Proposed Subdivision Billy's Lookout -Stages 6 & 9 Site Classification

Fishermans Drive, Teralba

NEW15P-0070A-AJ 15 November 2017



15 November 2017

McCloy Development Management Pty Ltd Suite 1, Level 3, 426 King Street NEWCASTLE WEST NSW 2309

Attention: Jon Hines

Dear Sir.

RE: PROPOSED SUBDIVISION – BILLY'S LOOKOUT – STAGES 6 & 9
FISHERMANS DRIVE, TERALBA
SITE CLASSIFICATION (LOTS 601 TO 614 & 901 TO 926)

Please find enclosed our geotechnical report for Stages 6 and 9 of the residential subdivision of Billy's Lookout, located at Fishermans Drive, Teralba.

The report provides site classification with respect to reactive soils, in accordance with the requirements of AS2870-2011 'Residential Slabs and Footings', Stages 6 and 9 (Lots 601 to 614 and 901 to 926).

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

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

Jason Lee

Principal Geotechnical Engineer

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Appendix B: Results of Laboratory Testing

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1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this site classification report on behalf of McCloy Development Management Pty Ltd (McCloy), for Stages 6 and 9 of the residential subdivision of Billy's Lookout, located at Fishermans Drive, Teralba.

Based on the brief and drawing provided by the client, Stages 6 and 9 are understood to comprise of 40 residential allotments (Lots 601 to 614 and 901 to 926, respectively).

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 Stages 6 and 9 following completion of site regrade works

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

2.0 Desktop Study

The scope of work has included a review of the following reports completed by Qualtest:

- Site Classification report, 'Proposed Subdivision, Billy's Lookout Stages 5 to 9, Fishermans Drive, Teralba, (Report Reference: NEW15P-0070A-AA, dated 16 February 2016);
- Site Classification report, 'Proposed Subdivision, Billy's Lookout Stage 8, Fishermans Drive, Teralba, (Report Reference: NEW15P-0070A-AG, dated 15 March 2017);
- Site Classification report, 'Proposed Subdivision, Billy's Lookout Stage 5, Fishermans Drive, Teralba, (Report Reference: NEW15P-0070A-AH, dated 11 August 2017);
- Level 1 Site Regrade Assessment report, 'Proposed Subdivision, Billy's Lookout Stage 9, Fishermans Drive, Teralba, (Report Reference: NEW17P-0090-AA, dated 9 November 2017).
- Level 1 Site Regrade Assessment report, 'Proposed Subdivision, Billy's Lookout Stage 6, Fishermans Drive, Teralba, (Report Reference: NEW17P-0140-AA, dated November 2017).

This report includes a summary of selected results from the previous reports. Reference should be made to the reports outlined above for further details of site description, subsurface conditions, field work conducted, engineering logs of test pits, laboratory testing results, site supervision and density testing carried out.

3.0 Field Work

Following the completion of site regrade works, additional field work investigations were carried out on 24 October 2017, comprising of:

- Excavation of fourteen test pits (TP601 to TP606 and TP901 to TP908) using a 2.5 tonne tracked excavator with a 0.45m wide toothed bucket, to depths of between 0.25m – 2.10m;
- Undisturbed samples (U50 tubes) were taken for subsequent laboratory testing;
- Test pits were backfilled with the excavation spoil and compacted using the excavator bucket and tracks.

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

Approximate test pit locations are shown on the attached Figure AJ1, which also includes test pit locations from the previous investigations conducted on site. Engineering logs of the test pits are presented in Appendix A.

The engineer returned to the site on 15 November 2017 to confirm that a temporary fill stockpile that had existed on Lot 908 during the investigation had been removed.

4.0 Site Description

4.1 Site Regrade Works

Site re-grading works were conducted on Lots 601 to 607 for Stage 6 (as shown on Figure AJ1), between the dates 18 January 2017 and 3 August 2017. Site re-grading works were conducted on Lots 918 to 922 for Stage 9 (as shown on Figure AJ1), between the dates of 7 September 2016 and 1 July 2017.

Prior to filling, re-grade areas were stripped of all topsoil and unsuitable material to expose suitable natural residual foundation profile. Re-grade works then consisted of filling with approved site fill to finish design levels.

Filling was performed using site material won from excavations cut from around the site. The fill material could generally be described as mixtures of Gravelly Sandy CLAY, Silty SAND and Clayey SAND, of medium plasticity, fine to coarse grained sand, and with some fine to coarse grained gravel inclusions.

As the geotechnical testing authority engaged for the project, we state that the filling performed for the regrade areas (Lots 601 to 607 and 918 to 922), 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'.

The recommendations of this report are based on the understanding that any existing lot re-grade works outside the areas shown on Figure AJ1, and described above are limited to cutting and/or placement of fill including topsoil to depths of less than 0.4m, in general accordance with the design. Qualtest should be informed without delay if additional earthworks are known to have been carried out.

4.2 Surface Conditions

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



Photograph 1: Facing southwest from near TP606, Fishermans Drive in background.



Photograph 2: Facing west from near TP606.



Photograph 3: Facing west from TP908 (along the boundary of Lots 901 & 902), showing Castaway Crescent in background.



Photograph 4: Facing northwest from TP908 (along the boundary of Lots 901 & 902).



Photograph 5: Facing northwest from near eastern corner of Lot 906.



Photograph 6: Facing north from near north-eastern corner of Lot 906.

4.3 Subsurface Conditions

Reference should be made to the previous reports outlined in Section 2.0 for full details of site description, subsurface conditions, field work conducted, engineering logs of test pits, laboratory testing results, site supervision and density testing carried out.

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

Table 1 presents a summary of the typical soil types encountered on site during the field investigations, divided into representative geotechnical units. The units adopted have typically remained consistent with those previously provided, with the addition of Controlled Fill.

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

No groundwater levels or water inflows were encountered in the test pits during the limited time that they remained open on the day of the field investigation.

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

TABLE 1 – SUMMARY OF GEOTECHNICAL UNITS AND SOIL TYPES

Unit	Soil Type	Description
1A	FILL – TOPSOIL & MULCH	Generally up to about 50mm of mulch, overlying Silty SAND / Clayey SAND - fine to coarse grained, dark grey to grey, fines of low to medium plasticity, with some fine to medium grained gravel.
1B	CONTROLLED	Sandy CLAY – medium and low to medium plasticity, dark grey- brown, orange-brown to dark orange and pale grey-white, fine to coarse grained sand, with some fine to medium grained sub-angular to sub-rounded gravel and trace cobbles in places.
15	FILL	SAND – fine to coarse grained, grey. Clayey SAND – fine to coarse grained, grey to grey-brown, fines of low to medium plasticity, trace fine to medium grained sub-rounded to sub-angular gravel.
2	TOPSOIL	Silty SAND - fine to coarse grained, grey, fines of low plasticity, root affected.
_		Clayey SAND - fine to coarse grained, dark brown to grey, fines of medium plasticity, root affected.
3	SLOPEWASH /	Silty SAND, SAND - fine to medium grained, pale brown / grey, some Silt / fines of low plasticity.
	COLLUVIUM	Clayey SAND - fine to coarse grained, dark brown to grey, fines of medium plasticity.
4	residual soil	CLAY / Sandy CLAY – medium and medium to high plasticity, variable colours such as pale brown, orange to pale brown, pale grey, grey, and brown to red, some sand / fine to coarse grained sand.
		Clayey SAND / SAND – fine to coarse grained, orange-brown and pale grey-white, with clay / fines of low to medium plasticity, trace fine to medium grained sub-angular to sub-rounded gravel.
5	EXTREMELY WEATHERED (XW) ROCK	Extremely Weathered SANDSTONE with Soil Properties; excavating as SAND – fine to coarse grained, pale grey-white and orange-brown to orange, with some clay. Breaks down into Clayey SAND in places.
6	HIGHLY WEATHERED	SANDSTONE - fine to coarse grained, variable colours such as pale grey to white, grey, orange, pale brown, variable estimated strength ranging from low to high.
	(HW) ROCK	Sandy SILTSTONE – pale orange-brown to brown and pale grey, estimated medium strength, with some Extremely Weathered pockets.

TABLE 2 – SUMMARY OF GEOTECHNICAL UNITS ENCOUNTERED AT TEST PIT LOCATIONS

TEST PIT NO.	UNIT 1A Fill – Mulch & Topsoil	UNIT 1B Fill - Controlled	UNIT 2 Topsoil	Unit 3 Slopewash Colluvium	Unit 4 Residual Soil	Unit 5 XW Rock	Unit 6 HW Rock							
		Depth (m)												
	Current Ge	eotechnical A	Assessment (R	ef: NEW15P-0	0070A-AJ, No	vember 2017	')							
TP601	TP601 - - 0.00 - 0.25 - - - TP602 0.00 - 0.20 - - - 0.20 - 0.25 -													
TP602	0.00 - 0.20	-	-	-	0.20 - 0.25	-	0.25 - 0.27*							
TP603	-	-	0.00 - 0.10	0.10 - 0.40	0.40 - 0.70	-	0.70 - 0.80*							
TP604	0.00 - 0.03	-	-	0.03 - 0.15	0.15 - 1.00	1.00 - 1.60 ^	-							
TP605	0.00 - 0.15	-	-	-	0.30 - 2.00^	-	-							
TP606	0.00 - 0.40	-	-	0.40 - 0.60	0.60 - 1.70	-	1.70 - 1.72*							
TP901	0.00 - 0.20	0.20 - 0.90	-	-	0.90 - 2.10	-	-							
TP902	0.00 - 0.07	0.07 - 0.50	-	-	0.50 - 1.10	-	1.10 - 1.20*							
TP903	0.00 - 0.20	-	-	-	-	-	0.20 - 0.25*							
TP904	0.00 - 0.20	-	-	-	-	0.20 - 0.30	0.30 - 0.40 ^							
TP905	0.00 - 0.30	-	-	0.30 - 0.50	0.50 - 0.90	-	0.90 - 0.95*							
TP906	0.00 - 0.25	-	-	-	-	-	0.25 - 0.30*							
TP907	0.00 - 0.35	-	-	-	0.35 - 0.40	-	0.40 - 0.90*							
TP908	0.00 - 0.20	-	-	-	0.20 - 0.40	-	0.40 - 0.60^							
	Previous Inv	estigations (F	ebruary 2016	6, June 2016,	March 2017	& August 201	7)							
TP118	-	-	0.00 - 0.35	-	0.35 - 1.50	-	1.50 - 1.70#							
TP206	1	-	0.00 - 0.22	0.22 - 0.40	0.40 - 1.60	1	1.60 - 1.80							
TP208	-	-	0.00 - 0.27	0.27 - 0.45	0.45 - 1.40	-	1.40 - 1.70 ^							
TP210	-	-	0.00 - 0.10	0.10 - 0.38	0.38 - 0.80	0.80 - 1.30	1.30 - 1.50 ^							
TP212	-	-	0.00 - 0.20	0.20 - 0.45	0.45 - 1.00	-	1.00 - 1.40^							
BH804	0.00 - 0.20	0.20 - 0.90	-	-	0.90 - 1.50	-	-							
BH809	0.00 - 0.20	0.20 – 1.10	1	-	1.10 - 1.50	-	•							
TP5-5	0.00 - 0.25	0.25 - 1.20	-	-	1.20 - 1.40	-	-							
TP5-7	0.00 - 0.25	0.25 - 1.80	-	-	-	-	-							
TP5-8	0.00 - 0.25	0.25 - 1.60	-	1.60 - 1.75	1.75 - 1.90	-	-							
Notes:	* =			al of 2.5 tonne at investigatio			/							
# = Practical refusal or refusal of 22 tonne excavator met on Highly Weathered Rock (preliminary investigation Feb 2016).														
	۸ =	Slow to very	slow progre	ss, close to pr	actical exca	vator refusal.								

5.0 Laboratory Testing

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

- (6 no.) Atterberg Limits tests;
- (4 no.) Shrink / Swell tests;

Results of the laboratory testing have been kept on file for reference, with a summary of the Atterberg limits and Shrink/Swell results presented respectively in Tables 3 and 4.

