Douglas PARTNERS

GROUNDED EXPERTISE

Report on Lot Classification and Salinity Assessment

Proposed Residential Subdivision

Light Green - Cobbitty Road, Cobbitty NSW

Prepared for Mirvac Homes Pty Ltd

Project 92323.21

26 September 2025

Document History

Details

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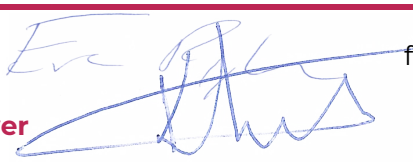
The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

Signature		Date
Author	 for AS	26 September 2025
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Report on Lot Classification and Salinity Assessment
Proposed Residential Subdivision
Light Green - Cobbitty Road, Cobbitty NSW

1. Introduction

This report presents the results of a lot classification and salinity assessment undertaken for a proposed residential subdivision at Light Green - Cobbitty Road, Cobbitty NSW. The investigation was undertaken in accordance with Douglas Partners Pty Ltd (Douglas) proposal 92323.21.P.002.Rev0 dated 11 December 2024.

The creation of 14 residential lots (Lots 2101 – 2114) and one super lot (Lot 2115) is proposed, and investigation was carried out to provide information on the subsurface conditions to determine the classification of each lot in accordance with the requirements of AS 2870:2011 *Residential Slabs and Footings* and to provide a post bulk earthworks Salinity Management Plan (SMP).

The investigation comprised test pit excavation and dynamic cone penetrometer (DCP) testing followed by laboratory testing of selected samples, engineering analysis and reporting. Details of the field work and laboratory test results are given in this report, together with comments relating to design and construction practice.

This report should be read in conjunction with the notes *About this Report* and the explanatory notes included in Appendix A and Appendix B respectively.

2. Background

Previous investigation within the site was undertaken by Douglas with details given in a report titled "*Report on Preliminary Salinity Assessment, Proposed Residential Subdivision, Lot 2005, D.P. 1162239, Cobbitty, NSW*" (Project 92323.01) dated February 2020 (Douglas, 2020). In summary, results from the Douglas 2020 investigation indicate that the soils underlying the site were non-saline to moderately saline.

Detailed salinity assessment was also undertaken by Geotest Services Pty Ltd (Geotest) with results given in a report titled *"Detailed Salinity Assessment Report, 321 The Northern Road, Cobbitty NSW 2570"* (Project Ref. P33603.1_R01) dated 2 February 2022 (Geotest, 2022). In summary, results from the Geotest 2022 assessment indicate that the soils underlying the site are non-saline to moderately saline, moderately aggressive to concrete and non-aggressive to steel.

3. Site description

The site is an irregular shape with maximum north-south and east-west plan dimensions of some 140 m and 290 m respectively with an approximate area of 1.4 ha. It is bounded in all directions by various stages of the ongoing residential development at Cobbitty. The surface levels across the site are generally flat, with a slight fall towards the south at an approximate grade of 1 in 22. The overall difference in level from the lowest part of the site (Pit 10, RL 76.1 mAHD) to the highest part (Pit 1, RL 79.9 mAHD) is approximately 3.8 m.

At the time of the investigation, bulk earthworks were complete, and topsoil had been spread across the lots.

4. Regional geology

Reference to the NSW Seamless Geological Series (GSNSW, 2019) indicates that the site is underlain by Bringelly Shale of the Wianamatta Group of Triassic age. This formation typically comprises shale, carbonaceous claystone, laminite, fine to medium-grained lithic sandstone with occasional coal and tuff. Bringelly Shale typically weathers to form clays of medium to high plasticity. The results of the investigation were consistent with the broad-scale geological mapping with shale encountered in nine out of the 10 test pits that extended beyond residual clays.

5. Field work

5.1 Methods

The field work comprised excavation of 10 test pits (Pits 1 – 10) using an 8-tonne Kobelco excavator or a CAT 432 backhoe fitted with a 450 mm wide toothed bucket, to depths of 0.5 – 1.8 m. The pits were logged on site by a geotechnical engineer who the collected disturbed and 'undisturbed' samples (in 50 mm diameter thin-walled steel tubes) to assist in strata identification and for laboratory testing.

Dynamic cone penetrometer (DCP) tests (AS 1289.6.3.2) were carried out to depths of up to 1.2 m adjacent to each test location to assess the penetration resistance of the near-surface soils. The results are shown on the attached logs (Appendix B).

The test locations were nominated and located on site by Douglas and are shown on Drawing 1 (Appendix B). The surface levels relative to the Australian Height Datum (AHD) and coordinates to MGA20 given on the logs were recorded using a differential GPS unit for which accuracy of ±0.1 m is typical. It is important to note that Douglas is not a registered surveyor, hence the coordinates and elevations given are considered approximate.

5.2 Results

The results of the test pits are shown on the logs presented in Appendix B and should be read in conjunction with the standard notes defining classification methods and descriptive terms (refer Appendix B). In summary, the succession of strata encountered is broadly summarised below:

Topsoil fill	Silty clay topsoil fill encountered to depths of 0.05 – 0.4 m at all test pits.
Fill (controlled):	Silty clay fill encountered to a depth of 0.9 m at Pit 10.
Residual clay:	Generally stiff to hard, medium to high plasticity silty clay encountered to depths of 0.2 – 1.8 m at all test pits except Pits 5 and 7.
Rock:	Generally, very low to medium strength shale encountered at all test pits except Pit 10, from depths of 0.05 - 1.5 m and continuing to the termination depths of 0.5 – 1.8 m.

No free groundwater was observed at any of the test pits during the field work. It is noted that following excavation and sampling, the test pits were immediately backfilled which precluded

longer term monitoring of groundwater levels. Furthermore, groundwater levels are influenced by soil/rock permeability, changes in site topography and preceding climatic conditions and can therefore fluctuate with time.

6. Laboratory testing

6.1 Plasticity and field moisture content

Selected samples from the test locations were tested in the laboratory for measurement of field moisture content and plasticity. The detailed laboratory test report sheets are presented in Appendix C, with the results summarised in Table 1.

Table 1: Summary of test results – plasticity

Pit No.	Depth (m)	FMC (%)	LL (%)	PL (%)	PI (%)	LS (%)	Material
2	0.5 – 0.63	13.9	49	18	31	14.0	Residual silty clay
3	0.5	25.4	66	23	43	12.5	Residual silty clay
8	0.5	17.3	54	20	34	13.5	Residual silty clay, with XW-HW shale bands

Where: FMC = Field moisture content; LL = Liquid limit; LS = Linear shrinkage; PL = Plastic limit; PI = Plasticity Index

The field moisture content of the plasticity test samples were 4.1% dry to 2.4% wet of the plastic limit. The plasticity results indicate the soils tested would be susceptible to shrink-swell movements with changes in the soils moisture content.

6.2 Salinity, aggressivity, sodicity and dispersibility

Selected samples collected from the test pits were tested in the laboratory for determination of aggressivity to concrete and steel, sodicity (erosion potential), Emerson class number (dispersion potential), textural classification and salinity.

The detailed laboratory report sheets along with Summary Table C1 presenting the individual test results are presented in Appendix C. Table C1 also presents aggressivity and salinity classifications for each sample tested based on pH, chloride concentration, sulphate concentration, calculated resistivity and calculated ECe values.

The number of samples tested for each parameter and the range of test results obtained are summarised in Table 2.

Table 2: Results of Laboratory Testing – Chemical

Parameter		Units	Number of Tests	Range of Results
pH		pH units	15	4.7 – 9.0
Chlorides		(mg/kg)	8	10 – 1000
Sulphates		(mg/kg)	8	10 – 130
Aggressivity (AS 2159: 2009)	to Concrete	-	15	Non-aggressive to mildly aggressive
	to Steel	-	15	Non-aggressive to mildly aggressive
Exchangeable Sodium (Na)		(meq/100g)	1	0.7
CEC (cation exchange capacity)		(meq/100g)	1	4.0
Sodicity [Na/CEC]		(ESP%)	1	18
Sodicity Class		[after DLWC]	1	Highly sodic
Emerson Class Number		-	1	3
EC1:5 [Lab.]		(mS/cm)	15	85.6 – 643.9
Resistivity		Ω.cm	15	1553 – 11682
ECe [M x EC1:5]		(dS/m)	15	0.6 – 4.5
Salinity Class (Richards, 1954)		-	15	Non-saline to moderately saline

Where M = soil textural factor

6.2.1 Salinity

Sample salinity classifications (refer Table C1, Appendix C) are based on calculated ECe values using the method of Richards *"Diagnosis of Saline and Alkaline Soils."* (Richards, 1954).

The results indicate that 11 samples were non-saline, three samples were slightly saline, and one sample was moderately saline.

6.2.2 Aggressivity

Sample aggressivity classifications (refer Table C1, Appendix C) are based on pH, sulphate concentration, chloride concentration and calculated resistivity values and are assessed in accordance with AS 2159 *"Piling Design and Installation"* (AS 2159, 2009). The inferred very low permeability of the sampled clay-rich soils indicates that soils at all test pits are in Condition "B" (AS 2159, 2009).

The results indicate that:

- 10 samples were non-aggressive and five were mildly aggressive to concrete; and
- 13 samples were non-aggressive and two were mildly aggressive to steel.

6.2.3 Sodicity and dispersibility

The sodicity test results (refer Table C1, Appendix C) indicate soils are highly sodic and would have potential for soil erosion if left exposed. Emerson class number testing undertaken on one sample at a depth of 0.5 m below ground level indicate shallow soils are Class 3, indicating high potential for dispersion.

7. Comments

7.1 General

The following comments are based on a review of information provided to Douglas; the surface and subsurface profiles encountered at the time of the investigation and the results of laboratory testing of selected samples from within the proposed development area.

7.2 Geotechnical model

Based on a review of the geological mapping and experience on the site, the geotechnical model includes:

- Silty clay topsoil fill;
- Locally, controlled silty clay fill (encountered only in Pit 10 to a depth of 0.9 m);
- Residual silty clays – typically stiff to hard; and/or
- Rock comprising shale, typically very low to medium strength, belonging to the Bringelly Shale formation.

Groundwater likely to be within the underlying rock profile, although seepage would be expected at the clay/rock interface and through rock joints, subject to preceding climatic conditions. It is noted that groundwater levels can fluctuate with seasonal climatic changes and variability in the permeability of the subsurface strata.

7.3 Fill placed on allotments

To achieve design levels, fill to depths up to 1.0 m has been placed in the southern portion of Lot 2115 as shown on the WAE fill plan dated 15 September 2025 prepared by Orion Consulting Engineers Pty Ltd (Appendix D). It is understood that the WAE fill plan is based on the difference in levels of the stripped surface and the finished surface of controlled fill. Based on the WAE fill plan and the results of the field investigation, the depth of fill placed on the individual lots is summarised in Table 3. It is noted that there may be some localised discrepancies in actual fill depths on site and the WAE contours where tree stumps or similar objects have been removed, and the localised holes backfilled with controlled fill.

Table 3: Controlled fill summary

Lot no.	Depth of controlled fill (m)	Lot no.	Depth of controlled fill (m)	Lot no.	Depth of controlled fill (m)	Lot no.	Depth of controlled fill (m)
2101	0	2105	0	2109	0	2113	0
2102	0	2106	0	2110	0	2114	0
2103	0	2107	0	2111	0	2115	0 – 1.0
2104	0	2108	0	2112	0		

The results of Level 1 testing carried out by Douglas indicate that the project specification minimum density ratio of 98% relative to Standard maximum dry density (SMDD) has been achieved. This satisfies Camden Council's specified minimum dry density ratio of 95% SMDD. Moisture content of the fill was maintained within 2% of OMC (where OMC is the optimum moisture content for Standard compaction). An Earthworks Quality Report (EQR) has been prepared (Project 92323.21) for earthworks testing operations and inspections completed during the period 24 April 2024 and 26 November 2024 for Tr 4 St 3a ("Cyan") and "Light Green" Subdivision, Cobbitty NSW. The EQR is included in Appendix C and includes the test result summary sheets and a test location plan.

7.4 Lot classification

Lot classification has been carried out by estimation of characteristic surface movements (y_s) using the methods outlined in (AS 2870, 2011), taking account of the subsurface profiles determined from the test locations and WAE fill plan, together with inferred shrink-swell index values from laboratory soil plasticity test results.

Characteristic surface movements (y_s) of up to approximately 60 mm are predicted for the lots. Accordingly, the lot classifications have been determined and are summarised in Table 4.

Table 4: Lot classification summary

Lot no.	Lot classification
2101 – 2109	H1
2110 – 2114	M
2115	H1*

Where: M = Class M (moderately reactive) H1 = Class H (highly reactive)
Note: (*) Denotes a filled lot

It should be noted that the classifications given in Table 4 are appropriate for the undeveloped lots at the time of this report and revision of the classifications may be required once development details and proposed site works for individual lots are known. AS 2870 (2011) recommends that the classification of a site should be reconsidered if the depth of subsequent cutting exceeds 0.5 m or depth of subsequent fill exceeds 0.4 m.

7.5 Site preparation

Subject to site-specific design requirements, site preparation for the construction of residential structures will most likely include the removal of all vegetation, organic topsoils and other deleterious materials from the building area.

Where a level building platform is to be constructed by cut and fill methods, reference should be made to AS 2870 which gives guidelines on fill placement methods and specification for compaction. The placement and compaction of fill should also be carried out in accordance with the requirements of Camden Council.

The requirements of Camden Council for controlled fill specify compaction of cohesive (clay) fill to a minimum dry density ratio of 95% relative to Standard compaction. Moisture content of the fill should be maintained near OMC measured in the Standard compaction test. Density testing would be required to confirm the placement of fill in the above controlled manner.

7.6 Footings

It is recommended that footing systems be designed and constructed in accordance with AS 2870 for the nominated classification (refer Section 6.4) and the additional requirements given in this report.

Footing systems founded uniformly in natural stiff or stronger clay or controlled fill could be designed using an allowable bearing pressure of 100 kPa. Footings founded in very low strength (or stronger) rock could be designed using an allowable bearing pressure of 700 kPa.

Where footing systems are proposed adjacent to services or retaining walls or located through areas of uncontrolled fill (for example, following construction of a level building platform placed without engineering control), local deepening of the footings or alternatively the inclusion of piers will most likely be required. Founding levels should also be constructed below the zone of influence of the service trenches and retaining walls, which is generally taken to be within a 45° (i.e.: 1 horizontal:1 vertical) line extending from the base of the trench or retaining wall to the ground surface and through fill to the residual (undisturbed) soils or weathered rock.

Where partial rock foundations result following construction of cut to fill platforms or where exposed conditions include controlled fill, residual soils/rock and/or large variations in controlled fill depth, reference must be made to AS 2870:2011 regarding the provision of articulation within the structure and/or the construction of a foundation system that provides uniform bearing.

All footing systems should be designed and constructed in accordance with sound engineering principles, with care exercised to ensure that footing trenches/piers are inspected for design compliance prior to the placement of steel and pouring of concrete.

Where raft slabs are proposed, the raft stiffness should be designed in accordance with the designated lot classification and the requirements of AS 2870:2011. If a suspended raft is proposed, then it must take account of the likely range of swell movements of the construction platform for the relevant classification.

Masonry walls should be articulated in accordance with Cement Concrete & Aggregates Australia *"Technical Note 61, Articulated Walling"* (CCAA, 2008).

7.7 Site management and drainage

The site classifications in Section 6.4 are conditional on the developed lots being maintained in accordance with the CSIRO publication *Foundation Maintenance and Footing Performance: A Homeowners Guide,* a copy of which is included in Appendix E.

Whilst it must be accepted that some minor cracking in most structures is inevitable on reactive sites, the guide describes suggested site maintenance practices aimed at limiting foundation movements and at keeping cracking within acceptable limits.

Surface drainage should be installed and maintained at the site. If drainage measures (surface and subsurface) are not installed and maintained adverse moisture conditions could arise, and footing performance could be compromised. All collected stormwater, groundwater and roof runoff should be discharged into the stormwater disposal system.

8. Salinity management plan

Based on the laboratory test results and encountered subsurface and groundwater conditions, the adopted aggressivity to concrete and steel and salinity classifications for each lot are summarised in Table 5.

Table 5: Aggressivity and salinity classification summary

Lot no.	Exposure classification for concrete (AS 3600)	Exposure classification for concrete piles (AS 2159)	Exposure classification for steel piles (AS 2159)	Salinity classification (Richards 1954)
2101 – 2109	A2	Mildly aggressive	Non-aggressive	Non-saline
2110 – 2114	A2	Mildly aggressive	Mildly aggressive	Moderately saline
2115	A2	Mildly aggressive	Non-aggressive	Slightly saline

The classifications given in Table 5 must be taken into account by the designer when determining durability and corrosion requirements as per AS 3600:2018 *"Concrete Structures"* (AS 3600, 2018), AS 2159:2009 *"Piling Design and Installation"* (AS 2159, 2009) and *"Precast concrete pipes"* (AS 4058, 2007) for:

- Concrete foundations and concrete structure (AS 3600).
- Concrete piles (AS 2159).
- Corrosion allowances for steel (as per AS 2159).
- Precast concrete pipes (as per AS 4058).

The above should be complementary to standard building practices.

This salinity management plan (SMP) is a post earthworks assessment only and as such, the classifications given within do not apply to services previously installed during the bulk earthworks and civil works phases of the development.

9. References

AS 2159. (2009). *Piling Design and Installation.* Standards Australia.

AS 2870. (2011). *Residential Slabs and Footings.* Standards Australia.

AS 3600. (2018). *Concrete Structures.* including Amendment 1:2018 and Amendment 2:2021: Standard Australia.

AS 4058. (2007). *Precast Concrete Pipe (Pressure and Non-Pressure).* Australian Standard.

CCAA. (2008). *TN61, Articulated Walling*. Technical Note 61, 3rd Edition: Cement Concrete & Aggregates Australia.

Douglas. (2020). *Report on Preliminary Salinity Assessment, Proposed Residential Subdivision, Lot 2005, D.P. 1162239, Cobbitty, NSW.* Macarthur: Douglas Partners Pty Ltd, Project 92323.01.

Geotest. (2022). *Detailed Salinity Assessment Report, 321 The Northern Road, Cobbitty NSW 2570.* Sydney: Geotest Services Pty Ltd, Project Ref. P33603.1_R01.

Richards, L. A. (1954). *Diagnosis of Saline and Alkaline Soils.* Washington D.C: US Department of Agriculture.

10. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at Light Green - Cobbitty Road, Cobbitty NSW in line with Douglas' proposal dated 11 December 2024. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of Mirvac Homes Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by Douglas in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations.

The assessment of atypical safety hazards arising from this advice is restricted to the (geotechnical) components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed ‘safety in design’ assessment is outside the current scope of this report and requires additional project data and assessment.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

Appendix A

About this Report

About this Report

October 2024

Introduction

These notes have been provided to amplify Douglas' report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

Douglas' reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, Douglas will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, Douglas cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, Douglas will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, Douglas requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. Douglas would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

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Appendix B

Explanatory notes

Drawing 1 – Test location plan

Test pit logs

Terminology, Symbols and Abbreviations

November 2023

Introduction to Terminology, Symbols and Abbreviations

Douglas Partners' reports, investigation logs, and other correspondence may use terminology which has quantitative or qualitative connotations. To remove ambiguity or uncertainty surrounding the use of such terms, the following sets of notes pages may be attached Douglas Partners' reports, depending on the work performed and conditions encountered:

- Soil Descriptions;
- Rock Descriptions; and
- Sampling, insitu testing, and drilling methodologies

In addition to these pages, the following notes generally apply to most documents.

