Proposed Subdivision Brush Creek Estate - Stage 1 Site Classification

Transfield Avenue, Edgeworth

NEW18P-0170-AD.Rev1
28 August 2019

Qualtest
LABORATORY (NSW) PTY LTD

GEOTECHNICAL I LABORATORY I EARTHWORKS I QUARRY I CONSTRUCTION MATERIAL TESTING

28 August 2019

McCloy Group
Suite 1, Level 3, 426 King Street
NEWCASTLE WEST NSW 2309

Attention: Jon Hines

Dear Sir,

RE: PROPOSED SUBDIVISION – BRUSH CREEK ESTATE – STAGE 1
TRANSFIELD AVENUE, EDGEWORTH
SITE CLASSIFICATION (LOTS 101 TO 145)

Please find enclosed our geotechnical report for Lots 101 to 145 within Stage 1 of the Brush Creek Estate residential subdivision, located at Transfield Avenue, Edgeworth.

The report includes recommendations for Site Classification in accordance with AS2870-2011, "*Residential Slabs and Footings*" following the completion of site regrading earthworks.

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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1.0 Introduction

Qualtest Laboratory NSW Pty Ltd (Qualtest) is pleased to present this report on behalf of McCloy Group (McCloy), for Stage 1 of the Brush Creek Estate residential subdivision, located at Transfield Avenue, Edgeworth.

Based on the brief and drawings provided by the client, Stage 1 is understood to comprise of 45 residential allotments (Lots 101 to 145), as shown on a copy of the Drainage and Roadworks Plan prepared by Costing Roe Consulting, (Ref. Drawing No. C013358.00-C400, Issue I), a copy of which is attached.

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*', 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, Brush Creek Estate – Stage 1, 93 Transfield Avenue, Edgeworth, (Report Reference: NEW18P-0170-AA, dated 18 September 2018);
- Level 1 Site Regrade Assessment Report, 'Proposed Subdivision, Brush Creek – Stage 1, Transfield Avenue, Edgeworth, (Report Reference: NEW19P-0027-AA, dated 9 August 2019).

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 20 June 2019, 25 July 2019, and 16 August 2019, comprising of:

- Review of plans and visual check of proposed test locations for the presence of underground services;
- Site walkover to make observations of surface features at the property and in the immediate surrounding area;
- Excavation of 28 test pits (TP001 to TP028) using a 2.7 tonne and a 5.5 tonne rubber tracked excavator with a 0.45m wide toothed bucket, to depths of between 0.45m and 2.20m;
- Undisturbed samples (U50 tubes) were taken for subsequent laboratory testing;
- Test pits were backfilled with the excavation spoil and compacted using the excavator tracks and bucket.

Investigations were carried out by an experienced Geotechnical Engineer from Qualtest who carried out the sampling and testing, provided field logs, and located test pits using handheld GPS and site features including trees, boundaries, and existing developments.

Approximate test pit locations are shown on the attached Figure AD1.

Engineering logs of the test pits are presented in Appendix A.

4.0 Site Description

4.1 Site Regrade Works

Site re-grading works were conducted between 13 February 2019 and 30 June 2019. Re-grading works within the development consisted of the removal of unsuitable material, blending of existing colluvium materials with site won residual and imported materials, along with the cutting and filling of proposed residential lots within Stage 1 of the subdivision.

Filling works were performed within Lot 101 to 123, 128 to 133, 136 to 145 and portions of Lot 134. Cutting works were performed within Lot 134 and 135. No works were performed on Lot 124 to lot 127, other than the filling of an existing 'V-drain' which crossed portions of Lot 125 and 126. The approximate extent of re-grade works is shown on Figure AD1.

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

Filling was performed using either site material won from the detention basin, road and drainage excavations cut from around the site, or imported material assessed as Virgin Excavated Natural Material (VENM) by others, from a number of different sources.

The site won material could generally be described as mixtures of Residual (CI-CH) Sandy CLAY, of medium to high plasticity, dark brown in colour, fine to coarse grained sand, with some fine to coarse grained gravel inclusions, blended with Extremely Weathered (EW) Siltstone / Sandstone, pale grey / red stained in colour, along with some Silty SAND material (Colluvium).

The imported material could generally be described as a (CL-CI) Sandy CLAY, of low to medium plasticity, pale red / orange in colour, with some fine to coarse grained gravel, (EW) Siltstone, that when compacted, generally produced a (CL) Sandy Gravelly CLAY, of low to medium plasticity, with fine to coarse gravel and sand inclusions.

The approximate depth of fill placed ranged in the order of 0.1m to about 3.0m. The fill was compacted in maximum lifts of 0.3m thickness. Any unsuitable or deleterious material within the fill was removed by hand or mechanical means prior to final compaction of the material.

As the geotechnical testing authority engaged for the project, Qualtest state that the re-grading works performed within Stage 1 of the development as shown on Figure AA1 of the Level 1 Site Re-grade Assessment Report, 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 our understanding of lot re-grade works from the Level 1 fill supervision by Qualtest, and placement of low reactivity topsoil material such that total depth of topsoil and uncontrolled fill does not exceed 0.4m. Qualtest should be informed without delay if additional earthworks are known to have been carried out.

4.2 Surface Conditions

The site comprises proposed Stage 1 of the proposed residential subdivision known as Brush Creek Estate at 93 Transfield Avenue, Edgeworth, as shown on Figure AD1 attached.

The site is bounded to the east by undeveloped bushland, to the west by an ephemeral creek draining to the north to Brush Creek and undeveloped bushland, to the north by a thin band of undeveloped bushland and Brush Creek, and to the south by Transfield Avenue and low

density residential developments. Undeveloped bushland to the north and west contains proposed future stages of the Brush Creek Estate residential subdivision.

Selected photographs of the site taken during site investigations are shown below.

Photograph 1: Facing northwest from near south-eastern corner of Lot 109. Showing excavator at TP001.

Photograph 2: Facing east from near south-eastern corner of Lot 109.

Photograph 3: Facing southeast from near TP010.

Photograph 4: Facing west from near TP010.

Photograph 5: Facing west from near TP016.

Photograph 6: Facing northwest from near TP016.

Photograph 7: Facing east from near TP016.

Photograph 8: Facing southeast from near TP016.

Photograph 9: Facing southwest from near TP016.

Photograph 10: Facing west from near TP016.

4.3 Subsurface Conditions

Reference to the 1:100,000 Newcastle Coalfield Regional Geology Sheet indicates the site to be underlain by the Adamstown and Boolaroo Subgroups of the Newcastle Coal Measures, which are characterised by Sandstone, Conglomerate, Siltstone, Coal, and Tuff 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 Unit 1C – 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 days of the field investigations.

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	Silty SAND / SAND– fine to medium grained, brown / dark brown / yellow-brown, fines of low plasticity, trace fine to medium grained sub-angular to sub-rounded gravel, root affected. Sandy CLAY – low plasticity, brown to pale brown, fine to medium grained sand, root affected.
1B	FILL - UNCONTROLLED	Not encountered in this investigation.
1C	FILL - CONTROLLED	Sandy CLAY – low to medium plasticity, grey-brown and dark grey, fine grained sand, with some fine to coarse grained angular to sub-angular gravel. CLAY – medium to high plasticity, pale grey and orange to red-brown.
2	TOPSOIL	Silty SAND – fine to medium grained, brown, fines of low plasticity, trace fine grained angular to sub-angular gravel in places, root affected. Sandy CLAY – low to medium plasticity, brown, mostly fine to medium grained sand, trace fine to medium grained angular gravel in places, root affected.
3	SLOPEWASH	Not encountered in this investigation.
4	COLLUVIUM	Not encountered in this investigation.
5	RESIDUAL SOIL	Gravelly CLAY / Sandy CLAY / CLAY – medium to high plasticity, grey to pale grey and pale brown with some orange and red-brown in places, fine to coarse grained sand, fine to medium grained angular gravel.
6	EXTREMELY WEATHERED (XW) ROCK	Silty Sandstone / Shale with soil properties; breaks down into Sandy CLAY / CLAY – medium to high plasticity, pale grey to grey, fine to medium grained sand.
7	HIGHLY WEATHERED (HW) ROCK	SILTSTONE / SHALE – pale grey to grey with some pale brown, estimated very low to medium strength. Extremely to highly weathered at most locations. Moderately to Slightly weathered at TP005.

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

Test Pit	Unit 1A Fill – Topsoil	Unit 1B Fill - Uncontrolled	Unit 1C Fill - Controlled	UNIT 2 Topsoil	Unit 3 Slopewash	Unit 4 Colluvium	Unit 5 Residual Soil	Unit 6 XW Rock	Unit 7 HW Rock
	Depth (m)								
Current Investigation									
TP001	-	-	0.00 - 0.90	-	-	-	0.90 - 2.00	-	-
TP002	0.00 - 0.10	-	0.10 - 0.90	-	-	-	0.90 - 2.20	-	-
TP003	0.00 - 0.05	-	0.05 - 0.80	-	-	-	0.80 - 2.00	-	-
TP004	0.00 - 0.10	-	0.10 - 1.20	-	-	-	1.20 - 2.00	-	-
TP005	-	0.00 - 0.05	0.05 - 1.20	-	-	-	1.20 - 2.10	-	2.10 - 2.15
TP006	-	-	0.00 - 0.95	-	-	-	0.95 - 1.70	-	1.70 - 1.85^
TP007	-	-	0.00 - 0.30	-	-	-	0.30 - 0.85	-	0.85 - 0.90^
TP008	0.00 - 0.10	-	0.10 - 0.30	-	-	-	0.30 - 0.75	-	0.75 - 0.85^
TP009	0.00 - 0.15	-	0.15 - 0.55	-	-	-	0.55 - 1.10	-	1.10 - 1.20^
TP010	0.00 - 0.05	-	0.05 - 0.50	-	-	-	0.50 - 1.05	-	1.05 - 1.20^
TP011	0.00 - 0.05	-	0.05 - 0.70	-	-	-	0.70 - 1.80	-	-
TP012	0.00 - 0.15	-	0.15 - 0.85	-	-	-	0.85 - 2.10	-	-
TP013	0.00 - 0.05	-	0.05 - 1.20	-	-	-	1.20 - 2.10	-	-
TP014	0.00 - 0.10	-	0.10 - 0.70	-	-	-	0.70 - 2.10	-	-
TP015	0.00 - 0.10	-	0.10 - 1.00	-	-	-	1.00 - 2.00	-	-
TP016	0.00 - 0.20	-	0.20 - 1.90	-	-	-	1.90 - 2.20	-	-
TP017	0.00 - 0.20	-	0.20 - 1.70	-	-	-	1.70 - 2.00	-	-

Test Pit	Unit 1A Fill – Topsoil	Unit 1B Fill - Uncontrolled	Unit 1C Fill - Controlled	UNIT 2 Topsoil	Unit 3 Slopewash	Unit 4 Colluvium	Unit 5 Residual Soil	Unit 6 XW Rock	Unit 7 HW Rock
	Depth (m)								
TP018	0.00 - 0.15	-	0.15 - 2.10	-	-	-	-	-	-
TP019	0.00 - 0.10	-	0.10 - 2.00	-	-	-	-	-	-
TP020	0.00 – 0.10	0.10 – 0.20	-	-	-	-	0.20 – 2.00	-	-
TP021	0.00 – 0.05	0.05 – 0.20	-	-	-	-	0.20- 2.10	-	-
TP022	0.00 – 0.05	0.05 – 0.30	-	-	-	-	0.30 – 2.00	-	-
TP023	0.00 – 0.10	-	0.10 – 0.40	-	-	-	0.40 – 1.60^	-	-
TP024	0.00 – 0.05	-	0.05 – 2.00	-	-	-	-	-	-
TP025	0.00 – 0.10	0.10 – 0.20	-	-	-	-	0.20 – 0.50	-	-
TP026	0.00 – 0.10	0.10 – 0.20	-	-	-	-	0.20 – 0.40	-	-
TP027	0.00 – 0.15	0.15 – 0.25	-	-	-	-	0.25 – 0.50	-	-
TP028	0.00 – 0.35	0.35 – 0.40	-	-	-	-	0.40 – 0.45	-	-
Previous Investigation (NEW18P-0170-AA, dated 18 September 2018)									
TP101	-	-	-	0.00 - 0.25	-	0.25 - 0.90	0.90 - 2.00	-	-
TP102	-	-	-	0.00 - 0.10	-	0.10 - 0.60	0.60 - 1.85	-	1.85 - 1.90^
TP103	-	-	-	0.00 - 0.20	-	-	0.20 - 0.55	-	0.55 - 0.65*
TP104	-	-	-	0.00 - 0.10	-	-	0.10 - 0.50	-	0.50 - 0.65*
TP105	0.00 - 0.10	0.10 - 1.40	-	-	-	-	1.40 - 1.70	1.70 - 1.90	-
TP106	0.00 - 0.20	0.20 - 0.30	-	-	-	0.30 - 0.85	0.85 - 1.10	1.10 - 1.40	1.40 - 1.60^
TP107	-	-	-	0.00 - 0.25	-	-	0.25 - 0.95	0.95 - 1.05	1.05 - 1.10^
TP108	-	-	-	0.00 - 0.10	-	0.10 - 0.70	0.70 - 1.60	-	1.60 - 1.65*

Test Pit	Unit 1A Fill – Topsoil	Unit 1B Fill - Uncontrolled	Unit 1C Fill - Controlled	UNIT 2 Topsoil	Unit 3 Slopewash	Unit 4 Colluvium	Unit 5 Residual Soil	Unit 6 XW Rock	Unit 7 HW Rock
	Depth (m)								
TP109	0.00 - 0.20	0.20 - 0.50	-	-	0.50 - 0.70	0.70 - 1.00	1.00 - 2.05	-	-
TP110	-	0.00 - 2.30	-	-	-	-	-	-	-
TP111	-	-	-	0.00 - 0.25	-	0.25 - 0.50	0.50 - 2.15	-	-
TP112	0.00 - 0.50	-	-	-	-	0.50 - 0.95	0.95 - 2.05	-	-
TP113	-	-	-	0.00 - 0.20	-	0.20 - 0.90	0.90 - 2.00	-	-
TP114	-	-	-	0.00 - 0.20	-	0.20 - 0.80	0.80 - 1.75	1.75 - 1.90	1.90 - 2.00
TP115	0.00 - 0.25	0.25 - 1.40	-	-	-	-	-	-	-

Notes: * = Practical refusal or refusal of 2.5 / 5.5 tonne excavator met on Highly Weathered Rock.

^ = Slow to very slow progress, close to practical excavator refusal.

5.0 Laboratory Testing

Samples collected during the current field investigations were returned to our NATA accredited Warabrook Laboratory for testing, comprising of:

- (24 no.) Shrink / Swell tests.

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

TABLE 4 – SUMMARY OF SHRINK / SWELL TESTING RESULTS

Location	Depth (m)	Material Description	I_{ss} (%)
Current Investigation			
TP001	0.40 – 0.70	FILL: (CH) CLAY	2.2
TP002	1.10 – 1.25	(CH) CLAY	4.2
TP003	0.50 – 0.80	FILL: (CH) CLAY	2.4
TP004	1.20 – 1.40	(CH) Silty CLAY	0.9
TP005	0.60 – 0.80	FILL: (CH) CLAY	1.9
TP006	0.50 – 0.70	FILL: (CL) Sandy CLAY	0.5
TP007	0.40 – 0.60	(CH) CLAY	2.4
TP008	0.40 – 0.70	(CH) CLAY	1.3
TP009	0.30 – 0.55	FILL: (CH) CLAY	3.3
TP010	0.70 – 0.80	(CH) CLAY	2.9
TP011	1.00 – 1.20	(CH) CLAY	2.9
TP012	0.30 – 0.45	FILL: (CL) Sandy CLAY	0.4
TP013	0.50 – 0.70	FILL: (CH) CLAY	0.9
TP014	0.80 – 0.95	(CH) CLAY	4.2
TP015	1.20 – 1.60	(CH) CLAY	4.2
TP016	1.00 – 1.30	FILL: (CL) Sandy CLAY	1.3
TP017	1.10 – 1.25	FILL: (CH) Sandy CLAY	0.8
TP018	0.60 – 0.80	FILL: (CL) Sandy CLAY	0.8
TP019	1.00 – 1.20	FILL: (CL) Sandy CLAY	1.5
TP020	0.50 – 0.65	(CH) CLAY	4.5
TP021	0.90 – 1.05	(CH) CLAY	4.2
TP022	0.10 – 0.30	FILL: (CH) CLAY	4.7
TP023	0.80 – 0.95	(CH) CLAY	3.7
TP024	0.50 – 0.70	FILL: (CI) Sandy CLAY	2.0

Location	Depth (m)	Material Description	I_{ss} (%)
Previous Geotechnical Investigation (NEW18P-0170-AA, dated 7 August 2018)			
TP101	0.30 - 0.40	(CH) CLAY	4.8
TP101	0.60 - 0.80	(CH) CLAY	4.4
TP102	0.40 - 0.80	(CH) CLAY	3.7
TP103	0.45 - 0.55	(CI) Sandy CLAY	2.1
TP104	0.25 - 0.45	(CH) CLAY	2.9
TP106	0.30 - 0.45	(CH) CLAY	2.9
TP107	0.40 - 0.50	(CH) CLAY	4.5
TP108	0.40 - 0.55	(CH) CLAY	3.7
TP109	0.75 - 0.90	(CI) Sandy CLAY	0.8
TP111	0.30 - 0.45	(CH) CLAY	3.1
TP111	1.20 - 1.45	(CH) CLAY	5.0
TP112	0.55 - 0.90	(CH) CLAY	3.7
TP113	0.50 - 0.85	(CH) CLAY	4.7
TP114	0.80 - 0.95	(CH) CLAY	4.1

6.0 Site Classification to AS2870-2011

Based on the results of the field work, laboratory testing and site regrade works conducted, residential lots located within Stage 1 of the Brush Creek Estate residential subdivision, as shown on the attached Figure AD1, are classified in their current condition in accordance with AS2870-2011 *'Residential Slabs and Footings'*, as shown in Table 4.

