

**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**

## **LUCAS GRANGE ESTATE - STAGE 2C**

Prepared for Bild Group

**Report Reference: GS5933.1 AA**

**Date: 14 February 2022**

**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	GS5933.1	Rev	AA
Project Title	Lucas Grange Estate Stage 2C		
Project Location	Lucas	State	VIC
Date	14 February 2022		

## CLIENT DETAILS

Prepared For (Client)	Bild Group
Client Address	7 Metrolink Circuit, Campbellfield VIC 3061

## DISTRIBUTION

Original Held By	Ground Science Pty Ltd
One (1) Electronic Copy	Bild Group

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:**



**Gee Singh, MIEAust (NER)  
Senior Geotechnical Engineer**

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## 1. INTRODUCTION

This report presents the results of the inspection activities, compaction control and laboratory testing services performed by Ground Science Pty Ltd for the proposed residential subdivisional development identified as the Lucas Grange Estate Stage 2C, in Lucas, Victoria (the site).

Ground Science were engaged to provide Level 1 Inspection and Testing services for the construction of building platforms to support proposed residential allotments, as part of the bulk earthworks phase of the project. Authorisation to proceed was provided by Bild Group (the 'Client').

Level 1 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'. The Level 1 Inspection and Testing services described in this report were undertaken by experienced geotechnicians from Ground Science.

## 2. SCOPE OF WORK

### 2.1 AREAS OF WORK

The areas requiring Level 1 Inspection & Testing are shown on site plan in Appendix A, which is based on the supplied Earthworks Plans prepared by Integra (LUG2C-CD-701 REV 2). This report details the Level 1 earthworks process performed between 9<sup>th</sup> September 2021 and 16<sup>th</sup> December 2021, which included 5 full days and 2 half days of filling operations. A base inspection was carried out on 8<sup>th</sup> September 2021, and field density tests #22 - #24 were performed on 21<sup>st</sup> December 2021, however these dates are not included in the daily Level 1 filling works.

### 2.2 PLACEMENT METHODOLOGY

A technical specification for the works was not provided. The placement of controlled fill on the above-mentioned areas was carried out in accordance with Level 1 fill procedures as detailed in AS3798 (2007) 'Guidelines on Earthworks for Commercial and Residential Developments'. The following fill placement guideline was adopted for the works:

- All existing loose surficial fill, topsoil, soft material, vegetation, and materials containing significant organic matter were removed to expose the natural soil subgrade.
- Suitable fill material, sourced by the contractor and approved by Ground Science, was placed in loose horizontal layers not exceeding 150mm - 200mm in thickness.
- The controlled fill material was compacted to achieve a target Dry Density Ratio of at least 95% Standard Compaction (AS 1289: 5.1.1, 5.4.1 or 5.7.1), based on the sites proposed use for residential purposes.
- The fill was moisture conditioned to within 85% – 115% of the standard optimum moisture content.
- The fill material was sorted and mixed to remove particles greater than 20% by volume, particles coarser than 37.5mm and no particle over 200mm in any dimension.
- The frequency of field density testing adopted for the project was generally in line with the requirements for large scale developments (Type 1), as detailed in AS3798 (2007), which nominates a frequency of not less than:
  - 1 test per layer or 200mm per 2500m<sup>2</sup>.
  - 1 test per 500m<sup>3</sup> distributed reasonably evenly throughout the full depth and area.
  - 3 tests per site visit; whichever requires the most tests.



### **3. INSPECTION AND TESTING**

#### **3.1 SUBGRADE PREPARATION**

Site stripping was carried out during the initial stages of the project and presented to the onsite GITA for inspection on 8<sup>th</sup> September 2021. Site stripping is understood to have occurred using a scraper/dozer with approximately 150mm of unsuitable materials (silt, topsoil, vegetation) removed. On the 8<sup>th</sup> September 2021, the onsite GITA observed remnant silt/organic material and instructions were provided to further strip these soils by 150mm to expose to underlying residual Sandy CLAY (brown/yellow). These works were carried out on 8<sup>th</sup> and 9<sup>th</sup> September 2021 with a total of approximately 300mm of materials removed.

The above subgrade was visually assessed using tactile methods described in AS1726 (2017) and approved by the GITA representative throughout the project. The subgrade typically comprised Silty/Sandy CLAY (CI-CH), brown/yellow, generally moist and stiff. The subgrade was moisture conditioned and test rolled with no soft spots or deflections observed, and approved for subsequent fill placement.

#### **3.2 CONSTRUCTION MATERIALS**

The fill material used in this project was nominated by the on-site contractor. The nominated fill used for the project was sourced from onsite excavations (e.g. road boxing and existing onsite stockpiles). The material was carted to the site and stockpiled adjacent to the fill zones. Ground Science performed an assessment of the fill source to identify the following material characteristics:

- Material suitability as an engineering property.
- Cohesiveness.
- Free of building debris and vegetative matter.
- Free of oversize rock particles.

Visual assessments on the above-mentioned properties were conducted on-site and the fill material used was considered acceptable for use on this project. The nominated fill products were visually assessed to comprise of Silty/Sandy CLAY (CI-CH), medium to high plasticity, brown to brown/yellow.

Ground Science did not perform any chemical or environmental analysis of the above fill sources. Fill materials that were found to be dry were moisture conditioned using a water cart prior to and during placement. All fill materials hauled to the site were however generally considered suitable for use as engineered fill.

### 3.3 FILL CONSTRUCTION

The contractor had the following plant available onsite during the construction period for use in the fill placement;

- 14-tonne Padfoot Roller.
- Scraper.
- Excavator.
- Water Cart.

Weather conditions varied throughout the works, with temperatures typically cool in the early stages and warm/sunny in the later stages of the works. Temperatures typically ranged between 10 and 25 degrees Celsius.

