	1	98.0	69.0	-4.0	P	
7/05/2020	15	S.E corner of Lot 140 / 6m North, 28m West	1	96.5	68.0	-4.0	P	
7/05/2020	16	S.E corner of Lot 108 / 28m North, 9m West	2	101.0	100.0	0.0	P	
7/05/2020	17	S.E corner of Lot 106 / 24m North, 9m West	2	105.5	96.0	-0.5	P	
7/05/2020	18	S.E corner of Lot 104 / 17m North, 10m West	2	102.0	100.0	0.0	P	
8/05/2020	19	S.E corner of Lot 102 / 6m North, 11m West	3	102.0	97.0	-0.5	P	
8/05/2020	20	S.E corner of Lot 110 / 4m North, 5m West (final surface layer)	3	104.0	97.0	-0.5	P	
8/05/2020	21	S.E corner of Lot 134 / 11m North, 9m West	2	105.0	86.0	-2.0	P	
8/05/2020	22	S.E corner of Lot 137 / 9m North, 18m West	2	106.0	85.0	-2.0	P	
8/05/2020	23	S.E corner of Lot 136 / 9m North, 9m West	3	102.0	100.0	0.0	P	
13/05/2020	24	Lot 131 / 24m North, 9m West	1	100.0	100.0	0.0	P	
13/05/2020	25	Lot 129 / 10m North, 12m West	1	102.5	100.0	0.0	P	
13/05/2020	26	Lot 128 / 24m North, 8m West	1	100.5	104.0	0.5	P	
4/06/2020	27	S.E corner of Lot 111 / 8m North, 9m West	1	104.5	97.0	-1.0	P	
4/06/2020	28	S.E corner of Lot 112 / 7m North, 8m West	1	107.5	99.0	-0.5	P	
4/06/2020	29	S.E corner of Lot 113 / 8m North, 6m West	1	103.0	103.0	1.0	P	
4/06/2020	30	S.E corner of Lot 114 / 12m North, 5m West	1	102.0	99.0	-0.5	P	



LEVEL 1 - COMPACTION TEST SUMMARY

Client:	BITU-MILL CIVIL PTY LTD	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1	Tech:	PRD / DVH
Location:	LARA		

Date	Test No.	Location	Layer No.	Density Ratio (%)	Moisture Ratio (%)	Moisture variation	(P) Pass (F) Fail	Comments
4/06/2020	31	S.E corner of Lot 115 / 12m North, 5m West	-	OVERSIZE	-	-	F	
4/06/2020	32	S.E corner of Lot 116 / 11m North, 5m West	-	OVERSIZE	-	-	F	
11/06/2020	33	Retest of #31	1	104.0	98.0	-0.5	P	
11/06/2020	34	Retest of #32	1	106.5	92.0	-2.0	P	
2/07/2020	35	S.E corner of Lot 117 / 11m North, 9m West	1	107.0	90.0	-2.5	P	
2/07/2020	36	S.E corner of Lot 118 / 5m North, 7m West	1	105.0	92.0	-2.0	P	
2/07/2020	37	S.E corner of Lot 119 / 7m North, 5m West	1	109.0	92.0	-2.0	P	
2/07/2020	38	S.E corner of Lot 120 / 7m North, 5m West	1	109.0	84.0	-4.0	P	
2/07/2020	39	S.E corner of Lot 121 / 5m North, 5m West	1	108.0	88.0	-3.0	P	
3/07/2020	40	S.E corner of each Lot 149 / 5m North, 7m West	1	106.0	90.0	-2.5	P	
3/07/2020	41	S.E corner of each Lot 150 / 7m North, 9m West	1	105.0	88.0	-3.0	P	
3/07/2020	42	S.E corner of each Lot 122 / 8m North, 10m West	1	102.5	90.0	-2.5	P	
3/07/2020	43	S.E corner of each Lot 123 / 3m North, 10m West	1	101.5	92.0	-2.0	P	
3/07/2020	44	S.E corner of each Lot 124 / 24m North, 8m West	1	104.0	92.0	-2.0	P	
3/07/2020	45	S.E corner of each Lot 125 / 27m North, 11m West	1	103.0	90.0	-2.5	P	
3/07/2020	46	S.E corner of each Lot 141 / 5m South, 15m West	1	103.5	90.0	-2.5	P	
3/07/2020	47	S.E corner of each Lot 130 / 23m North, 8m West	2	105.0	93.0	-1.5	P	
14/07/2020	48	S.E corner of Lot 127 / 27m North, 8m West	2	96.0	110.0	2.5	P	
14/07/2020	49	S.E corner of Lot 126 / 27m North, 6m West	2	98.5	111.0	3.0	P	
14/07/2020	50	S.E corner of Lot 127 / 8m North, 7m West	1	101.5	100.0	0.0	P	
14/07/2020	51	S.E corner of Lot 126 / 8m North, 6m West	1	102.5	96.0	-1.0	P	

