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LEVEL 1 INSPECTION & TESTING HARRIOTT ESTATE STAGE 6 ARMSTRONG CREEK

Prepared for BILD Group Pty Ltd

Report Reference: GSSW1547.1 AA

Date: 22 March 2023

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PROJECT DETAILS

Project Reference	GSSW1547.1	Rev	AA
Project Title	Harriott Estate Stage 6		
Project Location	Armstrong Creek	State	VIC
Date	22 March 2023		

CLIENT DETAILS

Prepared For (Client)	BILD Group Pty Ltd
Client Address	133 Metrolink Cct, Campbellfield VIC 3061

DISTRIBUTION

Original Held By	Ground Science South West Pty Ltd
One (1) Electronic Copy	BILD Group Pty Ltd

This document presents the results of the Level 1 Inspection and Testing performed by Ground Science South West 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:

Michael Knez
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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 South West Pty Ltd for the Harriott Estate Stage 6 project, located within Armstrong Creek, Victoria (the site).

2. PROJECT UNDERSTANDING

It is understood that the project involves the placement of fill as part of the bulk earthworks phase for Harriott Estate Stage 6. Ground Science was engaged to provide Level 1 Inspection and Testing services for the construction of these areas. Authorisation to proceed was provided by BILD Group Pty Ltd (the 'Client'). GPR Consulting Pty Ltd prepared the civil drawings for the project.

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' and AS1726 (2017) 'Geotechnical Site Investigations'. 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.

3. SCOPE OF WORK

3.1 AREAS OF WORK

Ground Science provided Level 1 Inspection and Testing services for the construction of fill in areas requiring greater than 200mm of fill to achieve finished levels. The areas requiring Level 1 Inspection & Testing are shown on the supplied construction drawing, on Figure 1, prepared by GPR Consulting Pty Ltd (Harriott at Armstrong Creek Stage 6 - Layout Plan [0352-06-R02 Rev A]).

This report details the Level 1 earthworks process performed on site which commenced on 23rd of June 2022 and was completed on the 21st of July 2022, requiring 1 full day and 1 half day of inspection and testing works.

3.2 PLACEMENT METHODOLOGY

A technical specification for the fill operations 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 250mm 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 our understanding that future building loads would be similar to residential type structures (i.e. non-commercial structural loading);
- The fill was moisture conditioned to within +/- 3% of the standard optimum moisture content;
- The fill material was sorted and mixed to eliminate 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 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.

4. INSPECTION AND TESTING

4.1 SUBGRADE PREPARATION

Site stripping was carried out prior to Ground Science South West's involvement in the project. It is understood that BILD Group removed all organics, topsoil and compressible (soft) soils between 20th and 22nd of June 2022. Inspection of the newly prepared subgrade surface was carried out on 23rd of June 2022 by the representative geotechnician from Ground Science South West. A proof roll with a 16 tonne water cart truck was performed and was noted to show minimum deflection. At the time of the inspection, the prepared subgrade was observed to be generally close of optimum moisture content. The prepared subgrade surface was then inspected and deemed suitable for subsequent works to proceed.

The above stripped subgrade was visually assessed using tactile methods described in AS1726 (2017) and approved by the GITA representative throughout the project.

4.2 CONSTRUCTION MATERIALS

The fill material used in this project was nominated by the on-site contractor. All the materials used for the project was sourced from on site. The material was carted to site in dump trucks 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 CLAY, high plasticity, brown, trace sand, moist. Ground Science did not perform any quality assurance, quality control, chemical or environmental analysis on the above fill material.

The fill source was assessed to range from dry to close of the optimum moisture content. Portions of the fill material that were found to be dry were moisture conditioned using a water cart prior to compaction. All fill materials were generally considered suitable for use as engineered fill.

4.3 FILL CONSTRUCTION

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

- Bulldozer;
- Scraper;
- Water Cart;
- Padfoot Compactor.

During fill placement, the weather conditions were fine to rain with temperatures typically ranging from 5 to 17 degrees Celsius.

The filling process was generally consistent throughout the project and involved the approved fill stockpiled adjacent to the fill placement zones. The material was spread using a scraper or bulldozer into thin loose layers. These layers were then moisture conditioned by a water cart, applying a minimum of 1-2 passes to bring the placed material close to optimum moisture content. Each layer was compacted using a padfoot roller applying a minimum of 5-8 passes, per layer observed. The thin layers of fill were compacted to form a composite layer, measuring 200mm thick, prior to undertaking the field density testing. This process was adopted for the fill placement works.

