Residential Subdivision The Gardens - Stage 6 Site Classification

Nos. 688 to 730 Medowie Road, Medowie

NEW19P-0143I-AA.Rev2 8 March 2024



GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

8 March 2024

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

Attention: Mr Bryson Cox

Dear Sir,

RE: RESIDENTIAL SUBDIVISION – THE GARDENS – STAGE 6 Nos. 688 TO 730 MEDOWIE ROAD, MEDOWIE SITE CLASSIFICATION (LOTS 601 TO 625)

Please find enclosed our geotechnical report for Stage 6 of "The Gardens" residential subdivision, located at Nos. 688 to 730 Medowie Road, Medowie.

The report provides site classification with respect to reactive soils, in accordance with the requirements of AS2870-2011 '*Residential Slabs and Footings*', for Stage 6 (Lots 601 to 625), following completion of site regrade works.

This report supersedes the previous report (ref. NEW19P-0143I-AA.Rev1, dated 23 August 2023), following completion of additional site regrade works on Lots 622 to 625.

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

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

the Les

Jason Lee Principal Geotechnical Engineer

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1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this geotechnical report on behalf of McCloy Development Management Pty Ltd (McCloy), for Stage 6 of 'The Gardens' residential subdivision, located at Nos. 688 to 730 Medowie Road, Medowie.

Based on the brief and sales plan provided by McCloy, Stage 6 is understood to include 25 residential allotments (Lots 601 to 625).

The scope of work for the geotechnical investigation included providing site classification with respect to reactive soils, in accordance with the requirements of AS2870-2011 '*Residential Slabs and Footings*', for Stage 6, which has included additional site regrade works undertaken on Lots 622 to 625.

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:

- Geotechnical Assessment, 'Proposed Residential Subdivision, Medowie Gardens, Medowie Road, Medowie, (Report Reference: NEW19P-0143-AA, dated 27 November 2019).
- Site Classification, 'Residential Subdivision, The Gardens Stage 1', (Report Reference: NEW19P-00143-AC, dated 1 July 2020);
- Site Classification, 'Residential Subdivision, The Gardens Stage 8', (Report Reference: NEW19P-00143D-AA, dated 26 October 2021);
- Site Classification, 'Residential Subdivision, The Gardens Stage 4', (Report Reference: NEW19P-00143G-AA, dated 9 September 2022);
- Site Classification, 'Residential Subdivision, The Gardens Stage 5', (Report Reference: NEW19P-00143H-AA, dated 14 February 2023);

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 14 July 2023 and 1 February 2024, comprising of:

- Excavation of fifteen (15 no.) boreholes (BH601 to BH615) using a 2.7 tonne excavator with a 300mm diameter auger, to depths of 2.00m;
- Excavation of one (1 no.) additional borehole (BH612A) using a 2.7 tonne excavator with a 300mm diameter auger, to a depth of 1.10m;
 - During site visit on 1 February 2024, fill identified near to BH612 from previous investigation was over-excavated. This area of the site was then subsequently reinstated under Level 1 supervision, refer Section 4.1 below.
- Undisturbed samples (U50 tubes) 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.

Approximate borehole locations are shown on the attached Figure AA1.

Engineering logs of the boreholes are presented in Appendix A.

4.0 Site Description

4.1 Site Regrade Works

Following an initial site visit, stripping assessment and recommendations performed on 6 December 2023 (Qualtest ref. NEW23P-0205-SR02, dated 08/12/23), site re-grading works within Stage 6 were conducted between 7 December 2023 and 11 December 2023, along with a single day of works on 29 February 2024.

Re-grade works included filling within all or portions of Lots 622 to 625. Filling within these lots consisted of the placement of remaining required fill to bring lots to finished design levels.

Refer to attached Figure AA1 for the approximate extent of re-grade filling works for this stage of the development.

Filling Method Performed

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 performed using site stockpiled material won from excavations cut from around the site. The fill material could generally be described as mixtures of Residual (CI-CH) Sandy CLAY, medium to high plasticity, red / brown / grey in colour, with fine to coarse grained sand.

The approximate depth of fill placed generally ranged in the order of 0.1m to about 0.8m, with the deepest areas being within the rear (western boundaries) of Lot 624 and 625.

A small isolated area on the boundary of Lots 622 and 623 was over-excavated to remove loose fill and deleterious material associated with an old tree stump. This loose and unsuitable material was removed to expose the suitable Residual profile, prior to backfilling to design finish levels. The maximum depth of fill within this isolated area was approximately 1.8m.

The approximate range of fill placed was in the order of:

- Lot 622 0.0m to 0.2m;
- Lot 623 0.3m to 0.6m;
- Lot 624 0.3m to 0.6m;
- Lot 625 0.3m to 0.8m;
- Isolated area located on boundary of Lot 622 and 623 0.3m to 1.8m.

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.

Geotechnicians from Qualtest were present at the site during the placement of fill and performed compaction testing at various locations during the course of the project. All tests equalled or exceeded the required density ratio of 95% Standard Compaction (AS1289 5.7.1-2006), and were generally within ±2% of Optimum Moisture Content (OMC).

As the geotechnical testing authority engaged for the project, we state that the filling performed between 7 December 2023 and 11 December 2023, and also on 29 February 2024 for the re-grade areas within Stage 6 (as shown on Figure AA1), 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".

4.2 Surface Conditions

The site is located east of Medowie Road, Medowie. The site comprises Stage 6 of the Medowie Gardens residential subdivision at Nos. 688 to 730 Medowie Rd, Medowie, off Macadamia Circuit. The site comprises 25 proposed residential allotments and associated road pavements. The site of the proposed development is shown on Figure AA1.

Stage 6 is bounded to the north by existing residential allotments, to the west by existing Stages 1, 4 and 5, to the south by existing Stage 8, and to the east by undeveloped bushland.

On the initial day of the investigation the site was vacant and undeveloped. The site was judged to be reasonably well drained by way of surface run-off towards inter-allotment drainage systems of existing Stage 8 to the south-west. At the time of final site visit (1/02/2024), construction of road pavements was being completed.

Photographs of the site taken on the day of the site investigations are shown below.



Photograph 1: From near southern boundary of Lot 603, facing west.



Photograph 2: From near southern boundary of Lot 603, facing north.



Photograph 3: From near south-eastern corner of Lot 607, facing west.



Photograph 4: From near south-eastern corner of Lot 607, facing north.



Photograph 5: From near eastern boundary of Lot 611, facing southeast.



Photograph 7: From near shared boundary of Lots 613, 615, & 616, facing northeast.



Photograph 6: From near eastern boundary of Lot 611, facing southwest.



Photograph 8: From near shared boundary of Lots 613, 615, & 616, facing southeast.



Photograph 9: From near western boundary of Lot 620, facing east.



Photograph 10: From near western boundary of Lot 620, facing south.



Photograph 11: From near eastern boundary of Lot 623, facing south.



Photograph 12: From near eastern boundary of Lot 623, facing west.

4.3 Subsurface Conditions

Reference to the 1:100,000 Newcastle Coalfield Regional Geology Sheet 9231 indicates the majority of the site to be underlain by the Permian Aged Tomago Coal Measures, which are characterised by Siltstone, Sandstone, Coal, Tuff and Claystone 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.

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES
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Unit	Soil Type	Description
1A	FILL – TOPSOIL	Sandy CLAY – low plasticity, dark grey-brown, fine to medium grained sand, root affected.
		Silty Sandy GRAVEL – fine to medium grained, sub-angular to sub-rounded, grey-brown, fine to coarse grained (mostly fine to medium grained) sand, fines of low plasticity.
1B	UNCONTROLLED FILL	CLAY – medium plasticity, pale brown with some dark grey- brown, with some fine grained sand, (old stump backfill?).
		NOTE: Uncontrolled Filling identified during initial site works was removed and replaced under Level 1 supervision on 29 February 2024.
1C	CONTROLLED FILL	Sandy CLAY – medium plasticity, pale brown, fine to medium grained (mostly fine grained) sand.
2	TOPSOIL	Sandy CLAY – low plasticity, dark grey-brown to grey-brown, fine to medium grained sand, root affected. Clayey SAND – fine to medium grained, grey-brown, fines of
		low plasticity, root affected.
3	COLLUVIUM / SLOPEWASH	* Not Encountered during current investigation.
		CLAY – medium plasticity, pale brown to pale orange-brown, with some red-brown and pale brown to pale grey at depth, with some fine grained sand.
4	RESIDUAL SOIL	CLAY – medium to high plasticity, red-brown, pale grey, pale brown and pale orange-brown, with some fine grained sand, trace fine grained angular gravel in places.
5	EXTREMELY WEATHERED (XW) ROCK with soil properties	* Not Encountered during current investigation.

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 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT BOREHOLE LOCATIONS	S
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BH601 - BH602 -	-		Depth in metres (m nvestigation 0.00 – 0.25)		
				I		
		-	0.00 - 0.25			
BH602 -	-		0.00 - 0.23	-	0.25 – 2.00	-
		-	0.00 - 0.30	-	0.30 - 2.00	-
вн603 -	-	-	0.00 - 0.30	-	0.30 - 2.00	-
ВН604 -	-	-	0.00 – 0.30	-	0.30 - 2.00	-
вн605 -	-	-	0.00 – 0.25	-	0.25 – 2.00	-
вн606 -	-	-	0.00 - 0.30	-	0.30 – 2.00	-
вн607 -	0.00 - 0.10	-	0.10 - 0.40	-	0.40 - 2.00	-
вн608 -	-	-	0.00 - 0.25	-	0.25 – 2.00	-
вн609 -	-	-	0.00 – 0.25	-	0.25 – 2.00	-
BH610 -	-	-	0.00 – 0.30	-	0.30 – 2.00	-
BH611 -	-	-	0.00 – 0.25	-	0.25 – 2.00	-
BH612* 0.00 - 0.25	0.25 – 1.20*	-	-	-	1.20 - 2.00	-
Note: * = Uncontro	lled fill initially encoun	tered in BH612 sub	sequently remove	d and replaced as	part of Level 1 site r	egrade works.
BH612A -	-	-	0.00 - 0.30	-	0.30 – 1.10	-

Location	Unit 1A FILL – Topsoil	Unit 1B Uncontrolled Fill	Unit 1C Controlled Fill	Unit 2 Topsoil	Unit 3 Colluvium / Slopewash	Unit 4 Residual Soil	Unit 5 XW Rock				
	Depth in metres (m)										
BH613	-	-	-	0.00 – 0.25	-	0.25 – 2.00	-				
BH614	0.00 - 0.10	-	0.10 - 0.80	-	-	0.80 – 2.00	-				
BH615	0.00 - 0.10	-	0.10 - 0.90	-	-	0.90 - 2.00	-				
		Previous Inves	tigation (NEW19P-0	143H-AA, dated 14	4 February 2023)	<u> </u>					
BH501	-	0.00 - 0.30 -			-	0.30 – 2.00	-				
BH506	0.00 - 0.25	-	0.25 – 0.80	-	-	0.80 – 2.00	-				
BH507	0.00 - 0.25	-	0.25 – 0.90	-	-	0.90 - 2.00	-				
BH508	0.00 - 0.05	-	0.05 – 0.40	-	-	0.40 - 2.00	-				
BH509	-	-	-	0.00 – 0.30	-	0.30 – 2.00	-				
BH510	-	-	-	0.00 – 0.30	-	0.30 – 2.00	-				
BH511	-	-	-	0.00 - 0.40	-	0.40 - 2.00	-				
		Previous Invest	igation (NEW19P-01	143G-AA, dated 9	September 2022)						
BH411	-	-	-	0.00 – 0.25	_	0.25 – 2.00	-				
		Previous Inves	tigation (NEW19P-0	143D-AA, dated 2	6 October 2021)						
BH807	-	0.00 - 0.30 0.30 - 0.80		0.30 – 0.80	0.80 – 2.00	-					
BH808	-	-	-	0.00 – 0.30	0.30 – 0.90	0.90 - 2.00	-				
BH809	-	-	-	0.00 – 0.30	0.30 – 0.90	0.90 - 2.00	-				
BH810	-	-	-	0.00 - 0.25	0.25 – 1.10	1.10 - 2.00	-				

Unit 5 XW Rock	Unit 4 Residual Soil	Unit 3 Colluvium / Slopewash	Unit 2 Topsoil	Unit 1C Controlled Fill	Unit 1B Uncontrolled Fill	Unit 1A FILL – Topsoil	Location
)	Depth in metres (m	I			
		1 July 2020)	9P-0143-AC, dated	vestigation (NEW1	Previous In	L	
1.50 - 2.00	0.80 - 1.50	0.40 - 0.80	0.00 - 0.40	_	-	-	TP108
1.40 - 2.00	0.80 - 1.40	0.30 - 0.80	0.00 - 0.30	_	-	-	TP109
·		November 2019)	143-AA, dated 27	tigation (NEW19P-0	Previous Invest		
-	0.30 - 1.50^	-	0.00 - 0.30	-	-	-	TP07
-	0.30 - 1.80^	_	0.00 - 0.30	-	-	-	TP08
-	0.50 - 1.95	0.25 - 0.50	0.00 - 0.25	-	-	-	TP18
-	0.20 - 2.00	_	0.00 - 0.20	-			TP19
-	0.50 - 1.90^	0.25 - 0.50	0.00 - 0.25	-	-	-	TP20
25	0.50 - 1.90^ ng previous inve	ne excavator durir	0.00 - 0.25 al refusal of 2.7 ton	s / close to practic	- - o very slow progress previous investigatic		

regrade works being completed. BH612 specifically has been subject to regrade works to depths in the order of up to 1.8m.

