Proposed Subdivision
Billy's Lookout – Stages 10 & 19
Site Classification

Outrigger Drive, Teralba

NEW15P-0070F-AI.Rev1
26 September 2024

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

26 September 2024

McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
NEWCASTLE NSW 2300

Attention: Mr Bryson Cox

Dear Sir

RE: RESIDENTIAL SUBDIVISION – BILLY'S LOOKOUT – STAGES 10 & 19
OUTRIGGER DRIVE, TERALBA
SITE CLASSIFICATION (LOTS 1001 TO 1016 and 1901 TO 1904)

Please find enclosed our geotechnical report for Stages 10 & 19 of the 'Billy's Lookout' residential subdivision, located at Outrigger Drive, Teralba.

The report provides site classification with respect to reactive soils, in accordance with the requirements of AS2870-2011 '*Residential Slabs and Footings*', for Stages 10 & 19 (Lots 1001 to 1016 and 1901 to 1904).

If you have any questions regarding this report, please do not hesitate to contact Ben Edwards, Shannon Kelly, or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd

Jason Lee
Principal Geotechnical Engineer

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Attachments:

1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this geotechnical site classification report on behalf of McCloy Development Management Pty Ltd (McCloy), for Stages 10 & 19 of the 'Billy's Lookout' residential subdivision, located at Outrigger Drive, Teralba.

Based on the brief and drawing provided by the client, Stages 10 & 19 are understood to comprise of 20 residential allotments (Lots 1801 to 1816 and 1901 to 1904).

The scope of work for the geotechnical investigation included site classification with respect to reactive soils, in accordance with the requirements of AS2870-2011 '*Residential Slabs and Footings*', for Stages 10 & 19, following completion of site regrade works.

This report presents the results of the field work investigations and laboratory testing, and provides recommendations for the scope outlined above.

2.0 Desktop Study

The scope of work has included a review of the following reports completed by Qualtest or others, as noted below:

- Level 1 Site Re-grade Assessment Report, 'Billy's Lookout Subdivision – Stage 10, Teralba, (Qualtest Report Reference: NEW22P-0067-AC, dated 7 August 2024);
- Level 1 Site Re-grade Assessment Report, 'Billy's Lookout Subdivision – Stage 18, Teralba, (Qualtest Report Reference: NEW22P-0067-AB, dated 6 May 2024);
- Site Classification, 'Proposed Subdivision – Billy's Lookout – Stage 18, Outrigger Drive, Teralba', (Report Reference: NEW15P-0070F-AH, dated 13 May 2024); and,
- Geotechnical Assessment report by Qualtest, 'Proposed Subdivision, Billy's Lookout - Stages 10, 16 & 17, Outrigger Drive, Teralba, (Report Reference: NEW15P-0070F-AA, dated 22 November 2019).

This report includes a summary of selected results from the previous reports where applicable.

3.0 Field Work

Field work investigations were carried out on 28 August 2024 and comprised of:

- DBYD search and visual check of proposed test locations for the presence of underground services;
- Site walkover to make observations of surface features at the property and in the immediate surrounding area;
- Drilling 19 boreholes (BH1001 to BH1014 and BH1901 to BH1905) using a 2.7 tonne excavator equipped with a 300mm diameter auger attachment. Boreholes were terminated at depths of between 0.31m and 2.30m;
- Undisturbed samples (U50 tubes) and small bag samples were taken for subsequent laboratory testing; and,
- Boreholes were backfilled with the excavation spoil and compacted using the excavator auger and tracks.

Investigations were carried out by an experienced Geotechnical Engineer from Qualtest who located the boreholes, carried out the testing and sampling, produced field logs of the boreholes, and made observations of the site surface conditions.

Engineering logs of the boreholes are presented in Appendix A.

Approximate borehole locations are shown on the attached Figures AI1 & AI2. Boreholes were located in the field by handheld GPS and relative to existing site features.

4.0 Site Description

4.1 Site Regrade Works

Stage 10

Following an initial site visit, stripping assessment and recommendations performed on 24 June 2022 (Qualtest Site Record Form ref. NEW22P-0067-SR07, dated 06/07/22, and multiple subsequent visits throughout the project), site re-grading works within Stage 10, were conducted between 24 June 2022 and 26 July 2024.

Re-grade works included filling within all or portions of residential lots 1001, and 1004 to 1016. Refer to attached Figure AI1 for the approximate extent of lot re-grade filling works for this stage of the development.

The approximate depth of fill placed ranged in the order of 0.1m to about 2.7m, with the deepest areas being within the rear of the Lots 1008 to 1012. The approximate maximum depth of fill placed within each lot (excluding topsoil), was in the order of:

- Lot 1001 – 1.8m;
- Lots 1004 to 1007 – 0.3m;
- Lots 1008 to 1012 – 2.7m; and,
- Lots 1013 to 1016 – 1.8m.

Stage 19 (Former Future Lot, Stage 18)

Note: The below is extracted from Qualtest Level 1 Site Re-grade Assessment Report (Ref. NEW22P-0067-AB, dated 6 May 2024). The Site regrade report references Future Lots within Stage 18, now referred to as Lots 1901 to 1904 on the current Sales Plan.

Following an initial site visit, stripping assessment and recommendations performed on 4 October 2022 (Qualtest Site Record Form ref. NEW22P-0067-S09, dated 20/10/22, and multiple subsequent visits throughout the project), site re-grading works within Stage 18 (Stage 19 now renamed), were conducted between 14 October 2022 and 10 October 2023.

The approximate depth of fill placed ranged in the order of 0.1m to about 5m, with the deepest areas being within the future lot area, and the rear of the majority of the filled lots. The approximate maximum depth of fill placed within each lot (excluding topsoil), was in the order of:

- Lots 1901 to 1904 (Former Future Lot Area) – 5.0m.

Refer to attached Figure AI2 for the approximate extent of lot re-grade filling works for this stage of the development.

Prior to filling, re-grade areas were stripped of topsoil and unsuitable material to expose the suitable natural foundation profile. Preparation works were then performed, which consisted of tyning, re-conditioning and re-compaction of the stripped surface, prior to filling with approved site fill to design finish levels.

Filling was generally performed using site material won from excavations within the cut areas of the development. The fill material could generally be described as mixtures of Residual (CI-CH) Sandy CLAY, medium to high plasticity, brown / red / grey in colour, with fine to coarse grained Sand and Gravel, along with Extremely Weathered (EW) Conglomerate / Sandstone, pale yellow / brown in colour, blended with minor quantities of on-site pale brown Colluvium.

The fill was compacted in maximum lifts of 0.3m thickness. Any unsuitable or deleterious material within the fill was removed by hand or mechanical means prior to final compaction of the material.

As the geotechnical testing authority engaged for the project, Qualtest state that the filling performed for the re-grade areas within Stages 10 and 19 (including work carried out as part of Stage 18 works) as detailed in the site regrade reports, was carried out to Level 1 criteria as defined in Clause 8.2 – Section 8 of AS3798-2007, "*Guidelines on Earthworks for Commercial and Residential Developments*".

Refer to Qualtest Level 1 Site Re-grade Assessment Reports (Ref. Stage 18 - NEW22P-0067-AB, dated 6 May 2024 and Stage 10 - NEW22P-0067-AC, dated 7 August 2024) for further details including the approximate limit of filling works for this stage of the project.

The recommendations of this report are based on the understanding that any existing lot re-grade works are limited to the controlled earthworks supervised by Qualtest, and placement of low reactivity topsoil material such that total depth of topsoil and uncontrolled fill does not exceed 0.4m. Qualtest should be informed without delay if additional earthworks are known to have been carried out.

4.2 Surface Conditions

The site comprises proposed Stages 10 & 19 of the Billy's Lookout subdivision, located off Outrigger Drive, Teralba, as shown on Figures AI1 & AI2.

It is located in a region of gently to moderately undulating topography, on the upper to mid slopes of a broad hill formation.

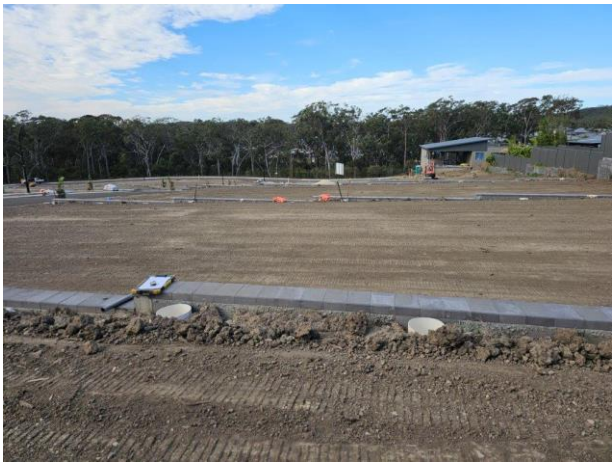
The site is bounded to the south by Outrigger Drive, Detention Basin, drainage reserve, and bushland to the north, and east by existing Stages 17 & 18, and to the west by existing Stage 4 of the subdivision.

On the day of the field investigations, the site had been cleared, associated retaining walls had been constructed, and topsoil had been placed on the lots.

The majority of the site was judged to be moderately drained by way of surface run off, and inter-allotment drainage systems located at the rear of allotments.

Trafficability was judged to be good by way of 4WD vehicle along the existing pavement at the front of the lots.

Selected photographs of the site taken on the day of the site investigations are shown as follows.



Photograph 1: From near BH1002 (Lot 1007), facing south.

Photograph 2: From near BH1002 (Lot 1007), facing north.

Photograph 3: From near BH1008 (Lot 1008), facing south.

Photograph 4: From near BH1008 (Lot 1008), facing west.

Photograph 5: From near BH1012 (Lot 1012), facing northeast.

Photograph 6: From near BH1012 (Lot 1012), facing south.

Photograph 7: From near BH1903 (Lot 1904), facing southwest.

Photograph 8: From near BH1903 (Lot 1904), facing west.

Photograph 9: From near BH1905 (Lot 1902 / 1903 boundary), facing west.

Photograph 10: From near BH1905 (Lot 1902 / 1903 boundary), facing northwest.

4.3 Subsurface Conditions

Reference to the 1:100,000 Newcastle Coalfield Regional Geology Sheet indicates the site to be underlain by the Moon Island Beach Subgroup of the Newcastle Coal Measures, which is characterised by Conglomerate, Sandstone, Siltstone, Claystone, Tuff and Coal rock types.

Table 1 presents a summary of the typical soil types encountered on site during the field investigations, divided into representative geotechnical units.

Table 2 contains a summary of the distribution of the above geotechnical units at the borehole locations.