TABLE 4 – SITE CLASSIFICATION TO AS2870-2011

Lot Numbers	Site Classification
101 to133 and 138 to 143	**H1**
134 to 137, 144 and 145	**H2**

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

A characteristic free surface movement of 60mm to 75mm is estimated for the lots classified as **Class 'H2'** in their existing condition.

The effects of changes to the soil profile by additional cutting and filling and the effects of past and future trees should be considered in selection of the design value for differential movement. If site re-grading works involving cutting or filling are performed after the date of this assessment, the classification may change and further advice should be sought.

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

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

The classification presented above assumes that:

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

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

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

7.0 Limitations

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 locations. It should be noted that subsurface conditions between and away from the test locations may be different to those observed during the field work and used as the basis of the recommendations contained in this report.

If 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.

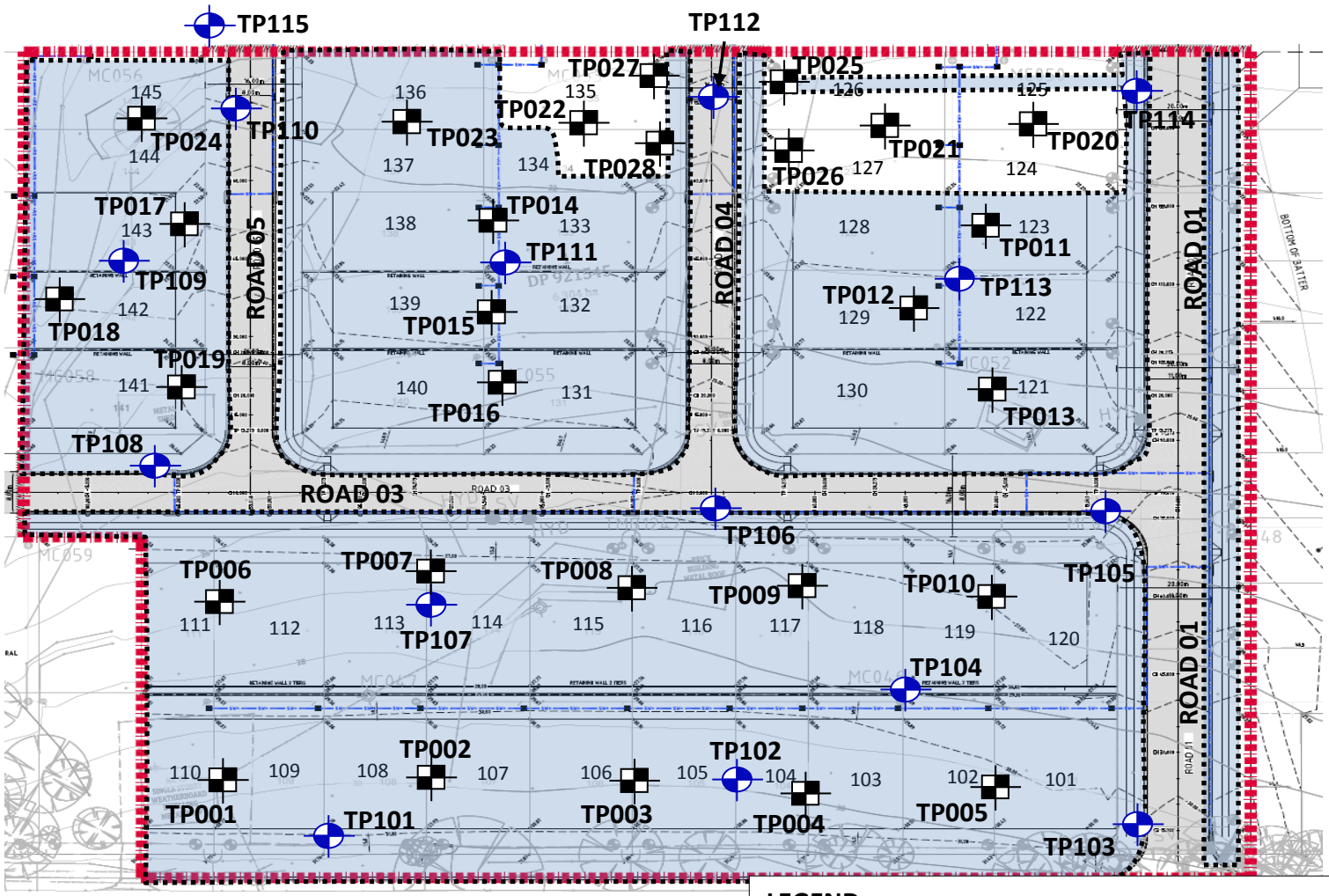
If you have any further questions regarding this report, please do not hesitate to contact Shannon Kelly or the undersigned.

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

Jason Lee
Principal Geotechnical Engineer

FIGURE AD1

Site Plan and Approximate Test Locations



TRANSFIELD AVENUE

LEGEND:

- Approximate test pit location.
- Approximate test pit location. (Previous Investigation NEW18P-0170-AA, dated: 18/09/2018).
- Approximate extent of re-grade works.

Based on Site Plan prepared by Costin Roe Consulting (Dwg No. C013358.00-C405, Iss. A, dated 01/08/2018).

Qualtest LABORATORY (NSW) PTY LTD

Client:	McCLOY GROUP	Drawing No:	FIGURE AD1
Project:	BRUSH CREEK ESTATE - STAGE 1	Project No:	NEW18P-0170
Location:	TRANSFIELD AVENUE, EDGEWORTH	Scale:	N.T.S.
Title:	SITE PLAN AND APPROXIMATE TEST LOCATIONS	Date:	28/08/2019

Costin Roe Plan:

Drawing No. C013358.00-C400, Issue I – Drainage and Roadworks Plan

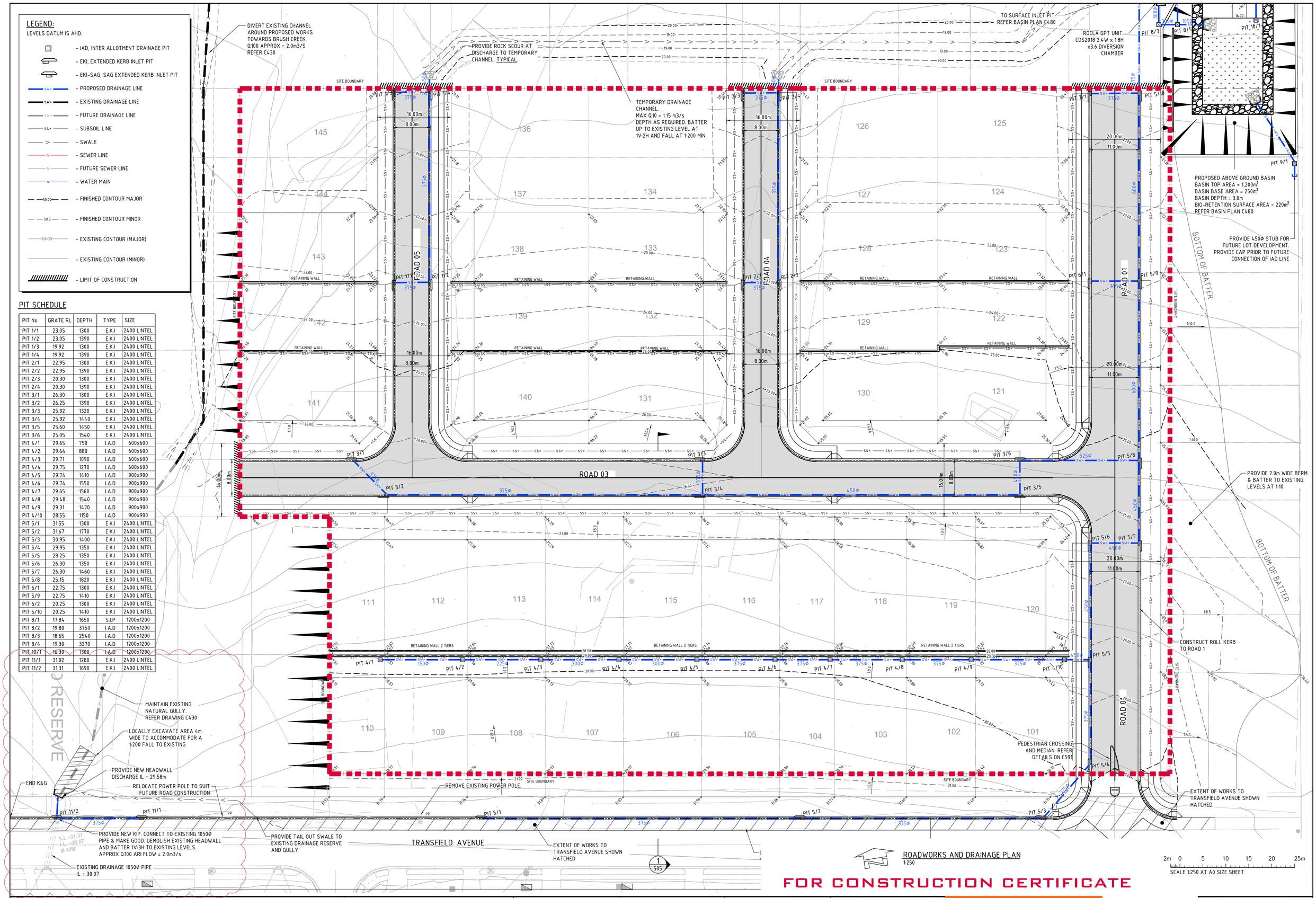
LEGEND:

LEVELS DATUM IS AHD.

- IAD, INTER ALLOTMENT DRAINAGE PIT
- EKI, EXTENDED KERB INLET PIT
- EKI-SAG, SAG EXTENDED KERB INLET PIT
- PROPOSED DRAINAGE LINE
- EXISTING DRAINAGE LINE
- FUTURE DRAINAGE LINE
- SUBSOIL LINE
- SWALE
- SEWER LINE
- FUTURE SEWER LINE
- WATER MAIN
- FINISHED CONTOUR MAJOR
- FINISHED CONTOUR MINOR
- EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- LIMIT OF CONSTRUCTION

PIT SCHEDULE

PIT No.	GRATE RL	DEPTH	TYPE	SIZE
PIT 1/1	23.05	1300	E.K.I	2400 LINTEL
PIT 1/2	23.05	1390	E.K.I	2400 LINTEL
PIT 1/3	19.92	1300	E.K.I	2400 LINTEL
PIT 1/4	19.92	1390	E.K.I	2400 LINTEL
PIT 2/1	22.95	1300	E.K.I	2400 LINTEL
PIT 2/2	22.95	1390	E.K.I	2400 LINTEL
PIT 2/3	20.30	1300	E.K.I	2400 LINTEL
PIT 2/4	20.30	1390	E.K.I	2400 LINTEL
PIT 3/1	26.30	1300	E.K.I	2400 LINTEL
PIT 3/2	26.25	1390	E.K.I	2400 LINTEL
PIT 3/3	25.92	1320	E.K.I	2400 LINTEL
PIT 3/4	25.92	1440	E.K.I	2400 LINTEL
PIT 3/5	25.60	1450	E.K.I	2400 LINTEL
PIT 3/6	25.05	1540	E.K.I	2400 LINTEL
PIT 4/1	29.65	750	I.A.D	600x600
PIT 4/2	29.64	880	I.A.D	600x600
PIT 4/3	29.71	1090	I.A.D	600x600
PIT 4/4	29.75	1270	I.A.D	600x600
PIT 4/5	29.74	1410	I.A.D	900x900
PIT 4/6	29.74	1550	I.A.D	900x900
PIT 4/7	29.65	1560	I.A.D	900x900
PIT 4/8	29.48	1540	I.A.D	900x900
PIT 4/9	29.31	1470	I.A.D	900x900
PIT 4/10	28.55	1150	I.A.D	900x900
PIT 5/1	31.55	1300	E.K.I	2400 LINTEL
PIT 5/2	31.67	1770	E.K.I	2400 LINTEL
PIT 5/3	30.95	1400	E.K.I	2400 LINTEL
PIT 5/4	29.95	1350	E.K.I	2400 LINTEL
PIT 5/5	28.25	1350	E.K.I	2400 LINTEL
PIT 5/6	26.30	1350	E.K.I	2400 LINTEL
PIT 5/7	26.30	1460	E.K.I	2400 LINTEL
PIT 5/8	25.15	1820	E.K.I	2400 LINTEL
PIT 6/1	22.75	1300	E.K.I	2400 LINTEL
PIT 5/9	22.75	1410	E.K.I	2400 LINTEL
PIT 6/2	20.25	1300	E.K.I	2400 LINTEL
PIT 5/10	20.25	1410	E.K.I	2400 LINTEL
PIT 8/1	17.84	1650	S.I.P	1200x1200
PIT 8/2	19.80	3750	I.A.D	1200x1200
PIT 8/3	18.65	2540	I.A.D	1200x1200
PIT 8/4	19.30	3270	I.A.D	1200x1200
PIT 10/1	16.30	1300	I.A.D	1200x1200
PIT 11/1	31.02	1280	E.K.I	2400 LINTEL
PIT 11/2	31.31	1690	E.K.I	2400 LINTEL



ROADWORKS AND DRAINAGE PLAN
1:250

2m 0 5 10 15 20 25m
SCALE 1:250 AT A0 SIZE SHEET

FOR CONSTRUCTION CERTIFICATE

AMENDMENTS	DATE	ISSUE
ISSUED FOR CONSTRUCTION CERTIFICATE	22.10.18	F
ISSUED FOR TENDER	12.10.18	E
ISSUED FOR INFORMATION	05.10.18	D
ISSUED FOR INFORMATION	06.09.18	C
ISSUED FOR INFORMATION	04.09.18	B
ISSUED FOR INFORMATION	01.08.18	A

AMENDMENTS	DATE	ISSUE
REVISED AS CLOUDED	11.01.19	I
ISSUED FOR CONSTRUCTION CERTIFICATE	30.11.18	H
ISSUED FOR CONSTRUCTION CERTIFICATE	31.10.18	G

AMENDMENTS	DATE	ISSUE

ARCHITECT

CLIENT
McCLOY GROUP
SUITE 2, GROUND FLOOR
317 HUNTER STREET, NEWCASTLE
(02) 4945 7500

PROJECT
PROPOSED SUBDIVISION
TRANSFIELD AVENUE
EDGEWORTH NSW

DESIGNED	DRAWN	DATE	CHECKED	SIZE	SCALE	CAD REF:
XC	DW			A0	AS SHOWN	C013358.00 - C400

Costin Roe Consulting Pty Ltd.
Consulting Engineers ACN 003 548 689
Level 1, 8 Windmill Street
Walsh Bay, Sydney NSW 2000
Tel: (02) 8251-7699 Fax: (02) 8251-3721
email: mail@costinroe.com.au

Costin Roe Consulting

PRECISION | COMMUNICATION | ACCOUNTABILITY

DRAWING TITLE
DRAINAGE AND ROADWORKS PLAN

DRAWING No C013358.00-C400

ISSUE

APPENDIX A:

Results of Field Investigations

ENGINEERING LOG - TEST PIT

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP001
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	FILL: Sandy CLAY - low to medium plasticity, grey-brown and dark grey, fine grained sand, with some fine to coarse grained angular to sub-angular gravel.			HP	>600	FILL - CONTROLLED
										HP	>600	
							0.30m					
		0.40m					FILL: CLAY - medium to high plasticity, pale grey and orange to red-brown.	M ~ w_P		HP	>600	
				0.5								
		U50				CH			H			
		0.70m								HP	>600	
										HP	>600	
							0.90m Trace pockets of Sandy CLAY - medium to high plasticity, grey, fine to coarse grained sand, with fine to medium grained sub-rounded gravel.					RESIDUAL SOIL
				1.0			CLAY - medium to high plasticity, brown with some orange to red-brown and pale grey.	M < w_P		HP	410	
							Pale grey with some orange to red-brown.					
										HP	380	
				1.5		CH		M > w_P	VSt	HP	350	
										HP	340	
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP002
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	0.10m FILL-TOPSOIL: Sandy CLAY - low plasticity, brown, fine to coarse grained sand, trace fine to medium grained sub-angular to sub-rounded gravel, root affected.					FILL - TOPSOIL
						CL	FILL: Sandy CLAY - low to medium plasticity, grey-brown to dark grey trace orange to brown and pale grey, fine to coarse grained sand (mostly fine grained), with some fine to coarse grained angular to sub-angular gravel.	M < w_P		HP HP	>600 >600	FILL - CONTROLLED
				0.5		CH	0.40m FILL: CLAY - medium to high plasticity, brown to red-brown and pale grey.		H	HP HP	580 550	
		1.10m U50 1.25m		1.0 1.5		CH	0.90m CLAY - medium to high plasticity, brown to red-brown and pale grey. Pale grey with some orange to red-brown. Dark brown.	M > w_P	VSt	HP HP HP	380 250 300	RESIDUAL SOIL
				2.0		CH	2.00m Silty CLAY - medium to high plasticity, pale grey.	M < w_P	H	HP	>600	
							2.20m Hole Terminated at 2.20 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP003
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
						CL	0.05m FILL-TOPSOIL: Sandy CLAY - low plasticity, brown, fine to coarse grained sand, trace fine to medium grained sub-angular to sub-rounded gravel, root affected.					FILL - TOPSOIL
						CL	FILL: Sandy CLAY - low to medium plasticity, grey-brown to dark grey trace orange to brown and pale grey, fine to coarse grained sand (mostly fine grained), with some fine to coarse grained angular to sub-angular gravel.	M < w_P	H	HP	>600	FILL - CONTROLLED
							0.35m FILL: CLAY - medium to high plasticity, brown to red-brown and pale grey.			HP	>600	
										HP	>600	
		0.50m		0.5						HP	350 - 420	
		U50				CH			VSt - H	HP	350 - 420	
		0.80m					0.80m CLAY - medium to high plasticity, brown to red-brown and pale grey.					RESIDUAL SOIL
E	Not Encountered			1.0				M > w_P		HP	400	
						CH	Pale grey with some orange to red-brown.		VSt	HP	310	
										HP	320	
				1.5			Dark brown to brown.			HP	420	
							1.60m Silty CLAY - medium to high plasticity, pale grey.		H	HP	>600	
						CH		M < w_P		HP	>600	
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP004
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	FILL-TOPSOIL: Sandy CLAY - low plasticity, brown, fine to coarse grained sand, trace fine to medium grained sub-angular to sub-rounded gravel, root affected. (0.10m)	$M < w_P$	H			FILL - TOPSOIL
						CL	FILL: Sandy CLAY - low to medium plasticity, grey-brown to dark grey trace orange to brown and pale grey, fine to coarse grained sand (mostly fine grained), with some fine to coarse grained angular to sub-angular gravel. (0.40m)			HP HP	>600 >600	FILL - CONTROLLED
				0.5		CH	FILL: CLAY - medium to high plasticity, brown to red-brown and pale grey. (0.90m)			HP HP	>600 >600	
				1.0		CI	FILL: Sandy CLAY - medium plasticity, grey-brown to red-brown and pale grey, fine grained sand. (1.10m)					
		1.20m				CH	FILL: CLAY - medium to high plasticity, brown to dark brown. (1.20m)			HP	>600	RESIDUAL SOIL
		U50 1.40m		1.5		CH	Silty CLAY - medium to high plasticity, pale grey trace pale orange to red-brown. (2.00m)			HP HP HP	>600 >600 >600	
				2.0			Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP005
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					GP	0.05m FILL: Gravelly SAND - fine to coarse grained, brown, fine to medium grained angular gravel, with some fines of low to medium plasticity.	D - M				FILL
										HP	>600	FILL - CONTROLLED
						CL	FILL: Sandy CLAY - low to medium plasticity, grey-brown to dark grey trace orange to brown and pale grey, fine to coarse grained sand (mostly fine grained), with some fine to coarse grained angular to sub-angular gravel.			HP	>600	
							0.35m FILL: CLAY - medium to high plasticity, brown to red-brown and pale grey.			HP	>600	
				0.5								
		0.60m										
		U50								HP	>600	
		0.80m				CH						
				1.0				$M < w_P$	H	HP	>600	
							1.20m CLAY - medium to high plasticity, brown to red-brown and pale grey.					RESIDUAL SOIL
										HP	>600	
							Pale orange with some orange.					
				1.5								
						CH						
										HP	>600	
				2.0								
							2.10m					
							2.15m SILTSTONE - pale grey trace orange, estimated medium to high strength.	D				MODERATELY TO SLIGHTLY WEATHERED ROCK
							Hole Terminated at 2.15 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP006
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CH	FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.			HP	>600	FILL - CONTROLLED
										HP	>600	
							0.25m					
							FILL: Sandy CLAY - low to medium plasticity, grey-brown to dark grey trace orange to brown and pale grey, fine to coarse grained sand (mostly fine grained), with some fine to coarse grained angular to sub-angular gravel.			HP	>600	
		0.50m		0.5				$M < w_P$				
		U50				CI				HP	>600	
		0.70m										
									H			
										HP	>600	
							0.95m					
		1.00m		1.0			CLAY - medium to high plasticity, brown to red-brown and pale grey.			HP	500	RESIDUAL SOIL
		U50 1.10m										
						CH		$M \sim w_P$		HP	480	
				1.5								
							1.70m			HP	500	
							SILTSTONE - pale grey to white, estimated low to medium strength, highly fractured, with some Extremely Weathered Pockets.					EXTREMELY TO HIGHLY WEATHERED ROCK
							1.85m					
							Hole Terminated at 1.85 m Very slow progress					
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP007
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CH	FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.			HP	>600	FILL - CONTROLLED
							0.30m					
		0.40m					CLAY - medium to high plasticity, brown to red-brown and pale grey.	$M < w_P$	H	HP	>600	RESIDUAL SOIL
		U50		0.5		CH						
		0.60m								HP	>600	
							0.85m					
							0.90m SILTSTONE - pale grey to white, estimated low to medium strength, highly fractured, with some Extremely Weathered Pockets.	D - M				EXTREMELY TO HIGHLY WEATHERED ROCK
				1.0			Hole Terminated at 0.90 m Very slow progress					
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP008
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	0.10m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, brown, fine to coarse grained sand (mostly fine to medium grained), trace fine to medium grained angular gravel, root affected.					FILL - TOPSOIL
						CH	0.30m FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.			HP	>600	FILL - CONTROLLED
		0.40m					CLAY - medium to high plasticity, brown to red-brown and pale grey.	$M < w_P$	H	HP	550	RESIDUAL SOIL
		U50		0.5		CH				HP	540	
		0.70m					Pale grey and trace orange.			HP	480	
							0.75m SILTSTONE - pale grey to white, estimated low to medium strength, highly fractured, with some Extremely Weathered Pockets. 0.85m	D - M				EXTREMELY TO HIGHLY WEATHERED ROCK
				1.0			Hole Terminated at 0.85 m Very slow progress					
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP009
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, brown, fine to coarse grained sand (mostly fine to medium grained), trace fine to medium grained angular gravel, root affected. (0.15m)	$M < w_P$				FILL - TOPSOIL
		0.30m				CH	FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.		H	HP	>600	FILL - CONTROLLED
		U50		0.5						HP	>600	
		0.55m					(0.55m) CLAY - medium to high plasticity, brown to red-brown and pale grey.			HP	>600	RESIDUAL SOIL
				1.0		CH				HP	>600	
							(1.10m) SILTSTONE - pale grey to white, estimated low to medium strength, highly fractured, with some Extremely Weathered Pockets. (1.20m)	D - M				EXTREMELY TO HIGHLY WEATHERED ROCK
				1.5			Hole Terminated at 1.20 m Very slow progress					
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP010
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	0.05m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, brown, fine to coarse grained sand (mostly fine to medium grained), trace fine to medium grained angular gravel, root affected.	M < w_P				FILL - TOPSOIL FILL - CONTROLLED
						CH	FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.	M ~ w_P		HP HP HP	480 450 >600	
				0.5			0.50m					
		0.70m U50 0.80m				CH	CLAY - medium to high plasticity, brown to red-brown and pale grey. Pale grey, trace orange.	M < w_P	H	HP HP HP	>600 >600 >600	RESIDUAL SOIL
				1.0			1.05m					
							SILTSTONE - pale grey to white, estimated low to medium strength, highly fractured, with some Extremely Weathered Pockets. 1.20m	D				EXTREMELY TO HIGHLY WEATHERED ROCK
							Hole Terminated at 1.20 m Very slow progress					
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP011
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	0.05m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, brown, fine to coarse grained sand (mostly fine to medium grained), trace fine to medium grained angular gravel, root affected.					FILL - TOPSOIL
							FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.			HP	>600	FILL - CONTROLLED
						CH				HP	>600	
				0.5						HP	>600	
							0.70m CLAY - medium to high plasticity, brown to red-brown and pale grey.					RESIDUAL SOIL
										HP	>600	
		1.00m		1.0				M ~ w_P	H	HP	>600	
		U50										
		1.20m								HP	450	
						CH						
				1.5								
							1.80m			HP	550	
							Hole Terminated at 1.80 m					
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP012
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected.	D - M				FILL - TOPSOIL
							0.15m					
		0.30m				CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel.	$M < w_P$		HP	450	FILL - CONTROLLED
		U50 0.45m								HP	520	
				0.5						HP	450	
							0.55m					
						CH	FILL: Sandy CLAY - medium to high plasticity, grey to brown with some pale grey to white and orange, fine to medium grained sand, trace fine to medium grained angular to sub-angular gravel.	$M \sim w_P$ - $M < w_P$		HP	480	
							0.85m					
		0.90m					CLAY - medium to high plasticity, grey-brown with some orange and pale grey.			HP	550	RESIDUAL SOIL
		U50 1.05m		1.0								
									H	HP	550	
							Pale grey with some pale brown and pale orange.					
						CH		$M \sim w_P$		HP	580	
				1.5								
							1.80m					
						CH	Silty CLAY - medium to high plasticity, pale grey to white, with some pockets of Extremely to Highly Weathered Rock.	$M < w_P$				
				2.0								
							2.10m					
							Hole Terminated at 2.10 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP013
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 20/6/19

EQUIPMENT TYPE: 5.5 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					CL	0.05m FILL-TOPSOIL: Sandy CLAY - low to medium plasticity, brown, fine to coarse grained sand (mostly fine to medium grained), trace fine to medium grained angular gravel, root affected.	$M < w_P$	H			FILL - TOPSOIL
							FILL: CLAY - medium to high plasticity, pale grey with some orange to red-brown, trace fine to coarse grained angular gravel.			HP	>600	FILL - CONTROLLED
						CH				HP	>600	
		0.50m		0.5								
		U50								HP	>600	
		0.70m					0.70m					
						CI	FILL: Sandy CLAY - medium plasticity, brown with some grey, fine to coarse grained sand, trace fine to medium grained sub-rounded to sub-angular gravel. 0.80m			HP	>600	
						CH	FILL: CLAY - medium to high plasticity, pale grey with orange to red-brown. 0.95m			HP	>600	
				1.0		CI	FILL: Gravelly Sandy CLAY - medium plasticity, grey-brown and dark grey trace pale grey and orange, fine to coarse grained sand, fine to coarse grained angular gravel. 1.20m			HP	>600	RESIDUAL SOIL
							CLAY - medium to high plasticity, pale grey to brown.			HP	>600	
				1.5		CH	Pale grey with some orange to red-brown.			HP	>600	
				2.0			2.10m					
							Hole Terminated at 2.10 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP014
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected. (0.10m)	D - M				FILL - TOPSOIL
						CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel. (0.30m)	M < w_P		HP HP	450 440	FILL - CONTROLLED
				0.5		CH	FILL: Sandy CLAY - medium to high plasticity, grey to brown with some pale grey to white and orange, fine to medium grained sand, trace fine to medium grained angular to sub-angular gravel. With some Gravel. (0.70m)	M > w_P	H	HP HP HP	420 480 420	
		0.80m U50 0.95m		1.0 1.5		CH	CLAY - medium to high plasticity, pale grey to pale brown with some pale orange. Pale grey with some pale brown and pale orange to red-brown. (1.80m)		VSt	HP HP HP HP	380 350 300 230 220	RESIDUAL SOIL
				2.0		CH	Silty CLAY - medium to high plasticity, pale grey to white, with some Extremely Weathered to Highly Weathered pockets. (2.10m)	M < w_P	H	HP	>600	
							Hole Terminated at 2.10 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP015
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected. (0.10m)					FILL - TOPSOIL
						CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel. (0.45m)			HP	580	FILL - CONTROLLED
										HP	580	
		0.50m		0.5		CL	FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel. (0.75m)	M < w_P	H	HP	>600	
		U50 0.65m								HP	>600	
						CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel. (1.00m)			HP	>600	
				1.0			CLAY - medium to high plasticity, grey-brown with some orange and pale grey.			HP	580	RESIDUAL SOIL
		1.20m								HP	360	
							pale grey with some pale brown and pale orange.			HP	300	
		U50		1.5		CH		M > w_P	VSt	HP	250	
		1.60m								HP	200	
				2.0			(2.00m)			HP	200	
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP016
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected.	D - M				FILL - TOPSOIL
							0.20m					
						CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel.	$M \sim w_P$ - $M > w_P$	VSt - H	HP HP	380 - 450 360 - 440	FILL - CONTROLLED
				0.5								
							0.75m					
						CL	FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel.	$M < w_P$		HP HP	440 450	
		1.00m		1.0			1.00m					
		U50				CL	FILL: Sandy CLAY - low to medium plasticity, brown to red-brown with some pale grey to white, fine to coarse grained sand, with some fine to medium grained angular to sub-angular gravel.	$M < w_P$ - $M \sim w_P$	H	HP HP	400 450	
		1.30m					1.40m					
				1.5		CL	FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel.			HP	450	
							1.70m					
						CL	FILL: Sandy CLAY - low to medium plasticity, brown to red-brown with some pale grey to white, fine to coarse grained sand, with some fine to medium grained angular to sub-angular gravel.					
							1.90m					RESIDUAL SOIL
				2.0		CH	CLAY - medium to high plasticity, grey-brown with some orange and pale grey.	$M > w_P$	VSt	HP	380	
							2.20m					
							Hole Terminated at 2.20 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP017
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected.	D - M				FILL - TOPSOIL
							0.20m					
						CH	FILL: Sandy CLAY - medium to high plasticity, brown with some orange to red-brown trace pale grey to white, fine to coarse grained sand, with some fine to medium grained angular to sub-angular gravel, trace Clayey SAND pockets.	$M < w_P$	H	HP	450	FILL - CONTROLLED
										HP	430	
				0.5								
										HP	450	
							0.65m					
		0.70m				CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel.			HP	450	
		U50					0.80m			HP	430	
		0.90m					FILL: Sandy CLAY - medium to high plasticity, brown with some orange to red-brown trace pale grey to white, fine to coarse grained sand, with some fine to medium grained angular to sub-angular gravel, trace Clayey SAND pockets.			HP	430	
				1.0						HP	450	
						CH						
		1.10m								HP	400	
		U50						$M \sim w_P$		HP	450	
		1.25m										
							1.30m					
							FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel.			HP	450	
				1.5		CL		$M < w_P$				
										HP	450	
							1.70m					
							CLAY - medium to high plasticity, grey-brown with some orange and pale grey.					RESIDUAL SOIL
						CH		$M > w_P$	St	HP	180	
										HP	190	
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP018
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected.	D - M				FILL - TOPSOIL
							0.15m					
						CL	FILL: Sandy CLAY - low to medium plasticity, pale grey to grey and brown to orange, fine to coarse grained sand, with some fine to coarse grained angular to sub-angular gravel, trace Clayey SAND pockets.	$M < w_P$	H	HP	>600	FILL - CONTROLLED
				0.5						HP	550	
		0.60m										
		U50										
		0.80m								HP	580	
							0.85m					
						CL	FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel.			HP	560	
				1.0						HP	550	
				1.5						HP	550	
				2.0								
							2.10m					
							Hole Terminated at 2.10 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP019
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 25/7/19