4.4 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 3 in-situ density tests using a nuclear moisture-density gauge in accordance with Australian Standard (AS1289 5.8.1) together with 3 "Rapid HILF" Compaction tests (AS1289 5.7.1).

Field density and compaction control testing report sheets are presented in Appendix A. It should be noted that the tests are a representation of the fill placed and support the visual assessment of the works completed. No test areas failed to meet the required target density ratio or the required moisture condition.

4.5 FINAL SURFACE LEVELS

Observations were made by a Ground Science staff member that filling had been complete up to the nominated finished levels designated on Figure 1 as per confirmation provided from the contractor's site foreman. We understand that the observed final levels are the constructed finished surface levels of the controlled fill. The overall fill depths are estimated using onsite visual tactile 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.

5. 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 guidelines provided by the technical specification provided in 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 amounts of fill placed and do not necessarily reflect an accurate survey of the fill levels.

6. 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 wetlands, 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.

**For & on behalf of
Ground Science Pty Ltd**

AUTHOR:



**Michael Knez
Geotechnical Engineer**

REVIEWED:



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

7. 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.

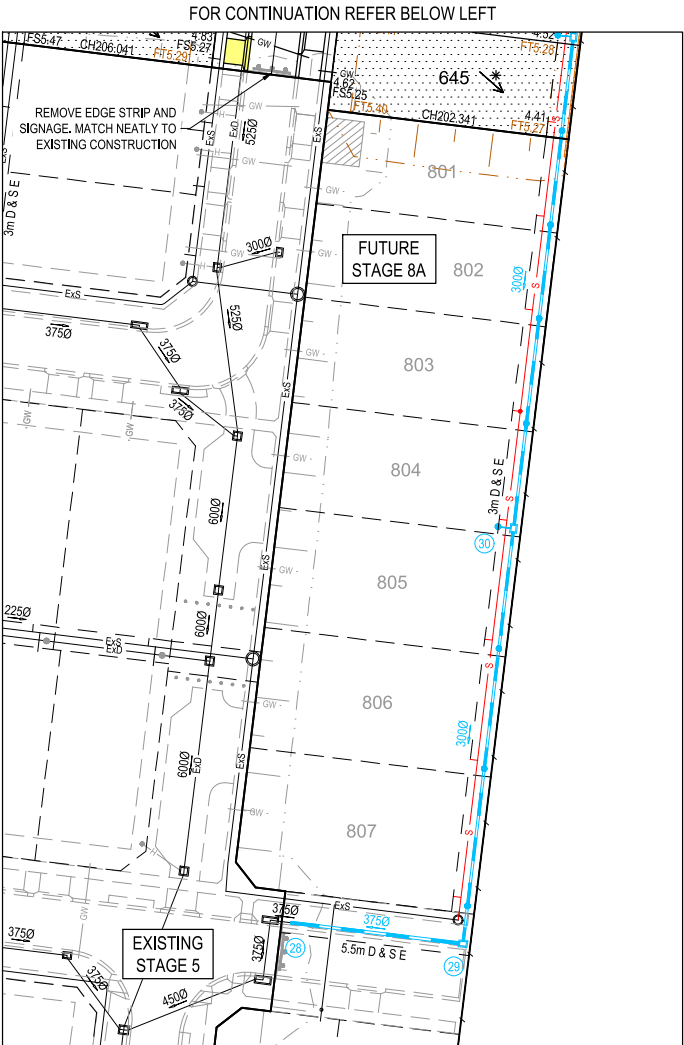
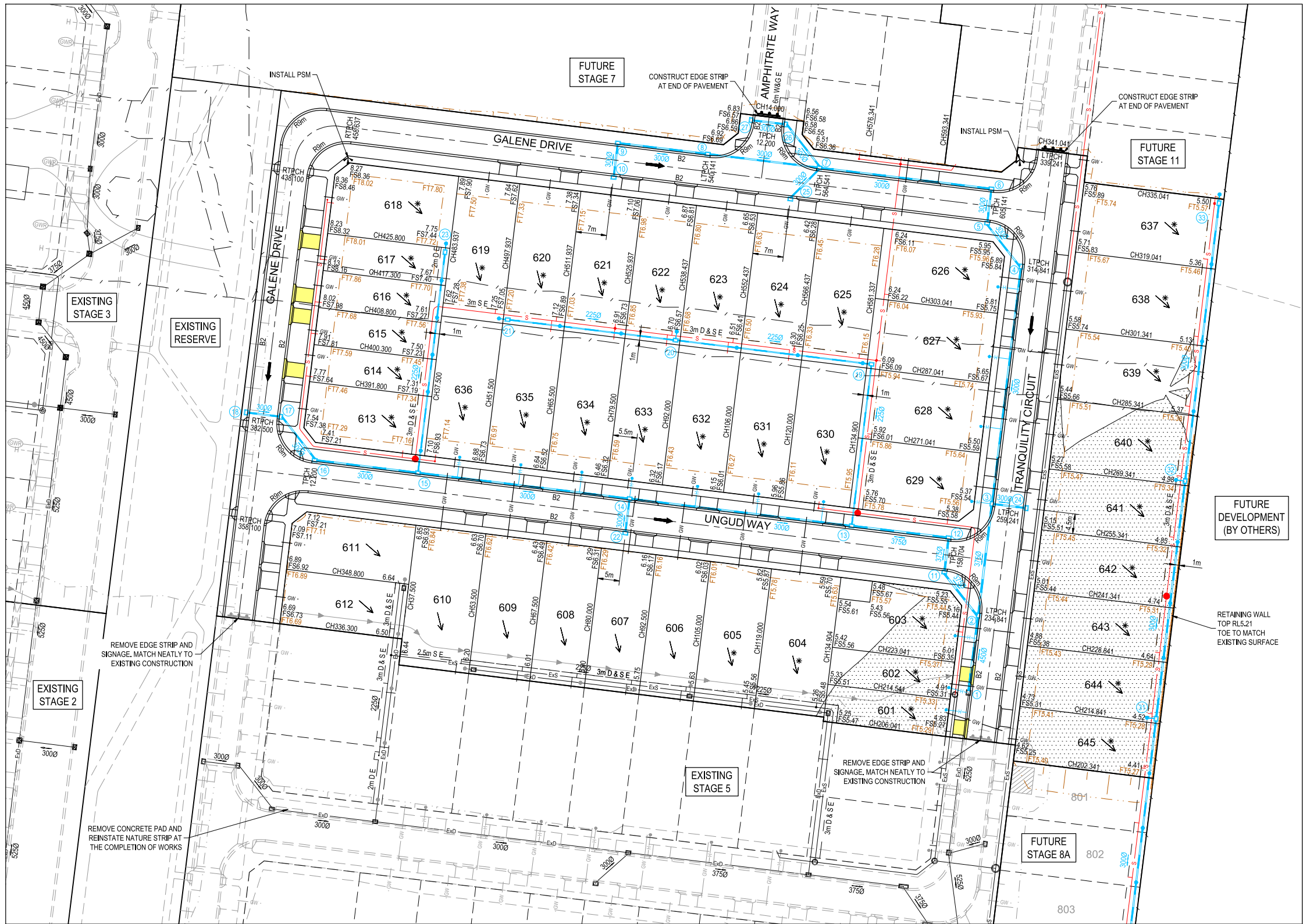
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8. REFERENCES

