
Report on Lot Classification and Salinity Assessment

Proposed Residential Subdivision

"Orange" Stage 1, Cobbitty Road, Cobbitty NSW

Prepared for Mirvac Homes NSW Pty Ltd

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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

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Report on Lot Classification and Salinity Assessment Proposed Residential Subdivision "Orange" Stage 1, 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 "Orange" Stage 1, 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 65 residential lots (Lots 1101 – 1165) and four super lots (Lots 1166 – 1169) 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 275 m and 460 m respectively with an approximate area of 6.3 ha. The site is bounded in all directions by various stages of the ongoing residential development at Cobbitty, except for the south-western boundary, which adjoins undeveloped land comprising a grassed paddock.

The surface levels across the site slightly fall in a south-westerly direction at an approximate grade of 1 in 34. The overall difference in level from the lowest part of the site (Pit 22, RL 73.7 mAHD) to the highest part (Pit 34, RL 79.4 mAHD) is approximately 5.7 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 residual clays encountered in 30 test pits and shale and/or sandstone encountered in 14 test pits that extended beyond residual clays.

5. Field work

5.1 Methods

The field work comprised excavation of 45 test pits (Pits 1 – 45) using a 6-tonne excavator fitted with a 450 mm wide toothed bucket, to depths of 0.6 – 2.5 m. The pits were logged on site by a geotechnical engineer who 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 – 0.3 m in all test pits.
Fill (controlled):	Silty clay and/or silty gravelly clay fill encountered to depths of 0.4 – 2.5 m at Pits 1 – 10, 12 – 15, 17 – 29, and 39 – 45. Sandy gravel fill also encountered at Pit 20. Pits 1 – 6, 8, 15, 21, 22, 24, 41 and 43 were terminated within the fill materials.
Residual clay:	Generally stiff to hard, medium to high plasticity silty clay encountered to depths of 0.6 – 2.5 m at Pits 7, 9 – 14, 16 – 20, 23, 25 – 31, 33 – 37, 39 – 40, and 44 – 45. Pits 7, 9 – 14, 17 – 20, 23, 25, 26, 28, 29, 42 and 44 were terminated within the residual clays.
Rock:	Generally, very low to medium strength shale and/or sandstone encountered at Pits 16, 27, 30 – 40, and 45 from depths of 0.15 – 1.7 m and continuing to the termination depths of 0.6 – 2.1 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 Shrink-swell index, plasticity and field moisture content

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

Table 1: Summary of test results – shrink-swell index and plasticity

Pit No.	Depth (m)	FMC (%)	LL (%)	PL (%)	PI (%)	LS (%)	I _{ss} (%/ΔpF)	Material
4	0.5 – 0.7	18.6	-	-	-	-	1.4	Fill
7	0.5 – 0.7	14.7	-	-	-	-	0.8	Fill
12	0.5 – 0.75	22.8	-	-	-	-	1.5	Silty CLAY
15	0.5 – 0.9	14.7	-	-	-	-	1.3	Fill
24	0.5 – 0.8	16.4	-	-	-	-	1.4	Fill
30	0.5 – 0.7	19.4	-	-	-	-	2.5	Silty CLAY
35	0.5 – 0.63	18.4	-	-	-	-	2.0	Silty CLAY
37	0.5	20.5	56	20	36	13.0	-	Silty CLAY
43	0.5 – 0.73	13.8	-	-	-	-	1.0	Fill
45	0.5 – 0.78	12.4	-	-	-	-	0.8	Silty CLAY

Where:

FMC	=	Field moisture content	PL	=	Plastic limit
LL	=	Liquid limit	PI	=	Plasticity Index
LS	=	Linear shrinkage	I _{ss}	=	Shrink-swell index

The field moisture content of the plasticity test sample (Pit 37) was 0.5% wet of the plastic limit. The plasticity results indicate the soil tested is of high plasticity and would be susceptible to shrink-swell movements with changes in the soils moisture content. The shrink-swell index (I_{ss}) results indicate that the soils are of low and medium shrink-swell potential.

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	64	4.6 – 9.1
Chlorides		(mg/kg)	15	22 – 550
Sulphates		(mg/kg)	15	10 – 240
Aggressivity (AS 2159: 2009)	to Concrete	-	64	Non-aggressive to mildly aggressive
	to Steel	-	64	Non-aggressive to mildly aggressive
Exchangeable Sodium (Na)		(meq/100g)	5	0.8 – 2.8
CEC (cation exchange capacity)		(meq/100g)	5	13 – 18
Sodicity [Na/CEC]		(ESP%)	5	6 – 16
Sodicity Class		[after DLWC]	5	Sodic to highly sodic
Emerson Class Number		-	3	2 – 3
EC1:5 [Lab.]		(mS/cm)	64	34.8 – 713.7
Resistivity		Ω .cm	64	1401 – 28736
ECe [M x EC1:5]		(dS/m)	64	0.3 – 5.0
Salinity Class (Richards, 1954)		-	64	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 32 samples were non-saline, 31 samples were slightly saline, and one sample was moderately saline. These results are generally consistent with the findings of the previous Douglas 2020 and Geotest 2022 investigations.

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:

- 39 samples were non-aggressive and 25 were mildly aggressive to concrete; and
- 60 samples were non-aggressive and four (4) were mildly aggressive to steel.

Compared to the previous Geotest 2022 assessment, which reported soils as moderately aggressive to concrete and non-aggressive to steel, the current results indicate generally less aggressive conditions to concrete and similar conditions to steel.

6.2.3 Sodicty and dispersibility

The sodicty test results (refer Table C1, Appendix C) indicate soils are sodic to highly sodic and would have potential for soil erosion if left exposed. Emerson class number testing undertaken on three samples at a depth of 0.5 m below ground level indicate shallow soils are Class 2 to 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;
- Controlled silty clay and/or silty gravelly clay fill in large parts for subdivision construction; and/or
- Residual silty clays – typically stiff to hard;

- Rock comprising shale and/or sandstone, 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 the required design levels, fill up to and greater than 3 m in depth has been placed over the majority of the site, with the depth of fill decreasing towards the north, as shown on the WAEX fill plan dated 31 October 2025 prepared by Orion Consulting Engineers Pty Ltd (Appendix D). The fill plan is understood to represent the difference between the stripped surface levels and the finished surface levels of the controlled fill. Based on the fill plan and the results of the field investigation, the estimated fill depths across the individual lots are summarised in Table 3. It is noted that some localised variation in fill depth may occur between the WAEX contours and actual site conditions, particularly where tree stumps or similar obstructions have been removed and the resulting voids 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)
1101	0 – 0.25	1119	>3.0	1137	0	1155	0 – 0.5
1102	0 – 0.5	1120	>3.0	1138	0	1156	0 – 0.25
1103	0 – 0.75	1121	>3.0	1139	0	1157	0
1104	0.25 – 0.75	1122	>3.0	1140	0	1158	0
1105	0.25 – 0.75	1123	1.75 – 2.5	1141	0	1159	0 – 0.75
1106	0.25 – 1.0	1124	1.25 – 2.0	1142	0	1160	0 – 2.0
1107	0.25 – 1.25	1125	0.75 – 1.5	1143	0 – 0.25	1161	0 – 1.75
1108	0.25 – 1.5	1126	0.5 – 1.25	1144	0 – 0.75	1162	0 – 1.5
1109	0.5 – 1.75	1127	0.25 – 1.0	1145	0 – 1.0	1163	0 – 1.25
1110	1.25 – 2.25	1128	0.25 – 0.75	1146	0.25 – 1.25	1164	0.5 – 1.75
1111	1.25 – 2.5	1129	0 – 0.75	1147	0.5 – 1.25	1165	1.25 – 2.5
1112	1.75 – 2.75	1130	0 – 0.5	1148	0.75 – 1.75	1166	1.5 – >3.0
1113	2.5 – >3.0	1131	0 – 0.25	1149	1.25 – 2.5	1167	1.75 – 3.0
1114	2.25 – 3.0	1132	0 – 0.25	1150	1.25 – 2.25	1168	0.5 – >3.0
1115	2.0 – >3.0	1133	0 – 0.25	1151	0.75 – 2.25	1169	0 – >3.0
1116	2.75 – >3.0	1134	0	1152	0.25 – 1.75		
1117	2.5 – >3.0	1135	0 – 0.25	1153	0 – 1.0		

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)
1118	2.75 – >3.0	1136	0	1154	0 – 0.75		

The results of Level 1 controlled fill 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). A report titled 'Level 1 Inspections and Testing of Filling' has been prepared (Project 92323.36) for earthworks testing operations and inspections completed during the period 21 November 2024 and 6 May 2025 for "Orange" Stage 1, Cobbitty Road, Cobbitty NSW. The report 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 actual and inferred shrink-swell index values from laboratory soil test results.

Characteristic surface movements (y_s) of up to approximately 55 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
1101 – 1102	M*
1103 – 1106	H1*
1107 – 1126	M*
1127 – 1133	H1*
1134	H1
1135	H1*
1136 – 1142	H1
1143 – 1146	H1*
1147 – 1152	M*
1153 – 1155	H1*
1156	M*
1157 – 1158	M
1159 – 1163	H1*
1164 – 1168	M*
1169	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 7.4) 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 7.4 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 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)
1101 – 1103	A2	Mildly aggressive	Non-aggressive	Slightly saline
1104 – 1108	A2	Mildly aggressive	Mildly aggressive	Slightly saline
1109 – 1117	A2	Mildly aggressive	Non-aggressive	Slightly saline
1118 – 1122	A2	Mildly aggressive	Mildly aggressive	Slightly saline
1123 – 1132	A2	Mildly aggressive	Non-aggressive	Slightly saline
1133 – 1136	A2	Mildly aggressive	Non-aggressive	Moderately saline
1137 – 1141	A2	Mildly aggressive	Mildly aggressive	Moderately saline
1142	A2	Mildly aggressive	Mildly aggressive	Slightly saline
1143 – 1154	A2	Mildly aggressive	Non-aggressive	Slightly saline
1155 – 1159	A2	Mildly aggressive	Mildly aggressive	Slightly saline
1160 – 1169	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.

GSNSW. (2019). *NSW Seamless Geology*. Geological Survey NSW Web Map Service.

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 "Orange" Stage 1, 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 NSW 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

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.

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This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Engagement Terms for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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

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

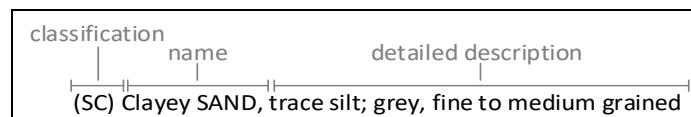
Graphic Symbols

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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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”.

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)	
	Coarse	Fine
Gravel	19 - 63	6.7 - 19
	Medium	2.36 - 6.7
	Fine	0.6 - 2.36
Sand	0.21 - 0.6	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:

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

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:

SAMPLE			DEPTH (m)	TESTING	
SAMPLE REMARKS	TYPE	INTERVAL		TEST TYPE	RESULTS AND REMARKS
	SPT		1.0 1.45	SPT	4,9,11 N=20

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

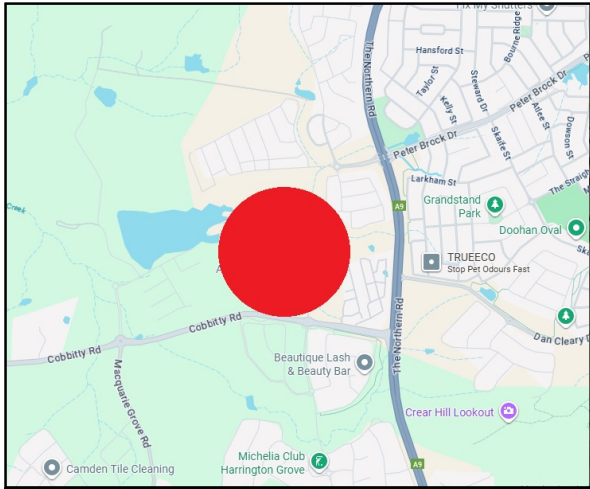
	water seepage/inflow
	water seepage/outflow
	standing or observed water level
NFGWO	no free groundwater observed
OBS	observations obscured by drilling fluids