5.0 Laboratory Testing

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

• (13 no.) Shrink / Swell tests.

Results of the laboratory testing are included in Appendix B, with a summary of the Shrink/Swell test results presented in Table 3 below.

Results of Shrink / Swell test results from previous investigations are included in Table 3. Results of Atterberg Limits test results from previous investigations are included in Table 4.

Location	Depth (m)	Material Description	Iss (%)							
Current Investigation										
BH601	1.00 - 1.20	(CH) CLAY	1.7							
BH602	0.50 - 0.65	(CI) CLAY	1.8							
BH603	1.00 - 1.20	(CH) CLAY	1.3							
BH604	0.40 - 0.65	(CI) CLAY	1.8							
BH605	0.50 - 0.70	(CH) CLAY	1.3							
BH606	0.90 - 1.10	(CH) CLAY	1.8							
BH607	0.50 - 0.70	(CI) CLAY	1.5							
BH608	0.90 - 1.10	0.90 - 1.10 (CH) CLAY								
BH609	0.50 - 0.70	(CH) CLAY	1.6							
BH610	1.00 - 1.15	(CH) CLAY								
BH611	0.30 - 0.45	(CI) CLAY	0.7							
BH612A	0.70 - 0.90	(CI) CLAY	1.9							
BH613	0.50 - 0.65	(CI) CLAY	1.7							
BH614	0.10 - 0.25	FILL: (CI) Sandy CLAY	0.9							
BH614	0.90 – 1.10	(CH) CLAY	1.7							
BH615	0.10 - 0.25	FILL: (CI) Sandy CLAY	1.2							
BH615	1.10 – 1.30	(CH) CLAY	2.4							
P	revious Investigat	tion (NEW19P-0143H-AA, dated 14 Februa	ry 2023)							
BH501	0.60 - 0.80	(CI) Sandy CLAY	1.1							
BH506	0.30 - 0.45	FILL: (CH) CLAY	1.3							

TABLE 3 – SUMMARY OF SHRINK / SWELL TESTING RESULTS

Location	Depth (m)	Material Description	Iss (%)								
BH506	1.10 - 1.30	(CH) Sandy CLAY	2.7								
BH507	0.30 - 0.50	FILL: (CH) Sandy CLAY	1.0								
BH507	1.00 - 1.15	(CH) Sandy CLAY	1.4								
BH508	0.50 - 0.65	(CH) Sandy CLAY	2.1								
BH509	0.60 - 0.75	(CH) Sandy CLAY	1.7								
BH510	0.50 - 0.65	(CH) CLAY	1.9								
BH511	0.80 - 1.00	(CH) CLAY	1.6								
Pi	Previous Investigation (NEW19P-0143G-AA, dated 9 September 2022)										
BH411	0.80 - 1.00	(CI) Sandy CLAY	1.6								
F	Previous Investiga	tion (NEW19P-0143D-AA, dated 26 October 2	021)								
BH807	1.00 - 1.20	(CH) CLAY	2.0								
BH808	0.40 - 0.60	(CH) CLAY	1.9								
BH809	1.00 - 1.20	(CH) CLAY	1.5								
	Previous Inves	tigation (NEW19P-0143-AC, dated 1 July 2020)								
TP108	0.50 - 0.75	(CI) Sandy CLAY	1.7								
TP109	0.80 - 1.00	(CH) CLAY	2.0								
P	revious Investiga	tion (NEW19P-0143-AA, dated 27 November 2	019)								
TP07	0.85 - 1.20	(CI) Gravelly CLAY	0.9								
TP08	0.50 - 0.65	(CH) CLAY	2.0								
TP18	0.90 - 1.15	(CH) CLAY	0.9								
TP20	0.30 - 0.50	(CL) CLAY	0.8								

TABLE 4 – SUMMARY OF ATTERBERG LIMITS TESTING RESULTS

Location	Sample Depth (m)	Material Description	Liquid Limit (%)	Plastic limit (%)	Plasticity Index (%)	Linear Shrinkage (%)							
	Previous Investigation (NEW19P-0143D-AA, dated 26 October 2021)												
BH810	0.50 - 0.70	(CH) CLAY	57	29	28	14.5							

6.0 Site Classification to AS2870-2011

Based on the results of the field work, site regrade and laboratory testing, residential lots located within Stage 6 of The Gardens residential subdivision located at Nos. 688 to 730 Medowie Road, Medowie, as shown on Figure AA1, are classified in their current condition in accordance with AS2870-2011 '*Residential Slabs and Footings*', as shown in Table 4.

Stage	Lot Numbers	Site Classification				
6	601 to 621 (current condition – natural soil profile)	м				
	622 to 625 (following Level 1 site regrade work)	H1				
Note:	If any areas of topsoil and/or uncontrolled fill of dep are encountered during construction, footings shoul accordance with engineering principles for Class 'P	d be designed in				

TABLE 4 – SITE CLASSIFICATION TO AS2870-2011

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

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

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 the type of fill and 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 natural 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*, *H*1, *H*2 and *E* sites' including architectural restrictions, plumbing and drainage requirements; and,
- 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 regardless of their site classification should be supported on footings founded beneath all uncontrolled fill, layers of inadequate bearing capacity, soft/loose, or other potentially deleterious material.

If any 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 Bunting, Shannon Kelly, or the undersigned.

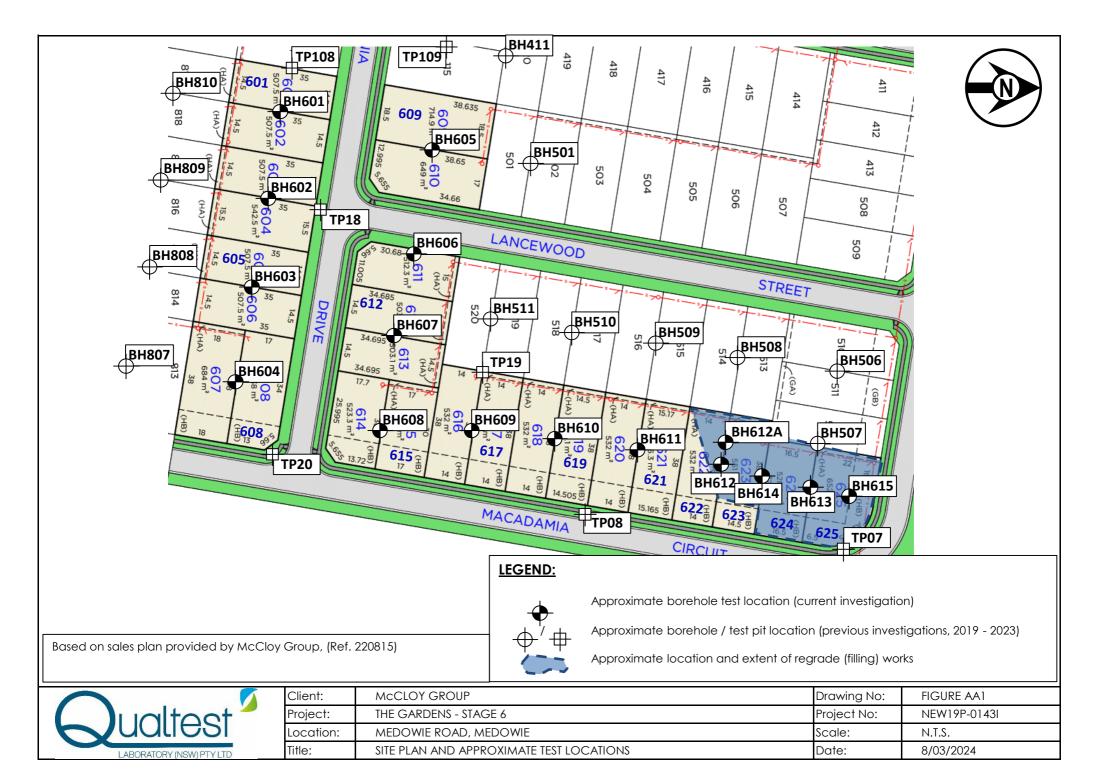
For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

ma les

Jason Lee Principal Geotechnical Engineer

FIGURE AA1:

Site Plan and Approximate Test Locations



APPENDIX A:

Engineering Logs of Boreholes



ENGINEERING LOG - BOREHOLE CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

BOREHOLE NO:

PAGE:

DATE:

JOB NO:

LOGGED BY:

BH601

1 OF 1

NEW19P-0143I

BB 14/7/23

		YPE: Ole diam			EXCA 300 m		OR WITH AUGER SURI	FACE RL: JM:					
	Drill	ing and Sam	pling				Material description and profile information				Field	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, dau grey-brown, fine grained sand, root affecte	rk d.	M < w _P				TOPSOIL
AD/T	Not Encountered	<u>1.00m</u>		- 0. <u>5</u> - - - 1. <u>0</u>		CI	Logm CLAY - medium plasticity, pale brown to particity or ange-brown, with some fine grained sand becoming pale brown to pale orange-brow some red-brown. 1.00m CLAY - medium to high plasticity, red-brow brown, with some fine grained sand.	d. n with	_		ΗΡ	380 300	RESIDUAL SOIL
	Ž	U50 1.20m		- - 1.5_ - - -		сн	Becoming red-brown with some pale grey a brown.	and pale	M > W _P	VSt	HP HP HP	380 280 300	
				2.0			2.00m Hole Terminated at 2.00 m						
<u>Wat</u> ▼	Wat (Dat ∙ Wat I Wat ata Cha ata Cha tra	er Level er and time sh er Inflow er Outflow anges radational or ansitional stra afinitive or dis rata change	iown) ta	I Notes, Sa U₅₀ CBR E ASS B Field Test PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid S (Plast Bulk S Bulk S Photo Dynar	i Diame ample i onmenta s jar, se Sulfate \$ ic bag, Sample ionisationis pen	Is ter tube sample or CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled) on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	S S F F St S VSt N H F	L ency Very Soft Soft Firm Stiff Very Stiff Hard Friable V L D	Ve Lc D M	22 25 50 10 20 20 >4 ery Lo pose	5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet Wp Plastic Limit WL Liquid Limit Density Index <15%



DRILL TYPE:

ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP

BOREHOLE NO:

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14/7/23

NEW19P-0143I

2.7 TON IETER:	NE EXCAVATOR WITH AUGER 300 mm	SURFACE RL: DATUM:	
			DATE:
nonyi ii cib	LOCATION: MEDOWIE ROAD, MEDOV	VIE NSW	LOGGED BY:
	PROJECT: MEDOWIE GARDENS - ST	AGE 6	JOB NO:

		YPE: OLE DIAM			EXCA 300 m		R WITH AUGER SURI DATU	FACE RL: JM:					
	Dril	ing and Sam	pling				Material description and profile information				Field	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	ty/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, dan grey-brown, fine grained sand, root affecte		M < w _P				TOPSOIL
		0.50m		- 0.5			0.30m CLAY - medium plasticity, pale brown to pa orange-brown, with some fine grained sand	ale d.	M ~ W	VSt	HP	350	RESIDUAL SOIL
		U50 0.65m		-			With some red-brown.			Н	HP	>600	
	Not Encountered			- 1. <u>0</u> - - 1. <u>5</u> - - - -		CI	Becoming red-brown with some pale brown grey.	n and pale	M < wp	H / Fb	ΗP	>600	
, ;				2.0			2.00m						
							Hole Terminated at 2.00 m						
	Wat (Da Wat Wat Wat	er Level te and time sh er Inflow er Outflow anges radational or	own)	Notes, Sa U ₅₀ CBR E ASS B Field Test	50mm Bulk s Enviro (Glass Acid S (Plast Bulk S	Diamet ample fo onmenta s jar, sea Sulfate S ic bag, a Sample	er tube sample or CBR testing I sample aled and chilled on site) oil Sample ir expelled, chilled)	S S F F St S VSt V H F	Very Soft Soft Stiff Very Stiff lard Triable V	V	25 25 50 10 20 >4 ery Lo	5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit Density Index <15%
	tra D	ansitional strat efinitive or dis rata change		PID DCP(x-y) HP	Dynar	nic pene	n detector reading (ppm) trometer test (test depth interval shown) meter test (UCS kPa)		L MC D VD	D M	oose ediun ense ery De	n Dense ense	Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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		TYPE: OLE DIAM			EXCA 300 m		R WITH AUGER SURF	FACE RL: JM:					
	Dril	ling and San	npling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, dar grey-brown, fine grained sand, root affected		M < Wp				TOPSOIL
				- 0. <u>5</u>			CLAY - medium plasticity, pale brown to pa orange-brown, with some fine grained sand With some red-brown.		M ~ W	VSt	HP	310	RESIDUAL SOIL
				-		CI	Becoming red-brown and pale brown.						
AD/T	Not Encountered	<u>1.00m</u>		- 1. <u>0</u>			1.00m CLAY - medium to high plasticity, red-brow some pale grey and trace pale brown, with		_				
OT LIB 1.1GLB LOG NON-CORED BOREHOLE TEST PIT 00- TEMPLATE LOGS SHEET.GPJ < <drawingfile>> 08/03/2024 09:19 10.02.00.04 Datget Lab and in Stu Tool</drawingfile>	Z	U50 1.20m		- - 1. <u>5</u>		СН	grained sand.		M < W _P	H / Fb	HP	>600	
.FJ < <drawingfile>> 08/03/2024 09:19</drawingfile>							2.00m			Н	HP	580	
STPIT 00- TEMPLAIE LUGS SHEELL				-			Hole Terminated at 2.00 m						
	(Da – Wai ⊲ Wai ata Ch	ter Level te and time sh ter Inflow ter Outflow anges	hown)	Notes, Sar U₅₀ CBR E ASS B	50mm Bulk s Enviro (Glass Acid s (Plast Bulk s	n Diame ample f onmenta s jar, se Sulfate S	<u>s</u> ter tube sample or CBR testing I sample aled and chilled on site) toil Sample air expelled, chilled)	S S F F St S VSt V H F Fb F	/ery Soft Soft Firm Stiff /ery Stiff Hard Friable		<2 25 50 10 20 >4	CS (kPa) 25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
QT LIB 1.1.GLB L	tr D	radational or ansitional stra efinitive or dis trata change	ata	Field Test PID DCP(x-y) HP	Photo Dynar	nic pene	n detector reading (ppm) trometer test (test depth interval shown) meter test (UCS kPa)	<u>Density</u>	V L ME D VE	Lo D M D	ery Lo bose lediun ense ery Do	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

CLIENT:

BOREHOLE NO:

BH604

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NEW19P-0143I

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BB 14/7/23

		YPE: OLE DIAN			EXCA 300 m		DR WITH AUGER SURI	FACE RL: JM:					
	Dril	ing and San	npling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen		MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, dar grey-brown, fine grained sand, root affecte	k d.	M < Wp				TOPSOIL
	tered	0.40m U50 0.65m		- 0. <u>5</u> - -		CI	CLAY - medium plasticity, pale brown, trac orange-brown, with some fine grained sand	e pale d.	~ Wp	VSt	HP	230	RESIDUAL SOIL
AD/T	Not Encountered			1. <u>0</u> - -			Becoming red-brown and pale orange-brown brown.		- 4	H / Fb			
				1. <u>5</u> - - -		СН	CLAY - medium to high plasticity, red-brow some pale orange-brown to pale brown an grey, with some fine grained sand. Becoming red-brown with some pale grey, brown to pale orange-brown.	d pale	- ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	н	HP		
				2.0	<i>[]]]]]</i>		2.00m Hole Terminated at 2.00 m						
				-	-								
<u>Wat</u> ▼	Wat (Da Wat	er Level te and time sl er Inflow er Outflow	hown)	Notes, Sa U₅₀ CBR E ASS B	50mm Bulk s Enviro (Glass Acid S (Plasti	Diame ample f nmenta jar, se sulfate \$	ter tube sample ter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F I St S VSt V	Arrow Pery Soft Soft Firm Stiff Very Stiff Hard Friable		<: 2! 50 10 20	CS (kPa 25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit
<u>stra</u>	G tra D	anges radational or ansitional stra efinitive or dis rata change		в PID DCP(x-y) HP	<u>ts</u> Photoi Dynar	ionisati nic pen	on detector reading (ppm) etrometer test (test depth interval shown) ometer test (UCS kPa)	<u>Density</u>	Friable V L ME D VD	Lo M D	ery Lo bose lediur ense ery D	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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BB 14/7/23

	YPE: OLE DIAM						FACE RL: JM:					
Drill	ing and Sam	pling				Material description and profile information				Field	d Test	
WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL			MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
			-		CL	fine grained sand, root affected.	-	M ~ W _P				TOPSOIL
	0.50m		-		СІ	CLAY - medium plasticity, pale orange-bro brown, with some fine grained sand.		M > Wp		HP	250	RESIDUAL SOIL
	U50 0.70m		-			CLAY - medium to high plasticity, pale orar			VSt	ΗP	380	
Not Encountered			- - 1. <u>0</u>			Becoming red-brown and pale orange-brown brown.	<i>w</i> n to pale	√~ W _P		HP	450	
			- - 1. <u>5</u>		СН	Becoming red-brown with some pale orang and pale brown.	ge-brown	2	VSt - H	HP	450	
			-			Becoming red-brown with some pale grey, orange-brown.	trace pale	M < Wp	Н	HP	500 480	
			2.0			2.00m Hole Terminated at 2.00 m						
(Dat Wat Wat Mat Cha tra	e and time sh er Inflow er Outflow anges radational or ansitional stra	iown) ta	U ₅₀ CBR E ASS B <u>Field Test</u> PID	50mm Bulk s Enviro (Glass Acid S (Plasti Bulk S S S	Diame ample f onmenta s jar, se Sulfate S c bag, a sample	ter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled) on detector reading (ppm)	VS V S S F F St S VSt V H H	/ery Soft Soft Firm Stiff /ery Stiff Hard Friable V L	Vi	25 25 50 20 20 20 24 ery Lo 20se	25 5 - 50 0 - 100 00 - 200 00 - 400 400	Moisture Condition D Dry M Moist W Wet Wp Plastic Limit WL Liquid Limit Density Index <15%
	Not Encountered NATER AND	PUILING and SAM DIILING and SAM SAMPLES SAMPLES 0.50m U50 0.70m U50 0.70m	REHOLE DIAMETER Drilling and Sampling SAMPLES RL 0.50m (m) 0.50m 0.50m 0.50m <td>REHOLE DIAMETER: Drilling and Sampling AMPLES RL DEPTH SAMPLES RL DEPTH 0.50m 0.5 0.5 0.70m 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5</td> <td>REHOLE DIAMETER: 300 m Drilling and Sampling Image: Samples and Sam</td> <td>Patientic Diametere: 300 mm Drilling and Sampling Image: Constraint of the shown with the shown with</td> <td>REHOLE DIAMETER: 300 mm Data Driling and Sampling Material description and profile information Image: SaMPLES RL (m) DEFTH (m) Image: Sample set of the sample set of t</td> <td>REHOLE DIAMETER: 300 mm Datum: Driling and Sampling Material description and profile information Bit SAMPLES RL OEPTH OPTH OPTH</td> <td>REHOLE DIAMETER: 300 mm DATUM: Dilling and Sampling Material description and profile information Image: Constraint of the second profile information Image: Consecond profile inf</td> <td>REHOLE DIAMETER: 300 mm DATUR: Data and Sampling Material description and profile information Image: Construct on the profile information</td> <td>REHOLE DIAMETER: 300 mm DATUR: Diffing and Sampling Material description and profile information Image: Construction of the pro</td> <td>REPOLE DAMETER: 300 mm DATUM: Diffing and Sampling Material description and profile information Field Test Bit SAMPLES Rin DEFT</td>	REHOLE DIAMETER: Drilling and Sampling AMPLES RL DEPTH SAMPLES RL DEPTH 0.50m 0.5 0.5 0.70m 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5 1.5 0.15 1.5	REHOLE DIAMETER: 300 m Drilling and Sampling Image: Samples and Sam	Patientic Diametere: 300 mm Drilling and Sampling Image: Constraint of the shown with	REHOLE DIAMETER: 300 mm Data Driling and Sampling Material description and profile information Image: SaMPLES RL (m) DEFTH (m) Image: Sample set of the sample set of t	REHOLE DIAMETER: 300 mm Datum: Driling and Sampling Material description and profile information Bit SAMPLES RL OEPTH OPTH OPTH	REHOLE DIAMETER: 300 mm DATUM: Dilling and Sampling Material description and profile information Image: Constraint of the second profile information Image: Consecond profile inf	REHOLE DIAMETER: 300 mm DATUR: Data and Sampling Material description and profile information Image: Construct on the profile information	REHOLE DIAMETER: 300 mm DATUR: Diffing and Sampling Material description and profile information Image: Construction of the pro	REPOLE DAMETER: 300 mm DATUM: Diffing and Sampling Material description and profile information Field Test Bit SAMPLES Rin DEFT



ENGINEERING LOG - BOREHOLE MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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BB

14/7/23

		'YPE: OLE DIAM			EXCA 300 m		R WITH AUGER SURF	ACE RL: JM:					
	Drill	ling and Sam	npling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity characteristics,colour,minor component	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, darl grey-brown, fine grained sand, root affected	k J.	$M\sim w_{\rm P}$				TOPSOIL
				- 0.5_ -		CI	O.30mCLAY - medium plasticity, pale brown to pa orange-brown, with some fine grained. With some red-brown.	ie	M > w _P	VSt	HP	210 280	RESIDUAL SOIL
AD/T	Not Encountered	0.90m U50 1.10m		- - 1. <u>0</u> -			CLAY - medium to high plasticity, red-brown some pale brown and pale grey.		$M \sim w_P$		HP	330 380	
				- - 1. <u>5</u> - - -		СН	Becoming red-brown with some pale grey, t brown.	trace pale	M < w _p	Н	HP	450	
-				2.0	V/////	1	2.00m Hole Terminated at 2.00 m				-		
1.50	GEND:			- - - Notes, Sa	mplas a	nd Tee	s	Consiste				CS (kPa) Moisture Condition
	ter (Dat - Wat ∎ Wat ∎ Wat ∎ G G D	ter Level te and time sh ter Inflow ter Outflow	nown) Ita	U ₅₀ CBR E ASS B Field Test PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid S (Plasti Bulk S S Photo Dynar	ample i onmenta s jar, se Sulfate \$ ic bag, Sample ionisationis pen	IS ter tube sample or CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled) on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	VS V S S F F St S VSt V H H	ricy Very Soft Soft Stiff Very Stiff Hard Friable V L D	Vi La	22 25 50 20 20 20 20 20 20 20 20 20 20 20 20 20	25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit Density Index <15% Density Index 15 - 35%