EQUIPMENT TYPE: 8 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty SAND - fine to coarse grained, grey-brown, fines of low plasticity, trace fine grained angular to sub-angular gravel, root affected. (0.10m)	D - M				FILL - TOPSOIL
						CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel.	$M < w_P$	H	HP	550	FILL - CONTROLLED
				0.5						HP	480	
							(0.65m)			HP	>600	
						CL	FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel.			HP	550	
		1.00m		1.0						HP	480	
		U50								HP	550	
		1.20m					(1.20m)					
						CL	FILL: Sandy CLAY - low to medium plasticity, orange to brown trace pale grey to white, fine to coarse grained sand, with Clayey SAND pockets, trace fine to medium grained angular to sub-angular gravel.					
				1.5								
							(1.95m)					
				2.0		CL	(2.00m) FILL: Sandy CLAY - low to medium plasticity, dark grey, fine grained sand, with some fine to medium grained angular to sub-angular gravel.					
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP020
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected. (0.10m)	D - M				FILL - TOPSOIL
						CH	FILL: Sandy CLAY - medium to high plasticity, dark grey to brown, fine grained sand. (0.20m)		F - St	HP	100	FILL / POSSIBLE COLLUVIUM
							CLAY - medium to high plasticity, grey to brown and pale orange.			HP	230	RESIDUAL SOIL
		0.50m		0.5						HP	250	
		U50 0.65m										
				1.0		CH	Pale grey with some orange to red-brown.	M > w_P	VSt	HP	280	
				1.5						HP	310	
						CH	Silty CLAY - high plasticity, pale grey with some orange to orange-brown. (1.80m)			HP	320	
				2.0			Hole Terminated at 2.00 m (2.00m)					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP021
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	0.05m FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected.	D - M				FILL - TOPSOIL
						CH	0.20m FILL: Sandy CLAY - medium to high plasticity, dark grey to brown, fine grained sand.			HP	300	FILL / POSSIBLE COLLUVIUM
							CLAY - medium to high plasticity, grey to brown and pale orange.			HP	250	RESIDUAL SOIL
							Pale grey with some orange to red-brown.			HP	220	
		0.90m		0.5								
		U50 1.05m		1.0		CH		M > w_P	VSt	HP	280	
				1.5						HP	300	
							1.70m Silty CLAY - high plasticity, pale grey with some orange to orange-brown.			HP	330	
				2.0		CH	2.10m					
							Hole Terminated at 2.10 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP022
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered	0.10m				SM	0.05m FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected.	D - M				FILL - TOPSOIL
		U50				CH	FILL: CLAY - medium to high plasticity, dark grey to brown.	M > w_P	St - VSt	HP	200 - 280	FILL / POSSIBLE COLLUVIUM
		0.30m					0.30m CLAY - medium to high plasticity, grey to brown and pale orange.			HP	420	RESIDUAL SOIL
				0.5			Pale grey with some orange to red-brown.			HP	380	
										HP	320	
				1.0		CH			VSt			
				1.5						HP	300	
							1.80m Silty CLAY - high plasticity, pale grey with some orange to orange-brown.	M < w_P				
				2.0		CH	2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

Qualtest LABORATORY (NSW) PTY LTD

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP023
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected. (0.10m)	D - M				FILL - TOPSOIL
						CH	FILL: Sandy Gravelly CLAY - medium to high plasticity, grey to brown and orange to red-brown, fine to coarse grained angular to sub-angular gravel, fine to coarse grained sand. (0.40m)	M < w_P	H	HP	450 - >600	FILL - CONTROLLED
				0.5		CH	CLAY - medium to high plasticity, grey to brown and pale orange.	M > w_P		HP	410	RESIDUAL SOIL
							Pale grey with some orange to red-brown.			HP	410	
		0.80m								HP	390	
		U50 0.95m		1.0					VSt			
				1.5						HP	380	
							(1.60m)					
				2.0			Hole Terminated at 1.60 m Very slow progress					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP024
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	0.05m FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected.	D - M				FILL - TOPSOIL
						CH	FILL: Sandy Gravelly CLAY - medium to high plasticity, grey to brown and orange to red-brown, fine to coarse grained sand, fine to medium grained angular to sub-angular gravel, with some pockets of CLAY.	M > w_P	St - VSt	HP HP	180 - 280 180	FILL - CONTROLLED
		0.50m		0.5			0.55m					
		U50				CI	FILL: Sandy CLAY - medium plasticity, red-brown and white, fine to coarse grained sand, with some fine to coarse grained angular gravel.			HP	250 - 260	
		0.70m					0.70m					
						SM	FILL: Gravelly Sandy CLAY - low to medium plasticity, pale grey and pale brown, fine to coarse grained sand, fine to coarse grained angular gravel.	M < w_P	H	HP HP	410 410	
				1.0			1.30m					
				1.5		CI	FILL: Sandy CLAY - medium to high plasticity, brown to red-brown and pale grey, fine to coarse grained sand, with some fine to medium grained sub-rounded to sub-angular gravel.	M > w_P	St	HP	150	
				2.0			2.00m					
							Hole Terminated at 2.00 m					

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP025
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
SURFACE RL:
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected. (0.10m)	D - M				FILL - TOPSOIL
						CH	FILL: Sandy CLAY - medium to high plasticity, dark grey to brown, fine grained sand. (0.20m)	M > w_P	VSt	HP	320	FILL / POSSIBLE COLLUVIUM
						CH	CLAY - medium to high plasticity, grey to brown and pale orange.			HP HP	250 270	RESIDUAL SOIL
				0.5			(0.50m)					
							Hole Terminated at 0.50 m					
				1.0								
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP026
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
SURFACE RL:
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	0.10m FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected.	D - M				TOPSOIL
						CH	0.20m FILL: Sandy CLAY - medium to high plasticity, dark grey to brown, fine grained sand.	M > w_P	St	HP	150	COLLUVIUM RESIDUAL SOIL
						CH	CLAY - medium to high plasticity, grey to brown and pale orange.		VSt	HP	300	
							0.40m Hole Terminated at 0.40 m			HP	310	
				0.5								
				1.0								
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP027
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
SURFACE RL:
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected. (0.15m)	D - M				FILL - TOPSOIL
						CI	FILL: Sandy CLAY - medium plasticity, grey to dark grey and brown, fine to coarse grained sand, with some fine to medium grained sub-rounded gravel. (0.25m)	M > w_P	VSt - H	HP	350 - 480	FILL
						CH	CLAY - medium to high plasticity, grey to brown and pale orange. Pale grey with some orange to red-brown. (0.50m)			HP	310	RESIDUAL SOIL
				0.5			Hole Terminated at 0.50 m			HP	280	
				1.0								
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

ENGINEERING LOG - TEST PIT

CLIENT: MCCLOY GROUP
PROJECT: BRUSH CREEK ESTATE - STAGE 1
LOCATION: TRANSFIELD AVENUE, EDGEWORTH

TEST PIT NO: TP028
PAGE: 1 OF 1
JOB NO: NEW18P-0170
LOGGED BY: BE
DATE: 16/8/19

EQUIPMENT TYPE: 2.7 TONNE EXCAVATOR
SURFACE RL:
TEST PIT LENGTH: 2.0 m **WIDTH:** 0.5 m
DATUM:

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
E	Not Encountered					SM	FILL-TOPSOIL: Silty Gravelly SAND - fine to coarse grained, grey, fine to medium grained angular to sub-angular gravel, fines of low plasticity, root affected.	D - M				FILL - TOPSOIL
							0.35m	M > w_P				
						SP	0.40m FILL: SAND - fine to coarse grained, yellow to pale grey.					FILL
						CH	0.45m CLAY - medium to high plasticity, grey to brown and pale orange.		VSt	HP	350	RESIDUAL SOIL
				0.5			Hole Terminated at 0.45 m					
				1.0								
				1.5								
				2.0								

LEGEND:

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

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

Notes, Samples and Tests

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

Field Tests

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

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

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

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

APPENDIX B:

Results of Laboratory Testing

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW19W-2154--S02
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 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.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S02	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP002 - (1.1 - 1.25m)		
Borehole Number:	TP002		
Borehole Depth (m):	1.1 - 1.25		

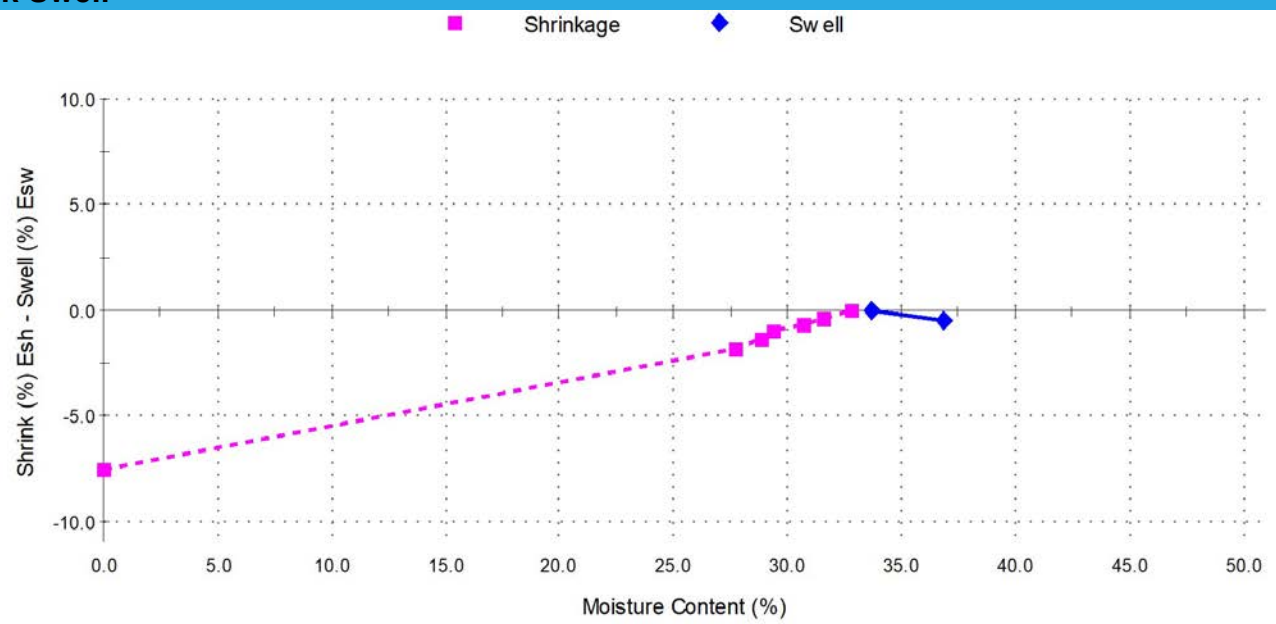
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.5
Moisture Content before (%):	33.7
Moisture Content after (%):	36.8
Est. Unc. Comp. Strength before (kPa):	175
Est. Unc. Comp. Strength after (kPa):	150

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	7.6
Shrinkage Moisture Content (%):	32.8
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 4.2

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW19W-2154--S01
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 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.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S01	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP001 - (0.4 - 0.7m)		
Borehole Number:	TP001		
Borehole Depth (m):	0.4 - 0.7		

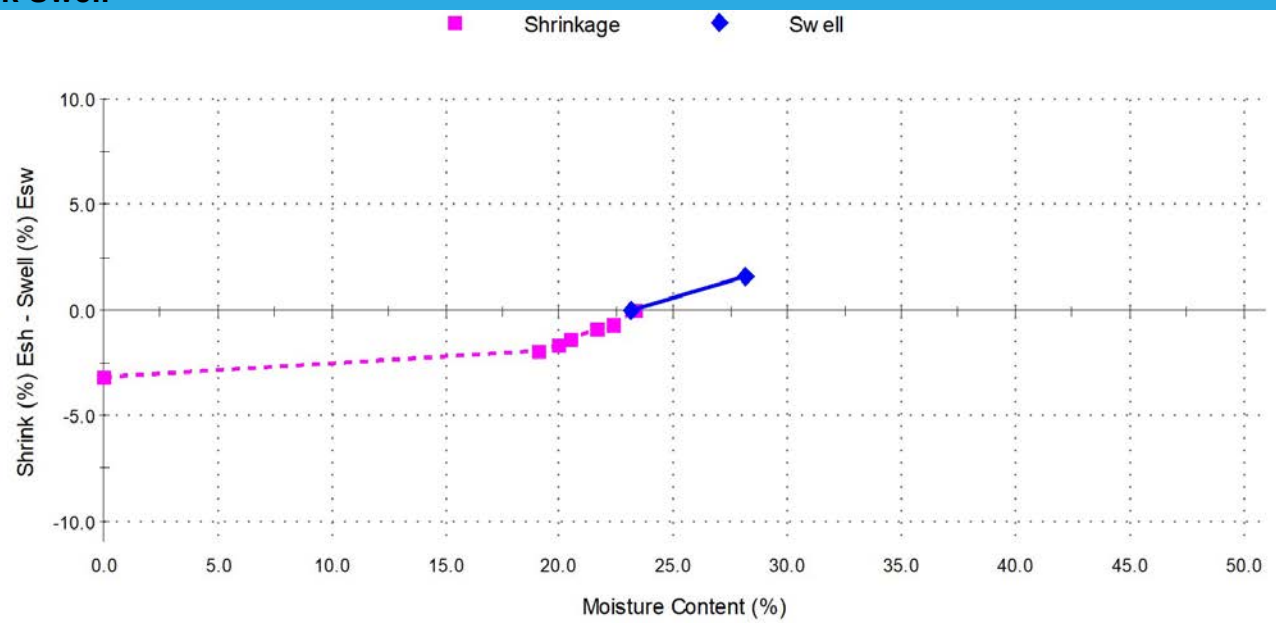
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	1.6
Moisture Content before (%):	23.1
Moisture Content after (%):	28.1
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	350

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	3.2
Shrinkage Moisture Content (%):	23.3
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 2.2

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW19W-2154--S03
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S03	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP003 - (0.5 - 0.8m)		
Borehole Number:	TP003		
Borehole Depth (m):	0.5 - 0.8		

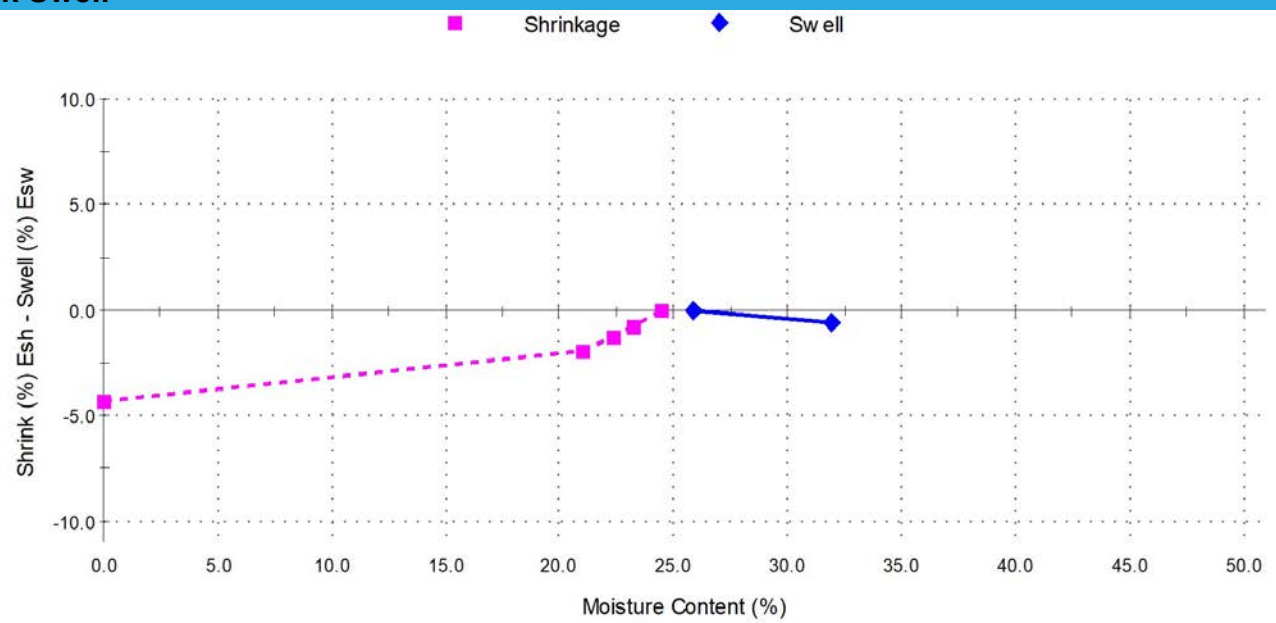
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	25.8
Moisture Content after (%):	31.9
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	250

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	4.3
Shrinkage Moisture Content (%):	24.4
Est. inert material (%):	2.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 2.4

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW19W-2154--S04
Issue No: 2
This report replaces all previous issues of report no 'SSI:NEW19W-2154--S04'.