The filling process was generally consistent throughout the project and involved the approved fill sources stockpiled adjacent to the fill placement zones. The material was spread using an onsite excavator into thin loose layers and moisture conditioned. Each layer was compacted using a Padfoot Roller applying a minimum of 6 - 10 passes, per layer observed. The thin layers of fill were compacted to form a composite layer of up to a maximum of 150mm – 200mm thick, prior to undertaking the field density testing. Generally, between 1 - 3 layers were placed and compacted. The compacted fill was moisture conditioned prior to the application of subsequent layers of fill however in some situations required the post-compacted fill to be moisture conditioned and re-tested where found to be dry. This process was adopted for the fill placement works.

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. Appendix A provides a guide to the fill placement and is limited to the areas described in this report. It is considered that a 100mm to 150mm thick layer of topsoil may be spread at the completion of all works, which does not form part of the Level 1 process. Any fill placed as part of newly constructed drainage, sewer works, or similar 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 24 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289 5.8.1) and 24 "Rapid HILF" Compaction tests (AS1289 5.7.1) which included associated re-tests of areas that did not achieve the target density ratio of 95% Standard Compaction or moisture ratio.

A summary of the field density tests and test locations performed for the project is presented in **Appendix A**. Field density and compaction control testing report sheets are presented in **Appendix B**. Site photographs taken during the works are presented in **Appendix C**. It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed.

Tests #19 - #21 failed to meet the required target density ratio and the area of these tests were subsequently reworked, recompacted, and retested with compliant test results achieved (Tests #22 - #24). The moisture ratio of the compacted fill material was typically within the recommended moisture range. Test #1 was found to be dry of the recommended moisture range and this area was moisture conditioned and visually deemed acceptable.

### 3.5 FINAL SURFACE LEVELS

Observations were made by a Ground Science staff member that filling had been completely 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 tactile methods and may not be a true representation of fill depths given that conditions onsite 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 in Appendix A. 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 guidelines provided by AS3798 (2007) and 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 dwellings or buildings. The levels nominated in this report are a guide to the amounts of fill placed and do not necessarily reflect an accurate survey of the fill levels.

#### 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 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.

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.



## 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**

Field Density Test Results Summary & Test Positions

# Project Summary Report



**Report Date:** 01/02/2022  
**Client:** BildGroup

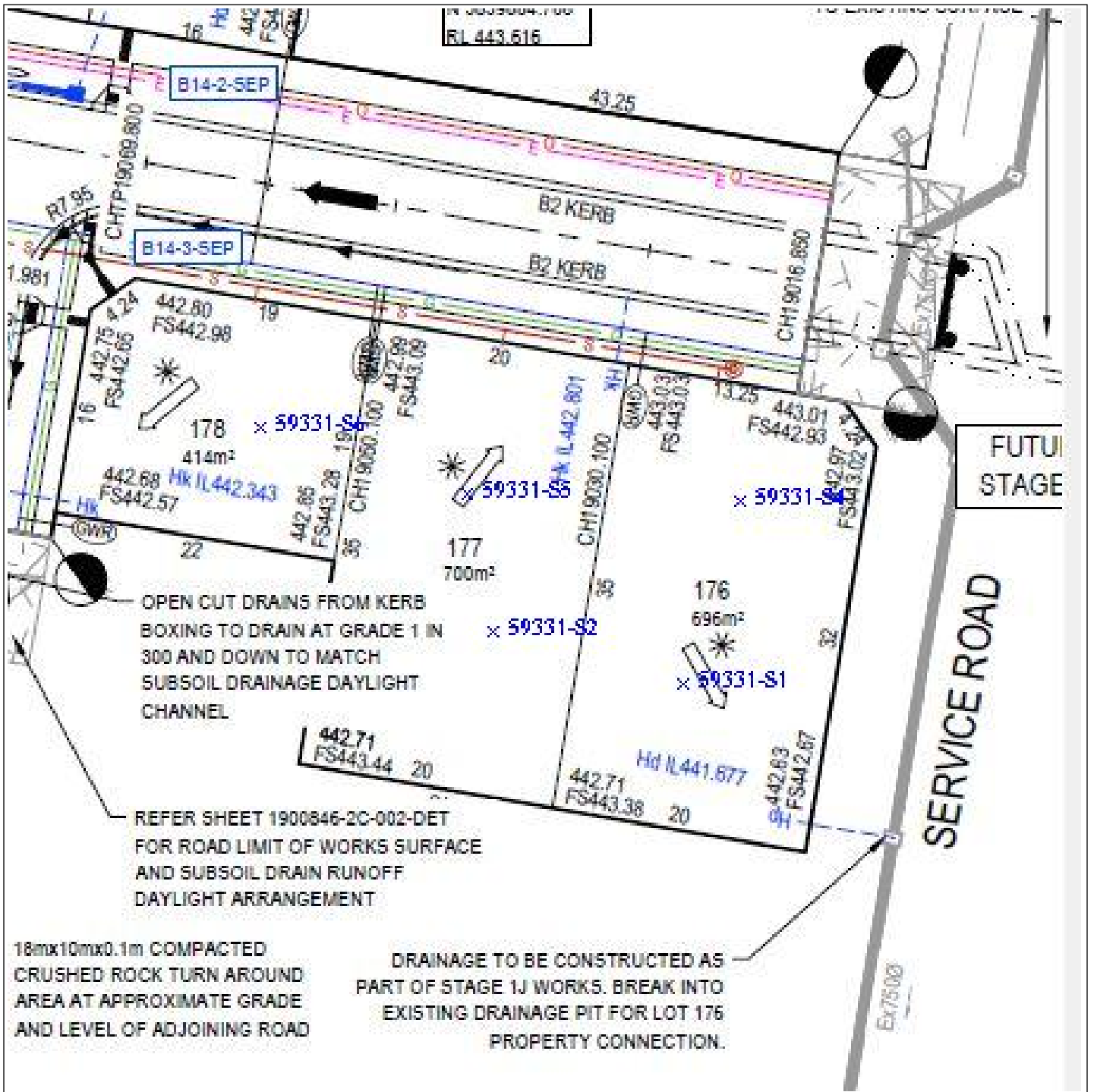
Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: chris@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Specification:** 98% Standard Compaction  
**Test Methods:** AS 1289 5.7.1 STD & 5.8.1 & 2.1.1