ENGINEERING LOG - BOREHOLE MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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		YPE: OLE DIAME			300 m		R WITH AUGER SURI	FACE RL: JM:					
	Drill	ling and Sampl	ing				Material description and profile information				Fiel	d Test	
METHOD	WATER		RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componer	ty/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				_		GP	FILL: Silty Sandy GRAVEL - fine to mediur sub-angular to sub-rounded, grey-brown, f	ine to	D				FILL
				-		CL	sand, fines of low plasticity. BURIED TOPSOIL: Sandy CLAY - low plas grey-brown, fine grained sand, root affecte	 sticity, dark	M < W				BURIED TOPSOIL
		0.50m		- 0. <u>5</u>			0.40m CLAY - medium plasticity, pale brown, with grained sand.	some fine			HP	230	RESIDUAL SOIL
		U50 0.70m		-		CI	Becoming pale brown to pale orange-brow some red-brown.	n with	M > W _P	VSt			
	Not Encountered			-			0.80m CLAY - medium to high plasticity, red-brow some pale grey, trace pale brown, with sor grained sand.		+		HP	380	
AD/T	Not Enc			1. <u>0</u> - - 1. <u>5</u> -		СН	Becoming red-brown, trace pale grey.		$M \sim W_p$	н	HP	>600	
				2.0			^{2.00m} Hole Terminated at 2.00 m				HP	580	
				-									
LEG	END:	I	1	Notes, Sa				Consiste				CS (kPa	
<u>Wat</u> ▼	Ater Water Level (Date and time shown)	vn)	U ₅₀ CBR E ASS	Bulk s Enviro (Glass Acid S (Plasti	ample f nmenta jar, se culfate \$ c bag, ;	ter tube sample or CBR testing I sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt V H H	/ery Soft Soft Firm Stiff /ery Stiff Hard		25 50 10 20	25 5 - 50 0 - 100 00 - 200 00 - 400 400	P	
<u>Stra</u>	Gi tra Do	<u>anges</u> radational or ansitional strata efinitive or distic rata change		B Field Test PID DCP(x-y) HP	<u>:s</u> Photoi Dynan	nic pen	on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	Fb F Density	Friable V L ME D VD	La D M D	ery Lo bose lediun ense ery D	n Dense	Density Index <15% Density Index 15 - 35% e Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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	Drill	ling and Sam	plina				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additiona observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, gre fine to medium grained (mostly fine grained root affected.	y-brown, d) sand,					TOPSOIL
				-			0.25m CLAY - medium plasticity, pale brown with orange-brown, with some fine grained sand	 some pale 1.	-		HP	310	RESIDUAL SOIL
				0.5			With some red-brown, trace fine angular g	avel.			HP	380	
	ountered	<u>0.90m</u>		-		CI				VSt	HP	380	
AD/T	Not Encountered	U50 1.10m		1. <u>0</u> -			1.20m		M ~ WP		HP	430	
				- 1.5_			CLAY - medium to high plasticity, red-brow orange-brown, with some fine grained sand Becoming red-brown trace pale orange-bro pale grey.	1.			HP	>600	
				-		СН	Becoming red-brown with some pale grey to orange-brown.	race pale		H	HP	>600	
				2.0			2.00m Hole Terminated at 2.00 m						
				-									
<u>Wat</u> ▼	Wat (Dat Wat	ter Level te and time sh ter Inflow ter Outflow anges	own)	Notes, Sar U₅₀ CBR E ASS	50mm Bulk s Enviro (Glass Acid S (Plasti	Diame ample f nmenta jar, se sulfate S	ts ter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt N H F	ency /ery Soft Soft Firm Stiff /ery Stiff Hard Friable		<2 25 50 10 20	CS (kPa) 25 5 - 50 0 - 100 00 - 200 00 - 400 400	Moisture Condition D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	G tra D	<u>anges</u> iradational or ansitional strat efinitive or dis irata change	ta	Field Test PID DCP(x-y) HP	: <u>s</u> Photo Dynar	onisatio	on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	<u>Density</u>	V L ME D	L D N	ery Lo oose lediun	oose n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85%



ENGINEERING LOG - BOREHOLE CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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BO					300 m	m	DATU	JIVI:					
	Drill	ing and Sam	pling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additiona observations
				-		SC	TOPSOIL: Clayey SAND - fine to medium grey-brown, fines of low plasticity, root affe	grained, cted.	м				TOPSOIL
		0.50m U50 0.70m		- 0. <u>5</u> -		СН	0.25mCLAY - medium to high plasticity, pale brow orange-brown, with some fine grained sand	vn to pale d.		VSt	HP	300 410	RESIDUAL SOIL
AD/T	Not Encountered			- 1. <u>0</u> - -			CLAY - medium to high plasticity, pale orar and red-brown, with some fine grained san Becoming red-brown with some pale grey, orange-brown.	ď.	M ~ Wp	VSt -	HP	550	
				- 1. <u>5</u> - - -		СН	Trace fine grained angular gravel.			H	HP	580 >600	
				2.0			2.00m Hole Terminated at 2.00 m						
				- - -									
<u>Wat</u> ▼	Wat (Dat Wat Wat I Wat I Wat I G tra	er Level te and time sh er Inflow er Outflow anges radational strat efinitive or dist	own)	I Notes, Sa U ₅₀ CBR E ASS B Field Test PID DCP(x-y)	50mm Bulk s Enviro (Glass Acid S (Plasti Bulk S S Photo	Diame ample f nmenta i jar, se culfate S c bag, a ample onisatio	ts ts ter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled) on detector reading (ppm) etrometer test (test depth interval shown)	S S F F St S VSt N H F	⊥ /ery Soft Soft Firm Stiff /ery Stiff Hard Friable V L ME	Ve	25 26 50 20 20 20 20 20 20 20 20 20 20 20 20 20	CS (kPa) 25 5 - 50 0 - 100 00 - 200 00 - 400 400 Doose n Dense	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit Density Index <15%



ENGINEERING LOG - BOREHOLE MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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BB 14/7/23

	Drill	ing and Sam	pling				Material description and profile information				Fiel	d Test	
MEIHOU	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plastic characteristics,colour,minor component	ty/particle hts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additiona observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, gr fine grained sand, root affected.	ey-brown,	M < w _p				TOPSOIL
				- 0. <u>5</u> -			0.30m CLAY - medium plasticity, pale brown, with grained sand.	n some fine			HP	250	RESIDUAL SOIL
AD/ I	Not Encountered	1.00m U50		- - 1. <u>0</u>		СІ	With some red-brown.		$M \sim w_P$		HP	300	
		1.15m		-			1.40m CLAY - medium to high plasticity, red-brow some pale grey, trace pale orange-brown,			VSt	HP	310	
				1. <u>5</u> - -		СН	fine grained sand.	with some	M > w _P		HP	350 320	
				2.0			2.00m Hole Terminated at 2.00 m						
	Wat (Dat Wat	er Level te and time sh er Inflow er Outflow	own)	Notes, Sa U ₅₀ CBR E ASS	50mm Bulk s Enviro (Glass Acid S (Plast	i Diame ample f onmenta s jar, se Sulfate S ic bag, a	ter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt V H H	/ery Soft Soft Stiff /ery Stiff lard		<2 25 50 10 20	CS (kP 25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit
<u>stra</u>	G tra	anges radational or ansitional strat efinitive or dist	a	B Field Test PID DCP(x-y) HP	<u>:s</u> Photo Dynar	nic pene	on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	Fb F Density	Friable V L M[D	Lo	ery Lo oose lediun	oose n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85%



ENGINEERING LOG - BOREHOLE

BOREHOLE NO:

CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

PAGE: JOB NO: LOGGED BY:

DATE:

1 OF 1 NEW19P-0143I BB

BH611

14/7/23

		YPE: OLE DIAN			EXCA 300 m		OR WITH AUGER SURI	FACE RL: JM:					
	Drill	ing and Sar	npling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen		MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, gre fine grained sand, root affected.	ey-brown,	M < w _p				TOPSOIL
		0.30m U50 0.45m					CLAY - medium plasticity, pale brown, with grained sand.	some fine	M > Wp		HP	220	RESIDUAL SOIL
				-		CI	With some red-brown.		M ~ Wp	VSt	HP	300	
AD/T	Not Encountered			- 1. <u>0</u> -			CLAY - medium to high plasticity, red-brow orange-brown trace pale grey, with some fi grained sand. Becoming red-brown with some pale grey, orange-brown, trace fine angular gravel.	ne			HP	>600	
				- 1. <u>5</u> - -		СН			M < Wp	Н	HP	>600 >600	
				2.0			2.00m Hole Terminated at 2.00 m						
<u>Wat</u> ▼	Wat (Dat - Wat Wat	er Level te and time s er Inflow er Outflow anges	hown)	Notes, Sa U ₅₀ CBR E ASS B Field Test	50mm Bulk s Enviro (Glass Acid S (Plast Bulk S	i Diame ample f onmenta s jar, se Sulfate \$	ts ter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt N H H	ency /ery Soft Soft Firm Stiff /ery Stiff Hard Friable V		<2 25 50 10 20	CS (kPa 25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit
	tra D	radational or ansitional stra efinitive or dis rata change	ata	PID DCP(x-y) HP	Photo Dynar	nic pen	on detector reading (ppm) etrometer test (test depth interval shown) ometer test (UCS kPa)		L MI D VE	La D M D	ose	n Dense	Density Index 15 - 35%



ENGINEERING LOG - BOREHOLE

CLIENT:

MCCLOY GROUP **PROJECT:** MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

BOREHOLE NO:

PAGE:

DATE:

JOB NO:

LOGGED BY:

BH612 1 OF 1

NEW19P-0143I

BB

14/7/23

		YPE: OLE DIAN			EXCA 300 m		R WITH AUGER SUR	FACE RL: JM:					
	Drill	ing and San	npling				Material description and profile information				Field	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plastici characteristics,colour,minor componer	ty/particle its	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
	Not Encountered	0.80m U50 1.00m				CI	FILL-TOPSOIL: Sandy CLAY - low plasticit grey-brown, fine grained sand, root affecte some roots. 0.25m FILL: CLAY - medium plasticity, pale brown some dark grey-brown, with some fine grained satisfy the some fine grained satisfy the some fine grained satisfy the some pale grey, with some fine grained satisfy some rootlets. 1.20m CLAY - medium to high plasticity, red-brown some pale grey, with some fine grained satisfy some rootlets. 2.00m Hole Terminated at 2.00 m	d, with	M < Wp M > Wp	St		150	FILL - TOPSOIL
LEG Wat	Wat (Dat Wat	er Level e and time sl er Inflow er Outflow anges	nown)	Notes, Sa U ₅₀ CBR E ASS B	50mm Bulk s Enviro (Glass Acid S (Plasti	Diame ample f nmenta jar, se sulfate \$	ts ter tube sample or CBR testing al sample aled and chilled on site) soil Sample air expelled, chilled)	S S F F St S VSt V	ency Very Soft Soft Firm Stiff Very Stiff Hard Friable		<2 25 50 10 20	CS (kPa 25 5 - 50 0 - 100 00 - 200 00 - 400 00 - 400	D Dry M Moist W Wet
	Gi tra De	radational or ansitional stra efinitive or dis rata change		Field Test PID DCP(x-y) HP	Photo Dynar	nic pen	on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	<u>Density</u>	V L D VD) M D	ery Lo bose ledium ense ery De	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

BOREHOLE NO: PAGE: JOB NO:

LOGGED BY:

DATE:

BH612A 1 OF 1 NEW19P-0143I

> BB 14/7/23

		TYPE: Ole diam			EXCA 300 m		R WITH AUGER SURI	FACE RL: JM:					
	Dril	ling and San	npling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, dau grey-brown, fine grained sand, root affecte						TOPSOIL
AD/T	Not Encountered	0.70m U50		- 0. <u>5</u> - -		CI	CLAY - medium plasticity, pale brown, with grained sand. With some red-brown.			VSt	HP	250 310	RESIDUAL SOIL
0		<u>0.90m</u>		- 1. <u>0</u>		СН	CLAY - medium to high plasticity, red-brown some pale brown to pale orange-brown, wi fine grained sand.				HP	300	
OT LIB 1.1G.LB Log NON-CORED BORKHOLE TEST PIT 00-TEMPLATE LOCS SHEET.GPJ <				- - 1. <u>5</u> - - - - - - - - - - - - - - - - - - -			Hole Terminated at 1.10 m						
	 (Da – Wa' ■ Wa' ■ Wa' <u>ata Ch</u> tr: D	ter Level te and time sl ter Inflow ter Outflow	hown)	Notes, Sar U ₅₀ CBR E ASS B Field Test PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid S (Plasti Bulk S S Photo Dynar	Diame ample f onmenta s jar, sea sulfate S c bag, a c bag, a c bag, a conisationic pene	§ er tube sample or CBR testing I sample aled and chilled on site) ioil Sample ir expelled, chilled) en detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	S S F F St S VSt N H F	vncy /ery Soft Firm Stiff /ery Stiff Hard Friable V L D VD	Vi La D M	22 25 50 20 20 20 20 20 20 20 20 20 20 20 20 20	5 - 50 0 - 100 00 - 200 00 - 400 000 00se n Dense	D Dry M Moist W Wet Wp, Plastic Limit UL Liquid Limit Density Index <15% Density Index 15 - 35%



ENGINEERING LOG - BOREHOLE CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

BOREHOLE NO:

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LOGGED BY:

BH613 1 OF 1

NEW19P-0143I

BB 14/7/23

		YPE: OLE DIAN			EXCA 300 m		R WITH AUGER SURI	FACE RL: JM:					
	Drill	ing and San	npling		Material description and profile information						Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componer		MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		CL	TOPSOIL: Sandy CLAY - low plasticity, da grey-brown, fine grained sand, root affecte	d. 	_				
		<u>0.50m</u> U50		0.5_		CI	CLAY - medium plasticity, pale brown trace red-brown, with some fine grained sand.	9	M ~ Wp		HP	290 310	RESIDUAL SOIL
	untered	<u>0.65m</u>		-			0.85m CLAY - medium to high plasticity, red-brow orange-brown to pale brown, with some fin	 n and pale e grained	Å.	VSt	HP	250	
AD/T	Not Encountered			1. <u>0</u> -		СН	sand. <u>1.05m</u> CLAY - medium to high plasticity, red-brow grey, trace pale orange-brown, with some grained sand, trace fine angular gravel.	/n and pale fine	ž		HP	>600	
				- 1. <u>5</u> - - -		СН	Becoming red-brown with some pale grey, orange-brown.	trace pale	M < wp	Н	HP	>600	
				2.0			2.00m Hole Terminated at 2.00 m						
	Wat (Dat - Wat ■ Wat ■ Wat ■ Cha ■ Cha ■ Cha ■ Cha	er Level e and time sl er Inflow er Outflow unges radational or insitional stra finitive or disi rata change	nown) Ita	Notes, Sa U ₅₀ CBR E ASS B Field Test PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid S (Plast Bulk S Bulk S Photo Dynar	a Diame ample to onmenta s jar, se Sulfate \$ ic bag, a Sample ionisationic pen	Set ter tube sample or CBR testing il sample aled and chilled on site) Soil Sample air expelled, chilled) on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	S S F F St S VSt N H H	Pincy /ery Soft Soft Stiff /ery Stiff Hard Eriable V L ME D V V	Vi La D M	22 25 50 20 20 20 20 20 20 20 20 20 20 20 20 20	CS (kPa) 25 5 - 50 5 - 100 00 - 200 00 - 200 00 - 400 400 m Dense	D Dry M Moist W Wet Wp Plastic Limit WL Liquid Limit Density Index <15%



ENGINEERING LOG - BOREHOLE

CLIENT: MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

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LOGGED BY:

DATE:

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NEW19P-0143I

BB 29/1/24

		TYPE: OLE DIAN			EXCA 300 m		R WITH AUGER SURF DATL	FACE RL: JM:					
	Dril	ling and San	npling				Material description and profile information				Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticit characteristics,colour,minor componen	y/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
		0.10m				CL	FILL-TOPSOIL: Sandy CLAY - low plasticity 0.10m grey-brown, fine to coarse grained (mostly		√ M ~ M				FILL - TOPSOIL
		U50 0.25m		- - - - - - - -		CI	grained) sand. FILL: Sandy CLAY - medium plasticity, pale fine to medium grained (mostly fine grained	/	M < Wp	VSt	HP	350 380	FILL - CONTROLLED
AD/T	Not Encountered	0.90m U50 1.10m		- - 1. <u>0</u> -			0.80m Pockets of Sandy CLAY - low plasticity, gre fine grained sand. CLAY - medium to high plasticity, pale brow some fine grained sand. Pale brown to pale orange-brown and red-b	<i>J</i>	,		HP	500	RESIDUAL SOIL
				- 1. <u>5</u> - - -		СН	Red-brown with some pale brown to pale orange-brown. Red-brown and pale grey to white, trace pa	ıle brown.	$M \sim W_P$	н	HP	>600	
				2.0			2.00m Hole Terminated at 2.00 m						
				-									
<u>Wat</u> ▼	Wat (Da Wat	ter Level te and time sl ter Inflow ter Outflow <u>anges</u>	hown)	Notes, Sa U ₅₀ CBR E ASS B	50mm Bulk s Enviro (Glass Acid S (Plasti Bulk S	Diame ample i nmenta i jar, se sulfate \$ c bag,	ter tube sample ter tube sample or CBR testing al sample aled and chilled on site) soil Sample air expelled, chilled)	S S F I St S VSt V	Very Soft Soft Firm Stiff Very Stiff Hard Friable		<2 25 50 10 20 >4	<u>CS (kPa</u> 25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
	G tra D	ansitional or ansitional stra efinitive or dis trata change		Field Test PID DCP(x-y) HP	Photoi Dynan	nic pen	on detector reading (ppm) etrometer test (test depth interval shown) meter test (UCS kPa)	<u>Density</u>	V L D VD	L N D	ery Lo bose lediun ense ery D	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - BOREHOLE MCCLOY GROUP

PROJECT: MEDOWIE GARDENS - STAGE 6

LOCATION: MEDOWIE ROAD, MEDOWIE NSW

CLIENT:

BOREHOLE NO:

PAGE:

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JOB NO:

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BH615

1 OF 1

NEW19P-0143I

BB

29/1/24

	Dril	ling and Samp	ling							Fiel	ld Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plastici characteristics,colour,minor componer	ty/particle ts	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additiona observations
		0.10m				CL	FILL-TOPSOIL: Sandy CLAY - low plasticit 0.10m grey-brown, fine to coarse grained (mostly	fine	Å ∼				FILL - TOPSOIL
		U50 0.25m		-			grained) sand, trace fine to medium graine gravel FILL: Sandy CLAY - medium plasticity, red with some grey-brown, fine to medium grai		/ <u>-</u> ≥-		HP	370	FILL - CONTROLLED
				0.5		CI			M < wp	VSt - H	HP	420	
AD/ I	Not Encountered			- - 1. <u>0</u>			0.90m CLAY - medium to high plasticity, pale oran with some fine grained sand.	 nge-brown,			HP	300	RESIDUAL SOIL
¥	Not I	1.10m U50 1.30m	-			Red-brown and pale orange-brown to pale	brown.			HP	>600		
				- 1. <u>5</u> -		СН	Red-brown, trace pale grey to white and pa	ale brown.	M ~ WP	н	HP	>600	
				2.0			2.00m				HP	>600	
				-			Hole Terminated at 2.00 m						
	Wat (Da Wat Wat	ter Level te and time sho ter Inflow ter Outflow	wn)	Notes, Sar U ₅₀ CBR E ASS B	50mm Bulk s Enviro (Glass Acid S (Plasti	Diame ample f nmenta jar, se ulfate S c bag, a	ts ter tube sample or CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt N H H	ency /ery Soft Soft Firm Stiff /ery Stiff Hard Friable		<: 2! 50 10 20	CS (kPa 25 5 - 50 0 - 100 00 - 200 00 - 400 400) <u>Moisture Condition</u> D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit
transitional strata Definitive or distict				Field Test PID DCP(x-y) HP	Photoionisation detector reading (ppm)				Density V L MD D			oose m Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85%

APPENDIX B:

Results of Laboratory Testing



	k S	well	Inde	ex R	epor	t			Repo	ort No: SS	il:NEW23	W-3555-S Issue No
ent:		McCloy F PO Box 2 Dangar 1	2214		ent Pty Lto	1		N		Accredited for co Testing. Results provided sampled. This report shall	l relate only to th	e items tested or
oject No. oject Nar oject Loc	ne:	NEW19P Proposed 688 - 730	d Subdivi			s, Stage 6			D RECOGNISED	Approved Signat (Engineering Ger NATA Accredited Date of Issue: 1/	ologist) d Laboratory Nui	
ample	Deta	ils										
mple ID:			W-3555-S	501								
mpling M	Method	d: The res	ults outline	ed below a	apply to the	sample as r	eceived					
aterial:		Clay					Date Sa	-	14/07/2023	3		
ource:		On-Site					Date Su	bmitted:	14/07/2023	3		
ecificatio			cification	a a \								
imple Lo		BH601 -		.20m)								
		21101120	JZ3									
well Te vell on Sa		ion (9/).				89.7.1.1			(0/).	0.4	AS	1289.7.1
		t before (0/.).	-0. 26			11	on drying ((%): re Content	3.1		
		t after (%		20 26				rt material		1%		
	••		<i>,</i> .	20	.0							
	comp.	Strength	before (kPa): 59	0				shrinkage	e: Nil		
st. Unc. C	-	Strength Strength	-		0 00		Crumbli	ing during	shrinkage:			
t. Unc. C t. Unc. C	omp.	-	-				Crumbli	ing during	-			
st. Unc. C	omp.	-	-			Shrinkage	Crumbli Crackin	ing during	shrinkage:			
st. Unc. C st. Unc. C	omp.	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C	omp.	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C	Somp.	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C <mark>1rink S</mark>	Swell	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C <mark>1rink S</mark>	Somp.	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C <mark>1rink S</mark>	Swell	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S	10.0 - 5.0 -	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S	Swell	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S	10.0 - 5.0 -	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S	10.0 - 5.0 - 0.0 -	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S ™IP	10.0 - 5.0 -	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C <mark>1rink S</mark>	10.0 - 5.0 - 0.0 -	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S	10.0 - 5.0 - -5.0 -	-	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:			
t. Unc. C t. Unc. C nrink S	10.0 - 5.0 - -5.0 - -10.0 -	Strength	after (kl	Pa): >6			Crumbli Crackin	ing during g during s Sw ell	shrinkage:	Minor		50.0
t. Unc. C t. Unc. C nrink S	10.0 - 5.0 - -5.0 -	Strength	-			20.0	Crumbli Crackin	ing during g during s Sw ell	shrinkage:		45.0	50.0

Comments



Shrinl	k Sw	ell Inc	dex R	epor	t			Repo	ort No: SS	il:NEW23	W-3555-S Issue No
ient:	Mc ⁰ PO	Cloy Project Box 2214 ngar NSW	t Managem	•			N		Accredited for co Testing. Results provided sampled. This report shall	l relate only to th	e items tested or
oject No.: oject Nam oject Loca	1e: Pro	W19P-0143 posed Subo 3 - 730 Medo	division - Th		s, Stage 6			REDITATION	Approved Signat (Engineering Ger NATA Accredited Date of Issue: 1/	ologist) d Laboratory Nui	
ample [
mple ID:		EW23W-355									
aterial:		he results out lay	lined below	apply to the	sample as I	Date Sa	mnled:	14/07/2023	2		
ource:		n-Site Insitu				Date Sul	-	14/07/2023			
oecificatio	on: N	o Specificatio	on								
mple Loc	cation: B	H602 - (0.50	- 0.65m)								
ite Tested	d: 2	7/07/2023									
well Tes	st			AS 12	89.7.1.1	Shrink	< Test			AS	1289.7.1
vell on Sa			-0).8			on drying (3.3		
oisture Co				3.5			ge Moistu		. ,		
oisture Co				0.5		11	rt material		2%		
	-	ength befor ength after		30 600		11	ing during g during s	-			
	-			500		Orackin	g during 3	inninage.			
h <mark>rink S</mark> v	well			_	Shrinkage	s 🌢	Sw ell				
					Ommag		Ow ci				
	1 0.0 T · · · ·										
3	+										
Es	5.0 - · · ·					· · · ·	· · · · · .				. .
ell (%) Esw				:	:	:		:			
	T				-						
Shrink (%) Esh - Sw	0.0	+ + + + + + + + + + + + + + + + + + + +	· · · ·		- inter			+I	· · · · ·	i	
Esh				المعاصين المراجع							
(%	•			- T)		÷					:
) Y	-5.0 - · · ·			• • • • • • • • • • •							
Shri	1										
	-10.0 + · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · ·			· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		•••••	· · · · · · · · · · · · · · · · · · ·	
		5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
	0.0	5.0	10.0						40.0		
	0.0	5.0	10.0	1010		sture Conte			40.0		

Comments



Shrin	k Sw	ell Ind	dex R	epor	t			Repo	ort No: SS	il:NEW23	W-3555-S Issue No
ient:	Mc(PO		t Managem	•			N		Accredited for co Testing. Results provided sampled. This report shall	l relate only to th	e items tested or
oject No.: oject Nan oject Loc	1e: Pro		l division - Tł owie Road,		s, Stage 6			D RECOGNISED	Approved Signat (Engineering Ge NATA Accredited Date of Issue: 1)	ologist) d Laboratory Nui	
ample I	Details										
mple ID:		EW23W-355	5-S03								
mpling N	lethod: T	ne results ou	tlined below	apply to the	sample as i	received					
aterial:	С	lay				Date Sa	-	14/07/2023	3		
urce:		n-Site Insitu				Date Su	bmitted:	14/07/2023	3		
ecificatio		o Specificatio									
ite Testec		H603 - (1.00 7/07/2023	- 1.20m)								
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	ontent aft	• •		+. I 1.6			rt material		1%		
			 re (kPa): >∈			11	ing during				
	•	ength after	• •	600			g during s	-			
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	0.0	5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
					Mo	sture Conte	nt (%)				