Drilling or Excavation Methods/Tools

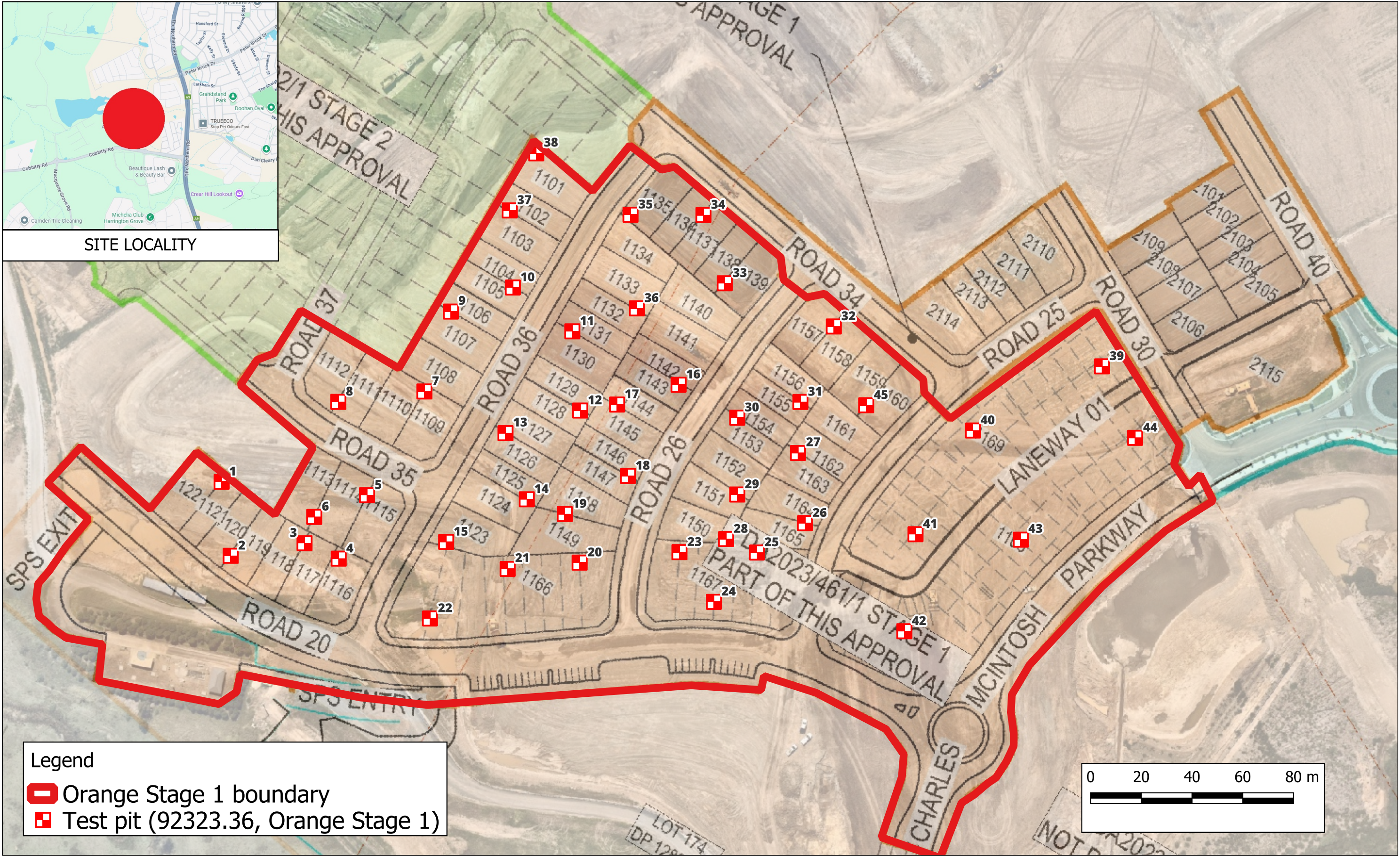
The drilling/excavation methods used to perform the investigation may be shown either in a dedicated column down the left-hand edge of the log, or stated in the log footer. In some circumstances abbreviation codes may be used.

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



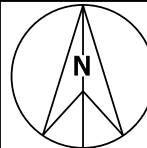
Legend

- Orange Stage 1 boundary
- Test pit (92323.36, Orange Stage 1)



CLIENT:	Mirvac Homes NSW Pty Ltd	
OFFICE:	Macarthur	DRAWN BY: AS
SCALE:	As shown	DATE: 03.October.2025

TITLE: **Drawing 1 - Test pit location plan**
Proposed Residential Subdivision
"Orange" Stage 1, Cobbitty Road, Cobbitty



PROJECT:	92323.36
DRAWING No:	1
REVISION:	0

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.4 AHD
COORDINATE: E:288214.7, N:6234475.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 1
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(®)	CONSIS. (¹)		MOISTURE	REMARKS	SAMPLE		DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
						■	■			TYPE	INTERVAL					
28/08/25 No free groundwater observed	74	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								DCP9/150			
		FILL / Silty CLAY (CL-CI): brown and grey-brown; low to medium plasticity; with fine to coarse gravel, trace rootlets.	NA												w<PL	
	73	1														
	72	2														
			Test Pit discontinued at 2.30m depth. Limit of investigation.													

NOTES: ¹®Soil origin is "probable" unless otherwise stated. ¹Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.3m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.0 AHD
COORDINATE: E:288218.3, N:6234446.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 2
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													TESTING AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾	DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
28/08/25 No free groundwater observed	73	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								DCP9/150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																														

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT:	Mirvac Homes NSW Pty Ltd	SURFACE LEVEL:	73.9 AHD	LOCATION ID:	3
PROJECT:	Proposed Residential Subdivision	COORDINATE:	E:288247.4, N:6234451.0	PROJECT No:	92323.36
LOCATION:	"Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570	DATUM/GRID:	MGA2020 Zone 56	DATE:	28/08/25
		DIP/AZIMUTH:	90°/---°	SHEET:	1 of 1

CONDITIONS ENCOUNTERED												SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS			
28/08/25 No free groundwater observed	73	0.15	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA		w<PL					DCP9/150				
			FILL / Silty CLAY (CL-CI): brown and grey-brown; low to medium plasticity; with fine to coarse gravel, trace cobbles and rootlets.		FILL												
					FILL												
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					FILL												
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					FILL												
					FILL												

PLANT:	Hyundai 60CR-9 excavator	OPERATOR:	Quake Excavations	LOGGED:	AS
METHOD:	450mm TB to 2.5m				
REMARKS:					

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 73.8 AHD
COORDINATE: E:288260.9, N:6234444.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 4
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
28/08/25 No free groundwater observed	73	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA		w<PL					DCP9/150			
			FILL / Silty CLAY (CL-CI): brown and grey-brown; low to medium plasticity; with fine to coarse gravel, trace rootlets.													

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS



Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.1 AHD
COORDINATE: E:288272.1, N:6234469.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 5
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED												SAMPLE			TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
28/08/25 No free groundwater observed	74	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								DCP9/150			
			FILL / Silty CLAY (CL): brown; low plasticity; with fine to coarse gravel, trace rootlets.													
	1		From 1.20m: grading to (CL-CI) low to medium plasticity		FILL	NA		w<PL						21		
	73															
	2															
	72															
			Test Pit discontinued at 2.50m 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.

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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.1 AHD
COORDINATE: E:288251.3, N:6234461.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 6
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										TESTING AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	SAMPLE			TEST TYPE	RESULTS AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																										
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28/08/25 No free groundwater observed	74	0.05	FILL / TOPSOIL / Silty CLAY (CL-Cl): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL				0.50	1.00	1.50	2.00	2.50	DCP 9/150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.7 AHD
COORDINATE: E:288294.7, N:6234510.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 7
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(ⁱ)	CONSIS. (ⁱ) DENSITY. (ⁱ)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	
28/08/25 No free groundwater observed	74	0.20	FILL / TOPSOIL / Silty CLAY (CL-Cl): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL						 DCP9/150 23 Ref 25/120mm	
			FILL / Silty CLAY (CL-Cl): brown; low to medium plasticity; with fine to coarse gravel, trace rootlets.		FILL									
		1	From 0.80m: grading to grey, trace cobbles		FILL									
		1.50	Silty CLAY (Cl-CH): orange-brown; medium to high plasticity; with fine to coarse gravel, trace rootlets.											
		2	From 2.30m: grading to orange-brown mottled pale grey		RS	H								
		2.50	Test Pit discontinued at 2.50m depth. Limit of investigation.											
	72													

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.6 AHD
COORDINATE: E:288260.8, N:6234506.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 8
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE				TESTING AND REMARKS			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾	DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS							
28/08/25 No free groundwater observed	74	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								DCP9/150		5	10	15				
			FILL / Silty CLAY (CL-CI): brown and grey-brown; low to medium plasticity; with fine to coarse gravel, trace rootlets.																		
73	1			FILL	NA		w<PL														
72	2			FILL	NA		w<PL														
		Test Pit discontinued at 2.50m depth. Limit of investigation.		FILL	NA		w<PL														

NOTES: ⁽¹⁾Soil origin is "probable" unless otherwise stated. ⁽²⁾Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations
LOGGED: HH

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.2 AHD
COORDINATE: E:288305.1, N:6234542.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 9
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	
28/08/25 No free groundwater observed	75	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA							DCP9/150		
			FILL / Silty Gravelly CLAY (CL-CI): brown; low to medium plasticity; fine to coarse gravel.		FILL					D	0.50				
		0.80	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; with fine to coarse gravel, trace rootlets.							D	1.00				
		1						D		1.50	PP	500->600kPa			
			From 1.60m: grading to mottled pale grey and orange		RS	H				D	2.00	PP			400-500kPa
										D	2.50	PP			>500kPa
			Test Pit discontinued at 2.50m 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.

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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.3 AHD
COORDINATE: E:288329.6, N:6234551.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 10
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE		TESTING AND REMARKS											
GROUNDWATER	FL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS										
28/08/25 No free groundwater observed	76	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA							DCP9/150										
			FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; fine to coarse gravel.		FILL																		
		0.60	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; with fine to coarse gravel, trace rootlets.		RS	H	w<PL		D		0.50	PP	480->600kPa										
		1																					
		75																					
2		From 2.10m: grading to mottled pale grey and orange-brown																					
74																							
			Test Pit discontinued at 2.50m depth. Limit of investigation.																				
NOTES: ⁽¹⁾ Soil origin is "probable" unless otherwise stated. ⁽²⁾ Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.																							

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.4 AHD
COORDINATE: E:288353.0, N:6234534.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 11
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS					
	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
27/08/25 No free groundwater observed	76	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA									
			Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine to coarse gravel and rootlets.												
	75														

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.7 AHD
COORDINATE: E:288356.1, N:6234503.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 12
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS			
	FL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
27/08/25 No free groundwater observed			FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA							
	0.30	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to coarse gravel.		FILL									
	0.50	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine to coarse gravel and rootlets.						D	0.50				
								U	0.70				
				</									

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.8 AHD
COORDINATE: E:288326.7, N:6234494.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 13
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS			
RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
27/08/25 No free groundwater observed	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA							DCP9/150		
		FILL / Silty CLAY (CL-CI): brown-grey; low to medium plasticity; with fine to coarse gravel, trace rootlets.		FILL										
	0.70	Silty CLAY (CI-CH): orange-brown mottled pale grey; medium to high plasticity; trace fine to coarse gravel and rootlets.		RS	VSt · H	w<PL								
	1													
	1.50													
	2	From 1.80m: with ironstone and shale gravel, trace sand												
	2.00													
	2.50													
			Test Pit discontinued at 2.50m depth. Limit of investigation.											

Generated with CORE-GS by Geoc - Soil Log

NOTES: ⁽¹⁾Soil origin is "probable" unless otherwise stated. ⁽²⁾Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.8 AHD
COORDINATE: E:288335.1, N:6234468.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 14
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS										
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS												
27/08/25 No free groundwater observed	74	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								PP	250-350kPa												
							</																			

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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.1 AHD
COORDINATE: E:288303.3, N:6234451.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 15
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
27/08/25 No free groundwater observed	74	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL									DCP9/150				
			FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.															
	73	1			FILL	NA		w<PL										

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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations
LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.6 AHD
COORDINATE: E:288394.9, N:6234513.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 16
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED																	SAMPLE			TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS						
					ORIGIN ^(#)	CONSIS. ^(%)	DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)						STRENGTH	TEST TYPE	RESULTS AND REMARKS				
27/08/25 No free groundwater observed	76	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA									DCP9/150	5	10	15				
			Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.					w<PL				D	0.50									
		1.20	SANDSTONE: pale brown-grey. Bringelly Shale.		RS	VSt				1.20			D	1.00								
	75								XW - HW				D	1.50								
	74	2											D	2.00								
Test Pit discontinued at 2.10m 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.

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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.1m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.1 AHD
COORDINATE: E:288370.7, N:6234505.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 17
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS			
	FL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
27/08/25 No free groundwater observed	76		FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA							
	0.30		FILL / Silty CLAY (CI-CH): orange-brown; medium to high plasticity; with fine to coarse gravel, trace rootlets.		FILL								
	0.40		Silty CLAY (CI-CH): orange-red; medium to high plasticity; trace fine gravel and rootlets.										
										</			

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH



Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.6 AHD
COORDINATE: E:288375.0, N:6234477.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 18
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS																		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(c)	DENSITY. ^(c)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS																	
27/08/25 No free groundwater observed	75	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA							DCP9/150																		
			FILL / Silty CLAY (CL-CI): orange-grey; low to medium plasticity; with fine to coarse gravel.																												
			1.10m-1.20m: previous topsoil layer		FILL																										
			1.20	Silty CLAY (CI-CH): orange-brown mottled grey; medium to high plasticity; trace fine gravel and rootlets.														RS	VSt + H	w<PL											
			2	From 1.80m: grading to red-brown and pale grey																											
							</																								

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.0 AHD
COORDINATE: E:288350.1, N:6234462.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 19
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED							SAMPLE			TESTING AND REMARKS		
	FL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
27/08/25 No free groundwater observed	74	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL						
			FILL / Silty CLAY (CL-CI): orange-brown; low to medium plasticity; with fine to coarse gravel, trace cobbles.		FILL								
					FILL								
	1												
	1.40	FILL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to coarse gravel (previous topsoil layer).		FILL									
	1.50	Silty CLAY (CI-CH): orange; medium to high plasticity; with fine to coarse gravel, trace rootlets.											
	73	2			RS	VSt - H							
			From 2.20m: grading to mottled grey with orange-brown										
				</									

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.7 AHD
COORDINATE: E:288355.9, N:6234443.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 20
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS		
GROUNDWATER	FL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS	
27/08/25 No free groundwater observed	74	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL										
			FILL / Silty CLAY (CL-CI): pale grey and brown; low to medium plasticity; with fine to coarse gravel, trace rootlets.		FILL										
	73	1	From 1.20m: grading to orange brown and brown		FILL	NA		w<PL							
	72	1.90	FILL / Sandy GRAVEL (CL-CI): pale brown and grey; fine to coarse gravel.		FILL										
		2			FILL										
		2.30	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt H									
			Test Pit discontinued at 2.50m depth. Limit of investigation.									2.50	PP	370-510kPa	
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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.4 AHD
COORDINATE: E:288327.5, N:6234440.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 21
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
27/08/25 No free groundwater observed	74	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA		w<PL					DCP9/150					
			FILL / Silty Gravelly CLAY (CL-CI): brown; low to medium plasticity; fine to coarse gravel.		FILL											D	0.50	22
		1.00	FILL / Silty CLAY (CL-CI): brown and orange-brown; low to medium plasticity; with fine to coarse gravel, trace rootlets.		FILL											D	1.00	26
					FILL											D	1.50	
		2			FILL											D	2.00	
					FILL											D	2.50	
					FILL											D		
					FILL											D		
					FILL											D		
					FILL											D		
			Test Pit discontinued at 2.50m 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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 73.7 AHD
COORDINATE: E:288296.9, N:6234421.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 22
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE				TESTING AND REMARKS	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS					
27/08/25 No free groundwater observed	73	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA		w<PL					DCP9/150						
			FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.		FILL														
		0.50	FILL / Silty Gravelly CLAY (CL-CI): brown; low to medium plasticity; fine to coarse gravel.		FILL														
		0.65m: boulder																	
		0.70	FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.		FILL														
		1																	
		1.50																	
		2																	
		2.50																	
		72																	
71																			
Test Pit discontinued at 2.50m 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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.3 AHD
COORDINATE: E:288395.3, N:6234447.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 23
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED							SAMPLE			TESTING AND REMARKS		
	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
27/08/25 No free groundwater observed	74	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL							DCP9/150	
			FILL / Silty CLAY (CL-CI): orange-brown and brown; low to medium plasticity; with fine to coarse gravel.										