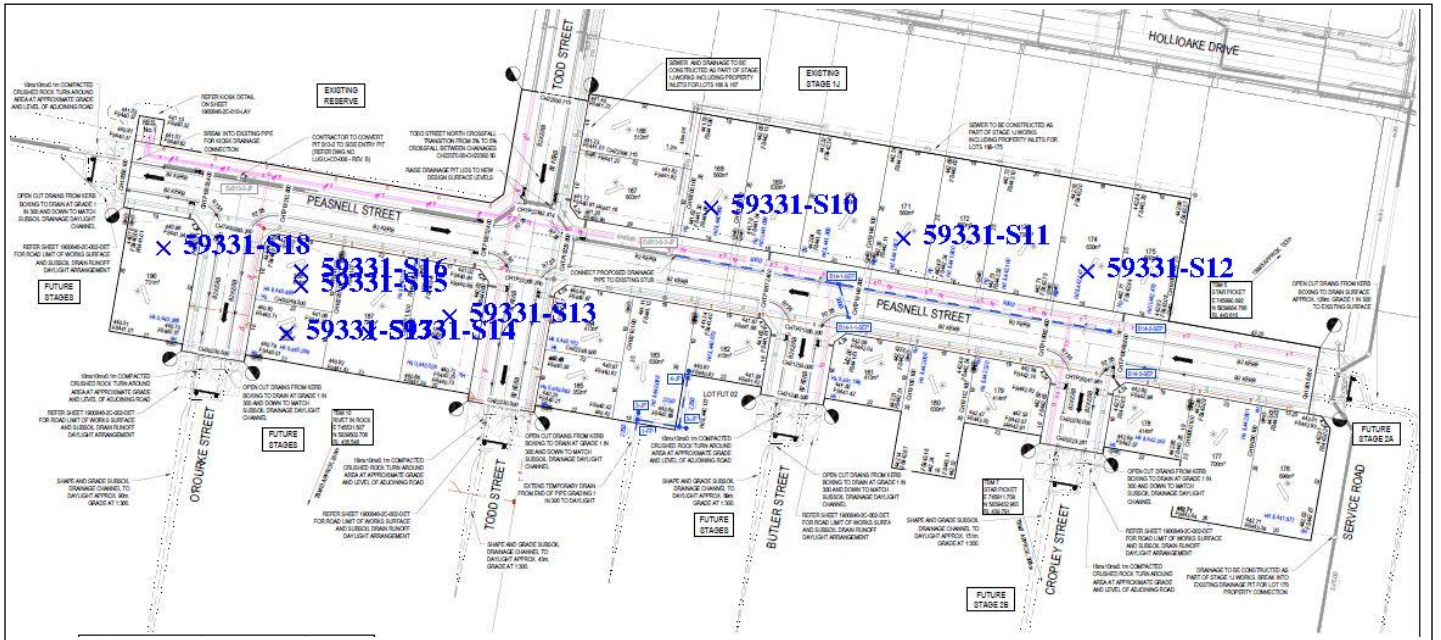
Lot #	Sample #	Date Sampled	Location	Line / Offset	Offset	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	59331-S1	09/09/2021	S.E CORNER OF LOT 176	15n	10w	**	L1	98.0	-4.0	25.3	2.12
**	59331-S2	09/09/2021	S.E CORNER OF LOT 177	12n	5w	**	L1	100.5	-2.5	25.3	2.14
**	59331-S3	14/09/2021	RETEST OF #1 Lot-176	**	**	**	L1	98.5	-2.0	23.2	2.09
**	59331-S4	15/09/2021	S.E corner of Lot 178	8N	12W	**	L1	101.0	-0.5	21.5	2.19
**	59331-S5	15/09/2021	S.E corner of Lot 176	16N	10W	**	L1	96.5	-0.5	20.4	2.06
**	59331-S6	15/09/2021	S.E corner of Lot 177	18N	12W	**	L1	101.5	-1.0	22.4	2.18
**	59331-S7	16/09/2021	From S.E corner of lot 176	5 N	10 W	**	L2	103.0	-1.0	26.7	2.03
**	59331-S8	16/09/2021	From S.E corner of lot 176/177	10 N	21 W	**	L2	104.0	-1.5	25.4	2.10
**	59331-S9	16/09/2021	From S.E corner of 177	6 N	36 W	**	L2	103.5	0.0	27.3	2.04
**	59331-S10	14/12/2021	From n/w corner of lot 168	5m north	5m east	**	1	96.5	0.0	18.6	1.98
**	59331-S11	14/12/2021	From n/w corner of lot 171	5m north	4m east	**	1	103.5	1.5	18.9	2.07
**	59331-S12	14/12/2021	From n/w corner of lot 174	5m north	10m east	**	1	97.5	0.5	22.2	1.96
**	59331-S13	14/12/2021	From n/w corner of lot 186	15m north	7m east	**	2	107.5	0.0	19.8	2.13
**	59331-S14	14/12/2021	From n/w corner of lot 187	15m north	7m east	**	2	99.5	1.5	22.0	1.96
**	59331-S15	14/12/2021	From n/w corner of lot 188	5m north	7m east	**	2	97.5	2.0	20.7	1.96
**	59331-S16	15/12/2021	From n/w corner of lot 188	5m east	7m south	**	3	99.0	2.5	22.7	1.87
**	59331-S17	15/12/2021	From n/w corner of lot 189	5m east	5m south	**	3	100.0	2.5	24.8	1.88
**	59331-S18	15/12/2021	From n/w corner of lot 190	5m east	5m south	**	2	96.0	-0.5	18.9	1.99
**	59331-S19	16/12/2021	From n/w corner of lot 179	5m south	4m east	**	1	92.0	1.5	21.8	1.86
**	59331-S20	16/12/2021	From n/w corner of lot 180	10m south	5m east	**	2	92.5	-2.5	22.7	1.95
**	59331-S21	16/12/2021	From n/w corner of lot 181	5m south	4m east	**	3	89.0	0.0	19.7	1.90
**	59331-S22	21/12/2021	Retest of 19	**	**	**	**	102.5	2.5	21.2	1.98
**	59331-S23	21/12/2021	Retest of 20	**	**	**	**	110.0	1.5	20.8	2.17
**	59331-S24	21/12/2021	Retest of 21	**	**	**	**	105.0	3.5	15.0	2.13