Shrin	k Sw	ell Ind	dex R	epor	t			Repo	ort No: 55	I:NEW23	W-3555-S Issue No
ient:	PC	Cloy Projec Box 2214 ngar NSW		ent Pty Ltd	l		N		Accredited for co Testing. Results provided sampled. This report shall	relate only to th	e items tested o
oject No. oject Nan oject Loc	ne: Pro	W19P-0143 posed Sub 3 - 730 Med	division - Th		s, Stage 6			RECOGNISED	Approved Signate (Engineering Geo NATA Accredited Date of Issue: 1/	ologist) I Laboratory Nur	
ample	Details										
ample ID:	Ν	IEW23W-355	5-S04								
Impling M	/lethod: ⊺	he results ou	tlined below a	apply to the	sample as r	eceived					
aterial:	C	lay				Date Sar	-	14/07/2023			
ource:		n-Site Insitu				Date Sul	bmitted:	14/07/2023			
pecificatio		lo Specificatio									
imple Loo ate Testeo		H604 - (0.40	- 0.65m)								
		7/07/2023									
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ırınk (%) Esh - Swell (%) Esw	0.0	+					· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·		
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Shrink (%) Esh - Swell (%) Esw	-5.0	50	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
Shrink (%) Esh - Swell (%) Esw	-5.0	5.0	10.0	15.0	20.0	25.0 sture Contel	30.0	35.0	40.0	45.0	50.0

Comments



tient: McCloy Project Management Pty Ltd PO Box 2214 Dangar NSW 2309 roject Name: NEW19P-01431 roject Acation:688 - 730 Medowie Road, Medowie roject Location:688 - 730 Medowie Road, Medowie ample De tails ample ID: NEW23W-3555-S05 ampling Method: The results outlined below apply to the sample as received laterial: Clay ource: Or-Site Inatu pecification: 8H605 - (0.50 - 0.70m) ate Tested: 27/07/2023 well on Saturation (%): 0.9 bioisture Content after (%): 22.5 bioisture Content after (%): 22.5 bioisture Content after (%): 22.5 bioisture Content after (%): 20.8 st. Unc. Comp. Strength after (kPa): 480 st.	nrink S	Swel	l Ind	ex R	epor	t			Repo	ort No: SS	SI:NEW23	W-3555-S Issue No
Approved specification maple Details maple D: NEW23W-3555-S05 maple Details aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample as received aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample as received aterial: Clay Date Submitted: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: Clay Date Sampled: 14/07/2023 beer floation with the sample served aterial: (Clay Date Sampled: 14/07/2023 beer floation (%): 2.3 Shrink or drying (%): 2.3 Shrink condrying (%): 2.3 Shrink age bisture Content (%): 21.9 Est. inert material (%): 19/6 Crumbling during shrinkage: Nil Cracking during shrinkage: Nil floating floating floatin	nt:	PO Box	2214	-	ent Pty Ltd	l		N		Testing. Results provided sampled.	I relate only to th	e items tested or
Imple ID: NEW23W-3555-S05 Impling Method: The results outlined below apply to the sample as received aterial: Clay Date Sampled: 14/07/2023 Date Submitted: 14/07/2023 Shrink on drying (%): 2.3 Shrink on drying (%): 2.3 Shrinkage Moisture Content (%): 21.9 Est. inert material (%): 1% Crumbling during shrinkage: Nil Cracking during shrinkage: Nil Cracking during shrinkage: Moderate Noderate Noderate Noderate	ect Name:	Propos	ed Subdi			s, Stage 6			RECOGNISED	(Engineering Ge NATA Accredited	ologist) d Laboratory Nui	
mpling Method: The results outlined below apply to the sample as received tetrail: Clay Date Sampled: 14/07/2023 urce: On-Site Insitu Date Submitted: 14/07/2023 ecification: No Specification mple Location: BH605 - (0.50 - 0.70m) te Tested: 27/07/2023 well Test AS 1289.7.1.1 Fell on Saturation (%): -0.9 oisture Content after (%): 22.5 oisture Content after (%): 20.8 t. Unc. Comp. Strength before (kPa): 480 t. Unc. Comp. Strength after (kPa): 480 t. Unc. Comp. Strength after (kPa): 480 t. Unc. Governous trength after (kPa): 480 t. U	mple Deta	ails										
tterial: Clay Date Sampled: 14/07/2023 urce: On-Site Insitu cecification mple Location: BH605 - (0.50 - 0.70m) te Tested: 27/07/2023 well Test AS 1289.7.1.1 rell on Saturation (%): -0.9 bisture Content offore (%): 22.5 bisture Content after (%): 20.8 t. Unc. Comp. Strength after (kPa): 480 t. Unc. Comp. Strength after (kPa): 480 trink Swell frink Swell for a function of the strength after (kPa): 480 trink Swell for a function of the strength after (kPa): 480 for a function of the strength after (kPa): 480	•											
<pre>provide the second second</pre>			esults outli	ned below a	apply to the	sample as i						
recification: No Specification mple Location: BH605 - (0.50 - 0.70m) te Tested: 27/07/2023 vell Test AS 1289.7.1.1 rell on Saturation (%): 0.9 obisture Content before (%): 22.5 obisture Content after (%): 20.8 t. Unc. Comp. Strength after (kPa): 480 t. Unc. Comp. Strength after (kPa): 480 t. Unc. Comp. Strength after (kPa): 480 t. Unc. Comp. Strength after (kPa): 480 trink Swell Shrinkage Swell			to Incitu					-				
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hrink Swell Shrinkage Swell Swell Shrinkage Swell Shrinkage Swell	-	-			0		11		-			
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Shrink (%) Esh -10.0						Shrinkage	e 🔶	Sw ell				
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Moisture Content (%)						Mo	sture Conter	nt (%)				

Comments



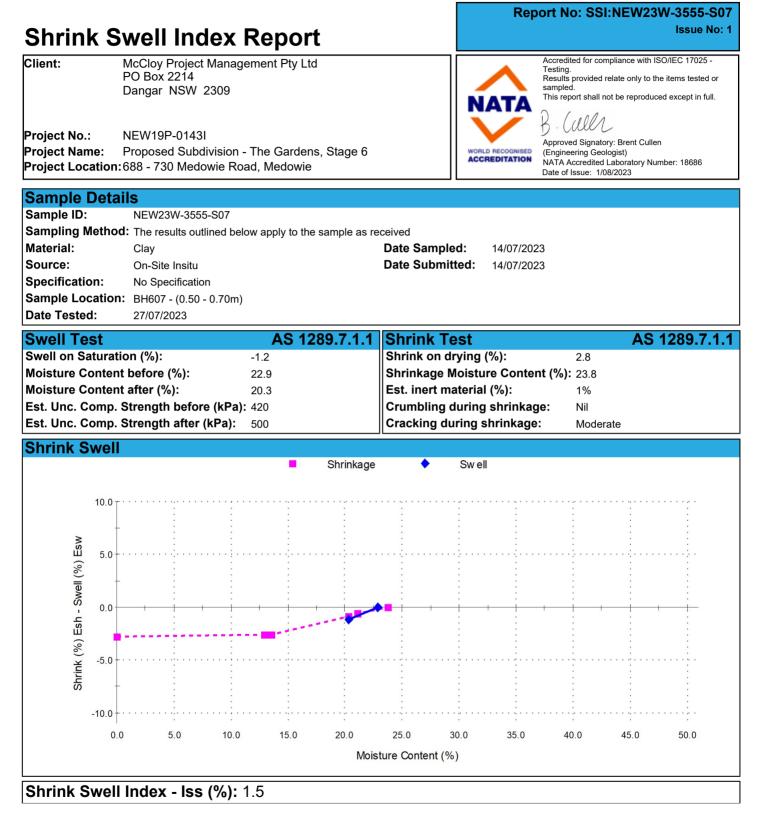
hrinl	k Sw	ell Inc	dex R	epor	t			Repo	ort No: 55	51:NEW23	W-3555-S Issue No
ent:	PO	Cloy Project Box 2214 gar NSW	t Managem 2309	ent Pty Ltd	I		N	\wedge	Accredited for co Testing. Results provided sampled. This report shall	I relate only to th	e items tested or
oject No.: oject Nam oject Loca	ne: Prop		l division - Th owie Road,		s, Stage 6			EDITATION	Approved Signat (Engineering Ger NATA Accredited Date of Issue: 1/	ologist) d Laboratory Nui	
mple [Details										
mple ID:		EW23W-355	5-S06								
mpling M	/lethod: Th	ne results out	tlined below	apply to the	sample as i	received					
aterial:	CI	ay				Date Sa	mpled:	14/07/2023	}		
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ecificatio		o Specificatio									
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		nath befor	• (kPa)• >6	00							
t. Unc. Co	omp. Stre	ngth befor ngth after	re (kPa): >6 (kPa): ⇒6	600 600		Crumbli	ing during g during s	shrinkage	e: Nil		
t. Unc. Co t. Unc. Co	omp. Stre omp. Stre	-				Crumbli	ing during	shrinkage	e: Nil		
t. Unc. Co t. Unc. Co	omp. Stre omp. Stre	-			Shrinkage	Crumbli Crackin	ing during	shrinkage	e: Nil		
t. Unc. C	omp. Stre omp. Stre	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage	e: Nil		
t. Unc. Co t. Unc. Co	omp. Stre omp. Stre	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage	e: Nil	<u>.</u>	
t. Unc. Co t. Unc. Co	omp. Stre omp. Stre well	-			Shrinkage	Crumbli Crackin	ing during g during s	shrinkage	e: Nil		
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t. Unc. Co t. Unc. Co nrink So Ntrink So Shrink (%) Esw	omp. Stre omp. Stre well 10.0 - · · · · · 5.0 - · · · · 5.0 - · · · ·	ngth after	(kPa): >6	500		Crumbli Crackin	ing during s g during s Sw ell	shrinkage hrinkage:	S: Nil Nil		
t. Unc. Co t. Unc. Co nrink Si Shrink (%) Esw Shrink (%) Esw	omp. Stre omp. Stre well	-			20.0	25.0	ing during g during s Sw ell	shrinkage	e: Nil	45.0	50.0
st. Unc. Co st. Unc. Co hrink (%) Esh - Swell (%) Esw	omp. Stre omp. Stre well 10.0 - · · · · · 5.0 - · · · · 5.0 - · · · ·	ngth after	(kPa): >6	500	20.0	Crumbli Crackin	ing during g during s Sw ell	shrinkage hrinkage:	S: Nil Nil	45.0	50.0

Comments



QUALTEST Laboratory (NSW) Pty Ltd (20708) 2 Murray Dwyer Circuit, Mayfield West, NSW 2304

- 02 4968 4468 т٠
 - 02 4960 9775
- F: E: W: E: admin@qualtest.com.au W: www.qualtest.com.au ABN: 98 153 268 896



Comments



hrin	k Sv	well	Inde	ex R	eport	t			Repo	ort No: SS	01:NEW23	W-3555-S Issue No
ent:	F	McCloy P PO Box 2 Dangar ♪	214		ent Pty Ltd	l		N		Accredited for co Testing. Results provided sampled. This report shall	l relate only to th	ne items tested or
oject No. oject Nar oject Loc	ne: I		l Subdivi		e Gardens Medowie	s, Stage 6			D RECOGNISED	Approved Signat (Engineering Geo NATA Accredited Date of Issue: 1/	ologist) d Laboratory Nui	
ample	Detai	ls										
mple ID:			N-3555-S	808								
mpling M	Nethod	: The resu	ults outline	ed below a	apply to the	sample as r	eceived					
aterial:		Clay					Date Sa	-	14/07/2023	3		
ource:		On-Site					Date Sul	bmitted:	14/07/2023	3		
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oisture C	oment						ILEST. INC	ri materia	1 /01.	1 %		
		• •	•					rt material ing during	. ,	1% e: Nil		
t. Unc. C	omp. S	Strength	before (kPa): 58	0		Crumbli	ing during	shrinkage shrinkage:	e: Nil		
t. Unc. C t. Unc. C	omp. S omp. S	Strength	before (kPa): 58	0		Crumbli	ing during	shrinkage	e: Nil		
t. Unc. C t. Unc. C	omp. S omp. S	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during	shrinkage:	e: Nil		
bisture C it. Unc. C it. Unc. C nrink S	omp. S omp. S	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		
t. Unc. C t. Unc. C	omp. S omp. S	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		
t. Unc. C t. Unc. C	comp. S comp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		
t. Unc. C t. Unc. C <mark>1rink S</mark>	omp. S omp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		· · · · · · · · · · · · · · · · · · ·
t. Unc. C t. Unc. C nrink S	comp. S comp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		· · · · · · · · · · · · · · · · · · ·
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t. Unc. C t. Unc. C nrink S	comp. S comp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		
t. Unc. C t. Unc. C nrink S	omp. S omp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		· · · · · · · · · · · · · · · · · · ·
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t. Unc. C t. Unc. C nrink S	comp. S comp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		· · · · · · · · · · · · · · · · · · ·
t. Unc. C t. Unc. C <mark>1rink S</mark>	comp. S comp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		
t. Unc. C t. Unc. C nrink S	comp. S comp. S well	Strength	before (kPa): 58	0	Shrinkage	Crumbli Crackin	ing during g during s	shrinkage:	e: Nil		
t. Unc. C t. Unc. C nrink S	Comp. S Comp.	Strength	before (after (kl	kPa): 58 Pa): >6			Crumbli Crackin	sw el	shrinkage:	E Nil Minor		50.0
nt. Unc. C nt. Unc. C nrink S	comp. S comp. S well	Strength	before (kPa): 58	0	20.0	Crumbli Crackin	Sw el	shrinkage:	e: Nil	45.0	50.0