Shrink Swell Index Report

Client:	McCloy Development Management Pty Ltd Suite 2, Ground Floor, 317 Hunter Street Newcastle NSW 2300
Principal:	
Project No.:	NEW18P-0170
Project Name:	Brush Creek Estate Stage 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.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S04	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP004 - (1.2 - 1.4m)		
Borehole Number:	TP004		
Borehole Depth (m):	1.2 - 1.4		

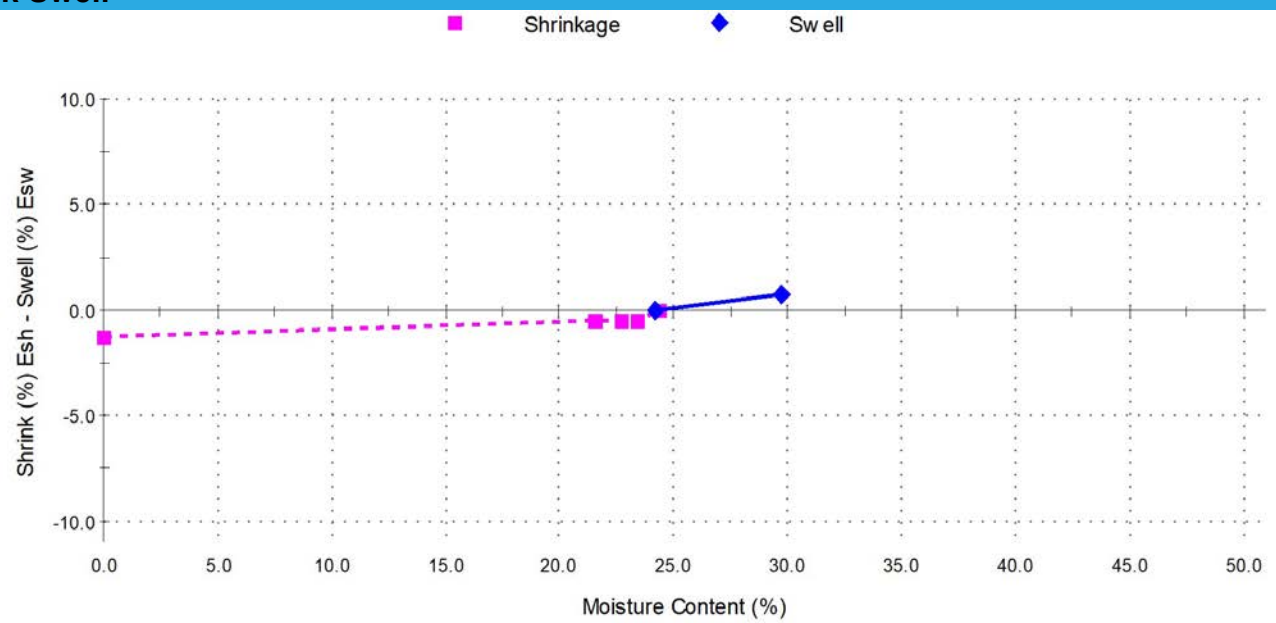
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	0.8
Moisture Content before (%):	24.2
Moisture Content after (%):	29.8
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	450

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	1.3
Shrinkage Moisture Content (%):	24.3
Est. inert material (%):	0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 0.9

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
E: admin@qualtest.com.au
W: www.qualtest.com.au
ABN: 98 153 268 896

Report No: SSI:NEW19W-2154--S05
Issue No: 2
This report replaces all previous issues of report no 'SSI:NEW19W-2154--S05'.

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 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.
Results provided relate only to the items tested or sampled.
This report shall not be reproduced except in full.

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S05	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP005 - (0.6 - 0.8m)		
Borehole Number:	TP005		
Borehole Depth (m):	0.6 - 0.8		

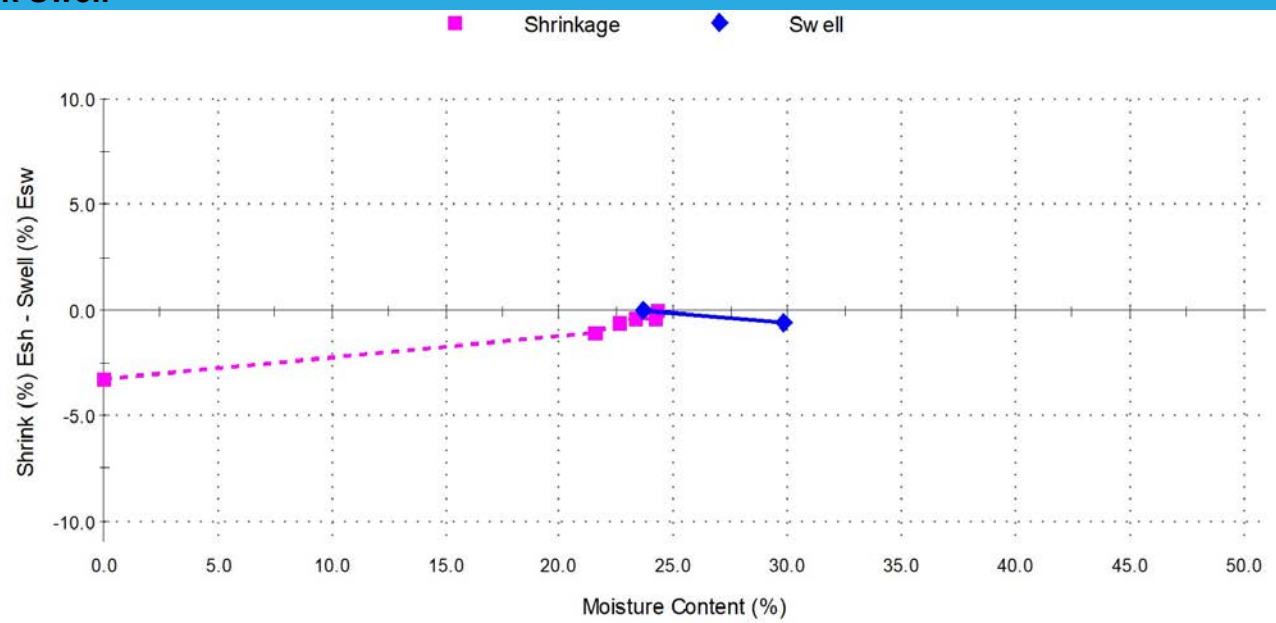
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	23.7
Moisture Content after (%):	29.8
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	300

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	3.3
Shrinkage Moisture Content (%):	24.3
Est. inert material (%):	5.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Major

Shrink Swell



Shrink Swell Index - Iss (%): 1.9

Comments

The results outlined above apply to the sample as received

QUALTEST Laboratory (NSW) Pty Ltd (20708)
8 Ironbark Close Warabrook NSW 2304
T: 02 4968 4468
F: 02 4960 9775
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Report No: SSI:NEW19W-2154--S06
Issue No: 2
This report replaces all previous issues of report no 'SSI:NEW19W-2154--S06'.

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 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.
Results provided relate only to the items tested or sampled.
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S06	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy CLAY	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP006 - (0.5 - 0.7m)		
Borehole Number:	TP006		
Borehole Depth (m):	0.5 - 0.7		

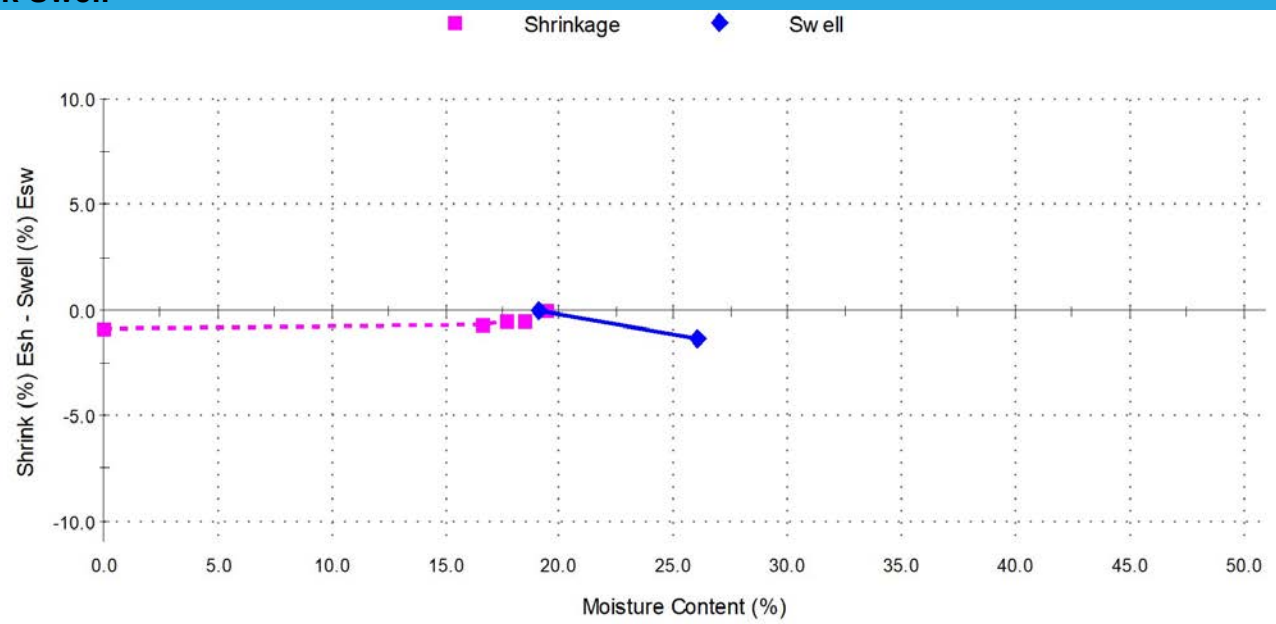
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-1.3
Moisture Content before (%):	19.1
Moisture Content after (%):	26.0
Est. Unc. Comp. Strength before (kPa):	575
Est. Unc. Comp. Strength after (kPa):	200

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	0.9
Shrinkage Moisture Content (%):	19.4
Est. inert material (%):	15.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Major

Shrink Swell



Shrink Swell Index - Iss (%): 0.5

Comments

The results outlined above apply to the sample as received

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ABN: 98 153 268 896

Report No: SSI:NEW19W-2154--S07
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S07	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP007 - (0.4 - 0.6m)		
Borehole Number:	TP007		
Borehole Depth (m):	0.4 - 0.6		

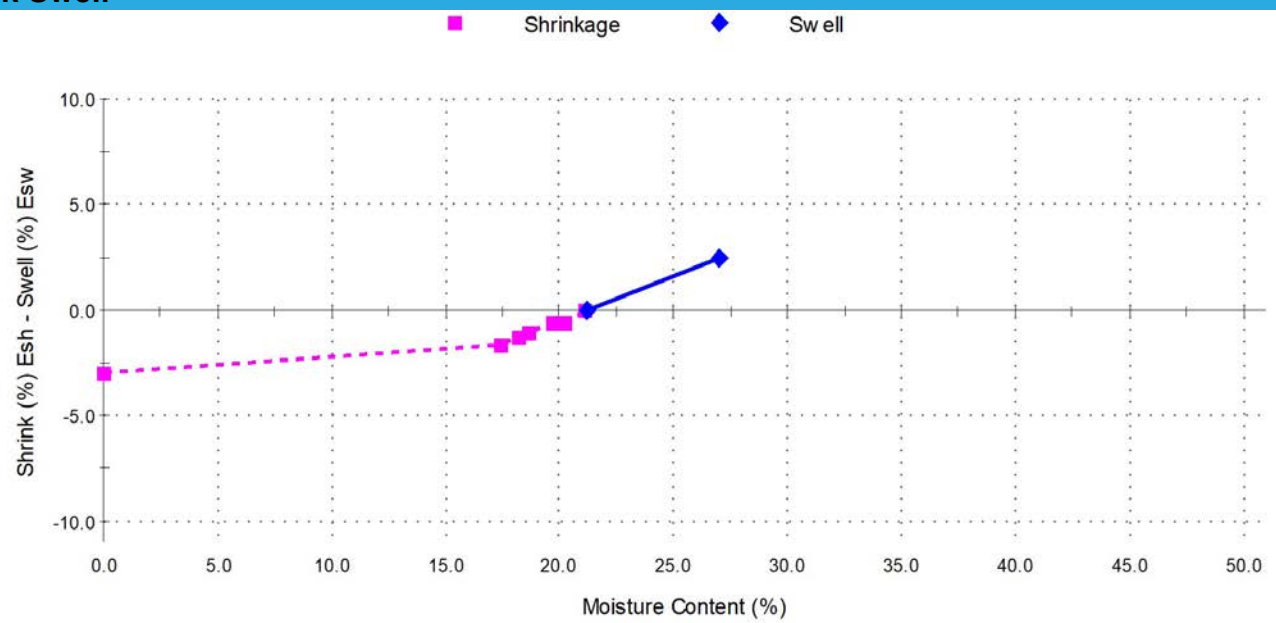
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	2.4
Moisture Content before (%):	21.2
Moisture Content after (%):	27.0
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	300

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	3.0
Shrinkage Moisture Content (%):	21.1
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 2.4

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2154--S08
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S08	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP008 - 0.4 - 0.7m		
Borehole Number:	TP008		
Borehole Depth (m):	0.4 - 0.7		

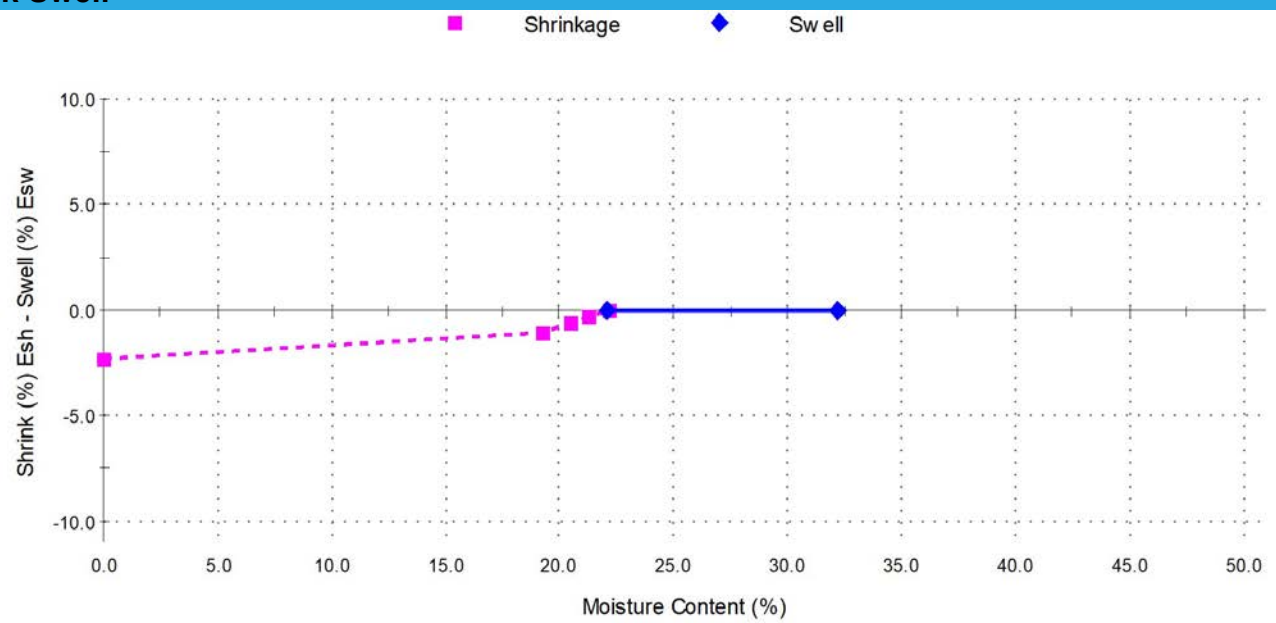
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	0.0
Moisture Content before (%):	22.0
Moisture Content after (%):	32.2
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	270

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	2.3
Shrinkage Moisture Content (%):	22.2
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 1.3

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2154--S09
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S09	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP009 - (0.3 - 0.55m)		
Borehole Number:	TP009		
Borehole Depth (m):	0.3 - 0.55		

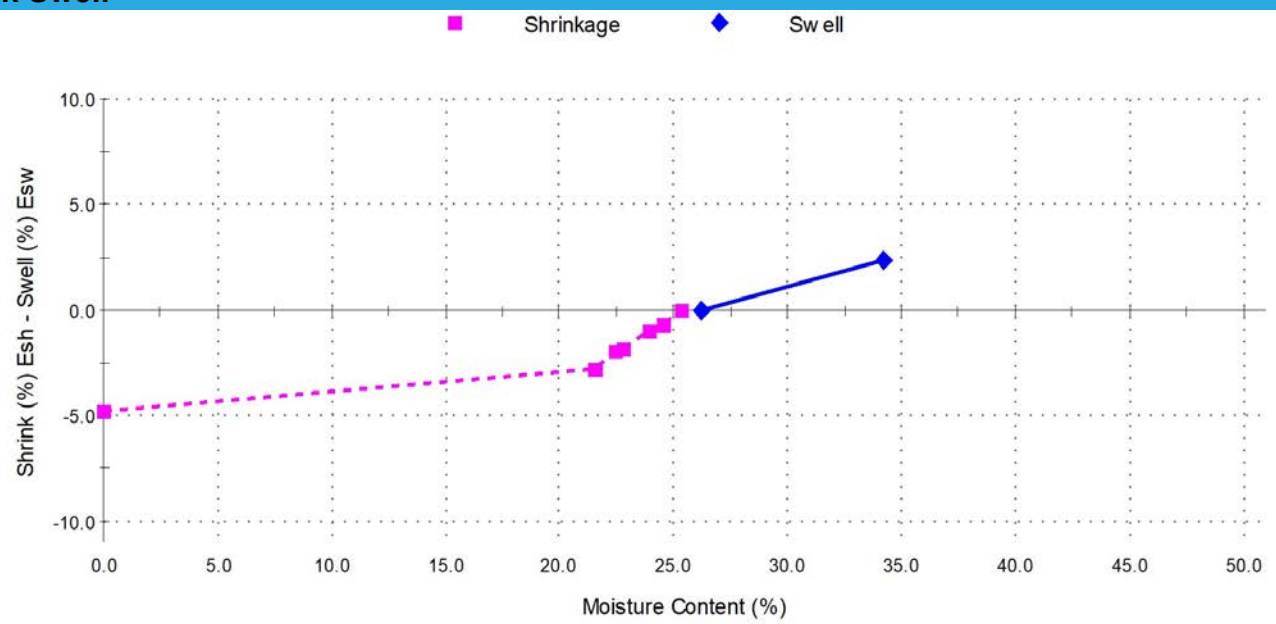
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	2.3
Moisture Content before (%):	26.2
Moisture Content after (%):	34.2
Est. Unc. Comp. Strength before (kPa):	520
Est. Unc. Comp. Strength after (kPa):	300

