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LEVEL 1 INSPECTION & TESTING
LUCAS GRANGE ESTATE - STAGE 1D

Prepared for Bild Group

Report Reference: GS6357.1 AA

Date: 23 May 2022

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PROJECT DETAILS

Project Reference	GS6357.1	Rev	AA
Project Title	Lucas Grange Estate Stage 1D		
Project Location	Alfredton, Ballarat	State	VIC
Date	23 May 2022		

CLIENT DETAILS

Prepared For (Client)	Bild Group
Client Address	133 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:

Anton Manoj
Geotechnical Engineer

REVIEWED:

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 development at Lucas Grange Estate Stage 1D, Alfredton, Ballarat, 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 in Appendix A, which is based on plans prepared by Integra (LUG2F-CD-710 REV 1). This report details the Level 1 earthwork process performed onsite which commenced and was completed on the 18th May 2022, including 1 full day of filling operations.

2.2 PLACEMENT METHODOLOGY

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 topsoil and vegetation 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 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 site's 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 100mm 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^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

Site stripping was carried out during the initial stages of the project and presented to the onsite GITA for inspection. It is understood that stripping was conducted to expose suitable subgrade material which involved the removal of all surface vegetation, and topsoil and then proof rolled with a fully loaded Moxy truck with no soft spots observed.

The above subgrade was visually assessed using tactile methods described in AS1726 (2017) and approved by the GITA representative. Typically, the subgrade material comprises silty CLAY (CI- CH), medium to high plasticity, brown, and was found to be dry and in a stiff or better consistency. The exposed subgrade was considered suitable and approved for subsequent fill placement. Subgrade soil was then ripped, and moisture condition, prior to the placement of the fill layers.

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 on-site excavations.

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 silty CLAY(CI-CH), medium to high plasticity, and brown. The moisture content was observed to be dry of the optimum moisture content (OMC).

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;

- Padfoot Roller;
- Moxy Truck;
- Water Cart;
- Dozer.

During fill placement, the weather conditions were generally fine to overcast.

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 on-site dozer into thin loose layers and moisture conditioned. Each layer was compacted using a Padfoot Roller applying a minimum of 8 passes, per layer observed. The thin layers of fill were compacted to form a composite layer of up to a maximum of 200mm thick, prior to undertaking the field density testing. Generally, up to 4 layers were placed and compacted. The compacted

fill was ripped, and moisture conditioned prior to the application of subsequent layers of fill. 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 technician 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 3 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289 5.8.1) and 3 "Rapid HILF" Compaction tests (AS1289 5.7.1).

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

All the tests achieved the target density ratio of 95% standard compaction. The moisture ratio of the compacted fill material was found to be within the recommended moisture ratio.

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.

7. REFERENCES

- AS3798 (2007) Guidelines on Earthworks for Residential and Commercial Developments.
- AS1289 Methods of Testing Soils for Engineering Purposes.
- AS1726 (2017): Geotechnical Site Investigations

APPENDIX A

Field Density Test Summary and Test Locations

Project Summary Report

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

Report Date: 20/05/2022
Client: BildGroup
7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061
Contact: Ash Beddion
Project Number: GS6357/1
Project Name: Lucas Grange - Stage 1D (Level 1)
Project Location: Ballarat
Specification: 95% Standard Compaction & +/- 3% Moisture Variation
Test Methods: AS 1289 5.7.1 STD & 5.8.1 & 2.1.1

