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Report

Additional Geotechnical Investigation
Proposed Residential Precinct – RP1
Edmondson Park South Town Centre
Soldiers Parade and Campbelltown Road
Edmondson Park NSW

Prepared for
Frasers Australia
Level 3, 1C Homebush Bay Drive
RHODES NSW 2138

Ref: JG15942A-r6(rev)
December 2016

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2nd December 2016

Our Ref: JG15942A-r6(rev)

Frasers Australia
Level 3, 1C Homebush Bay Drive
RHODES NSW 2138

Attention: Mr Matthew Kuhn

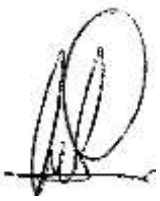
Dear Sir,

Re Additional Geotechnical Investigation
Proposed Residential Precinct – RP1
Edmondson Park South Town Centre
Soldiers Parade and Campbelltown Road Edmondson Park

Further to our geotechnical report referenced JC15942A-r2 dated February 2016, this report presents the results of our additional geotechnical investigation carried out on the residential precinct RP1 of the Edmondson Park South Town Centre development site as shown on Drawing No 1.

Should you have any queries, please contact the undersigned.

Yours faithfully
GeoEnviro Consultancy Pty Ltd



Solern Liew CPEng (NPER)
Director

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1. INTRODUCTION

Further to our previous geotechnical investigation report referenced JG15942A-r2 dated February 2016 (Reference 1), this report presents the results of our additional geotechnical investigation for the proposed RP1 Residential Precinct of the Edmondson Park South Town Centre as shown on Drawing No 1. The investigation was commissioned by Mr Matthew Kuhn following our fee proposal referenced PG15889D dated 7th November 2016.

We understand that the RP1 Residential Precinct (ie Subject Site) will occupy the south western corner of the Edmondson Park South Town Centre development site extending over an area of about 230m by 400m. The proposed development will include construction of up to 3 storey high residential buildings with a display village on the eastern portion. Building platform construction for the Subject Site is proposed to include excavation up to about 2m at the south western corner and filling over the majority of the Subject Site up to 2.5m high. Pad and deep pier footings are proposed for the residential buildings.

The objectives of this additional investigation were to;

- Assess of bedrock quality in order to reduce pile socket length.
- Comments and recommendations on earthwork procedure to optimise the site classification to achieve Class M of better.
- Comments on pavement design which reflects on the proposed bulk earthworks schedule, taking into consideration cutting into shale on the southern portion and fill on the northern and north eastern portion.
- Recommendations on soil stiffness (ie long term and short term) to enable raft analysis and comments on alternative footing arrangement, in particular use of screw piles

For completeness of this report, test pit information of our previous geotechnical report (Reference 1) is included in Appendix A of this report.

2. SITE INFORMATION

2.1 Site Description

The Subject Site (ie RP1) is located immediately to the south of the Town Centre Precinct with Soldiers Parade forming the eastern boundary and Campbelltown Road forming the southern boundary. The Subject Site is roughly rectangular in shape with an approximate 400m frontage to Campbelltown Road by about 230m.

The site is situated on gently undulating terrain. Ground surface within the site is approximately level and drains in a general direction to the north east. Based on the survey drawing provided, ground surface along the south western corner of the site is at about Reduced Level (RL) 68m Australian Height Datum (AHD) and the ground surface at the north eastern corner of the site is at about RL 59m AHD.

The 1:100,000 Soil Landscape of Penrith Series 9030 (Reference 2) prepared by the Soil Conservation Services of NSW indicates the site to be underlain by residual soil of the Blacktown landscape group and colluvial soil of the Luddenham landscape group on the upper slopes. Typical residual soil consists of low permeability, highly plastic and moderately reactive soil. The colluvial soil consists of dark podzolic soils or massive earthy clays on the crest and typical characteristics of this soil unit is high plasticity, moderately reactive and low permeability.