No groundwater was encountered in the boreholes during the limited time that they remained open on the day of the field investigation.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES

Unit	Soil Type	Description
1A	FILL – TOPSOIL	Sandy CLAY – low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.
1B	FILL – Uncontrolled	Not Encountered within current investigation.
1C	FILL – Controlled	Gravelly Sandy CLAY – low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel.
2	TOPSOIL	Sandy CLAY – low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.
3	SLOPEWASH / COLLUVIUM	Not Encountered within current investigation.
4	RESIDUAL SOIL	Sandy CLAY, CLAY – medium to high plasticity, pale brown, with pale orange to orange and pale grey to white, with fine to medium/coarse grained rounded gravel, fine to coarse grained sand, trace cobbles in places. Gravelly Sandy CLAY, Sandy CLAY – low to medium plasticity, fine to coarse grained sand, pale brown, pale grey, and grey-brown, fine to medium grained rounded to sub-rounded gravel. Clayey SAND – fine to medium grained, pale orange and pale grey, fines of low plasticity.
5	EXTREMELY WEATHERED (XW) ROCK with soil properties	Pebbly Sandstone: breaks down into Gravelly Clayey SAND – fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fines of low plasticity, fine to medium grained rounded to sub-rounded gravel.
6	HIGHLY WEATHERED (HW) ROCK	Pebbly SANDSTONE – fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, generally estimated low to medium rock strength, with estimated very low strength in places, with extremely weathered pockets / bands in places.

TABLE 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT TEST LOCATIONS

Location	UNIT 1A Fill - Topsoil	UNIT 1B Fill - Uncontrolled	UNIT 1C Fill - Controlled	UNIT 2 Topsoil	UNIT 3 Slopewash / Colluvium	Unit 4 Residual Soil	Unit 5 XW Rock	Unit 6 HW to SW Rock
	Depth (m)							
Current Investigation								
BH1001	–	–	–	0.00 – 0.20	–	0.20 – 0.35	0.35 – 0.60	0.60 – 0.61*
BH1002	–	–	–	0.00 – 0.30	–	0.30 – 0.90	0.90 – 1.00	1.00 – 1.01*
BH1003	–	–	–	0.00 – 0.30	–	0.30 – 0.90	0.90 – 1.60	1.60 – 1.61*
BH1004	–	–	–	0.00 – 0.20	–	0.20 – 1.50	1.50 – 1.60	1.60 – 1.61*
BH1005	–	–	–	0.00 – 0.20	–	0.20 – 0.50	0.50 – 0.60	0.60 – 0.61*
BH1006	–	–	–	0.00 – 0.10	–	–	0.10 – 0.30	0.30 – 0.31*
BH1007	0.00 – 0.10	–	0.10 – 0.70	–	–	0.70 – 1.00	1.00 – 1.20	1.20 – 2.00^
BH1008	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1009	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1010	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1011	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1012	0.00 – 0.10	–	0.10 – 1.80	–	–	1.80 – 2.00	–	–
BH1013	0.00 – 0.10	–	0.10 – 1.60	–	–	1.60 – 2.00	–	–
BH1014	0.00 – 0.10	–	0.10 – 1.80	–	–	1.80 – 2.30	–	–
BH1901	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1902	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1903	0.00 – 0.10	–	0.10 – 2.00	–	–	–	–	–
BH1904	0.00 – 0.10	–	0.10 – 1.50	–	–	1.50 – 2.00	–	–
BH1905	0.00 – 0.10	–	0.10 – 1.80	–	–	1.80 – 2.00	–	–

Location	UNIT 1A Fill - Topsoil	UNIT 1B Fill - Uncontrolled	UNIT 1C Fill - Controlled	UNIT 2 Topsoil	UNIT 3 Slopewash / Colluvium	Unit 4 Residual Soil	Unit 5 XW Rock	Unit 6 HW to SW Rock
	Depth (m)							
Previous investigation (Ref. NEW15P-0070F-AH, dated 13/05/2024)								
BH1805	0.00 – 0.05	–	0.05 – 0.70	–	–	0.70 – 2.20	–	–
BH1806	0.00 – 0.20	–	0.20 – 1.10	–	–	1.10 – 2.30	–	–
BH1807	0.00 – 0.10	–	0.10 – 1.30	–	–	1.30 – 2.30	–	–
BH1810	0.00 – 0.20	–	0.20 – 1.80	–	–	1.80 – 2.20	–	–
BH1811	0.00 – 0.10	–	0.10 – 2.20	–	–	–	–	–
BH1812	0.00 – 0.10	–	0.10 – 1.80	–	–	1.80 – 2.20	–	–
Previous investigation (Ref. NEW15P-0070F-AA, dated 22/11/2019) – Prior to Site Regrade / Site Filling								
TPP03	–	–	–	0.00 – 0.30	–	0.30 – 1.00	–	1.00 – 1.05*
TPP05	-	0.00 - 0.90	-	-	-	0.90 - 1.90	1.90 - 1.95	-
TPP07	–	–	–	0.00 – 0.20	0.20 – 0.40	0.40 – 0.95	0.95 – 1.10	1.10 – 1.15*
TPP13	–	–	–	0.00 – 0.10	0.10 – 0.20	0.20 – 1.20	1.20 – 1.50	1.50 – 1.60*
Note: * = Refusal or Practical refusal of 2.7 tonne excavator on Highly Weathered to Slightly Weathered Rock.								

5.0 Laboratory Testing

Samples collected during the field investigations were returned to our NATA accredited Newcastle Laboratory for testing which comprised of:

- (17 no.) Shrink / Swell tests; and,
- (2 no.) Atterberg Limits tests.

Proposed shrink/swell testing for some of samples were replaced by Atterberg Limits classification tests due to the friable nature of the site soils.

Results of the laboratory testing are presented in Appendix B, with a summary of the test results presented in Table 3 and Table 4.

The tables also include a summary of laboratory testing information where applicable from the previous Geotechnical Assessment carried out by Qualtest.

TABLE 3 – SUMMARY OF SHRINK/SWELL TESTING RESULTS

Location	Depth (m)	Material Description	I_{ss} (%)
Current Investigation			
BH1001	0.20 – 0.35	(CL) Gravelly Sandy CLAY	0.6
BH1002	0.50 – 0.65	(CH) CLAY	2.3
BH1003	0.35 – 0.50	(CH) CLAY	2.6
BH1004	0.35 – 0.50	(CH) Sandy CLAY	1.6
BH1007	0.50 – 0.64	FILL: (CL) Gravelly Sandy CLAY	0.4
BH1008	1.10 – 1.22	FILL: (CL) Gravelly Sandy CLAY	0.8
BH1009	0.50 – 0.61	FILL: (CL) Gravelly Sandy CLAY	0.5
BH1010	1.00 – 1.15	FILL: (CL) Gravelly Sandy CLAY	0.7
BH1011	0.50 – 0.70	FILL: (CL) Gravelly Sandy CLAY	0.7
BH1012	1.00 – 1.11	FILL: (CL) Gravelly Sandy CLAY	0.4
BH1013	0.40 – 0.57	FILL: (CL) Gravelly Sandy CLAY	0.6
BH1014	0.60 – 0.78	FILL: (CL) Gravelly Sandy CLAY	1.4
BH1014	1.00 – 1.18	FILL: (CL) Gravelly Sandy CLAY	0.6
BH1901	1.10 – 1.25	FILL: (CL) Gravelly Sandy CLAY	0.7
BH1903	0.50 – 0.71	FILL: (CL) Gravelly Sandy CLAY	0.5
BH1904	1.00 – 1.30	FILL: (CL) Gravelly Sandy CLAY	1.2
BH1905	0.50 – 0.72	FILL: (CL) Gravelly Sandy CLAY	0.5

Previous investigation (Ref. NEW15P-0070F-AH, dated 13/05/2024)			
BH1805	0.30 - 0.45	FILL: (CL) Sandy CLAY	1.1
BH1806	0.50 - 0.70	FILL: (CL) Sandy CLAY	0.6
BH1807	0.60 - 0.75	FILL: (CL) Sandy CLAY	1.0
BH1810	0.40 - 0.55	FILL: (CL) Gravelly Sandy CLAY	0.2
BH1810	1.00 - 1.12	FILL: (CL) Gravelly Sandy CLAY	0.3
BH1811	0.60 - 0.75	FILL: (CL) Gravelly Sandy CLAY	0.7
BH1812	0.60 - 0.75	FILL: (CL) Gravelly Sandy CLAY	0.3
Previous investigation (Ref. NEW15P-0070F-AA, dated 22/11/2019)			
TPP03	0.45 - 0.65	(CH) Sandy CLAY	2.9
TPP05	1.00 - 1.20	(CI) Gravelly Sandy CLAY	2.4

TABLE 4 – SUMMARY OF ATTERBERG LIMITS TESTING RESULTS

Location	Depth (m)	Material Description	Liquid Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
Current Investigation					
BH1902	0.50 – 0.66	FILL: (CL) Gravelly Sandy CLAY	45	27	11.0
BH1903	1.00 – 1.16	FILL: (CL) Gravelly Sandy CLAY	36	18	10.0
Previous investigation (Ref. NEW15P-0070F-AH, dated 13/05/2024)					
BH1805	0.80 - 1.00	(CL) Gravelly Clayey SAND	32	12	6.0
BH1807	1.40 - 1.60	(SC) Gravelly Clayey SAND	35	15	7.0
BH1812	1.80 - 1.90	(CH) CLAY	62	39	10.5
Previous investigation (Ref. NEW15P-0070F-AA, dated 22/11/2019)					
TPP07	0.70 - 0.80	(CI) Sandy CLAY	32	14	5.0

6.0 Site Classification to AS2870-2011

Based on the results of the field work and laboratory testing carried out, proposed residential lots located within Billy's Lookout Stages 10 & 19 at Outrigger Drive, Teralba, as shown on attached Figures AI1 & AI2, are classified in their current condition in accordance with AS2870-2011 '*Residential Slabs and Footings*', as shown in Table 5.

TABLE 5 – SITE CLASSIFICATION TO AS2870-2011

Stage No.	Lot Numbers	Site Classification
10	1002, 1003	**M**
	1001, 1004 to 1016	**H1**
19	1901 to 1904	**H1**

A characteristic free surface movement of 20mm to 40mm is estimated for lots classified as **Class 'M'** in their existing condition.

A characteristic free surface movement of 40mm to 60mm is estimated for lots classified as **Class 'H1'** in their existing condition.

The effects of changes to the soil profile by additional cutting and filling and the effects of past and future trees should be considered in selection of the design value for differential movement.

If site re-grading works involving cutting or filling are performed after the date of this assessment, the classification may change and further advice should be sought.

Final site classification will be dependent on a number of factors, including depth of topsoil, depth of fill and residual soil, reactivity of the natural soil and any fill material placed, and the level of supervision carried out. Re-classification of lots should be confirmed by the geotechnical authority at the time of construction following any site re-grade works.

Footings for the proposed development should be designed and constructed in accordance with the requirements of AS2870-2011.