APPENDIX C

Field Density Test Report Sheets



Field Density Test Results

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

Client:	BITU-MILL (CAMPBELLFIELD)	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.	AA
Location:	LARA	Test date:	28-Apr-20

Test Number	1	2	3			
Test location taken from (verge x 5m wide)	Coridale Boulevard verge Southern Side	Coridale Boulevard verge Southern Side	Coridale Boulevard verge Southern Side			
Chainage 10 - 165	145	90	35			
Offset	centreline of verge	centreline of verge	centreline of verge			
Layer Number	1	1	2			
Time of tests	12:30:00	11:45:00	14:45:00			
Depth of Layer	mm 200	mm 200	mm 200			
Depth of Test	mm 175	mm 175	mm 175			
Field Wet Density	t/m ³ 1.83	t/m ³ 1.77	t/m ³ 1.75			
Field Dry Density	t/m ³ 1.40	t/m ³ 1.31	t/m ³ 1.30			
Field Moisture Content	% 30.5	% 34.5	% 34.5			

Oversize Material	Wet % 0	Wet % 0	Wet % 0			
Sieve Size	mm 19.0	mm 19.0	mm 19.0			
Peak Converted Wet Density	t/m ³ 1.76	t/m ³ 1.76	t/m ³ 1.73			
Optimum Moisture Content	% 33.5	% 38.0	% 36.5			
Compactive Effort Used	std / mod STD	std / mod STD	std / mod STD			

Moisture Ratio	% 91	% 91	% 95			
Moisture Variation	% -3.0	% -3.5	% -2.0			
Moisture Variation	DRY	DRY	DRY			
Density Ratio	% 104.0	% 100.5	% 101.0			

Specification Requirements 95% Standard compaction

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

Material description CLAY, medium to high plasticity, brown / grey, with gravel

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

 <p>ACCREDITED FOR TECHNICAL COMPETENCE</p>	<p>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</p>	 <p>Tim Senserrick Approved Signatory Date</p>	<p>18-May-20</p>
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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:	GS5211/1	
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)			Report No.	AB	
Location:	LARA			Test date:	5-May-20	
Test Number	4	5	6			
Test location taken from	Lot 135	Lot 132	Coridale Boulevard			
S.E corner of Lots	6m North 12m West	25m North 7.5m West	Chainage 30 5m North			
Layer Number	1	1	1			
Time of tests	13:45:00	14:30:00	14:45:00			
Depth of Layer	mm 200	mm 200	mm 200			
Depth of Test	mm 175	mm 175	mm 175			
Field Wet Density	t/m ³ 2.08	t/m ³ 2.08	t/m ³ 2.11			
Field Dry Density	t/m ³ 1.80	t/m ³ 1.82	t/m ³ 1.83			
Field Moisture Content	% 15.5	% 14.0	% 15.0			
Oversize Material	Wet % 0	Wet % 0	Wet % 3			
Sieve Size	mm 19.0	mm 19.0	mm 19.0			
Peak Converted Wet Density	t/m ³ 2.11	t/m ³ 2.10	t/m ³ 2.10			
Optimum Moisture Content	% 14.0	% 14.0	% 16.0			
Compactive Effort Used	std / mod STD	std / mod STD	std / mod STD			
Moisture Ratio	% 111	% 100	% 94			
Moisture Variation	% 1.5	% 0.0	% -1.0			
Moisture Variation	WET	-	DRY			
Density Ratio	% 98.5	% 99.0	% 100.5			

Specification Requirements 95% Standard compaction

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

Material description sandy CLAY, medium to high plasticity, orange / brown, fine to coarse

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

 <p>ACCREDITED FOR TECHNICAL COMPETENCE</p>	<p>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</p>	 <p>Tim Senserrick Approved Signatory Date</p>	<p>18-May-20</p>
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Field Density Test Results