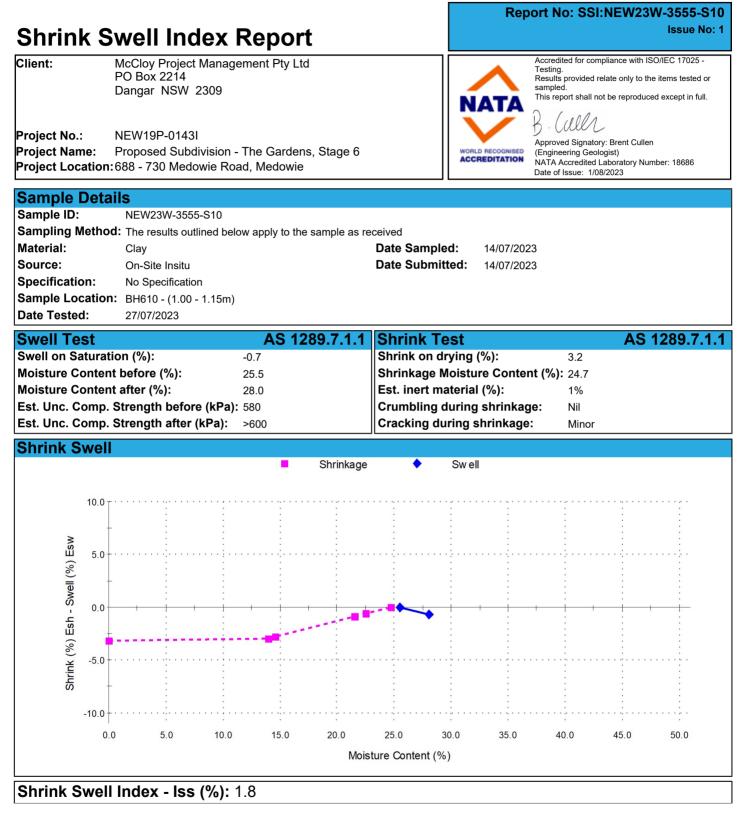


ample Det imple ID: impling Meth aterial: burce: becification: imple Location ate Tested: well Test vell on Satura bisture Conte bisture Conte	PO Box 22 Dangar NS NEW19P-0 Proposed S on:688 - 730 M tails NEW23W od: The result Clay On-Site In No Specifi on: BH609 - ((27/07/202 ation (%): ent before (%)	SW 2309 143I Subdivision - Th Aedowie Road, -3555-S09 s outlined below situ cation 0.50 - 0.70m) 3	ne Gardens Medowie apply to the AS 12 .9 5.4	s, Stage 6	Date San Date Sub Shrink Shrink o	mpled: bmitted: c Test on drying (⁶	14/07/2023 14/07/2023		relate only to th not be reproduce ory: Brent Culler ologist) I Laboratory Nur 08/2023	ne items tested o ed except in full n
oject Name: oject Locatio ample Det mple ID: mpling Meth iterial: urce: ecification: mple Locatio te Tested: vell Test vell on Satura oisture Conte oisture Conte t. Unc. Comp t. Unc. Comp	Proposed S m: 688 - 730 M tails NEW23W- tod: The result Clay On-Site In No Specifi On: BH609 - ((27/07/202 ation (%): ent before (%):	Subdivision - Th Aedowie Road, -3555-S09 s outlined below s situ cation 0.50 - 0.70m) 3 -0): -0	Medowie apply to the AS 12 .9 5.4	e sample as r	Date San Date Sub Shrink Shrink o	mpled: bmitted: c Test on drying (⁶	RECOONISED EDITATION 14/07/2023 14/07/2023	Engineering Geo (ATA Accredited Date of Issue: 1//	ologist) I Laboratory Nur 08/2023	mber: 18686
mple ID: mpling Meth iterial: urce: ecification: mple Locatio te Tested: vell Test vell on Satura bisture Conte bisture Conte t. Unc. Comp t. Unc. Comp	NEW23W- nod: The result Clay On-Site In No Specifi on: BH609 - (0 27/07/202 ation (%): ent before (%):	s outlined below situ cation 0.50 - 0.70m) 3 -0): -0	AS 12 .9 5.4		Date San Date Sub Shrink Shrink o	ted: CTest on drying (⁶	14/07/2023 %):	2.8	AS	1289.7.
mple ID: mpling Meth terial: urce: ecification: mple Locatio te Tested: vell On Satura vell on Satura isture Conte isture Conte t. Unc. Comp t. Unc. Comp	NEW23W- nod: The result Clay On-Site In No Specifi on: BH609 - (0 27/07/202 ation (%): ent before (%):	s outlined below situ cation 0.50 - 0.70m) 3 -0): -0	AS 12 .9 5.4		Date San Date Sub Shrink Shrink o	ted: CTest on drying (⁶	14/07/2023 %):	2.8	AS	1289.7.
terial: urce: ecification: mple Locatio te Tested: vell Test vell on Satura visture Conte bisture Conte t. Unc. Comp t. Unc. Comp	Clay On-Site In No Specifi Dn: BH609 - (0 27/07/202 ation (%): ent before (% ent after (%):	situ cation 0.50 - 0.70m) 3 -0): 25	AS 12 .9 5.4		Date San Date Sub Shrink Shrink o	ted: CTest on drying (⁶	14/07/2023 %):	2.8	AS	1289.7.
ecification: mple Locatio te Tested: well Test vell on Satura pisture Conte pisture Conte t. Unc. Comp t. Unc. Comp	On-Site In No Specifi Dn: BH609 - (0 27/07/202 ation (%): ent before (% ent after (%):	cation 0.50 - 0.70m) 3 -0): 25	.9 5.4	89.7.1.1	Date Sub Shrink Shrink o	ted: CTest on drying (⁶	14/07/2023 %):	2.8	AS	1289.7.
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te Tested: well Test vell on Satura disture Conte disture Conte t. Unc. Comp t. Unc. Comp	27/07/202 ation (%): ent before (% ent after (%):	3 -0): 25	.9 5.4	89.7.1.1	Shrink o	on drying (-		AS	1289.7.
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t. Unc. Comp	. Guongui D	efore (kPa): 59				ng during				
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				Shrinkage	ə 🔶	Sw ell				
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					05.0					
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				Moi	isture Conter	nt (%)				



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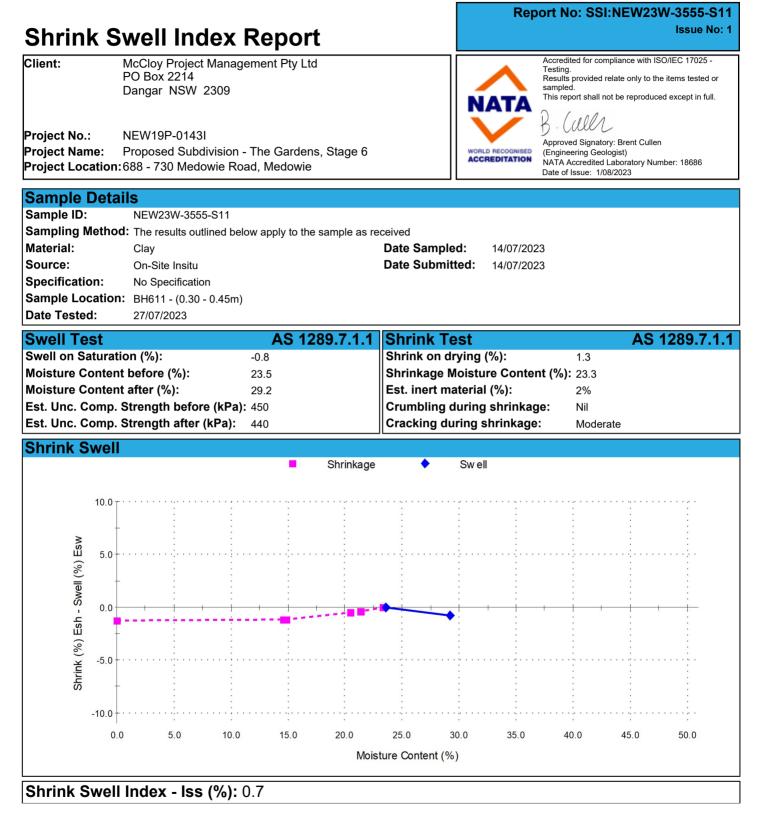
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- 02 4960 9775
- F: E: W: E: admin@qualtest.com.au W: www.qualtest.com.au ABN: 98 153 268 896





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Comments



Vell Ind AcCloy Projec O Box 2214 bangar NSW EW19P-0143 roposed Sub 88 - 730 Med S NEW23W-355 The results ou Clay On-Site Insitu No Specificati BH612A - (0.7 27/07/2023 n (%): before (%): after (%): trength befo trength after	t Manageme 2309 31 division - Th owie Road, 55-S12 tlined below a 0 - 0.90m) -0. 24 22 re (kPa): >6	ent Pty Ltc ne Garden: Medowie apply to the apply to the .7 .2	s, Stage 6 sample as	Date Sar Date Su Shrink of Shrinka Est. ine Crumbli Crackin	mpled: bmitted: k Test on drying (ige Moistu rt material ing during	(%): re Content (%): shrinkage:	3.4 t (%): 26.0 1% ə: Nil	A relate only to the not be reproduce tory: Brent Culled ologist) d Laboratory Nut /08/2023	ne items tested o xed except in full
roposed Sub 88 - 730 Med S NEW23W-355 The results ou Clay On-Site Insitu No Specificatio BH612A - (0.7 27/07/2023 n (%): before (%): after (%): trength befo	division - Th owie Road, 55-S12 tlined below a on 0 - 0.90m) -0. 24 22 re (kPa): >6	Medowie apply to the AS 12 .9 .7 .2 500 500	e sample as	Date Sar Date Su Shrink of Shrinka Est. ine Crumbli Crackin	mpled: bmitted: k Test on drying (age Moistu rt material ing during s	(%): re Content (%): re Content (%): shrinkage:	(Engineering Gea NATA Accredited Date of Issue: 1/ 3 3 3 4 t (%): 26.0 1% 9: Nil	ologist) d Laboratory Nuu /08/2023	mber: 18686
NEW23W-355 The results ou Clay On-Site Insitu No Specificati BH612A - (0.7 27/07/2023 n (%): before (%): after (%): trength befor	tlined below a on 0 - 0.90m) -0. 24 22 re (kPa): >6	AS 12 .9 .7 .2 500 500	89.7.1.1	Date Sar Date Su Shrink of Shrinka Est. ine Crumbli Crackin	bmitted: k Test on drying (age Moistu rt material ing during s ag during s	14/07/2023 (%): re Content (%): shrinkage:	3.4 t (%): 26.0 1% ə: Nil		1289.7.
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Clay On-Site Insitu No Specificati BH612A - (0.7 27/07/2023 n (%): before (%): after (%): trength befor	on 0 - 0.90m) -0. 24 22 re (kPa): >6	AS 12 .9 .7 .2 500 500	89.7.1.1	Date Sar Date Su Shrink of Shrinka Est. ine Crumbli Crackin	bmitted: k Test on drying (age Moistu rt material ing during s ag during s	14/07/2023 (%): re Content (%): shrinkage:	3.4 t (%): 26.0 1% ə: Nil		1289.7.
On-Site Insitu No Specificati BH612A - (0.7 27/07/2023 n (%): before (%): after (%): trength befo	0 - 0.90m) -0. 24 22 re (kPa): >6	.9 7 2.2 600 600		Date Su Shrink Shrinka Est. ine Crumbli Crackin	bmitted: k Test on drying (age Moistu rt material ing during s ag during s	14/07/2023 (%): re Content (%): shrinkage:	3.4 t (%): 26.0 1% ə: Nil		1289.7.
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27/07/2023 n (%): before (%): after (%): trength befo	-0. 24 22 re (kPa): >6	.9 7 2.2 600 600		Shrink o Shrinka Est. ine Crumbli Crackin	on drying (Ige Moistu rt material ing during Ig during s	re Content (%): shrinkage shrinkage:	t (%): 26.0 1% e: Nil		1289.7.
n (%): before (%): after (%): trength befo	24 22 re (kPa): >6	.9 7 2.2 600 600		Shrink o Shrinka Est. ine Crumbli Crackin	on drying (Ige Moistu rt material ing during Ig during s	re Content (%): shrinkage shrinkage:	t (%): 26.0 1% e: Nil		1289.7.
before (%): after (%): trength befo	24 22 re (kPa): >6	.9 7 2.2 600 600		Shrink o Shrinka Est. ine Crumbli Crackin	on drying (Ige Moistu rt material ing during Ig during s	re Content (%): shrinkage shrinkage:	t (%): 26.0 1% e: Nil		1289.7.
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after (%): trength befo	22 r e (kPa): >6	2.2 600 600	Shrinkag	Est. ine Crumbli Crackin	rt material ing during g during s	l (%): shrinkage shrinkage:	1% e: Nil		
trength befo	re (kPa): >6	600 600	Shrinkag	Crumbli Crackin	ing during Ig during s	shrinkage shrinkage:	e: Nil	-	
-	• •	600	Shrinkag	Crackin	g during s	shrinkage:		-	
trength after	(KPa): >6		Shrinkag			-	Minor	-	
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5.0	10.0	15.0	20.0	25.0	30.0	35.0	40.0	45.0	50.0
			Mo	isture Conte	nt (%)				
	5.0	5.0 10.0	5.0 10.0 15.0			5.0 10.0 15.0 20.0 25.0 30.0 Moisture Content (%)			