The classification presented above assumes that:

- All footings are founded in controlled fill (if applicable) or in the residual clayey soils or rock below all non-controlled fill, topsoil material and root zones, and fill under slab panels meets the requirements of AS2870-2011, in particular, the root zone must be removed prior to the placement of fill materials beneath slabs.
- The performance expectations set out in Appendix B of AS2870-2011 are acceptable, and that site foundation maintenance is undertaken to avoid extremes of wetting and drying.
- Footings are to be founded outside of or below all zones of influence resulting from existing or future service trenches.
- The constructional and architectural requirements for reactive clay sites set out in AS2870-2011 are followed.

- Adherence to the detailing requirement outlined in Section 5 of AS2870-2011 '*Residential Slabs and Footings*' is essential, in particular Section 5.6, '*Additional requirements for Classes M, H1, H2 and E sites*' including architectural restrictions, plumbing and drainage requirements.
- Site maintenance complies with the provisions of CSIRO Sheet BTF 18, "*Foundation Maintenance and Footing Performance: A Homeowner's Guide*", a copy of which is attached in Appendix C.

All structural elements on all lots should be supported on footings founded beneath all uncontrolled fill, layers of inadequate bearing capacity, soft/loose, wet or other potentially deleterious material.

If any localised areas of uncontrolled fill of depths greater than 0.4m are encountered during construction, footings should be designed in accordance with engineering principles for Class 'P' sites.

7.0 Limitations

This report comprises the results of an investigation carried out for a specific purpose and client as defined in the document. The report should not be used by other parties or for purposes or projects other than those assumed and stated within the report, as it may not contain adequate or appropriate information for applications other than those assumed or advised at the time of its preparation. The contents of the report are for the sole use of the client and no responsibility or liability will be accepted to any third party. The report should not be reproduced either in part or in full, without the express permission of Qualtest.

Geotechnical site investigation is based on data collection, judgment, experience, and opinion. By its nature, it is less exact than other engineering disciplines. The findings presented in the report and used as the basis for recommendations presented herein were obtained using normal, industry accepted geotechnical design practices and standards. To our knowledge, they represent a reasonable interpretation of the general conditions of the site. Under no circumstances, however, can it be considered that these findings represent the actual state of the site at all points.

The recommended depth and properties of any soil, rock, groundwater, or other material referred to in this report is an engineering estimate based on the information available at the time of its writing. The estimate is influenced and limited by the fieldwork method and testing carried out in the site investigation, and other relevant information as has been made available. In cases where information has been provided to Qualtest for the purposes of preparing this report, it has been assumed that the information is accurate and appropriate for such use. No responsibility is accepted by Qualtest for inaccuracies within any data supplied by others.

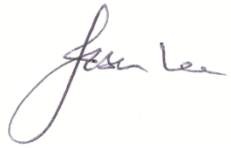
The extent of testing associated with this assessment is limited to discrete test locations. It should be noted that subsurface conditions between and away from the test locations may be different to those observed during the field work and used as the basis of the recommendations contained in this report.

If site conditions encountered during construction differ from those given in this report, further advice should be sought without delay.

This report alone should not be used by contractors as the basis for preparation of tender documents or project estimates. Contractors using this report as a basis for preparation of tender documents should avail themselves of all relevant background information regarding the site before deciding on selection of construction materials and equipment.

If you have any further questions regarding this report, please do not hesitate to contact Ben Edwards, Shannon Kelly, or the undersigned.

For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.



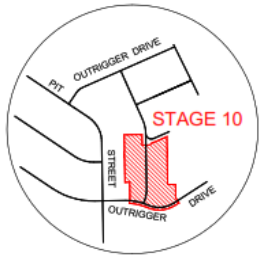
Jason Lee
Principal Geotechnical Engineer

FIGURE AI1:

Site Plan and Approximate Test Locations (Stage 10)

FIGURE AI2:

Site Plan and Approximate Test Locations (Stage 19)



LOCALITY PLAN

(EA) - EASEMENT TO DRAIN WATER 2 WIDE
(EB) - RESTRICTION ON THE USE OF LAND 0.7 WIDE
(EC) - EASEMENT FOR SIGNAGE 3 WIDE

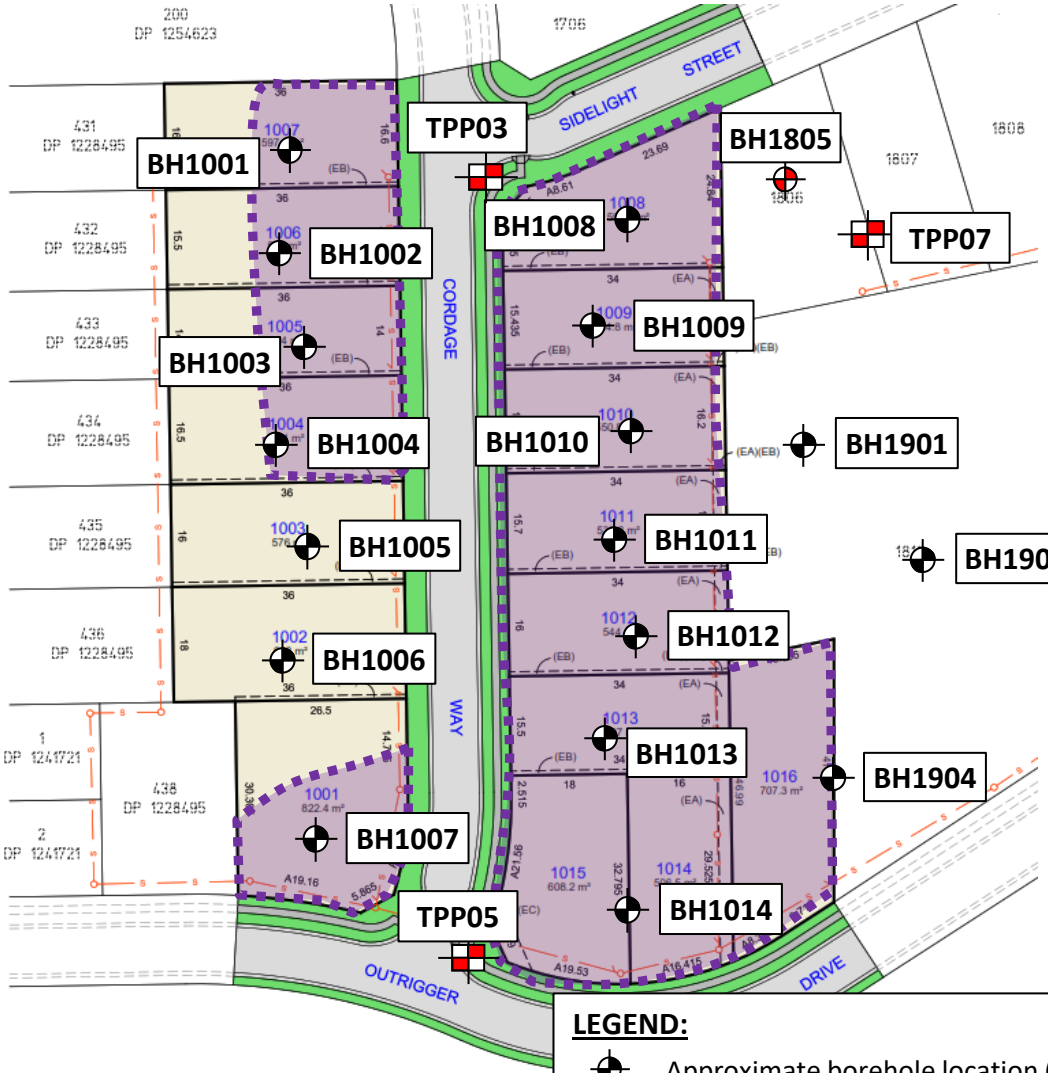
(GENERAL RESTRICTIONS ON THE USE OF LAND EFFECTS ALL LOTS. ALL AREAS, DIMENSIONS & EASEMENTS ARE SUBJECT TO FINAL SURVEY)

PROPOSED SEWER LINE

SALE PLAN FOR BILLY'S LOOKOUT STAGE 10

McCLOYGROUP

BILLY'S LOOKOUT EST. 2015 LAKE MACQUARIE



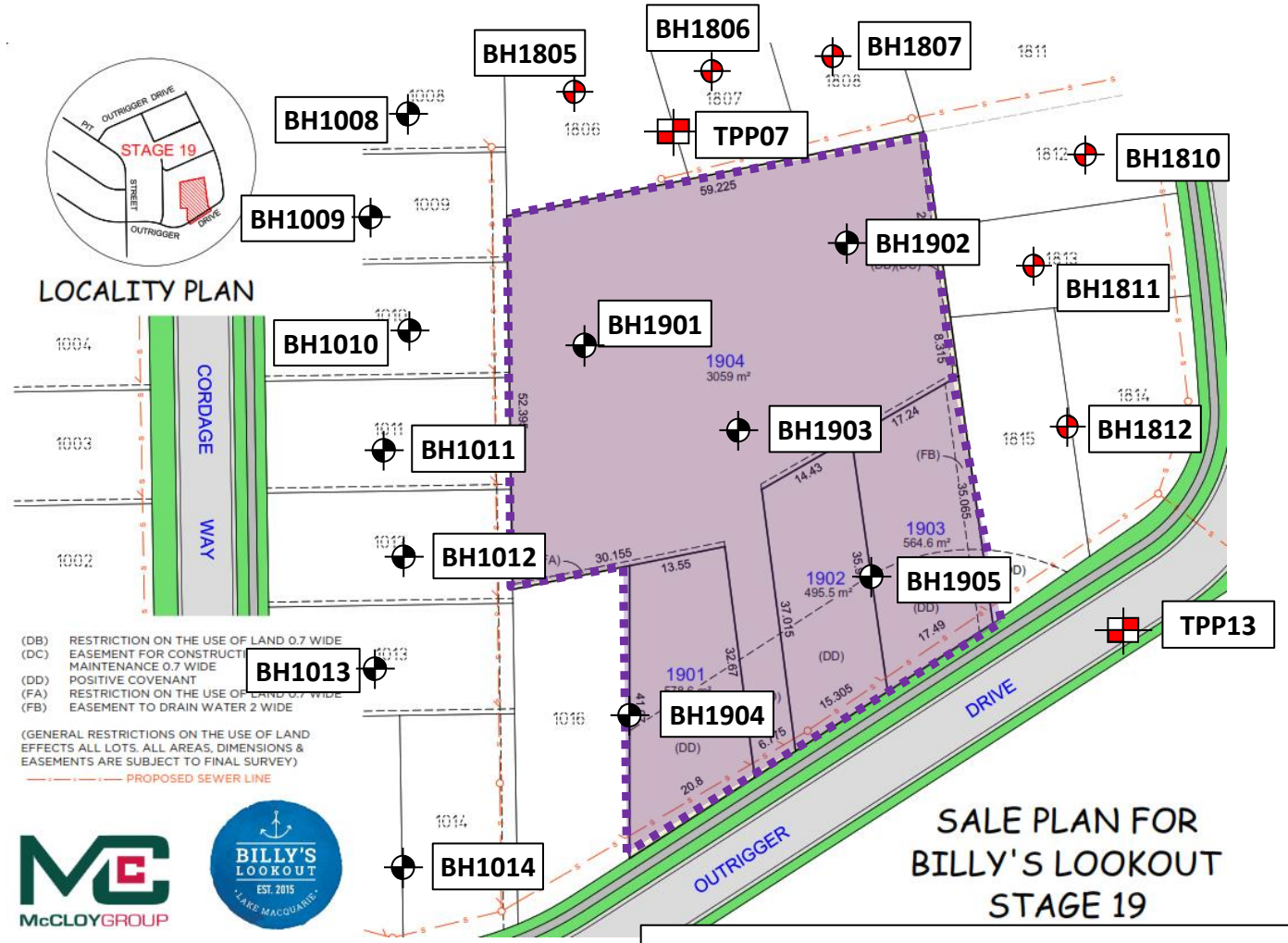
LEGEND:

- Approximate borehole location (current investigation).
- Approximate borehole location (Qualtest, previous investigations).
- Approximate test pit location. (Qualtest, previous investigations).
- Approximate extent of Lot regrade filling works within Stage 10.