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

Client:	BITU-MILL (CAMPBELLFIELD)	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.	AC
Location:	LARA	Test date:	6-May-20

Test Number	7	8	9	10	11	12
Test location taken from	Lot 101	Lot 103	Lot 105	Lot 107	Lot 109	Lot 133
S.E corner of Lots	10m North	24m North	8m North	19m North	6m North	10m North
	13m West	11m West	15m West	14m West	8m West	6m West
Layer Number	1	1	1	1	1	1
Time of tests	12:30:00	12:55:00	13:10:00	13:25:00	14:05:00	14:25:00
Depth of Layer	mm 250					
Depth of Test	mm 225					
Field Wet Density	t/m ³ 2.20	t/m ³ 2.18	t/m ³ 2.18	t/m ³ 2.11	t/m ³ 2.09	t/m ³ 2.17
Field Dry Density	t/m ³ 1.92	t/m ³ 1.91	t/m ³ 1.93	t/m ³ 1.84	t/m ³ 1.84	t/m ³ 1.94
Field Moisture Content	% 14.5	% 11.5	% 12.5	% 14.0	% 13.0	% 11.5

Oversize Material	Wet % 0	Wet % 20	Wet % 2	Wet % 6	Wet % 7	Wet % 1
Sieve Size	mm 19.0					
Peak Converted Wet Density	t/m ³ 2.15	t/m ³ 2.20	t/m ³ 2.12	t/m ³ 2.09	t/m ³ 2.06	t/m ³ 2.17
Optimum Moisture Content	% 15.0	% 11.5	% 12.5	% 15.0	% 14.5	% 12.0
Compactive Effort Used	std / mod STD					

Moisture Ratio	% 97	% 100	% 100	% 94	% 90	% 96
Moisture Variation	% -0.5	% 0.0	% 0.0	% -1.0	% -1.5	% -0.5
Moisture Variation	DRY	-	-	DRY	DRY	DRY
Density Ratio	% 102.5	% 99.0	% 103.0	% 101.0	% 101.5	% 100.0

Specification Requirements 95% Standard compaction

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

Material description gravelly CLAY, medium to high plasticity, brown, fine to coarse

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	18-May-20



Field Density Test Results

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

Client:	BITU-MILL (CAMPBELLFIELD)	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.	AD
Location:	LARA	Test date:	7-May-20

Test Number	13	14	15	16	17	18
Test location taken from	Lot 138	Lot 139	Lot 140	Lot 108	Lot 106	Lot 104
S.E corner of Lots	5m North 28m West	8m North 29m West	6m North 28m West	28m North 9m West	24m North 9m West	17m North 10m West
Layer Number	1	1	1	2	2	2
Time of tests	11:45:00	11:50:00	12:30:00	14:05:00	14:25:00	14:45:00
Depth of Layer	mm 250					
Depth of Test	mm 225					
Field Wet Density	t/m ³ 1.96	t/m ³ 1.96	t/m ³ 1.95	t/m ³ 2.11	t/m ³ 2.24	t/m ³ 2.12
Field Dry Density	t/m ³ 1.80	t/m ³ 1.80	t/m ³ 1.80	t/m ³ 1.84	t/m ³ 1.97	t/m ³ 1.84
Field Moisture Content	% 8.5	% 9.0	% 8.5	% 14.0	% 12.5	% 14.5
Oversize Material	Wet % 0	Wet % 0	Wet % 0	Wet % 5	Wet % 7	Wet % 4
Sieve Size	mm 19.0					
Peak Converted Wet Density	t/m ³ 2.01	t/m ³ 2.00	t/m ³ 2.02	t/m ³ 2.09	t/m ³ 2.12	t/m ³ 2.08
Optimum Moisture Content	% 12.5	% 13.0	% 12.5	% 14.0	% 13.0	% 14.5
Compactive Effort Used	std / mod STD					
Moisture Ratio	% 68	% 69	% 68	% 100	% 96	% 100
Moisture Variation	% -4.0	% -4.0	% -4.0	% 0.0	% -0.5	% 0.0
Moisture Variation	DRY	DRY	DRY	-	DRY	-
Density Ratio	% 97.0	% 98.0	% 96.5	% 101.0	% 105.5	% 102.0

Specification Requirements 95% Standard compaction

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

Material description sandy CLAY medium plasticity, orange / gravelly CLAY, medium to high plasticity, brown, fine to coarse