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.3 AHD
COORDINATE: E:288408.9, N:6234427.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 24
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED													SAMPLE			TESTING AND REMARKS		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
27/08/25 No free groundwater observed	74	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA		w<PL					DCP9/150					
			FILL / Silty Gravelly CLAY (CL-CI): brown; low to medium plasticity; fine to coarse gravel.		FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
73		1.10	FILL / Silty CLAY (CL-CI): orange-brown; low to medium plasticity; with fine to coarse gravel.		FILL	NA		w<PL										
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
72		2			FILL	NA		w<PL										
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													
					FILL													

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 74.6 AHD
COORDINATE: E:288425.8, N:6234447.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 25
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS												
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. (%)	DENSITY, (g/cm³)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS												
RL (m)																									
26/08/25 No free groundwater observed	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL						DCP9/150													
		FILL / Silty CLAY (CL-CI): orange-brown; low to medium plasticity; with fine to coarse gravel.																							
	1.80	Silty CLAY (CI-CH): orange-brown mottled pale grey; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt							PP	390kPa												
	2.00																								
	2.50	Test Pit discontinued at 2.50m 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.

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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.5 AHD
COORDINATE: E:288444.8, N:6234458.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 26
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED						SAMPLE			TESTING AND REMARKS													
	FL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS										
26/08/25 No free groundwater observed	75	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL					D	0.50	PP	450kPa								
			FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.		FILL																		
	74	1.50	Silty CLAY (CI-CH): orange-brown mottled pale grey; medium to high plasticity; trace fine gravel and rootlets.			H						D	1.50	PP	450kPa								
							</																

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.3 AHD
COORDINATE: E:288442.0, N:6234486.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 27
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING						
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS			
					ORIGIN ^(#)	CONSIS. ^(%)	DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)						STRENGTH	TEST TYPE	RESULTS AND REMARKS	
26/08/25 No free groundwater observed	76	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL											DCP9/150			
			FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.		FILL	NA													
		0.50	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.					w<PL				D		0.50					
		1	1.00m: grading to pale brown, with sand, extremely to highly weathered shale and sandstone bands		RS	VSt - H						D		1.00					
		1.10	SANDSTONE: pale brown. Bringelly Shale.						HW - MW	1.10		L - M							
	75		Test Pit discontinued at 1.20m depth. Refusal on low to medium strength sandstone.																
		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.

NOTES: (1)Soil origin is "probable" unless otherwise stated. (2)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.2m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.1 AHD
COORDINATE: E:288413.7, N:6234452.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 28
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

[illegible]

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 75.8 AHD
COORDINATE: E:288418.1, N:6234470.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 29
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE		TESTING AND REMARKS							
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS								
26/08/25 No free groundwater observed	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA					DCP@150									
		FILL / Silty CLAY (CL-CI): brown and orange-brown; low to medium plasticity; with fine to coarse gravel.		FILL															
	0.90m: becomes orange brown											D	0.50						
												D	1.00						
												D	1.50	PP → 380-410kPa					
												D	2.00	PP → >600kPa					
												D	2.50						
												D	2.50						
	1.30	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.										VSt - H							
		From 1.80m: grading to pale orange		RS								H							
2	From 2.30m: with shale gravel, highly weathered shale bands																		
	Test Pit discontinued at 2.50m depth. Limit of investigation.																		

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.1 AHD
COORDINATE: E:288418.1, N:6234500.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 30
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

[illegible]

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.9 AHD
COORDINATE: E:288443.0, N:6234506.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 31
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED																	SAMPLE			TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS						
					ORIGIN(%)	CONSIS. ^(%)	DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)							STRENGTH					
26/08/25 No free groundwater observed		0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with rootlets.		FILL	NA		w<PL														
		0.60	Silty CLAY (CI-CH): pale brown mottled grey; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt H						D		0.50								
				SANDSTONE: pale brown. Bringelly Shale.					HW	0.60	VL L		D		0.70							
Test Pit discontinued at 0.70m depth. Refusal on low strength sandstone.																						
	76	1																				
	75	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.

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 0.7m
REMARKS:

OPERATOR: Quake Excavations
LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.5 AHD
COORDINATE: E:288456.1, N:6234536.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 32
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED																	SAMPLE			TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS						
					ORIGIN ^(#)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH												
26/08/25 No free groundwater observed	77	0.15	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL									↓ DCP9/150	5	10	15			
			SHALE: pale brown. Bringelly Shale.						XW · HW	0.15	VL · L											

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1m
REMARKS:

OPERATOR: Quake Excavations
LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 78.8 AHD
COORDINATE: E:288413.1, N:6234553.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 33
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING			
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
					ORIGIN ^(#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	WEATH.	DEPTH (m)						
28/08/25 No free groundwater observed	78	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA										
			Silty CLAY (CI-CH): pale grey and orange-brown; medium to high plasticity; with fine to coarse gravel.		RS	H	w<PL						D		0.50	PP
		0.70	SHALE: pale grey and brown, with sanstone bands. Bringelly Shale.									U50		0.63		
			1													
Test Pit discontinued at 1.20m depth. Refusal on low strength shale.																
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.

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 79.4 AHD
COORDINATE: E:288404.7, N:6234580.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 34
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE					TESTING	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
					ORIGIN(%)	CONSIS. ^(%)	DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)						
28/08/25 No free groundwater observed	79	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA										
			Silty CLAY (CI-CH): orange-brown and pale grey; medium to high plasticity; with fine to coarse gravel.		RS	H	w<PL									
			From 0.50m: shale bands													
		0.60	SHALE: dark blue and pale grey. Bringelly Shale.					HW - MW	0.60	L - M						
		1	Test Pit discontinued at 0.80m depth. Refusal on low to medium strength shale.													
		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: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 0.8m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: HH

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 79.1 AHD
COORDINATE: E:288376.0, N:6234580.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 35
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

[illegible]

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.5 AHD
COORDINATE: E:288378.5, N:6234543.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 36
PROJECT No: 92323.36
DATE: 27/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED																SAMPLE			TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS					
					ORIGIN ^(#)	CONSIS. ^(%)	DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)						STRENGTH	TEST TYPE	RESULTS AND REMARKS			
27/08/25 No free groundwater observed	77	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA									DCP9/150		5	10	15		
			Silty CLAY (CI-CH): orange-brown and pale grey; medium to high plasticity; with fine gravel and rootlets.																		
76		1	From 1.00m: grading to pale brown and grey, with sand, extremely to highly weathered sandstone bands		RS	VSt · H		w<PL								B 10/10mm					
			SANDSTONE: pale brown. Bringelly Shale.						XW · HW	1.40											
75		2	Test Pit discontinued at 1.50m depth. Refusal on low to medium strength sandstone.																		

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.

NOTES: (1)Soil origin is "probable" unless otherwise stated. (2)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.1 AHD
COORDINATE: E:288328.3, N:6234582.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 37
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED														SAMPLE			TESTING	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
					ORIGIN ^(#)	CONSIS. ^(*) DENSITY. ^(*)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH								
28/08/25 No free groundwater observed	77		FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA												
		0.30	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt - H	w<PL					D	0.50	PP	310-420kPa			
		0.80	SANDSTONE: pale brown. Bringelly Shale.															
		1										D	1.00					
	76																	

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.6m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS/HH

Refer to explanatory notes for symbol and abbreviation definitions

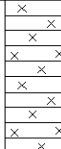
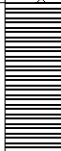


TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.6 AHD
COORDINATE: E:288338.8, N:6234604.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 38
PROJECT No: 92323.36
DATE: 28/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE					TESTING	
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
					ORIGIN(#)	CONSIS. (%)	DENSITY. (g)	MOISTURE	WEATH.	DEPTH (m)						
28/08/25 No free groundwater observed	77	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA	w<PL									
			SHALE: dark blue grey, with sandstone bands. Bringelly Shale.				XW HW	0.30	L M				D	0.50		
Test Pit discontinued at 0.60m depth. Refusal on low to medium strength shale.																

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 0.6m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.8 AHD
COORDINATE: E:288561.9, N:6234520.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 39
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING							
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS				
					ORIGIN(%)	CONSIS. ^(%) DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH										
26/08/25 No free groundwater observed	77	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA											5	10	15	
		0.60	FILL / Silty Gravelly CLAY (CL-CI): brown; low to medium plasticity; fine to coarse gravel.																	FILL
		1.00	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt - H	w<PL													
		1.60	From 1.00m: grading to pale brown																	
76		1.60	SHALE: pale brown and brown, with sandstone bands. Bringelly Shale.							1.60										
75		2	Test Pit discontinued at 1.80m depth. Refusal on low strength shale.																	

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.8m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.4 AHD
COORDINATE: E:288511.0, N:6234495.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 40
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED																SAMPLE			TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS					
					ORIGIN ^(#)	CONSIS. ^(%)	DENSITY ^(%)	MOISTURE	WEATH.	DEPTH (m)						STRENGTH	TEST TYPE	RESULTS AND REMARKS			
26/08/25 No free groundwater observed	77	0.25	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL																
			FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.		FILL																
					FILL																
					FILL																
					FILL																
					FILL																
					FILL																
					FILL																
					FILL																
					FILL																
76	1.20	FILL / Silty Gravelly CLAY (CL-CI): brown; low to medium plasticity; fine to coarse gravel.		FILL																	
				FILL																	
				FILL																	
				FILL																	
				FILL																	
				FILL																	
				FILL																	
				FILL																	
				FILL																	
				FILL																	
75	1.50	Silty CLAY (CI-CH): pale brown; medium to high plasticity; with rootlets, extremely weathered shale bands.		RS	H																
				RS	H																
				RS	H																
				RS	H																
				RS	H																
				RS	H																
				RS	H																
				RS	H																
				RS	H																
				RS	H																
	1.70	SHALE: brown. Bringelly Shale.																			
		Test Pit discontinued at 1.80m depth. Refusal on low to medium strength shale.																			

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.

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.5 AHD
COORDINATE: E:288488.3, N:6234454.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 41
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

GROUNDWATER	CONDITIONS ENCOUNTERED							SAMPLE			TESTING AND REMARKS							
	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS. ⁽¹⁾ DENSITY. ⁽²⁾	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS					
26/08/25 No free groundwater observed			FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								DCP/9/150					
	0.20		FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.															
			From 0.60m: grading to orange-brown															

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.2 AHD
COORDINATE: E:288483.9, N:6234416.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 42
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(®)	CONSIS. (°)	DENSITY. (°)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																				
RL (m)	5												10	15																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
26/08/25 No free groundwater observed	0.10	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								DCP9/150																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																					
	76	FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT:	Mirvac Homes NSW Pty Ltd	SURFACE LEVEL:	76.5 AHD	LOCATION ID:	43
PROJECT:	Proposed Residential Subdivision	COORDINATE:	E:288529.9, N:6234452.0	PROJECT No:	92323.36
LOCATION:	"Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570	DATUM/GRID:	MGA2020 Zone 56	DATE:	26/08/25
		DIP/AZIMUTH:	90°/---°	SHEET:	1 of 1

CONDITIONS ENCOUNTERED										SAMPLE			TESTING AND REMARKS		
GROUNDWATER	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN#)	CONSIS. ^(*)	DENSITY. ^(*)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS		
26/08/25 No free groundwater observed	RL (m)														
	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL											
	76	FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.													
	1														

PLANT:	Hyundai 60CR-9 excavator	OPERATOR:	Quake Excavations	LOGGED:	AS
METHOD:	450mm TB to 2.5m				
REMARKS:					

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 77.0 AHD
COORDINATE: E:288574.9, N:6234492.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 44
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

GROUNDWATER		CONDITIONS ENCOUNTERED					SAMPLE				TESTING AND REMARKS	
RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	ORIGIN(%)	CONSIS.(%) DENSITY.(%)	MOISTURE	REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS
77	0.20	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL								
		FILL / Silty CLAY (CL-CI): brown and pale brown; low to medium plasticity; with fine to coarse gravel.		FILL								
				NA								
76	1			FILL								
				w<PL								
	1.70	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.		RS	VSt							
	2	From 2.20m: grading to pale brown		RS	VSt							
75				RS	VSt							
		Test Pit discontinued at 2.50m depth. Limit of investigation.		RS	VSt							

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

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 2.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

TEST PIT LOG

CLIENT: Mirvac Homes NSW Pty Ltd
PROJECT: Proposed Residential Subdivision
LOCATION: "Orange" Stage 1, Cobbitty Road, Cobbitty, NSW 2570

SURFACE LEVEL: 76.7 AHD
COORDINATE: E:288468.9, N:6234505.0
DATUM/GRID: MGA2020 Zone 56
DIP/AZIMUTH: 90°/---°

LOCATION ID: 45
PROJECT No: 92323.36
DATE: 26/08/25
SHEET: 1 of 1

CONDITIONS ENCOUNTERED																SAMPLE			TESTING		
GROUNDWATER	RL (m)	DEPTH (m)	DESCRIPTION OF STRATA	GRAPHIC	SOIL			ROCK			SAMPLE REMARKS	TYPE	INTERVAL	DEPTH (m)	TEST TYPE	RESULTS AND REMARKS					
					ORIGIN ^(#)	CONSIS. ^(%) DENSITY. ^(%)	MOISTURE	WEATH.	DEPTH (m)	STRENGTH						TEST TYPE	RESULTS AND REMARKS				
26/08/25 No free groundwater observed	76	0.30	FILL / TOPSOIL / Silty CLAY (CL-CI): dark brown; low to medium plasticity; with fine to medium gravel, roots and rootlets.		FILL	NA										DCP9/150	5	10	15		
		0.50	FILL / Silty CLAY (CL-CI): brown; low to medium plasticity; with fine to coarse gravel.		FILL																
		0.78	Silty CLAY (CI-CH): orange-brown; medium to high plasticity; trace fine gravel and rootlets.			VSt H	w<PL					D									
		1.00	From 0.90m: with fine to coarse gravel and rootlets		RS							U50									
	75	1.30	SANDSTONE: brown. Bringelly Shale.																28		
	74		Test Pit discontinued at 1.50m depth. Refusal on low to medium strength sandstone.																		