Abbreviation Codes

Site conditions may also be presented in a number of different formats, such as investigation logs, field mapping, or as a written summary. In some of these formats textual or symbolic terminology may be presented using textual abbreviation codes or graphic symbols, and, where commonly used, these are listed alongside the terminology definition. For ease of identification in these note pages, textual codes are presented in these notes in the following style XW. Code usage conforms with the following guidelines:

- Textual codes are case insensitive, although herein they are generally presented in upper case; and
- Textual codes are contextual (i.e. the same or similar combinations of characters may be used in different contexts with different meanings (for example `PL` is used for plastic limit in the context of soil moisture condition, as well as in `PL(A)` for point load test result in the testing results column)).

Data Integrity Codes

Subsurface investigation data recorded by Douglas Partners is generally managed in a highly structured database environment, where records "span" between a top and bottom depth interval. Depth interval "gaps" between records are considered to introduce ambiguity, and, where appropriate, our practice guidelines may require contiguous data sets. Recording meaningful data is not always appropriate (for example assigning a "strength" to a concrete pavement) and the following codes may be used to maintain contiguity in such circumstances.

Term	Description	Abbreviation Code
Core loss	No core recovery	KL
Unknown	Information was not available to allow classification of the property. For example, when auguring in loose, saturated sand auger cuttings may not be returned.	UK
No data	Information required to allow classification of the property was not available. For example if drilling is commenced from the base of a hole predrilled by others	ND
Not Applicable	Derivation of the properties not appropriate or beyond the scope of the investigation. For example providing a description of the strength of a concrete pavement	NA

Graphic Symbols

Douglas Partners' logs contain a "graphic" column which provides a pictorial representation of the basic composition of the material. The symbols used are directly representing the material name stated in the adjacent "Description of Strata" column, and as such no specific graphic symbology legend has been provided in these notes.

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Soil Descriptions

Terminology
Symbols
Abbreviations

March 2024

Introduction

All materials which are not considered to be "in-situ rock" are described in general accordance with the soil description model of AS 1726-2017 Part 6.1.3, and can be broken down into the following description structure:

The "classification" comprises a two character "group symbol" providing a general summary of dominant soil characteristics. The "name" summarises the particle sizes within the soil which most influence its behaviour. The detailed description presents more information about composition, condition, structure, and origin of the soil.

Classification, naming and description of soils require the relative proportion of particles of different sizes within the whole soil mixture to be considered.

Particle size designation and Behaviour Model

Solid particles within a soil are differentiated on the basis of size.

The engineering behaviour properties of a soil can subsequently be modelled to be either "fine grained" (also known as "cohesive" behaviour) or "coarse grained" ("non cohesive" behaviour), depending on the relative proportion of fine or coarse fractions in the soil mixture.

Particle Size Designation	Particle Size (mm)	Behaviour Model	
		Behaviour	Approximate Dry Mass
Boulder	>200	Excluded from particle behaviour model as "oversize"	
Cobble	63 - 200		
Gravel[1]	2.36 - 63	Coarse	>65%
Sand[1]	0.075 - 2.36		
Silt	0.002 - 0.075	Fine	>35%
Clay	<0.002		

[1] – refer grain size subdivision descriptions below

The behaviour model boundaries defined above are not precise, and the material behaviour should be assumed from the name given to the material (which considers the particle fraction which dominates the behaviour, refer "component proportions" below), rather than strict observance of the proportions of particle sizes. For example, if a material is named a "Sandy CLAY", this is indicative that the material exhibits fine grained behaviour, even if the dry mass of coarse grained material may exceed 65%.

Component proportions

The relative proportion of the dry mass of each particle size fraction is assessed to be a "primary", "secondary", or "minor" component of the soil mixture, depending on its influence over the soil behaviour.

Component Proportion Designation	Definition[1]	Relative Proportion	
		In Fine Grained Soil	In Coarse Grained Soil
Primary	The component (particle size designation, refer above) which dominates the engineering behaviour of the soil	The clay/silt component with the greater proportion	The sand/gravel component with the greater proportion
Secondary	Any component which is not the primary, but is significant to the engineering properties of the soil	Any component with greater than 30% proportion	Any granular component with greater than 30%; or Any fine component with greater than 12%
Minor[2]	Present in the soil, but not significant to its engineering properties	All other components	All other components

[1] As defined in AS1726-2017 6.1.4.4

[2] In the detailed material description, minor components are split into two further sub-categories. Refer "identification of minor components" below.

Composite Materials

In certain situations, a lithology description may describe more than one material, for example, collectively describing a layer of interbedded sand and clay. In such a scenario, the two materials would be described independently, with the names preceded or followed by a statement describing the arrangement by which the materials co-exist. For example, "INTERBEDDED Silty CLAY AND SAND".

Soil Descriptions

Classification

The soil classification comprises a two character group symbol. The first character identifies the primary component. The second character identifies either the grading or presence of fines in a coarse grained soil, or the plasticity in a fine grained soil. Refer AS1726-2017 6.1.6 for further clarification.

Soil Name

For most soils, the name is derived with the primary component included as the noun (in upper case), preceded by any secondary components stated in an adjective form. In this way, the soil name also describes the general composition and indicates the dominant behaviour of the material.

Component [1]	Prominence in Soil Name
Primary	Noun (eg "CLAY")
Secondary	Adjective modifier (eg "Sandy")
Minor	No influence

[1] – for determination of component proportions, refer component proportions on previous page

For materials which cannot be disaggregated, or which are not comprised of rock or mineral fragments, the names "ORGANIC MATTER" or "ARTIFICIAL MATERIAL" may be used, in accordance with AS1726-2017 Table 14.

Commercial or colloquial names are not used for the soil name where a component derived name is possible (for example "Gravelly SAND" rather than "CRACKER DUST").

Materials of "fill" or "topsoil" origin are generally assigned a name derived from the primary/secondary component (where appropriate). In log descriptions this is preceded by uppercase "FILL" or "TOPSOIL". Origin uncertainty is indicated in the description by the characters (?), with the degree of uncertainty described (using the terms "probably" or "possibly" in the origin column, or at the end of the description).

Identification of minor components

Minor components are identified in the soil description immediately following the soil name. The minor component fraction is usually preceded with a term indicating the relative proportion of the component.

Minor Component Proportion Term	Relative Proportion	
	In Fine Grained Soil	In Coarse Grained Soil
With	All fractions: 15-30%	Clay/silt: 5-12% sand/gravel: 15-30%
Trace	All fractions: 0-15%	Clay/silt: 0-5% sand/gravel: 0-15%

The terms "with" and "trace" generally apply only to gravel or fine particle fractions. Where cobbles/boulders are encountered in minor proportions (generally less than about 12%) the term "occasional" may be used. This term describes the sporadic distribution of the material within the confines of the investigation excavation only, and there may be considerable variation in proportion over a wider area which is difficult to factually characterise due to the relative size of the particles and the investigation methods.

Soil Composition

Plasticity

Descriptive Term	Laboratory liquid limit range	
	Silt	Clay
Non-plastic materials	Not applicable	Not applicable
Low plasticity	≤50	≤35
Medium plasticity	Not applicable	>35 and ≤50
High plasticity	>50	>50

Note, Plasticity descriptions generally describe the plasticity behaviour of the whole of the fine grained soil, not individual fine grained fractions.

Grain Size

Type		Particle size (mm)
Gravel	Coarse	19 - 63
	Medium	6.7 - 19
	Fine	2.36 – 6.7
Sand	Coarse	0.6 - 2.36
	Medium	0.21 - 0.6
	Fine	0.075 - 0.21

Grading

Grading Term	Particle size (mm)
Well	A good representation of all particle sizes
Poorly	An excess or deficiency of particular sizes within the specified range
Uniformly	Essentially of one size
Gap	A deficiency of a particular size or size range within the total range

Note, AS1726-2017 provides terminology for additional attributes not listed here.

Soil Condition

Moisture

The moisture condition of soils is assessed relative to the plastic limit for fine grained soils, while for coarse grained soils it is assessed based on the appearance and feel of the material. The moisture condition of a material is considered to be independent of stratigraphy (although commonly these are related), and this data is presented in its own column on logs.

Applicability	Term	Tactile Assessment	Abbreviation code
Fine	Dry of plastic limit	Hard and friable or powdery	w<PL
	Near plastic limit	Can be moulded	w=PL
	Wet of plastic limit	Water residue remains on hands when handling	w>PL
	Near liquid limit	"oozes" when agitated	w=LL
	Wet of liquid limit	"oozes"	w>LL
Coarse	Dry	Non-cohesive and free running	D
	Moist	Feels cool, darkened in colour, particles may stick together	M
	Wet	Feels cool, darkened in colour, particles may stick together, free water forms when handling	W

The abbreviation code NDF, meaning "not-assessable due to drilling fluid use" may also be used.

Note, observations relating to free ground water or drilling fluids are provided independent of soil moisture condition.

Consistency/Density/Compaction/Cementation/Extremely Weathered Material

These concepts give an indication of how the material may respond to applied forces (when considered in conjunction with other attributes of the soil). This behaviour can vary independent of the composition of the material, and on logs these are described in an independent column and are generally mutually exclusive (i.e it is inappropriate to describe both consistency and compaction at the same time). The method by which the behaviour is described depends on the behaviour model and other characteristics of the soil as follows:

- In fine grained soils, the "consistency" describes the ease with which the soil can be remoulded, and is generally correlated against the materials undrained shear strength;
- In granular materials, the relative density describes how tightly packed the particles are, and is generally correlated against the density index;
- In anthropogenically modified materials, the compaction of the material is described qualitatively;
- In cemented soils (both natural and anthropogenic), the cemented "strength" is described qualitatively, relative to the difficulty with which the material is disaggregated; and
- In soils of extremely weathered material origin, the engineering behaviour may be governed by relic rock features, and expected behaviour needs to be assessed based the overall material description.

Quantitative engineering performance of these materials may be determined by laboratory testing or estimated by correlated field tests (for example penetration or shear vane testing). In some cases, performance may be assessed by tactile or other subjective methods, in which case investigation logs will show the estimated value enclosed in round brackets, for example (VS).

Consistency (fine grained soils)

Consistency Term	Tactile Assessment	Undrained Shear Strength (kPa)	Abbreviation Code
Very soft	Extrudes between fingers when squeezed	<12	VS
Soft	Mouldable with light finger pressure	>12 - ≤25	S
Firm	Mouldable with strong finger pressure	>25 - ≤50	F
Stiff	Cannot be moulded by fingers	>50 - ≤100	St
Very stiff	Indented by thumbnail	>100 - ≤200	VSt
Hard	Indented by thumbnail with difficulty	>200	H
Friable	Easily crumbled or broken into small pieces by hand	-	Fr

Relative Density (coarse grained soils)

Relative Density Term	Density Index	Abbreviation Code
Very loose	<15	VL
Loose	>15 - ≤35	L
Medium dense	>35 - ≤65	MD
Dense	>65 - ≤85	D
Very dense	>85	VD

Note, tactile assessment of relative density is difficult, and generally requires penetration testing, hence a tactile assessment guide is not provided.

Compaction (anthropogenically modified soil)

Compaction Term	Abbreviation Code
Well compacted	WC
Poorly compacted	PC
Moderately compacted	MC
Variably compacted	VC

Cementation (natural and anthropogenic)

Cementation Term	Abbreviation Code
Moderately cemented	MOD
Weakly cemented	WEK

Extremely Weathered Material

AS1726-2017 considers weathered material to be soil if the unconfined compressive strength is less than 0.6 MPa (i.e. less than very low strength rock). These materials may be identified as "extremely weathered material" in reports and by the abbreviation code XWM on log sheets. This identification is not correlated to any specific qualitative or quantitative behaviour, and the engineering properties of this material must therefore be assessed according to engineering principles with reference to any relic rock structure, fabric, or texture described in the description.

Soil Origin

Term	Description	Abbreviation Code
Residual	Derived from in-situ weathering of the underlying rock	RS
Extremely weathered material	Formed from in-situ weathering of geological formations. Has strength of less than 'very low' as per as1726 but retains the structure or fabric of the parent rock.	XWM
Alluvial	Deposited by streams and rivers	ALV
Fluvial	Deposited by channel fill and overbank (natural levee, crevasse splay or flood basin)	FLV
Estuarine	Deposited in coastal estuaries	EST
Marine	Deposited in a marine environment	MAR
Lacustrine	Deposited in freshwater lakes	LAC
Aeolian	Carried and deposited by wind	AEO
Colluvial	Soil and rock debris transported down slopes by gravity	COL
Slopewash	Thin layers of soil and rock debris gradually and slowly deposited by gravity and possibly water	SW
Topsoil	Mantle of surface soil, often with high levels of organic material	TOP
Fill	Any material which has been moved by man	FILL
Littoral	Deposited on the lake or seashore	LIT
Unidentifiable	Not able to be identified	UID

Cobbles and Boulders

The presence of particles considered to be "oversize" may be described using one of the following strategies:

- Oversize encountered in a minor proportion (when considered relative to the wider area) are noted in the soil description; or
- Where a significant proportion of oversize is encountered, the cobbles/boulders are described independent of the soil description, in a similar manner to composite soils (described above) but qualified with "MIXTURE OF".

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Rock Strength

Rock strength is defined by the unconfined compressive strength, and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $I_{s(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Unconfined Compressive Strength (MPa)	Point Load Index[1] $I_{s(50)}$ MPa	Abbreviation Code
Very low	0.6 - 2	0.03 - 0.1	VL
Low	2 - 6	0.1 - 0.3	L
Medium	6 - 20	0.3 - 1.0	M
High	20 - 60	1 - 3	H
Very high	60 - 200	3 - 10	VH
Extremely high	>200	>10	EH

[1] Rock strength classification is based on UCS. The UCS to $I_{s(50)}$ ratio varies significantly for different rock types and specific ratios may be required for each site. The point load Index ranges shown above are as suggested in AS1726 and should not be relied upon without supporting evidence.

The following abbreviation codes are used for soil layers or seams of material "within rock" but for which the equivalent UCS strength is less than 0.6 MPa.

Scenario	Abbreviation Code
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The properties of the material encountered over this interval are described in the "Description of Strata" and soil properties columns.	SOIL
The material encountered has an equivalent UCS strength of less than 0.6 MPa, and therefore is considered to be soil (as per Note 1 of Table 20 of AS 1726-2017). The prominence of the material is such that it can be considered to be a seam (as defined in Table 22 of AS1726-2017) and the properties of the material are described in the defect column.	SEAM

Degree of Weathering

The degree of weathering of rock is classified as follows:

Weathering Term	Description	Abbreviation Code
Residual Soil[1]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.	RS
Extremely weathered[1]	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible	XW
Highly weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.	HW
Moderately weathered	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MW
Slightly weathered	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.	SW
Fresh	No signs of decomposition or staining.	FR
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.	DW

[1] The parent rock type, of which the residual/extremely weathered material is a derivative, will be stated in the description (where discernible).

Degree of Alteration

The degree of alteration of the rock material (physical or chemical changes caused by hot gasses or liquids at depth) is classified as follows:

Term	Description	Abbreviation Code
Extremely altered	Material is altered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.	XA
Highly altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is changed by alteration. Some primary minerals are altered to clay minerals. Porosity may be increased by leaching or may be decreased due to precipitation of secondary materials in pores.	HA
Moderately altered	The whole of the rock material is discoloured, usually by staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.	MA
Slightly altered	Rock is slightly discoloured but shows little or no change of strength from fresh rock	SA
Note: If HA and MA cannot be differentiated use DA (see below)		
Distinctly altered	Rock strength usually changed by alteration. The rock may be highly discoloured, usually by staining or bleaching. Porosity may be increased by leaching or may be decreased due to precipitation of secondary minerals in pores.	DA

Degree of Fracturing

The following descriptive classification apply to the spacing of natural occurring fractures in the rock mass. It includes bedding plane partings, joints and other defects, but excludes drilling breaks. These terms are generally not required on investigation logs where fracture spacing is presented as a histogram, and where used are presented in an unabbreviated format.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections > 100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e., drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

These terms may be used to describe the spacing of bedding partings in sedimentary rocks. Where used, these terms are generally presented in an unabbreviated format

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Defect Descriptions

Defect Type

Term	Abbreviation Code
Bedding plane	B
Cleavage	CL
Crushed seam	CS
Crushed zone	CZ
Drilling break	DB
Decomposed seam	DS
Drill lift	DL
Extremely Weathered seam	EW
Fault	F
Fracture	FC
Fragmented	FG
Handling break	HB
Infilled seam	IS
Joint	JT
Lamination	LAM
Shear seam	SS
Shear zone	SZ
Vein	VN
Mechanical break	MB
Parting	P
Sheared Surface	S

Rock Defect Orientation

Term	Abbreviation Code
Horizontal	H
Vertical	V
Sub-horizontal	SH
Sub-vertical	SV

Rock Defect Coating

Term	Abbreviation Code
Clean	CN
Coating	CT
Healed	HE
Infilled	INF
Stained	SN
Tight	TI
Veneer	VNR

Rock Defect Infill

Term	Abbreviation Code
Calcite	CA
Carbonaceous	CBS
Clay	CLAY
Iron oxide	FE
Manganese	MN
Pyrite	Py
Secondary material	MS
Silt	M
Quartz	Qz
Unidentified material	MU

Rock Defect Shape/Planarity

Term	Abbreviation Code
Curved	CU
Discontinuous	DIS
Irregular	IR
Planar	PR
Stepped	ST
Undulating	UN

Rock Defect Roughness

Term	Abbreviation Code
Polished	PO
Rough	RF
Smooth	SM
Slickensided	SL
Very rough	VR

Defect Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

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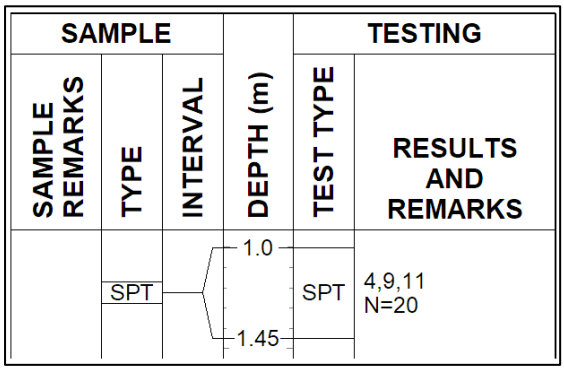
Sampling and Testing

A record of samples retained, and field testing performed is usually shown on a Douglas Partners' log with samples appearing to the left of a depth scale, and selected field and laboratory testing (including results, where relevant) appearing to the right of the scale, as illustrated below:



Sampling

The type or intended purpose for which a sample was taken is indicated by the following abbreviation codes.

Sample Type	Code
Auger sample	A
Acid Sulfate sample	ASS
Bulk sample	B
Core sample	C
Disturbed sample	D
Environmental sample	ES
Driven Tube sample	DT
Gas sample	G
Piston sample	P
Sample from SPT test	SPT
Undisturbed tube sample	U[1]
Water sample	W
Material Sample	MT
Core sample for unconfined compressive strength testing	UCS

[1] – numeric suffixes indicate tube diameter/width in mm

The above codes only indicate that a sample was retained, and not that testing was scheduled or performed.