The 1:100,000 geological map of Penrith (Reference 3) indicates the site to be underlain by Bringelly Shale consisting of shale, carbonaceous claystone, laminite, fine to medium grained lithic sandstone, rare coal and tuff.

2.2 Previous Geotechnical Investigation

An initial geotechnical investigation was carried out by GeoEnviro Consultancy Pty Ltd in February 2016 (Reference 1) and the investigation included excavation of twenty six (TP 1 to 26) test pits across the entire residential lot precinct to depths ranging from 0.9m to 3.1m. Within the Subject Site (ie RP1), eleven test pits (ie TP 1 to 11) were excavated.

Reference may be made to the test pit logs and test location plan in Appendix A. The following is a summary of the subsurface profiles encountered in the test pits excavated within the Subject Site.

- Topsoil and topsoil/fill were encountered on the surface in all test pits except TP 2, 10, and 11 consisting predominantly of Clayey Silt of low liquid limit. Thickness of the topsoil and topsoil/fill was found to range from 100mm to 400mm.

- Fill was encountered on the surface of TP 2, 10 and 11 to depths of 0.25m and 1.4m below existing ground surface. The fill consists predominantly of Gravelly Clayey Silt and Gravelly Silty Clay.

- Natural soil was encountered in all test pits underlying the topsoil/fill and fill at depths varying from 0.1m to 1.4m below existing ground surface. The natural soil generally comprises of high plasticity Silty Clay in the upper profiles reducing to medium plasticity at lower depths. Some ironstone gravel and shale gravel was encountered in the natural clay at lower depths. The upper natural clay stratum was generally found to be dry to moist (ie moisture content less than or equal to the plastic limit) and very stiff to hard. The moisture content of the natural clay generally decreases with lower depths and there is generally a slight improvement in the strength of the natural clay to hard at lower depths.

- Bedrock consisting of Shale/Siltstone was encountered in TP 1 to 12 at depths varying from 0.8m to 2.8m below existing ground surface. The shale was subjectively assessed to be low to medium strength and be extremely to distinctly weathered.

- Groundwater was not encountered in the test pits during and shortly after completion of the investigation

3. ADDITIONAL INVESTIGATION

Fieldwork for the additional investigation was carried out on the 10th and 11th November 2016. The investigation included drilling of three boreholes (BH 401 to 403) using a truck mounted hydrapower drill rig equipped for site investigation purposes. A fourth borehole (BH 301) was also drilled within the Subject Site for the proposed wastewater reticulation system and details of this borehole are included in this report.

Prior to the field investigations, an underground services search was carried out using drawings supplied by Dial-before-you-dig and an underground services contractor equipped with an electromagnetic device was engaged as an extra precautionary measure to prevent damage of underground services caused by the drilling.

The boreholes were initially drilled using spiral augers attached to a Tungsten Carbide (TC) bit drilling to depths varying from 1.5m to 2.9m below existing ground surface. The boreholes were further advanced using NMLC diamond bit coring technique to depths of about 5.56m to 8.49m below existing ground surface.

The strength of the subsurface clayey soil was assessed by Standard Penetration Tests (SPT). The SPT tests involved driving a split tube steel spoon into the ground using a standard weight (ie 63.5kg) hammer and measuring the penetration resistance in number of blow counts per 150mm penetration. A hand penetrometer was also used to assess the strength of the soil.

The cored bedrock samples were carefully boxed on site before returning to our laboratory for Point Load Index testing to assess the strength of the bedrock and obtain correlated Unconfined Compressive Strength (UCS) parameters. The strength of the bedrock from the augered boreholes was subjectively assessed by examining the rock cuttings and observing the penetration resistance of the TC bit during drilling.

The boreholes were observed for groundwater seepage, during and upon completion of spiral augering. Groundwater monitoring was not possible during coring as water was used during coring.

The field investigation was supervised on a full-time basis by our geotechnical engineer who was responsible for locating the boreholes, undertaking field testing, boxing of the core samples and logging of the subsurface profiles encountered.