Based on Sale Plan for Billy's Lookout Stage 18 provided by client.

Qualtest LABORATORY (NSW) PTY LTD

Client:	MCCLOY GROUP	Drawing No:	FIGURE AI1
Project:	BILLYS LOOKOUT - STAGE 10	Project No:	NEW15P-0070F
Location:	OUTRIGGER DRIVE, TERALBA	Scale:	AS SHOWN
Title:	SITE PLAN AND APPROXIMATE TEST LOCATIONS	Date:	28/08/2024



LEGEND:

- Approximate borehole location (current investigation).
- Approximate borehole location (Qualtest, previous investigations).
- Approximate test pit location. (Qualtest, previous investigations).
- Approximate extent of Lot regrade filling works within Stage 19.

Based on Sale Plan for Billy's Lookout Stage 19 provided by client.

Client:	MCCLOY GROUP	Drawing No:	FIGURE AI2
Project:	BILLYS LOOKOUT - STAGE 19	Project No:	NEW15P-0070F
Location:	OUTRIGGER DRIVE, TERALBA	Scale:	AS SHOWN
Title:	SITE PLAN AND APPROXIMATE TEST LOCATIONS	Date:	28/08/2024

Qualtest LABORATORY (NSW) PTY LTD

APPENDIX A:

Results of Field Investigations

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1001
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered	0.20m				CL	TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				TOPSOIL
		U50 0.35m				CL	0.20m Gravelly Sandy CLAY - low to medium plasticity, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel, fine to coarse grained sand.	M > w_P	VSt	HP HP	350 450	RESIDUAL SOIL
				0.5		SC	0.35m Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel.	D - M	VD			EXTREMELY WEATHERED ROCK
							0.60m 0.61m Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated low to medium rock strength	D				HIGHLY WEATHERED ROCK
				1.0			Hole Terminated at 0.61 m Refusal on weathered rock					
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1002
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered	0.50m U50 0.65m		0.5		CL	TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	$M < w_P$				TOPSOIL
							0.30m CLAY - medium to high plasticity, pale brown, with pale orange to orange and pale grey to white, with fine to coarse grained rounded gravel, trace fine to coarse grained sand, trace cobbles.					RESIDUAL SOIL
						CH		$M > w_P$	VSt	HP	210	
				1.0		SC	0.90m Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel.	D - M	VD			EXTREMELY WEATHERED ROCK
							1.00m 1.01m Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated low to medium rock strength	D				HIGHLY WEATHERED ROCK
							Hole Terminated at 1.01 m Refusal on weathered rock					
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1003

CLIENT: MCCLOY GROUP

PAGE: 1 OF 1

PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19

JOB NO: NEW15P-0070F

LOCATION: BILLY'S LOOKOUT, TERALBA

LOGGED BY: BE

DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**

BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered	0.35m U50 0.50m		0.5 1.0 1.5 2.0		CL CH SC	TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. 0.30m CLAY - medium to high plasticity, pale brown, with pale orange to orange and pale grey to white, with fine to coarse grained rounded gravel. Increasing in sand and gravel content. 0.90m Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel. 1.60m 1.61m Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated low to medium rock strength Hole Terminated at 1.61 m Refusal on weathered rock	M < w_P M > w_P M < w_P D - M D	VSt H / Fb VD	HP HP	350 350	TOPSOIL RESIDUAL SOIL EXTREMELY WEATHERED ROCK HIGHLY WEATHERED ROCK

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1004

CLIENT: MCCLOY GROUP
PAGE: 1 OF 1
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
JOB NO: NEW15P-0070F
LOCATION: BILLY'S LOOKOUT, TERALBA
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered					CL	TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				TOPSOIL
							0.20m					
		0.35m				CH	Sandy CLAY - medium to high plasticity, brown to orange-brown, fine to coarse grained sand, with fine to medium grained sub-rounded gravel.			HP	350	RESIDUAL SOIL
		U50 0.50m		0.5								
							0.60m					
						CL	Gravelly Sandy CLAY - low to medium plasticity, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel, fine to coarse grained sand.	M > w_P	VSt	HP	350	
				1.0								
										HP	320	
				1.5			1.50m					
						SC	Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel, trace cobbles.	D - M	VD			EXTREMELY WEATHERED ROCK
							1.60m 1.61m	D				HIGHLY WEATHERED ROCK
							Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated low to medium rock strength					
				2.0			Hole Terminated at 1.61 m Refusal on weathered rock					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1005

CLIENT: MCCLOY GROUP
PAGE: 1 OF 1
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
JOB NO: NEW15P-0070F
LOCATION: BILLY'S LOOKOUT, TERALBA
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered					CL	TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				TOPSOIL
							0.20m					
						CL	Gravelly Sandy CLAY - low to medium plasticity, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel, fine to coarse grained sand.	M > w_P	VSt	HP	300	RESIDUAL SOIL
				0.5			0.50m					
						SC	Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel, trace cobbles.	D - M	VD			EXTREMELY WEATHERED ROCK
							0.60m 0.61m	D				HIGHLY WEATHERED ROCK
							Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated low to medium rock strength					
							Hole Terminated at 0.61 m Refusal on weathered rock					
				1.0								
				1.5								
				2.0								

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1006

CLIENT: MCCLOY GROUP

PAGE: 1 OF 1

PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19

JOB NO: NEW15P-0070F

LOCATION: BILLY'S LOOKOUT, TERALBA

LOGGED BY: BE

DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**

BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered					CL	0.10m TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				TOPSOIL
						SC	Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel, trace cobbles.	D - M	VD			EXTREMELY WEATHERED ROCK
							0.30m 0.31m Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated low to medium rock strength	D				HIGHLY WEATHERED ROCK
				0.5			Hole Terminated at 0.31 m Refusal on weathered rock					
				1.0								
				1.5								
				2.0								

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1007
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered					CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				FILL-TOPSOIL
							FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel.			HP	120	FILL-CONTROLLED
						CL		M > w_P	St	HP	100	
		0.50m U50 0.64m		0.5						HP	100	
							0.70m Clayey SAND - fine to medium grained, pale orange and pale grey, fines of low plasticity.					RESIDUAL SOIL
						SC		M	D - VD			
				1.0			1.00m Extremely weathered Pebbly Sandstone with soil properties: breaks down into Gravelly Clayey SAND - fine to coarse grained, pale brown, with pale orange to orange and pale grey to white, fine to medium grained rounded to sub-rounded gravel.					EXTREMELY WEATHERED ROCK
						SC			VD			
							1.20m Pebbly SANDSTONE - fine to coarse grained, pale brown, trace pale grey, fine to medium grained rounded to sub-rounded gravel in rock matrix, estimated very low rock strength, with extremely weathered pockets / bands.					HIGHLY WEATHERED ROCK
				1.5				D - M				
				2.0			2.00m Hole Terminated at 2.00 m Slow progress					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1008
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	1.10m U50 1.22m		0.5 1.0 1.5 2.0		CL CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 2.00m	M < w_P M > w_P	VSt St	HP HP HP HP HP HP	360 200 180 140 130 180 180	FILL-TOPSOIL FILL-CONTROLLED
							Hole Terminated at 2.00 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1009
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	0.50m U50 0.61m		0.5 1.0 1.5 2.0		CL CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	St	HP HP HP HP HP HP HP HP	120 180 190 150 180 150 130 140 180	FILL-TOPSOIL FILL-CONTROLLED

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1010
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	1.00m U50 1.15m		0.5 1.0 1.5 2.0		CL CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	VSt St	HP HP HP HP HP HP HP	250 180 170 150 150 160 150 130	FILL-TOPSOIL FILL-CONTROLLED

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1011
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	0.50m U50 0.70m		0.5 1.0 1.5 2.0		CL CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	St	HP HP HP HP HP	200 150 180 180 180	FILL-TOPSOIL FILL-CONTROLLED

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1012
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	1.00m U50 1.11m		0.5 1.0 1.5 2.0		CL CL CI	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 1.80m Sandy CLAY - medium plasticity, orange to red-brown, with grey, fine grained sand. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	F - St St St - VSt St VSt	HP HP HP HP HP HP HP	80 - 110 150 150 - 210 180 - 210 110 110 300	FILL-TOPSOIL FILL-CONTROLLED RESIDUAL SOIL

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1013
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
AD/T	Not Encountered	0.40m U50 0.57m		0.5 1.0 1.5 2.0		CL CL CI	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 1.60m Sandy CLAY - medium plasticity, orange to red-brown, with grey, fine to coarse (mostly fine) grained sand, with fine to medium grained sub-rounded gravel. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	St - VSt VSt	HP HP HP HP HP	200 150 - 200 180 - 220 150 - 220 250 300	FILL-TOPSOIL FILL-CONTROLLED RESIDUAL SOIL

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1014
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	0.60m U50 0.78m 1.00m U50 1.18m		0.5 1.0 1.5 2.0		CL CL CI	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 1.80m Sandy CLAY - medium plasticity, orange to red-brown, with grey, fine grained sand. 2.30m Hole Terminated at 2.30 m	M < w_P M > w_P	St VSt	HP HP HP HP HP HP	100 120 150 250 250 350	FILL-TOPSOIL FILL-CONTROLLED RESIDUAL SOIL

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1901
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	1.10m U50 1.25m		0.5 1.0 1.5 2.0		CL CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. With CLAY pockets of medium to high plasticity. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	VSt St St - VSt	HP HP HP HP HP HP HP	300 350 350 300 210 180 200	FILL-TOPSOIL FILL-CONTROLLED

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1902
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
				0.0		CL	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				FILL-TOPSOIL
							0.10m FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel.					FILL-CONTROLLED
										HP	180	
		0.50m		0.5								
		U50 0.66m								HP	150	
	Not Encountered			1.0		CL		M > w_P	St			
										HP	110	
				1.5								
										HP	110	
										HP	120	
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