Field and Laboratory Testing

A record that field and laboratory testing was performed is indicated by the following abbreviation codes.

Test Type	Code
Pocket penetrometer (kPa)	PP
Photo ionisation detector (ppm)	PID
Standard Penetration Test x/y =*x* blows for *y* mm penetration HB = hammer bouncing HW = fell under weight of hammer	SPT
Shear vane (kPa)	V
Unconfined compressive strength, (MPa)	UCS
Point load test, (MPa), axial (A), diametric (D), irregular (I)	PLT(_)
Dynamic cone penetrometer, followed by blow count penetration increment in mm (cone tip, generally in accordance with AS1289.6.3.2)	DCP9/150
Perth sand penetrometer, followed by blow count penetration increment in mm (flat tip, generally in accordance with AS1289.6.3.3)	PSP/150
Dynamic probe super heavy, followed by blow count penetration increment in mm	DPSH/100

Groundwater Observations

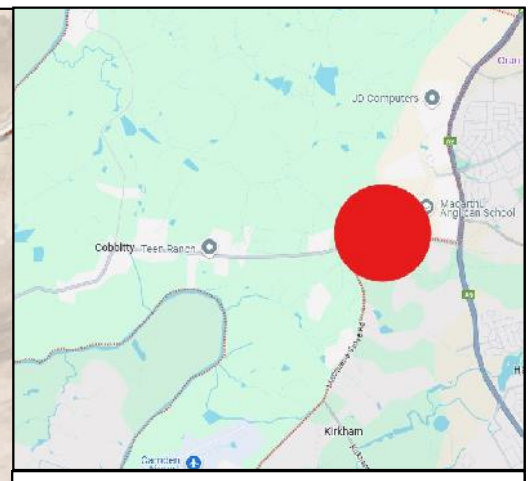
	water seepage/inflow
	water seepage/outflow
	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

Method	Abbreviation Code
Direct Push	DP
Solid flight auger. Suffixes: /T = tungsten carbide tip, /V = v-shaped tip	AD[1]
Air Track	AT
Diatube	DT[1]
Hand auger	HA[1]
Hand tools (unspecified)	HAND
Existing exposure	X
Hollow flight auger	HSA[1]
HQ coring	HQ3
HMLC series coring	HMLC
NMLC series coring	NMLC
NQ coring	NQ3
PQ coring	PQ3
Predrilled	PD
Push tube	PT[1]
Ripping tyne/ripper	R
Rock roller	RR[1]
Rock breaker/hydraulic hammer	EH
Sonic drilling	SON[1]
Mud/blade bucket	MB[1]
Toothed bucket	TB[1]
Vibrocore	VC[1]
Vacuum excavation	VE
Wash bore (unspecified bit type)	WB[1]

[1] – numeric suffixes indicate tool diameter/width in mm



Site locality

LOT 2009
DP 1168651

DA2023/292/1 STAGE 1
PART OF THIS APPROVAL

ROAD 34
ROAD 25
ROAD 30
ROAD 40
ROAD 26
LANEWAY 01
MCINTOSH PARKWAY

1 2 3 4 5 6 7 8 9 10

1134 1135 1136 1137 1138 1139 1140 1141 1142 1143 1144 1145 1146 1147 1150 1151 1152 1153 1154 1155 1156 1157 1158 1159 1160 1161 1162 1163 1164 1165 1167 1168 1169

2101 2102 2103 2104 2105 2106 2107 2108 2109 2110 2111 2112 2113 2114 2115

DA2023/461/1 STAGE 1
PART OF THIS APPROVAL

Legend

- Boundary
- Test pit

Douglas PARTNERS GROUNDED EXPERTISE	TITLE: **Test pit location plan** **Proposed residential subdivision** **Light Green - Cobbitty Road, Cobbitty NSW**	N MGA	OFFICE: Macarthur DRAWN BY: AS DATE: 4 September 2025
CLIENT: Mirvac Homes NSW Pty Ltd	PROJ. #: 92323.21	DRAWING No: 1	REVISION: 0 / SCALE: As Shown

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 79.9 AHD
COORDINATE: E:288614.7, N:6234590.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 1
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED											SAMPLE			TESTING	
				SOIL			ROCK								
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(^)/ DENSITY.(^)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH (VL L M H VH EH)	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed	0.10	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA	w<PL								DCP9/150	5 10 15 B 18/10mm
	0.20	Silty CLAY (CI-CH): pale grey; medium to high plasticity; trace fine gravels and rootlets.		RS	H			0.20							
		SHALE: brown and dark blue. Bringelly Shale.					HW		L - M						
		Test Pit discontinued at 0.50m depth. Limit of investigation.									D		0.50		

79
1
78
2
77

NOTES: (#)Soil origin is "probable" unless otherwise stated. (^)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 78.5 AHD
COORDINATE: E:288605.1, N:6234560.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 2
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	TESTING DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed	78	0.00	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA										
		0.30	Silty CLAY (CI-CH): orange-brown mottled grey; medium to high plasticity; trace fine gravels and rootlets.		RS	VSt - H	w<PL					D		0.50	DCP9/150	5 10 15
												U50		0.63		
		1.00	From 0.90m: grading to pale grey and orange-brown, with extremely to highly weathered shale bands									D		1.00		
	77	1.30	SHALE: brown and dark blue. Bringelly Shale.					HW	1.30	L - M						
		1.50	Test Pit discontinued at 1.50m depth. Limit of investigation.									D		1.50		
	76	2.00														

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil with Simple Rock Log

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 77.6 AHD
COORDINATE: E:288615.5, N:6234543.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 3
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(^)/DENSITY.(^)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	TESTING DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed			FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA						D		0.30	DCP9/150	5 10 15
	77	0.40	Silty CLAY (CI-CH): orange-brown mottled grey; medium to high plasticity; trace fine gravels and rootlets.		RS	St - VSt	w<PL					D		0.50		
		1	From 1.00m: grading to pale grey and orange-brown, with extremely to highly weathered shale bands									D		1.00		
	76	1.50	SHALE: pale brown. Bringelly Shale.					HW	1.50	VL - L		D		1.50		
			Test Pit discontinued at 1.70m depth. Limit of investigation.													
	75	2														

NOTES: (#)Soil origin is "probable" unless otherwise stated. (^)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 77.6 AHD
COORDINATE: E:288578.9, N:6234550.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 4
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(^)/DENSITY.(^)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	SAMPLE DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
07/04/25 No free groundwater observed			FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA	w<PL								DCP9/150	5 10 15 B 25/100mm
		0.20	Silty CLAY (CI-CH): pale grey and orange-brown; medium to high plasticity; with extremely to highly weathered shale bands.		RS	H										
	77	0.30	SHALE: brown and dark blue. Bringelly Shale.					HW	0.30	L - M		D		0.50		
	76	1	Test Pit discontinued at 0.70m depth. Limit of investigation.													
	75	2														

NOTES: (#)Soil origin is "probable" unless otherwise stated. (^)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 78.7 AHD
COORDINATE: E:288586.2, N:6234577.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 5
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING	
				SOIL			ROCK										
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(^)/ DENSITY.(^)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH (VL L M H VH EH)	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed		0.10	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA	w<PL								DCP9/150	5 10 15 B 18/100mm
			SHALE: brown and dark blue. Bringelly Shale.					HW	0.10	L - M						
			Test Pit discontinued at 0.50m depth. Limit of investigation.									D		0.50		
	78	1														
	77	2														
	76															

NOTES: (#)Soil origin is "probable" unless otherwise stated. (^)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 77.8 AHD
COORDINATE: E:288537.8, N:6234553.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 6
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED												SAMPLE			TESTING	
				SOIL			ROCK									
GROUNDWATER	RL (m) / DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(^)/ DENSITY.(^)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH (VL L M H VH EH)	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed	0.20	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA	w<PL								DCP9/150	5 10 15 B 24/140mm
	0.30	Silty CLAY (CI-CH): pale grey and orange-brown; medium to high plasticity; with extremely to highly weathered shale bands.		RS	H										
		SHALE: brown and dark blue. Bringelly Shale.					HW	0.30	L - M						
	77	Test Pit discontinued at 0.50m depth. Refusal on low to medium strength shale.									D		0.50		
	1														
	76														
	2														
	75														

NOTES: (#)Soil origin is "probable" unless otherwise stated. (^)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 77.9 AHD
COORDINATE: E:288509.7, N:6234557.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 7
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE				TESTING	
				SOIL				ROCK										
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) DENSITY.(*)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH (VL L M H VH EH)	SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed		0.05	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA	w<PL								DCP9/150	5 B 28/40mm
			SHALE: brown and dark blue. Bringelly Shale.					HW	0.05	L - M						
			Test Pit discontinued at 0.50m depth. Limit of investigation.									D		0.50		
	77	1														
	76	2														
	75															

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 77.4 AHD
COORDINATE: E:288514.3, N:6234537.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 8
PROJECT No: 92323.21
DATE: 07/04/25
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	TESTING DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
07/04/25 No free groundwater observed	77	0.10	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, rootlets and grass cover, trace fine to medium gravels, topsoil.		FILL	NA										
			Silty CLAY (CI-CH): pale grey and orange-brown; medium to high plasticity; with extremely to highly weathered shale bands.		RS	VSt - H	w<PL					D		0.50	DCP9/150	5 10 15 B 15/40mm
		0.60	SHALE: brown and dark blue. Bringelly Shale.					HW	0.60	L - M		D		1.00		
	76	1														
	75	2	Test Pit discontinued at 1.20m depth. Limit of investigation.													

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Kobelco 8 tonne excavator
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil with Simple Rock Log

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 76.6 AHD
COORDINATE: E:288644.6, N:6234533.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 9
PROJECT No: 92323.21
DATE: 20/06/25
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL ORIGIN(#)	SOIL CONSIS.(*) DENSITY.(*)	SOIL MOISTURE	ROCK WEATH.	ROCK DEPTH (m)	ROCK STRENGTH	SAMPLE REMARKS	SAMPLE TYPE	SAMPLE INTERVAL	SAMPLE DEPTH (m)	TESTING TEST TYPE	TESTING RESULTS AND REMARKS
20/06/25 No free groundwater observed			TOPSOIL / FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots and trace fine coarse gravels .		TOP	NA										
		0.20	Silty CLAY (CI-CH): orange-brown mottled pale grey; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt	w<PL					D		0.50	DCP9/150	5 10 15 Ref 15/50mm
	76		From 0.50m: grading to pale grey and orange-brown, with fine to medium gravel													
		1										D		1.00		
			1.30m: with extremely to highly weathered shale bands			H									PP	>600kPa
		1.50	SHALE: brown, with clay bands.					XW - HW	1.50	L - M		D		1.50		
	75															
			Test Pit discontinued at 1.80m depth. Limit of investigation.													
		2														
	74															

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: CAT 432 backhoe
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Douglas PARTNERS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Development
LOCATION: Light Green - Cobbitty Road, Cobbitty NSW

SURFACE LEVEL: 76.1 AHD
COORDINATE: E:288611.2, N:6234507.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 10
PROJECT No: 92323.21
DATE: 20/06/25
SHEET: 1 of 1

GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS.(*) / DENSITY.(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
20/06/25 No free groundwater observed	76	0.15	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with roots, trace gravel.		FILL							DCP9/150	5 10 15
			FILL / Silty CLAY (CI): brown and dark brown; medium plasticity; with fine to coarse gravel.		FILL	NA			D		0.50		
		0.90	Silty CLAY (CI-CH): orange-brown mottled pale grey; medium to high plasticity; trace fine to medium gravel and rootlets.		RS	VSt - H	w<PL		D		1.00	PP	>600kPa
	75	1	1.50m: grading to pale grey, with extremely to highly weathered shale and sandstone bands						D		1.50		
			Test Pit discontinued at 1.80m depth. Limit of investigation.										
	74	2											

NOTES: (#)Soil origin is "probable" unless otherwise stated. (*)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: CAT 432 backhoe
METHOD: 450mm bucket
REMARKS:

OPERATOR: TRN Group
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

Generated with CORE-GS by Geroc - Soil Log

Appendix C

Laboratory test results

Salinity summary - Table C1

Earthworks quality report

Material Test Report

Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Email: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Report Number: **92323.21-1**
Issue Number: 2 - *This version supersedes all previous issues*
Reissue Reason: *Changed location details as requested by engineer*
Date Issued: 16/05/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Ayberk Sahin
Project Number: 92323.21
Project Name: Proposed Residential Development
Project Location: Light Green – Cobbitty Road, Cobbitty NSW
Work Request: 15451
Sample Number: MA-15451A
Date Sampled: 07/04/2025
Dates Tested: 08/04/2025 - 09/05/2025
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Preparation Method: AS 1289.1.1 - Sampling and Preparation of Soils
Remarks: The sample was not sufficient enough to test for shrinks swell index.
Sample Location: **2 , Depth: 0.5 - 0.63 m**
Material: Silty CLAY

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	49		
Plastic Limit (%)	18		
Plasticity Index (%)	**31**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**14.0**		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	13.9		

Material Test Report

Report Number:	**92323.21-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Changed location details as requested by engineer*
Date Issued:	16/05/2025
Client:	Mirvac Homes NSW Pty Ltd
	PO Box 787, Parramatta NSW
Contact:	Ayberk Sahin
Project Number:	92323.21
Project Name:	Proposed Residential Development
Project Location:	Light Green – Cobbitty Road, Cobbitty NSW
Work Request:	15451
Sample Number:	MA-15451B
Date Sampled:	07/04/2025
Dates Tested:	08/04/2025 - 12/05/2025
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Preparation Method:	AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location:	**3 , Depth: 0.5 m**
Material:	Silty CLAY

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	66		
Plastic Limit (%)	23		
Plasticity Index (%)	**43**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**12.5**		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	25.4		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**3**		
Soil Description	As above		
Nature of Water	Distilled water		
Temperature of Water (^{o}C)	26		

Douglas Partners Pty Ltd
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Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Material Test Report

Douglas Partners Pty Ltd
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Phone: (02) 4647 0075
Email: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Report Number:	**92323.21-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Changed location details as requested by engineer*
Date Issued:	16/05/2025
Client:	Mirvac Homes NSW Pty Ltd
	PO Box 787, Parramatta NSW
Contact:	Ayberk Sahin
Project Number:	92323.21
Project Name:	Proposed Residential Development
Project Location:	Light Green – Cobbitty Road, Cobbitty NSW
Work Request:	15451
Sample Number:	MA-15451C
Date Sampled:	07/04/2025
Dates Tested:	08/04/2025 - 09/05/2025
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Preparation Method:	AS 1289.1.1 - Sampling and Preparation of Soils
Sample Location:	**8 , Depth: 0.5 m**
Material:	Silty CLAY, with XW-HW shale bands

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	54		
Plastic Limit (%)	20		
Plasticity Index (%)	**34**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	**13.5**		
Cracking Crumbling Curling	Curling		

Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	17.3		

Material Test Report

Report Number:	**92323.21-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Changed location details as requested by engineer*
Date Issued:	16/05/2025
Client:	Mirvac Homes NSW Pty Ltd
	PO Box 787, Parramatta NSW
Contact:	Ayberk Sahin
Project Number:	92323.21
Project Name:	Proposed Residential Development
Project Location:	Light Green – Cobbitty Road, Cobbitty NSW
Work Request:	15451
Date Sampled:	07/04/2025
Dates Tested:	08/04/2025 - 12/05/2025
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Location:	Red West - 499 Cobbitty Road, Cobbitty

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Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
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Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Determination of pH of Soil (In-House) DP MAC1

Sample Number	Location	Depth (m)	Material	pH Value
MA-15451D	1	0.5 m	Soil	7.2
MA-15451E	2	0.5 m	Soil	5.6
MA-15451F	2	1.0 m	Soil	5.8
MA-15451G	2	1.5 m	Soil	6.2
MA-15451H	3	0.5 m	Soil	7.5
MA-15451I	3	1.0 m	Soil	5.1
MA-15451J	3	1.5 m	Soil	5.3
MA-15451K	4	0.5 m	Soil	6.8
MA-15451L	5	0.5 m	Soil	9.0
MA-15451M	6	0.5 m	Soil	6.8
MA-15451N	7	0.5 m	Soil	7.4
MA-15451O	8	0.5 m	Soil	4.7
MA-15451P	8	1.0 m	Soil	4.9

Material Test Report

Report Number:	**92323.21-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Changed location details as requested by engineer*
Date Issued:	16/05/2025
Client:	Mirvac Homes NSW Pty Ltd
	PO Box 787, Parramatta NSW
Contact:	Ayberk Sahin
Project Number:	92323.21
Project Name:	Proposed Residential Development
Project Location:	Light Green – Cobbitty Road, Cobbitty NSW
Work Request:	15451
Date Sampled:	07/04/2025
Dates Tested:	08/04/2025 - 12/05/2025
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Location:	Red West - 499 Cobbitty Road, Cobbitty

Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Email: meregal.henakaa@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Determination of EC of Soil (In-House) DP MAC2

Sample Number	Location	Depth (m)	Material	EC Value (µS/cm)
MA-15451D	1	0.5 m	Soil	135.80
MA-15451E	2	0.5 m	Soil	85.60
MA-15451F	2	1.0 m	Soil	89.50
MA-15451G	2	1.5 m	Soil	94.20
MA-15451H	3	0.5 m	Soil	101.40
MA-15451I	3	1.0 m	Soil	283.60
MA-15451J	3	1.5 m	Soil	282.10
MA-15451K	4	0.5 m	Soil	202.70
MA-15451L	5	0.5 m	Soil	134.90
MA-15451M	6	0.5 m	Soil	392.50
MA-15451N	7	0.5 m	Soil	182.50
MA-15451O	8	0.5 m	Soil	643.90
MA-15451P	8	1.0 m	Soil	561.50

Material Test Report

Report Number:	**92323.21-3**
Issue Number:	1
Date Issued:	01/07/2025
Client:	Mirvac Homes NSW Pty Ltd
	PO Box 787, Parramatta NSW
Contact:	Ayberk Sahin
Project Number:	92323.21
Project Name:	Proposed Residential Development
Project Location:	Light Green – Cobbitty Road, Cobbitty NSW
Work Request:	16063
Date Sampled:	20/06/2025
Dates Tested:	25/06/2025 - 25/06/2025
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Location:	Light Green – Cobbitty Road, Cobbitty NSW

Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
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Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Determination of pH of Soil (In-House) DP MAC1				
Sample Number	Location	Depth (m)	Material	pH Value
MA-16063A	9	1.0	Soil	5.3
MA-16063B	10	0.5	Soil	6.5

Material Test Report

Report Number:	**92323.21-3**
Issue Number:	1
Date Issued:	01/07/2025
Client:	Mirvac Homes NSW Pty Ltd
	PO Box 787, Parramatta NSW
Contact:	Ayberk Sahin
Project Number:	92323.21
Project Name:	Proposed Residential Development
Project Location:	Light Green – Cobbitty Road, Cobbitty NSW
Work Request:	16063
Date Sampled:	20/06/2025
Dates Tested:	25/06/2025 - 25/06/2025
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Location:	Light Green – Cobbitty Road, Cobbitty NSW

Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Email: meregal.henakaa@douglaspartners.com.au

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Approved Signatory: Nilusha Arachchi
Senior Technician
Laboratory Accreditation Number: 828

Determination of EC of Soil (In-House) DP MAC2				
Sample Number	Location	Depth (m)	Material	EC Value (µS/cm)
MA-16063A	9	1.0	Soil	189.10
MA-16063B	10	0.5	Soil	310.30

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 377691

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Eric Riggle
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	**92323.21 Cobbitty**
Number of Samples	8 Soil
Date samples received	08/04/2025
Date completed instructions received	08/04/2025

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	15/04/2025
Date of Issue	15/04/2025

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Results Approved By
Diego Bigolin, Inorganics Supervisor
Giovanni Agosti, Group Technical Manager

Authorised By
Nancy Zhang, Laboratory Manager

Misc Inorg - Soil						
Our Reference		377691-1	377691-2	377691-3	377691-4	377691-5
Your Reference	UNITS	2	2	2	4	5
Depth		0.5	1	1.5	0.5	0.5
Date Sampled		07/04/2025	07/04/2025	07/04/2025	07/04/2025	07/04/2025
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	09/04/2025	09/04/2025	09/04/2025	09/04/2025	09/04/2025
Date analysed	-	09/04/2025	09/04/2025	09/04/2025	09/04/2025	09/04/2025
Chloride, Cl 1:5 soil:water	mg/kg	33	10	<10	120	45
Sulphate, SO4 1:5 soil:water	mg/kg	130	42	20	20	10

Misc Inorg - Soil				
Our Reference		377691-6	377691-7	377691-8
Your Reference	UNITS	7	8	8
Depth		0.5	0.5	1
Date Sampled		07/04/2025	07/04/2025	07/04/2025
Type of sample		Soil	Soil	Soil
Date prepared	-	09/04/2025	09/04/2025	09/04/2025
Date analysed	-	09/04/2025	09/04/2025	09/04/2025
Chloride, Cl 1:5 soil:water	mg/kg	130	1,000	470
Sulphate, SO4 1:5 soil:water	mg/kg	23	100	51

ESP/CEC		
Our Reference		377691-7
Your Reference	UNITS	8
Depth		0.5
Date Sampled		07/04/2025
Type of sample		Soil
Date prepared	-	11/04/2025
Date analysed	-	11/04/2025
Exchangeable Ca	meq/100g	0.2
Exchangeable K	meq/100g	0.1
Exchangeable Mg	meq/100g	2.9
Exchangeable Na	meq/100g	0.7
Cation Exchange Capacity	meq/100g	4.0
ESP	%	18

Method ID	Methodology Summary
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-OES analytical finish.