- AS3798 (2007) Guidelines on Earthworks for Residential and Commercial Developments.
- AS2870 (2011) Residential Slabs and Footings.
- AS1289 Methods of Testing Soils for Engineering Purposes.
- AS1726 (2017): Geotechnical Site Investigations

FIGURE 1

Harriott at Armstrong Creek Stage 6 - Layout Plan [0352-06-R02 Rev A]



SERVICES OFFSET SCHEDULE								
STREET NAME	ROAD RESERVE	BACK OF KERB	SEWER	GAS	NON DRINKING WATER	DRINKING WATER	COMMUNICATIONS	ELECTRICITY
AMPHITRITE WAY	14.50	2.85 W / 4.35 E	-	2.10 E	2.60 E	3.10 E	0.55 W	1.30 W
GALENE DRIVE (LOT 612 TO 618)	14.50	1.35 W / 5.85 E	1.00 E	1.90 E	2.40 E	2.90 E	3.60 E	4.40 E
GALENE DRIVE (LOT 618 TO 623)	14.50	2.85 N / 4.35 S	-	2.10 S	2.60 S	3.10 S	0.55 N	1.30 N
GALENE DRIVE (LOT 623 TO 626)	16.00	4.35	1.00 N	2.10 S	2.60 S	3.10 S	2.05 N	2.80 N
TRANQUILITY CIRCUIT	16.00	4.35	1.00 W & E	2.10 E	2.60 E	3.10 E	1.85 W	2.60 W
UNGUD WAY	16.00	4.35	1.00 N	2.10 N	2.60 N	3.10 N	1.85 S	2.60 S