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

TABLE 3 - SUMMARY OF ATTERBERG LIMITS TESTING RESULTS

Location	Depth (m)	Material Description	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	Linear Shrinkage (%)
		Current Investigation	(Novembe	r, 2017)		
TP602	0.20 - 0.25	(SC) Clayey SAND	27	17	10	3.5
TP603	0.50 – 0.70	(CL) Sandy CLAY	37	17	20	6.0
TP604	0.70 – 0.90	(CH) Sandy CLAY	60	17	43	9.5
TP901	0.10 - 0.20	FILL: (SC) Clayey SAND	15	12	3	1.0
TP903	0.10 - 0.20	FILL: (SC) Clayey SAND	23	15	8	3.0
TP904	0.20 - 0.30	(SC) Clayey SAND	23	18	5	2.0
TP905	0.40 - 0.50	(SC) Clayey SAND	37	17	20	9.0
TP906	0.10 - 0.20	FILL: (SC) Clayey SAND	29	16	13	4.0
TP907	0.10 - 0.30	FILL: (SC) Clayey SAND	23	16	7	2.5
TP908	0.20 - 0.40	(CI) Sandy CLAY	44	18	26	5.5
		Previous Investigat	ion (March	2017)		
BH804	0.60 - 0.90	(CL) Gravelly Sandy	29	12	17	5.0
BH809	0.20 - 0.60	CLAY	25	14	11	3.0

TABLE 4 - SUMMARY OF SHRINK / SWELL TESTING RESULTS

Location	Depth (m)	Material Description	I _{ss} (%)									
	Current Investigation (November 2017)											
TP605	0.70 – 1.00	(CH) CLAY - Residual	2.7									
TP606	0.65 – 0.80	(CH) CLAY - Residual	3.0									
TP901	1.00 – 1.30	(CH) Sandy CLAY - Residual	3.3									
TP902	0.80 – 0.95	(CH) CLAY - Residual	4.8									
	Previous	Investigations (June 2016 & August 2017)										
TP5-5	0.40 - 0.80	(CH) Sandy CLAY- Fill	0.9									
TP5-7	0.50 - 0.80	(CH) Sandy CLAY- Fill	2.0									
TP5-8	0.40 - 0.80	(CH) Sandy CLAY- Fill	2.0									
TP206	0.55 - 0.70	(CI) Sandy CLAY- Residual	2.1									
TP208	0.50 - 0.90	(CI) Sandy CLAY - Residual	1.5									
TP210	0.50 - 0.65	(CL) Sandy CLAY- Residual	0.6									
TP212	0.60 - 0.76	(CL) Sandy CLAY- Residual	0.7									

6.0 Site Classification to AS2870-2011

Based on the results of the field work, laboratory testing, and Level 1 site supervision and testing carried out, residential lots located within the proposed Stages 6 and 9 of the Billy's Lookout subdivision located Fishermans Drive, Teralba, as shown on Figure AJ1, are classified in their current condition in accordance with AS2870-2011 'Residential Slabs and Footings', as shown in Table 5.

TABLE 5 - SITE CLASSIFICATION TO AS2870-2011

Stage	Lot Numbers	Site Classification	Estimated Characteristic Free Surface Movement
4	607 to 614	M	20mm to 40mm
6	601 to 606	Н1	40mm to 60mm
9	901 to 917, 922 to 926	M	20mm to 40mm
7	918 to 921	Н1	40mm to 60mm

Characteristic free surface movements have been estimated for lots in their existing condition as shown in Table 5.

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 residual clayey soils or rock below all non-controlled fill, topsoil material and root zones, and fill under slab panels meets the requirements of AS2870-2011, in particular, the root zone must be removed prior to the placement of fill materials beneath slabs.
- The performance expectations set out in Appendix B of AS2870-2011 are acceptable, and that site foundation maintenance is undertaken to avoid extremes of wetting and drying.
- Footings are to be founded outside of or below all zones of influence resulting from existing or future service trenches.
- The constructional and architectural requirements for reactive clay sites set out in AS2870-2011 are followed.
- Adherence to the detailing requirement outlined in Section 5 of AS2870-2011 'Residential Slabs and Footings' is essential, in particular Section 5.6, 'Additional requirements for Classes M, H1, H2 and E sites' including architectural restrictions, plumbing and drainage requirements.
- Site maintenance complies with the provisions of CSIRO Sheet BTF 18, "Foundation Maintenance and Footing Performance: A Homeowner's Guide", a copy of which is attached in Appendix C.

All structural elements on all lots 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

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.

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

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

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

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

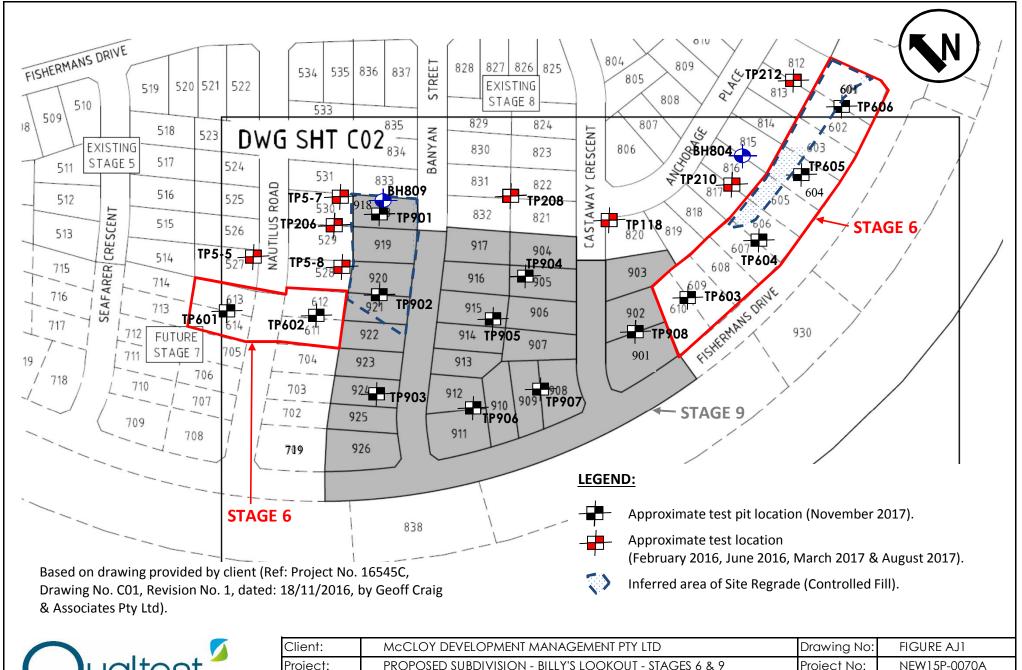
For and on behalf of Qualtest Laboratory (NSW) Pty Ltd.

Jason Lee

Principal Geotechnical Engineer

FIGURES:

Figure AJ1 –Approximate Test Location Plan





Client:	McCloy Development Management PTY LTD	Drawing No:	FIGURE AJ1
Project:	PROPOSED SUBDIVISION - BILLY'S LOOKOUT - STAGES 6 & 9	Project No:	NEW15P-0070A
Location:	FISHERMANS DRIVE, TERALBA	Scale:	NOT TO SCALE
Title:	APPROXIMATE TEST PIT LOCATION PLAN	Date:	15-11-2017

APPENDIX A:

Engineering Logs of Test Pits



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

PAGE: 1 OF 1 **JOB NO:** NEW15P-0070A

TP601

TEST PIT NO:

LOGGED BY: BE **DATE:** 24/10/17

		IENT TYPI		2.5 TO 1.5 m		IDTH:		SURFACE RL: DATUM:					
	Dril	ling and San	npling				Material description and profile	information		1	Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil t characteristics,colour,mind		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additiona observations
ш	Not Encountered			_		SM	TOPSOIL: Silty SAND - fine to fines of low plasticity, root affe	coarse grained, grey, cted.	D				TOPSOIL
	Not	0.25m D		_	<u> { } </u>		SANDSTONE - fine to coarse pale grey, estimated medium s	grained, red-brown and strength.	-				HIGHLY WEATHERED ROCK
		.0.35m ,		_			Hole Terminated at 0.35 m Practical Refusal						
				0.5			Tradition Political						
				_									
				-									
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LEG	END:			Notes, Sar	nples an	d Tests		Consiste	encv		U	CS (kPa	Moisture Condition
Wat	<u>er</u>	or Love		U ₅₀ CBR	50mm	Diame	ter tube sample for CBR testing	VS	Very Soft Soft	:	<2	25 5 - 50	D Dry M Moist
_	(Dat	er Level e and time sh	1	E	Enviro (Glass	nmenta jar, se	l sample aled and chilled on site)	St	Firm Stiff		10) - 100)0 - 200	P P
_	l Wat	er Inflow er Outflow		ASS	(Plasti	c bag,	Soil Sample air expelled, chilled)	н	Very Stiff Hard			00 - 400 400	W _L Liquid Limit
<u>Stra</u>		radational or		B Field Tests PID	<u> </u>	Sample	on detector reading (ppm)	Fb Density	Friable V L		ery Lo	oose	Density Index <15% Density Index 15 - 35%
	_ D	ansitional stra efinitive or dis		DCP(x-y) HP	Dynan	nic pen	on detector reading (ppm) etrometer test (test depth interval shown meter test (UCS kPa))	ME D) M		n Dense	
	st	rata change			· iand	5.700			VE		ery De	ense	Density Index 85 - 100%



McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: **TP602**

PAGE: 1 OF 1

JOB NO: NEW15P-0070A

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LOGGED BY:

									DA	TE:		24/10/17
		IENT TYPE					VATOR SURFAC					
TE		IT LENGTH		1.5 m	W	IDTH:		l:				T
-	Dri	ling and Sam	npling			I	Material description and profile information				Field Te	st
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/pacharacteristics,colour,minor components	article	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Structure and additional observations
ш	Not Encountered	0.20m		-		SM	o.05m FILL: TREE MULCH FILL: TOPSOIL- Silty SAND - fine to coarse gr dark grey, fines of low plasticity, with some fine medium grained sub-angular to sub-rounded groot affected.	e to	M			FILL - MULCH FILL - TOPSOIL
	Not	0.25m D		_		SP	0.25m Clayey SAND - fine to coarse grained, orange-		D)	D		RESIDUAL SOIL / POSSIBLE COLLUVIUM
				- 0. <u>5</u> - -			and pale grey-white, trace fine to medium grair sub-angular to sub-rounded gravel. SANDSTONE - fine to coarse grained, pale orange-brown and pale grey-white, estimated r to high strength. Hole Terminated at 0.27 m Practical Refusal					HIGHLY WEATHERED ROCK
U. Datger Lab and in Situ. i ou				1.0_ -								
STAGES & & 9.GFJ <cd awngfile="">> 15/17/2017 12/04 10.0.000 Datgel Lab and IN SIGN TOO</cd>				- 1. <u>5</u> - - - 2.0								
NON-CORED BOREHOI	Wa (Da	ter Level te and time sh ter Inflow ter Outflow	hown)	Notes, Sar U ₅₀ CBR E ASS	50mm Bulk s Enviro (Glass Acid s (Plast Bulk s	n Diame sample onmenta s jar, se Sulfate	eter tube sample for CBR testing al sample saled and chilled on site) Soil Sample air expelled, chilled)	S S F Fi St S VSt V H H Fb Fi	ery Soft oft rm tiff ery Stiff ard riable		UCS (I <25 25 - 50 50 - 11 100 - 2 200 - 2 >400	D Dry M Moist D W Wet D W _p Plastic Limit D W _L Liquid Limit
LIB1.1.GLB	tr D	radational or ansitional stra efinitive or dis rata change		PID DCP(x-y) HP	Photo Dynar	nic pen	ion detector reading (ppm) netrometer test (test depth interval shown) ometer test (UCS kPa)	<u>Density</u>	V L MD D	Lo M D	ery Loose oose ledium De ense	Density Index <15% Density Index 15 - 35% nse Density Index 35 - 65% Density Index 65 - 85% Density Index 95 - 100%