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			09/04/2025	1	09/04/2025	09/04/2025		09/04/2025	[NT]
Date analysed	-			09/04/2025	1	09/04/2025	09/04/2025		09/04/2025	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	33	31	6	104	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	130	120	8	106	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			11/04/2025	[NT]	[NT]	[NT]	[NT]	11/04/2025	[NT]
Date analysed	-			11/04/2025	[NT]	[NT]	[NT]	[NT]	11/04/2025	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Table C1: Summary Table - Laboratory Tests and Assessments

Test Pit	Sample Depth	pH	Chloride Concentration	Sulfate Concentration	Resistivity	Soil Condition	Sample Aggressivity Class					Exchangeable Sodium (Na) Concentration	Cation Exchange Capacity	Sodicity [Na/CEC]	Sodicity Class	Emerson Crumb Class Number	Dispersion? (from Emerson Class)	Soil Texture Group (for detailed soil logs see Report Appendix)	Textural Factor (M)	$EC_{1:5}$ [Lab.]	EC_e [M x $EC_{1:5}$]	Sample Salinity Class (Based on sample ECe)
					By inversion of EC1:5		Aggr. to Concrete - from sample pH	Aggr. to Concrete - from Sulphate conc.	Aggr. to Steel - from sample pH	Aggr. to Steel - from Chloride conc.	Aggr. to Steel - from sample Resistivity											
	(m bgl)	(pH units)	(mg/kg)	(mg/kg)	Ω.cm	[AS2159-2009]	[AS2159-2009]					(meq/100g)	(meq/100g)	(%)	[after DLWC]		[AS1289.3.8.1]	[after DLWC]	[after DLWC]	(microS/cm)	(deciS/m)	[Richards 1954]
1	0.5	7.2			7364	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	135.8	1.1	Non-Saline
2	0.5	5.6	33	130	11682	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	85.6	0.6	Non-Saline
2	1.0	5.8	10	42	11173	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	89.5	0.6	Non-Saline
2	1.5	6.2	10	20	10616	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	94.2	0.7	Non-Saline
3	0.5	7.5			9862	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					3	Dispersive	Heavy clay	6	101.4	0.6	Non-Saline
3	1.0	5.1			3526	B	Mild		Non-Aggressive		Non-Aggressive							Heavy clay	6	283.6	1.7	Non-Saline
3	1.5	5.3			3545	B	Mild		Non-Aggressive		Non-Aggressive							Heavy clay	6	282.1	1.7	Non-Saline
4	0.5	6.8	120	20	4933	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	202.7	1.4	Non-Saline
5	0.5	9	45	10	7413	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	134.9	0.9	Non-Saline
6	0.5	6.8			2548	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	392.5	2.7	Slightly Saline
7	0.5	7.4	130	23	5479	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	182.5	1.3	Non-Saline
8	0.5	4.7	1000	100	1553	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild	0.70	4.00	18	Highly Sodic			Medium clay	7	643.9	4.5	Moderately Saline
8	1.0	4.9	470	51	1781	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild							Medium clay	7	561.5	3.9	Slightly Saline
9	1.0	5.3			5288	B	Mild		Non-Aggressive		Non-Aggressive	0.70	4.00	18	Highly Sodic			Medium clay	7	189.1	1.3	Non-Saline
10	0.5	6.5			3223	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	310.3	2.5	Slightly Saline

Douglas PARTNERS | GROUNDED EXPERTISE

Mirvac Homes NSW Pty Ltd
c-/ Orion Group
PO Box 787
Parramatta, NSW 2124

Attention: Trent Argaet
Email: t.argaet@the oriongroup.au

Project 92323.21
26 September 2025
R.004.Rev1
AS

Report on Level 1 Inspections and Testing of Filling
Proposed Residential Subdivision
Tr 4 St 3a ("Cyan") and "Light Green" Subdivision, Cobbitty NSW

1. Introduction

This report presents a summary of earthworks inspections and testing undertaken over the period 24 April 2024 to 26 November 2024 for the bulk fill placed within Tr 4 St 3a ("Cyan") and "Light Green" Subdivision, Cobbitty NSW. This report also includes fill placed for the curtilage mound to the north and the Sydney Water REF site to the south. The earthworks for all areas were undertaken concurrently. Drawing 1 attached, shows the approximate boundaries of the various areas.

This report must be read in conjunction with the notes *"About this Inspection Report"* which are attached.

2. Fill standard and specification

The scope of works requires Level 1 inspection and testing as defined in AS 3798 *"Guidelines on Earthworks for Commercial and Residential Developments"* (AS 3798, 2007) for the bulk fill placed The standards and the specifications for the placement of bulk fill for the project include but are not limited to:

- Strip inspections of fill areas prior to the placement of fill to ensure that stripped natural subgrade or previously placed controlled fill is exposed and comprises suitable material free from uncontrolled fill, weak or soft subgrade, vegetation and highly organic topsoil.
- Compaction of bulk fill to a minimum 98% Standard maximum dry density (SMDD) which is in excess of Camden Council requirements.
- Moisture content within the range ±2% of Standard optimum moisture content (OMC) within the residential lots and within the range ±3% in the curtilage mound.
- Testing frequency in accordance with AS 3798 Table 8.1.

2.1 Stripping inspections

Stripped areas were inspected then test rolled by a Douglas earthworks superintendent or geotechnical engineer, prior to the placement of fill, between 17 April 2024 and 26 November 2024. The stripped subgrades generally comprised in-situ natural silty clay or bedrock, free from vegetation and highly organic topsoil. The subgrade areas were stripped to what was considered an appropriate surface to support the placement of controlled fill.

2.2 Placement and testing of fill

The bulk fill was placed by TRN Group (TRN) during the period. In addition, a fill survey undertaken by Orion Group (copies attached) was provided by the client indicating the extents of placed fill. It is understood that the fill plan has been prepared based on the original site surface and not the actual stripped surface. As a result, there may be minor fill in areas shown as no fill.

The fill was placed continuously under compaction plant and was tested in lifts of up to 300 mm thickness. The fill materials typically comprised both site-won and imported clays, shale and sandstone. When informed by TRN that controlled fill was to be placed, a soils technician was present on site full-time during the fill placement to observe the earthworks and undertake field testing.

A total of 428 conforming density tests (excluding 17 failed tests) were carried out in the fill during the period. Rectification of failed areas was undertaken and retests produced conforming results. The locations of tests were randomly selected by Douglas to achieve distribution throughout the fill volume and are shown on Drawing 1 which is attached. The results of the density tests are given on the attached Project Summary Report and are summarised in Table 1.

Table 1: Summary of density testing

	Density ratio	Moisture content variance
Specification	98% – 104%	Lot Fill: -2.0% (wet) to +2.0% (dry) Mound Fill: -3.0% (wet) to +3.0% (dry)
Range (passed tests)	98% – 104%	-3.0% (wet) to +3.0% (dry)
Mean (passed tests)	100.5%	+0.5% (dry)
Median (passed tests)	100.5%	+0.5% (dry)
Standard deviation (passed tests)	1.4%	0.5%
No. passed tests (inc. retests)	428	
No. of retests	17	

Notes: Statistics provided are rounded to the nearest 0.5%.

3. Comments

Douglas undertook inspection and earthworks testing of fill placed within Tr 4 St 3a ("Cyan") and "Light Green" Subdivision, Cobbitty NSW, as requested by Mirvac Homes NSW Pty Ltd. It is considered that the placement and compaction of the bulk fill by TRN in the areas strip inspected by Douglas during the period have been carried out in accordance with the project specification

as far as Douglas has been able to determine in accordance with the requirements of AS 3798. Douglas does not undertake to guarantee the work of the contractor nor relieve their responsibility to produce a completed product conforming to the requirements of the specification.

For building on the filled areas, consideration should be given by the user/designer to the following:

- Possible disruption of the compacted fill by installation of services.
- The possibility that additional fill has been placed after the date of the last field density test, including the spreading of topsoil.
- Adequate containment of the filled area.
- The suitability of the filled land to support structures of various types without excessive deflection. In particular, the shrink/swell properties of the fill and natural soils must be considered in foundation/footing slab design and in detailing structures.
- The possible softening of the compacted fill because of rainfall and/or inundation from other sources. The moisture content (thus strength) of the placed fill could vary considerably from the time of placement to the time of construction.
- Variation in fill depth.

We trust that the above information is in accordance with your present needs. Please do not hesitate to contact the undersigned should you require additional information at this stage.

4. References

AS 3798. (2007). *Guidelines on Earthworks for Commercial and Residential Developments*. Standards Australia.

Please contact the undersigned if you have any questions on this matter.

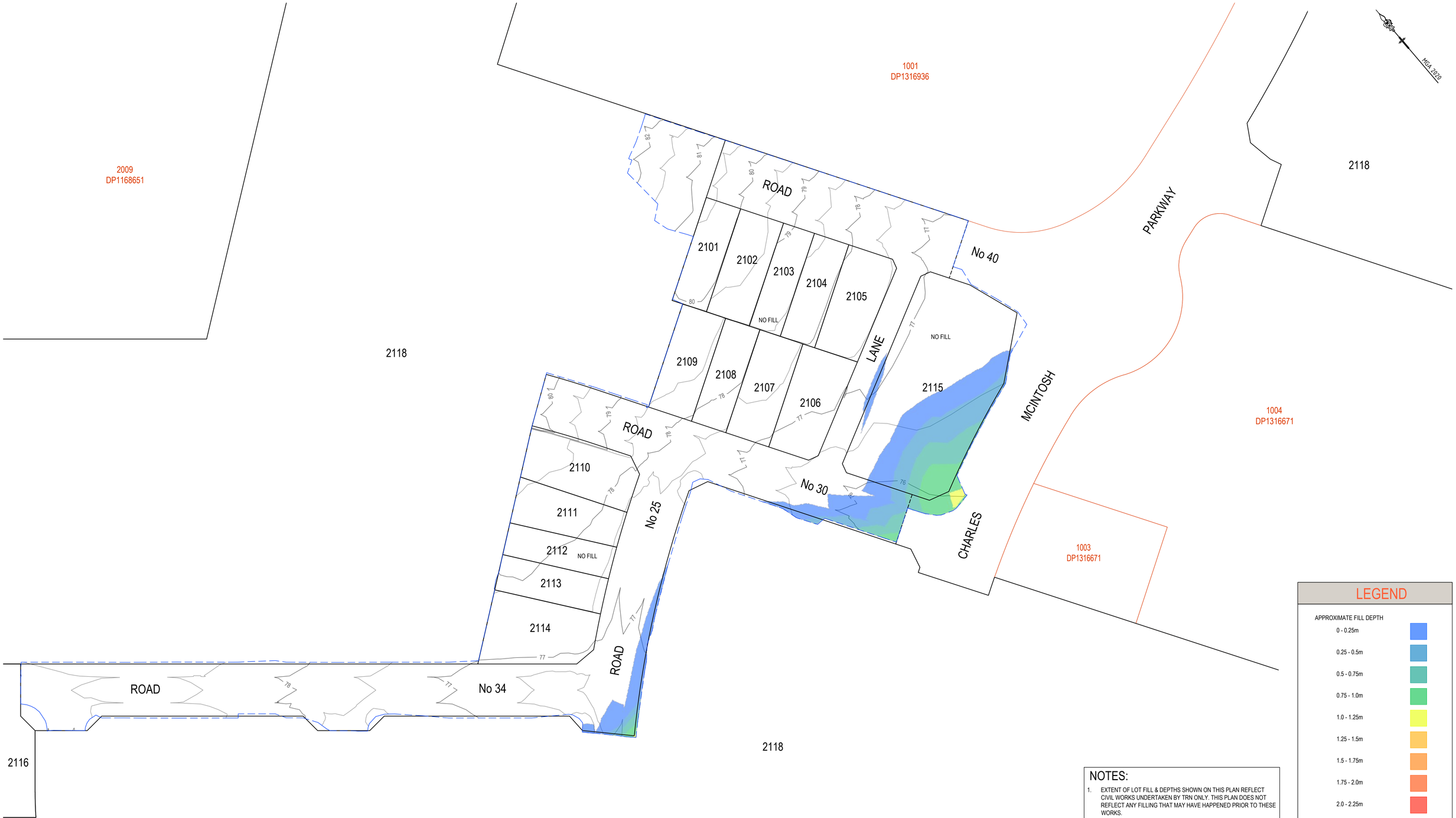
Yours faithfully
Douglas Partners Pty Ltd

p.p.
Afham Syed
Geotechnical Engineer

Reviewed by

Konrad Schultz
Principal

Attachments: Works-as-executed fill plans (prepared by Orion Group)
Drawing 1 – Density test location plan
Density test results
About this Inspection Report



NOTES:

1. EXTENT OF LOT FILL & DEPTHS SHOWN ON THIS PLAN REFLECT CIVIL WORKS UNDERTAKEN BY TRN ONLY. THIS PLAN DOES NOT REFLECT ANY FILLING THAT MAY HAVE HAPPENED PRIOR TO THESE WORKS.
2. ORIGINAL SURFACE SURVEY & DTM PREPARED BY PREMISE (DRAWING FILE 322165.02A.DS01) ORION GROUP TAKES NO RESPONSIBILITY FOR THE ACCURACY OF THIS SURVEY.
3. FINISHED SURFACE SURVEY & DTM PREPARED BY ORION GROUP. DATE OF SURVEY: 09/09/2025
4. EXTENT OF LOT FILL & DEPTHS SHOWN ON THIS PLAN REPRESENT THE LEVEL DIFFERENCE BETWEEN THE ORIGINAL SURFACE AND FINISHED SURFACE, WHICH BOTH INCLUDE COMPARABLE DEPTHS OF TOPSOIL. THEREFORE, THE FILL SHOWN ON THIS PLAN REFLECTS THE EXTENTS OF CONTROLLED FILL.

LEGEND

APPROXIMATE FILL DEPTH

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 0.75m
- 0.75 - 1.0m
- 1.0 - 1.25m
- 1.25 - 1.5m
- 1.5 - 1.75m
- 1.75 - 2.0m
- 2.0 - 2.25m
- 2.25 - 2.5m
- 2.5 - 2.75m
- 2.75m - 3.0m
- 3.0m +

LIMIT OF FINISHED SURFACE LEVELS

Rev	Drawn	Check	Appd.	Date	Revision Description
01	AM	AM	AM	25/09/2025	UPDATED NOTES
00	NAI	AM	AM	15/09/2025	INITIAL ISSUE

Scale: 0 5 10 15 20 25 30 35 40 45 50
SCALE 1:500 (A1) SCALE 1:1000 (A3)

Surveyor	NAI	Date of Survey	9/09/2025
Height Datum	AHD	Horizontal Datum	MGA2020
Origin	SSM18301 RL73.899 (SCIMS - 26/05/25)	Origin	SSM18303 - SSM23117 349°34'36" (SCIMS - 26/05/25)