NOTES: (1)Soil origin is "probable" unless otherwise stated. (2)Consistency/Relative density shading is for visual reference only - no correlation between cohesive and granular materials is implied.

PLANT: Hyundai 60CR-9 excavator
METHOD: 450mm TB to 1.5m
REMARKS:

OPERATOR: Quake Excavations

LOGGED: AS

Refer to explanatory notes for symbol and abbreviation definitions



Appendix C

Laboratory test results

Salinity summary - Table C1

Level 1 inspections and testing report

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Argæt
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Sample Number: MA-16555J
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 18/09/2025
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: 37 , Depth: 0.5 m
Material: Silty CLAY, orange brown



Douglas Partners Pty Ltd

Macarthur Laboratory

18 Waler Crescent Smeaton Grange NSW 2567

Phone: (02) 4647 0075

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Atenabawel

Approved Signatory: Nilusha Arachchi

Senior Technician

Laboratory Accreditation Number: 828

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Air Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	56		
Plastic Limit (%)	20		
Plasticity Index (%)	36		
Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.2		
Linear Shrinkage (%)	13.0		
Cracking Crumbling Curling	Curling		
Moisture Content (AS 1289 2.1.1)		Min	Max
Moisture Content (%)	20.5		

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Arguet
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Sample Number: MA-16555K
Client Sample #: 7
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 17/09/2025
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: 7 (0.5 m)
Material: Fill: Silty CLAY



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A handwritten signature in black ink, appearing to read 'Nilusha Arachchi'.

Approved Signatory: Nilusha Arachchi

Senior Technician

Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	2		
Soil Description	As above		
Nature of Water	Distilled water		

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Argaut
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Sample Number: MA-16555L
Client Sample #: 35
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 17/09/2025
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: 35 (0.5 m)
Material: Silty CLAY, orange brown



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A handwritten signature in black ink, appearing to read 'Nilusha Arachchi'.

Approved Signatory: Nilusha Arachchi

Senior Technician

Laboratory Accreditation Number: 828

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	2		
Soil Description	As above		
Nature of Water	Distilled water		

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Arguet
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Sample Number: MA-16555M
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 17/09/2025
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: 45 (0.5 m)
Material: Silty CLAY, orange brown



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A handwritten signature in black ink, appearing to read 'Nilusha Arachchi'.

Approved Signatory: Nilusha Arachchi

Senior Technician

Laboratory Accreditation Number: 828

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		

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Argaut
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 16/09/2025
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
Location: "Orange" Stage 1, Cobbitty Road, Cobbitty



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Atenabawels

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-16555N	1	0.5	Soil	7.5
MA-16555O	2	0.5	Soil	8.1
MA-16555P	2	1.5	Soil	7.3
MA-16555Q	2	2.5	Soil	5.1
MA-16555R	3	0.5	Soil	9.0
MA-16555S	4	0.5	Soil	7.9
MA-16555T	5	0.5	Soil	8.6
MA-16555U	6	0.5	Soil	8.0
MA-16555V	7	0.5	Soil	5.6
MA-16555W	8	0.5	Soil	5.4
MA-16555X	8	1.5	Soil	9.0
MA-16555Y	8	2.5	Soil	7.4
MA-16555Z	9	0.5	Soil	7.0
MA-16555AA	10	0.5	Soil	7.2
MA-16555AB	10	1.5	Soil	5.2
MA-16555AC	10	2.5	Soil	5.0
MA-16555AD	11	0.5	Soil	5.3
MA-16555AE	12	0.5	Soil	5.3
MA-16555AF	13	0.5	Soil	5.8
MA-16555AG	13	1.5	Soil	5.3
MA-16555AH	13	2.5	Soil	5.5
MA-16555AI	14	0.5	Soil	5.2
MA-16555AJ	15	0.5	Soil	6.9
MA-16555AK	16	0.5	Soil	5.0
MA-16555AL	16	1.5	Soil	5.3
MA-16555AM	17	0.5	Soil	5.5
MA-16555AN	18	0.5	Soil	5.1
MA-16555AO	19	0.5	Soil	5.3
MA-16555AP	20	0.5	Soil	8.0
MA-16555AQ	20	1.5	Soil	6.5

Sample Number	Location	Depth (m)	Material	pH Value
MA-16555AR	20	2.5	Soil	6.5
MA-16555AS	21	0.5	Soil	8.7
MA-16555AT	22	0.5	Soil	9.1
MA-16555AU	23	0.5	Soil	5.6
MA-16555AV	24	0.5	Soil	6.0
MA-16555AW	25	0.5	Soil	5.2
MA-16555AX	26	0.5	Soil	7.4
MA-16555AY	26	1.5	Soil	6.5
MA-16555AZ	26	2.5	Soil	7.6
MA-16555BA	27	0.5	Soil	5.9
MA-16555BB	28	0.5	Soil	4.8
MA-16555BC	29	0.5	Soil	5.5
MA-16555BD	29	1.5	Soil	4.9
MA-16555BE	29	2.5	Soil	8.1
MA-16555BF	30	0.5	Soil	5.7
MA-16555BG	31	0.5	Soil	7.6
MA-16555BH	32	0.5	Soil	4.8
MA-16555BI	33	0.5	Soil	4.6
MA-16555BJ	34	0.5	Soil	5.0
MA-16555BK	35	0.5	Soil	5.2
MA-16555BL	36	0.5	Soil	5.7
MA-16555BM	37	0.5	Soil	5.3
MA-16555BN	38	0.5	Soil	7.8
MA-16555BO	39	0.5	Soil	8.3
MA-16555BP	39	1.5	Soil	5.7
MA-16555BQ	39	1.8	Soil	8.0
MA-16555BR	40	0.5	Soil	6.0
MA-16555BS	41	0.5	Soil	7.7
MA-16555BT	42	0.5	Soil	7.6
MA-16555BU	42	1.5	Soil	5.4
MA-16555BV	42	2.5	Soil	5.5
MA-16555BW	43	0.5	Soil	7.1
MA-16555BX	44	0.5	Soil	7.7
MA-16555BY	45	0.5	Soil	6.0

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Argat
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 16/09/2025
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
Location: "Orange" Stage 1, Cobbitty Road, Cobbitty



Douglas Partners Pty Ltd

Macarthur Laboratory

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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-16555N	1	0.5	Soil	305.70
MA-16555O	2	0.5	Soil	506.50
MA-16555P	2	1.5	Soil	287.00
MA-16555Q	2	2.5	Soil	334.90
MA-16555R	3	0.5	Soil	327.90
MA-16555S	4	0.5	Soil	318.40
MA-16555T	5	0.5	Soil	340.20
MA-16555U	6	0.5	Soil	268.60
MA-16555V	7	0.5	Soil	266.80
MA-16555W	8	0.5	Soil	211.60
MA-16555X	8	1.5	Soil	366.20
MA-16555Y	8	2.5	Soil	317.70
MA-16555Z	9	0.5	Soil	500.10
MA-16555AA	10	0.5	Soil	212.30
MA-16555AB	10	1.5	Soil	185.80
MA-16555AC	10	2.5	Soil	351.30
MA-16555AD	11	0.5	Soil	138.80
MA-16555AE	12	0.5	Soil	64.80
MA-16555AF	13	0.5	Soil	420.30
MA-16555AG	13	1.5	Soil	100.60
MA-16555AH	13	2.5	Soil	124.90
MA-16555AI	14	0.5	Soil	341.90
MA-16555AJ	15	0.5	Soil	236.90
MA-16555AK	16	0.5	Soil	318.30
MA-16555AL	16	1.5	Soil	155.70
MA-16555AM	17	0.5	Soil	70.90
MA-16555AN	18	0.5	Soil	261.00
MA-16555AO	19	0.5	Soil	356.70
MA-16555AP	20	0.5	Soil	269.40
MA-16555AQ	20	1.5	Soil	340.90

Sample Number	Location	Depth (m)	Material	EC Value (µS/cm)
MA-16555AR	20	2.5	Soil	102.00
MA-16555AS	21	0.5	Soil	331.10
MA-16555AT	22	0.5	Soil	278.00
MA-16555AU	23	0.5	Soil	149.80
MA-16555AV	24	0.5	Soil	267.30
MA-16555AW	25	0.5	Soil	198.60
MA-16555AX	26	0.5	Soil	253.20
MA-16555AY	26	1.5	Soil	156.00
MA-16555AZ	26	2.5	Soil	210.00
MA-16555BA	27	0.5	Soil	41.60
MA-16555BB	28	0.5	Soil	330.80
MA-16555BC	29	0.5	Soil	328.30
MA-16555BD	29	1.5	Soil	242.80
MA-16555BE	29	2.5	Soil	243.60
MA-16555BF	30	0.5	Soil	49.70
MA-16555BG	31	0.5	Soil	101.00
MA-16555BH	32	0.5	Soil	544.20
MA-16555BI	33	0.5	Soil	713.70
MA-16555BJ	34	0.5	Soil	447.90
MA-16555BK	35	0.5	Soil	327.00
MA-16555BL	36	0.5	Soil	165.50
MA-16555BM	37	0.5	Soil	34.80
MA-16555BN	38	0.5	Soil	174.90
MA-16555BO	39	0.5	Soil	152.30
MA-16555BP	39	1.5	Soil	194.50
MA-16555BQ	39	1.8	Soil	175.20
MA-16555BR	40	0.5	Soil	277.90
MA-16555BS	41	0.5	Soil	295.50
MA-16555BT	42	0.5	Soil	270.80
MA-16555BU	42	1.5	Soil	234.60
MA-16555BV	42	2.5	Soil	493.80
MA-16555BW	43	0.5	Soil	319.50
MA-16555BX	44	0.5	Soil	179.10
MA-16555BY	45	0.5	Soil	80.10

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
 PO Box 787, Parramatta NSW
Contact: Trent Argat
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 05/09/2025
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
Location: "Orange" Stage 1, Cobbitty Road, Cobbitty



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Nilusha Arachchi

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

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	MA-16555A	MA-16555B	MA-16555C	MA-16555D	MA-16555E
Date Sampled	26/08/2025	26/08/2025	26/08/2025	26/08/2025	26/08/2025
Date Tested	03/09/2025	03/09/2025	03/09/2025	03/09/2025	03/09/2025
Material Source	**	**	**	**	**
Sample Location	4 (0.5 - 0.7 m)	7 (0.5 - 0.7 m)	12 (0.5 - 0.75 m)	15 (0.5 - 0.9 m)	24 (0.5 - 0.8 m)
Inert Material Estimate (%)	9	2	0	19	15
Pocket Penetrometer before (kPa)	600	600	600	600	600
Pocket Penetrometer after (kPa)	230	180	390	360	440
Shrinkage Moisture Content (%)	16.8	12.4	20.3	17.5	13.8
Shrinkage (%)	2.3	0.9	2.7	2.2	2.0
Swell Moisture Content Before (%)	18.6	14.7	22.8	14.7	16.4
Swell Moisture Content After (%)	20.3	22.6	28.5	20.6	21.4
Swell (%)	0.3	1.1	0.2	0.3	1.2
Shrink Swell Index Iss (%)	1.4	0.8	1.5	1.3	1.4
Visual Description	Fill: Silty CLAY	Fill: Silty CLAY	Silty CLAY, orange brown	Fill: Silty CLAY	Fill: Silty Gravelly CLAY
Cracking	HC	SC	SC	HC	SC
Crumbling	No	No	No	No	No
Remarks	**	**	**	**	**

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.

Cracking Terminology: UC Uncracked, SC Slightly Cracked, MC Moderately Cracked, HC Highly Cracked, FR Fragmented.

NATA Accreditation does not cover the performance of pocket penetrometer readings.

Material Test Report

Report Number: 92323.36-1
Issue Number: 1
Date Issued: 18/09/2025
Client: Mirvac Homes NSW Pty Ltd
PO Box 787, Parramatta NSW
Contact: Trent Argat
Project Number: 92323.36
Project Name: Proposed Residential Subdivision
Project Location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Work Request: 16555
Date Sampled: 26/08/2025
Dates Tested: 03/09/2025 - 05/09/2025
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
Location: "Orange" Stage 1, Cobbitty Road, Cobbitty



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

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	MA-16555F	MA-16555G	MA-16555H	MA-16555I	
Date Sampled	26/08/2025	26/08/2025	26/08/2025	26/08/2025	
Date Tested	05/09/2025	03/09/2025	05/09/2025	03/09/2025	
Material Source	**	**	**	**	
Sample Location	30 (0.5 - 0.7 m)	35 (0.5 - 0.63 m)	43 (0.5 - 0.73 m)	45 (0.5 - 0.78 m)	
Inert Material Estimate (%)	11	1	32	2	
Pocket Penetrometer before (kPa)	410	520	600	580	
Pocket Penetrometer after (kPa)	260	280	300	200	
Shrinkage Moisture Content (%)	16.9	18.1	9.2	12.9	
Shrinkage (%)	3.5	3.2	0.7	1.5	
Swell Moisture Content Before (%)	19.4	18.4	13.8	12.4	
Swell Moisture Content After (%)	23.3	25.4	18.9	13.8	
Swell (%)	2.0	0.8	2.2	0.0	
Shrink Swell Index Iss (%)	2.5	2.0	1.0	0.8	
Visual Description	Silty CLAY, orange brown	Silty CLAY, orange brown	Fill: Silty CLAY	Silty CLAY, orange brown	
Cracking	SC	UC	SC	SC	
Crumbling	Yes	No	No	No	
Remarks	**	**	**	**	

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.