The locations of the boreholes were established by survey and are indicated on Drawing No 1. The field test results for the additional boreholes, together with details of the subsurface profile encountered are presented on the Borehole and Cored Borehole Reports in Appendix B of this report.

Explanatory notes are also attached in Appendix D and they provide additional information on the investigation methodology and its limitations.

4. RESULTS OF THE INVESTIGAITON

4.1 Subsurface Conditions

Reference should be made to the Borehole and Cored Borehole Reports in Appendix B for details of the subsurface profiles encountered in our additional investigation.

The following is a summary of the subsurface profiles encountered in the boreholes;

Topsoil and Topsoil/Fill

Topsoil was encountered on the surface in BH 401 to 403 consisting predominantly Clayey Silt of low liquid limit. Thickness of the topsoil was found to range from 100mm to 400mm.

Fill

Thick fill about 2.4m was encountered in BH 304 consisting predominantly of medium plasticity Silty Clay with some ironstone gravel. A thin layer of fill about 300mm was encountered beneath the topsoil/fill in BH 401 consisting of Gravelly Silty Clay.

Based on the SPT test results, the fill in BH 304 was assessed to be compacted. The fill was generally assessed to be dry.

Natural Soil

Underlying the topsoil and fill at depths varying from 0.1m to 2.4m below existing ground surface, natural clay was encountered consisting predominantly of medium to high plasticity Silty Clay. In general, the plasticity of the natural clayey soil reduces with lower depths and also becomes more shaley. Based on the SPT and hand penetrometer test results, the natural clay was generally found to be very stiff and the consistency of the clayey soil increases to hard at lower depths. The natural clay was generally found to be dry (ie moisture content less than the plastic limit).

Bedrock

Bedrock consisting of shale was encountered in all boreholes at depths varying from 1.5m to 3.8m below existing ground surface.

The cored boreholes indicate the upper 0.6m to 3.0m of the shale to be generally Very Low to Low strength (ie UCS less than 6 MPa) and extremely to distinctly weathered. The strength increases significantly to Medium to High strength (ie UCS about 6 MPa to 60 MPa) and some very high strength (ie UCS up to 71 MPa) shale was encountered at about 5.3m in BH 402.

Groundwater

All boreholes were found to be dry during and shortly after completion of the augered boreholes. Groundwater monitoring could not be carried out in the cored boreholes as water was used in the coring of bedrock.

It is possible for groundwater to be present at or immediately above the interface between the soil and rock profiles, particularly after prolonged wet weather conditions.

4.2 Laboratory Results

The point load tests generally confirm our field classification of the rock strength. The bedrock quality November be classified to Class I (good quality) to V (poor quality) in accordance with Pells et al – 1998 (Reference 4) based on the Unconfined Compressive Strength (UCS), degree of fracturing and allowable defects.

The following is a summary of the point load results which includes the results of previous investigation are as follows;

Previous BH	Depth (m)		$I_{s(50)}$ (MPa)		Class	
	Start	End	Min.	Max.	Based on Strength Only	Based on Strength & Defects
301	3.8	6.07	-	-	-	V
401	2.9	4.1	-	-	-	V
	4.1	6.3	0.54	0.86	II-I	IV
	6.3	8.43	0.74	1.16	II-I	III-II
402	4.0	4.5	-	-	-	V
	4.5	6.2	0.95	3.59	I	IV
	6.2	8.49	0.4	7.9	II-I	III
403	1.0	2.8	0.19	0.19	III	V
	2.8	4.0	0.22	0.3	III	IV
	4.0	5.4	0.22	0.62	III-II	IV-III
	5.4	5.56	0.3	0.3	III	III

Note: * Subjective rock class assessment based on auger resistance and visual inspection of disturbed samples

Note that the strength of the shale was generally found to be higher than the assigned classification (ie based on Strength and Defects) and this was due to the presence of defects, therefore the overall classification of the bedrock was downgraded (ie poorer quality).