For: mirvac

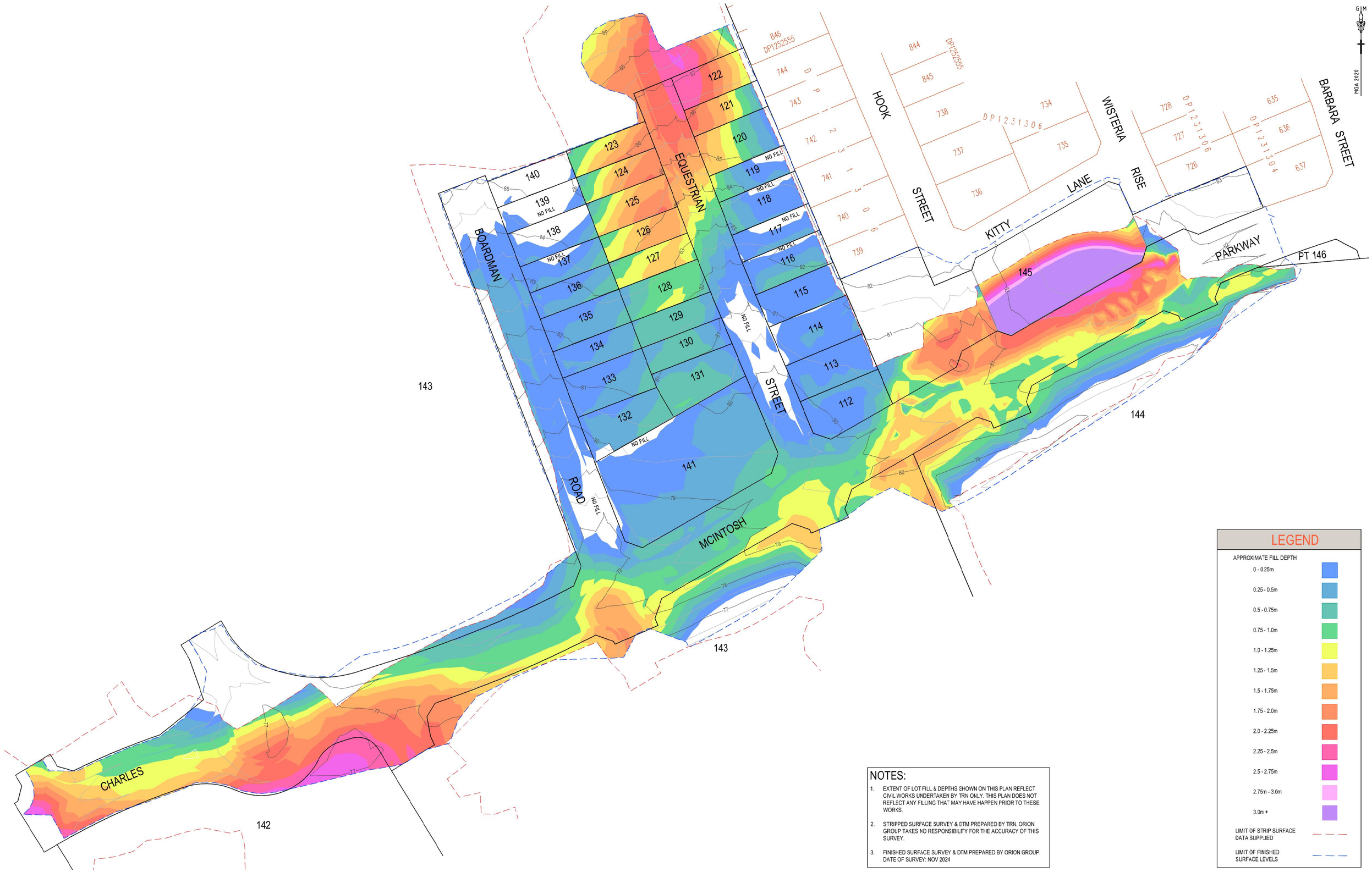
By: ORION

ABN:25 604 069 981 **PO Box:**7936, BAULKHAM HILLS NSW 2153 **T:**(02) 8660 0035 **E:** info@theoriongroup.au

Project: COBBITTY BY MIRVAC

Title: LOT FILL PLAN
LIGHT GREEN - STAGE 1

Project No.	Drawing No.	Milestone	Sheet	Revision
23-0088	SV-03-001	-	01 of 01	01



LEGEND

APPROXIMATE FILL DEPTH

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 0.75m
- 0.75 - 1.0m
- 1.0 - 1.25m
- 1.25 - 1.5m
- 1.5 - 1.75m
- 1.75 - 2.0m
- 2.0 - 2.25m
- 2.25 - 2.5m
- 2.5 - 2.75m
- 2.75m - 3.0m
- 3.0m +
- LIMIT OF STRIP SURFACE DATA SUPPLIED
- LIMIT OF FINISHED SURFACE LEVELS

NOTES:

1. EXTENT OF LOT FILL & DEPTHS SHOWN ON THIS PLAN REFLECT CIVIL WORKS UNDERTAKEN BY TRN ONLY. THIS PLAN DOES NOT REFLECT ANY FILLING THAT MAY HAVE HAPPEN PRIOR TO THESE WORKS.
2. STRIPPED SURFACE SURVEY & DTM PREPARED BY TRN. ORION GROUP TAKES NO RESPONSIBILITY FOR THE ACCURACY OF THIS SURVEY.
3. FINISHED SURFACE SURVEY & DTM PREPARED BY ORION GROUP. DATE OF SURVEY: NOV 2024

Rev	Drawn	Check	Appd.	Date	Revision Description
01	AM	AM	AM	27/11/2024	EXPANDED AREA COVERED
00	NAI	AM	AM	18/11/2024	INITIAL ISSUE

Scale: 0 6 12 18 24 30 36 42 48 54 60
SCALE 1:600 (A1) SCALE 1:1200 (A3)

Surveyor	NAI & JH	Date of Survey	NOV 2024
Height Datum	AHD	Horizontal Datum	MGA2020
Origin	SSM18303 RL75.154 (SCIMS - 06/06/22)	Origin	SSM18303 - SSM23117 349°34'35" (SCIMS - 06/06/22)

For: mirvac

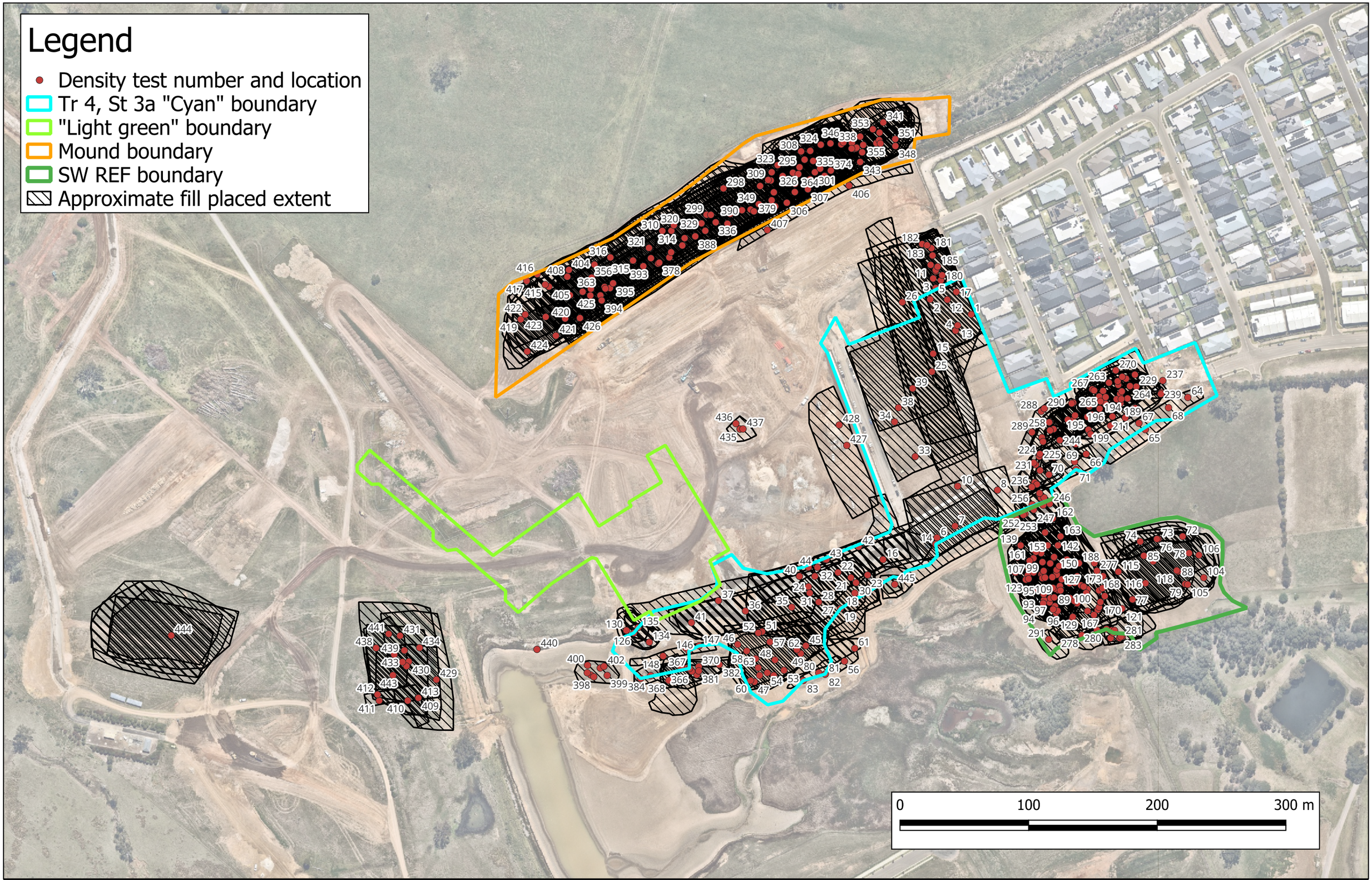
By: ORION

ABN:25 604 069 981 **PO Box:**7936, BAULKHAM HILLS NSW 2153 **T:**(02) 8660 0035 **E:** info@theoriongroup.au

Project: COBBITTY BY MIRVAC

Title: LOT FILL PLAN STAGE CYAN

Project No.	Drawing No.	Milestone	Sheet	Revision
23-0563	SV-04	-	01 of 01	00



Douglas PARTNERS GROUNDED EXPERTISE	CLIENT: Mirvac Homes NSW Pty Ltd	
	OFFICE: Macarthur	DRAWN BY: AS
	SCALE: As shown	DATE: 4 September 2025

TITLE: **Density test location plan**
Earthworks quality report
Tranche 4, Stage 3a ("Cyan") and "Light green", Cobbitty Road, Cobbitty, NSW

MGA

PROJ. #:	92323.21
DRAWING No:	1
REVISION:	0

Project Summary Report

Report Date: 27/11/2024
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Argaet
Project Number: 220469.02
Project Name: COBBITTY, Tr 4 St 3a ("Cyan") and "Light Green" Subdivision Level 1
Project Location: Tr 4 St 3a ("Cyan") and "Light Green" Subdivision, Cobbitty NSW
Specification:
Test Methods: AS 1289 5.7.1 STD & 5.8.1

Douglas Partners Pty Ltd
Macarthur Laboratory
18 Waler Crescent Smeaton Grange NSW 2567
Phone: (02) 4647 0075
Email: macarthur@douglaspartners.com.au

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-12612A	1	24/04/2024	Refer to map	288853.566	6234730.594	85.511	**	99.5	1.5	**	1.93
**	MA-12612B	2	24/04/2024	Refer to map	288821.661	6234742.233	85.433	**	100.5	0.5	**	2.08
**	MA-12612C	3	24/04/2024	Refer to map	288823.977	6234758.443	86.495	**	100.0	0.0	**	2.12
**	MA-12612D	4	24/04/2024	Refer to map	288841.408	6234717.879	84.057	**	102.5	0.0	**	2.12
**	MA-12618A	5	29/04/2024	See map	288826	6234751	86.343	**	101.0	-0.5	**	2.10
**	MA-12618B	6	29/04/2024	See map	288827	6234557	77.801	**	100.5	0.0	**	2.14
**	MA-12618C	7	29/04/2024	See map	288841	6234566	78.135	**	101.0	1.0	**	2.21
**	MA-12618D	8	29/04/2024	See map	288874	6234594	78.952	**	99.0	1.0	**	2.12
**	MA-12618E	9	29/04/2024	See map	288830	6234757	87.052	**	99.0	0.5	**	2.07
**	MA-12625A	10	30/04/2024	See map	288843	6234597	79.281	**	100.0	-1.0	**	2.04
**	MA-12625B	11	30/04/2024	See map	288822	6234769	88.474	**	101.5	-0.5	**	2.06
**	MA-12625C	12	30/04/2024	See map	288835	6234742	86.421	**	99.0	0.0	**	2.01
**	MA-12625D	13	30/04/2024	See map	288843	6234722	85.203	**	99.0	1.5	**	2.01
**	MA-12625E	14	30/04/2024	See map	288826	6234552	77.640	**	100.5	-0.5	**	2.18
**	MA-12625F	15	30/04/2024	See map	288824	6234700	83.530	**	99.5	1.5	**	2.08
**	MA-12625G	16	30/04/2024	See map	288785	6234540	77.360	**	101.0	1.0	**	2.17
**	MA-12631A	17	01/05/2024	See map	288842	6234748	86.952	**	101.5	0.5	**	2.05
**	MA-12631B	18	01/05/2024	See map	288763	6234514	75.697	**	99.0	0.0	**	2.01
**	MA-12631C	19	01/05/2024	See map	288752	6234502	75.384	**	102.5	2.0	**	2.09
**	MA-12631D	20	01/05/2024	See map	288732	6234527	76.175	**	102.5	2.0	**	2.09
**	MA-12644A	21	02/05/2024	See map	288760	6234526	76.8	**	101.0	-0.5	**	2.14
**	MA-12644B	22	02/05/2024	See map	288750	6234530	76.7	**	99.5	-0.5	**	2.11
**	MA-12644C	23	02/05/2024	See map	288773	6234528	76.8	**	107.0	2.0	**	2.14
**	MA-12644D	24	02/05/2024	See map	288727	6234519	76.1	**	104.0	0.5	**	2.11
**	MA-12648A	25	03/05/2024	See map	288823	6234686	83.482	**	101.5	1.0	**	2.11
**	MA-12648B	26	03/05/2024	See map	288800	6234740	87.718	**	101.5	1.0	**	2.09
**	MA-12648C	27	03/05/2024	See map	288735	6234507	76.180	**	95.0	0.5	**	1.97
**	MA-12648D	28	03/05/2024	Retest #27	288735	6234507	76.180	**	101.0	1.5	**	2.16
**	MA-12648E	29	03/05/2024	Retest #23	288773	6234528	76.8	**	102.0	-0.5	**	2.12
**	MA-12648F	30	03/05/2024	See map	288764	6234522	76.764	**	101.5	-0.5	**	2.13
**	MA-12648G	31	03/05/2024	See map	288728	6234514	76.317	**	102.5	-0.5	**	2.14
**	MA-12672A	32	15/05/2024	See map	288734	6234534	77.080	**	100.5	0.0	**	2.18
**	MA-12672B	33	15/05/2024	See map	288810	6234620	80.495	**	101.5	-0.5	**	2.04
**	MA-12672C	34	15/05/2024	See map	288794	6234647	81.799	**	100.0	-0.5	**	2.01
**	MA-12672D	35	15/05/2024	See map	288714	6234503	76.292	**	100.0	0.0	**	2.16
**	MA-12672E	36	15/05/2024	See map	288678	6234500	76.064	**	102.0	1.5	**	2.16
**	MA-12677A	37	16/05/2024	See map	288657	6234508	76.229	**	100.0	0.5	**	2.02
**	MA-12677B	38	16/05/2024	See map	288797	6234658	82.422	**	101.0	1.0	**	2.10
**	MA-12677C	39	16/05/2024	See map	288808	6234673	83.219	**	101.5	0.5	**	2.10
**	MA-12677D	40	16/05/2024	See map	288720	6234527	76.838	**	102.0	1.0	**	2.22
**	MA-12677E	41	16/05/2024	See map	288636	6234491	75.813	**	102.5	1.0	**	2.24
**	MA-12683A	42	17/05/2024	See map	288766	6234550	77.917	**	102.0	1.0	**	2.18
**	MA-12683B	43	17/05/2024	See map	288741	6234540	77.641	**	102.0	0.5	**	2.19
**	MA-12683C	44	17/05/2024	See map	288727	6234534	77.436	**	103.0	1.0	**	2.18
**	MA-12705A	45	21/05/2024	See map	288725	6234473	74.434	**	102.5	0.0	**	2.13
**	MA-12705B	46	21/05/2024	See map	288672	6234474	73.258	**	102.5	-0.5	**	2.14
**	MA-12705C	47	21/05/2024	See map	288685	6234445	73.524	**	100.5	0.0	**	2.13
**	MA-12723A	48	23/05/2024	See map	288701	6234462	74.034	**	100.0	-1.0	**	2.13

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-12723B	49	23/05/2024	See map	288721	6234467	74.188	**	101.0	0.5	**	2.17
**	MA-12723C	50	23/05/2024	See map	288689	6234450	73.781	**	101.0	-1.0	**	2.12
**	MA-12733A	51	24/05/2024	**	288691	6234484	75.850	**	101.5	-1.0	**	2.11
**	MA-12733B	52	24/05/2024	**	288688	6234483	75.475	**	98.0	-0.5	**	2.03
**	MA-12733C	53	24/05/2024	**	288708	6234454	73.961	**	100.5	-1.0	**	2.20
**	MA-12733D	54	24/05/2024	**	288695	6234452	73.827	**	101.5	0.5	**	2.24
**	MA-12733E	55	24/05/2024	**	288700	6234450	73.856	**	99.5	0.0	**	2.20
**	MA-12733F	56	24/05/2024	**	288755	6234461	72.927	**	99.0	1.5	**	2.18
**	MA-12733G	57	24/05/2024	**	288697	6234476	74.576	**	101.5	1.0	**	2.23
**	MA-12733H	58	24/05/2024	**	288679	6234469	74.210	**	100.0	-0.5	**	2.23
**	MA-12744A	59	27/05/2024	See map	288686	6234463	74.391	**	101.5	2.0	**	2.18
**	MA-12744B	60	27/05/2024	See map	288682	6234446	73.876	**	100.5	1.5	**	2.20
**	MA-12744C	61	27/05/2024	See map	288763	6234471	74.176	**	100.5	1.5	**	2.21
**	MA-12744D	62	27/05/2024	See map	288718	6234470	74.468	**	101.0	1.5	**	2.22
**	MA-12744E	63	27/05/2024	See map	288688	6234456	74.284	**	98.5	1.0	**	2.11
**	MA-12752A	64	28/05/2024	See map	289022	6234666	81.201	**	98.0	-1.0	**	2.14
**	MA-12752B	65	28/05/2024	See map	288989	6234641	80.456	**	99.5	-0.5	**	2.14
**	MA-12752C	66	28/05/2024	See map	288943	6234622	79.798	**	102.0	0.0	**	2.17
**	MA-12752D	67	28/05/2024	See map	288984	6234646	80.956	**	101.0	0.5	**	2.17
**	MA-12752E	68	28/05/2024	See map	289007	6234658	81.544	**	99.0	0.0	**	2.13
**	MA-12758A	69	29/05/2024	See map	288934	6234616	80.136	**	101.0	-0.5	**	2.08
**	MA-12758B	70	29/05/2024	See map	288914	6234606	79.569	**	101.5	0.0	**	2.14
**	MA-12758C	71	29/05/2024	See map	288935	6234610	79.640	**	100.5	0.0	**	2.11
**	MA-12758D	72	29/05/2024	See map	289018	6234558	76.632	**	101.0	0.0	**	2.13
**	MA-12758E	73	29/05/2024	See map	288999	6234556	76.770	**	98.5	-0.5	**	2.06
**	MA-12765F	79	30/05/2024	See map	289020	6234521	77.699	**	101.0	0.0	**	2.25
**	MA-12765A	74	30/05/2024	See map	288985	6234554	78.096	**	100.5	-0.5	**	2.16
**	MA-12765B	75	30/05/2024	Test failed	288998	6234556	78.228	**	96.5	0.5	**	2.10
**	MA-12765C	76	30/05/2024	Retest 75	288998	6234556	78.228	**	100.0	0.0	**	2.21
**	MA-12765D	77	30/05/2024	See map	288979	6234509	77.577	**	102.0	0.0	**	2.23
**	MA-12765E	78	30/05/2024	See map	289023	6234545	78.828	**	99.0	0.5	**	2.16
**	MA-12779A	80	31/05/2024	**	288735	6234452	73.000	98%	101.5	1.5	**	2.15
**	MA-12779B	81	31/05/2024	**	288740	6234451	73.320	98%	101.0	1.5	**	2.11
**	MA-12779C	82	31/05/2024	**	288740	6234451	73.670	98%	100.0	1.0	**	2.14
**	MA-12779D	83	31/05/2024	**	288723	6234446	74.020	98%	101.0	1.5	**	2.17
**	MA-12779E	84	31/05/2024	**	288920	6234530	75.620	98%	100.5	1.5	**	2.16
**	MA-12801A	85	04/06/2024	**	288987.830	6234542.944	75.820	**	98.0	2.0	**	2.13
**	MA-12801B	86	04/06/2024	**	289014.419	6234530.832	76.235	**	97.5	2.0	**	2.15
**	MA-12801C	87	04/06/2024	**	288987.830	6234542.944	75.820	**	95.5	0.5	**	2.13
**	MA-12801D	88	04/06/2024	Re Test (86)	289014.419	6234530.832	76.235	**	94.5	0.5	**	2.10
**	MA-12801E	89	04/06/2024	**	288918.711	6234503.767	75.141	**	95.0	0.5	**	2.09
**	MA-12809A	90	05/06/2024	Re Test (87)	288987.830	6234542.944	75.820	**	103.0	0.5	**	2.23
**	MA-12809B	91	05/06/2024	Re Test (88)	289014.419	6234530.832	76.235	**	101.5	0.5	**	2.21
**	MA-12809C	92	05/06/2024	Re Test (89)	288918.711	6234503.767	75.141	**	100.5	0.5	**	2.21
**	MA-12809D	93	05/06/2024	**	288905.631	6234500.231	75.103	**	98.0	2.0	**	2.18
**	MA-12809E	94	05/06/2024	Re Test (93)	288905.631	6234500.231	75.103	**	102.5	0.5	**	2.28
**	MA-12809F	95	05/06/2024	**	288905.682	6234516.155	75.314	**	100.0	0.5	**	2.30
**	MA-12839A	96	13/06/2024	**	288919.465	6234498.554	75.432	**	99.0	-1.0	**	2.23
**	MA-12839B	97	13/06/2024	**	288914.487	6234506.717	75.357	**	99.5	-0.5	**	2.12
**	MA-12839C	98	13/06/2024	**	288920.125	6234528.215	75.582	**	100.5	0.5	**	2.13
**	MA-12839D	99	13/06/2024	**	288908.253	6234528.454	75.673	**	98.0	-0.5	**	2.12
**	MA-12858A	100	14/06/2024	**	288930.363	6234510.028	75.901	**	103.5	0.0	**	2.28
**	MA-12858B	101	14/06/2024	**	288921.151	6234516.202	75.805	**	102.5	0.5	**	2.28
**	MA-12858C	102	14/06/2024	**	288916.645	6234526.353	75.929	**	102.5	0.0	**	2.23
**	MA-12858D	103	14/06/2024	**	288911.319	6234517.826	75.761	**	100.5	0.0	**	2.19
**	MA-12867A	104	17/06/2024	**	289034.425	6234525.904	76.398	**	102.5	0.0	**	2.19
**	MA-12867B	105	17/06/2024	**	289021.883	6234520.628	76.158	**	102.0	0.0	**	2.17
**	MA-12867C	106	17/06/2024	**	289030.642	6234543.457	76.586	**	102.5	-0.5	**	2.20
**	MA-12867D	107	17/06/2024	**	288897.567	6234527.786	75.996	**	102.5	0.0	**	2.22