Cracking Terminology: UC Uncracked, SC Slightly Cracked, MC Moderately Cracked, HC Highly Cracked, FR Fragmented.

NATA Accreditation does not cover the performance of pocket penetrometer readings.

CERTIFICATE OF ANALYSIS 389973

Client Details

Client	Douglas Partners Pty Ltd Smeaton Grange
Attention	Afham Syed
Address	18 Waler Crescent, Smeaton Grange, NSW, 2567

Sample Details

Your Reference	<u>92323.36 Cobbitty</u>
Number of Samples	15 Soil
Date samples received	03/09/2025
Date completed instructions received	03/09/2025

Analysis Details

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

Samples were analysed as received from the client unless as indicated below in the method summaries. 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.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	10/09/2025
Date of Issue	05/09/2025

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Results Approved By

Loren Bardwell, Development Chemist
Nancy Zhang, Laboratory Manager, Sydney

Authorised By

Nancy Zhang, Laboratory Manager

Misc Inorg - Soil

Our Reference		389973-1	389973-2	389973-3	389973-4	389973-5
Your Reference	UNITS	2	2	2	8	8
Depth		0.5	1.5	2.5	0.5	1.5
Sampling Period Dates		26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Chloride, Cl 1:5 soil:water	mg/kg	140	87	210	140	120
Sulphate, SO4 1:5 soil:water	mg/kg	240	180	42	68	34

Misc Inorg - Soil

Our Reference		389973-6	389973-7	389973-8	389973-9	389973-10
Your Reference	UNITS	8	13	13	13	29
Depth		2.5	0.5	1.5	2.5	0.5
Sampling Period Dates		26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Chloride, Cl 1:5 soil:water	mg/kg	190	430	22	64	250
Sulphate, SO4 1:5 soil:water	mg/kg	85	78	170	110	150

Misc Inorg - Soil

Our Reference		389973-11	389973-12	389973-13	389973-14	389973-15
Your Reference	UNITS	29	29	42	42	42
Depth		1.5	2.5	0.5	1.5	2.5
Sampling Period Dates		26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Date analysed	-	04/09/2025	04/09/2025	04/09/2025	04/09/2025	04/09/2025
Chloride, Cl 1:5 soil:water	mg/kg	180	50	280	300	550
Sulphate, SO4 1:5 soil:water	mg/kg	220	<10	85	57	42

ESP/CEC						
Our Reference		389973-1	389973-4	389973-7	389973-10	389973-13
Your Reference	UNITS	2	8	13	29	42
Depth		0.5	0.5	0.5	0.5	0.5
Sampling Period Dates		26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25	26/8/25-28/8/25
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	05/09/2025	05/09/2025	05/09/2025	05/09/2025	05/09/2025
Date analysed	-	05/09/2025	05/09/2025	05/09/2025	05/09/2025	05/09/2025
Exchangeable Ca	meq/100g	8.2	5.6	6.1	8.5	4.7
Exchangeable K	meq/100g	0.3	0.3	0.3	0.2	0.2
Exchangeable Mg	meq/100g	4.8	8.2	8.6	7.1	6.8
Exchangeable Na	meq/100g	0.8	2.4	2.8	1.0	1.4
Cation Exchange Capacity	meq/100g	14	16	18	17	13
ESP	%	6	15	16	6	11

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	389973-2
Date prepared	-			04/09/2025	1	04/09/2025	04/09/2025		04/09/2025	04/09/2025
Date analysed	-			04/09/2025	1	04/09/2025	04/09/2025		04/09/2025	04/09/2025
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	140	140	0	82	71
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	1	240	240	0	90	#

QUALITY CONTROL: Misc Inorg - Soil					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	11	04/09/2025	04/09/2025		[NT]	[NT]
Date analysed	-			[NT]	11	04/09/2025	04/09/2025		[NT]	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	11	180	190	5	[NT]	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	[NT]	11	220	220	0	[NT]	[NT]

QUALITY CONTROL: ESP/CEC					Duplicate			Spike Recovery %		
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	389973-4
Date prepared	-			05/09/2025	1	05/09/2025	05/09/2025		05/09/2025	05/09/2025
Date analysed	-			05/09/2025	1	05/09/2025	05/09/2025		05/09/2025	05/09/2025
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	1	8.2	8.6	5	93	115
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	1	0.3	0.3	0	96	91
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	1	4.8	4.8	0	90	95
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	1	0.8	0.5	46	102	91
ESP	%	1	Metals-020	[NT]	1	6	4	40	[NT]	[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.

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.

Air volumes are typically provided by customers (often as flow rate(s) and sampling time(s) and/or simply volumes) sampled or exposure times (determines 'volume' passive badges are exposed to)). Hence in such circumstances the volume measurement is inevitably not covered by Envirolab's NATA accreditation. An exception may occur where Envirolab Newcastle does the sampling where accreditation exists for certain types of sampling and hence volume determination(s). Note air volumes are often used to determine concentrations for dust and/or analyses on filters, sorbents and in impingers. For canister sampling, the air volume is covered by Envirolab's NATA accreditation.

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.

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.

For Dust Deposit Gauge (DDG) analysis the sampling, sampling period and funnel exposure area do not fall under Envirolab's NATA accreditation (unless the Newcastle laboratory where responsible for the sampling), hence the annotation on the DDG units of reporting.

Urine Analysis - The BEI values listed are taken from the 2022 edition of "TLVs and BEIs Threshold Limits" by ACGIH.

Report Comments

MISC_INORG_DRY:# Low spike recovery was obtained for this sample. This is due to matrix interferences. However, an acceptable recovery was obtained for the LCS.

Table C1: Summary Table - Laboratory Tests and Assessments

Test	Sample Depth	pH	Chloride Concentration	Sulphate 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}	EC _e	Sample Salinity Class
					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									[Lab.]	[M x EC _{1:5}]	
	(m bgl)	(pH units)			Ω.cm	[AS2159-2009]	[AS2159-2009]					(meq/100g)	(meq/100g)	(%)	[after DLWC]		[AS1289.3.8.1]	[after DLWC]	[after DLWC]	(microS/cm)	(dciS/m)	[Richards 1954]
1	0.5	7.5			3271	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	305.7	2.1	Slightly Saline
2	0.5	8.1	140	240	1974	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Mild	0.8	14	6	Sodic			Medium clay	7	506.5	3.5	Slightly Saline
2	1.5	7.3	87	180	3484	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	287	2.0	Slightly Saline
2	2.5	5.1	210	42	2986	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Heavy clay	6	334.9	2.0	Slightly Saline
3	0.5	9			3050	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light clay	8.5	327.9	2.8	Slightly Saline
4	0.5	7.9			3141	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	318.4	2.5	Slightly Saline
5	0.5	8.6			2939	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	340.2	2.4	Slightly Saline
6	0.5	8			3723	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	268.6	2.1	Slightly Saline
7	0.5	5.6			3748	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					2	Some	Medium clay	7	266.8	1.9	Non-Saline
8	0.5	5.4	140	68	4726	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	2.4	16	15	Sodic			Medium clay	7	211.6	1.5	Non-Saline
8	1.5	9	120	34	2731	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Heavy clay	6	366.2	2.2	Slightly Saline
8	2.5	7.4	190	85	3148	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Light medium clay	8	317.7	2.5	Slightly Saline
9	0.5	7			2000	B	Non-Aggressive		Non-Aggressive		Mild							Heavy clay	6	500.1	3.0	Slightly Saline
10	0.5	7.2			4710	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Heavy clay	6	212.3	1.3	Non-Saline
10	1.5	5.2			5382	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	185.8	1.5	Non-Saline
10	2.5	5			2847	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	351.3	2.5	Slightly Saline
11	0.5	5.3			7205	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	138.8	1.0	Non-Saline
12	0.5	5.3			15432	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	64.8	0.5	Non-Saline
13	0.5	5.8	430	78	2379	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	2.8	18	16	Highly Sodic			Light medium clay	8	420.3	3.4	Slightly Saline
13	1.5	5.3	22	170	9940	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	100.6	0.7	Non-Saline
13	2.5	5.5	64	110	8006	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Heavy clay	6	124.9	0.7	Non-Saline
14	0.5	5.2			2925	B	Mild		Non-Aggressive		Non-Aggressive							Medium clay	7	341.9	2.4	Slightly Saline
15	0.5	6.9			4221	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light clay	8.5	236.9	2.0	Slightly Saline
16	0.5	5			3142	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	318.3	2.5	Slightly Saline
16	1.5	5.3			6423	B	Mild		Non-Aggressive		Non-Aggressive							Clay loam	9	155.7	1.4	Non-Saline
17	0.5	5.5			14104	B	Mild		Non-Aggressive		Non-Aggressive							Heavy clay	6	70.9	0.4	Non-Saline
18	0.5	5.1			3831	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	261	2.1	Slightly Saline
19	0.5	5.3			2803	B	Mild		Non-Aggressive		Non-Aggressive							Heavy clay	6	356.7	2.1	Slightly Saline
20	0.5	8			3712	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	269.4	2.2	Slightly Saline
20	1.5	6.5			2933	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	340.9	2.4	Slightly Saline
20	2.5	6.5			9804	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	102	0.8	Non-Saline
21	0.5	8.7			3020	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	331.1	2.3	Slightly Saline
22	0.5	9.1			3597	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	278	1.9	Non-Saline
23	0.5	5.6			6676	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Heavy clay	6	149.8	0.9	Non-Saline
24	0.5	6			3741	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light clay	8.5	267.3	2.3	Slightly Saline
25	0.5	5.2			5035	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	198.6	1.6	Non-Saline
26	0.5	7.4			3949	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	253.2	1.8	Non-Saline
26	1.5	6.5			6410	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	156	1.2	Non-Saline
26	2.5	7.6			4762	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Heavy clay	6	210	1.3	Non-Saline
27	0.5	5.9			24038	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	41.6	0.3	Non-Saline
28	0.5	4.8			3023	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	330.8	2.6	Slightly Saline
29	0.5	5.5	250	150	3046	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	1	17	6	Sodic			Light medium clay	8	328.3	2.6	Slightly Saline
29	1.5	4.9	180	220	4119	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Light medium clay	8	242.8	1.9	Non-Saline
29	2.5	8.1	50	10	4105	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	243.6	1.7	Non-Saline
30	0.5	5.7			20121	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Heavy clay	6	49.7	0.3	Non-Saline
31	0.5	7.6			9901	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	101	0.7	Non-Saline
32	0.5	4.8			1838	B	Mild		Non-Aggressive		Mild							Medium clay	7	544.2	3.8	Slightly Saline
33	0.5	4.6			1401	B	Mild		Non-Aggressive		Mild							Medium clay	7	713.7	5.0	Moderately Saline
34	0.5	5			2233	B	Mild		Non-Aggressive		Non-Aggressive							Heavy clay	6	447.9	2.7	Slightly Saline
35	0.5	5.2			3058	B	Mild		Non-Aggressive		Non-Aggressive					2	Some	Light medium clay	8	327	2.6	Slightly Saline
36	0.5	5.7			6042	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	165.5	1.3	Non-Saline
37	0.5	5.3			28736	B	Mild		Non-Aggressive		Non-Aggressive							Light medium clay	8	34.8	0.3	Non-Saline
38	0.5	7.8			5718	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	174.9	1.2	Non-Saline
39	0.5	8.3			6566	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	152.3	1.2	Non-Saline
39	1.5	5.7			5141	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	194.5	1.4	Non-Saline
39	1.8	8			5708	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	175.2	1.2	Non-Saline
40	0.5	6			3598	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light medium clay	8	277.9	2.2	Slightly Saline
41	0.5	7.7			3384	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Light clay	8.5	295.5	2.5	Slightly Saline
42	0.5	7.6	280	85	3693	B	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive	1.4	13	11	Sodic			Heavy clay	6	270.8	1.6	Non-Saline
42	1.5	5.4	300	57	4263	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Medium clay	7	234.6	1.6	Non-Saline
42	2.5	5.5	550	42	2025	B	Mild	Non-Aggressive	Non-Aggressive	Non-Aggressive	Non-Aggressive							Heavy clay	6	493.8	3.0	Slightly Saline
43	0.5	7.1			3130	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	319.5	2.2	Slightly Saline
44	0.5	7.7			5583	B	Non-Aggressive		Non-Aggressive		Non-Aggressive							Medium clay	7	179.1	1.3	Non-Saline
45	0.5	6			12484	B	Non-Aggressive		Non-Aggressive		Non-Aggressive					3	Dispersive	Light medium clay	8	80.1	0.6	Non-Saline

"Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Lot Classification and Salinity Assessment

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

Project 92323.36
3 November 2025
R.001.Rev0
AS

Attention: Trent Argaet
Email: t.argaet@theoriongroup.au

Report on Level 1 Inspections and Testing of Filling Proposed Residential Subdivision "Orange" Stage 1, Cobbitty Road, Cobbitty NSW

1. Introduction

This report presents a summary of Level 1 earthworks inspections and testing undertaken over the period 21 November 2024 to 6 May 2025 for the bulk fill placed within "Orange" Stage 1, Cobbitty Road, Cobbitty NSW. Drawing 1 attached, shows the approximate density testing locations for the site.

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:

- Stripped inspections of proposed 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 (Council requires a minimum 95% SMDD).
- Moisture content within the range $\pm 2\%$ of Standard optimum moisture content (OMC) within the residential lots.
- 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 21 November 2024 to 6 May 2025. 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 detailed above. In addition, a fill survey undertaken by Orion Consulting Engineers Pty Ltd (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.