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	4.8
Shrinkage Moisture Content (%):	25.3
Est. inert material (%):	2.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Major

Shrink Swell



Shrink Swell Index - Iss (%): 3.3

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2154--S10
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S10	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP010 - (0.7 - 0.8m)		
Borehole Number:	TP010		
Borehole Depth (m):	0.7 - 0.8		

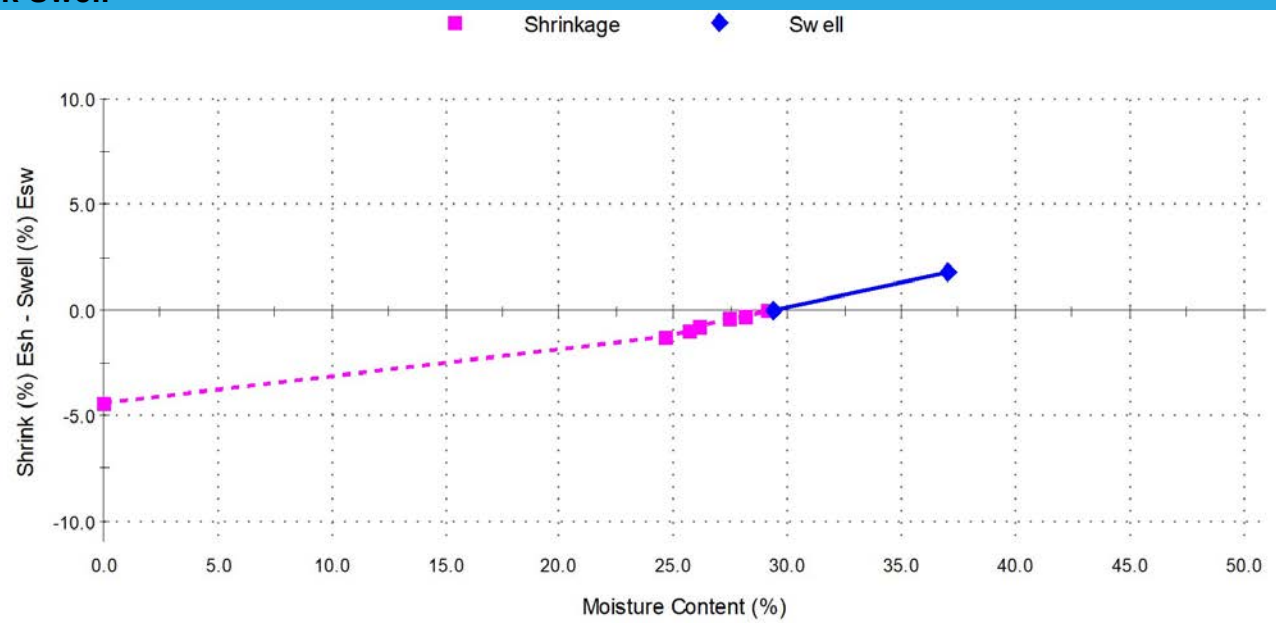
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	1.8
Moisture Content before (%):	29.3
Moisture Content after (%):	37.0
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	300

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	4.4
Shrinkage Moisture Content (%):	29.1
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Major

Shrink Swell



Shrink Swell Index - Iss (%): 2.9

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2154--S11
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S11	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP011 - (1.0 - 1.20m)		
Borehole Number:	TP011		
Borehole Depth (m):	1.0 - 1.20		

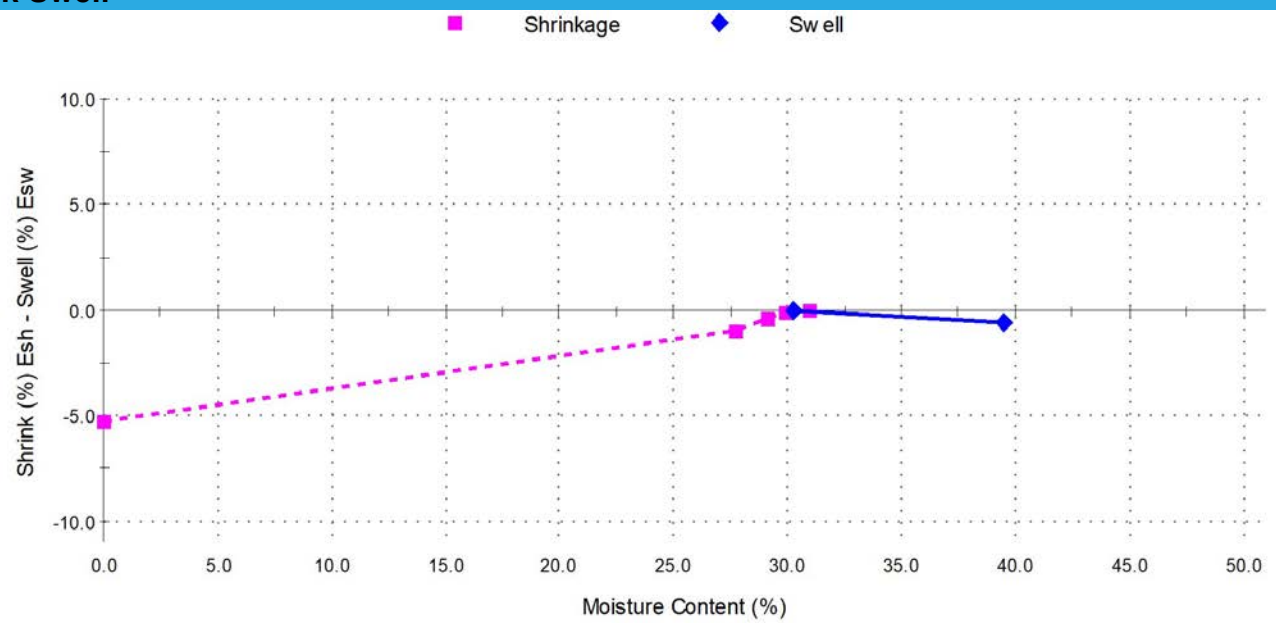
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	30.2
Moisture Content after (%):	39.5
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	220

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	5.3
Shrinkage Moisture Content (%):	30.9
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 2.9

Comments

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Report No: SSI:NEW19W-2541--S01
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S01	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP012 - (0.3 - 0.45m)		
Borehole Number:	TP012		
Borehole Depth (m):	0.3 - 0.45		

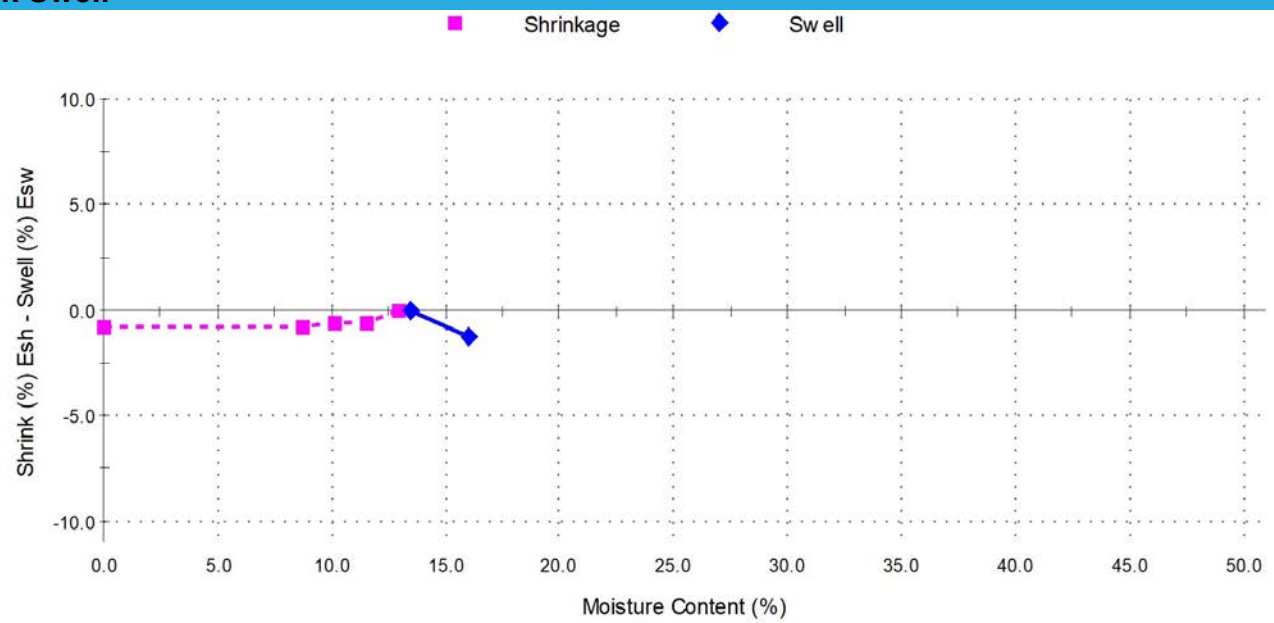
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-1.3
Moisture Content before (%):	13.5
Moisture Content after (%):	16.0
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	> 600

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	0.8
Shrinkage Moisture Content (%):	12.9
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 0.4

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2154--S12
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2154--S12	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	20/06/2019
Source:	On Site	**Date Submitted:**	24/06/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP013 - (0.5 - 0.7m)		
Borehole Number:	TP013		
Borehole Depth (m):	0.5 - 0.7		

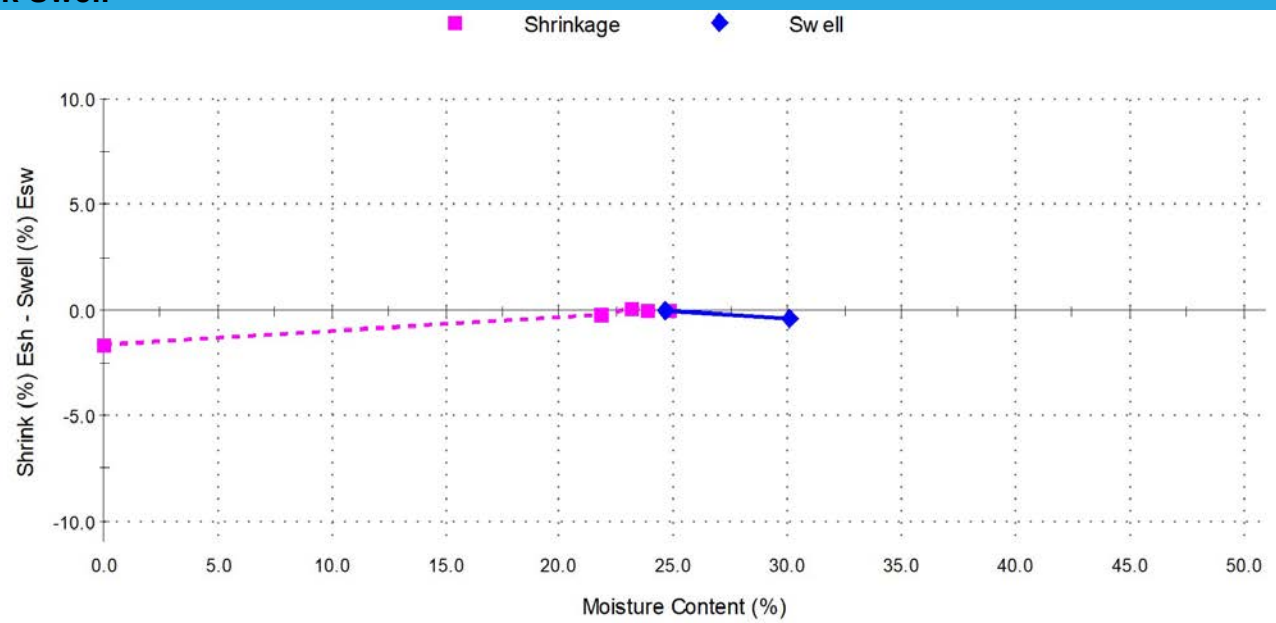
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.4
Moisture Content before (%):	24.7
Moisture Content after (%):	30.1
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	250

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	1.6
Shrinkage Moisture Content (%):	24.8
Est. inert material (%):	5.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 0.9

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2541--S02
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S02	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP014 - (0.8 - 0.95m)		
Borehole Number:	TP014		
Borehole Depth (m):	0.8 - 0.95		

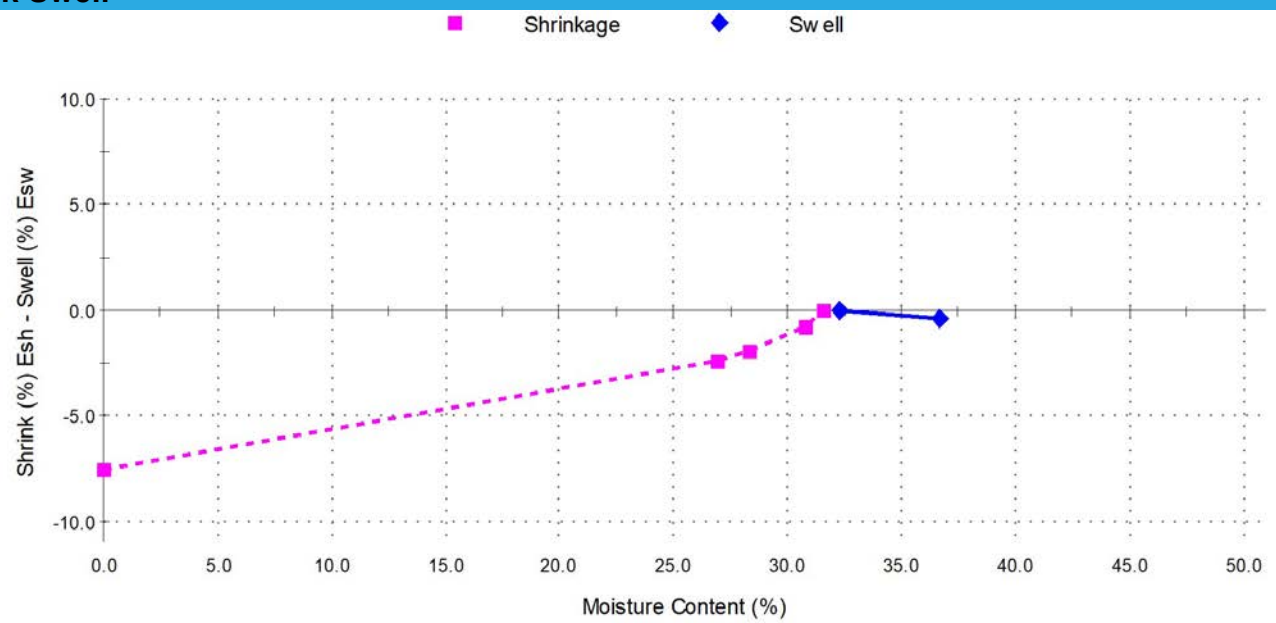
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.4
Moisture Content before (%):	32.2
Moisture Content after (%):	36.7
Est. Unc. Comp. Strength before (kPa):	250
Est. Unc. Comp. Strength after (kPa):	130

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	7.6
Shrinkage Moisture Content (%):	31.6
Est. inert material (%):	5.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 4.2

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2541--S03
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S03	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP015 - (1.2 - 1.6m)		
Borehole Number:	TP015		
Borehole Depth (m):	1.2 - 1.6		

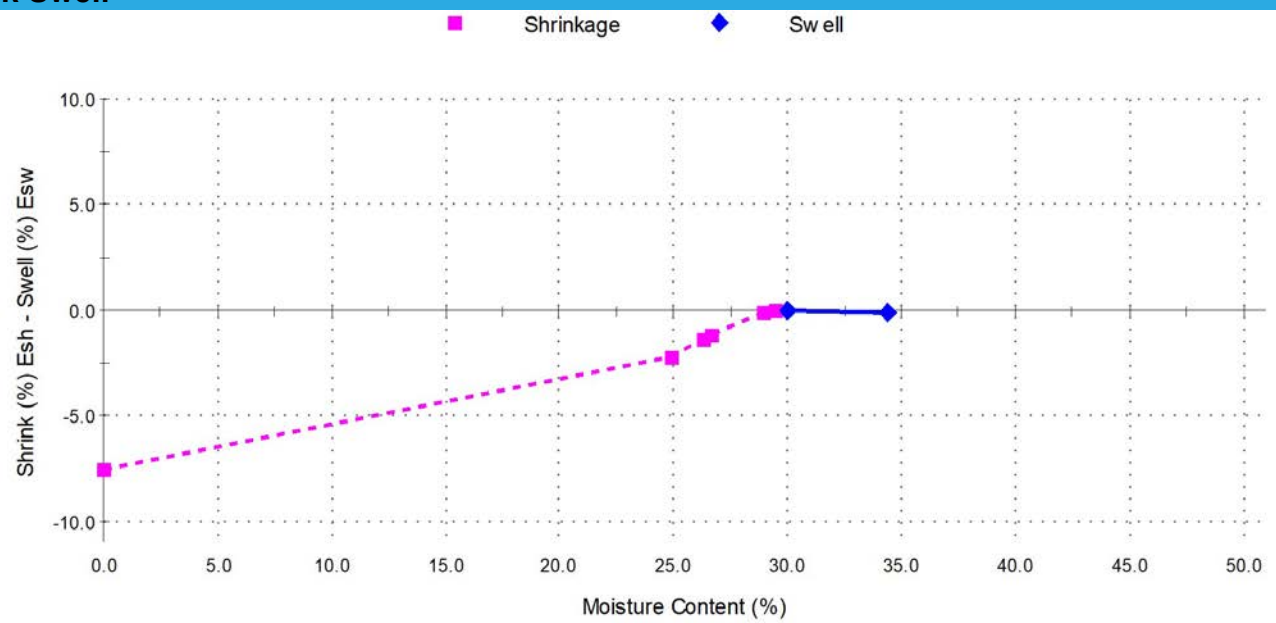
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.1
Moisture Content before (%):	29.9
Moisture Content after (%):	34.4
Est. Unc. Comp. Strength before (kPa):	200
Est. Unc. Comp. Strength after (kPa):	110