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-12867E	108	17/06/2024	**	288909.489	6234528.152	76.133	**	99.0	0.0	**	2.16
**	MA-12867F	109	17/06/2024	**	288918.945	6234517.284	76.098	**	98.5	0.0	**	2.14
**	MA-12867G	110	17/06/2024	**	288915.309	6234510.057	76.083	**	101.0	0.0	**	2.16
**	MA-12875A	111	18/06/2024	**	288924.002	6234524.650	76.360	**	101.5	0.0	**	2.21
**	MA-12875B	112	18/06/2024	**	288908.928	6234525.564	76.095	**	99.5	0.0	**	2.19
**	MA-12875C	113	18/06/2024	**	288910.230	6234508.642	76.075	**	100.5	0.0	**	2.15
**	MA-12875D	114	18/06/2024	**	288918.125	6234510.558	76.182	**	100.0	-0.5	**	2.17
**	MA-12887A	115	19/06/2024	**	288968.016	6234530.537	76.135	**	102.0	-0.5	**	2.15
**	MA-12887B	116	19/06/2024	**	288989.137	6234521.613	75.946	**	98.5	-0.5	**	2.19
**	MA-12887C	117	19/06/2024	**	288995.135	6234538.574	76.262	**	101.5	0.0	**	2.18
**	MA-12887D	118	19/06/2024	**	289013.415	6234531.532	76.415	**	100.0	0.0	**	2.15
**	MA-12887E	119	19/06/2024	**	288920.770	6234500.148	76.404	**	98.0	0.0	**	2.18
**	MA-12887F	120	19/06/2024	**	288909.523	6234505.965	76.166	**	101.5	0.0	**	2.18
**	MA-12898A	121	20/06/2024	**	288970.845	6234501.914	75.934	**	99.5	0.0	**	2.19
**	MA-12898B	122	20/06/2024	**	288951.958	6234501.013	76.050	**	101.0	0.0	**	2.18
**	MA-12898C	123	20/06/2024	**	288896.053	6234524.420	76.333	**	103.5	-0.5	**	2.18
**	MA-12898D	124	20/06/2024	**	288898.204	6234532.799	76.506	**	100.0	0.0	**	2.18
**	MA-12898E	125	20/06/2024	**	288931.997	6234493.547	76.431	**	100.0	0.0	**	2.19
**	MA-12898F	126	20/06/2024	**	288591.179	6234482.928	74.015	**	99.5	0.0	**	2.14
**	MA-12906A	127	21/06/2024	**	288922.538	6234519.469	76.709	**	100.0	0.0	**	2.19
**	MA-12906B	128	21/06/2024	**	288917.250	6234501.322	76.870	**	101.0	0.0	**	2.14
**	MA-12906C	129	21/06/2024	**	288932.583	6234495.472	76.607	**	101.0	0.0	**	2.20
**	MA-12906D	130	21/06/2024	**	288585.487	6234484.940	74.191	**	102.0	0.0	**	2.15
**	MA-12921A	131	24/06/2024	See Map	288909.940	6234531.130	76.815	**	98.5	0.5	**	2.16
**	MA-12921B	132	24/06/2024	See Map	288902.191	6234547.486	76.955	**	102.5	0.0	**	2.22
**	MA-12921C	133	24/06/2024	See Map	288917.905	6234541.523	76.873	**	100.5	0.5	**	2.18
**	MA-12921D	134	24/06/2024	See Map	288603.277	6234475.814	74.342	**	100.5	0.5	**	2.19
**	MA-12928A	135	25/06/2024	See Map	288594.523	6234487.101	74.916	**	99.5	1.0	**	2.21
**	MA-12928B	136	25/06/2024	See Map	288898.193	6234525.002	76.913	**	100.5	0.5	**	2.22
**	MA-12928C	137	25/06/2024	See Map	288889.638	6234541.851	77.052	**	100.5	0.5	**	2.18
**	MA-12941A	138	26/06/2024	See Map	288888	6234530	77.120	98% STD	99.5	0.5	**	2.14
**	MA-12941B	139	26/06/2024	See Map	288892	6234551	77.440	98% STD	100.5	0.5	**	2.15
**	MA-12941C	140	26/06/2024	See Map	288902	6234530	77.420	98% STD	101.0	1.5	**	2.14
**	MA-12950A	141	27/06/2024	See map	288928	6234540	77.886	**	101.5	0.5	**	2.21
**	MA-12950B	142	27/06/2024	See map	288921	6234551	78.100	**	99.5	0.5	**	2.20
**	MA-12950C	143	27/06/2024	See map	288918	6234542	77.994	**	101.0	-1.0	**	2.19
**	MA-12950D	144	27/06/2024	See map	288913	6234551	78.007	**	100.0	1.0	**	2.16
**	MA-12962A	145	28/06/2024	See map	288632	6234471	73.862	**	101.0	-0.5	**	2.14
**	MA-12962B	146	28/06/2024	See map	288634	6234469	73.964	**	102.0	-0.5	**	2.19
**	MA-12962C	147	28/06/2024	See map	288642	6234473	74.020	**	99.0	0.0	**	2.11
**	MA-12962D	148	28/06/2024	See map	288614	6234465	73.627	**	98.5	0.0	**	2.12
**	MA-12988A	149	08/07/2024	See map	288911	6234526	77.819	**	98.0	-0.5	**	2.13
**	MA-12988B	150	08/07/2024	See map	288920	6234532	77.777	**	101.5	-0.5	**	2.22
**	MA-12988C	151	08/07/2024	See map	288911	6234561	77.872	**	99.0	1.0	**	2.13
**	MA-12988D	152	08/07/2024	See map	288902	6234541	77.964	**	99.5	0.5	**	2.15
**	MA-12998A	153	10/07/2024	See map	288908	6234545	78.163	**	101.0	0.0	**	2.15
**	MA-12998B	154	10/07/2024	See map	288915	6234537	77.949	**	101.5	-0.5	**	2.18
**	MA-12998C	155	10/07/2024	See map	288917	6234518	77.488	**	98.0	-0.5	**	2.14
**	MA-13002A	156	11/07/2024	See map	288909	6234538	78.204	**	100.0	0.5	**	2.06
**	MA-13002B	157	11/07/2024	See map	288904	6234546	78.310	**	101.0	0.5	**	2.06
**	MA-13002C	158	11/07/2024	See map	288922	6234535	78.123	**	100.5	-1.0	**	2.07
**	MA-13006A	159	12/07/2024	See map	288934	6234522	77.150	**	100.5	-0.5	**	2.16
**	MA-13006B	160	12/07/2024	See map	288910	6234513	77.374	**	99.0	0.0	**	2.12
**	MA-13006C	161	12/07/2024	See map	288899	6234539	77.781	**	102.0	0.5	**	2.19
**	MA-13021A	162	15/07/2024	See map	288917	6234572	78.628	**	100.0	0.0	**	2.13
**	MA-13021B	163	15/07/2024	See map	288923	6234558	78.715	**	98.0	-0.5	**	2.12
**	MA-13021C	164	15/07/2024	See map	288923	6234516	77.925	**	99.0	0.5	**	2.12
**	MA-13031A	165	16/07/2024	See map	288953	6234503	76.054	**	102.0	-0.5	**	2.22
**	MA-13031B	166	16/07/2024	See map	288944	6234517	76.481	**	99.0	-1.0	**	2.13
**	MA-13031C	167	16/07/2024	See map	288949	6234497	76.637	**	100.5	-0.5	**	2.14

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-13042D	171	17/07/2024	See map	288944	6234500	77.100	**	100.5	0.0	**	2.17
**	MA-13042A	168	17/07/2024	See map	288953	6234516	76.548	**	98.5	0.0	**	2.14
**	MA-13042B	169	17/07/2024	See map. Test failed	288954	6234507	76.958	**	97.0	-0.5	**	2.09
**	MA-13042C	170	17/07/2024	See map. Retest 169	288954	6234507	76.958	**	99.0	-0.5	**	2.12
**	MA-13055A	172	18/07/2024	**	288943	6234514	77.395	**	100.0	0.0	**	2.13
**	MA-13055B	173	18/07/2024	**	288939	6234520	77.490	**	101.0	0.0	**	2.16
**	MA-13055C	174	18/07/2024	**	288936	6234506	77.610	**	100.5	0.5	**	2.15
**	MA-13067A	175	19/07/2024	**	288936	6234527	77.950	**	100.0	-0.5	**	2.14
**	MA-13067B	176	19/07/2024	**	288941	6234519	78.100	**	101.0	0.5	**	2.15
**	MA-13067C	177	19/07/2024	**	288937	6234510	78.140	**	100.5	0.5	**	2.14
**	MA-13085A	178	22/07/2024	**	288825.984	6234764.069	88.465	**	100.5	0.5	**	2.14
**	MA-13097A	179	23/07/2024	See map	288826	6234765	88.588	**	100.5	0.0	**	2.15
**	MA-13097B	180	23/07/2024	See map	288831	6234761	88.336	**	101.0	0.0	**	2.17
**	MA-13111A	181	24/07/2024	**	288822.600	6234781.956	90.060	**	100.5	0.0	**	2.14
**	MA-13128A	182	25/07/2024	**	288815.449	6234785.190	90.366	**	99.5	0.5	**	2.11
**	MA-13143A	183	26/07/2024	**	288819.239	6234784.300	90.273	**	100.0	-0.5	**	2.12
**	MA-13143B	184	26/07/2024	**	288823.548	6234776.312	89.634	**	101.5	-0.5	**	2.14
**	MA-13143C	185	26/07/2024	**	288827.485	6234767.623	88.815	**	100.5	-0.5	**	2.13
**	MA-13143D	186	26/07/2024	See map	288929.958	6234521.544	78.116	**	101.0	0.5	**	2.29
**	MA-13143E	187	26/07/2024	See map	288933.926	6234507.727	77.847	**	99.5	0.5	**	2.24
**	MA-13143F	188	26/07/2024	See map	288937.354	6234537.151	78.559	**	99.5	1.5	**	2.20
**	MA-13168A	189	31/07/2024	**	288969.602	6234661.554	78.764	**	99.0	-1.0	**	2.10
**	MA-13168B	190	31/07/2024	**	288947.512	6234652.558	78.614	**	99.0	-0.5	**	2.09
**	MA-13180A	191	01/08/2024	**	288914.769	6234640.619	78.629	**	100.0	-0.5	**	2.12
**	MA-13180B	192	01/08/2024	**	288975.139	6234665.219	79.252	**	100.0	-0.5	**	2.11
**	MA-13180C	193	01/08/2024	**	288917.636	6234641.342	78.935	**	99.5	0.0	**	2.10
**	MA-13197A	194	02/08/2024	**	288966.686	6234664.649	79.488	**	100.5	-0.5	**	2.12
**	MA-13197B	195	02/08/2024	**	288943.918	6234650.866	79.502	**	101.5	-0.5	**	2.15
**	MA-13197C	196	02/08/2024	**	288953.433	6234657.256	79.853	**	101.0	-0.5	**	2.13
**	MA-13197D	197	02/08/2024	**	288932.703	6234648.226	79.774	**	101.0	0.0	**	2.12
**	MA-13208A	198	03/08/2024	**	288963.430	6234651.143	80.238	**	101.0	0.0	**	2.13
**	MA-13208B	199	03/08/2024	**	288944.742	6234640.874	80.186	**	101.0	-0.5	**	2.13
**	MA-13214A	200	05/08/2024	**	288969.430	6234668.819	80.160	**	100.0	0.0	**	2.12
**	MA-13214B	201	05/08/2024	**	288945.586	6234658.954	79.833	**	101.0	0.0	**	2.13
**	MA-13227A	202	06/08/2024	**	288970.289	6234664.729	80.488	**	101.0	-0.5	**	2.13
**	MA-13227B	203	06/08/2024	**	288945.940	6234660.084	80.412	**	100.5	0.0	**	2.12
**	MA-13227C	204	06/08/2024	**	288928.682	6234648.676	80.078	**	101.0	0.5	**	2.15
**	MA-13243A	205	07/08/2024	**	288934.796	6234629.787	79.964	**	101.5	0.0	**	2.15
**	MA-13243B	206	07/08/2024	**	288961.878	6234644.054	80.279	**	100.5	0.0	**	2.12
**	MA-13243C	207	07/08/2024	**	288934.796	6234629.787	79.964	**	101.0	-0.5	**	2.13
**	MA-13243D	208	07/08/2024	**	288907.086	6234589.852	78.139	**	100.5	-1.0	**	2.12
**	MA-13243E	209	07/08/2024	**	288902.607	6234600.080	77.407	**	100.5	-1.0	**	2.12
**	MA-13243F	210	07/08/2024	**	288902.972	6234599.881	77.855	**	100.5	0.0	**	2.12
**	MA-13243G	211	07/08/2024	**	288973.357	6234650.224	80.541	**	100.0	-0.5	**	2.11
**	MA-13243H	212	07/08/2024	**	288946.501	6234637.418	80.426	**	101.5	-0.5	**	2.15
**	MA-13243I	213	07/08/2024	**	288904.623	6234598.431	78.350	**	99.5	-0.5	**	2.10
**	MA-13258A	214	08/08/2024	see map	288909	6234628	77.619	300	99.5	-3.0	**	2.08
**	MA-13258B	215	08/08/2024	retest #214	288909	6234628	77.619	300	100.5	0.0	**	2.10
**	MA-13258C	216	08/08/2024	see map	288912	6234633	78.426	300	100.5	-0.5	**	2.08
**	MA-13258G	220	08/08/2024	see map	288996.742	6234666.989	77.615	300	98.0	-1.0	**	2.10
**	MA-13258F	219	08/08/2024	see map	288936.922	6234630.212	77.619	300	102.5	1.0	**	2.10
**	MA-13258H	221	08/08/2024	Retest #220	288996.742	6234666.989	77.615	300	97.0	-1.0	**	2.09
**	MA-13258I	222	08/08/2024	see map	288977.629	6234655.901	77.618	300	99.5	-1.0	**	2.13
**	MA-13272A	224	09/08/2024	**	288981.212	6234657.701	80.650	**	102.0	0.5	**	2.14
**	MA-13272B	225	09/08/2024	**	288934.310	6234651.998	80.727	**	101.0	0.0	**	2.12
**	MA-13272C	226	09/08/2024	**	288906.871	6234621.000	78.147	**	100.0	-1.0	**	2.10
**	MA-13272D	227	09/08/2024	**	288906.521	6234620.137	78.356	**	100.0	-0.5	**	2.11
**	MA-13272E	228	09/08/2024	**	288907.013	6234622.100	78.736	**	99.5	-0.5	**	2.10
**	MA-13272F	229	09/08/2024	**	288983.796	6234656.182	81.090	**	101.0	0.0	**	2.11
**	MA-13285A	230	10/08/2024	**	288917.230	6234621.862	79.611	**	101.5	0.0	**	2.16
**	MA-13285B	231	10/08/2024	**	288918.046	6234619.664	80.038	**	100.5	-0.5	**	2.13
**	MA-13291A	232	12/08/2024	**	288981.985	6234674.417	80.993	**	100.5	-0.5	**	2.12