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Report No: SSI:NEW23W-3555-S13 **Issue No: 1 Shrink Swell Index Report** Accredited for compliance with ISO/IEC 17025 -Client: McCloy Project Management Pty Ltd Testing. Results provided relate only to the items tested or PO Box 2214 Dangar NSW 2309 sampled. This report shall not be reproduced except in full. ΝΔΤΔ all Project No.: NEW19P-0143I Approved Signatory: Brent Cullen Project Name: Proposed Subdivision - The Gardens, Stage 6 BLD BEC (Engineering Geologist) ACCREDITATION NATA Accredited Laboratory Number: 18686 Project Location: 688 - 730 Medowie Road, Medowie Date of Issue: 1/08/2023 Sample Details Sample ID: NEW23W-3555-S13 Sampling Method: The results outlined below apply to the sample as received Material: **Date Sampled:** 14/07/2023 Clay Source: **Date Submitted: On-Site Insitu** 14/07/2023 Specification: No Specification Sample Location: BH613 - (0.50 - 0.65m) Date Tested: 27/07/2023 Swell Test AS 1289.7.1.1 Shrink Test AS 1289.7.1.1 Swell on Saturation (%): Shrink on drying (%): -0.6 3.0 Moisture Content before (%): Shrinkage Moisture Content (%): 24.5 23.2 Moisture Content after (%): Est. inert material (%): 25.6 2% Est. Unc. Comp. Strength before (kPa): >600 Crumbling during shrinkage: Nil Est. Unc. Comp. Strength after (kPa): >600 Cracking during shrinkage: Minor Shrink Swell Shrinkage Sw ell 10.0 Shrink (%) Esh - Swell (%) Esw 5.0 0.0 -5.0 -10.0 0.0 5.0 10.0 15.0 20.0 25.0 30.0 35.0 40.0 45.0 50.0 Moisture Content (%) Shrink Swell Index - Iss (%): 1.7

Comments

Report Number:	NEW19P-0143I-1
Issue Number:	1
Date Issued:	12/02/2024
Client:	McCloy Project Management Pty Ltd
	PO Box 2214, Dangar NSW 2309
Project Number:	NEW19P-0143I
Project Name:	Proposed Subdivision - The Gardens, Stage 6
Project Location:	688 - 730 Medowie Road, Medowie
Work Request:	2137
Sample Number:	NEW24S-2137A
Date Sampled:	01/02/2024
Dates Tested:	02/02/2024 - 05/02/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	BH614 - (0.10 - 0.25m)
Material:	Sandy Clay
Material Source:	On-Site Insitu

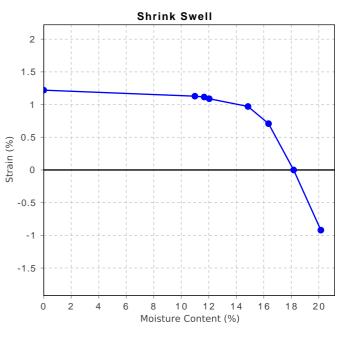
Shrink Swell Index (A	S 1289 7.1.1 & 2.1.1)	
lss (%)	0.9	
Visual Description	Sandy Clay	
* Shrink Swell Index (pF change in suction.	lss) reported as the percentage vertic	al strain per
Core Shrinkage Test		
Shrinkage Strain - O	ven Dried (%)	1.2
Estimated % by volum	ne of significant inert inclusions	6
Cracking		Slightly Cracked
Crumbling		No
Moisture Content (%)		18.2
Swell Test		
Initial Pocket Penetror	meter (kPa)	>600
Final Pocket Penetror	neter (kPa)	>600
Initial Moisture Conter	nt (%)	15.6
Final Moisture Conten	it (%)	20.2
Swell (%)		0.9
* NATA Accreditation penetrometer reading	does not cover the performance of po s.	ocket



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



Report Number:	NEW19P-0143I-1
Issue Number:	1
Date Issued:	12/02/2024
Client:	McCloy Project Management Pty Ltd
	PO Box 2214, Dangar NSW 2309
Project Number:	NEW19P-0143I
Project Name:	Proposed Subdivision - The Gardens, Stage 6
Project Location:	688 - 730 Medowie Road, Medowie
Work Request:	2137
Sample Number:	NEW24S-2137B
Date Sampled:	01/02/2024
Dates Tested:	02/02/2024 - 05/02/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	BH614 - (0.90 - 1.10m)
Material:	Sandy Clay
Material Source:	On-Site Insitu

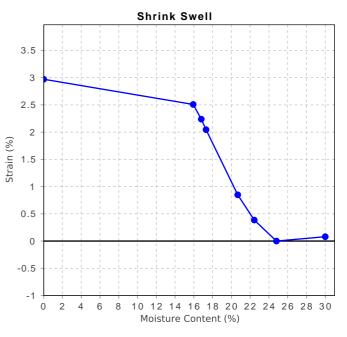
Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)			
lss (%)	1.7		
Visual Description	Sandy Clay		
* Shrink Swell Index (pF change in suction.	ss) reported as the percentage vertic	al strain per	
Core Shrinkage Test			
Shrinkage Strain - O	ven Dried (%)	3.0	
Estimated % by volum	ne of significant inert inclusions	2	
Cracking		Slightly Cracked	
Crumbling		No	
Moisture Content (%) 24.8			
Swell Test			
Initial Pocket Penetror	meter (kPa)	580	
Final Pocket Penetrometer (kPa)		590	
Initial Moisture Content (%)		27.9	
Final Moisture Content (%)		30.0	
Swell (%)		-0.1	
* NATA Accreditation penetrometer reading	does not cover the performance of po s.	ocket	



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Report Number: NEW19P-0143I-1

Report Number:	NEW19P-0143I-1
Issue Number:	1
Date Issued:	12/02/2024
Client:	McCloy Project Management Pty Ltd
	PO Box 2214, Dangar NSW 2309
Project Number:	NEW19P-0143I
Project Name:	Proposed Subdivision - The Gardens, Stage 6
Project Location:	688 - 730 Medowie Road, Medowie
Work Request:	2137
Sample Number:	NEW24S-2137C
Date Sampled:	01/02/2024
Dates Tested:	02/02/2024 - 05/02/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	BH615 - (0.10 - 0.25m)
Material:	Sandy Clay
Material Source:	On-Site Insitu

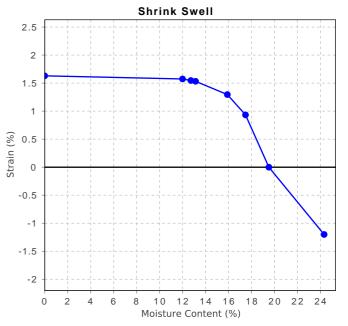
Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)			
lss (%)	1.2		
Visual Description	Sandy Clay		
* Shrink Swell Index (pF change in suction.	ss) reported as the percentage vertic	al strain per	
Core Shrinkage Test			
Shrinkage Strain - O	ven Dried (%)	1.6	
Estimated % by volum	ne of significant inert inclusions	4	
Cracking		Slightly Cracked	
Crumbling		No	
Moisture Content (%) 19.5			
Swell Test			
Initial Pocket Penetror	meter (kPa)	>600	
Final Pocket Penetrometer (kPa)		>600	
Initial Moisture Content (%)		18.9	
Final Moisture Content (%)		24.3	
Swell (%)		1.2	
* NATA Accreditation does not cover the performance of pocket penetrometer readings.			



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



Report Number:	NEW19P-0143I-1
Issue Number:	1
Date Issued:	12/02/2024
Client:	McCloy Project Management Pty Ltd
	PO Box 2214, Dangar NSW 2309
Project Number:	NEW19P-0143I
Project Name:	Proposed Subdivision - The Gardens, Stage 6
Project Location:	688 - 730 Medowie Road, Medowie
Work Request:	2137
Sample Number:	NEW24S-2137D
Date Sampled:	01/02/2024
Dates Tested:	02/02/2024 - 05/02/2024
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	BH615 - (1.10 - 1.30m)
Material:	Sandy Clay
Material Source:	On-Site Insitu

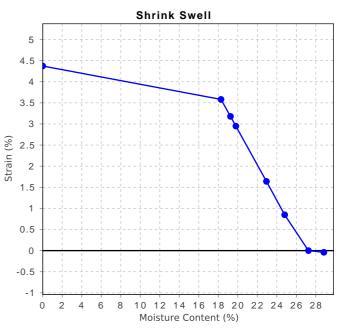
Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)			
lss (%)	2.4		
Visual Description	Sandy Clay		
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.			
Core Shrinkage Test			
Shrinkage Strain - O	ven Dried (%)	4.4	
Estimated % by volum	ne of significant inert inclusions	2	
Cracking		Uncracked	
Crumbling		No	
Moisture Content (%) 27.2			
Swell Test			
Initial Pocket Penetron	meter (kPa)	590	
Final Pocket Penetrometer (kPa)		>600	
Initial Moisture Content (%)		26.4	
Final Moisture Content (%)		28.8	
Swell (%)		0.0	
* NATA Accreditation does not cover the performance of pocket penetrometer readings.			



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



Report Number:	NEW19P-0143I-1
Issue Number:	1
Date Issued:	12/02/2024
Client:	McCloy Project Management Pty Ltd
	PO Box 2214, Dangar NSW 2309
Project Number:	NEW19P-0143I
Project Name:	Proposed Subdivision - The Gardens, Stage 6
Project Location:	688 - 730 Medowie Road, Medowie
Work Request:	2137
Dates Tested:	02/02/2024 - 05/02/2024



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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-2137A	NEW24S-2137B	NEW24S-2137C	NEW24S-2137D	
Date Sampled	01/02/2024	01/02/2024	01/02/2024	01/02/2024	
Date Tested	05/02/2024	05/02/2024	05/02/2024	05/02/2024	
Material Source	On-Site Insitu	On-Site Insitu	On-Site Insitu	On-Site Insitu	
Sample Location	BH614 - (0.10 - 0.25m)	BH614 - (0.90 - 1.10m)	BH615 - (0.10 - 0.25m)	BH615 - (1.10 - 1.30m)	
Inert Material Estimate (%)	6	2	4	2	
Pocket Penetrometer before (kPa)	>600	580	>600	590	
Pocket Penetrometer after (kPa)	>600	590	>600	>600	
Shrinkage Moisture Content (%)	18.2	24.8	19.5	27.2	
Shrinkage (%)	1.2	3.0	1.6	4.4	
Swell Moisture Content Before (%)	15.6	27.9	18.9	26.4	
Swell Moisture Content After (%)	20.2	30.0	24.3	28.8	
Swell (%)	0.9	-0.1	1.2	0.0	
Shrink Swell Index Iss (%)	0.9	1.7	1.2	2.4	
Visual Description	Sandy Clay	Sandy Clay	Sandy Clay	Sandy Clay	
Cracking	SC	SC	SC	UC	
Crumbling	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.

APPENDIX C:

CSIRO Sheet BTF 18

Foundation Maintenance and Footing Performance: A Homeowner's Guide

Foundation Maintenance and Footing Performance: A Homeowner's Guide



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 boglike 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	
А	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	
М	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes	
Н	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	
Р	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.



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.

Trees can cause shrinkage and damage

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		



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.

The information in this and other issues in the series was derived from various sources and was believed to be correct when published.

The information is advisory. It is provided in good faith and not claimed to be an exhaustive treatment of the relevant subject.

Further professional advice needs to be obtained before taking any action based on the information provided.

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