Refer to Laboratory Test Reports in Appendix C for Point Load Test results and correlated UCS of the bedrock at specific depths

5. ASSESSMENT AND RECOMMENDATIONS

5.1 Earthworks and Site Classification

Our previous report (Reference 1) provided recommendations on earthworks procedure which principally involves the following;

- Stripping of topsoil and upper organic layer and stockpile separately for reuse in landscaping at a later stage.
- Excavation of all insitu fill and stockpile separately for potential reuse in the earthworks.
- Proof rolled of the exposed natural clay areas using a minimum 10 tonne vibrating roller to identify any soft or heaving areas.
- Any soft or heaving areas observed during proof rolling should be excavated and replaced with a select granular fill such as ripped sandstone having a maximum particle size of 75mm. All structural fill required to elevate the site to design level should be controlled and compacted in layers not exceeding 250mm thickness compacted to a minimum 95% Standard Maximum Dry Density at ±2% Optimum Moisture.
- Earthworks should be closely monitored by a geotechnical consultant and should include field density testing of fill at an appropriate frequency and level of supervision as detailed in AS3798 -2007 (Reference 10).

Subject to the above, shallow footings consisting of stiffened raft slabs, waffle slabs or strip and pad footings may be adopted for future residential buildings or light weight structures.

Deep footings such as bored piles, grout injected piles or steel piles should be adopted for heavy and sensitive structures or for site with minimal earthworks undertaken to improve poor foundation material. (eg “Uncontrolled” fill or soft and poor foundation material).

We understand that earthworks for the Subject Site (ie RP1) will include excavation up to about 2m below existing ground surface at the south western corner and filling over the majority of the Subject Site up to 2.5m high.

Based on the subsurface profiles encountered in our previous test pit investigation (Reference 1) and the proposed earthworks plan, shale is expected to be exposed on the south western portion of the Subject Site and the northern and north eastern portions of the site is expected to have relatively thick soil profiles (ie fill and natural clay) up to 6m. Refer to Drawing No 2 for indicative depths to shale at proposed design platform level.

Preliminary site classification in accordance to AS 2870 "Residential Slabs and Footings" may be based on the following site conditions;

Site Classification	**Site Conditions**
'S' (Slight)	➢ Topsoil or uncontrolled fill less than 400mm thick ➢ Stable 'Controlled' fill compacted to a minimum 95% Standard ➢ Natural clay to be of very stiff or better consistency ➢ Bedrock profiles less than 0.6m deep ➢ Surface movements from reactive clay less than 20mm
'M' (Moderate)	➢ Topsoil or uncontrolled fill less than 400mm thick ➢ 'Controlled" fill compacted to a minimum 95% Standard ➢ Natural clay to be of very stiff or better consistency ➢ Bedrock profiles less than 1.8m deep ➢ Surface movements from reactive clay between 20mm to 40mm
'H1' or 'H2' (High)	➢ Topsoil or uncontrolled fill less than 400mm thick ➢ 'Controlled' fill compacted to a minimum 95% Standard ➢ Natural clay to be of very stiff or better consistency ➢ Bedrock profiles greater than 1.8m deep ➢ Surface movements from reactive clay between 40mm to 80mm
'P' (Problem)	➢ Topsoil or 'Uncontrolled' fill greater than 400mm thick ➢ Soft and wet natural clay ➢ Steep site with slope gradients greater than 12 degrees.

We note that the lot classifications of Class 'H1' and 'H2' may be improved to Class 'M' if good quality stable fill such as ripped sandstone and/or ripped shale is used to form the upper 2m of the building platform. We understand that the proposed town centre development will require deep excavation into shale and therefore the use of ripped shale is being considered in the proposed development to improve the site classification. Some mixing and blending of the ripped shale with insitu clay material may be required to improve compactability of the ripped shale.