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-13291B	233	12/08/2024	**	288953.130	6234666.704	80.974	**	101.0	-0.5	**	2.12
**	MA-13291C	234	12/08/2024	**	288903.762	6234613.746	78.933	**	100.0	-0.5	**	2.10
**	MA-13316A	235	16/08/2024	**	288957.872	6234661.268	81.636	**	100.5	-1.0	**	2.13
**	MA-13316B	236	16/08/2024	**	288970.654	6234670.707	81.636	**	100.0	-1.0	**	2.11
**	MA-13327A	237	19/08/2024	**	288967.908	6234675.764	81.950	**	100.5	0.0	**	2.14
**	MA-13327B	238	19/08/2024	**	288956.166	6234671.041	81.929	**	101.0	-0.5	**	2.15
**	MA-13335A	239	20/08/2024	**	288900.702	6234596.390	79.337	**	102.5	0.5	**	2.18
**	MA-13335B	240	20/08/2024	**	289002.552	6234670.039	80.712	**	101.5	-0.5	**	2.14
**	MA-13335C	241	20/08/2024	**	289001.332	6234669.619	80.978	**	102.0	0.0	**	2.17
**	MA-13335D	242	20/08/2024	**	289001.112	6234668.696	81.295	**	102.0	0.0	**	2.17
**	MA-13350A	243	21/08/2024	**	288902.159	6234615.162	79.894	**	100.5	0.0	**	2.13
**	MA-13350B	244	21/08/2024	**	288907.124	6234609.247	80.051	**	101.0	0.5	**	2.14
**	MA-13350C	245	21/08/2024	**	288932.925	6234661.891	80.373	**	101.0	-0.5	**	2.13
**	MA-13350D	246	21/08/2024	**	288923.669	6234615.330	80.329	**	100.5	-0.5	**	2.13
**	MA-13350E	247	21/08/2024	**	288922.448	6234632.752	80.653	**	101.0	0.0	**	2.14
**	MA-13350F	248	21/08/2024	**	288931.726	6234661.329	80.789	**	101.0	0.5	**	2.13
**	MA-13365A	249	22/08/2024	**	288914.624	6234583.348	77.386	**	100.0	-0.5	**	2.11
**	MA-13365B	250	22/08/2024	**	288902.159	6234578.733	77.621	**	99.5	-0.5	**	2.10
**	MA-13365C	251	22/08/2024	**	288907.886	6234587.940	78.166	**	100.5	-0.5	**	2.13
**	MA-13365D	252	22/08/2024	**	288909.576	6234582.226	78.594	**	100.0	-1.0	**	2.11
**	MA-13376A	253	23/08/2024	**	288895.424	6234575.366	77.490	**	99.5	0.0	**	2.10
**	MA-13376B	254	23/08/2024	**	288910.220	6234588.162	78.920	**	100.0	1.0	**	2.11
**	MA-13376C	255	23/08/2024	**	288894.162	6234574.734	77.913	**	99.5	-1.0	**	2.11
**	MA-13376D	256	23/08/2024	**	288888.509	6234572.130	78.207	**	100.0	0.0	**	2.11
**	MA-13376E	257	23/08/2024	**	288906.752	6234591.553	79.332	**	98.5	2.5	**	2.13
**	MA-13376F	258	23/08/2024	RE-TEST (257)	288906.752	6234591.553	79.332	**	101.0	0.5	**	2.13
**	MA-13388A	259	24/08/2024	**	288901.007	6234582.729	79.663	**	101.5	0.5	**	2.14
**	MA-13393A	260	26/08/2024	**	288914.211	6234646.696	79.751	**	99.0	3.0	**	2.09
**	MA-13393B	261	26/08/2024	RE TEST (260)	288914.211	6234646.696	79.751	**	101.0	1.0	**	2.13
**	MA-13393C	262	26/08/2024	**	288908.559	6234634.830	79.885	**	100.5	0.0	**	2.11
**	MA-13408A	263	27/08/2024	**	288909.433	6234631.667	80.112	**	101.0	0.5	**	2.14
**	MA-13408B	264	27/08/2024	**	288914.960	6234640.336	80.540	**	100.5	0.5	**	2.13
**	MA-13408C	265	27/08/2024	**	288973.982	6234680.613	82.283	**	99.5	0.5	**	2.10
**	MA-13408D	266	27/08/2024	**	288960.699	6234677.420	82.481	**	102.0	0.0	**	2.18
**	MA-13422A	267	28/08/2024	**	288977.041	6234674.821	82.709	**	99.5	0.0	**	2.09
**	MA-13422B	268	28/08/2024	**	288954.074	6234662.905	83.047	**	98.0	1.0	**	2.06
**	MA-13439B	270	29/08/2024	**	288947.792	6234672.309	82.792	**	100.0	1.0	**	2.10
**	MA-13439A	269	29/08/2024	**	288958.130	6234666.244	83.441	**	100.5	0.5	**	2.11
**	MA-13462A	271	30/08/2024	**	288949.180	6234671.399	83.145	**	101.0	0.5	**	2.13
**	MA-13462B	272	30/08/2024	**	288967.474	6234678.613	83.623	**	101.5	0.0	**	2.15
**	MA-13468A	273	31/08/2024	See map	288966	6234687	83.538	**	101.5	0.0	**	2.19
**	MA-13468B	274	31/08/2024	See map	288971	6234682	83.677	**	101.0	0.0	**	2.18
**	MA-13480A	275	02/09/2024	See map	288980.9	6234683.7	83.46	**	99.0	-0.5	**	2.15
**	MA-13480B	276	02/09/2024	See map	288956.1	6234527.1	76.27	**	98.0	-1.5	**	2.07
**	MA-13488A	277	03/09/2024	See map	288949.403	6234537.210	76.546	**	98.5	-1.5	**	2.06
**	MA-13488B	278	03/09/2024	See map	288955.614	6234517.736	76.789	**	98.5	-1.5	**	2.07
**	MA-13488C	279	03/09/2024	See map	288957.460	6234511.633	77.441	**	99.0	-0.5	**	2.08
**	MA-13488D	280	03/09/2024	See map	288951.302	6234531.215	77.024	**	99.5	-1.0	**	2.09
**	MA-13488E	281	03/09/2024	See map	288939.636	6234481.274	77.270	**	98.0	-1.5	**	2.06
**	MA-13502A	282	04/09/2024	**	288958.784	6234486.	76.415	**	102.0	0.5	**	2.18
**	MA-13502B	283	04/09/2024	**	288951.398	6234485.105	77.012	**	101.0	0.0	**	2.15
**	MA-13612A	284	12/09/2024	See map	288971	6234480	74.662	**	99.5	0.5	**	2.08
**	MA-13612B	285	12/09/2024	See map	288969	6234479	75.285	**	100.0	-0.5	**	2.10
**	MA-13612C	286	12/09/2024	See map	288970	6234480	75.540	**	100.5	0.5	**	2.12
**	MA-13627A	287	13/09/2024	See map	288962	6234479	75.928	**	101.5	0.5	**	2.19
**	MA-13627B	288	13/09/2024	See map	288964	6234483	76.622	**	100.0	0.5	**	2.17
**	MA-13627C	289	13/09/2024	See map	288963	6234485	76.615	**	101.0	0.0	**	2.18
**	MA-13627D	290	13/09/2024	See map	288965	6234485	76.850	**	100.5	0.5	**	2.18
**	MA-13660A	291	17/09/2024	**	288908.0	6234655.2	80.06	**	99.5	1.0	**	2.03
**	MA-13660B	292	17/09/2024	**	288900.8	6234638.9	79.93	**	100.5	-1.0	**	2.20
**	MA-13660C	293	17/09/2024	**	288910.4	6234657.4	80.97	**	100.5	1.5	**	2.17
**	MA-13693A	294	19/09/2024	**	288913.9	6234478.0	76.99	FL	100.5	-1.0	**	2.16
**	MA-13841A	295	10/10/2024	**	288720.073	6234844.9	90.06	**	101.5	3.0	**	2.01

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-13841B	296	10/10/2024	**	288666.1	6234808.7	90.43	**	100.5	2.5	**	2.01
**	MA-13841C	297	10/10/2024	**	288689.4	6234830.3	90.08	**	99.5	2.5	**	1.98
**	MA-13865A	298	11/10/2024	**	288660.9	6234828.4	89.47	**	102.5	2.0	**	2.09
**	MA-13865B	299	11/10/2024	**	288647.8	6234808.0	90.00	**	102.0	2.0	**	2.08
**	MA-13865C	300	11/10/2024	**	288697.7	6234834.6	90.43	**	102.0	2.0	**	2.09
**	MA-13875A	301	12/10/2024	See map	288732	6234841	91.443	**	99.5	1.5	**	2.16
**	MA-13875B	302	12/10/2024	See map	288707	6234838	90.762	**	100.0	0.0	**	2.17
**	MA-13875C	303	12/10/2024	See map	288682	6234812	91.079	**	101.5	0.5	**	2.22
**	MA-13884A	304	14/10/2024	**	288664.0	6234801.0	90.88	**	99.0	1.0	**	2.11
**	MA-13884B	305	14/10/2024	**	288742.0	6234834.2	91.98	**	99.5	2.0	**	2.14
**	MA-13884C	306	14/10/2024	**	288710.2	6234817.3	91.73	**	99.5	2.0	**	2.17
**	MA-13896A	307	15/10/2024	**	288726.6	6234827.8	92.33	**	100.0	2.0	**	2.05
**	MA-13896B	308	15/10/2024	**	288721.3	6234857.2	90.98	**	100.0	1.5	**	2.11
**	MA-13896C	309	15/10/2024	**	288695.7	6234835.0	91.21	**	99.0	1.5	**	2.09
**	MA-13903A	310	16/10/2024	**	288613.4	6234795.4	89.38	**	99.0	2.0	**	2.04
**	MA-13903B	311	16/10/2024	**	288604.5	6234774.2	90.10	**	98.0	1.5	**	2.00
**	MA-13903C	312	16/10/2024	**	288565.2	6234745.3	89.96	**	95.0	1.5	**	1.92
**	MA-13921A	313	17/10/2024	**	288620.4	6234795.5	89.66	**	100.0	1.0	**	2.12
**	MA-13921B	314	17/10/2024	**	288590.6	6234772.4	89.95	**	100.0	2.0	**	2.13
**	MA-13921C	315	17/10/2024	**	288573.0	6234774.8	89.35	**	101.0	2.5	**	2.18
**	MA-13933A	316	18/10/2024	**	288630.7	6234789.8	90.62	**	100.5	2.5	**	2.14
**	MA-13933B	317	18/10/2024	**	288618.8	6234774.8	91.01	**	100.5	2.0	**	2.17
**	MA-13933C	318	18/10/2024	**	288572.7	6234751.0	90.49	**	99.5	2.0	**	2.12
**	MA-13939A	319	19/10/2024	**	288622.4	6234799.8	90.58	**	100.0	2.0	**	2.15
**	MA-13947A	320	21/10/2024	**	288603.0	6234782.2	91.05	**	100.5	2.5	**	2.14
**	MA-13947B	321	21/10/2024	**	288736.6	6234862.4	91.28	**	97.0	1.5	**	1.95
**	MA-13947C	322	21/10/2024	**	288703.0	6234846.5	91.04	**	97.5	2.5	**	1.95
**	MA-13903D	325	21/10/2024	Retest #312	288565.2	6234745.3	89.96	**	101.0	2.5	**	2.00
**	MA-13947D	323	21/10/2024	Retest 321	288736.6	6234862.4	91.28	**	101.5	2.0	**	1.97
**	MA-13947E	324	21/10/2024	Retest 322	288703.0	6234846.5	91.04	**	100.0	2.0	**	1.97
**	MA-13966A	326	22/10/2024	**	288714.9	6234840.6	92.46	**	103.0	2.0	**	2.15
**	MA-13966B	327	22/10/2024	**	288728.4	6234857.6	91.82	**	99.0	2.0	**	2.10
**	MA-13966C	328	22/10/2024	**	288698.4	6234841.0	92.05	**	101.5	2.0	**	2.19
**	MA-13980A	329	23/10/2024	**	288643.8	6234801.3	91.94	**	103.5	2.5	**	2.16
**	MA-13980B	330	23/10/2024	**	288620.2	6234778.8	92.19	**	102.0	2.5	**	2.17
**	MA-13980C	331	23/10/2024	**	288633.2	6234799.5	91.69	**	102.5	2.0	**	2.13
**	MA-14001A	332	24/10/2024	**	288724.0	6234850.8	92.53	**	102.0	2.0	**	2.11
**	MA-14001B	333	24/10/2024	**	288744.1	6234863.4	91.86	**	102.0	2.5	**	2.10
**	MA-14001C	334	24/10/2024	**	288737.0	6234849.7	92.74	**	103.0	2.5	**	2.18
**	MA-14018A	335	25/10/2024	**	288730.7	6234849.8	92.76	**	102.0	2.0	**	2.11
**	MA-14018B	336	25/10/2024	**	288654.9	6234802.1	92.75	**	101.5	2.0	**	2.12
**	MA-14018C	337	25/10/2024	**	288700.1	6234825.4	93.12	**	99.5	2.0	**	2.11
**	MA-14028A	338	26/10/2024	**	288760.8	6234863.7	91.58	**	101.0	2.5	**	2.12
**	MA-14035A	339	28/10/2024	**	288739.6	6234838.1	93.61	**	101.5	2.0	**	2.00
**	MA-14035B	340	28/10/2024	**	288779.8	6234863.6	92.28	**	100.5	2.0	**	2.06
**	MA-14035C	341	28/10/2024	**	288785.2	6234879.7	91.28	**	102.0	2.5	**	2.19
**	MA-14048A	342	29/10/2024	**	288752.5	6234862.7	92.62	**	101.5	2.0	**	2.00
**	MA-14048B	343	29/10/2024	**	288767.2	6234849.0	93.54	**	100.5	2.0	**	2.10
**	MA-14048C	344	29/10/2024	**	288782.0	6234866.0	92.19	**	101.5	2.0	**	2.16
**	MA-14065A	345	30/10/2024	**	288768.8	6234856.5	93.42	**	102.5	2.0	**	2.21
**	MA-14065B	346	30/10/2024	**	288753.9	6234866.8	93.36	**	100.5	2.5	**	2.18
**	MA-14065C	347	30/10/2024	**	288763.8	6234859.5	93.75	**	101.5	2.5	**	2.20
**	MA-14081A	348	31/10/2024	**	288794.6	6234861.4	94.78	**	100.5	2.0	**	2.08
**	MA-14081B	349	31/10/2024	**	288688.4	6234816.2	93.32	**	100.0	2.5	**	2.14
**	MA-14081C	350	31/10/2024	**	288701.2	6234814.5	93.45	**	100.5	2.0	**	2.18
**	MA-14106A	351	01/11/2024	**	288794.5	6234866.8	94.51	**	100.5	2.0	**	2.13
**	MA-14106B	352	01/11/2024	**	288754.2	6234864.2	93.98	**	100.5	2.5	**	2.18
**	MA-14106C	353	01/11/2024	**	288777.1	6234874.4	93.91	**	100.5	2.5	**	2.17
**	MA-14122A	354	02/11/2024	**	288767.2	6234868.7	94.50	**	100.5	2.0	**	2.04
**	MA-14128A	355	04/11/2024	**	288783.0	6234863.4	95.29	**	102.0	1.5	**	2.14
**	MA-14128B	356	04/11/2024	**	288558.4	6234759.1	91.04	**	100.5	1.5	**	2.10

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-14128C	357	04/11/2024	**	288568.5	6234751.9	91.90	**	100.5	1.5	**	2.12
**	MA-14128D	358	04/11/2024	**	288764.4	6234860.1	95.49	**	101.5	2.0	**	2.19
**	MA-14128E	359	04/11/2024	**	288782.3	6234871.8	95.04	**	102.0	1.5	**	2.16
**	MA-14145A	360	05/11/2024	**	288769.6	6234862.2	95.82	**	100.0	0.0	**	2.05
**	MA-14145B	361	05/11/2024	Basin	288640.2	6234450.5	70.98	**	100.0	-0.5	**	2.00
**	MA-14145C	362	05/11/2024	Basin	288632.5	6234455.7	70.86	**	101.0	0.0	**	2.03
**	MA-14145D	363	05/11/2024	**	288557.8	6234750.4	92.09	**	101.5	1.0	**	2.05
**	MA-14145E	364	05/11/2024	**	288719.1	6234839.6	94.15	**	100.5	1.5	**	2.07
**	MA-14145F	365	05/11/2024	**	288760.6	6234859.4	95.62	**	100.0	1.5	**	2.03
**	MA-14145G	366	05/11/2024	Basin	288636.3	6234453.2	71.46	**	103.0	0.0	**	2.12
**	MA-14157A	367	06/11/2024	**	288569.1	6234750.6	92.72	**	100.5	1.5	**	2.12
**	MA-14157B	368	06/11/2024	**	288716.4	6234825.6	94.05	**	102.0	1.5	**	2.21
**	MA-14156A	369	06/11/2024	**	288634.5	6234455.4	72.39	**	100.0	1.5	**	2.06
**	MA-14156B	370	06/11/2024	**	288618.4	6234446.1	72.36	**	100.0	1.5	**	2.07
**	MA-14157C	371	06/11/2024	**	288728.2	6234832.6	95.03	**	100.0	1.5	**	2.10
**	MA-14157D	372	06/11/2024	**	288744.4	6234842.3	96.01	**	100.0	1.5	**	2.11
**	MA-14156C	373	06/11/2024	**	288628.2	6234455.5	72.84	**	99.5	1.5	**	2.03
**	MA-14156D	374	06/11/2024	**	288641.7	6234456.8	72.59	**	100.0	1.5	**	2.04
**	MA-14178A	375	07/11/2024	**	288610.1	6234770.0	93.23	**	105.0	1.5	**	2.17
**	MA-14178B	376	07/11/2024	**	288628.9	6234784.1	92.89	**	103.0	1.5	**	2.15
**	MA-14178C	377	07/11/2024	**	288684.6	6234810.6	94.46	**	102.0	1.5	**	2.14
**	MA-14183A	378	07/11/2024	**	288641.7	6234453.5	72.59	**	100.5	-0.5	**	2.05
**	MA-14183B	379	07/11/2024	**	288657.7	6234458.4	72.72	**	98.5	1.5	**	2.00
**	MA-14178D	380	07/11/2024	Retest#375	288611.0	6234770.7	93.27	**	100.0	1.5	**	2.13
**	MA-14178E	381	07/11/2024	**	288698.4	6234819.2	95.26	**	101.0	1.5	**	2.20
**	MA-14178F	382	07/11/2024	**	288728.3	6234835.5	96.15	**	101.0	1.5	**	2.18
**	MA-14183C	383	07/11/2024	**	288604.3	6234449.8	72.07	**	100.0	2.0	**	2.07
**	MA-14183D	384	07/11/2024	**	288596.5	6234447.6	71.98	**	99.5	1.5	**	2.01
**	MA-14194A	385	08/11/2024	**	288716.5	6234832.0	95.72	**	100.5	1.5	**	2.17
**	MA-14194B	386	08/11/2024	**	288736.1	6234843.8	96.43	**	99.0	-0.5	**	2.12
**	MA-14194C	387	08/11/2024	**	288651.1	6234807.9	92.54	**	100.0	1.5	**	2.16
**	MA-14194D	388	08/11/2024	**	288639.0	6234791.2	93.67	**	101.0	1.0	**	2.14
**	MA-14205A	389	09/11/2024	**	288633.772	6234443.221	0.00	**	99.5	0.5	**	2.14
**	MA-14205B	390	09/11/2024	**	288620.198	6234422.911	0.00	**	101.0	2.0	**	2.18
**	MA-14204A	391	09/11/2024	**	288646.8	6234795.5	93.92	**	99.0	0.0	**	2.06
**	MA-14204B	392	09/11/2024	**	288675.3	6234811.5	94.40	**	98.5	0.0	**	2.05
**	MA-14207A	393	11/11/2024	**	288598.6	6234768.0	93.30	**	101.5	1.5	**	2.19
**	MA-14207B	394	11/11/2024	**	288566.2	6234741.4	93.68	**	100.0	1.5	**	2.10
**	MA-14207C	395	11/11/2024	**	288575.1	6234754.7	93.04	**	100.0	1.5	**	2.10
**	MA-14230A	396	12/11/2024	**	288565.1	6234455.7	71.74	**	100.0	1.5	**	2.09
**	MA-14230B	397	12/11/2024	**	288557.8	6234450.3	71.78	**	100.0	2.0	**	2.10
**	MA-14230C	398	12/11/2024	**	288560.1	6234448.9	71.92	**	100.0	1.5	**	2.08
**	MA-14230D	399	12/11/2024	**	288570.5	6234450.0	71.80	**	101.0	2.0	**	2.12
**	MA-14233A	400	12/11/2024	**	288551.4	6234748.1	91.75	**	99.5	0.5	**	2.13
**	MA-14230F	404	12/11/2024	See Map	288555	6234452	72.31	**	101.0	1.0	**	2.19
**	MA-14230G	405	12/11/2024	See Map	288568	6234457	72.12	**	100.5	1.5	**	2.18
**	MA-14233B	401	12/11/2024	**	288540.7	6234765.1	88.77	**	101.5	1.5	**	2.12
**	MA-14233C	402	12/11/2024	**	288525.2	6234752.1	89.02	**	101.0	2.0	**	2.13
**	MA-14230E	403	12/11/2024	**	288555.2	6234457.9	72.68	**	101.0	1.5	**	2.20
**	MA-14246A	406	13/11/2024	#Retaining wall	288758.6	6234830.6	91.57	**	98.5	-0.5	**	1.97
**	MA-14246B	407	13/11/2024	#Retaining wall	288695.0	6234796.1	90.41	**	101.0	-0.5	**	2.02
**	MA-14246C	408	13/11/2024	#mount	288539.5	6234759.8	89.49	**	99.0	1.0	**	2.15
**	MA-14246D	409	13/11/2024	#hole area	288423.5	6234432.7	70.75	**	94.0	-0.5	**	1.97
**	MA-14246E	410	13/11/2024	#hole area	288415.4	6234430.4	70.81	**	99.0	0.5	**	2.01
**	MA-14246F	411	13/11/2024	#hole area	288393.2	6234430.4	71.15	**	99.5	1.5	**	2.09
**	MA-14246G	412	13/11/2024	#hole area	288391.9	6234435.1	71.22	**	99.5	1.5	**	2.08
**	MA-14246H	413	13/11/2024	Retest #409. #hole area	288423.7	6234432.5	71.11	**	99.0	1.5	**	2.09
**	MA-14246I	414	13/11/2024	#mount	288560.6	6234769.2	89.76	**	99.5	1.5	**	2.16
**	MA-14246J	415	13/11/2024	#mount	288522.3	6234753.7	89.24	**	99.0	2.0	**	2.08
**	MA-14246K	416	13/11/2024	#hole area	288516.1	6234761.8	87.88	**	99.5	1.5	**	2.06