ENGINEERING LOG - TEST PIT

McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP603

PAGE: 1 OF 1

JOB NO: NEW15P-0070A

ΒE

LOGGED BY:

VD

Density Index 85 - 100%

	DATE:							24/10/17				
		MENT TYPI						ACE RL:				
TE		IT LENGT		1.5 m	W	IDTH:	0.5 m DATU	IM:			ı	T
-	Dri	lling and San	npling			I	Material description and profile information				Field Tes	<u>t</u>
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity characteristics, colour, minor components		MOISTURE	CONSISTENCY DENSITY	Test Type Result	Structure and additional observations
						SM	TOPSOIL: Silty SAND - fine to coarse graine grey-brown, fines of low plasticity, root affect	ed, ted	М			TOPSOIL
	Encountered			-	1(11(1	SP	SAND - fine to coarse grained, grey-brown, some silt.	:	D	D		COLLUVIUM
Ш	Not Enc	0.50m D 0.70m		0.5_		CL	Sandy CLAY - low to medium plasticity, orange-brown and pale grey, fine to coarse sand.	grained	M < W _P	VSt	HP 320	RESIDUAL SOIL
		J. 7 JIII		-	<i>7.7.7.7.7.</i> : : : : : :		SANDSTONE - fine to coarse grained, pale SANDSTONE - fine to coarse grained, pale orange-brown and pale grey, estimated med strength.	_	D			HIGHLY WEATHERED ROCK
21 LIB 11.GLB LOG NON-CORELD BOREHOLE - TEST PIT NEWTSP-0070A LOGS - STAGES 6 & 9.GFJ <				1.0_ - - 1.5_ - - 2.0_			Hole Terminated at 0.80 m Practical Refusal					
LE Was Str	(Da (Da Wa ⊲ Wa rata Cha tr	ter Level te and time sl ter Inflow ter Outflow	ata	Motes, Sar U ₅₀ CBR E ASS B Field Tests PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid s (Plast Bulk s Photo Dynar	n Diame sample to primenta si jar, sei Sulfate Si ic bag, a Sample sionisationic peno	ter tube sample or CBR testing I sample alled 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 V H H	dery Soft for Soft for Soft for Stiff for Stiff for Stiff for Stiff for Stiff L MC D	V Lo M	UCS (KF <25 25 - 50 50 - 100 100 - 20 200 - 40 >400 ery Loose edium Dense ense	D Dry M Moist W Wet D W _p Plastic Limit W Liquid Limit Density Index <15% Density Index 15 - 35%



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP604

PAGE: 1 OF 1

JOB NO: NEW15P-0070A

RF

DATE: 24/10/17

LOGGED BY:

EQUIPMENT TYPE: 2.5 TONNE EXCAVATOR SURFACE RL: **TEST PIT LENGTH:** WIDTH: 1.5 m $0.5 \, m$ DATUM: Drilling and Sampling Field Test Material description and profile information CLASSIFICATION SYMBOL CONSISTENCY DENSITY MOISTURE CONDITION GRAPHIC LOG Test Type Structure and additional METHOD Result RL DEPTH MATERIAL DESCRIPTION: Soil type, plasticity/particle SAMPLES (m) (m) characteristics, colour, minor components FILL: MULCH М 0.03m FILL: TREE MULCH SLOPE WASH / TOPSOIL Silty SAND - fine to coarse grained, grey, fines of low SM plasticity. Clayey SAND - fine to coarse grained, orange-brown to brown, fines of medium plasticity. RESIDUAL SOIL / POSSIBLE 0.20m **COLLUVIUM** D D D 0.40mSandy CLAY - medium to high plasticity, red-brown and grey, fine to coarse grained sand, with fine to RESIDUAL SOIL Encountered 0.70m HP >600 medium grained sub-angular gravel. ш D CH Н Š ş 0.90m HP >600 10.0.000 Datgel Lab and In Situ Tool EXTREMELY WEATHERED Extremely Weathered SANDSTONE with Soil ROCK Properties; breaks down into Sandy CLAY - medium plasticity, red-brown and grey, fine to coarse grained sand, with fine to medium grained sub-angular gravel. D - M VD 15/11/2017 12:04 Hole Terminated at 1.60 m STAGES 6 & 9.GPJ <<DrawingFile>> Slow progress 2.0 TEST PIT NEW15P-0070A LOGS -LEGEND: Notes, Samples and Tests UCS (kPa) **Moisture Condition** Consistency Very Soft 50mm Diameter tube sample VS <25 D Drv Water CBR Bulk sample for CBR testing 25 - 50 S Soft M Moist Water Level Ε Environmental sample F Firm 50 - 100 W Wet (Date and time shown) (Glass jar, sealed and chilled on site) Plastic Limit St Stiff 100 - 200W. Water Inflow Acid Sulfate Soil Sample ASS 200 - 400 Liquid Limit VSt Very Stiff W, (Plastic bag, air expelled, chilled) ■ Water Outflow Н Hard >400 В **Bulk Sample** Fb Friable Strata Changes S_i Field Tests **Density** Very Loose Density Index <15% Gradational or PID Photoionisation detector reading (ppm) Loose Density Index 15 - 35% transitional strata DCP(x-y) Dynamic penetrometer test (test depth interval shown) MD Medium Dense Density Index 35 - 65% Definitive or distict ΗP Hand Penetrometer test (UCS kPa) D Dense Density Index 65 - 85% strata change VD Density Index 85 - 100%



DCP(x-y)

ΗP

Definitive or distict

strata change

Dynamic penetrometer test (test depth interval shown)

Hand Penetrometer test (UCS kPa)

ENGINEERING LOG - TEST PIT

McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TP605 TEST PIT NO:

PAGE: 1 OF 1

LOGGED BY:

MD

D

VD

Medium Dense

Dense

Very Den

Density Index 35 - 65%

Density Index 65 - 85%

Density Index 85 - 100%

JOB NO: NEW15P-0070A

RF

DATE: 24/10/17 **EQUIPMENT TYPE:** 2.5 TONNE EXCAVATOR SURFACE RL: **TEST PIT LENGTH:** WIDTH: 1.5 m $0.5 \, m$ DATUM: Drilling and Sampling Material description and profile information Field Test CLASSIFICATION SYMBOL CONSISTENCY DENSITY MOISTURE CONDITION GRAPHIC LOG Test Type Structure and additional METHOD Result RL DEPTH MATERIAL DESCRIPTION: Soil type, plasticity/particle SAMPLES (m) (m) characteristics, colour, minor components FILL - MULCH \ FILL: TREE MULCH MD FILL - TOPSOIL FILL: TOPSOIL - Clayey SAND - fine to coarse SC grained, dark grey-brown, fines of low to medium plasticity, trace fine to medium grained sub-angular to D CONTROLLED FILL \sub-rounded gravel. 120 ΗP CI St FILL: Sandy CLAY - medium plasticity, orange-brown with some dark-orange and pale grey-white, fine to RESIDUAL SOIL coarse grained sand, with some fine to medium grained sub-angular to sub-rounded gravel. ΗP 360 CLAY - high plasticity, orange-brown to orange and grey to pale grey, with some fine to medium grained 0.5 HP 320 0.70m HP 320 Becoming pale orange-brown and pale grey-white. Encountered U50 VSt 1.00m STAGES 6 & 9.GPJ <<DrawingFile>> 15/11/2017 12:04 10.0.000 Datgel Lab and In Situ Tool ğ HP 320 CH ΗP 270 ΗP 420 380 HP 420 HP 380 VSt Н HP 420 Hole Terminated at 2.00 m TEST PIT NEW15P-0070A LOGS -LEGEND: Notes, Samples and Tests UCS (kPa) **Moisture Condition** Consistency Very Soft 50mm Diameter tube sample VS <25 D Drv Water CBR Bulk sample for CBR testing 25 - 50 Moist S Soft M Water Level Ε Environmental sample F Firm 50 - 100 W Wet (Date and time shown) (Glass jar, sealed and chilled on site) Plastic Limit St Stiff 100 - 200W. Water Inflow Acid Sulfate Soil Sample ASS Very Stiff 200 - 400 Liquid Limit VSt W, (Plastic bag, air expelled, chilled) ■ Water Outflow Н Hard >400 В **Bulk Sample** Fb Friable Strata Changes S_i Field Tests **Density** Very Loose Density Index <15% Gradational or LIB 1.1.GLB PID Photoionisation detector reading (ppm) Loose Density Index 15 - 35% transitional strata



McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

PAGE: 1 OF 1 JOB NO: NEW15P-0070A

TP606

TEST PIT NO:

LOGGED BY: BE DATE: 24/10/17

		IENT TYPI		2.5 TC 1.5 m		EXCA\ IDTH :		RFACE RL:	:				
F		ling and San		1.0 111	VV	וחום:	Material description and profile information	TUM:			Fiol	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plastic characteristics,colour,minor compone		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
		0.65m		- - 0.5_		SC SP	D.04m FILL: TREE MULCH FILL-TOPSOIL: Clayey SAND - fine to co grained, grey to grey-brown, fines of low the plasticity, trace fine to medium grained sure to sub-angular gravel, trace rootlets. D.40m SAND - fine to coarse grained, grey. CLAY - high plasticity, orange-brown with	o medium b-rounded	M	MD - D			FILL - MULCH FILL: TOPSOIL COLLUVIUM RESIDUAL SOIL
-DrawingFile>> 15/11/2017 12:04 10.0,000 Datget Lab and In Situ Tool	Not Encountered	U50 0.80m		1.0_ -		CH	becoming orange-brown to dark orange we pale grey-white. Increasing in sand conte	vith some nt.	W _P M > W _P	VSt	HP HP HP	300 390 420 420	
V				1. <u>5</u> 2.0		CH	1.70m SANDSTONE - fine to coarse grained, pa grey-white and pale orange, estimated hig Hole Terminated at 1.72 m Practical Refusal	le gh strength.	×	D			HIGHLY WEATHERED //ROCK
NON-CORED BOREHOI	✓ Wa (Da — Wa ■ Wa ata Cha — G tri — D	ter Level te and time sl ter Inflow ter Outflow	hown)	Notes, Sar U ₅₀ CBR E ASS B Field Teste PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid S (Plast Bulk S Photo Dynar	Diame ample inmenta igar, se Gulfate S ic bag, a cample ionisationic pen	eter tube sample for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F St S VSt S	Very Soft Soft Firm Stiff Very Stiff Hard Friable V L MC D VD	V Lc D M	25 50 10 20 >2 ery Lo	n Dense	D Dry M Moist W Wet W _p Plastic Limit W _L Liquid Limit Density Index <15% Density Index 15 - 35%



McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: **TP901**

PAGE: 1 OF 1

JOB NO: NEW15P-0070A

BE

LOGGED BY:

									DA	TE:			24/10/17
		ENT TYPE					/ATOR SURFACE	RL:					
TE		IT LENGTI		1.5 m	W	IDTH:					I		
	Dril	ling and San	npling	<u> </u>		7	Material description and profile information	I			Field	l Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/partic characteristics,colour,minor components	cle	MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
		0.40					0.05m FILL: TREE MULCH						FILL - MULCH FILL: TOPSOIL
		0.10m D (0.20m		_		sc	FILL: TOPSOIL - Clayey SAND - fine to coarse grained, dark grey, fines of low to medium plasticit with some fine to medium grained sub-angular to 0.20m sub-rounded gravel.	y,	М				
				- 0. <u>5</u> - -		CL	FILL: Sandy CLAY - low to medium plasticity, orange-brown and pale grey, fine to coarse graine sand, trace fine to coarse grained sub-angular gra trace cobbles.			VSt			CONTROLLED FILL
	terec			-			Sandy CLAY - medium to high plasticity,						RESIDUAL SOIL
3	Encountered	1.00m		1.0_			orange-brown with some grey, fine to coarse grain sand.	ed			HP	250	
Ш	Not En			_					W _P		HP	280	
20 20 20 20 20 20 20 20 20 20 20 20 20 2	z	U50							× × ×				
alge E		1 20m							_				
CLIBITICE LOG NON-CORED BORRENCE: TEST PIT NEWTON-OWALCOS: -STAGES & 8.5.57 K-CHARMIGNES TOTTIZOT 12.04 TOUCOU DAGGE LAD AND TOUCOU DAG		1.30m		- 1.5_ - - - 2.0_		CH	Becoming pale grey and red-brown.			Н	HP	480	
							Hole Terminated at 2.10 m						
LEC War Strain Strain	Wa (Da - Wa	ter Level te and time sh ter Inflow ter Outflow	hown)	Notes, Sar U ₅₀ CBR E ASS	50mm Bulk s Enviro (Glass Acid S (Plast	n Diame sample f onmenta s jar, se Sulfate S	ter tube sample VS for CBR testing Is sample Stelled and chilled on site) Soil Sample VStelled, chilled) Fb	Soi Firi Stii Vei Ha	ry Soft ft m ff ry Stiff		25 50 100	- 50 - 100 0 - 200 0 - 400	D Dry M Moist W Wet W _p Plastic Limit
	G tr: D	radational or ansitional stra efinitive or dis rata change		Field Tests PID DCP(x-y) HP	Photo Dynar	ionisationis	Dense		V L MD D VD	M D	ery Loo oose ledium ense ery De	Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

JOB NO: NEW15P-0070A LOGGED BY: BE

TP902

1 OF 1

TEST PIT NO:

PAGE:

DATE: 24/10/17

		ENT TYPE						FACE RL:					
-		IT LENGTI		1.5 m	VV	IDTH:		UIVI:			Eigl	d Toot	
	Dril	ling and San	ipiing			Z	Material description and profile information				riel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plastic characteristics,colour,minor compone		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
	ountered			- - - 0.5_		SC CI	FILL: TREE MULCH	plasticity, ular to ange-brown , trace fine n clayey	M ~ W _p - M > W _p	Н	HP	420 - >600	FILL - MULCH FILL - TOPSOIL CONTROLLED FILL
ш	Not Encountered	0.80m U50 0.95m		-		СН			M > W _P	St	HP HP HP	180 180 150 150 220	
itgel Lab and In Situ Tool				1.0_ _			SANDSTONE - fine to coarse grained, ora to red-brown and pale grey, estimated hig Iron stained in places. Hole Terminated at 1.20 m	nge-brown n strength.	D	VSt	HP	250	HIGHLY WEATHERED ROCK
OT LIB 11.1GLB Log NON-CORED BOREHOLE - TEST PIT NEWISP-0070A LOGS - STAGES 6 & 9.GPJ < <drawngfile>> 15/11/2017 12/04 10.0,000 Datget Lab and in Situ Tool</drawngfile>	GEND:			1.5	mples an	d Test	Very slow progress	Consiste	ncv		The state of the s	CS (kPa) Moisture Condition
OT LIB 11.GLB Log NON-CORED BOREHOLE Stra	ter Wa (Da Wa Wa Wa tra Cha	ter Level te and time si ter Inflow ter Outflow anges radational or ansitional stra efinitive or dis rata change	nown)	Notes, Sar U ₅₀ CBR E ASS B Field Tests PID DCP(x-y) HP	50mm Bulk s Enviro (Glass Acid S (Plasti Bulk S Photo Dynar	Diame ample nmenta jar, se culfate s c bag, ample onisationic pen	eter tube sample for CBR testing al sample saled and chilled on site) Soil Sample air expelled, chilled)	VS VS S S S S S S S S S S S S S S S S S	very Soft Soft Firm Stiff Very Stiff Hard Friable V L MD D VD	Lo M D	25 50 10 20 >2 ery Lo	25 5 - 50 0 - 100 00 - 200 00 - 400 400 pose n Dense	D Dry M Moist W Wet W, Plastic Limit Liquid Limit Density Index < 15% Density Index 15 - 35%



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

PAGE: 1 OF 1

TEST PIT NO:

JOB NO: NEW15P-0070A

TP903

LOGGED BY: BE **DATE:** 24/10/17

TE	ST P	IT LENGTH	ł:	1.5 m	W	IDTH:	0.5 m DATU	IM:					
	Dril	ling 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, plasticity characteristics,colour,minor component		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
Э	Not Encountered			-		SC	0.05m FILL: TREE MULCH FILL-TOPSOIL: Clayey SAND - fine to coars grained, dark grey, fines of low to medium p with some fine to medium grained sub-angu sub-rounded gravel.	lasticity,	M - M				FILL - MULCH FILL - TOPSOIL
				1.5			SANDSTONE - fine to coarse grained, pale orange-brown and pale grey-white, estimate to high strength. Hole Terminated at 0.25 m Practical Refusal	d medium	D	VD			HIGHLY WEATHERED
LE Wa		ter Level	-	Notes, San U ₅₀ CBR	50mm	Diame	ter tube sample for CBR testing	s s	ery Soft		<2 25	5 - 50) Moisture Condition D Dry M Moist
	(Dat	te and time sh ter Inflow ter Outflow		E ASS B	(Glass Acid S (Plasti Bulk S	jar, se sulfate s	il sample aled and chilled on site) Soil Sample air expelled, chilled)	St S VSt V H H Fb F	irm Stiff Yery Stiff lard Triable		10 20 >4	0 - 100 00 - 200 00 - 400 100	W _L Liquid Limit
<u>Str</u>	tra De	radational or ansitional strat efinitive or dist rata change	ta	Field Tests 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 MD D VD	Lo D D	ery Lo pose 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%



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP904

PAGE: 1 OF 1

JOB NO: NEW15P-0070A

ΒE

DATE: 24/10/17

LOGGED BY:

TES	ST P	IT LENGTH	-: 1:	1.5 m		IDTH:		JM:					
	Dril	ling 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 component		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
	Encountered			-		sc	FILL-MULCH: TREE MULCH. FILL-TOPSOIL: Clayey SAND - fine to coar grained, dark grey-brown, fines of low to me plasticity, with fine to medium grained sub-a	edium	M - M				FILL - MULCH FILL: TOPSOIL
ш	Not Enc	D 0.30m			XXXX / : / . / : / .	SC	gravel. Extremely Weathered SANDSTONE with so 9.30m properties; breaks down into Clayey SAND	<i></i> oil	D	D			EXTREMELY WEATHERE ROCK
		0.30111					coarse grained, pale grey-white and orange 0.40m SANDSTONE - fine to coarse grained, pale grey-white and orange-brown to orange, es	e-brown.		VD			HIGHLY WEATHERED ROCK
				0.5_			low to medium strength. Hole Terminated at 0.40 m	limated					
				-			Very slow progress						
				_									
				-									
				1.0_									
				-									
				_									
				-									
				1. <u>5</u>									
				-									
				-									
				2.0_									
				-									
				_									
	END:		[7	Notes, San			ter tube sample	Consiste VS \	ncy /ery Soft		_	CS (kPa 25	Moisture Condition D Dry
Wate	_	ter Level		CBR			for CBR testing	s s	oft		25	5 - 50	M Moist
-		ter Lever te and time sh	nown)	Е			ll sample		irm) - 100	W Wet
-	Wa	ter Inflow	1	ASS	Acid S	Sulfate S	aled and chilled on site) Soil Sample	VSt \	Stiff /ery Stiff		20	00 - 200 00 - 400	P
-√		ter Outflow		В		c bag, a Sample	air expelled, chilled)		lard riable		>4	100	
otra	ta Cha G	anges radational or		Field Tests	<u> </u>			Density	V		ery Lo	ose	Density Index <15%
	tra	ansitional strat		PID			on detector reading (ppm)		L ME		oose Iediun	n Dona	Density Index 15 - 35%
		efinitive or dist	tict	DCP(x-y) HP	-		etrometer test (test depth interval shown) ometer test (UCS kPa)		ME D		lediun ense	n Dense	Density Index 35 - 65% Density Index 65 - 85%
	st	rata change		<u> </u>					VE		ery De	ense	Density Index 85 - 100%



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP905

PAGE: 1 OF 1

LOGGED BY:

JOB NO: NEW15P-0070A

ΒE

DATE: 24/10/17

		IENT TYPI IT LENGTI		1.5 m		IDTH:		ACE RL: JM:					
	Dril	ling and San	npling	1			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		MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		sc	On FILL: TREE MULCH FILL-TOPSOIL: Clayey SAND - fine to coar grained, dark grey, fines of low to medium put with some fine to medium grained sub-angusub-rounded gravel.	lasticity,	M - W				FILL - MULCH FILL - TOPSOIL
Ш	Not Encountered	0.40m D		0.5		SC	Clayey SAND - fine to coarse grained, oran and pale grey, fines of low to medium plasti weakly cemented, with some fine to mediun sub-angular to sub-rounded gravel.	city,	М	D			COLLUVIUM
	Not E	(0.50m (0.60m		-			Sandy CLAY - low to medium plasticity, orange-brown with some pale grey, fine to c grained sand.	coarse	W _P				RESIDUAL SOIL
		D 0.80m		-		CL	0.90m		×	Н	HP	>600	
				1.0_			0.95m SANDSTONE - fine to coarse grained, pale orange-brown and pale grey-white, estimate to high strength. Hole Terminated at 0.95 m	ed medium	D	VD			HIGHLY WEATHERED NOCK
argel Lab and III or				_			Practical Refusal						
Sandamiigmean 1971 (2017 12.04 10.0.000 Daigei Lab aiu III siu 1001				1.5									
19711761 77911				-									
				-									
00 - 01 AGEG C G				2.0_									
W 191-00 A CO				-									
150	SEND:			Notes, Sar	mnloe a	d Toots		Consister	CV.		114	CS (kPa	a) Moisture Condition
Wat	er Wai (Dai Wai	ter Outflow	hown)	U₅ CBR E ASS	50mm Bulk s Enviro (Glass Acid S (Plasti	Diame ample nmenta jar, se sulfate s c bag,	ter tube sample for CBR testing il sample aled and chilled on site) Soil Sample air expelled, chilled)	S So F Fin St St VSt Ve H Ha	ery Soft oft rm iff ery Stiff ard		25 50 10 20	25 (KPa 25 5 - 50 0 - 100 00 - 200 00 - 400	D Dry M Moist W Wet W _p Plastic Limit
Stra	Water Inflow Water Outflow trata Changes Gradational or transitional strata Definitive or distict strata change			B Field Tests 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 Fr Density	iable V L MD D VD	Lo M D	ery Lo oose ediun ense ery De	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP906

PAGE: 1 OF 1

JOB NO: NEW15P-0070A

ΒE

DATE: 24/10/17

LOGGED BY:

	ST P	IT LENGTH		1.5 m		DTH:	0.5 m DATU	JM:					
	Dril	ling and Sam	npling				Material description and profile information				Field	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity characteristics,colour,minor component		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
ш	Not Encountered	0.10m D 0.20m		_		sc	FILL: TREE MULCH FILL-TOPSOIL: Clayey SAND - fine to coar grained, dark grey, fines of low to medium p with some fine to medium grained sub-angu sub-rounded gravel. 0.30m SANDSTONE - fine to medium grained, pale	lasticity, lar to	D - M	D - VD			FILL - MULCH FILL - TOPSOIL HIGHLY WEATHERED
				1.5_			o.30m SANDSTONE - fine to medium grained, pali orange-brown and pale grey-white, estimate to high strength. Hole Terminated at 0.30 m Practical Refusal						ROCK
Wat	Wat (Dat Wat Wat		nown)	Notes, Sar U ₅₀ CBR E ASS	50mm Bulk s Enviro (Glass Acid S	Diame ample f nmenta jar, se ulfate s c bag, a	ter tube sample for CBR testing il sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt V	ncy /ery Soft Soft Firm Stiff /ery Stiff lard		25 50 10 20	CS (kPa) 25 5 - 50 0 - 100 00 - 200 00 - 400	D Dry M Moist W Wet W _p Plastic Limit
Stra	■ Water Outflow rata Changes Gradational or transitional strata Definitive or distict strata change			Field Tests PID DCP(x-y) HP	Photoi Dynam	onisatio	on detector reading (ppm) etrometer test (test depth interval shown) emeter test (UCS kPa)	<u>Density</u>	V L MC D VD	Lo M De	ery Lo oose ediun ense ery De	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