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	7.6
Shrinkage Moisture Content (%):	29.5
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 4.2

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2541--S04
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S04	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP016 - (1.0 - 1.3m)		
Borehole Number:	TP016		
Borehole Depth (m):	1.0 - 1.3		

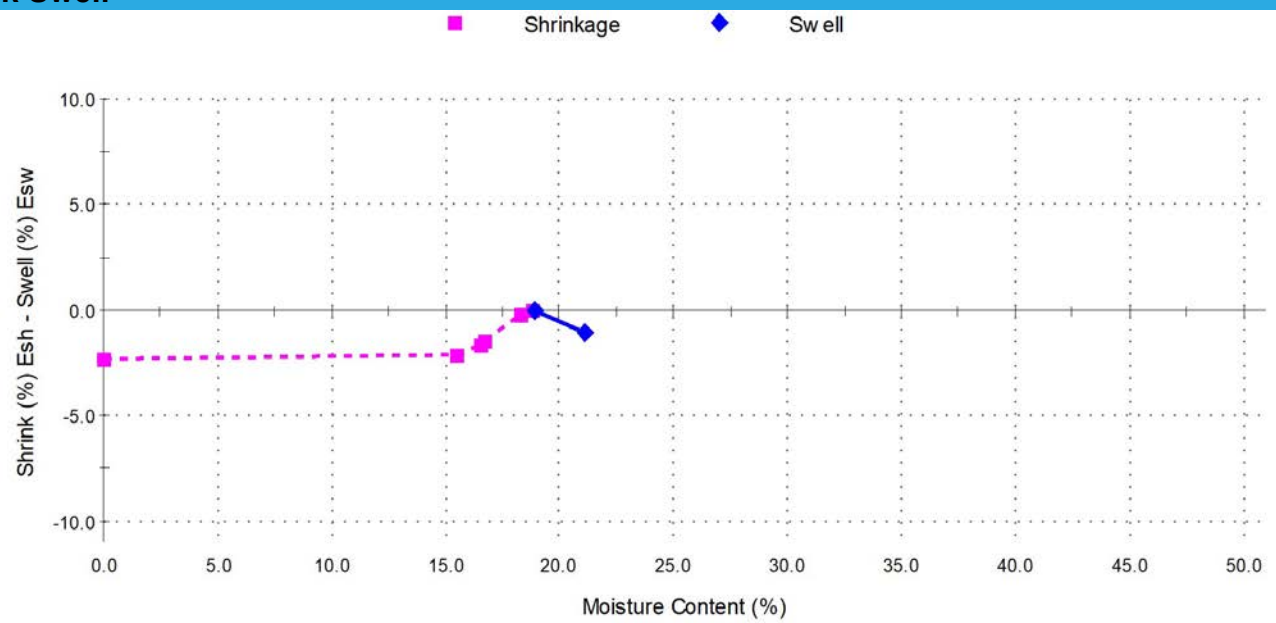
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-1.0
Moisture Content before (%):	18.9
Moisture Content after (%):	21.1
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	350

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	2.3
Shrinkage Moisture Content (%):	18.9
Est. inert material (%):	2.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 1.3

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2541--S05
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S05	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP017 - (1.1 - 1.25m)		
Borehole Number:	TP017		
Borehole Depth (m):	1.1 - 1.25		

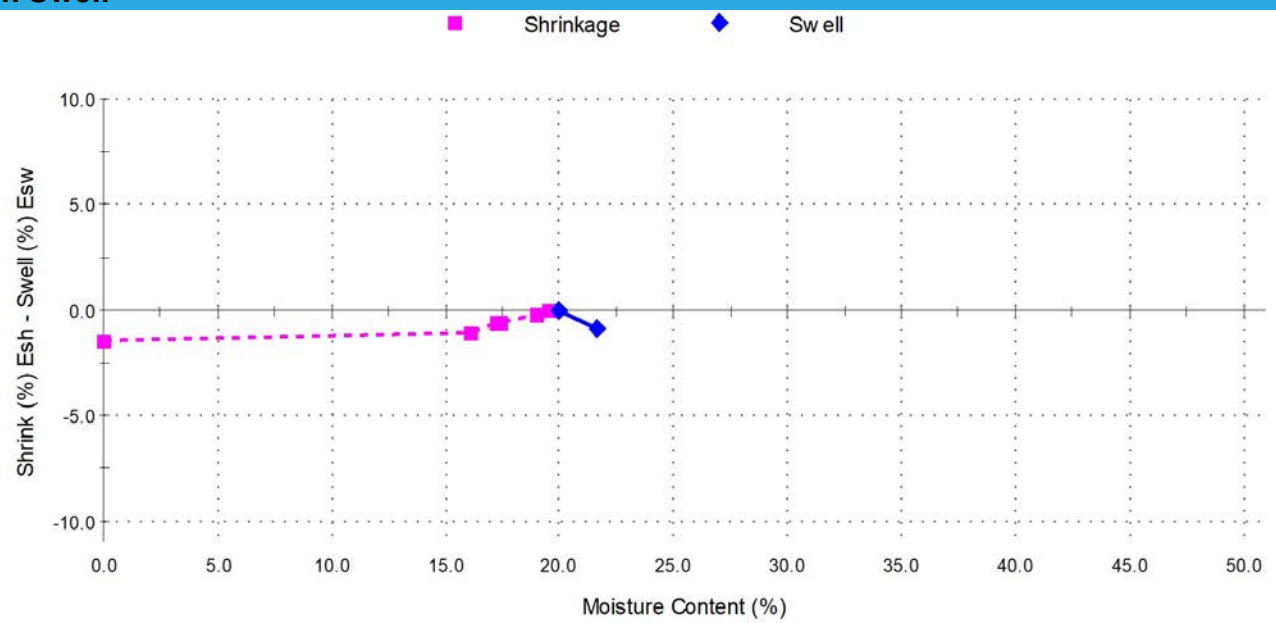
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.9
Moisture Content before (%):	20.0
Moisture Content after (%):	21.6
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	350

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	1.5
Shrinkage Moisture Content (%):	19.6
Est. inert material (%):	10.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 0.8

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2541--S06
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S06	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP018 - (0.6 - 0.8m)		
Borehole Number:	TP018		
Borehole Depth (m):	0.6 - 0.8		

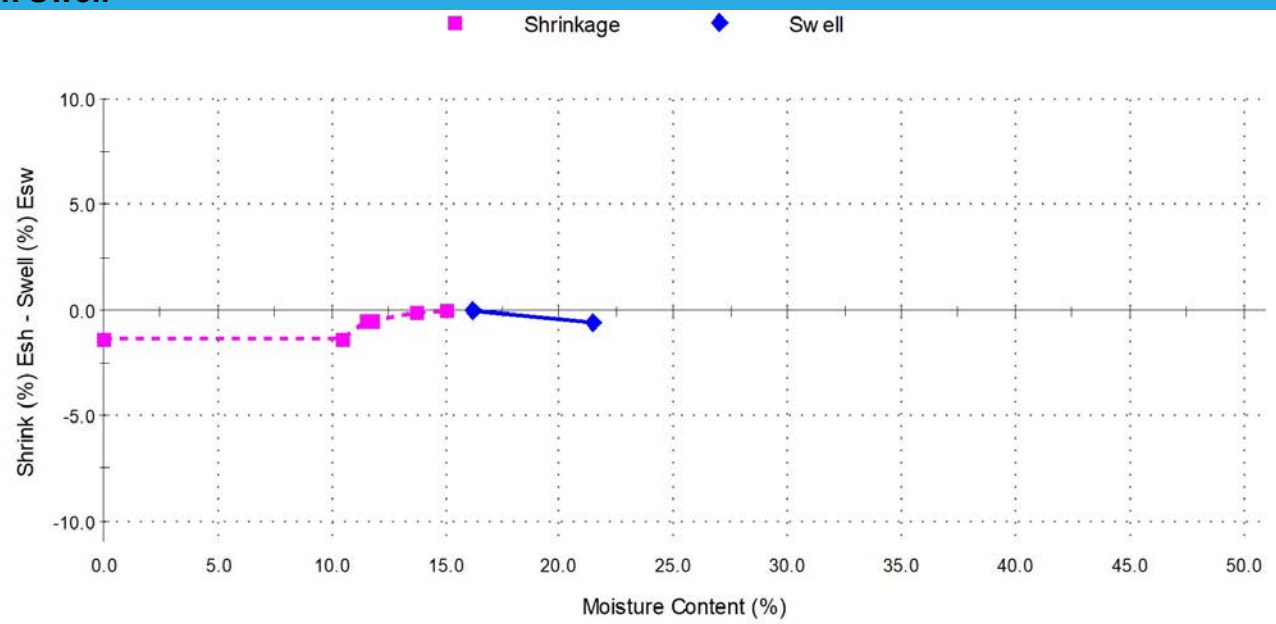
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	16.1
Moisture Content after (%):	21.4
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	450

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	1.4
Shrinkage Moisture Content (%):	15.1
Est. inert material (%):	15.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 0.8

Comments

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Report No: SSI:NEW19W-2541--S07
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2541--S07	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy Clay	**Date Sampled:**	25/07/2019
Source:	On Site	**Date Submitted:**	26/07/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP019 - (1.0 - 1.2m)		
Borehole Number:	TP019		
Borehole Depth (m):	1.0 - 1.2m		

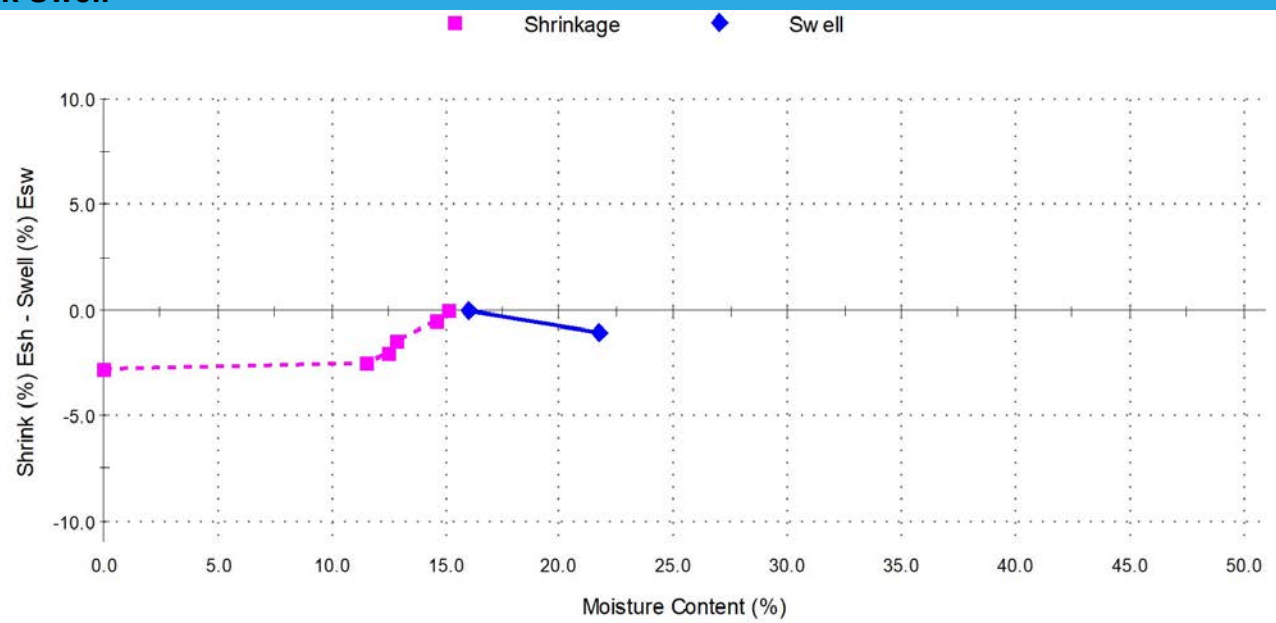
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-1.0
Moisture Content before (%):	16.0
Moisture Content after (%):	21.7
Est. Unc. Comp. Strength before (kPa):	> 600
Est. Unc. Comp. Strength after (kPa):	250

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	2.8
Shrinkage Moisture Content (%):	15.1
Est. inert material (%):	10.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Moderate

Shrink Swell



Shrink Swell Index - Iss (%): 1.5

Comments

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Report No: SSI:NEW19W-2851--S01
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2851--S01	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	CLAY	**Date Sampled:**	16/08/2019
Source:	On-Site	**Date Submitted:**	19/08/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP020 - 0.50 to 0.65m		
Borehole Number:	TP020		
Borehole Depth (m):	0.50 - 0.65		

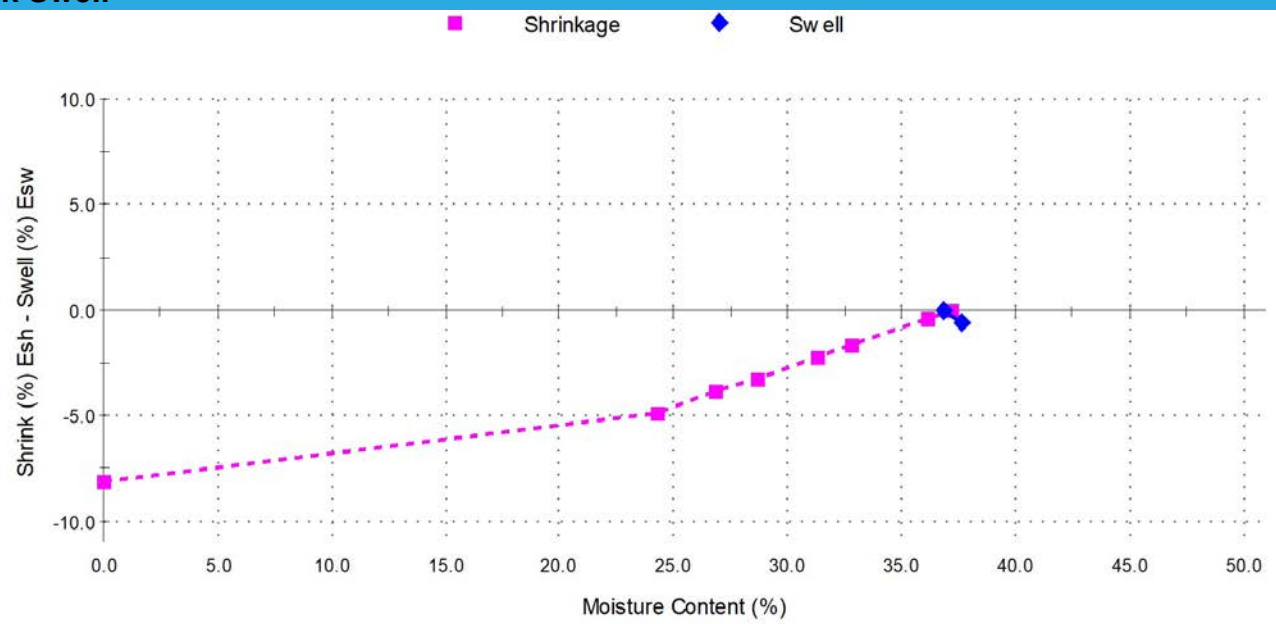
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	36.9
Moisture Content after (%):	37.7
Est. Unc. Comp. Strength before (kPa):	260
Est. Unc. Comp. Strength after (kPa):	250

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	8.1
Shrinkage Moisture Content (%):	37.2
Est. inert material (%):	1.0
Crumbling during shrinkage:	Moderate
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 4.5

Comments

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Report No: SSI:NEW19W-2851--S02
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2851--S02	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	CLAY	**Date Sampled:**	16/08/2019
Source:	On-Site	**Date Submitted:**	19/08/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP021 - 0.90 to 1.05m		
Borehole Number:	TP021		
Borehole Depth (m):	0.90 - 1.05		