Lot #	Sample #	Test #	Date Sampled	Location	Easting	Northing	Elevation (m)	Layer	Relative Compaction (%)	Moisture Variation (%)	Moisture Content (%)	Field Wet Density (t/m3)
**	MA-14246L	417	13/11/2024	#hole area	288507.9	6234756.6	88.01	**	100.0	1.5	**	2.06
**	MA-14261A	418	14/11/2024	**	288541.5	6234745.5	91.85	**	101.0	1.0	**	2.13
**	MA-14261B	419	14/11/2024	**	288503.3	6234726.7	90.09	**	99.0	1.0	**	2.06
**	MA-14261C	420	14/11/2024	**	288537.8	6234727.3	92.91	**	99.0	1.5	**	2.07
**	MA-14273A	421	15/11/2024	**	288530.6	6234714.0	92.49	**	98.0	1.5	**	2.07
**	MA-14273B	422	15/11/2024	**	288506.8	6234730.4	90.89	**	99.5	1.5	**	2.10
**	MA-14273C	423	15/11/2024	**	288522.7	6234728.6	92.29	**	99.5	1.5	**	2.11
**	MA-14282A	424	16/11/2024	**	288508.3	6234701.7	91.94	**	98.5	1.5	**	2.08
**	MA-14304A	425	19/11/2024	See map	288557.4	6234745.2	93.307	**	101.5	0.0	**	2.21
**	MA-14304B	426	19/11/2024	See map	288549.3	6234727.7	93.813	**	99.5	0.0	**	2.17
**	MA-14311A	427	20/11/2024	See map	288756.8	6234628.7	80.925	**	99.5	-0.5	**	2.14
**	MA-14311B	428	20/11/2024	See map	288750.9	6234644.6	82.035	**	100.5	-1.0	**	2.15
**	MA-14324A	429	21/11/2024	See map	288437.7	6234446.7	73.552	**	100.5	-0.5	**	2.01
**	MA-14324B	430	21/11/2024	See map	288416.2	6234460.7	73.789	**	99.5	0.0	**	1.99
**	MA-14324C	431	21/11/2024	See map	288409.4	6234480.8	74.859	**	101.5	0.5	**	2.02
**	MA-14346A	432	22/11/2024	See map	288414.4	6234457.2	73.864	**	100.5	-0.5	**	2.05
**	MA-14346B	433	22/11/2024	See map	288411.3	6234460.4	74.157	**	98.5	0.5	**	2.03
**	MA-14346C	434	22/11/2024	See	288424.6	6234471.5	75.091	**	99.5	-0.5	**	2.03
**	MA-14360A	435	23/11/2024	See map	288673.8	6234641.4	82.285	**	101.0	0.0	**	2.14
**	MA-14360B	436	23/11/2024	See map	288670.6	6234645.7	82.537	**	101.5	0.5	**	2.14
**	MA-14360C	437	23/11/2024	See map	288676.1	6234641.5	82.849	**	100.5	-0.5	**	2.11
**	MA-14360D	438	23/11/2024	Seems	288390.8	6234471.3	74.557	**	102.5	0.0	**	2.12
**	MA-14363A	439	25/11/2024	See map	288404.9	6234466.1	74.755	**	101.0	-0.5	**	2.07
**	MA-14363B	440	25/11/2024	See map	288515.9	6234470.2	75.118	**	100.0	0.5	**	2.04
**	MA-14363C	441	25/11/2024	See map	288400.6	6234482.2	75.238	**	100.5	0.5	**	2.04
**	MA-14387A	442	26/11/2024	See map	288412.8	6234469.4	75.510	**	99.5	0.0	**	2.03
**	MA-14387B	443	26/11/2024	See map	288403.9	6234450.1	74.755	**	101.0	-0.5	**	2.08
**	MA-14387C	444	26/11/2024	See map	288231.5	6234481.0	70.311	**	101.0	0.0	**	2.10
**	MA-14387D	445	26/11/2024	See map	288794.1	6234520.7	73.409	**	102.5	0.0	**	2.09

Moisture Variation Note:

Positive values = test is dry of OMC

Negative values = test is wet of OMC

About this Inspection Report

October 2024

Introduction

These notes are provided to amplify Douglas' inspection report in regard to the limitations of carrying out inspection work. Not all notes are necessarily relevant to this report.

Standards

This inspection report has been prepared by qualified personnel to current engineering standards of interpretation and analysis.

Copyright and Limits of Use

This inspection report is the property of Douglas and is provided for the exclusive use of the client for the specific project and purpose as described in the report. It should not be used by a third party for any purpose other than to confirm that the construction works addressed in the report have been inspected as described. Use of the inspection report is limited in accordance with the Engagement Terms for the commission.

Douglas does not undertake to guarantee the works of the contractors or relieve them of their responsibility to produce a completed product conforming to the design.

Reports

This inspection report may include advice or opinion that is based on engineering and/or geological interpretation, information provided by the client or the client's agent, and information gained from:

- an investigation report for the project (if available to Douglas);
- inspection of the work, exposed ground conditions, excavation spoil and performance of excavating equipment while Douglas was on site;
- investigation and testing that was carried out during the site inspection;
- anecdotal information provided by authoritative site personnel; and
- Douglas' experience and knowledge of local geology.

Such information may be limited by the frequency of any inspection or testing that was able to be practically carried out, including possible site or cost constraints imposed by the client/ contractor(s). For these reasons, the reliability of this inspection report is limited by the scope of information on which it relies.

Every care is taken with the inspection report as it relates to interpretation of subsurface conditions and any recommendations or suggestions for construction or design. However, Douglas cannot anticipate or assume responsibility for:

- unexpected variations in subsurface conditions that are not evident from the inspection; and
- the actions of contractors responding to commercial pressures.

Should these issues occur, then additional advice should be sought from Douglas and, if required, amendments made.

This inspection report must be read in conjunction with any attached information. This inspection report should be kept in its entirety without separation of individual pages or sections. Douglas cannot be held responsible for interpretations or conclusions from review by others of this inspection report or test data, which are not otherwise supported by an expressed statement, interpretation, outcome or conclusion stated in this inspection report.

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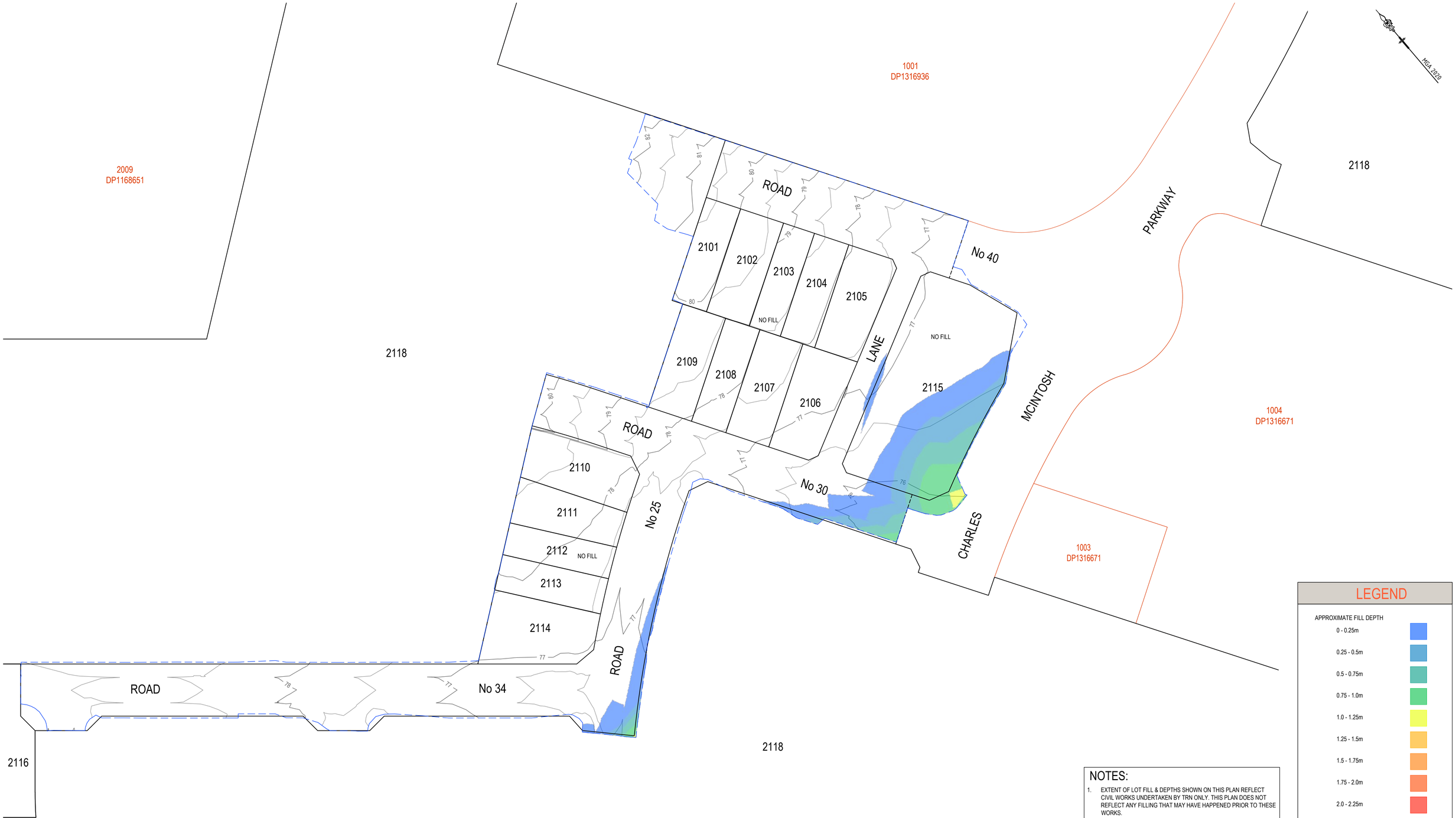
Appendix D

Works-as-executed fill plan (prepared by Orion Consulting Engineers Pty Ltd)



LEGEND

APPROXIMATE FILL DEPTH

- 0 - 0.25m
- 0.25 - 0.5m
- 0.5 - 0.75m
- 0.75 - 1.0m
- 1.0 - 1.25m
- 1.25 - 1.5m
- 1.5 - 1.75m
- 1.75 - 2.0m
- 2.0 - 2.25m
- 2.25 - 2.5m
- 2.5 - 2.75m
- 2.75m - 3.0m
- 3.0m +

LIMIT OF FINISHED SURFACE LEVELS

NOTES:

1. EXTENT OF LOT FILL & DEPTHS SHOWN ON THIS PLAN REFLECT CIVIL WORKS UNDERTAKEN BY TRN ONLY. THIS PLAN DOES NOT REFLECT ANY FILLING THAT MAY HAVE HAPPENED PRIOR TO THESE WORKS.
2. ORIGINAL SURFACE SURVEY & DTM PREPARED BY PREMISE (DRAWING FILE 322165.02A.DS01)
   ORION GROUP TAKES NO RESPONSIBILITY FOR THE ACCURACY OF THIS SURVEY.
3. FINISHED SURFACE SURVEY & DTM PREPARED BY ORION GROUP. DATE OF SURVEY: 09/09/2025
4. EXTENT OF LOT FILL & DEPTHS SHOWN ON THIS PLAN REPRESENT THE LEVEL DIFFERENCE BETWEEN THE ORIGINAL SURFACE AND FINISHED SURFACE, WHICH BOTH INCLUDE COMPARABLE DEPTHS OF TOPSOIL. THEREFORE, THE FILL SHOWN ON THIS PLAN REFLECTS THE EXTENTS OF CONTROLLED FILL.

Rev	Drawn	Check	Appd.	Date	Revision Description
01	AM	AM	AM	25/09/2025	UPDATED NOTES
00	NAI	AM	AM	15/09/2025	INITIAL ISSUE

Scale: 0 5 10 15 20 25 30 35 40 45 50
SCALE 1:500 (A1) SCALE 1:1000 (A3)

Surveyor	NAI	Date of Survey	9/09/2025
Height Datum	AHD	Horizontal Datum	MGA2020
Origin	SSM18301 RL73.899 (SCIMS - 26/05/25)	Origin	SSM18303 - SSM23117 349°34'36" (SCIMS - 26/05/25)

For: mirvac

By: ORION
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Project: COBBITTY BY MIRVAC

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LIGHT GREEN - STAGE 1

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Appendix E

CSIRO Publication

FOUNDATION MAINTENANCE AND FOOTING PERFORMANCE

Understanding and preventing soil-related building movement

This Building Technology Resource is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking.

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the home owner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

SOIL TYPES

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. Table 1 below is a reproduction of Table 2.1 from Australian Standard AS 2870-2011, Residential slabs and footings.

CAUSES OF MOVEMENT

SETTLEMENT DUE TO CONSTRUCTION

There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction but has been known to take many years in exceptional cases.

These problems may be the province of the builder and should be taken into consideration as part of the preparation of the site for construction.

EROSION

All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

SATURATION

This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume, particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

SEASONAL SWELLING AND SHRINKAGE OF SOIL

All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below, from AS 2870). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

SHEAR FAILURE

This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.

In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

TREE ROOT GROWTH

Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.

TABLE 1. GENERAL DEFINITIONS OF SITE CLASSES.

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
H1	Highly reactive clay sites, which may experience high ground movement from moisture changes
H2	Highly reactive clay sites, which may experience very high ground movement from moisture changes
F	Extremely reactive sites, which may experience extreme ground movement from moisture changes

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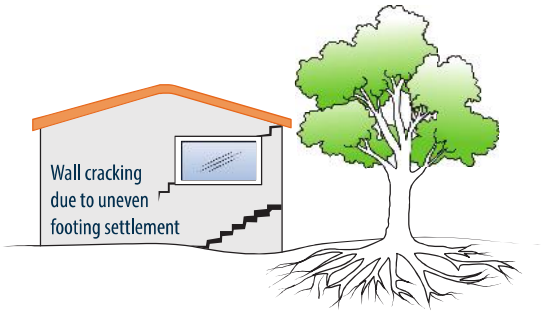

FIGURE 1 Trees can cause shrinkage and damage.

- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

UNEVENNESS OF MOVEMENT

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior through absorption. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Shrinkage usually begins on the side of the building where the sun's heat is greatest.

EFFECTS OF UNEVEN SOIL MOVEMENT ON STRUCTURES

EROSION AND SATURATION

Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

SEASONAL SWELLING/SHRINKAGE IN CLAY

Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated, and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry, and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

MOVEMENT CAUSED BY TREE ROOTS

In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

COMPLICATIONS CAUSED BY THE STRUCTURE ITSELF

Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

EFFECTS ON FULL MASONRY STRUCTURES

Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also

exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

EFFECTS ON FRAMED STRUCTURES

Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation causes a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

EFFECTS ON BRICK VENEER STRUCTURES

Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

WATER SERVICE AND DRAINAGE

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem. Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

SERIOUSNESS OF CRACKING

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. Table 2 below is a reproduction of Table C1 of AS 2870-2011.

AS 2870-2011 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

PREVENTION AND CURE

PLUMBING

Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

GROUND DRAINAGE

In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject may be regarded as an area for an expert consultant.

PROTECTION OF THE BUILDING PERIMETER

It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill.

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

CONDENSATION

In buildings with a subfloor void, such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

TABLE 2. CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS.

Description of typical damage and required repair	Approximate crack width limit	Damage category
Hairline cracks	<0.1 mm	0 – Negligible
Fine cracks which do not need repair	<1 mm	1 – Very Slight
Cracks noticeable but easily filled. Doors and windows stick slightly.	<5 mm	2 – Slight
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired.	5–15 mm (or a number of cracks 3 mm or more in one group)	3 – Moderate
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted.	15–25 mm but also depends on number of cracks	4 – Severe

Warning: Although this Building Technology Resource deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders, and mould.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

THE GARDEN

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

EXISTING TREES

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

INFORMATION ON TREES, PLANTS AND SHRUBS

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information.

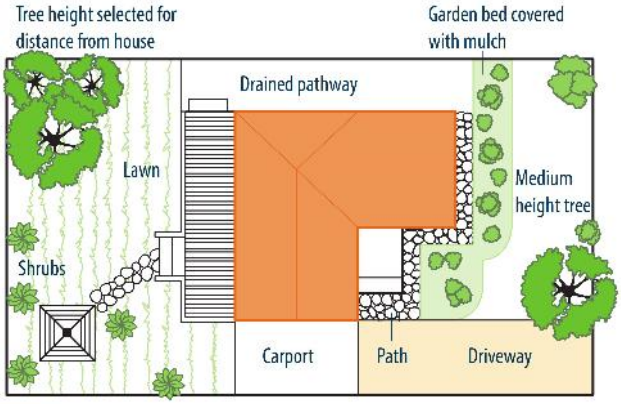

FIGURE 2 Gardens for a reactive site.

EXCAVATION

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

REMEDIATION

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the home owner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

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