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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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:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.:	AE
Location:	LARA	Test date:	8-May-20

Test Number	19	20	21	22	23	
Test location taken from	Lot 102	Lot 110	Lot 134	Lot 137	Lot 136	
S.E corner of Lots	6m North 11m West	4m North 5m West <small>(final surface layer)</small>	11m North 9m West	9m North 18m West	9m North 9m West	
Layer Number	3	3	2	2	3	
Time of tests	10:30:00	10:50:00	12:05:00	12:35:00	14:16:00	
Depth of Layer	mm 250	mm 250	mm 250	mm 250	mm 250	
Depth of Test	mm 225	mm 225	mm 225	mm 225	mm 225	
Field Wet Density	t/m ³ 2.17	t/m ³ 2.22	t/m ³ 2.19	t/m ³ 2.24	t/m ³ 2.13	
Field Dry Density	t/m ³ 1.86	t/m ³ 1.92	t/m ³ 1.94	t/m ³ 1.99	t/m ³ 1.82	
Field Moisture Content	% 14.0	% 15.0	% 12.5	% 11.5	% 17.0	

Oversize Material	Wet % 17	Wet % 3	Wet % 5	Wet % 9	Wet % 2	
Sieve Size	mm 19.0					
Peak Converted Wet Density	t/m ³ 2.13	t/m ³ 2.13	t/m ³ 2.09	t/m ³ 2.12	t/m ³ 2.09	
Optimum Moisture Content	% 14.5	% 15.5	% 14.5	% 13.5	% 17.0	
Compactive Effort Used	std / mod STD					

Moisture Ratio	% 97	% 97	% 86	% 85	% 100	
Moisture Variation	% -0.5	% -0.5	% -2.0	% -2.0	% 0.0	
Moisture Variation	DRY	DRY	DRY	DRY	-	
Density Ratio	% 102.0	% 104.0	% 105.0	% 106.0	% 102.0	

Specification Requirements 95% Standard compaction

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

Material description gravelly CLAY, medium to high plasticity, brown, fine to coarse

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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Field Density Test Results

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

Client:	BITU-MILL (CAMPBELLFIELD)	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.	AF
Location:	LARA	Test date:	13-May-20

Test Number	24	25	26			
Test location taken from	Lot 131	Lot 129	Lot 128			
Offset	24m North 9m West	10m North 12m West	24m North 8m West			
Layer Number	1	1	1			
Time of tests	12:01:00	12:11:00	12:21:00			
Depth of Layer	mm 250	250	250			
Depth of Test	mm 225	225	225			
Field Wet Density	t/m ³ 2.12	2.17	2.13			
Field Dry Density	t/m ³ 1.84	1.84	1.86			
Field Moisture Content	% 14.5	17.0	14.0			

Oversize Material	Wet % 7	5	4			
Sieve Size	mm 19.0	19.0	19.0			
Peak Converted Wet Density	t/m ³ 2.12	2.11	2.12			
Optimum Moisture Content	% 14.5	17.0	13.5			
Compactive Effort Used	std / mod STD	STD	STD			

Moisture Ratio	% 100	100	104			
Moisture Variation	% 0.0	0.0	0.5			
Moisture Variation	-	-	WET			
Density Ratio	% 100.0	102.5	100.5			

Specification Requirements 95% Standard compaction

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

Material description gravelly CLAY, medium to high plasticity, light grey, fine to coarse

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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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:	GS5211/1	
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)		Report No.	AG	
Location:	LARA		Test date:	4-Jun-20	

Test Number	27	28	29	30	31	32
Test location taken from	Lot 111	Lot 112	Lot 113	Lot 114	Lot 115	Lot 116
S.E Corner of each Lot	8m North	7m North	8m North	12m North	12m North	11m North
Offset (m)	9m West	8m West	6m West	5m West	5m West	5m West
Layer Number	1	1	1	1	1	1
Time of tests	11:15:00	11:35:00	11:40:00	11:50:00	12:20:00	12:30:00
Depth of Layer	mm 200	200	200	200	200	200
Depth of Test	mm 175	175	175	175	175	175
Field Wet Density	t/m ³ 1.87	1.91	1.83	1.86	1.95	1.94
Field Dry Density	t/m ³ 1.45	1.44	1.37	1.45	1.57	1.63
Field Moisture Content	% 29.0	32.5	34.0	28.5	18.0	14.0
Oversize Material	Wet % 0	0	0	0	26	26
Sieve Size	mm 19.0	19.0	19.0	19.0	37.5	37.5
Peak Converted Wet Density	t/m ³ 1.79	1.77	1.77	1.82	-	-
Optimum Moisture Content	% 30.0	33.0	33.0	29.0	-	-
Compactive Effort Used	std / mod STD	STD	STD	STD	STD	STD
Moisture Ratio	% 97	99	103	99	-	-
Moisture Variation	% -1.0	-0.5	1.0	-0.5	-	-
Moisture Variation	DRY	DRY	WET	DRY	-	-
Density Ratio	% 104.5	107.5	103.0	102.0	Oversize	Oversize