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC



# Sample Locations Plan



## **APPENDIX B**

Field Density Test Report Sheets

# Material Test Report



**Report Number:** GS5933/1-1  
**Issue Number:** 1  
**Date Issued:** 13/09/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: chris@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 5298  
**Date Sampled:** 09/09/2021  
**Dates Tested:** 09/09/2021 - 10/09/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 98% Standard Compaction  
**Location:** Lots 176 and 177  
**Material:** Sandy CLAY, medium to high plasticity, yellow/ brown.  
**Material Source:** Peasnell rd (rd boxing)



Accredited for compliance with ISO/IEC 17025 - Testing

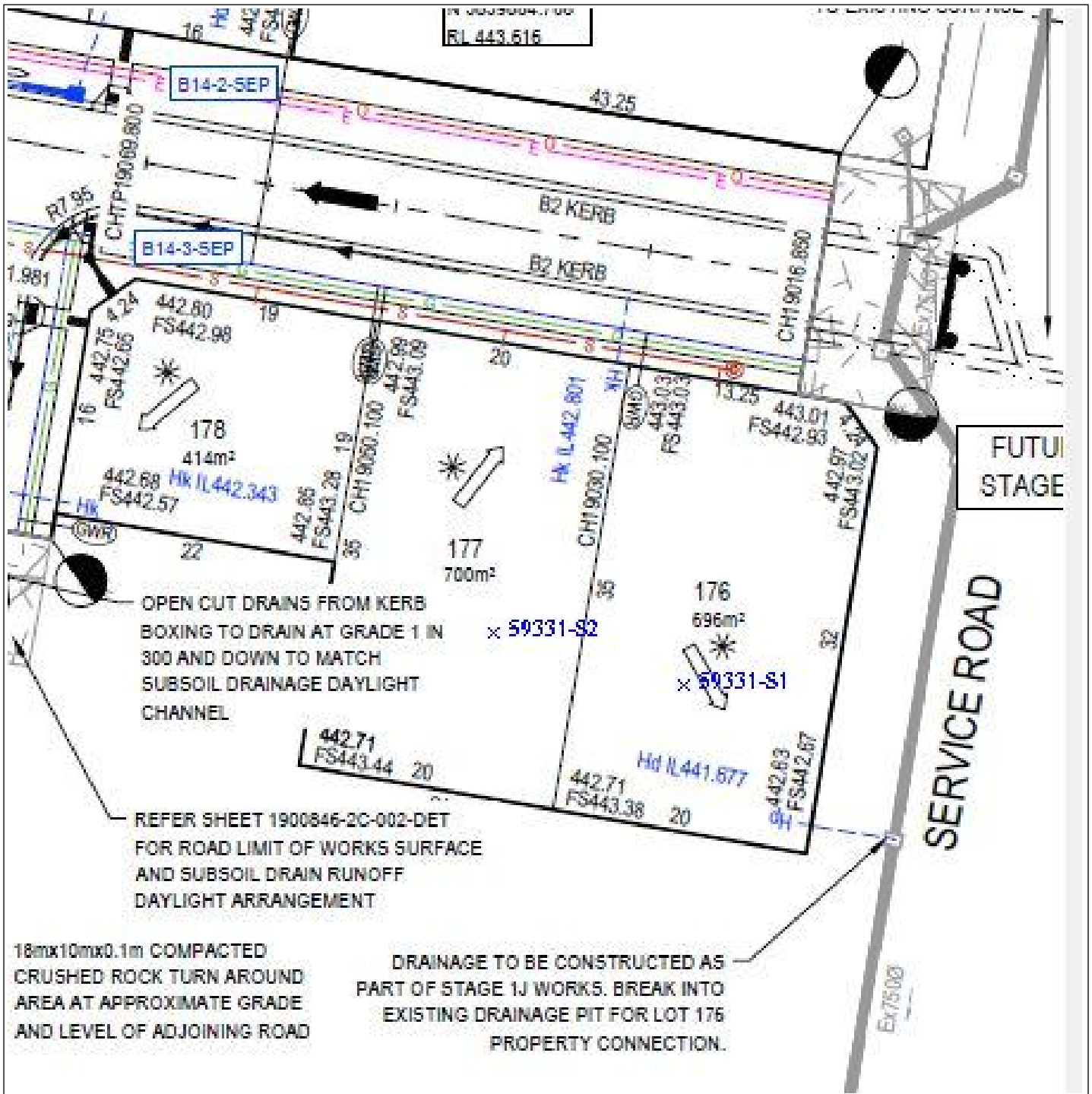
*Chris Senserrick*  
 Approved Signatory: Chris Senserrick  
 Laboratory Manager

NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S1	59331-S2	
Date Tested	09/09/2021	09/09/2021	
Time Tested	12:04	12:15	
Test Request #/Location	S.E CORNER OF LOT 176	S.E CORNER OF LOT 177	
Line / Offset	15n	12n	
Offset	10w	5w	
Layer / Reduced Level	L1	L1	
Thickness of Layer (mm)	300	300	
Soil Description	Sandy CLAY, medium to high plasticity, brown	Sandy CLAY, medium to high plasticity, brown	
Test Depth (mm)	275	275	
Sieve used to determine oversize (mm)	19.0	19.0	
Percentage of Wet Oversize (%)	0	0	
Field Wet Density (FWD) t/m <sup>3</sup>	2.12	2.14	
Field Moisture Content %	25.3	25.3	
Field Dry Density (FDD) t/m <sup>3</sup>	1.69	1.71	
Peak Converted Wet Density t/m <sup>3</sup>	2.17	2.13	
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	
Moisture Variation (Wv) %	-4.0	-2.5	
Adjusted Moisture Variation %	**	**	
Hilf Density Ratio (%)	<b>98.0</b>	<b>100.5</b>	
Compaction Method	<b>Standard</b>	<b>Standard</b>	
Report Remarks	**	**	