VEHICLE CROSSINGS		
STANDARD VEHICLE CROSSINGS ARE TO BE 4.0m WIDE OFFSET 1.0m FROM THE SIDE BOUNDARY		
NON STANDARD VEHICLE CROSSINGS ARE TO BE LOCATED AS PER BELOW		
LOT	WIDTH (m)	OFFSET (m)
601	3.3	0.75
602	3.3	0.75
614	3.3	0.60
615	3.3	0.75
616	3.3	0.75
617	3.3	0.60

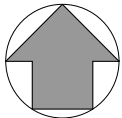
NOTE: HOUSE DRAINS
HOUSE DRAIN TO LOTS 601 & 602 TO BE CONNECTED TO EXISTING DRAINAGE.

NOTE: SWALE DRAINS
EXISTING SWALE DRAINS TO BE EXCAVATED TO A SOUND BASE AND FILLED AS SPECIFIED.

NOTE: FENCING
EXISTING FARM FENCES WITHIN THE WORKS AREA ARE TO BE REMOVED AND DISPOSED OFFSITE.

WARNING
BEWARE OF UNDERGROUND SERVICES
The locations of underground services are approximate only and their exact position should be proven on site.
No guarantee is given that all existing services are shown. Locate all underground services before commencement of works.
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Rev	Amendment	Des/Dft	App'd	Date	Legend				
A	Initial Issue	GP/DP	MG	16/03/22	Existing Drainage	— H —	Ex D	Drainage	— H —
					Existing Sewer	— Ex S —	Main Drainage	— H —	Finished Surface Level at Title
					Existing Gas	— Ex G —	Sewer	— S —	Level at Top/Toe of Batter/Ridge
					Existing Electricity UG	— Ex E —	Swale Drain	— S —	Centreline Chainage
					Existing Electricity OH	— OH E —	Gas & Water Conduits	— GW —	Sleeper Retaining Wall
					Existing Communications	— Ex T —	Direction of Lot Fall	— F —	Rock Retaining Wall
					Existing Drinking Water	— Ex DW —	Direction of Overland Flow	— OF —	PSM / TBM
					Existing Non Drinking Water	— Ex NDW —	Alignment to be Evenly Graded	— AG —	Structural Fill > 200mm
					Existing Swale Drain	— SD —	Vehicle Crossings	— VC —	Concrete Infill



Principal
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Council City of Greater Geelong
Project **Harriott at Armstrong Creek Stage 6**
Title **Layout Plan**
Designed: G.Pratt
Drafted: D.Pratt
Authorised: M.Graham
Date: February 2022

Scale @ A1: 1:500
0 5 10 15 20 25
Drawing No. **0352-06-R02**
Sheet 02 of 23
Rev **A**

APPENDIX A

Field Density Test Report Sheets & Test Locations

Material Test Report

Report Number: GSSW1547-1A
Issue Number: 1
Date Issued: 22/02/2022
Client: BILD GROUP (CAMPBELLFIELD, VIC)



Ground Science South West

Geotechnical & Environmental Consultants

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10 Dowsett Street South Geelong Vic 3220
Phone: (03) 5282 1566

Email: chrism@groundscience.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Project Number: GSSW1547
Project Name: HARRIOT ESTATE STAGE 6
Project Location: ARMSTRONG CREEK
Client Reference: PO - UG0109
Work Request: 15139
Date Sampled: 21/07/2022
Dates Tested: 22/07/2022 - 22/07/2022
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
Material: CLAY, with sand, trace gravel, brown, medium to high plasticity
Material Source: Site Won Fill



Approved Signatory: Chris Mamalis
Laboratory Manager
NATA Accredited Laboratory Number: 20109

Compaction Control AS 1289 5.7.1 & 5.8.1 & 2.1.1

Sample Number	1547-S1	1547-S2	1547-S3
Date Tested	21/07/2022	21/07/2022	21/07/2022
Time Tested	13:41	13:52	16:20
Test Request #/Location	Lot 601 - See attached plan	Lot 640 - See attached plan	Lot 645 - See attached plan
Layer / Reduced Level	1	1	2
Thickness of Layer (mm)	300	300	300
Soil Description	CLAY, with sand, trace gravel, brown, medium to high plasticity	CLAY, with sand, trace gravel, brown, medium to high plasticity	CLAY, with sand, trace gravel, brown, medium to high plasticity
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 ³	2.06	2.04	2.02
Field Moisture Content %	19.6	19.3	19.2
Field Dry Density (FDD) t/m ³	1.72	1.71	1.69
Peak Converted Wet Density t/m ³	2.01	2.01	2.02
Adjusted Peak Converted Wet Density t/m ³	**	**	**
Moisture Variation (Wv) %	1.5	2.0	2.0
Adjusted Moisture Variation %	**	**	**
Hilf Density Ratio (%)	102.5	101.5	100.0
Compaction Method	Standard	Standard	Standard
Report Remarks	**	**	**