Specification Requirements 95% Standard compaction

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

Material description #27 - #30: Silty CLAY, medium to high plasticity, brown.

#31 - #32: Gravelly 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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Field Density Test Results

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

Client:	BITU-MILL (CAMPBELLFIELD)	Job No:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.	AH
Location:	LARA	Test date:	11-Jun-20

Test Number	33	34				
Test location taken from	Retest of #31	Retest of #32				
Layer Number	1	1				
Time of tests	13:05:00	13:15:00				
Depth of Layer	mm 200	mm 200				
Depth of Test	mm 175	mm 175				
Field Wet Density	t/m ³ 2.00	t/m ³ 2.06				
Field Dry Density	t/m ³ 1.57	t/m ³ 1.63				
Field Moisture Content	% 22.5	% 22.5				

Oversize Material	Wet % 17	Wet % 14				
Sieve Size	mm 19.0	mm 19.0				
Peak Converted Wet Density	t/m ³ 1.92	t/m ³ 1.93				
Optimum Moisture Content	% 23.0	% 24.5				
Compactive Effort Used	std / mod STD	std / mod STD				

Moisture Ratio	% 98	% 92				
Moisture Variation	% -0.5	% -2.0				
Moisture Variation	DRY	DRY				
Density Ratio	% 104.0	% 106.5				

Specification Requirements 95% Standard compaction

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

Material description gravelly silty CLAY, medium to high plasticity, brown, gravel fine to coarse

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	15-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:	GS5211/1	
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)		Report No.	AI	
Location:	LARA		Test date:	2-Jul-20	
Test Number	35	36	37	38	39
Test location taken from	Lot 117	Lot 118	Lot 119	Lot 120	Lot 121
S.E corner of each Lot	11m North 9m West	5m North 7m West	7m North 5m West	7m North 5m West	5m North 5m West
Layer Number	1	1	1	1	1
Time of tests	15:30:00	15:40:00	15:50:00	16:00:00	16:10:00
Depth of Layer	mm 200	200	200	200	200
Depth of Test	mm 175	175	175	175	175
Field Wet Density	t/m ³ 1.98	2.00	1.98	1.97	1.93
Field Dry Density	t/m ³ 1.60	1.62	1.60	1.61	1.58
Field Moisture Content	% 22.0	21.0	22.5	21.0	22.0
Oversize Material	Wet % 8	10	5	6	3
Sieve Size	mm 19.0	19.0	19.0	19.0	19.0
Peak Converted Wet Density	t/m ³ 1.85	1.91	1.82	1.81	1.79
Optimum Moisture Content	% 24.5	23.0	24.5	25.0	25.0
Compactive Effort Used	std / mod STD	STD	STD	STD	STD
Moisture Ratio	% 90	92	92	84	88
Moisture Variation	% -2.5	-2.0	-2.0	-4.0	-3.0
Moisture Variation	DRY	DRY	DRY	DRY	DRY
Density Ratio	% 107.0	105.0	109.0	109.0	108.0

Specification Requirements 95% Standard compaction

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

Material description gravelly silty CLAY, medium to high plasticity, brown, fine to coarse gravel

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

	<p>NATA Accredited Laboratory No. 15055 Accredited for compliance with ISO/IEC 17025 - Testing</p> <p>The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/National Standards</p>	<p>Chris Senserrick Approved Signatory Date</p>	06-Jul-20
	<p>GS001/R V9 May 2019 App KC</p>		