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC





# Material Test Report



**Report Number:** GS5933/1-2  
**Issue Number:** 1  
**Date Issued:** 15/09/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: chris@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 5354  
**Date Sampled:** 15/09/2021  
**Dates Tested:** 15/09/2021 - 15/09/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction  
**Location:** Lucas Grange Estate  
**Material:** Sandy CLAY, medium to high plasticity, brown  
**Material Source:** Onsite



Accredited for compliance with ISO/IEC 17025 - Testing

*Chris Senserrick*  
 Approved Signatory: Chris Senserrick  
 Laboratory Manager  
 NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S3		
Date Tested	14/09/2021		
Time Tested	09:56		
Test Request #/Location	RETEST OF #1 Lot-176		
Layer / Reduced Level	L1		
Thickness of Layer (mm)	300		
Soil Description	Sandy CLAY, medium to high plasticity, brown		
Test Depth (mm)	275		
Sieve used to determine oversize (mm)	19.0		
Percentage of Wet Oversize (%)	0		
Field Wet Density (FWD) t/m <sup>3</sup>	2.09		
Field Moisture Content %	23.2		
Field Dry Density (FDD) t/m <sup>3</sup>	1.70		
Peak Converted Wet Density t/m <sup>3</sup>	2.12		
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**		
Moisture Variation (Wv) %	-2.0		
Adjusted Moisture Variation %	**		
Hilf Density Ratio (%)	<b>98.5</b>		
Compaction Method	<b>Standard</b>		
Report Remarks	**		

**Moisture Variation Note:**  
 Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

# Material Test Report



**Report Number:** GS5933/1-3  
**Issue Number:** 1  
**Date Issued:** 17/09/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: brent@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 5384  
**Date Sampled:** 15/09/2021 12:40  
**Dates Tested:** 15/09/2021 - 16/09/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (a) - Sampling from layers in earthworks or pavement - uncompacted  
**Specification:** 95% Standard Compaction  
**Location:** Lots 176 177 and 178  
**Material:** Sandy CLAY, medium to high plasticity, brown  
**Material Source:** Onsite



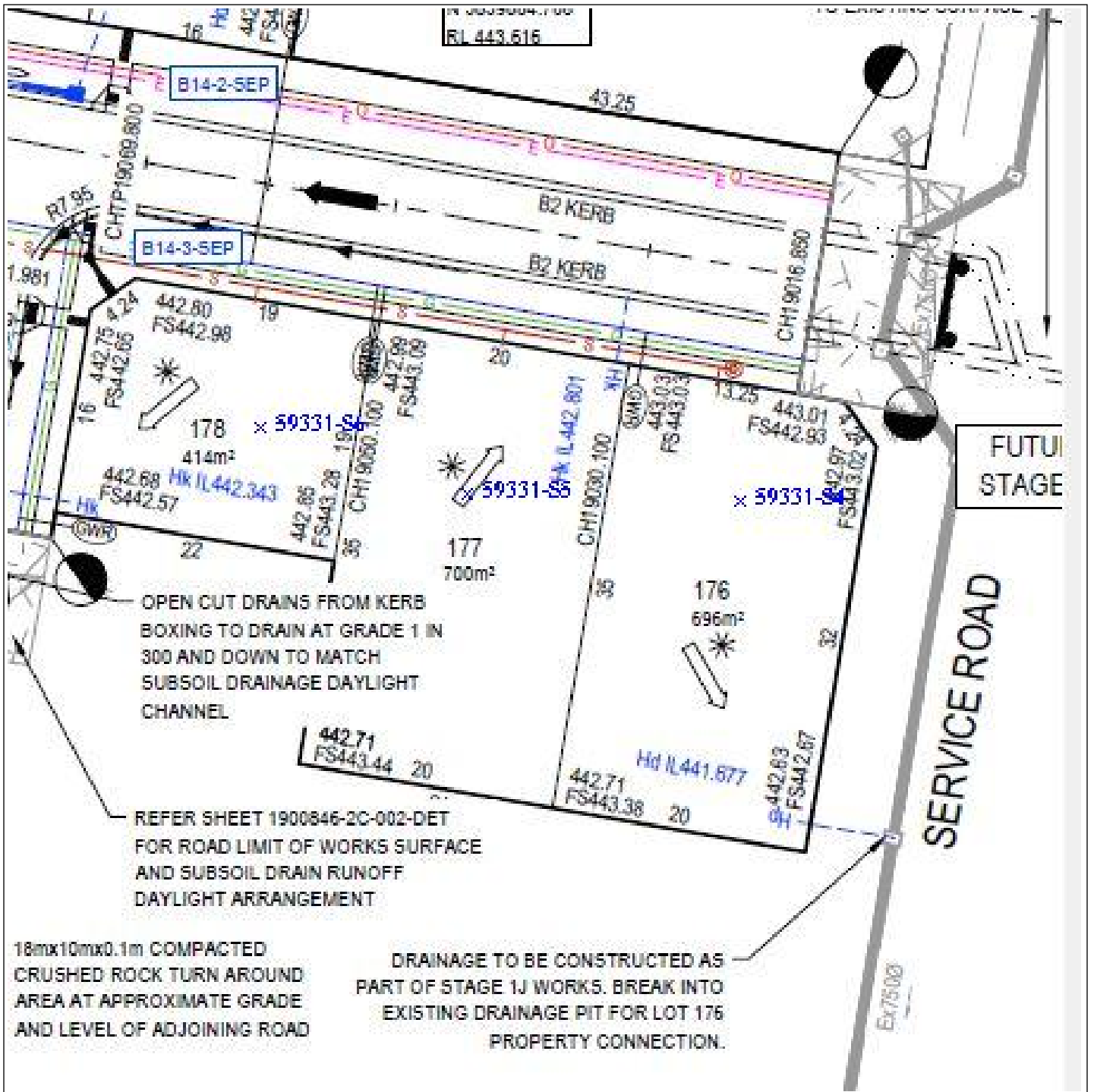
Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brent Elliott  
 Senior Field Technician  
 NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S4	59331-S5	59331-S6
Date Tested	15/09/2021	15/09/2021	15/09/2021
Time Tested	12:15	13:00	13:30
Test Request #/Location	S.E corner of Lot 178	S.E corner of Lot 176	S.E corner of Lot 177
Line / Offset	8N	16N	18N
Offset	12W	10W	12W
Layer / Reduced Level	L1	L1	L1
Thickness of Layer (mm)	250	250	250
Soil Description	Sandy CLAY, medium to high plasticity, brown	Sandy CLAY, medium to high plasticity, brown	Sandy CLAY, medium to high plasticity, brown
Test Depth (mm)	225	225	225
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	2	0
Field Wet Density (FWD) t/m <sup>3</sup>	2.19	2.06	2.18
Field Moisture Content %	21.5	20.4	22.4
Field Dry Density (FDD) t/m <sup>3</sup>	1.80	1.71	1.78
Peak Converted Wet Density t/m <sup>3</sup>	2.17	**	2.15
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	2.13	**
Moisture Variation (Wv) %	-0.5	**	-1.0
Adjusted Moisture Variation %	**	-0.5	**
Hilf Density Ratio (%)	<b>101.0</b>	<b>96.5</b>	<b>101.5</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC



# Material Test Report



**Report Number:** GS5933/1-4  
**Issue Number:** 1  
**Date Issued:** 20/09/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: brent@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 5413  
**Date Sampled:** 16/09/2021  
**Dates Tested:** 16/09/2021 - 17/09/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** Lots 176, 177 and 178  
**Material:** Sandy CLAY, medium to high plasticity, brown  
**Material Source:** Road boxing onsite



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brent Elliott  
 Senior Field Technician  
 NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S7	59331-S8	59331-S9
Date Tested	16/09/2021	16/09/2021	16/09/2021
Time Tested	13:58	14:30	15:00
Test Request #/Location	From S.E corner of lot 176	From S.E corner of lot 176/177	From S.E corner of 177
Line / Offset	5 N	10 N	6 N
Offset	10 W	21 W	36 W
Layer / Reduced Level	L2	L2	L2
Thickness of Layer (mm)	300	300	300
Soil Description	Sandy CLAY, medium to high plasticity, brown	Sandy CLAY, medium to high plasticity, brown	Sandy CLAY, medium to high plasticity, brown
Test Depth (mm)	275	275	275
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	0
Field Wet Density (FWD) t/m <sup>3</sup>	2.03	2.10	2.04
Field Moisture Content %	26.7	25.4	27.3
Field Dry Density (FDD) t/m <sup>3</sup>	1.61	1.67	1.60
Peak Converted Wet Density t/m <sup>3</sup>	1.98	2.01	1.97
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	**
Moisture Variation (Wv) %	-1.0	-1.5	0.0
Adjusted Moisture Variation %	**	**	**
Hilf Density Ratio (%)	<b>103.0</b>	<b>104.0</b>	<b>103.5</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

# Material Test Report



**Report Number:** GS5933/1-5  
**Issue Number:** 1  
**Date Issued:** 16/12/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: chris@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 6360  
**Date Sampled:** 14/12/2021 12:30  
**Dates Tested:** 14/12/2021 - 16/12/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** Lucas Grange  
**Material:** Silty CLAY, medium to high plasticity, brown