Based on the bulk earthworks plans provided by the client (Document No. 23-0579-02-SWC-000-A), an approximate total volume of 129,441 m³ of engineered fill has been placed within the bulk earthworks area. A total of 356 conforming in-situ density tests (refer Drawing 1, attached) were performed throughout the works. This satisfies the minimum testing frequency requirement of one test per 500 m³ of 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 silty and/or shaley clays. 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 356 conforming density tests (excluding 1 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%	-2.0% (wet) to +2.0% (dry)
Range (passed tests)	98% – 103.5%	-1.5% (wet) to +2.0% (dry)
Mean (passed tests)	101.1%	+0.2% (dry)
Median (passed tests)	101.0%	0.0%
Standard deviation (passed tests)	1.2%	0.8%
No. passed tests (inc. retests)	356	
No. of retests	1	

Notes: Statistics provided are rounded to the nearest 0.1%.

3. Comments

Douglas undertook inspection and earthworks testing of fill placed within "Orange" Stage 1, Cobbitty Road, 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 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 and in accordance with the requirements of AS 3798 and can be classified as controlled fill. 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



Afham Syed

Geotechnical Engineer

Reviewed by

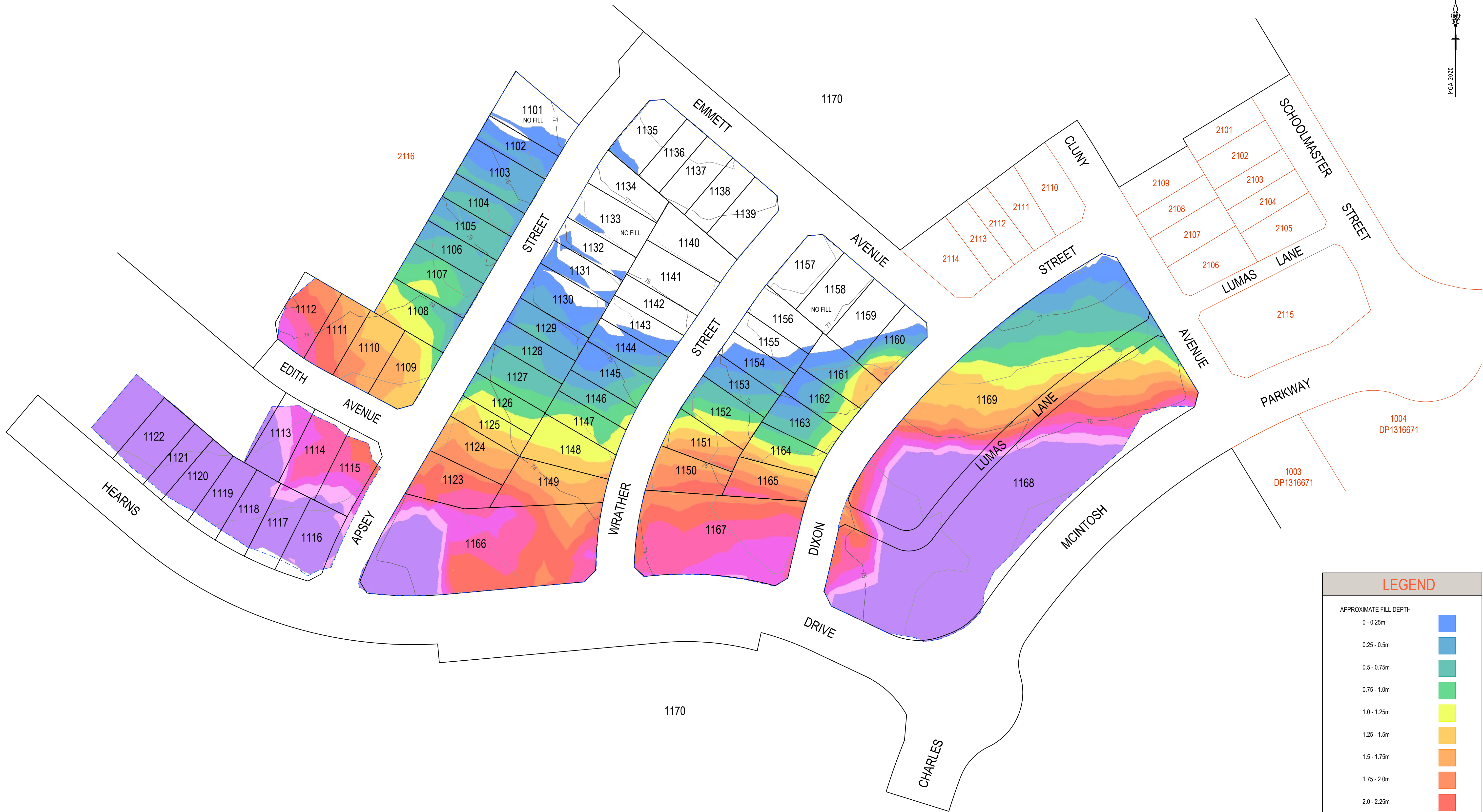


Michael Jones

Principal

Attachments: Works-as-executed fill plans (prepared by Orion Consulting Engineers Pty Ltd)
Drawing 1 – Density test location plan
Project Summary Report

About this Inspection Report



MGA 2020

LEGEND

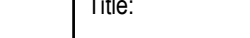
APPROXIMATE FILL DEPTH

- 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:

- 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.
- STRIPPED SURFACE SURVEY & DTM PREPARED BY TRN. ORION GROUP TAKES NO RESPONSIBILITY FOR THE ACCURACY OF THIS SURVEY.
- FINISHED SURFACE SURVEY & DTM PREPARED BY ORION GROUP. DATE OF SURVEY: OCTOBER 2025

					Disclaimer and Copyright: USE WRITTEN DIMENSIONS ONLY, DO NOT SCALE. THIS PLAN AND THE COPYRIGHT ARE THE PROPERTY OF ORION CONSULTING ENGINEERS PTY LTD AND MUST NOT BE REPRODUCED OR COPIED WHOLLY OR IN PART WITHOUT THE PERMISSION OF ORION CONSULTING ENGINEERS PTY LTD.		Scale: 0 6 12 18 24 30 36 42 48 54 60 SCALE 1:600 (A1) SCALE 1:1200 (A3)		For:			By:	  ABN:25 604 069 981 PO Box:7936, BULKHAM HILLS NSW 2153 T:(02) 8660 0035 E:info@theoriongroup.au		Project:	COBBITTY BY MIRVAC		Title:	LOT FILL PLAN ORANGE STAGE 1							
01	AM	AM	AM	31/10/2025	LOT FILL CALCULATED USING STRIP LEVELS		Surveyor NAI		Date of Survey	OCTOBER 2025	Height Datum AHD		Horizontal Datum	MGA2020	Origin SSM18301 RL73.899 (SCMS - 26/05/25)		Origin SSM18303 - SSM23117 349°34'36" (SCMS - 26/05/25)		Project No. 23-0579		Drawing No. SV-05-001	Milestone -	Sheet 01 of 01	Revision 01		
Rev	Drawn	Check	Appd.	Date	Revision Description																					



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

Project Summary Report



GROUND
ED EXPERTISE

Report date: 10/10/2025
Client: Mirvac Homes NSW Pty Ltd
c-/ Orion Group, PO Box 787, Parramatta, NSW 2124
Contact: Trent Argat
Project number: 92323.36
Project name: Proposed residential subdivision
Project location: "Orange" Stage 1, Cobbitty Road, Cobbitty NSW
Specification: 98 - 104% SMDD and -2.0% (wet) to 2.0% (dry) of SOMC
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

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
8	21/11/2024	288437.7	6234446.7	73.552	100.5	-0.5	Pass	
9	21/11/2024	288416.2	6234460.7	73.789	99.5	0	Pass	
10	21/11/2024	288409.4	6234480.8	74.859	101.5	0.5	Pass	
11	22/11/2024	288414.4	6234457.2	73.864	100.5	-0.5	Pass	
12	22/11/2024	288411.3	6234460.4	74.157	98.5	0.5	Pass	
13	22/11/2024	288424.6	6234471.5	75.091	99.5	-0.5	Pass	
17	23/11/2024	288390.8	6234471.3	74.557	102.5	0	Pass	
18	25/11/2024	288404.9	6234466.1	74.755	101	-0.5	Pass	
19	25/11/2024	288415.9	6234470.2	75.118	100	0.5	Pass	
20	25/11/2024	288400.6	6234482.2	75.238	100.5	0.5	Pass	
21	26/11/2024	288412.8	6234469.4	75.51	99.5	0	Pass	
22	26/11/2024	288403.9	6234450.1	74.755	101	-0.5	Pass	
23	26/11/2024	288231.5	6234481	70.311	101	0	Pass	
24	27/11/2024	288200.8	6234480	70.361	99	-0.5	Pass	
25	27/11/2024	288234.5	6234482.4	70.602	101	0	Pass	
26	27/11/2024	288206.9	6234510	70.919	101	0.5	Pass	
27	28/11/2024	288198	6234505.4	70.569	101	0	Pass	
28	28/11/2024	288216.1	6234494.9	70.998	101.5	0	Pass	
29	28/11/2024	288239.8	6234469.7	71.056	99.5	0	Pass	
30	29/11/2024	288236	6234495.2	71.79	100	-0.5	Pass	
31	3/12/2024	288258	6234488	71.963	100.5	0	Pass	
32	3/12/2024	288233	6234485	71.851	99.5	1	Pass	
33	3/12/2024	288209	6234484	71.236	101	-0.5	Pass	
34	3/12/2024	288193	6234490	71.017	100.5	0.5	Pass	
35	3/12/2024	288192	6234502	70.956	100	-0.5	Pass	
36	4/12/2024	288240	6234475	72.178	101.5	1	Pass	
37	4/12/2024	288182	6234479	70.974	102	1.5	Pass	
38	4/12/2024	288208	6234470	71.965	100.5	0.5	Pass	
39	4/12/2024	288241	6234488	71.547	100.5	1.5	Pass	
40	4/12/2024	288215	6234522	72.123	101	0	Pass	
41	4/12/2024	288197	6234511	72.511	100.5	-1	Pass	
42	5/12/2024	288194	6234495	71.794	100.5	-0.5	Pass	
43	5/12/2024	288295	6234464	71.309	101.5	-0.5	Pass	
44	5/12/2024	288226	6234470	72.688	100.5	0	Pass	
45	5/12/2024	288186	6234485	71.766	101	0.5	Pass	
46	5/12/2024	288312	6234480	72.35	101	-0.5	Pass	
47	5/12/2024	288357	6234476	73.495	100.5	-0.5	Pass	
48	6/12/2024	288326	6234472	73.23	101	0	Pass	
49	6/12/2024	288333	6234457	72.77	101	0.5	Pass	
50	6/12/2024	288368	6234490	74.248	101.5	1.5	Pass	
51	6/12/2024	288376	6234462	73.583	101.5	0	Pass	
52	6/12/2024	288335	6234465	73.231	101.5	0.5	Pass	
53	6/12/2024	288310	6234479	73.23	102	0	Pass	
54	6/12/2024	288284	6234485	72.537	101	-0.5	Pass	
55	7/12/2024	288282	6234472	72.619	102	0	Pass	
56	7/12/2024	288334	6234460	73.508	103	0.5	Pass	

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
57	7/12/2024	288305	6234450	73.621	102	1.5	Pass	
58	10/12/2024	288221.2	6234498.2	73.211	102	-0.5	Pass	
59	10/12/2024	288217.3	6234482.7	73.378	99	0	Pass	
60	10/12/2024	288238.3	6234499.1	73.69	101.5	0.5	Pass	
61	10/12/2024	288219.2	6234503.8	73.449	100.5	-0.5	Pass	
62	11/12/2024	288191	6234531.6	70.636	99	0	Pass	
63	11/12/2024	288169.3	6234521	69.872	100.5	0.5	Pass	
64	11/12/2024	288226.4	6234535.4	71.944	101	0.5	Pass	
65	11/12/2024	288219.4	6234489.2	73.435	99	-0.5	Pass	
66	11/12/2024	288195.1	6234501.1	72.622	99.5	0	Pass	
67	12/12/2024	288217	6234508	73.615	102.5	0.5	Pass	
68	12/12/2024	288186	6234534	71.202	102	-1	Pass	
69	12/12/2024	288194	6234531	72.013	103.5	0.5	Pass	
70	12/12/2024	288245	6234527	73.127	102.5	0	Pass	
71	12/12/2024	288211	6234544	72.667	102	-1	Pass	
72	12/12/2024	288228	6234507	73.705	103	0.5	Pass	
73	12/12/2024	288212	6234493	73.466	102.5	0.5	Pass	
74	13/12/2024	288422	6234380	70.805	101.5	0	Pass	
75	13/12/2024	288188.3	6234520.7	72.388	102.5	-1	Pass	
76	13/12/2024	288194.9	6234505.9	73.171	102	0	Pass	
77	13/12/2024	288212.2	6234508.5	73.726	102	0.5	Pass	
78	13/12/2024	288236.9	6234515.7	73.711	99.5	-0.5	Pass	
79	13/12/2024	288202.4	6234525.1	73.291	99	0	Pass	
80	13/12/2024	288440	6234383	71.601	99.5	0	Pass	
81	13/12/2024	288434	6234366	71.128	99.5	-0.5	Pass	
82	13/12/2024	288235.9	6234525.9	73.649	99.5	0.5	Pass	
83	13/12/2024	288180	6234507	72.46	103.5	0.5	Pass	
84	14/12/2024	288435.5	6234389.3	72.352	100	-0.5	Pass	
85	14/12/2024	288420	6234389	72.17	100	-1	Pass	
86	14/12/2024	288391	6234382.7	70.843	99	0	Pass	
87	14/12/2024	288394	6234399.5	71.004	98.5	-0.5	Pass	
88	16/12/2024	288370	6234425	71.434	101.5	-1	Pass	
89	16/12/2024	288381	6234406	71.504	101.5	1	Pass	
90	16/12/2024	288405	6234418	72.178	101.5	1.5	Pass	
91	16/12/2024	288342	6234402	71.598	102.5	0	Pass	
92	16/12/2024	288362	6234429	71.046	102	-0.5	Pass	
93	16/12/2024	288382	6234405	72.598	101.5	0	Pass	
94	17/12/2024	288342	6234423	72.087	101.5	-0.5	Pass	
95	17/12/2024	288377	6234433	73.087	101	-0.5	Pass	
96	17/12/2024	288371	6234439	73.333	101.5	-1	Pass	
97	17/12/2024	288356	6234404	71.834	101	-1.5	Pass	
98	18/12/2024	288393	6234404	72.362	101	1	Pass	
99	18/12/2024	288365	6234419	72.403	101	0.5	Pass	
100	18/12/2024	288380	6234441	73.625	101	-0.5	Pass	
101	18/12/2024	288352	6234421	72.891	101.5	-0.5	Pass	
102	18/12/2024	288334	6234398	71.81	102	1.5	Pass	
103	18/12/2024	288360	6234387	71.717	102	0.5	Pass	
104	19/12/2024	288421	6234427	74.008	102	1	Pass	
105	19/12/2024	288432	6234385	72.668	102	0.5	Pass	
106	19/12/2024	288332	6234392	72.288	101	-1	Pass	
107	19/12/2024	288348	6234410	73.08	100.5	1.5	Pass	
108	6/01/2025	288447	6234453	74.2	99	-0.5	Pass	
109	6/01/2025	288447	6234439	73.4	99	-0.5	Pass	
110	6/01/2025	288446	6234419	72.5	98	-0.5	Pass	
111	6/01/2025	288445	6234456	74.6	101.5	0.5	Pass	
112	6/01/2025	288446	6234384	72.1	101	0	Pass	
113	6/01/2025	288445	6234399	72.4	102	0	Pass	
114	9/01/2025	288443.9	6234435.7	74.37	100.5	-0.5	Pass	