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:	GS5211/1		
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)		Report No.	AJ		
Location:	LARA		Test date:	3-Jul-20		
Test Number	40	41	42	43	44	45
Test location taken from	Lot 149	Lot 150	Lot 122	Lot 123	Lot 124	Lot 125
S.E corner of each Lot	5m North 7m West	7m North 9m West	8m North 10m West	3m North 10m West	24m North 8m West	27m North 11m West
Layer Number	1	1	1	1	1	1
Time of tests	12:00:00	12:10:00	12:20:00	12:30:00	12:40:00	12:50:00
Depth of Layer	mm 200	200	200	200	200	200
Depth of Test	mm 175	175	175	175	175	175
Field Wet Density	t/m ³ 2.00	1.96	1.93	1.91	1.89	1.89
Field Dry Density	t/m ³ 1.63	1.60	1.55	1.56	1.54	1.54
Field Moisture Content	% 21.0	22.5	22.5	23.0	22.5	22.0
Oversize Material	Wet % 7	0	8	0	0	0
Sieve Size	mm 19.0	19.0	19.0	19.0	19.0	19.0
Peak Converted Wet Density	t/m ³ 1.89	1.86	1.88	1.89	1.82	1.83
Optimum Moisture Content	% 23.5	25.5	25.0	25.0	24.5	24.5
Compactive Effort Used	std / mod STD	STD	STD	STD	STD	STD
Moisture Ratio	% 90	88	90	92	92	90
Moisture Variation	% -2.5	-3.0	-2.5	-2.0	-2.0	-2.5
Moisture Variation	DRY	DRY	DRY	DRY	DRY	DRY
Density Ratio	% 106.0	105.0	102.5	101.5	104.0	103.0

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)

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	<p>GS001/R V9 May 2019 App KC</p>		



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:	GS5211/1		
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)		Report No.	AK		
Location:	LARA		Test date:	3-Jul-20		
Test Number	46	47				
Test location taken from	Lot 141	Lot 130				
S.E corner of each Lot	5m South 15m West	23m North 8m West				
Layer Number	1	2				
Time of tests	13:00:00	13:10:00				
Depth of Layer	mm 200	200				
Depth of Test	mm 175	175				
Field Wet Density	t/m ³ 1.93	1.90				
Field Dry Density	t/m ³ 1.58	1.58				
Field Moisture Content	% 22.0	20.5				
Oversize Material	Wet % 2	2				
Sieve Size	mm 19.0	19.0				
Peak Converted Wet Density	t/m ³ 1.86	1.81				
Optimum Moisture Content	% 24.5	22.0				
Compactive Effort Used	std / mod STD	STD				
Moisture Ratio	% 90	93				
Moisture Variation	% -2.5	-1.5				
Moisture Variation	DRY	DRY				
Density Ratio	% 103.5	105.0				

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 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 07-Jul-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:	GS5211/1
Project:	CORIDALE ESTATE - STAGE 1 (LEVEL 1)	Report No.	AL
Location:	LARA	Test date:	14-Jul-20

Test Number	48	49	50	51		
Test location taken from	Lot 127	Lot 126	Lot 127	Lot 126		
S.E corner of Lot	27m North 8m West	27m North 6m West	8m North 7m West	8m North 6m West		
Layer Number	2	2	1	1		
Time of tests	11:00:00	11:15:00	11:30:00	11:40:00		
Depth of Layer	mm 200	200	175	175		
Depth of Test	mm 175	175	150	150		
Field Wet Density	t/m ³ 1.87	1.88	1.98	1.95		
Field Dry Density	t/m ³ 1.46	1.44	1.62	1.57		
Field Moisture Content	% 28.0	30.0	21.5	23.5		

Oversize Material	Wet %	0	0	3	2		
Sieve Size	mm	19.0	19.0	19.0	19.0		
Peak Converted Wet Density	t/m ³	1.94	1.90	1.94	1.90		
Optimum Moisture Content	%	25.5	27.0	21.5	24.5		
Compactive Effort Used	std / mod	STD	STD	STD	STD		

Moisture Ratio	%	110	111	100	96		
Moisture Variation	%	2.5	3.0	0.0	-1.0		
Moisture Variation		WET	WET	-	DRY		
Density Ratio	%	96.0	98.5	101.5	102.5		

Specification Requirements 95% Standard compaction

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

Material description silty CLAY, medium to high plasticity, brown white mottled

Test Methods AS1289 5.8.1 5.7.1 2.1.1 1.2.1 (6.4)

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