Moisture Variation Note:

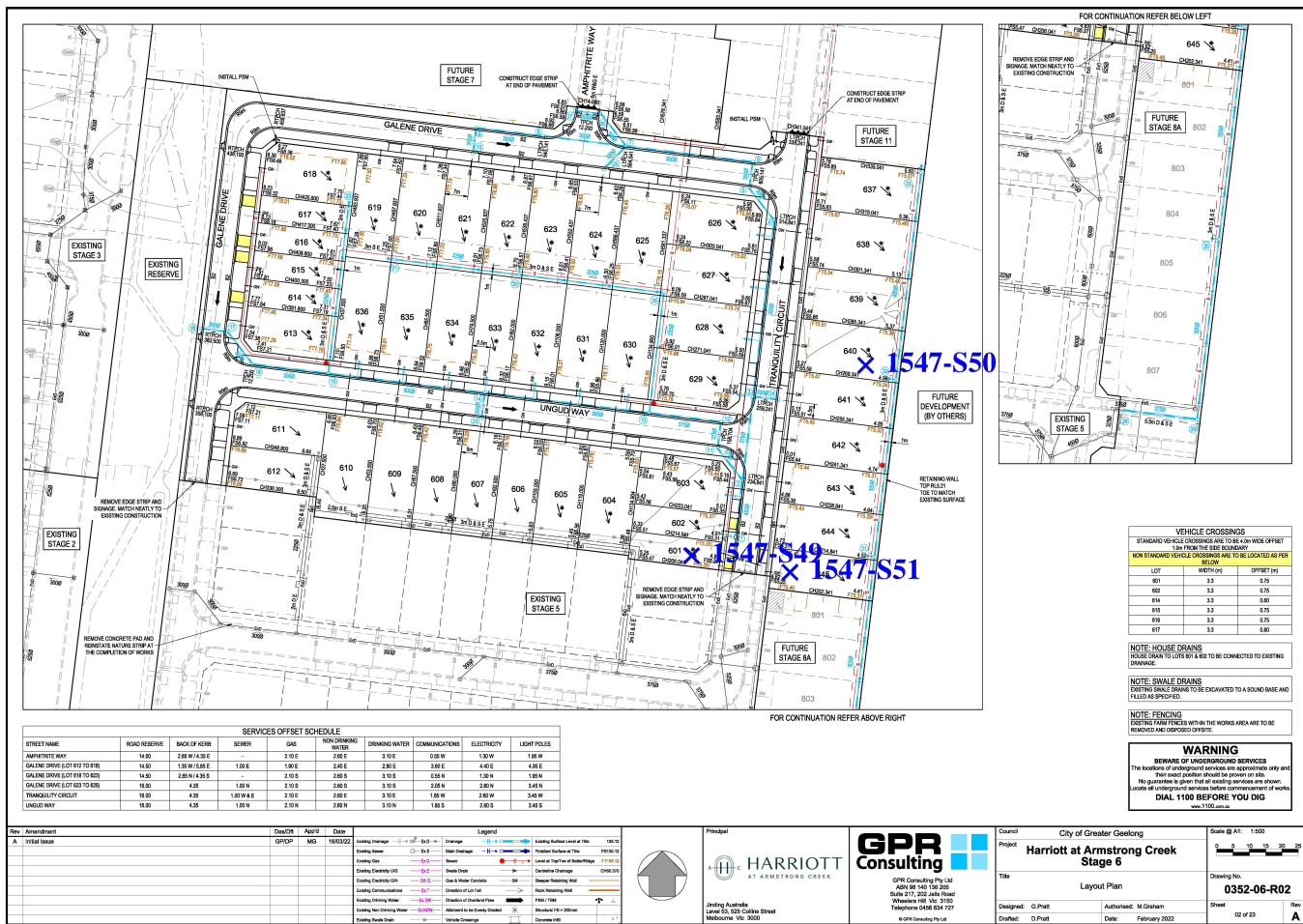
Positive values = test is dry of OMC

Negative values = test is wet of OMC

Sample Locations Plan



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APPENDIX B

Site Photographs