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
115	9/01/2025	288446.2	6234406.5	73.511	99	0	Pass	
116	9/01/2025	288439.1	6234446.5	74.781	100.5	-0.5	Pass	
117	9/01/2025	288436	6234428.7	74.306	100	-0.5	Pass	
118	9/01/2025	288555.9	6234477.8	74.283	101	0.5	Pass	
119	9/01/2025	288503.1	6234473.1	74.233	100	-0.5	Pass	
120	9/01/2025	288508.5	6234484.5	75.986	99	0	Pass	
121	13/01/2025	288529.1	6234499.4	75.59	100	1.5	Pass	
122	13/01/2025	288547.6	6234496.6	75.61	100.5	1.5	Pass	
123	13/01/2025	288479.4	6234499.2	75.95	100	1.5	Pass	
124	14/01/2025	288533	6234501	75.8	101	0	Pass	
125	14/01/2025	288471	6234497	75.8	102	0	Pass	
126	14/01/2025	288525	6234475	75.3	102.5	0	Pass	
127	14/01/2025	288457	6234476	75.3	101.5	0	Pass	
128	15/01/2025	288536	6234501	76.2	101	0	Pass	
129	15/01/2025	288498	6234492	76	100	0.5	Pass	
130	15/01/2025	288573	6234461	73.3	102.5	0.5	Pass	
131	15/01/2025	288559	6234453	72.7	103	0.5	Pass	
132	15/01/2025	288547	6234451	72.2	101	0.5	Pass	
133	20/01/2025	288575.58	6234460.4	73.937	102	0	Pass	
134	20/01/2025	288555.99	6234461.3	73.659	101	0	Pass	
135	20/01/2025	288576.21	6234473.1	74.558	101	0.5	Pass	
136	20/01/2025	288560.96	6234440.2	73.867	99.5	0.5	Pass	
137	21/01/2025	288579.46	6234470	74.992	101	0	Pass	
138	21/01/2025	288555.31	6234434.2	73.988	102	1	Pass	
139	21/01/2025	288560.48	6234474.6	74.839	98.5	-0.5	Pass	
140	21/01/2025	288549.2	6234449.6	74.181	99.5	-0.5	Pass	
141	22/01/2025	288553.64	6234474.1	75.341	102.5	-0.5	Pass	
142	22/01/2025	288550.46	6234452.5	74.9	100	1	Pass	
143	22/01/2025	288514.41	6234449.8	70.851	99	2	Pass	
144	23/01/2025	288533.31	6234456.5	73.891	103	1.5	Pass	
145	23/01/2025	288505.16	6234460.4	72.418	101.5	2	Pass	
146	23/01/2025	288527.87	6234455.1	73.681	103	1.5	Pass	
147	23/01/2025	288490.61	6234454	72.473	100	2	Pass	
148	24/01/2025	288507.82	6234438.4	71.111	100.5	0	Pass	
149	24/01/2025	288529.4	6234465.4	74.224	102.5	0	Pass	
150	24/01/2025	288490.31	6234462.4	73.066	101.5	0	Pass	
151	24/01/2025	288546.74	6234465.5	75.172	101.5	2	Pass	
152	24/01/2025	288508.63	6234464.3	74.492	99.5	2	Pass	
153	29/01/2025	288526.31	6234459.1	75.247	102	1.5	Pass	
154	29/01/2025	288499.41	6234472.6	75.456	98.5	2	Pass	
155	5/02/2025	288496	6234436	71.358	101.5	-0.5	Pass	
156	5/02/2025	288512	6234427	71.212	101.5	-0.5	Pass	
157	5/02/2025	288524	6234435	71.24	101	-0.5	Pass	
158	5/02/2025	288500	6234420	71.135	101	-0.5	Pass	
159	6/02/2025	288486	6234445	72.25	100.5	-1	Pass	
160	6/02/2025	288513	6234421	71.792	99.5	-1	Pass	
161	6/02/2025	288529	6234431	72.352	100	0	Pass	
162	6/02/2025	288489	6234435	72.688	100	1.5	Pass	
163	6/02/2025	288487	6234416	71.706	101	1	Pass	
164	7/02/2025	288529	6234416	72.36	100	1.5	Pass	
165	7/02/2025	288498	6234423	72.486	100.5	0.5	Pass	
166	7/02/2025	288503	6234408	72.498	100.5	0.5	Pass	
167	7/02/2025	288526	6234432	72.723	101	0	Pass	
168	7/02/2025	288524	6234371	70.327	99	0.5	Pass	
169	7/02/2025	288520	6234363	70.645	100	0.5	Pass	
170	8/02/2025	288527	6234347	70.577	102	0	Pass	
171	8/02/2025	288538	6234359	70.665	101.5	0	Pass	
172	8/02/2025	288513	6234374	71.055	98.5	-1	Pass	

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
173	8/02/2025	288469	6234408	72.479	101	-0.5	Pass	
174	10/02/2025	288538	6234380	72.108	103.5	1.5	Pass	
175	10/02/2025	288514	6234391	72.236	103.5	0.5	Pass	
176	12/02/2025	288488	6234445	73.882	100	-0.5	Pass	
177	12/02/2025	288525	6234447	73.803	101	1.5	Pass	
178	12/02/2025	288500	6234416	73.04	99	1	Pass	
179	12/02/2025	288527	6234420	73.167	100.5	1	Pass	
180	13/02/2025	288508	6234433	73.749	102.5	-0.5	Pass	
181	13/02/2025	288521	6234399	72.556	99.5	-0.5	Pass	
182	13/02/2025	288510	6234380	71.596	99	-0.5	Pass	
183	13/02/2025	288463	6234395	72.154	98.5	-1	Pass	
184	13/02/2025	288499	6234393	72.426	101	1.5	Pass	
185	14/02/2025	288470	6234389	72.716	102	0.5	Pass	
186	14/02/2025	288455	6234386	72.655	101	1.5	Pass	
187	14/02/2025	288468	6234345	71.42	99	0.5	Pass	
188	14/02/2025	288481	6234335	71.532	102	1.5	Pass	
189	14/02/2025	288460	6234361	71.844	101	0	Pass	
190	17/02/2025	288520	6234456	75.401	100.5	-1	Pass	
191	17/02/2025	288535	6234437	74.378	99.5	1	Pass	
192	17/02/2025	288486	6234425	74.38	99.5	1.5	Pass	
193	17/02/2025	288513	6234417	74.089	98	1	Pass	
194	17/02/2025	288501	6234438	74.729	100	1.5	Pass	
195	18/02/2025	288507	6234424	75.03	100	0.5	Pass	
196	18/02/2025	288489	6234407	74.071	101.5	1.5	Pass	
197	18/02/2025	288505	6234428	75.153	103	-1	Pass	
198	18/02/2025	288520	6234398	74.173	102	2	Pass	
199	18/02/2025	288538	6234414	74.948	99.5	0.5	Pass	
200	19/02/2025	288522	6234387	74.678	98.5	0	Pass	
201	19/02/2025	288510	6234383	74.384	101	0	Pass	
202	19/02/2025	288476	6234384	71.758	99.5	1.5	Pass	
203	19/02/2025	288485	6234354	71.518	100	1	Pass	
204	20/02/2025	288495	6234351	71.85	102	0.5	Pass	
205	20/02/2025	288509	6234336	71.023	101.5	0	Pass	
206	20/02/2025	288499	6234335	71.937	102	0.5	Pass	
207	20/02/2025	288503	6234358	71.921	102	0	Pass	
208	20/02/2025	288513	6234344	71.989	101	-0.5	Pass	
209	21/02/2025	288519	6234375	73.849	101	-0.5	Pass	
210	21/02/2025	288522	6234352	72.615	102	-1.5	Pass	
211	21/02/2025	288493	6234396	74.237	102.5	1.5	Pass	
212	21/02/2025	288474	6234392	73.719	101	1	Pass	
213	22/02/2025	288488	6234395	74.274	101.5	1.5	Pass	
214	22/02/2025	288479	6234376	73.175	102.5	0	Pass	
215	22/02/2025	288494	6234369	73.111	102.5	-0.5	Pass	
216	24/02/2025	288494	6234404	74.841	102.5	0.5	Pass	
217	24/02/2025	288479	6234393	74.051	103	1.5	Pass	
218	24/02/2025	288501	6234387	74.447	102.5	1.5	Pass	
219	24/02/2025	288492	6234374	73.409	103	-0.5	Pass	
220	25/02/2025	288460	6234332	70.894	102	0	Pass	
221	25/02/2025	288451	6234351	71.14	101	1	Pass	
222	25/02/2025	288446	6234334	70.722	101.5	1.5	Pass	
223	26/02/2025	288458	6234360	71.807	102	0.5	Pass	
224	26/02/2025	288458	6234334	71.278	101.5	2	Pass	
225	27/02/2025	288469	6234383	74.012	102.5	1.5	Pass	
226	27/02/2025	288482	6234389	74.671	101.5	0	Pass	
227	27/02/2025	288470	6234392	74.621	102.5	1.5	Pass	
228	27/02/2025	288487	6234370	73.465	101	-0.5	Pass	
229	27/02/2025	288521	6234376	74.398	101.5	1	Pass	
230	28/02/2025	288497	6234372	74.535	103	0.5	Pass	

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
231	28/02/2025	288482	6234383	74.77	102	1.5	Pass	
232	28/02/2025	288511	6234391	75.246	103.5	0.5	Pass	
233	28/02/2025	288490	6234393	75.15	102.5	0.5	Pass	
234	1/03/2025	288521	6234392	75.283	100.5	0.5	Pass	
235	1/03/2025	288521	6234381	75.263	101.5	1	Pass	
236	1/03/2025	288512	6234379	75.25	101	-0.5	Pass	
237	3/03/2025	288493	6234376	75.297	102.5	-0.5	Pass	
238	3/03/2025	288525	6234380	75.105	102	1.5	Pass	
239	3/03/2025	288472	6234374	74.785	101	-0.5	Pass	
240	3/03/2025	288507	6234376	75.41	102.5	0	Pass	
241	5/03/2025	288478	6234379	74.979	103	0	Pass	
242	5/03/2025	288495	6234375	75.438	103	0.5	Pass	
243	5/03/2025	288516	6234362	75.354	102.5	-0.5	Pass	
244	5/03/2025	288468	6234374	74.64	103	-0.5	Pass	
245	6/03/2025	288483	6234371	75.477	103	1	Pass	
246	6/03/2025	288473	6234368	75.175	102	0	Pass	
247	6/03/2025	288505	6234361	75.485	102.5	-0.5	Pass	
248	6/03/2025	288518	6234367	75.242	102.5	1	Pass	
249	10/03/2025	288472	6234343	74.847	102.5	-1	Pass	
250	10/03/2025	288482	6234342	75.301	100.5	0.5	Pass	
251	10/03/2025	288493	6234338	75.181	100.5	0	Pass	
252	10/03/2025	288488	6234333	75.499	100.5	0	Pass	
253	10/03/2025	288479	6234332	75.072	101	0	Pass	
254	10/03/2025	288468	6234332	74.441	100	-0.5	Pass	
255	10/03/2025	288478	6234332	74.318	101.5	-1	Pass	
256	13/03/2025	288512	6234318	72.471	102	2	Pass	
257	13/03/2025	288506	6234326	73.038	102	0	Pass	
258	13/03/2025	288502	6234320	73.667	101	-0.5	Pass	
259	13/03/2025	288510	6234317	72.859	101	0.5	Pass	
260	13/03/2025	288510	6234328	73.113	102	-0.5	Pass	
261	14/03/2025	288266	6234518	96.3	100.5	-0.5	Pass	
262	14/03/2025	288258	6234522	96.3	99.5	0.5	Pass	
263	14/03/2025	288251	6234526	96.3	99.5	0	Pass	
264	14/03/2025	288290	6234438	92.6	101	0.5	Pass	
265	14/03/2025	288256	6234441	92.6	101.5	0	Pass	
266	14/03/2025	288238	6234542	96.3	100.5	-0.5	Pass	
267	14/03/2025	288252	6234538	96.5	101	-1	Pass	
268	15/03/2025	288290	6234535	97.2	101	0.5	Pass	
269	15/03/2025	288294	6234542	97.2	101	-0.5	Pass	
270	15/03/2025	288299	6234551	97.5	100	0	Pass	
271	17/03/2025	288265	6234456	71.037	102.5	-0.5	Pass	
272	17/03/2025	288246	6234441	70.301	101.5	-0.5	Pass	
273	17/03/2025	288200	6234455	70.219	100	-0.5	Pass	
274	17/03/2025	288191	6234441	69.692	100	1.5	Pass	
275	17/03/2025	288180	6234451	69.798	100	0	Pass	
276	17/03/2025	288269	6234454	71.241	101	1.5	Pass	
277	18/03/2025	288228	6234452	70.637	101.5	-1.5	Pass	
278	18/03/2025	288202	6234454	70.454	102	-0.5	Pass	
279	18/03/2025	288237	6234444	70.497	101.5	-0.5	Pass	
280	18/03/2025	288223	6234453	70.868	101.5	-0.5	Pass	
281	18/03/2025	288205	6234459	70.103	102.5	-0.5	Pass	
282	19/03/2025	288255	6234447	71.621	102	-0.5	Pass	
283	19/03/2025	288243	6234455	72.028	102.5	0	Pass	
284	19/03/2025	288223	6234441	70.21	100.5	-1	Pass	
285	19/03/2025	288294	6234456	72.208	101	-0.5	Pass	
286	19/03/2025	288273	6234451	71.957	102.5	1.5	Pass	
287	19/03/2025	288283	6234444	71.779	101.5	0	Pass	
288	20/03/2025	288287	6234444	71.853	102.5	0.5	Pass	