JOB NO: NEW15P-0070A

TEST PIT NO:

LOGGED BY:

PAGE:

TP907

1 OF 1

ΒE

DATE: 24/10/17

PIT LENGTH Orilling and Sam SAMPLES 0.10m D 0.30m			CLASSIFICATION SYMBOL SYMBOL	Material description and profile information MATERIAL DESCRIPTION: Soil type, plastici characteristics, colour, minor componer FILL-TOPSOIL: Clayey SAND - fine to coa grained, dark grey-brown, fines of low to m plasticity, with some fine to medium graine sub-angular to sub-rounded gravel. 0.35m O.40m Sandy CLAY - low to medium plasticity, pa orange-brown and pale grey, with fine to no	ry/particle ts rse edium d	Moisture Condition	CONSISTENCY DENSITY	Test Type	Sesult Result	Structure and additional observations FILL - TOPSOIL
SAMPLES 0.10m D	RL DEPTH (m) (m)	GRAPHIC	sc	MATERIAL DESCRIPTION: Soil type, plastici characteristics, colour, minor componer FILL-TOPSOIL: Clayey SAND - fine to coa grained, dark grey-brown, fines of low to m plasticity, with some fine to medium graine sub-angular to sub-rounded gravel. 0.35m O.40m Sandy CLAY - low to medium plasticity, pa orange-brown and pale grey, with fine to no	rse edium d	М	CONSISTENCY DENSITY			observations
0.10m	(m) (m) -	GRAPHIC LOG	sc	characteristics, colour, minor componer FILL-TOPSOIL: Clayey SAND - fine to coa grained, dark grey-brown, fines of low to m plasticity, with some fine to medium graine sub-angular to sub-rounded gravel. 0.35m O.40m Sandy CLAY - low to medium plasticity, pa orange-brown and pale grey, with fine to n	rse edium d	М	CONSISTENCY DENSITY	Test Type	Result	observations
D	0.5		sc	grained, dark grey-brown, fines of low to m plasticity, with some fine to medium graine sub-angular to sub-rounded gravel. 0.35m O.40m Sandy CLAY - low to medium plasticity, pa orange-brown and pale grey, with fine to n	edium d le					FILL - TOPSOIL
2	0. <u>5</u>			l \arained eub_angular gravel (Siltetone fragn	nedium /	Λ Σ	VSt	HP	300	RESIDUAL SOIL HIGHLY WEATHERED ROCK
				\grained sub-angular gravel (Siltstone fragn Sandy SILTSTONE - pale orange-brown to pale grey, estimated medium strength with weathered pockets. Becoming less weathered.	brown and	D - M				ROCK
	10			Hole Terminated at 0.90 m Practical Refusal						
	1.0									
	-									
		_								
	-	_								
	1.5_									
	-									
	2.0_									
]								
	-	_								
		-								
D:	U ₅₀	50mm	Diame	ter tube sample	VS V	ery Soft		<2	25	Moisture Condition D Dry
Vater Level Date and time sh Vater Inflow Vater Outflow	hown) CBR E ASS	Enviro (Glass Acid S	nmenta jar, se sulfate S	al sample aled and chilled on site) Soil Sample	F Fi St S VSt V	irm tiff ery Stiff		50 10 20) - 100)0 - 200)0 - 400	P
<u>Changes</u>	B Field Test	Bulk S	_	· · · · · · · · · · · · · · · · · · ·	Fb F	riable	1/-			Density Index <15%
Definitive or dist	PID DCP(x v)	Photoi Dynan	nic pen	etrometer test (test depth interval shown)	Delially	L	Lo M	oose lediun		Density Index 15 - 35%
v D v z	ater Level ate and time si ater Inflow ater Outflow hanges Gradational or transitional stra	2.0_ Notes, Sa Uso CBR E ater Level ate and time shown) ater Inflow ater Outflow hanges Gradational or transitional strata Definitive or distict	2.0 2.0 2.0 2.0 2.0 2.0 2.0 2.0	2.0 Notes, Samples and Tests 2.0 2.0 2.0 Notes, Samples and Tests U ₅₀ 50mm Diame CBR Bulk sample in Environmenta (Glass jar, se and test) E environmenta (Glass jar, se and test)	Hole Terminated at 0.90 m Practical Refusal 1.5 1.5 2.0 2.0 2.0 3.5 form Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample (Glass jar, sealed and chilled on site) ASS Acid Sulfate Soil Sample ater Outflow that of the control of t	Hole Terminated at 0.90 m Practical Refusal 1.5 1.5 2.0 2.0 2.0 2.0 3 Somm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample (Glass jar, sealed and chilled on site) Set S S Environmental sample (Glass jar, sealed and chilled on site) Set S S S S F F F S Cadational or ransitional strata Definitive or distict Bulk Sample Plop Photoionisation detector reading (ppm) Deprixy Departity Density Density Density Density Density Density Density Density Density	Notes, Samples and Tests 1.5 2.0 2.0 Notes, Samples and Tests Uso Somm Diameter tube sample ater Level ate and time shown) ater Inflow ater Cutflow harmings Gradational or transitional strata Diameter State Soil Sample (Plastic bag, air expelled, chilled) B B Bulk Sample (Plastic bag, air expelled, chilled) B B Bulk Sample Photoionisation detector reading (ppm) DCP(Kyy) Dimamic penetrometer test (test depth interval shown) Level Reverse to the sample (pm) DCP(Kyy) Dimamic penetrometer test (test depth interval shown) Level Reverse to the sample (pm) DCP(Kyy) Dimamic penetrometer test (test depth interval shown) Level Reverse to the sample (pm) DCP(Kyy) Dimamic penetrometer test (test depth interval shown) Level Reverse to the sample (pm) DCP(Kyy) Dimamic penetrometer test (test depth interval shown)	2.0 1.0 1.0 1.0 1.0 1.0 1.0 1.0	Notes, Samples and Tests 2.0	2.0



CLIENT: McCLOY DEVELOPMENT MANAGEMENT

PROJECT: PROPOSED SUBDIVISION - STAGES 6 & 9

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP908

PAGE: 1 OF 1

LOGGED BY:

JOB NO: NEW15P-0070A

ΒE

DATE: 24/10/17

EQUIPMENT TYPE: 2.5 TONNE EXCAVATOR SURFACE RL:

TEST PIT LENGTH: 1.5 m WIDTH: 0.5 m DATIIM:

TES		T LENGTH		1.5 m	W	IDTH:		UM:			Fiol	d Test	
- 1	ווווט	ing and Sam	ihiiiiA			_	Material description and profile information		I		1 101	u 1621	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plastici characteristics,colour,minor componer		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
	red	D		_		SM	FILL-TOPSOIL: Silty SAND - fine to coarse dark grey-brown, fines of low plasticity, tramedium grained sub-angular to sub-rounde trace cobbles, root affected. Tree mulch in	ce fine to	М				FILL - TOPSOIL
ш	Not Encountered	D 0.40m		_		CI	Sandy CLAY - medium plasticity, orange-b brown, fine to coarse grained sand.	rown to	M × №	Н	HP	>600	RESIDUAL SOIL
	2	0.40m		0.5_	<i>(!//.//./</i>	<u> </u>	SANDSTONE - fine to coarse grained, pale orange-brown and pale grey-white, estimat to high strength.		D		_		HIGHLY WEATHERED ROCK
1							Hole Terminated at 0.60 m Very slow progress						
				_									
				1.0_									
				-									
				-									
				_									
				1.5_									
				_									
				-									
				_									
				2.0_									
				_									
				_									
				-									
LEGI Wate	END:		. !	Notes, Sar			<u>s</u> ster tube sample	Consister VS V	icy ery Soft			 CS (kPa 25	Moisture Condition D Dry
<u>*</u>	– Wat (Dat Wat	er Level e and time sh er Inflow	nown)	CBR E ASS	Enviro (Glass Acid S	nmenta jar, se sulfate s	for CBR testing al sample aled and chilled on site) Soil Sample	F F St S VSt V	oft irm tiff ery Stiff		50 10 20	5 - 50 0 - 100 00 - 200 00 - 400	P P
	a Cha	er Outflow Inges radational or		B Field Tests	Bulk S	c bag, ample	air expelled, chilled)	I	ard riable V	Ve	ery Lo	oose	Density Index <15%
	 tra De	radational or ansitional stra efinitive or dis rata change	ta	PID DCP(x-y) HP	Photoi Dynan	nic pen	on detector reading (ppm) etrometer test (test depth interval shown) ometer test (UCS kPa)		L ME D	Lo M	oose	n Dense	Density Index 15 - 35%



MCCLOY GROUP DEVELOPMENT MANAGEMENT PTPAGE:

PROJECT: PROPOSED SUBDIVISION - STAGES 5 TO 9 JOB NO: NEW15P-0070A

LOCATION: PITT STREET, TERALBA

TEST PIT NO:

LOGGED BY:

TP118

1 OF 1

SJK

DATE: 12-1-16 **EQUIPMENT TYPE:** 22 tonne excavator SURFACE RL: 24.0 m **TEST PIT LENGTH:** 3.0 m WIDTH: 1.5 m DATUM: Assumed Field Test Drilling and Sampling Material description and profile information CLASSIFICATION SYMBOL CONSISTENCY DENSITY MOISTURE CONDITION GRAPHIC LOG Structure and additional **Fest Type** METHOD Result RL DEPTH MATERIAL DESCRIPTION: Soil type, plasticity/particle SAMPLES (m) (m) characteristics, colour, minor components TOPSOIL Silty SAND - fine to coarse grained, brown to grey, fines of low plasticity, root affected. SM M RESIDUAL SOIL 0.40m CLAY - medium plasticity, pale brown to orange with grey and brown to red, some fine to medium grained 23.5 0.5 sand, some tree roots. CI St HP 180 CBR Not Encountered 0.80m Sandy CLAY - medium plasticity, pale grey and brown to red, fine to coarse grained sand. × ΗP 350 VSt `^ **>** 23.0 Some weakly cemented pockets / nodules. CI ΗP 500 10.0.000 Datgel Lab and In Situ Tool 22.5 HIGHLY WEATHERED SANDSTONE - mostly fine to medium grained, pale grey to white and orange, estimated medium to high ROCK М strength becoming high strength. TEST PIT NEW15P-0070 LOGS - STAGES 5 TO 9.GPJ <<DrawingFile>> 10-11-2017 14:32 Hole Terminated at 1.70 m Practical Refusal 22.0 2.0 21.5 2.5 LEGEND: Notes, Samples and Tests UCS (kPa) **Moisture Condition** Consistency Very Soft 50mm Diameter tube sample U. VS <25 D Drv Water CBR Bulk sample for CBR testing S 25 - 50 Soft M Moist Water Level Ε Environmental sample F Firm 50 - 100 W Wet (Date and time shown) (Glass jar, sealed and chilled on site) Plastic Limit St Stiff 100 - 200W. Water Inflow Acid Sulfate Soil Sample Liquid Limit ASS Very Stiff 200 - 400 VSt W, (Plastic bag, air expelled, chilled) ■ Water Outflow Н Hard >400 В **Bulk Sample** Fb Friable Strata Changes 8 Field Tests **Density** Very Loose Density Index <15% Gradational or PID Photoionisation detector reading (ppm) Loose Density Index 15 - 35% transitional strata Medium Dense DCP(x-y) Dynamic penetrometer test (test depth interval shown) MD Density Index 35 - 65% Definitive or distict HP Hand Penetrometer test (UCS kPa) D Dense Density Index 65 - 85% strata change VD Very Den Density Index 85 - 100%



McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 8

LOCATION: FISHERMANS DRIVE, TERALBA

JOB NO: NEW15P - 0070A LOGGED BY: BE

TP206

1 OF 1

TEST PIT NO:

PAGE:

DATE: 13-5-16

EQUIPMENT TYPE: KOBELCO - 5.5 Tonne Excavator SURFACE RL: 28.5 m

		IENT TYPI IT LENGTI		KOBE 2.0 m		5.5 Tc /IDTH:	nne Excavator 0.3 m	SURFACE RL: DATUM:		.8.5 m Assum			
	Dril	ling and San	npling				Material description and profile	information			-	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil characteristics, colour, min		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				_		SM	Silty SAND - fine to medium g affected.	ained, grey, root					TOPSOIL
				- - -		SP	SAND - fine to medium graine	d, grey, trace of silt.	_ D - M	MD -	_		COLLUVIUM
		0.55m	28.0	0.5			Sandy CLAY - medium to high orange brown, fine to medium	plasticity, orange and grained sand.					RESIDUAL SOIL
	pə.	U50 0.70m		- - -							HP	>600	
ш	Not Encountered		27.5	1.0									
	2		<u>-</u>	- · · · - 		CH			M < W _p	н	HP	>600	
			27.0	1.5			Becoming red-brown and grey				HP	>600	
				-			SANDSTONE - fine to mediun plasticity, estimated very low t						EXTREMELY TO HIGHLY WEATHERED ROCK
			20.5	-			Hole Terminated at 1.80 m Very slow progress						
			26. <u>5</u>	2.0_									
				- - -									
			26. <u>0</u>	2.5									
				Notes, Sai				Consiste			_	CS (kPa	·
Wate	LEGEND: Nater Water Level (Date and time s Water Inflow	te and time sl ter Inflow	hown)	U ₅₀ CBR E	Bulk Envir (Glas Acid	sample f onmenta s jar, se Sulfate S	ter tube sample or CBR testing I sample aled and chilled on site) oil Sample	S S F I St S VSt V	Very Soft Soft Firm Stiff Very Stiff		25 50 10 20	25 5 - 50 0 - 100 00 - 200 00 - 400	1 -
◀ Strat	ta Cha G tra	radational or ansitional stra	ata	B Field Test PID DCP(x-y)	Bulk <u>s</u> Photo	Sample pionisatio	air expelled, chilled) on detector reading (ppm) etrometer test (test depth interval shown	Fb I	Hard Friable V L MD	Lo	ery Lo	oose	Density Index <15% Density Index 15 - 35% Density Index 35 - 65%
		efinitive or dis rata change	stict	HP	-		meter test (UCS kPa)		D VD	D	ense ery D		Density Index 35 - 05% Density Index 65 - 85% Density Index 85 - 100%



McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 8

LOCATION: FISHERMANS DRIVE, TERALBA

LOGGED BY: ΒE DATE: 13-5-16

TP208

1 OF 1

NEW15P - 0070A

TEST PIT NO:

PAGE:

JOB NO:

		IENT TYPI IT LENGTI		KOBE 2.0 m		5.5 To I DTH:	onne Excavator 0.3 m	SURFACE RL DATUM:	.: 2	24.0 m	1		
	Dril	ling and San	npling				Material description and profile inform	nation			Fiel	d Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, characteristics,colour,minor cor	plasticity/particle nponents	MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
						SM	Silty SAND - fine to medium grained affected.	i, grey, root	D - M				TOPSOIL
				-		SP	SAND - fine to medium grained, gre yellow-brown, trace of fine to mediu sub-rounded.	y and m grained gravel,		MD - D			COLLUVIUM / RESIDUAL
		0.50m	23.5	0.5_			Sandy CLAY - medium to high plass orange-brown, fine to medium grain		-		HP	>600	RESIDUAL SOIL
	Not Encountered	U50		-			December and become and every						
Ш	Not En	0.90m	23.0	1. <u>0</u>		СН	Becoming red-brown and grey.		V _P		HP	>600	
				- - -					M < W _p	Н			
			22. <u>5</u>	1. <u>5</u>			SANDSTONE - fine to medium grain and grey, estimated very low to low increasing with depth.	ned, red-brown strength, strength	 1				EXTREMELY TO HIGHLY WEATHERED ROCK
							1.70m Hole Terminated at 1.70 m Very slow progress						
			22. <u>0</u>	2.0_									
			21. <u>5</u>	2.5_									
LEG Wat	iEND:			Notes, Sar			<u>s</u> eter tube sample	<u>Consist</u>	ency Very Soft		_	CS (kPa 25	a) Moisture Condition D Dry
¥	Wat (Dat Wat		nown)	CBR E ASS	Bulk s Enviro (Glass Acid S (Plasti	ample nmenta jar, se sulfate s c bag,	for CBR testing al sample aled and chilled on site) Soil Sample air expelled, chilled)	S F St VSt H	Soft Firm Stiff Very Stiff Hard		25 50 10 20	5 - 50 0 - 100 00 - 200 00 - 400 400	M Moist W Wet W Plastic Limit
Stra	▼ Water Outflow trata Changes Gradational or transitional strata Definitive or distict strata 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) ometer test (UCS kPa)	Fb Density	Friable V L ME D V D	Lo D D	ery Lo oose lediur ense	n Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 35 - 85% Density Index 85 - 100%



CLIENT: McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 8

LOCATION: FISHERMANS DRIVE, TERALBA

LOGGED BY: BE
DATE: 13-5-16

TP210

1 OF 1

NEW15P - 0070A

TEST PIT NO:

PAGE:

JOB NO:

		IENT TYPI IT LENGTI		KOBEI 2.0 m		5.5 To IDTH :	onne Excavator 0.3 m	SURFACE R DATUM:	L:	22.0 n	า		
		ling and San					Material description and p				Fiel	ld Test	
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: characteristics,colou		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additiona observations
					3 3	SM	Silty SAND - fine to med	ium grained, grey, root					TOPSOIL
				-			0.10m affected. Silty SAND - fine to med	 ium grained, grey.	-1		1		COLLUVIUM
				- -	/ / / / . / / .	SP	Trace of fine grained tree	e roots.	D -	MD -			
		0.50m	21. <u>5</u>	0.5			Sandy CLAY - low to me orange-brown, fine to me	dium plasticity, orange to edium grained sands.					RESIDUAL SOIL
	Encountered	U50 0.65m		-		CL			× × ×	н			
ш	t Encor						0.80m				HP	>600	
	Not		21. <u>0</u>	1.0			medium grained, red-bro	ANDSTONE with soil n into Clayey SAND - fine to wn to orange and grey, fine to medium grained gravel	o es		HP	>600	EXTREMELY WEATHERE ROCK
				- - 		SC	Becoming highly weathe	red.	D -	M D - VI			
			20.5	1.5	///		1.50m						
							Hole Terminated at 1.50 Very slow progress	m					
			20. <u>0</u>	2.0_									
			19.5	2.5									
				- - -									
LEG	END:			Notes, Sar			=	Consis			_	CS (kPa	-
	Wat (Dat Wat	er Level e and time sher Inflow er Outflow	nown)	U ₅₀ CBR E ASS	Bulk s Enviro (Glass Acid S (Plasti	ample nmenta jar, se Sulfate	eter tube sample for CBR testing al sample alled and chilled on site) Soil Sample air expelled, chilled)	VS S F St VSt H	Very Soft Firm Stiff Very Soft Hard Friable		2: 50 10 20	25 5 - 50 0 - 100 00 - 200 00 - 400 400	P
	G tra De	radational or ansitional stra efinitive or dis rata change	ıta	PID DCP(x-y) HP	<u>s</u> Photoi Dynan	ionisati nic pen	on detector reading (ppm) etrometer test (test depth interval s ometer test (UCS kPa)	Densit	! ! ! Y	. L MD N	ery Loose Mediur Dense	m Dense	Density Index <15% Density Index 15 - 35% Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



CLIENT: McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 8

LOCATION: FISHERMANS DRIVE, TERALBA

PAGE: 1 OF 1

TEST PIT NO:

LOGGED BY:

JOB NO: NEW15P - 0070A

TP212

BE

DATE: 13-5-16

EQUIPMENT TYPE: KOBELCO - 5.5 Tonne Excavator **SURFACE RL**: 19.0 m

			ENT TYPE		KOBE 2.0 m		5.5 To IDTH:	nne Excavator 0.3 m	SURFACE RL: DATUM:	1	9.0 m	1		
H			ing and San		2.0 111			Material description and pro				Fiel	d Test	
METHOD		WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Sincharacteristics, colour, r	oil type, plasticity/particle	MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
					-		SM	Silty SAND - fine to mediun affected.	n grained, grey, root					TOPSOIL
					- - - -		SM	0.20m Silty SAND - fine to mediun	n grained, grey.	D - M	D	-		COLLUVIUM/SLOPE WASH
		Not Encountered	0.60m	18.5	0.5			Sandy CLAY - low to mediu and grey, fine to medium gr				HP	>600	RESIDUAL SOIL
Ш		Not End	U50 0.76m	40.0	- - - -		SC	Becoming red-brown and g medium grained sandstone	rey, trace of fine to gravel, sub-angular	M < Wp	н	HP	>600	
itu Tool				18.0	1.0 	<i>V.A.A.</i>		SANDSTONE - fine to med and grey, estimated very lo	w to low strength.	М				HIGHLY WEATHERED ROCK
< <p><<drawngfile>> 10-11-2017 14:31 10.0.000 Dagel Lab and in Situ Tool</drawngfile></p>				17.5	1.5			1.40m Hole Terminated at 1.40 m Very slow progress						
-DrawingFile>> 10-11-2017 14:31 1				17. <u>0</u>	2.0_ 									
				16. <u>5</u>	 - 2.5_									
5 I		:ND:			Notes, Sar				Consister				CS (kPa	-
NON-CORED BONE	_ _	Wat (Dat Wat Wat	er Level e and time st er Inflow er Outflow nges	nown)	U ₅₀ CBR E ASS	Bulk s Enviro (Glass Acid s (Plast Bulk s	ample nmenta jar, se Sulfate S	ter tube sample for CBR testing I sample aled and chilled on site) Soil Sample air expelled, chilled)	S S F F St S VSt V H F Fb F	Yery Soft Soft Firm Stiff Yery Stiff Hard		25 50 10 20 >4	5 - 50 0 - 100 00 - 200 00 - 400 400	M Moist W Wet W _p Plastic Limit W _L Liquid Limit
Q1 LIB 1.1.GLB L	_	tra De	radational or insitional stra efinitive or dis rata change	ıta	Field Test PID DCP(x-y) HP	Photo Dynar	nic pen	on detector reading (ppm) etrometer test (test depth interval sho meter test (UCS kPa)	Density wn)	V L ME D VD	Lo D D	ery Lo oose 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%



CLIENT: McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 5

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP5-5

PAGE: 1 OF 1

JOB NO: NEW15P - 0070A

SJK

DATE: 28/7/17

LOGGED BY:

EQUIPMENT TYPE: CASE BACKHOE 580ST SURFACE RL:

		IENT TYPE IT LENGTH		CASE 1.5 m		IDTH:	0.5 m DAT U	FACE RL: JM:					
	Dril	ling 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 component		MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		sc	O.05m FILL: MULCH - grey to brown FILL-TOPSOIL: Clayey SAND - fine to coar grained, grey, fines of low to medium plastic some fine to medium grained gravel and organized gravel and organized gravel.	city, with	M - W				FILL - MULCH FILL - TOPSOIL
HB	Not Encountered	0.40m U50 0.80m		- 0. <u>5</u> - - - 1. <u>0</u>		СН	FILL: Sandy CLAY - medium to high plastic brown to orange, brown to red, pale grey, fi coarse grained sand, some fine to coarse gub-angular gravel.	ne to	M > w _P	VSt	HP	350	CONTROLLED FILL
				-		CH	CLAY - medium to high plasticity, pale brow brown to red and grey, with some fine to me grained sand.	— — — - vn with edium		St - VSt	HP	200	RESIDUAL SOIL
LEG Water				1.5									
LEG Water <u>Stra</u>		ter Level te and time sh ter Inflow ter Outflow anges	nown)	Notes, Sar U ₅₀ CBR E ASS B Field Test: PID	50mm Bulk s Enviro (Glass Acid S (Plast Bulk S	Diame ample funmenta sijar, sea Sulfate Sic bag, a sample	ter tube sample or CBR testing I sample saled and chilled on site) soil Sample sir expelled, chilled)	S S F Fi St S VSt V H H	ery Soft oft irm tiff ery Stiff ard riable V L		<2 25 50 10 20	5 - 50 0 - 100 00 - 200 00 - 400 100	D Dry M Moist W Wet W _p Plastic Limit
	_ D	ansitional stra efinitive or dis rata change		DCP(x-y) HP	Dynar	nic pene	etrometer test (test depth interval shown) meter test (UCS kPa)		MC D VD) M D		n Dense	•