BOREHOLE NO: BH1903

CLIENT: MCCLOY GROUP
PAGE: 1 OF 1
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
JOB NO: NEW15P-0070F
LOCATION: BILLY'S LOOKOUT, TERALBA
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered					CL	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel.	M < w_P				FILL-TOPSOIL
							0.10m					FILL-CONTROLLED
							FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel.			HP	300	
										HP	350	
									VSt	HP	390	
		0.50m		0.5								
		U50										
		0.71m								HP	200 - 350	
		1.00m		1.0				M > w_P				
		U50				CL			St - VSt	HP	180 - 350	
		1.16m										
				1.5			With CLAY pockets of medium to high plasticity.			HP	150	
									St			
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1904
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	1.00m U50 1.30m		0.5 1.0 1.5 2.0		CL CL CH	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 1.50m Sandy CLAY - medium to high plasticity, pale grey and orange to red-brown, fine grained sand. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	St	HP HP HP HP HP HP HP HP	180 150 130 150 120 110 180 180	FILL-TOPSOIL FILL-CONTROLLED RESIDUAL SOIL

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP
PROJECT: RESIDENTIAL SUBDIVISION - STAGES 10 & 19
LOCATION: BILLY'S LOOKOUT, TERALBA

BOREHOLE NO: BH1905
PAGE: 1 OF 1
JOB NO: NEW15P-0070F
LOGGED BY: BE
DATE: 28/8/24

DRILL TYPE: 2.7 TONNE EXCAVATOR WITH AUGER ATTACHMENT **SURFACE RL:**
BOREHOLE DIAMETER: 300 mm **DATUM:**

Drilling and Sampling					Material description and profile information					Field Test		Structure and additional observations
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	
AD/T	Not Encountered	0.50m U50 0.72m		0.5 1.0 1.5 2.0		CL CL CH	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, dark grey and dark grey-brown, fine to coarse grained sand, with fine to medium grained rounded to sub-rounded gravel. FILL: Gravelly Sandy CLAY - low to medium plasticity, grey to grey-brown, trace pale orange, fine to coarse grained sand, fine to coarse grained rounded to sub-rounded gravel. 1.80m Sandy CLAY - medium to high plasticity, pale grey and orange to red-brown, fine grained sand. 2.00m Hole Terminated at 2.00 m	M < w_P M > w_P	VSt St VSt	HP HP HP HP HP HP HP HP HP	350 300 280 250 180 180 150 180 210 310	FILL-TOPSOIL FILL-CONTROLLED RESIDUAL SOIL

LEGEND:

Water
- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes
- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

APPENDIX B:

Results of Laboratory Testing

Material Test Report

Qualtest LABORATORY (NSW) PTY LTD
Newcastle Laboratory
2 Murray Dwyer Circuit Mayfield West NSW 2304
Phone: (02) 4968 4468
Email: brentcullen@qualtest.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA WORLD RECOGNISED ACCREDITATION

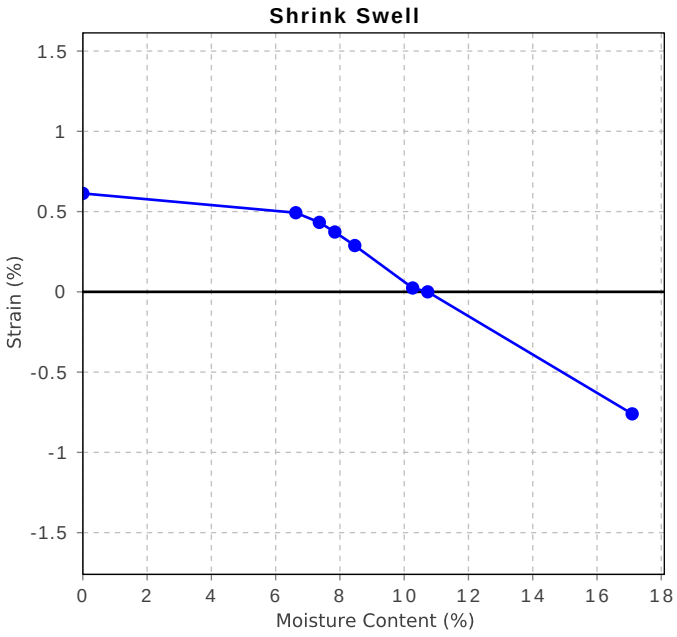
Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036A
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 10/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1001 - (0.20 - 0.35m)**
Material:	Gravelly Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.6**
Visual Description	Gravelly Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.6**
Estimated % by volume of significant inert inclusions	10
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	10.7

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	400
Initial Moisture Content (%)	10.5
Final Moisture Content (%)	17.1
Swell (%)	**0.8**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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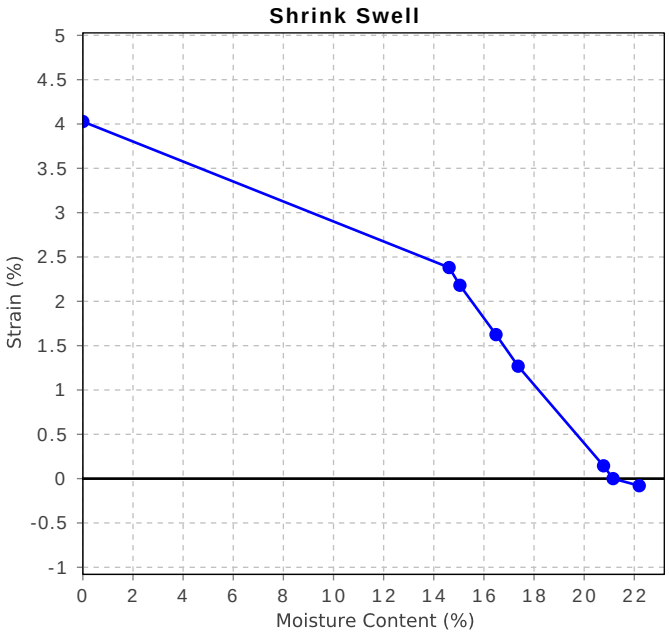
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036B
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 10/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1002 - (0.50 - 0.65m)**
Material:	Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.3**
Visual Description	Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**4.0**
Estimated % by volume of significant inert inclusions	5
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	21.2

Swell Test	
Initial Pocket Penetrometer (kPa)	250
Final Pocket Penetrometer (kPa)	240
Initial Moisture Content (%)	21.2
Final Moisture Content (%)	22.2
Swell (%)	**0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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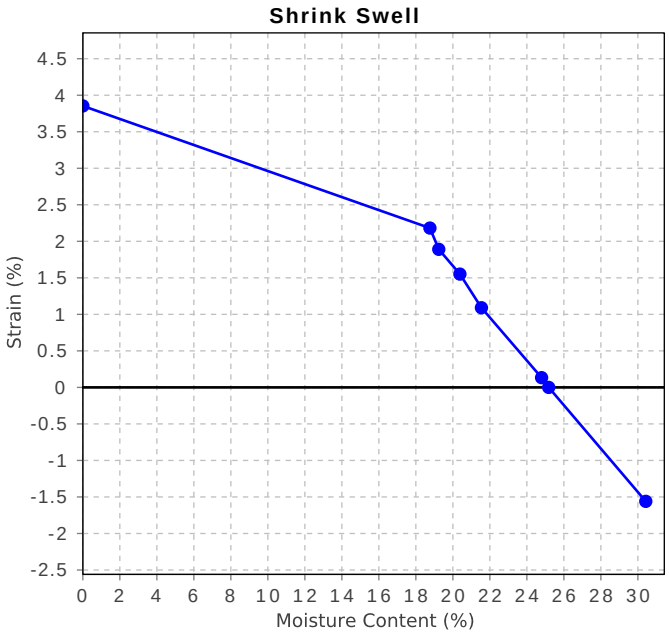
Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036C
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 10/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1003 - (0.35 - 0.50m)**
Material:	Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**2.6**
Visual Description	Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**3.9**
Estimated % by volume of significant inert inclusions	5
Cracking	Uncracked
Crumbling	No
Moisture Content (%)	25.2

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	450
Initial Moisture Content (%)	25.9
Final Moisture Content (%)	30.4
Swell (%)	**1.6**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036D
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 10/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1004 - (0.35 - 0.50m)**
Material:	Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**1.6**
Visual Description	Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**2.7**
Estimated % by volume of significant inert inclusions	5
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	24.8

Swell Test	
Initial Pocket Penetrometer (kPa)	600
Final Pocket Penetrometer (kPa)	400
Initial Moisture Content (%)	25.0
Final Moisture Content (%)	28.6
Swell (%)	**0.4**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	

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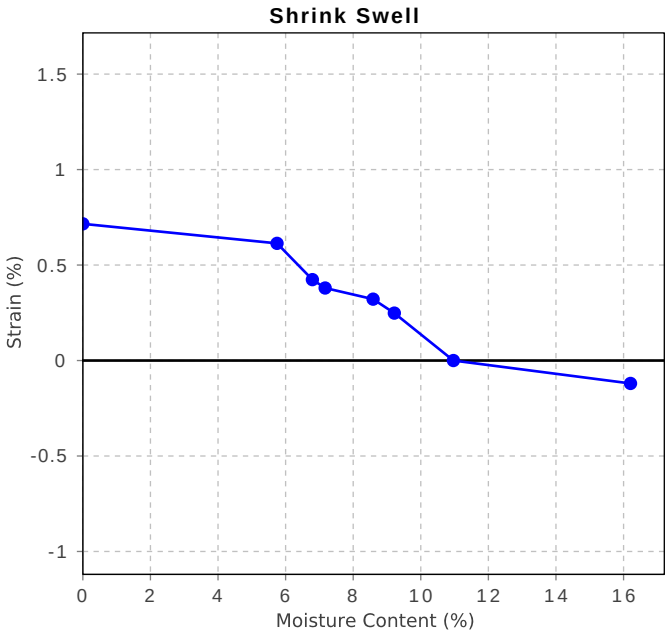
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036E
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 10/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1007 - (0.50 - 0.64m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.4**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.7**
Estimated % by volume of significant inert inclusions	15
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	11.0

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	400
Initial Moisture Content (%)	11.0
Final Moisture Content (%)	16.2
Swell (%)	**0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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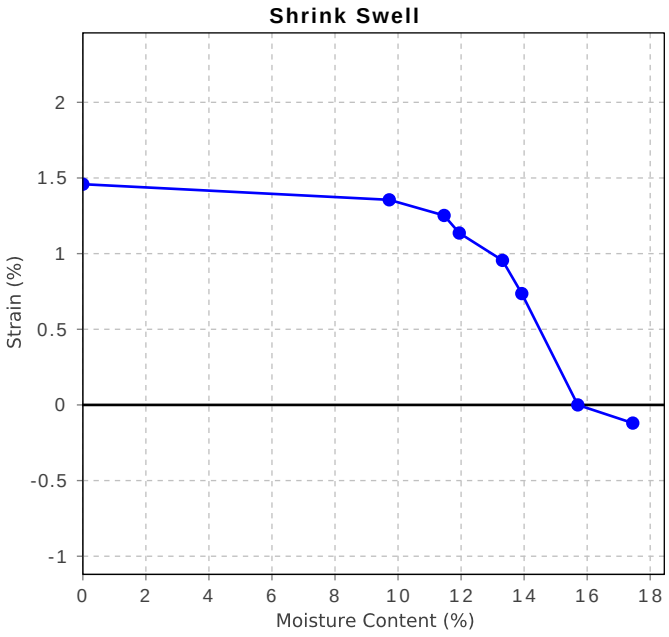
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036F
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 10/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1008 - (1.10 - 1.22m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.8**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.5**
Estimated % by volume of significant inert inclusions	10
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	15.7