Accredited for compliance with ISO/IEC 17025 - Testing

*Chris Senserrick*  
 Approved Signatory: Chris Senserrick  
 Laboratory Manager

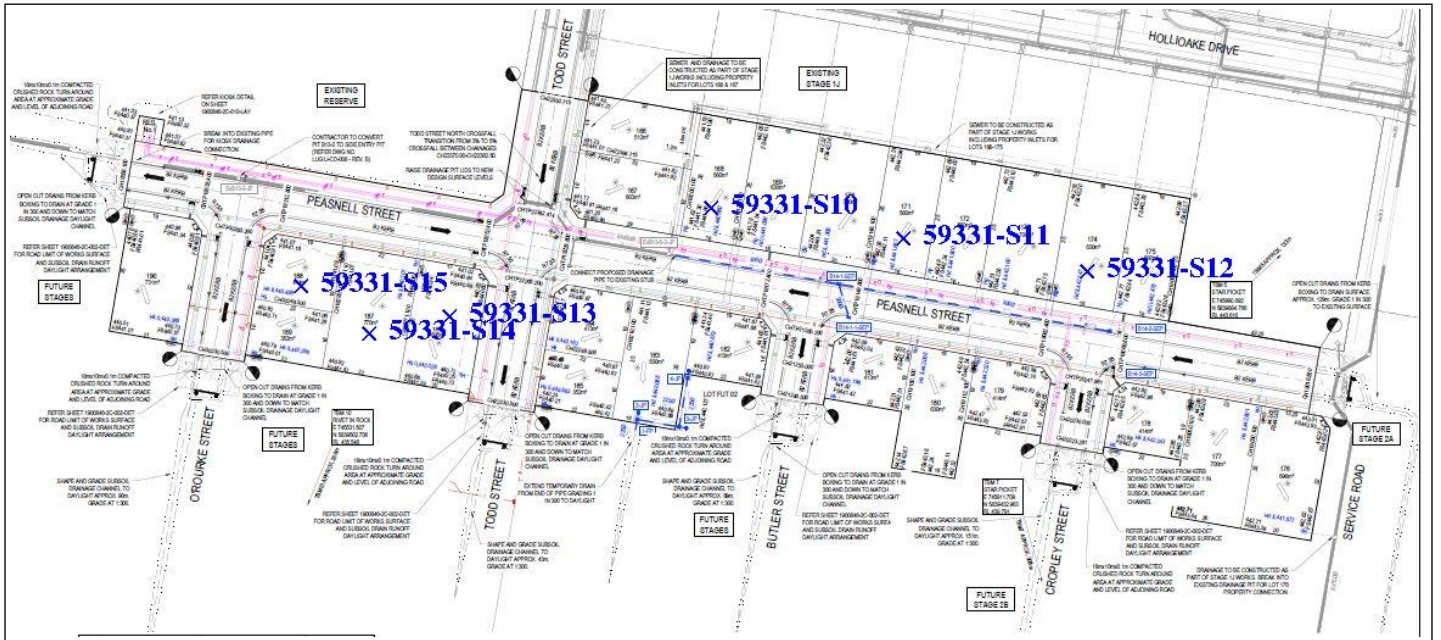
NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1						
Sample Number	59331-S10	59331-S11	59331-S12	59331-S13	59331-S14	59331-S15
Date Tested	14/12/2021	14/12/2021	14/12/2021	14/12/2021	14/12/2021	14/12/2021
Time Tested	13:22	13:29	14:02	14:23	14:27	14:38
Test Request #/Location	From n/w corner of lot 168	From n/w corner of lot 171	From n/w corner of lot 174	From n/w corner of lot 186	From n/w corner of lot 187	From n/w corner of lot 188
Latitude	5m north	5m north	5m north	15m north	15m north	5m north
Longitude	5m east	4m east	10m east	7m east	7m east	7m east
Layer / Reduced Level	1	1	1	2	2	2
Thickness of Layer (mm)	150	150	150	150	150	150
Soil Description	Silty CLAY, m-h plasticity, brown	Silty CLAY, m-h plasticity, brown	Silty CLAY, m-h plasticity, brown	Silty CLAY, m-h plasticity, brown	Silty CLAY, m-h plasticity, brown	Silty CLAY, m-h plasticity, brown
Test Depth (mm)	125	125	125	125	125	125
Sieve used to determine oversize (mm)	19.0	19.0	19.0	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	2	6	0	1	14
Field Wet Density (FWD) t/m <sup>3</sup>	1.98	2.07	1.96	2.13	1.96	1.96
Field Moisture Content %	18.6	18.9	22.2	19.8	22.0	20.7
Field Dry Density (FDD) t/m <sup>3</sup>	1.67	1.74	1.61	1.77	1.60	1.63
Peak Converted Wet Density t/m <sup>3</sup>	2.06	**	**	1.98	**	**
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	2.00	2.01	**	1.97	2.02
Moisture Variation (Wv) %	0.0	**	**	0.0	**	**
Adjusted Moisture Variation %	**	1.5	0.5	**	1.5	2.0
Hilf Density Ratio (%)	<b>96.5</b>	<b>103.5</b>	<b>97.5</b>	<b>107.5</b>	<b>99.5</b>	<b>97.5</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

# Sample Locations Plan



# Material Test Report



**Report Number:** GS5933/1-7  
**Issue Number:** 1  
**Date Issued:** 20/12/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: tim@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 6375  
**Date Sampled:** 15/12/2021 13:30  
**Dates Tested:** 15/12/2021 - 20/12/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** Lucas Grange  
**Material:** Silty CLAY, medium to high plasticity, brown  
**Material Source:** On-site sewer spoils



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Tim Senserrick  
 Laboratory 21C

NATA Accredited Laboratory Number: 15055

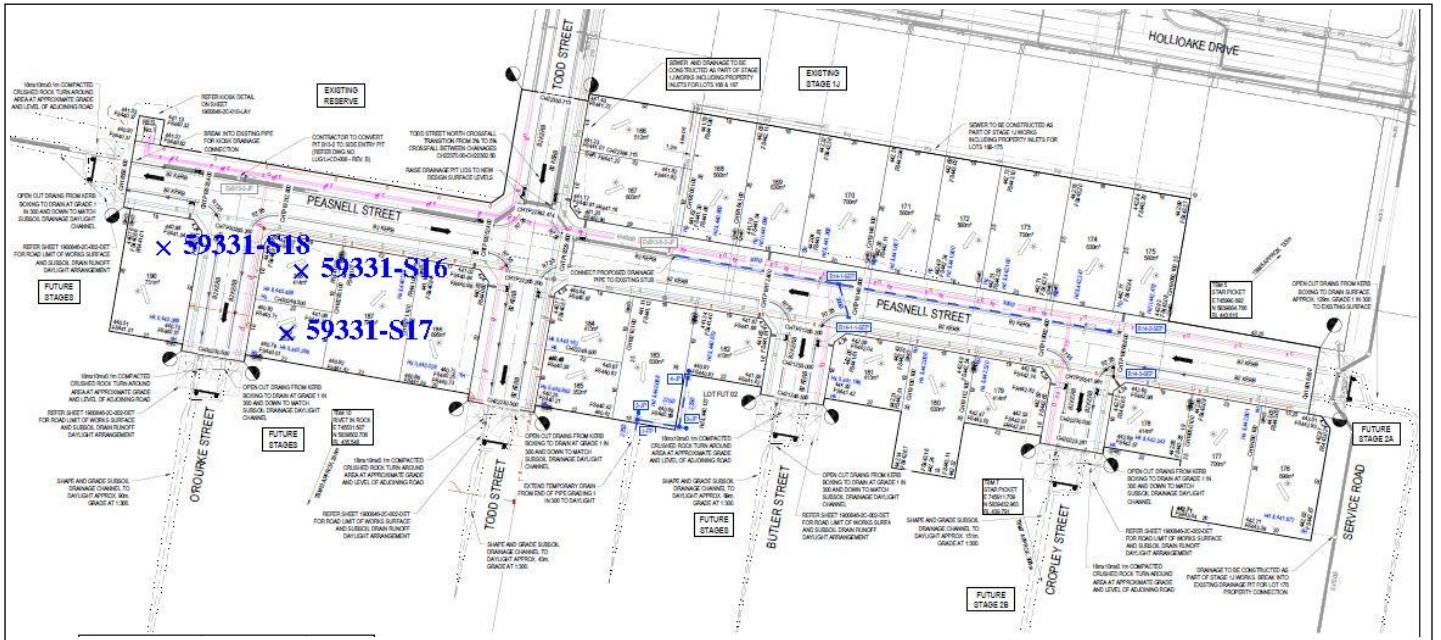
Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S16	59331-S17	59331-S18
Date Tested	15/12/2021	15/12/2021	15/12/2021
Time Tested	15:00	15:16	15:24
Test Request #/Location	From n/w corner of lot 188	From n/w corner of lot 189	From n/w corner of lot 190
Latitude	5m east	5m east	5m east
Longitude	7m south	5m south	5m south
Layer / Reduced Level	3	3	2
Thickness of Layer (mm)	200	200	200
Soil Description	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown
Test Depth (mm)	175	175	175
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	0
Field Wet Density (FWD) t/m <sup>3</sup>	1.87	1.88	1.99
Field Moisture Content %	22.7	24.8	18.9
Field Dry Density (FDD) t/m <sup>3</sup>	1.53	1.50	1.68
Peak Converted Wet Density t/m <sup>3</sup>	1.89	1.88	2.08
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	**
Moisture Variation (Wv) %	2.5	2.5	-0.5
Adjusted Moisture Variation %	**	**	**
Hilf Density Ratio (%)	<b>99.0</b>	<b>100.0</b>	<b>96.0</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC



# Sample Locations Plan





# Material Test Report



**Report Number:** GS5933/1-6  
**Issue Number:** 1  
**Date Issued:** 20/12/2021  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: tim@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 6390  
**Date Sampled:** 16/12/2021 13:00  
**Dates Tested:** 16/12/2021 - 24/12/2021  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** Lucas Grange  
**Material:** Silty CLAY, medium to high plasticity, brown  
**Material Source:** On-site



Accredited for compliance with ISO/IEC 17025 - Testing

*Tim Senserrick*  
 Approved Signatory: Tim Senserrick  
 Laboratory 21C

NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S19	59331-S20	59331-S21
Date Tested	16/12/2021	16/12/2021	16/12/2021
Time Tested	14:22	14:31	14:35
Test Request #/Location	From n/w corner of lot 179	From n/w corner of lot 180	From n/w corner of lot 181
Latitude	5m south	10m south	5m south
Longitude	4m east	5m east	4m east
Layer / Reduced Level	1	2	3
Thickness of Layer (mm)	200	200	200
Soil Description	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown
Test Depth (mm)	175	175	175
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	0	0	9
Field Wet Density (FWD) t/m <sup>3</sup>	1.86	1.95	1.90
Field Moisture Content %	21.8	22.7	19.7
Field Dry Density (FDD) t/m <sup>3</sup>	1.53	1.59	1.59
Peak Converted Wet Density t/m <sup>3</sup>	2.02	2.11	**
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	**	**	2.13
Moisture Variation (Wv) %	1.5	-2.5	**
Adjusted Moisture Variation %	**	**	0.0
Hilf Density Ratio (%)	<b>92.0</b>	<b>92.5</b>	<b>89.0</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**

**Moisture Variation Note:**

Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

# Material Test Report



**Report Number:** GS5933/1-8  
**Issue Number:** 1  
**Date Issued:** 11/01/2022  
**Client:** BildGroup

Ground Science Pty Ltd  
 Ground Science Laboratory  
 13 Brock Street Thomastown Victoria 3074  
 Phone: (03) 9464 4617  
 Email: brent@groundscience.com.au

**Contact:** Ash  
**Project Number:** GS5933/1  
**Project Name:** Lucas Grange Estate - Stage 2 (Level 1)  
**Project Location:** Lucas  
**Work Request:** 6445  
**Date Sampled:** 21/12/2021 15:00  
**Dates Tested:** 21/12/2021 - 10/01/2022  
**Sampling Method:** AS 1289.1.2.1 6.4 (b) - Sampling from layers in earthworks or pavement - compacted  
**Specification:** 95% Standard Compaction & +/- 3% Moisture Variation  
**Location:** Lucas Grange  
**Material:** Silty CLAY, medium to high plasticity, brown  
**Material Source:** On-site



Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brent Elliott  
 Laboratory 21C  
 NATA Accredited Laboratory Number: 15055

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	59331-S22	59331-S23	59331-S24
Date Tested	21/12/2021	21/12/2021	21/12/2021
Time Tested	15:11	15:18	15:24
Test Request #/Location	Retest of 19	Retest of 20	Retest of 21
Layer / Reduced Level	**	**	**
Thickness of Layer (mm)	200	200	200
Soil Description	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown	Silty CLAY, medium to high plasticity, brown
Test Depth (mm)	175	175	175
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	6	3	7
Field Wet Density (FWD) t/m <sup>3</sup>	1.98	2.17	2.13
Field Moisture Content %	21.2	20.8	15.0
Field Dry Density (FDD) t/m <sup>3</sup>	1.64	1.80	1.85
Peak Converted Wet Density t/m <sup>3</sup>	**	**	**
Adjusted Peak Converted Wet Density t/m <sup>3</sup>	1.93	1.97	2.02
Moisture Variation (Wv) %	**	**	**
Adjusted Moisture Variation %	2.5	1.5	3.5
Hilf Density Ratio (%)	<b>102.5</b>	<b>110.0</b>	<b>105.0</b>
Compaction Method	<b>Standard</b>	<b>Standard</b>	<b>Standard</b>
Report Remarks	**	**	**

**Moisture Variation Note:**  
 Positive values = test is dry of OMC  
 Negative values = test is wet of OMC

## **APPENDIX C**

Site Photographs







14 Dec 2021 at 2:08:26 pm  
86° E  
Lucas VIC 3350  
Australia