CLIENT: McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 5

LOCATION: FISHERMANS DRIVE, TERALBA

TEST PIT NO: TP5-7 PAGE: 1 OF 1

JOB NO: NEW15P - 0070A

SJK

DATE: 28/7/17

LOGGED BY:

EQUIPMENT TYPE: CASE BACKHOE 580ST SURFACE RL:

	EQUIPMENT TYPE: TEST PIT LENGTH:		CASE BACKHOE 580ST SURFA 1.5 m WIDTH: 0.5 m DATUI										
	Drilling and Sampling		Material description and profile information								d Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity characteristics, colour, minor component		MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
				-		SC	FILL: MULCH - grey to brown. FILL-TOPSOIL: Clayey SAND - fine to coar grained, grey, fines of low to medium plastic some fine to medium grained gravel and org	city, with	М				FILL - MULCH FILL - TOPSOIL
0.000 Datgel Lab and In Situ Tool BH	Not Encountered	0.50m U50 0.80m		- 0.5_ 1.0_ 		СН	FILL: Sandy CLAY - medium to high plastic grey and pale brown to orange with brown to medium grained sand, with small pockets Clayey SAND.	o red, fine	M > W _P	St - VSt	HP	180	CONTROLLED FILL
wingFile>> 15/11/2017 16:34 10				- 1. <u>5</u> - -		CI	FILL: Silty Gravelly SAND - fine to coarse g pale brown, fine to medium grained sub-rou gravel, fines of low plasticity.	rained, nded	М	MD - D	-		CONTROLLED FILL possibly COLLUVIUM
OT LIB 11.05LB Log NON-CORED BOREHOLE - TEST PIT NEWISP - 0070A LOGS - STAGE 5 FOLLOWING REGRADE.GPJ <				- 2.0 <u>-</u>			Hole Terminated at 1.80 m						
Log NON-CORED BOREHOLE-	LEGEND: Water Water Water Level (Date and time shown) Water Inflow Water Outflow Strata Changes			Notes, Samples and Tests U₅₀ 50mm Diameter tube sample CBR Bulk sample for CBR testing E Environmental sample (Glass jar, sealed and chilled on site) ASS Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled) B Bulk Sample					Consistency VS Very Soft S Soft F Firm St Stiff VSt Very Stiff H Hard Fb Friable			CS (kPa 25 5 - 50 0 - 100 00 - 200 00 - 400 400	D Dry M Moist W Wet U Wp Plastic Limit U WL Liquid Limit
Gradational or transitional strata Definitive or distict strata change				Field Tests PID Photoionisation detector reading (ppm) DCP(x-y) Dynamic penetrometer test (test depth interval shown) HP Hand Penetrometer test (UCS kPa)				L Lo MD M D D			Very Loose Loose Medium Dense Dense Very Dense		Density Index <15% Density Index 15 - 35% e Density Index 35 - 65% Density Index 65 - 85% Density Index 85 - 100%



ENGINEERING LOG - TEST PIT

McCLOY TERALBA

PROJECT: PROPOSED SUBDIVISION - STAGE 5

LOCATION: FISHERMANS DRIVE, TERALBA

TP5-8 TEST PIT NO:

PAGE: 1 OF 1

JOB NO: NEW15P - 0070A

SJK

DATE: 28/7/17

LOGGED BY:

CASE BACKHOE 580ST **EQUIPMENT TYPE:** SURFACE RL: **TEST PIT LENGTH:** 1.5 m WIDTH: 0.5 m DATUM:

		Drill	ing and Sam	npling				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 component		MOISTURE	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
					-		SC	FILL: MULCH - grey to brown FILL-TOPSOIL: Clayey SAND - fine to coar grained, grey, fines of low to medium plastic some fine to medium grained gravel and orgonome. FILL: Sandy CLAY - medium to high plastic brown to orange, brown to red, pale grey, fi	city, with ganics. — — — — ity, pale	M				FILL - MULCH FILL - TOPSOIL CONTROLLED FILL
			0.40m U50		- 0. <u>5</u> -		CH	coarse grained sand, some fine to coarse g sub-angular gravel.				HP	250	
Datgel Lab and In Situ Tool	5	Not Encountered	0.80m		1.0_ -		CI	FILL: Sandy CLAY / Clayey SAND - mediur plasticity, pale brown to orange and pale gr coarse grained sand.	m ey, fine to	M ~ Wp	VSt	HP	250	
FOLLOWING REGRADE.GPJ < <drawingfile>> 15/11/2017 16:34 10.0.000 Datgel Lab and In Situ Tool RH</drawingfile>					- 1.5_ -		SC	1.60m Clayey SAND - fine to coarse grained, dark grey, fines of medium plasticity.	brown to	М	MD			SLOPE WASH
PJ < <drawing< td=""><td></td><td></td><td></td><td></td><td>-</td><td></td><td>СН</td><td>Sandy CLAY - medium to high plasticity, parto orange and grey, fine to coarse grained stages 1.90m Hole Terminated at 1.90 m</td><td>lle brown sand.</td><td>M ~ w_P</td><td>Н</td><td>HP</td><td>450</td><td>RESIDUAL SOIL</td></drawing<>					-		СН	Sandy CLAY - medium to high plasticity, parto orange and grey, fine to coarse grained stages 1.90m Hole Terminated at 1.90 m	lle brown sand.	M ~ w _P	Н	HP	450	RESIDUAL SOIL
ro 2					2. <u>0</u> 2. <u>5</u>									
MEHO!	EGE Vater	<u>r</u> Wat	er Level e and time sh		Notes, Sar U ₅₀ CBR E	50mm Bulk s Enviro	n Diame sample onmenta	ter tube sample or CBR testing I sample aled and chilled on site)	S S F F	ncy ery Soft oft irm		<2 25 50	CS (kPa 25 5 - 50 0 - 100	D Dry M Moist W Wet
Log NON-COF	(Date and time shown) ► Water Inflow ASS Water Outflow Strata Changes B			Acid S (Plast Bulk S	Sulfate	soil Sample sir expelled, chilled)	VSt V H H	ery Stiff ard riable	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	20	00 - 400 100	· -		

LEGEND.						
Wate	<u>r</u>					
\blacksquare	Water Level					
	(Date and time shown					
—	Water Inflow					
⊸	Water Outflow					
Strata Changes						
	Gradational or					

Definitive or distict

strata change

site
)

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

00110101	00	<u> </u>		0 00
VS	Very Soft	<25	D	Dry
S	Soft	25 - 50	M	Moist
F	Firm	50 - 100	W	Wet
St	Stiff	100 - 200	W_p	Plastic Limit
√St	Very Stiff	200 - 400	W_L	Liquid Limit
Н	Hard	>400		
Fb	Friable			
Density	V	Very Loose	Density	Index <15%

Loose

Dense

Very Den

Medium Dense

MD

D

VD

Density Index 15 - 35%

Density Index 35 - 65%

Density Index 65 - 85%

Density Index 85 - 100%

APPENDIX B:

Results of Laboratory Testing



02 4968 4468 02 4960 9775

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Shrink Swell Index Report

McCloy Development Management Pty Ltd

Suite 1 Level 3, 426 King Street Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9

Report No: SSI:NEW17W-4907--S01 Issue No: 1



Accredited for compliance with ISO/IEC 17025 -

Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 1/11/2017

Sample Details

Sample ID: NEW17W-4907--S01

Test Request No.:

Material: Sandy CLAY Source: On-Site Specification: No Specification

Project Location: Pitt Street, Teralba TP605 - 0.70 to 1.00m Sample Location:

Borehole Number: TP605 Borehole Depth (m): 0.7 - 1.0 Client Sample ID:

Sampling Method: AS1289.1.2.1 cl 6.5

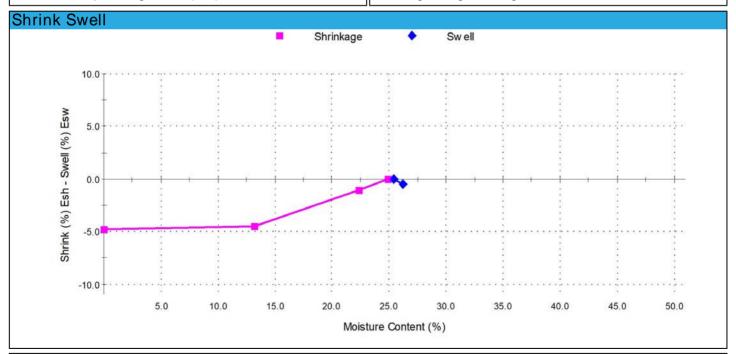
Date Sampled: 26/10/2017 Date Submitted: 26/10/2017

AS 1289.7.1.1 Swell Test

Swell on Saturation (%): -0.5 25.4 Moisture Content before (%): Moisture Content after (%): 26.2 Est. Unc. Comp. Strength before (kPa): 270 Est. Unc. Comp. Strength after (kPa):

AS 1289.7.1.1 Shrink Test

Shrink on drying (%): 4.8 Shrinkage Moisture Content (%): 24.9 Est. inert material (%): Nil Crumbling during shrinkage: Cracking during shrinkage: Moderate



Shrink Swell Index - Iss (%): 2.7



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Shrink Swell Index Report

McCloy Development Management Pty Ltd

Suite 1 Level 3, 426 King Street Newcastle West NSW 2300

Principal:

NEW15P-0070A Project No.:

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9

Report No: SSI:NEW17W-4907--S02 Issue No: 1



Accredited for compliance with ISO/IEC 17025 -

Testing
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Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 1/11/2017

Client Sample ID:

Sampling Method:

Date Sampled:

Date Submitted:

Sample Details

Sample ID: NEW17W-4907--S02

Test Request No.:

Material: Sandy CLAY Source: On-Site Specification: No Specification

Project Location: Pitt Street, Teralba TP606 - 0.65 to 0.80m Sample Location:

Borehole Number: **TP606** Borehole Depth (m): 0.65 - 0.8

AS 1289.7.1.1 Shrink Test

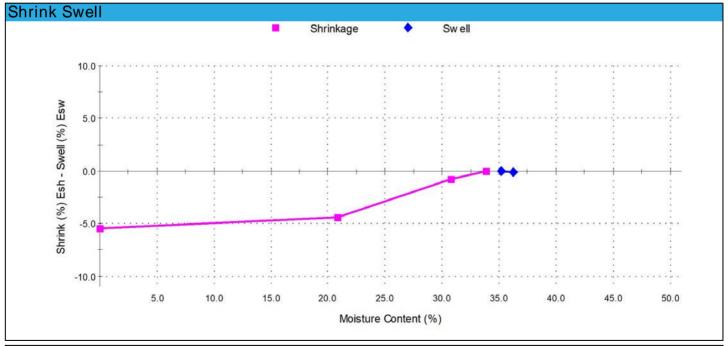
AS1289.1.2.1 cl 6.5

26/10/2017

26/10/2017

Shrink on drying (%): 5.5 Shrinkage Moisture Content (%): 33.9 Est. inert material (%): Nil Crumbling during shrinkage: Cracking during shrinkage: Nil

AS 1289.7.1.1 Swell Test Swell on Saturation (%): -0.2 35.2 Moisture Content before (%): Moisture Content after (%): 36.2 Est. Unc. Comp. Strength before (kPa): 340 Est. Unc. Comp. Strength after (kPa):



Shrink Swell Index - Iss (%): 3.0



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Shrink Swell Index Report

McCloy Development Management Pty Ltd

Suite 1 Level 3, 426 King Street Newcastle West NSW 2300

Principal:

NEW15P-0070A Project No.:

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9

Report No: SSI:NEW17W-4907--S03 Issue No: 1



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Testing
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Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 1/11/2017

Sample Details

Sample ID: NEW17W-4907--S03

Test Request No.:

Material: Sandy CLAY Source: On-Site Specification: No Specification

Project Location: Pitt Street, Teralba TP901 - 1.00 to 1.30m Sample Location:

Borehole Number: TP901 Borehole Depth (m): 1.0 - 1.3 Client Sample ID:

Sampling Method: AS1289.1.2.1 cl 6.5

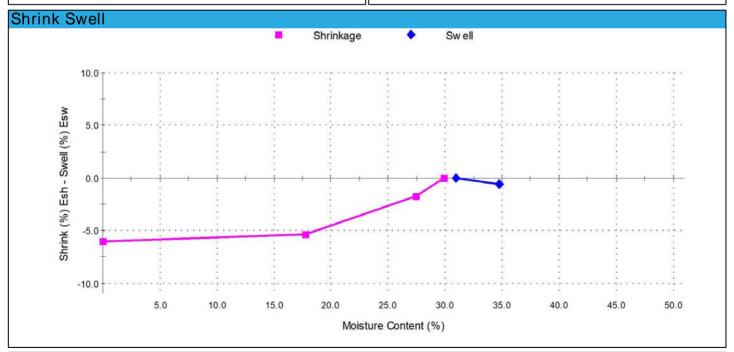
Date Sampled: 26/10/2017 Date Submitted: 26/10/2017

Swell	Test		AS 1289.7.1.1
	<u> </u>	(0()	0.0

Swell on Saturation (%): Moisture Content before (%): 30.9 Moisture Content after (%): 34.7 Est. Unc. Comp. Strength before (kPa): 400 Est. Unc. Comp. Strength after (kPa):

AS 1289.7.1.1 Shrink Test

Shrink on drying (%): 6.0 Shrinkage Moisture Content (%): 29.9 Est. inert material (%): Nil Crumbling during shrinkage: Cracking during shrinkage: Moderate



Shrink Swell Index - Iss (%): 3.3



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Shrink Swell Index Report

McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9

Report No: SSI:NEW17W-4907--S04 Issue No: 1



Accredited for compliance with ISO/IEC 17025 -Testing
The results of the tests, calibrations and/or

measurements included in this document are traceable to Australian/national standards

Approved Signatory: Dane Cullen

(Senior Geotechnician) NATA Accredited Laboratory Number: 18686 Date of Issue: 1/11/2017

Sample Details

Sample ID: NEW17W-4907--S04

Test Request No.:

Material: Sandy CLAY Source: On-Site Specification: No Specification

Project Location: Pitt Street, Teralba TP902 - 0.80 to 0.95m Sample Location:

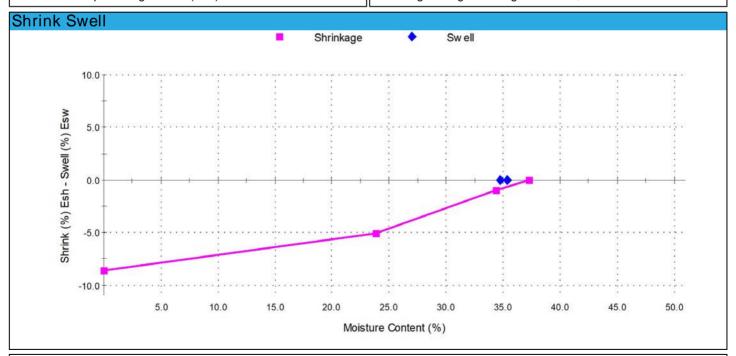
Borehole Number: TP902 Borehole Depth (m): 0.8 - 0.95

Client Sample ID:

Sampling Method: AS1289.1.2.1 cl 6.5

Date Sampled: 26/10/2017 Date Submitted: 26/10/2017

Swell Test	AS 1289.7.1.1	Shrink Test	AS 12	289.7.1.1
Swell on Saturation (%):	0.0	Shrink on drying (%):	8.6	
Moisture Content before (%):	34.7	Shrinkage Moisture Content (%):	37.3	
Moisture Content after (%):	35.3	Est. inert material (%):	2%	
Est. Unc. Comp. Strength before (kPa):	250	Crumbling during shrinkage:	Nil	
Est. Unc. Comp. Strength after (kPa):	90	Cracking during shrinkage:	Major	



Shrink Swell Index - Iss (%): 4.8



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Report No: MAT: NEW17W-4926--S01 Issue No: 1

Material Test Report

McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



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D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 9/11/2017

Sample Details

Sample ID: NEW17W-4926--S01 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Sandy Clay Specification: No Specification Pitt Street, Teralba Project Location: Sample Location: TP602 - (0.2 - 0.25m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	3.5
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	27
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	17
Plasticity Index (%)	AS 1289.3.3.1	10

Comments



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Report No: MAT: NEW17W-4926--S02

Issue No: 1



McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



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D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 9/11/2017

Sample Details

Sample ID: NEW17W-4926--S02 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Sandy Clay Specification: No Specification Project Location: Pitt Street, Teralba Sample Location: TP603 - (0.5 - 0.7m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	6.0
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	37
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	17
Plasticity Index (%)	AS 1289.3.3.1	20

Comments



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Report No: MAT: NEW17W-4926--S03

Issue No: 1



McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



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D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 9/11/2017

Sample Details

Sample ID: NEW17W-4926--S03 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Sandy Clay Specification: No Specification Pitt Street, Teralba Project Location: Sample Location: TP604 - (0.7 - 0.9m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	9.5
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	60
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	17
Plasticity Index (%)	AS 1289.3.3.1	43

Comments



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Material Test Report

McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9

Report No: MAT: NEW17W-4926--S04

Issue No: 1



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200 Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 6/11/2017

Sample Details

Sample ID: NEW17W-4926--S04 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Sandy Clay Specification: No Specification Pitt Street, Teralba Project Location: Sample Location: TP901 - (0.1 - 0.2m)

Test Results

Description	Method	Result Lim	nits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	1.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	15	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	12	
Plasticity Index (%)	AS 1289.3.3.1	3	

Comments



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Report No: MAT: NEW17W-4926--S05

Issue No: 1

Material Test Report

McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



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D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 6/11/2017

Sample Details

Sample ID: NEW17W-4926--S05 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Clayey Sand Specification: No Specification Pitt Street, Teralba Project Location: Sample Location: TP903 - (0.1 - 0.2m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	3.0
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	23
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	15
Plasticity Index (%)	AS 1289.3.3.1	8

Comments



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Report No: MAT: NEW17W-4926--S06

Issue No: 1



McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



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Testing
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D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 6/11/2017

Sample Details

Sample ID: NEW17W-4926--S06 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Clayey Sand Specification: No Specification Project Location: Pitt Street, Teralba Sample Location: TP904 - (0.2 - 0.3m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	2.0
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	23
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	18
Plasticity Index (%)	AS 1289.3.3.1	5

Comments



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

Report No: MAT: NEW17W-4926--S07

Issue No: 1



Accredited for compliance with ISO/IEC 17025 -Testing
The results of the tests, calibrations and/or

measurements included in this document are traceable to Australian/national standards

D. (1)

WORLD RECOGNISED
ACCREDITATION

Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 9/11/2017

Material Test Report

McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9

Sample Details

Sample ID: NEW17W-4926--S07 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Sandstone Specification: No Specification Project Location: Pitt Street, Teralba Sample Location: TP905 - (0.4 - 0.5m)

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	9.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	37	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	20	

Comments



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

Report No: MAT: NEW17W-4926--S08

Issue No: 1

Material Test Report

McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



Accredited for compliance with ISO/IEC 17025 -Testing
The results of the tests, calibrations and/or

measurements included in this document are traceable to Australian/national standards

D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 6/11/2017

Sample Details

Sample ID: NEW17W-4926--S08 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Clayey Sand Specification: No Specification Pitt Street, Teralba Project Location: Sample Location: TP906 - (0.1 - 0.2m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	4.0
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	29
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	16
Plasticity Index (%)	AS 1289.3.3.1	13

Comments



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Report No: MAT: NEW17W-4926--S09

Issue No: 1



McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

Principal:

Project No.: NEW15P-0070A

Project Name: Proposed Subdivision - Billy's Lookout - Stages 6 & 9



Accredited for compliance with ISO/IEC 17025 -Testing
The results of the tests, calibrations and/or

measurements included in this document are traceable to Australian/national standards

D. (1) Approved Signatory: Dane Cullen (Senior Geotechnician)

NATA Accredited Laboratory Number: 18686 Date of Issue: 6/11/2017

Sample Details

Sample ID: NEW17W-4926--S09 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Clayey Sand Specification: No Specification Pitt Street, Teralba Project Location: Sample Location: TP907 - (0.1 - 0.3m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	2.5
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	23
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	16
Plasticity Index (%)	AS 1289.3.3.1	7

Comments



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Report No: MAT: NEW17W-4926--S10

Issue No: 1



McCloy Development Management Pty Ltd Suite 1 Level 3, 426 King Street

Newcastle West NSW 2300

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NATA Accredited Laboratory Number: 18686 Date of Issue: 6/11/2017

Sample Details

Sample ID: NEW17W-4926--S10 Sampling Method: AS1289.1.2.1 cl 6.4b

Date Sampled: 24/10/2017 Source: On-Site Material: Clayey Sand Specification: No Specification Project Location: Pitt Street, Teralba Sample Location: TP908 - (0.2 - 0.4m)

Test Results

Description	Method	Result Limits
Sample History	AS 1289.1.1	Air-dried
Preparation	AS 1289.1.1	Dry Sieved
Linear Shrinkage (%)	AS 1289.3.4.1	5.5
Mould Length (mm)		250
Crumbling		No
Curling		No
Cracking		Yes
Liquid Limit (%)	AS 1289.3.1.1	44
Method		Four Point
Plastic Limit (%)	AS 1289.3.2.1	18
Plasticity Index (%)	AS 1289.3.3.1	26

Comments

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

Seasonal swelling and shrinkage of soil

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

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

Shear failure

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

- · Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES		
Class	Foundation	
A	Most sand and rock sites with little or no ground movement from moisture changes	
S	Slightly reactive clay sites with only slight ground movement from moisture changes	
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes	
Н	Highly reactive clay sites, which can experience high ground movement from moisture changes	
Е	Extremely reactive sites, which can experience extreme ground movement from moisture changes	
A to P	Filled sites	
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise	

Tree root growth

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

- Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.
- Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.

Unevenness of Movement

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

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

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

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

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

Effects of Uneven Soil Movement on Structures

Erosion and saturation

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

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

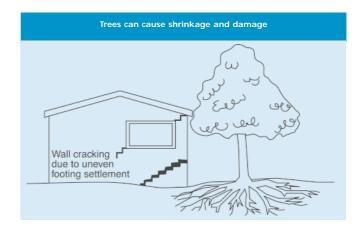
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay

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

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

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



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

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

Movement caused by tree roots

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

Complications caused by the structure itself

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

Effects on full masonry structures

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

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

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

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

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

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

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

Effects on framed structures

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

Effects on brick veneer structures

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

Water Service and Drainage

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

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.

Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

 Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.

- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

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

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

Prevention/Cure

Plumbing

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

Ground drainage

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

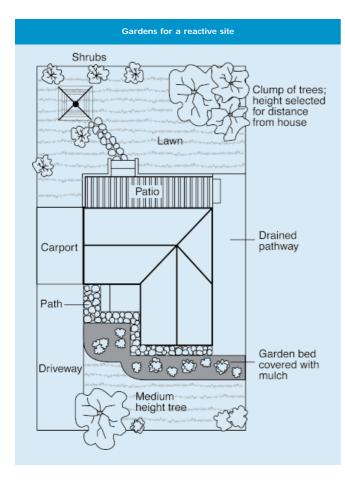
It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

Protection of the building perimeter

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

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

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



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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