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	550
Initial Moisture Content (%)	15.6
Final Moisture Content (%)	17.4
Swell (%)	**0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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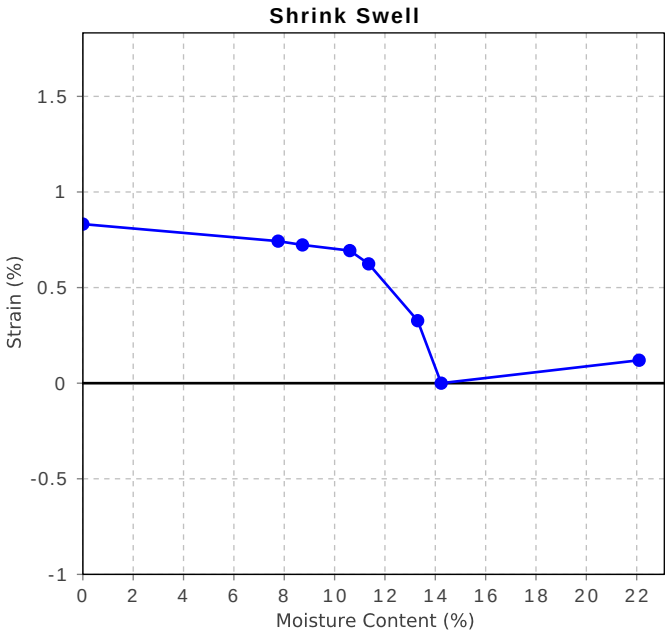
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036G
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department *The results apply to the sample as received*
Sample Location:	**BH1009 - (0.50 - 0.61m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.5**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.8**
Estimated % by volume of significant inert inclusions	10
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	14.2

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	100
Initial Moisture Content (%)	14.2
Final Moisture Content (%)	22.1
Swell (%)	**-0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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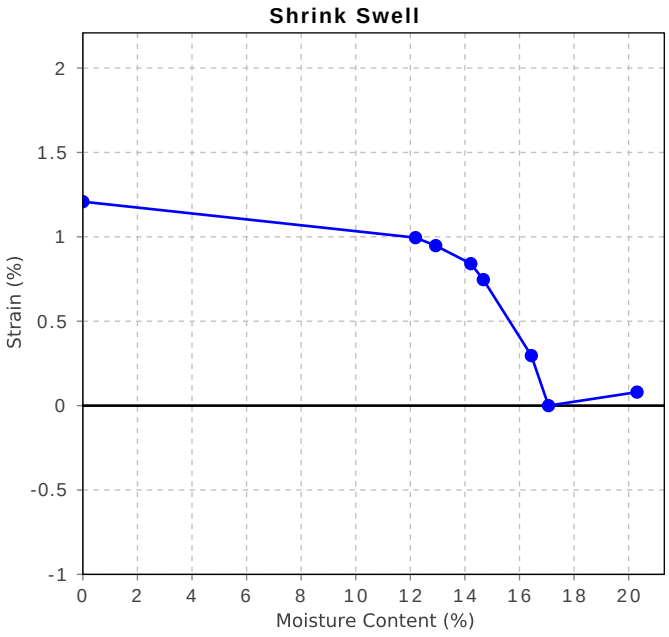
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036H
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department *The results apply to the sample as received*
Sample Location:	**BH1010 - (1.00 - 1.15m)**
Material:	Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.7**
Visual Description	Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.2**
Estimated % by volume of significant inert inclusions	5
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	17.1

Swell Test	
Initial Pocket Penetrometer (kPa)	300
Final Pocket Penetrometer (kPa)	200
Initial Moisture Content (%)	16.9
Final Moisture Content (%)	20.3
Swell (%)	**-0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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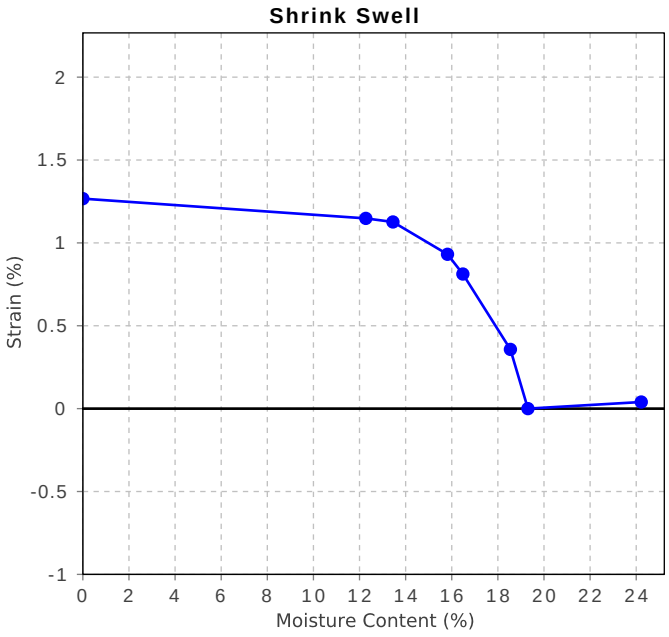
Client:	McCloy Development Management Pty Ltd Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036I
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department *The results apply to the sample as received*
Sample Location:	**BH1011 - (0.50 - 0.70m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.7**
Visual Description	Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.3**
Estimated % by volume of significant inert inclusions	3
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	19.3

Swell Test	
Initial Pocket Penetrometer (kPa)	200
Final Pocket Penetrometer (kPa)	250
Initial Moisture Content (%)	19.4
Final Moisture Content (%)	24.2
Swell (%)	**-0.0**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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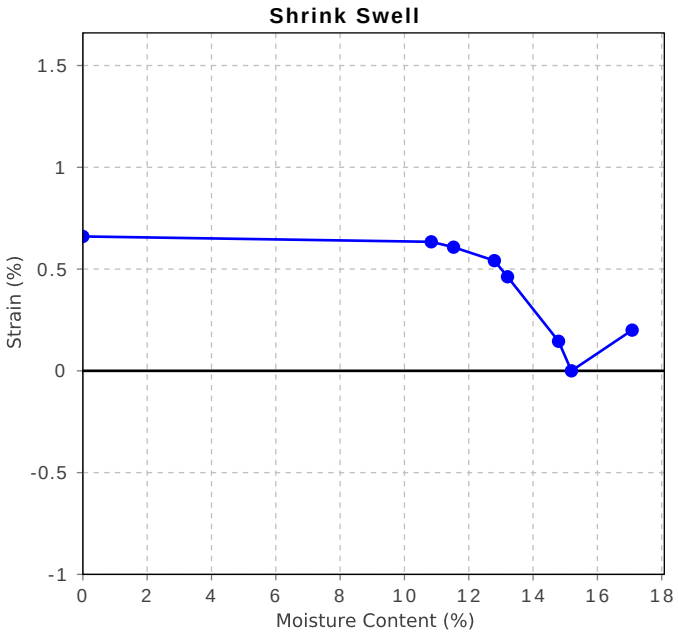
Client:	McCloy Development Management Pty Ltd Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036J
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department *The results apply to the sample as received*
Sample Location:	**BH1012 - (1.00 - 1.11m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.4**
Visual Description	Sandy Gravelly Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.7**
Estimated % by volume of significant inert inclusions	3
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	15.2

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	500
Initial Moisture Content (%)	15.1
Final Moisture Content (%)	17.1
Swell (%)	**-0.2**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

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NATA WORLD RECOGNISED ACCREDITATION

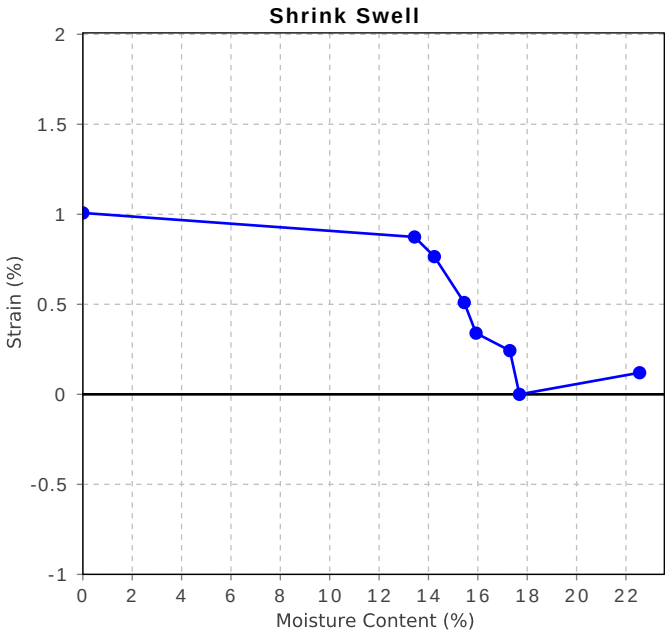
Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036K
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1013 - (0.40 - 0.57m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.6**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.0**
Estimated % by volume of significant inert inclusions	5
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	17.7

Swell Test	
Initial Pocket Penetrometer (kPa)	280
Final Pocket Penetrometer (kPa)	300
Initial Moisture Content (%)	17.6
Final Moisture Content (%)	22.6
Swell (%)	**-0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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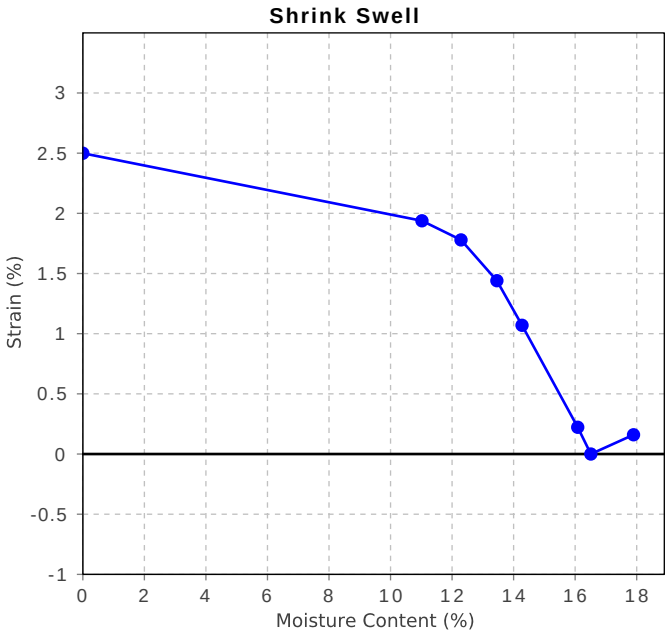
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036L
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1014 - (0.60 - 0.78m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**1.4**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**2.5**
Estimated % by volume of significant inert inclusions	10
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	16.5