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
289	20/03/2025	288275	6234456	72.549	102.5	-0.5	Pass	
290	20/03/2025	288255	6234441	71.384	100.5	1.5	Pass	
291	20/03/2025	288194	6234458	71.307	101.5	1.5	Pass	
292	20/03/2025	288205	6234440	69.911	101	1	Pass	
293	21/03/2025	288312	6234425	72.15	102.5	0.5	Pass	
294	21/03/2025	288290	6234427	71.704	102	0.5	Pass	
295	21/03/2025	288300	6234429	72.515	102.5	-0.5	Pass	
296	21/03/2025	288273	6234426	71.588	102.5	-1	Pass	
297	24/03/2025	288310	6234417	72.135	102.5	0.5	Pass	
298	24/03/2025	288282	6234424	71.931	102.5	1.5	Pass	
299	24/03/2025	288299	6234418	72.082	101	-1	Pass	
300	24/03/2025	288286	6234419	72.138	101.5	-0.5	Pass	
301	25/03/2025	288295	6234405	71.78	102.5	-0.5	Pass	
302	25/03/2025	288282	6234411	72.18	103	-0.5	Pass	
303	25/03/2025	288288	6234409	72.416	101.5	0.5	Pass	
304	25/03/2025	288293	6234396	71.893	103	0.5	Pass	
305	25/03/2025	288314	6234396	71.962	101.5	-0.5	Pass	
306	26/03/2025	288198	6234468	72.973	104	2.5	Fail	
307	26/03/2025	288225	6234465	73.129	103	-0.5	Pass	
308	26/03/2025	288201	6234457	72.203	103	0.5	Pass	Re-test of #306
309	26/03/2025	288229	6234449	71.928	103	0.5	Pass	
310	27/03/2025	288214	6234459	72.797	101	0.5	Pass	
311	27/03/2025	288196	6234463	72.656	100	1	Pass	
312	27/03/2025	288307	6234375	71.124	100.5	1.5	Pass	
313	27/03/2025	288314	6234382	71.519	101.5	1	Pass	
314	1/04/2025	288225	6234455	72.699	102.5	1	Pass	
315	1/04/2025	288202	6234464	72.934	103	0	Pass	
316	1/04/2025	288188	6234460	72.138	100.5	0.5	Pass	
317	1/04/2025	288241	6234446	72.252	100	0.5	Pass	
318	3/04/2025	288194.69	6234462.4	72.673	100.5	-1	Pass	
319	3/04/2025	288214.9	6234457	72.776	100	-1	Pass	
320	3/04/2025	288234.69	6234456.7	72.855	100	0	Pass	
321	3/04/2025	288253.34	6234446.3	72.365	101.5	-0.5	Pass	
322	3/04/2025	288222.18	6234444	72.197	100	-0.5	Pass	
323	3/04/2025	288196.63	6234449.8	72.012	102	1	Pass	
324	4/04/2025	288211	6234463	73.121	102	-1	Pass	
325	4/04/2025	288195	6234449	71.914	101	-1	Pass	
326	7/04/2025	288238	6234444	72.558	101	0	Pass	
327	7/04/2025	288183	6234465	72.654	101.5	1.5	Pass	
328	7/04/2025	288248	6234438	72.437	102	1.5	Pass	
329	7/04/2025	288218	6234439	72.325	101	-0.5	Pass	
330	7/04/2025	288194	6234446	72.364	101	2	Pass	
331	8/04/2025	288197	6234454	73.085	103	-0.5	Pass	
332	8/04/2025	288217	6234444	72.91	101.5	0	Pass	
333	8/04/2025	288223	6234433	72.435	101	1.5	Pass	
334	8/04/2025	288199	6234453	72.988	101.5	-0.5	Pass	
335	10/04/2025	288164	6234453	68.449	102	0	Pass	
336	10/04/2025	288161	6234464	67.995	102	0	Pass	
337	10/04/2025	288166	6234468	68.898	101.5	-0.5	Pass	
338	10/04/2025	288167	6234449	68.662	101.5	0.5	Pass	
339	10/04/2025	288156	6234471	68.938	101	-1.5	Pass	
340	11/04/2025	288171	6234445	69.961	101.5	-1	Pass	
341	11/04/2025	288162	6234465	69.554	101	1.5	Pass	
342	11/04/2025	288162	6234454	69.96	101.5	-0.5	Pass	
343	11/04/2025	288163	6234475	70.127	102	0	Pass	
344	12/04/2025	288295	6234392	72.565	102	0	Pass	
345	12/04/2025	288301	6234381	72.499	101.5	-0.5	Pass	
346	12/04/2025	288312	6234376	72.429	102	0	Pass	

Test #	Date	Easting	Northing	Elevation (m)	Relative compaction (%)	Moisture variation (%)	Pass/fail	Comment
347	14/04/2025	288164	6234447	71.081	102	0	Pass	
348	14/04/2025	288173	6234466	71.326	101	1	Pass	
349	14/04/2025	288178	6234459	72.203	101	-0.5	Pass	
350	14/04/2025	288164	6234448	71.165	101	-0.5	Pass	
351	15/04/2025	288178	6234443	72.057	102.5	0	Pass	
352	15/04/2025	288160	6234453	71.55	102.5	-0.5	Pass	
353	15/04/2025	288172	6234465	72.715	100.5	1.5	Pass	
354	15/04/2025	288166	6234474	72.166	100	0.5	Pass	
355	16/04/2025	288171	6234450	72.709	98.5	-0.5	Pass	
356	16/04/2025	288162	6234468	72.369	102	1.5	Pass	
357	16/04/2025	288169	6234450	72.799	101	0.5	Pass	
358	16/04/2025	288156	6234458	72.519	101	1.5	Pass	
359	17/04/2025	288154	6234487	70.621	100	1.5	Pass	
360	17/04/2025	288154	6234469	72.377	101	0	Pass	
361	17/04/2025	288149	6234478	72.085	101	-0.5	Pass	
362	17/04/2025	288156	6234489	71.378	100	0	Pass	
363	29/04/2025	288151	6234497	70.45	100.5	0	Pass	
364	29/04/2025	288153	6234508	69.841	101	-0.5	Pass	
365	6/05/2025	288152	6234489	72.404	101	-0.5	Pass	
366	6/05/2025	288152	6234498	71.123	100.5	0	Pass	
367	6/05/2025	288157	6234507	70.789	101.5	1.5	Pass	

Moisture variation note:

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

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.

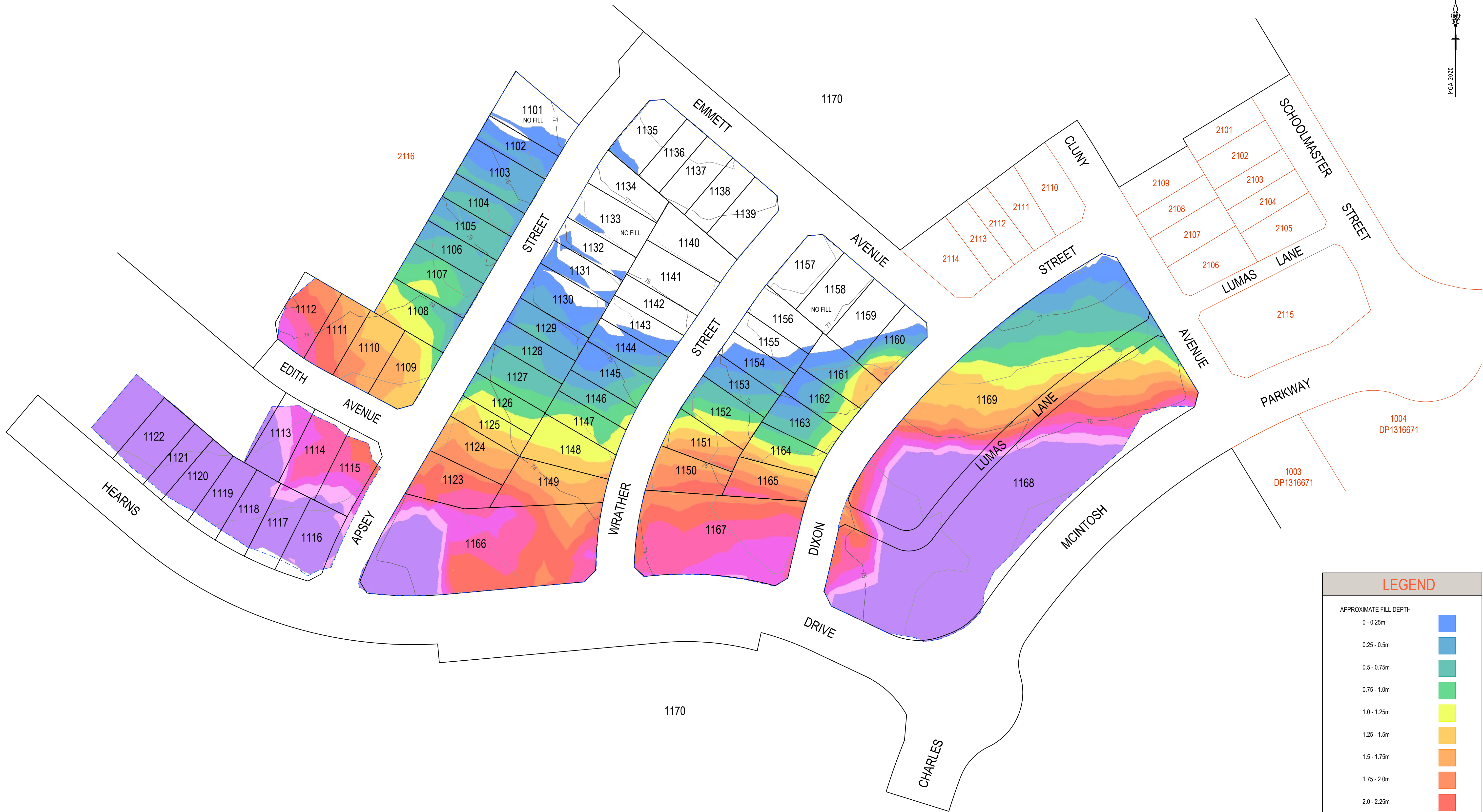
Should these issues occur, then additional advice should be sought from Douglas and, if required, amendments made.

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)



MGA 2020

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:

- 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.
- STRIPPED SURFACE SURVEY & DTM PREPARED BY TRN. ORION GROUP TAKES NO RESPONSIBILITY FOR THE ACCURACY OF THIS SURVEY.
- FINISHED SURFACE SURVEY & DTM PREPARED BY ORION GROUP. DATE OF SURVEY: OCTOBER 2025

Rev	Drawn	Check	Appd.	Date	Revision Description
01	AM	AM	AM	31/10/2025	LOT FILL CALCULATED USING STRIP LEVELS
00	NAI	AM	AM	21/10/2025	INITIAL ISSUE

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Scale:	
	
Surveyor	NAI
Date of Survey	OCTOBER 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)



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
ORANGE STAGE 1

Project No.	Drawing No.	Milestone	Sheet	Revision
23-0579	SV-05-001	-	01 of 01	01

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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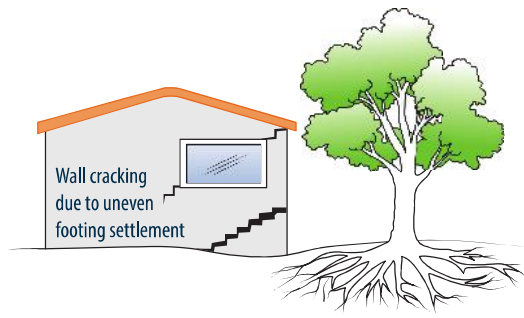


FIGURE 1 Trees can cause shrinkage and damage.

- ▶ 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 perpend).

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

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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.

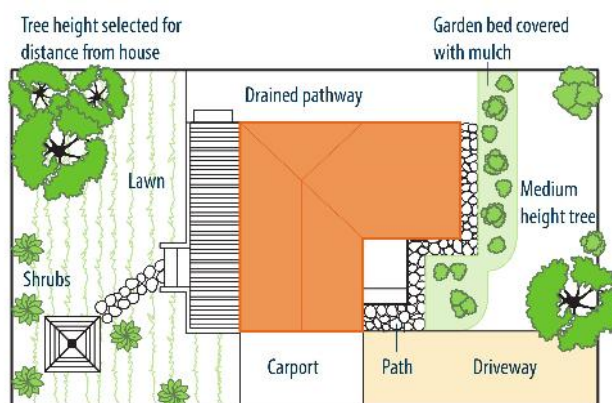


FIGURE 2 Gardens for a reactive site.

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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