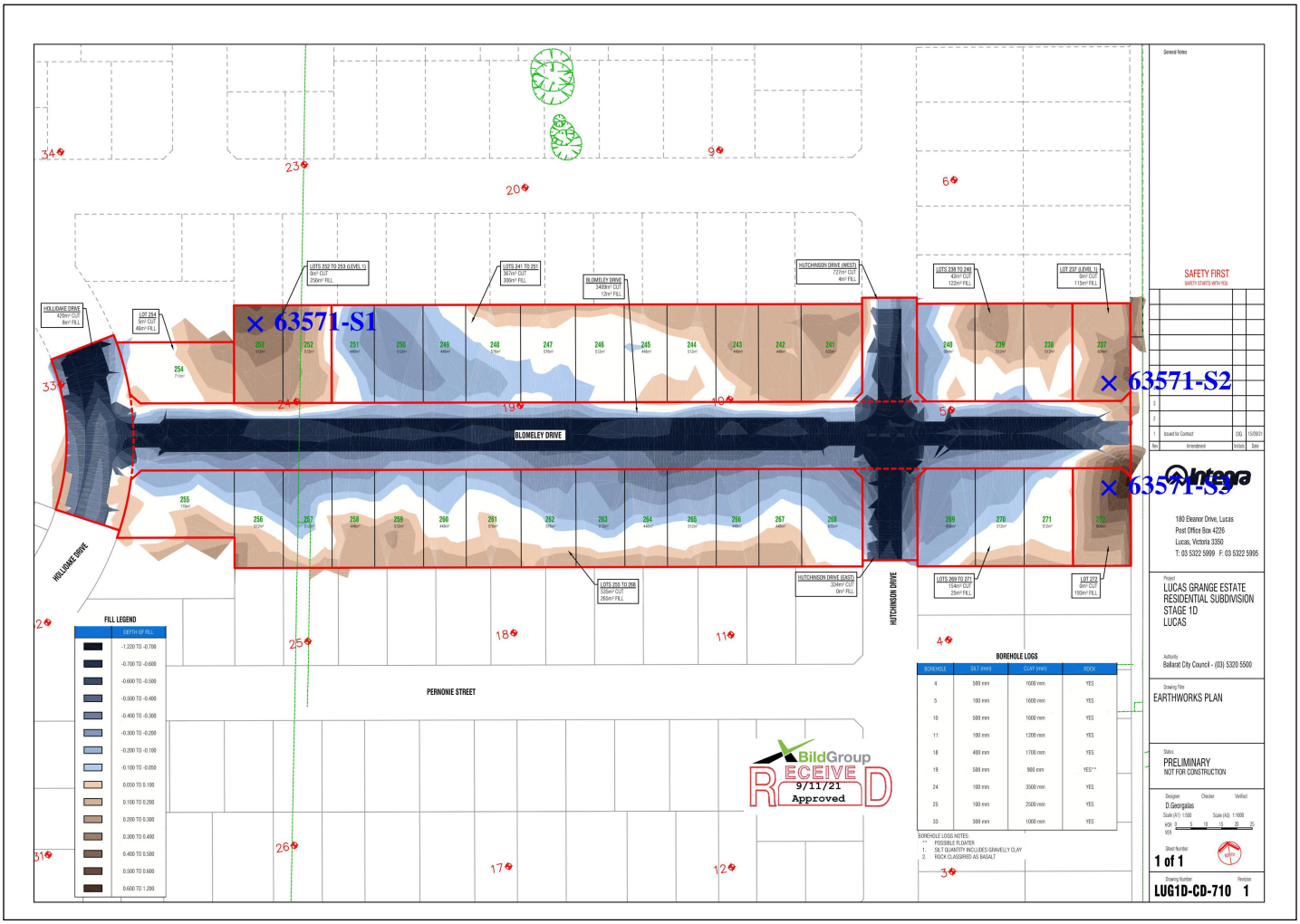
Lot #	Sample #	Date Sampled	Location	Latitude	Longitude	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	63571-S1	18/05/2022	From n/w corner of lot 253	5m south	5m east	**	2	98.0	-1.5	26.4	1.98
**	63571-S2	18/05/2022	From n/w corner of lot 237	20m south	12m east	**	3	100.0	-1.0	27.2	1.98
**	63571-S3	18/05/2022	From n/w corner of lot 272	15m south	15m east	**	4	96.0	-0.5	33.0	2.02

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

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

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brent Elliott
Laboratory 2IC
NATA Accredited Laboratory Number: 15055

Report Number: **GS6357/1-1**
Issue Number: 1
Date Issued: 20/05/2022
Client: BildGroup
7 Metrolink Circuit, Campbellfield, Melbourne VIC 3061
Project Number: GS6357/1
Project Name: Lucas Grange - Stage 1D (Level 1)
Project Location: Ballarat
Work Request: 8403
Date Sampled: 18/05/2022 11:00
Dates Tested: 18/05/2022 - 19/05/2022
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: Ballarat
Material: Silty CLAY, medium to high plasticity, brown

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1			
Sample Number	63571-S1	63571-S2	63571-S3
Date Tested	18/05/2022	18/05/2022	18/05/2022
Time Tested	11:32	11:58	12:37
Test Request #/Location	From n/w corner of lot 253	From n/w corner of lot 237	From n/w corner of lot 272
Latitude	5m south	20m south	15m south
Longitude	5m east	12m east	15m east
Layer / Reduced Level	2	3	4
Thickness of Layer (mm)	150	150	150
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)	125	125	125
Sieve used to determine oversize (mm)	19.0	19.0	19.0
Percentage of Wet Oversize (%)	3	1	0
Field Wet Density (FWD) t/m^3	1.98	1.98	2.02
Field Moisture Content %	26.4	27.2	33.0
Field Dry Density (FDD) t/m^3	1.56	1.56	1.52
Peak Converted Wet Density t/m^3	**	**	2.10
Adjusted Peak Converted Wet Density t/m^3	2.01	1.98	**
Moisture Variation (Wv) %	**	**	-0.5
Adjusted Moisture Variation %	-1.5	-1.0	**
Hilf Density Ratio (%)	**98.0**	**100.0**	**96.0**
Compaction Method	**Standard**	**Standard**	**Standard**
Report Remarks	**	**	**

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

APPENDIX C

Site Photographs