Swell Test	
Initial Pocket Penetrometer (kPa)	250
Final Pocket Penetrometer (kPa)	240
Initial Moisture Content (%)	16.3
Final Moisture Content (%)	17.9
Swell (%)	**-0.2**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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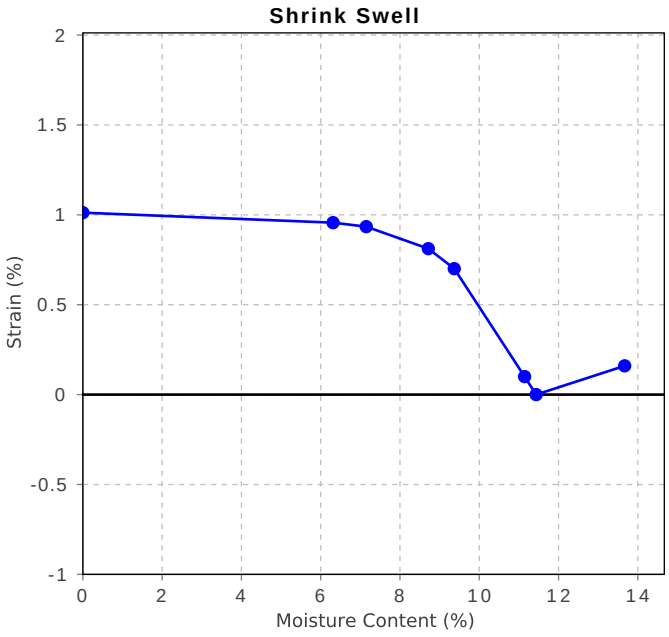
Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036M
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1014 - (1.00 - 1.18m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.6**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.0**
Estimated % by volume of significant inert inclusions	10
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	11.4

Swell Test	
Initial Pocket Penetrometer (kPa)	350
Final Pocket Penetrometer (kPa)	400
Initial Moisture Content (%)	11.1
Final Moisture Content (%)	13.7
Swell (%)	**-0.2**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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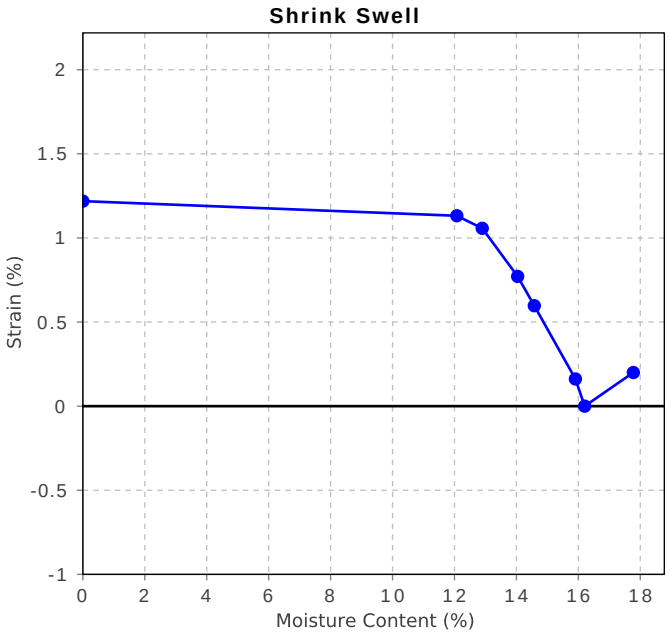
Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036N
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1901 - (1.10 - 1.25m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.7**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**1.2**
Estimated % by volume of significant inert inclusions	5
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	16.2

Swell Test	
Initial Pocket Penetrometer (kPa)	600
Final Pocket Penetrometer (kPa)	230
Initial Moisture Content (%)	15.8
Final Moisture Content (%)	17.8
Swell (%)	**-0.2**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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Report Number: **NEW15P-0070F-3**
Issue Number: 1
Date Issued: 18/09/2024
Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number: NEW15P-0070F
Project Name: Billy's Lookout - Stage 18
Project Location: Teralba, NSW
Work Request: 6036
Sample Number: NEW24S-6036O
Date Sampled: 28/08/2024
Dates Tested: 03/09/2024 - 16/09/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH1902 - (0.50 - 0.66m)**
Material: Gravelly Sandy Clay
Material Source: On-Site Insitu

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	45		
Plastic Limit (%)	18		
Plasticity Index (%)	**27**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	**11.0**		
Cracking Crumbling Curling	None		

Material Test Report

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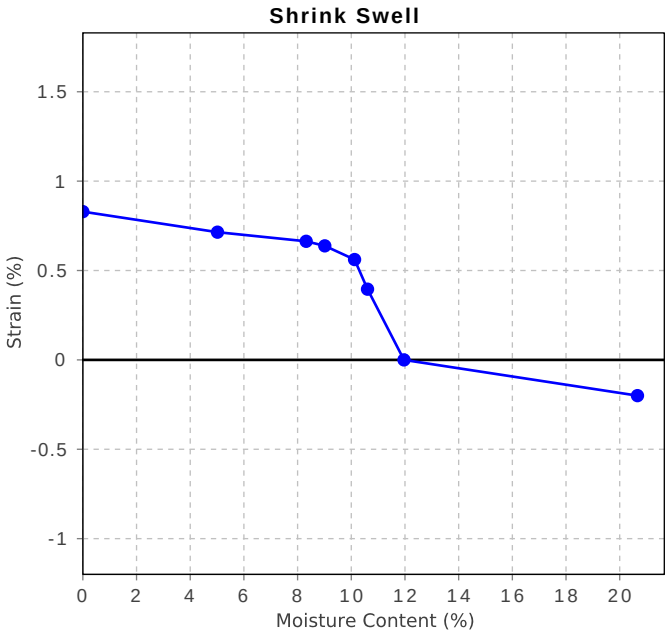
Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd
	Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036P
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH1903 - (0.50 - 0.71m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.5**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.8**
Estimated % by volume of significant inert inclusions	10
Cracking	Highly Cracked
Crumbling	No
Moisture Content (%)	12.0

Swell Test	
Initial Pocket Penetrometer (kPa)	>600
Final Pocket Penetrometer (kPa)	140
Initial Moisture Content (%)	12.8
Final Moisture Content (%)	20.7
Swell (%)	**0.2**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number: **NEW15P-0070F-3**
Issue Number: 1
Date Issued: 18/09/2024
Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number: NEW15P-0070F
Project Name: Billy's Lookout - Stage 18
Project Location: Teralba, NSW
Work Request: 6036
Sample Number: NEW24S-6036Q
Date Sampled: 28/08/2024
Dates Tested: 03/09/2024 - 16/09/2024
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH1903 - (1.00 - 1.16m)**
Material: Gravelly Sandy Clay
Material Source: On-Site Insitu

Atterberg Limit (AS1289 3.1.1 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	36		
Plastic Limit (%)	18		
Plasticity Index (%)	**18**		

Linear Shrinkage (AS1289 3.4.1)		Min	Max
Moisture Condition Determined By	AS 1289.3.1.1		
Linear Shrinkage (%)	**10.0**		
Cracking Crumbling Curling	None		

Material Test Report

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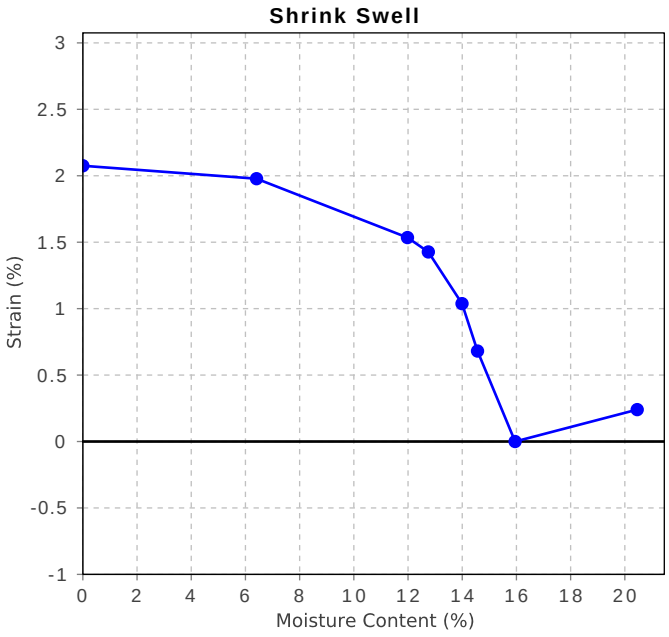
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Report Number:	**NEW15P-0070F-3**
Issue Number:	1
Date Issued:	18/09/2024
Client:	McCloy Development Management Pty Ltd Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036R
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department *The results apply to the sample as received*
Sample Location:	**BH1904 - (1.00 - 1.30m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**1.2**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**2.1**
Estimated % by volume of significant inert inclusions	8
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	16.0

Swell Test	
Initial Pocket Penetrometer (kPa)	200
Final Pocket Penetrometer (kPa)	180
Initial Moisture Content (%)	16.6
Final Moisture Content (%)	20.5
Swell (%)	**-0.2**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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Project Number:	NEW15P-0070F
Project Name:	Billy's Lookout - Stage 18
Project Location:	Teralba, NSW
Work Request:	6036
Sample Number:	NEW24S-6036S
Date Sampled:	28/08/2024
Dates Tested:	03/09/2024 - 11/09/2024
Sampling Method:	Sampled by Engineering Department *The results apply to the sample as received*
Sample Location:	**BH1905 - (0.50 - 0.72m)**
Material:	Gravelly Sandy Clay
Material Source:	On-Site Insitu

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.5**
Visual Description	Gravelly Sandy Clay
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.9**
Estimated % by volume of significant inert inclusions	5
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	19.1