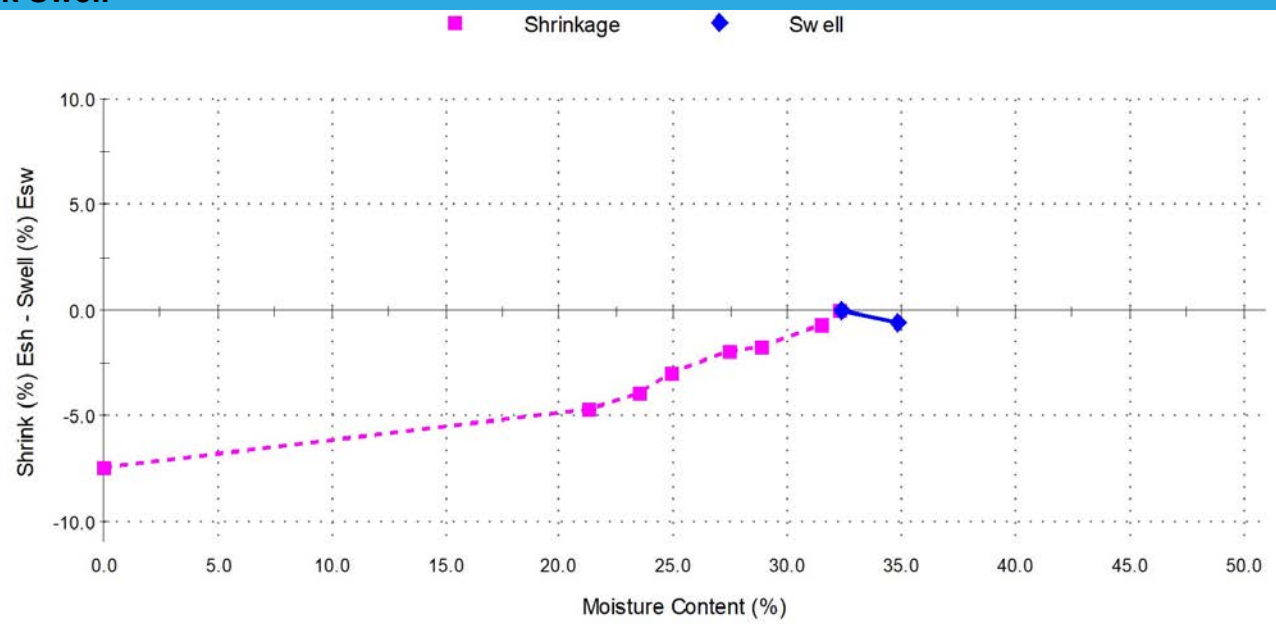
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	32.4
Moisture Content after (%):	34.9
Est. Unc. Comp. Strength before (kPa):	260
Est. Unc. Comp. Strength after (kPa):	220

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	7.5
Shrinkage Moisture Content (%):	32.3
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Minor

Shrink Swell



Shrink Swell Index - Iss (%): 4.2

Comments

The results outlined above apply to the sample as received

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Report No: SSI:NEW19W-2851--S03
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2851--S03	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	CLAY	**Date Sampled:**	16/08/2019
Source:	On-Site	**Date Submitted:**	19/08/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP022 - 0.10 to 0.30m		
Borehole Number:	TP022		
Borehole Depth (m):	0.10 - 0.30		

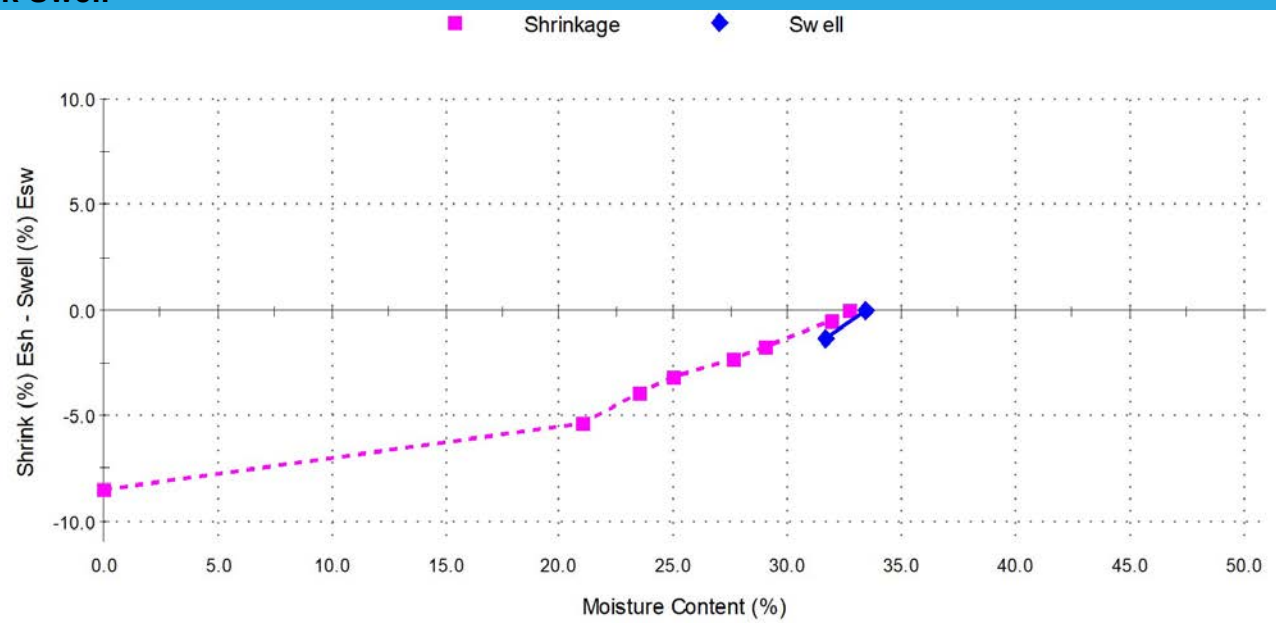
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-1.3
Moisture Content before (%):	33.4
Moisture Content after (%):	31.7
Est. Unc. Comp. Strength before (kPa):	300
Est. Unc. Comp. Strength after (kPa):	110

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	8.5
Shrinkage Moisture Content (%):	32.7
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 4.7

Comments

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Report No: SSI:NEW19W-2851--S04
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
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Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2851--S04	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	CLAY	**Date Sampled:**	16/08/2019
Source:	On-Site	**Date Submitted:**	19/08/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP023 - 0.80 to 0.95m		
Borehole Number:	TP023		
Borehole Depth (m):	0.80 - 0.95		

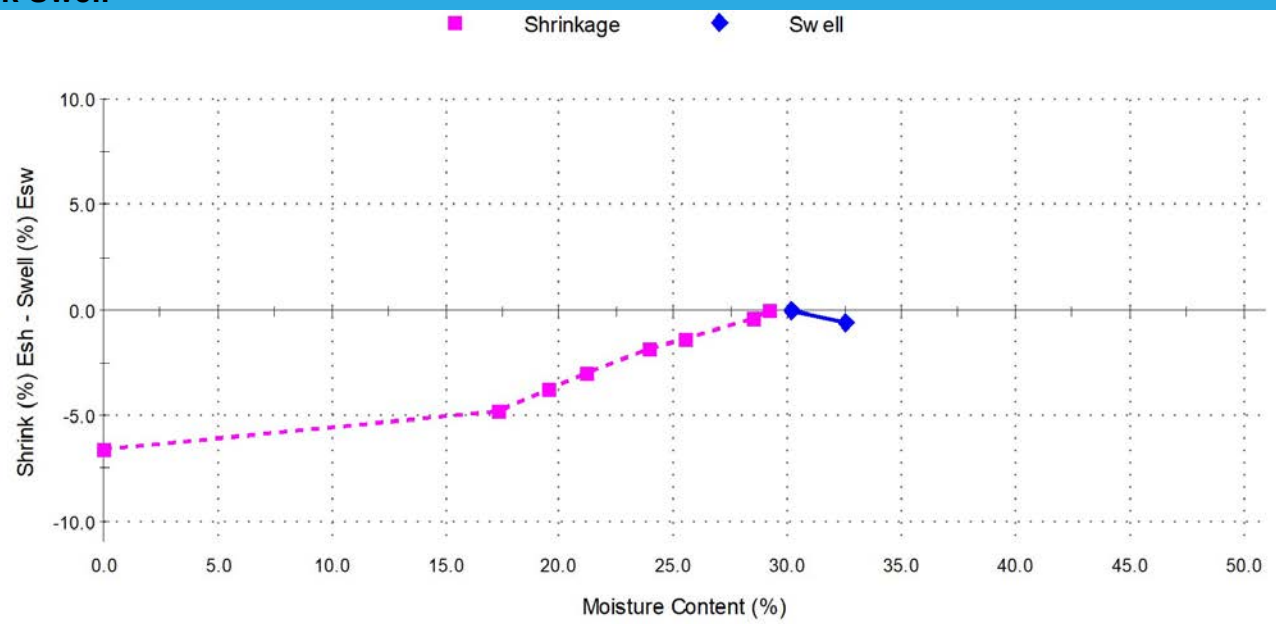
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.6
Moisture Content before (%):	30.2
Moisture Content after (%):	32.5
Est. Unc. Comp. Strength before (kPa):	300
Est. Unc. Comp. Strength after (kPa):	230

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	6.6
Shrinkage Moisture Content (%):	29.2
Est. inert material (%):	1.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	Nil

Shrink Swell



Shrink Swell Index - Iss (%): 3.7

Comments

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Report No: SSI:NEW19W-2851--S05
Issue No: 1

Shrink Swell Index Report

Client: McCloy Development Management Pty Ltd
Suite 2, Ground Floor, 317 Hunter Street
Newcastle NSW 2300

Principal:
Project No.: NEW18P-0170
Project Name: Brush Creek Estate Stage 1

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NATA Accredited Laboratory Number: 18686
Date of Issue: 28/08/2019

Sample Details

Sample ID:	NEW19W-2851--S05	**Client Sample ID:**	-
Test Request No.:	-	**Sampling Method:**	Sampled by Engineering Department
Material:	Sandy CLAY	**Date Sampled:**	16/08/2019
Source:	On-Site	**Date Submitted:**	19/08/2019
Specification:	No Specification		
Project Location:	Transfield Avenue, Edgeworth		
Sample Location:	TP024 - 0.50 to 0.70m		
Borehole Number:	TP024		
Borehole Depth (m):	0.50 - 0.70		

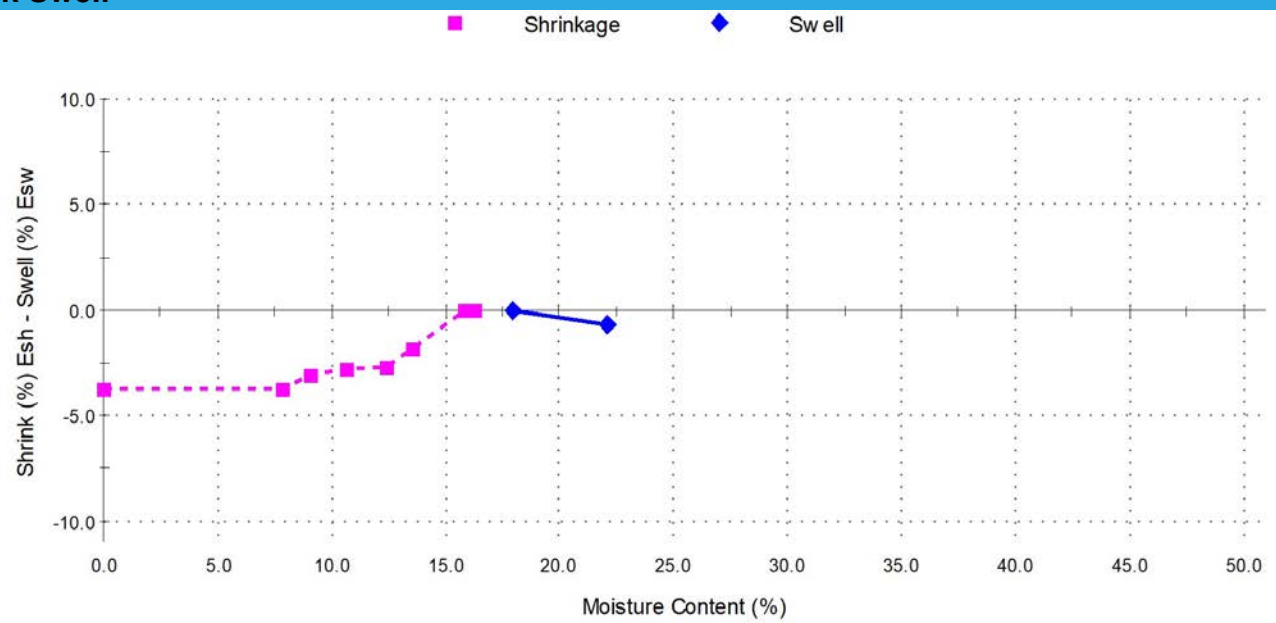
Swell Test — AS 1289.7.1.1

Swell on Saturation (%):	-0.7
Moisture Content before (%):	17.9
Moisture Content after (%):	22.1
Est. Unc. Comp. Strength before (kPa):	240
Est. Unc. Comp. Strength after (kPa):	200

Shrink Test — AS 1289.7.1.1

Shrink on drying (%):	3.7
Shrinkage Moisture Content (%):	16.3
Est. inert material (%):	5.0
Crumbling during shrinkage:	Nil
Cracking during shrinkage:	MInor

Shrink Swell



Shrink Swell Index - Iss (%): 2.0

Comments

The results outlined above apply to the sample as received

APPENDIX C:

CSIRO Sheet BTF 18

Foundation Maintenance and Footing Performance: A Homeowner's Guide

Foundation Maintenance and Footing Performance:

A Homeowner's Guide

CSIRO

BTF 18 replaces Information Sheet 10/91

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

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

Soil Types

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

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

Causes of Movement

Settlement due to construction

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

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

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

Erosion

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

Saturation

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

Seasonal swelling and shrinkage of soil

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

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

Shear failure

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

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

GENERAL DEFINITIONS OF SITE CLASSES

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

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

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

Unevenness of Movement

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

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

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

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

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

Effects of Uneven Soil Movement on Structures

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

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

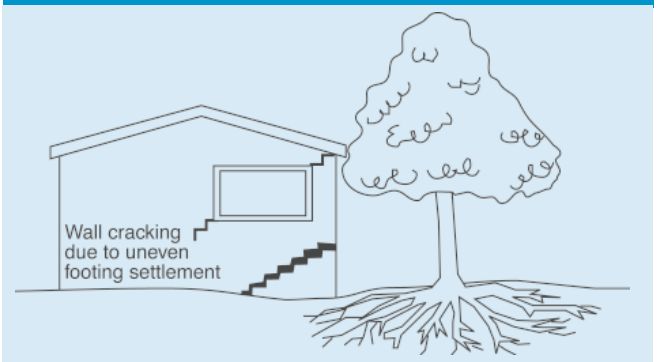
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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

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

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

Trees can cause shrinkage and damage



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

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

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

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

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

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

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

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

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

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

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

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

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

Water Service and Drainage

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

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

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

Seriousness of Cracking

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

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

Prevention/Cure

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

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

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

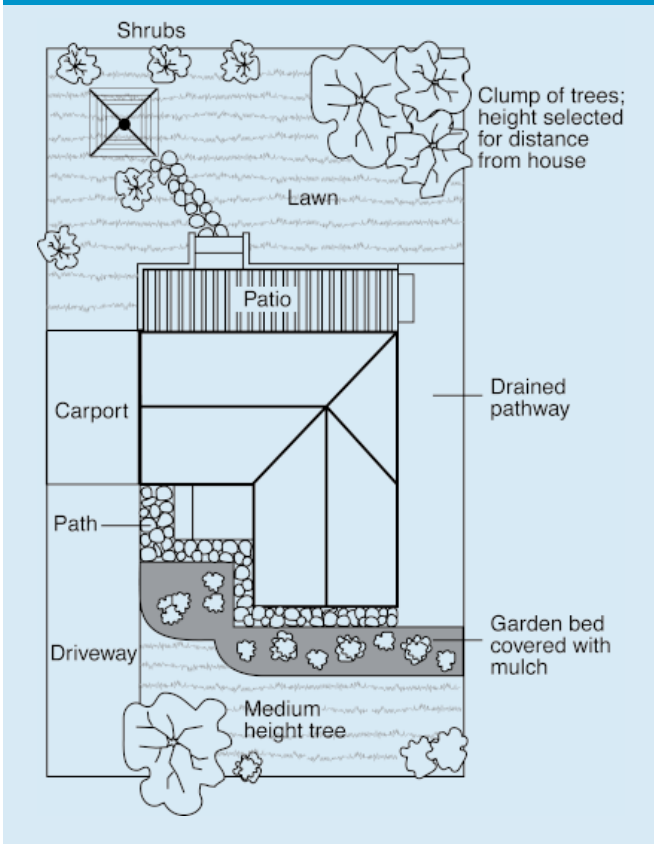
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

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

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

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

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

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

Condensation

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

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

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

The garden

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

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

Existing trees

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

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

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

Remediation

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

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

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