Swell Test	
Initial Pocket Penetrometer (kPa)	300
Final Pocket Penetrometer (kPa)	400
Initial Moisture Content (%)	19.3
Final Moisture Content (%)	21.7
Swell (%)	**0.0**
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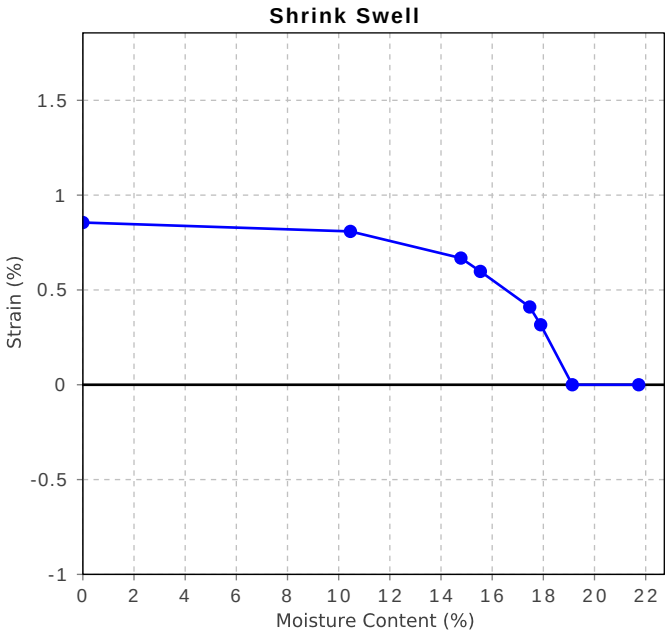

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Project Name: Billy's Lookout - Stage 18
Project Location: Teralba, NSW
Work Request: 6036
Dates Tested: 03/09/2024 - 11/09/2024

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Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	NEW24S-6036A	NEW24S-6036B	NEW24S-6036C	NEW24S-6036D	NEW24S-6036E
Date Sampled	28/08/2024	28/08/2024	28/08/2024	28/08/2024	28/08/2024
Date Tested	10/09/2024	10/09/2024	10/09/2024	10/09/2024	10/09/2024
Material Source	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu
Sample Location	BH1001 - (0.20 - 0.35m)	BH1002 - (0.50 - 0.65m)	BH1003 - (0.35 - 0.50m)	BH1004 - (0.35 - 0.50m)	BH1007 - (0.50 - 0.64m)
Inert Material Estimate (%)	10	5	5	5	15
Pocket Penetrometer before (kPa)	>600	250	>600	600	>600
Pocket Penetrometer after (kPa)	400	240	450	400	400
Shrinkage Moisture Content (%)	10.7	21.2	25.2	24.8	11.0
Shrinkage (%)	**0.6**	**4.0**	**3.9**	**2.7**	**0.7**
Swell Moisture Content Before (%)	10.5	21.2	25.9	25.0	11.0
Swell Moisture Content After (%)	17.1	22.2	30.4	28.6	16.2
Swell (%)	**0.8**	**0.1**	**1.6**	**0.4**	**0.1**
Shrink Swell Index Iss (%)	**0.6**	**2.3**	**2.6**	**1.6**	**0.4**
Visual Description	Gravelly Clay	Clay	Clay	Sandy Clay	Gravelly Sandy Clay
Cracking	SC	SC	SC	SC	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.
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Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number: NEW15P-0070F
Project Name: Billy's Lookout - Stage 18
Project Location: Teralba, NSW
Work Request: 6036
Dates Tested: 03/09/2024 - 11/09/2024

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Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	NEW24S-6036F	NEW24S-6036G	NEW24S-6036H	NEW24S-6036I	NEW24S-6036J
Date Sampled	28/08/2024	28/08/2024	28/08/2024	28/08/2024	28/08/2024
Date Tested	10/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
Material Source	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu
Sample Location	BH1008 - (1.10 - 1.22m)	BH1009 - (0.50 - 0.61m)	BH1010 - (1.00 - 1.15m)	BH1011 - (0.50 - 0.70m)	BH1012 - (1.00 - 1.11m)
Inert Material Estimate (%)	10	10	5	3	3
Pocket Penetrometer before (kPa)	>600	>600	300	200	>600
Pocket Penetrometer after (kPa)	550	100	200	250	500
Shrinkage Moisture Content (%)	15.7	14.2	17.1	19.3	15.2
Shrinkage (%)	**1.5**	**0.8**	**1.2**	**1.3**	**0.7**
Swell Moisture Content Before (%)	15.6	14.2	16.9	19.4	15.1
Swell Moisture Content After (%)	17.4	22.1	20.3	24.2	17.1
Swell (%)	**0.1**	**-0.1**	**-0.1**	**-0.0**	**-0.2**
Shrink Swell Index Iss (%)	**0.8**	**0.5**	**0.7**	**0.7**	**0.4**
Visual Description	Gravelly Sandy Clay	Gravelly Sandy Clay	Sandy Clay	Sandy Clay	Sandy Gravelly Clay
Cracking	SC	SC	SC	SC	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.
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Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number: NEW15P-0070F
Project Name: Billy's Lookout - Stage 18
Project Location: Teralba, NSW
Work Request: 6036
Dates Tested: 03/09/2024 - 11/09/2024

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NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	NEW24S-6036K	NEW24S-6036L	NEW24S-6036M	NEW24S-6036N	NEW24S-6036P
Date Sampled	28/08/2024	28/08/2024	28/08/2024	28/08/2024	28/08/2024
Date Tested	11/09/2024	11/09/2024	11/09/2024	11/09/2024	11/09/2024
Material Source	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu
Sample Location	BH1013 - (0.40 - 0.57m)	BH1014 - (0.60 - 0.78m)	BH1014 - (1.00 - 1.18m)	BH1901 - (1.10 - 1.25m)	BH1903 - (0.50 - 0.71m)
Inert Material Estimate (%)	5	10	10	5	10
Pocket Penetrometer before (kPa)	280	250	350	600	>600
Pocket Penetrometer after (kPa)	300	240	400	230	140
Shrinkage Moisture Content (%)	17.7	16.5	11.4	16.2	12.0
Shrinkage (%)	**1.0**	**2.5**	**1.0**	**1.2**	**0.8**
Swell Moisture Content Before (%)	17.6	16.3	11.1	15.8	12.8
Swell Moisture Content After (%)	22.6	17.9	13.7	17.8	20.7
Swell (%)	**-0.1**	**-0.2**	**-0.2**	**-0.2**	**0.2**
Shrink Swell Index Iss (%)	**0.6**	**1.4**	**0.6**	**0.7**	**0.5**
Visual Description	Gravelly Sandy Clay	Gravelly Sandy Clay	Gravelly Sandy Clay	Gravelly Sandy Clay	Gravelly Sandy Clay
Cracking	SC	SC	SC	SC	HC
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: **NEW15P-0070F-3**
Issue Number: 1
Date Issued: 18/09/2024
Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street, Newcastle NSW 2300
Project Number: NEW15P-0070F
Project Name: Billy's Lookout - Stage 18
Project Location: Teralba, NSW
Work Request: 6036
Dates Tested: 03/09/2024 - 11/09/2024

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NATA WORLD RECOGNISED ACCREDITATION

Accredited for compliance with ISO/IEC 17025 - Testing

Approved Signatory: Brent Cullen
Engineering Geologist
NATA Accredited Laboratory Number: 18686

Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	NEW24S-6036R	NEW24S-6036S			
Date Sampled	28/08/2024	28/08/2024			
Date Tested	11/09/2024	11/09/2024			
Material Source	On-Site Insitu	On-Site Insitu			
Sample Location	BH1904 - (1.00 - 1.30m)	BH1905 - (0.50 - 0.72m)			
Inert Material Estimate (%)	8	5			
Pocket Penetrometer before (kPa)	200	300			
Pocket Penetrometer after (kPa)	180	400			
Shrinkage Moisture Content (%)	16.0	19.1			
Shrinkage (%)	**2.1**	**0.9**			
Swell Moisture Content Before (%)	16.6	19.3			
Swell Moisture Content After (%)	20.5	21.7			
Swell (%)	**-0.2**	**0.0**			
Shrink Swell Index Iss (%)	**1.2**	**0.5**			
Visual Description	Gravelly Sandy Clay	Gravelly Sandy Clay			
Cracking	SC	SC			
Crumbling	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.

APPENDIX C:

CSIRO Sheet BTF 18

Foundation Maintenance and Footing Performance: A Homeowner's Guide

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18 replaces Information Sheet 10/91

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 homeowner 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.

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

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. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

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 are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

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). 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.

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 with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

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.
- 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. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation

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

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

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

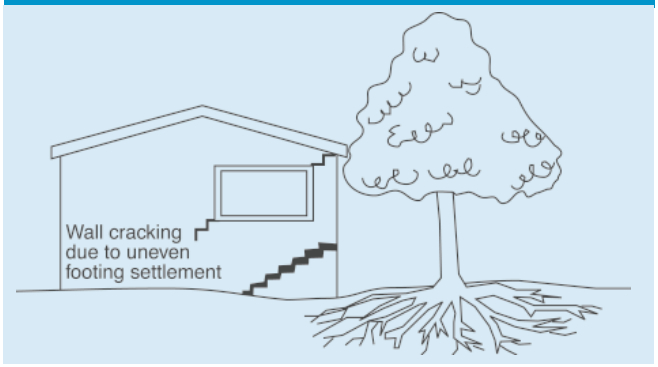
Seasonal swelling/shrinkage in clay

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

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

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

Trees can cause shrinkage and damage



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 cause 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. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 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/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 is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

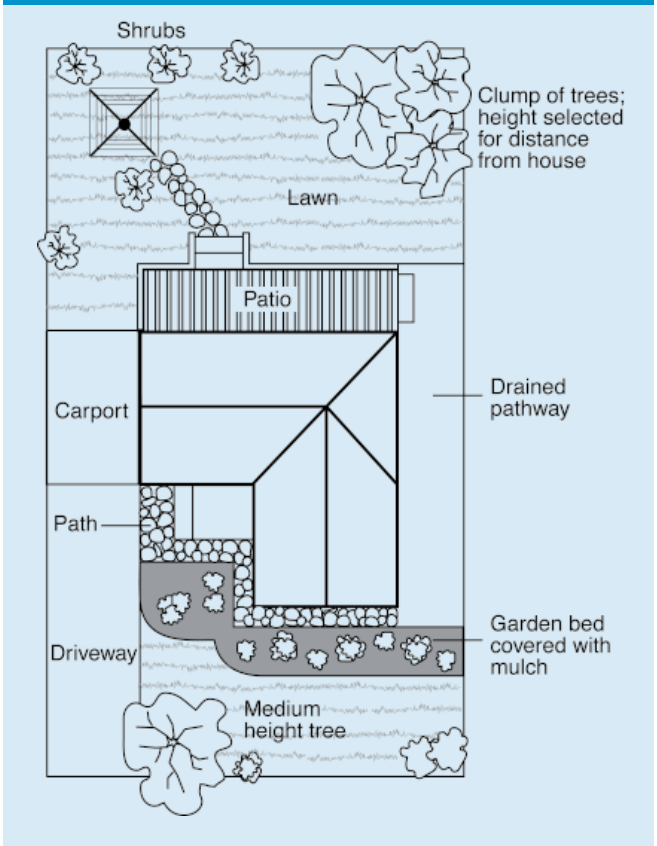
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
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
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 depend on number of cracks	4

Gardens for a reactive site



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 from it (see BTF 19).

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.

Warning: Although this Building Technology File 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.
- 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. For information on plant roots and drains, see Building Technology File 17.

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 homeowner 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.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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