5.2 Piled Foundation

We understand that some pier and pad footings are proposed for the residential buildings. Suitable piles may include bored piles, grout injected piles or Continuous Flight Auger (CFA) piles. Based on the cored borehole results, we recommend that the footings on shale may be designed based on the following allowable capacities;

BH	Depth (m)		Class	Allowable Bearing Capacity (kPa)	Allowable Shaft Adhesion (kPa)
	Start Depth (m)	End Depth (m)			
301	3.8	6.07	V	800	50
401	2.9	4.1	V	800	50
	4.1	6.3	IV	1000	100
	6.3	8.43	III-II	4000	400
402	4.0	4.5	V	800	50
	4.5	6.2	IV	1000	100
	6.2	8.49	III	3500	350
403	1.0	2.8	V	800	50
	2.8	4.0	IV	1000	100
	4.0	5.4	IV-III	1200	120
	5.4	5.56	III	3500	350

Note: * =No allowance for shaft adhesion should be provided for pad footings.

For piles designed using Ultimate values based on "Limit State Design", the Ultimate End Bearing of 2.5 times the above Allowable values November be adopted. The ultimate bearing pressures should be used in conjunction with the appropriate "Geotechnical Strength Reduction Factor" (Øg) and this factor will depend on the amount and quality of geotechnical data, construction supervision/control and pile proof load testing. A "Geotechnical Strength Reduction Factor" of 0.5 November be adopted for both end bearing and shaft adhesion. A lower reduction factor may be adopted subject to additional investigations to more accurately assess the bedrock conditions.

Footings proportioned to the above allowable loads may expect settlement to be within acceptable limits of 1% or less of the width/diameter of footings. All footings should be founded on similar geological stratum to ensure even bearing, otherwise adequate articulation should be provided to accommodate some differential settlements.

Alternative piling system such as steel screw piles may be considered suitable however this piling option is normally adopted for sites with deeper bedrock level typically in excess of 3m. Should this piling option be adopted, we recommend the design of piles be consulted with the respective proprietary piling contractor as the pile capacity is based in part on torque measurement during piling. Adoption of this piling system would also need to consider soil aggressiveness and pile durability.

For other light weight structures and ancillary buildings, the following allowable bearing capacities may be adopted for footings founded on clayey foundation;

Foundation Material	Allowable Bearing Capacities
Controlled Fill (95% Standard)	100kPa
Controlled Fill (98% Standard)	150kPa
Natural Very Stiff Clay or better	150kPa

5.3 Pavement Design

We understand that the Residential Precinct RP1 will include construction of the following roads;

Road Name	Road Class	Design Traffic Loading
Mews	Access Street/Place	5×10^4 ESA
Road No 7 and 9	Local Street	3×10^5 ESA
Neighbourhood Street	Collector Street	2×10^6 ESA
Bernera and Greenway Road	Local Sub-Arterial	8×10^6 ESA

Note; ESA = Equivalent Standard Axle provided by Council and in accordance to Liverpool City Council – Aus-Spec October 2003 D2-11

Based on our previous site investigation, the insitu clayey subgrade was found to have CBR values ranging from 2.5% to 8%. We understand that earthworks for the Subject Site (ie RP1) will include excavation up to about 2m below existing ground surface at the south western corner and shale is exposed to be exposed in this area. We also understand that good quality fill such as ripped sandstone or ripped shale is proposed to be used in the earthworks for the portion of the site in fill.

Based on the assumption that good quality fill will be used in the residential development, a higher design CBR value of 6% may be adopted and the following pavement configuration should be adequate for the various design traffic loading conditions;

Material	**ESA**			
	5×10^4	**3×10^5**	**2×10^6**	**8×10^6**
Asphaltic Concrete (AC10)	25mm	25mm	25mm	25mm
Asphaltic Concrete (AC10)	25mm	25mm	25mm	25mm
Primer				
DGB20 Base Course	150mm	150mm	150mm	150mm
Crushed Sandstone Subbase Course	150mm	150mm	200mm	280mm
Total	**350mm***	**350mm***	**400mm**	**480mm**

Note: * Minimum pavement thickness.

For the section of subgrade where shale is exposed on the surface, we recommend the upper 250mm of the shale be tyned using a dozer in order to improve drainage. The pavement design assumes the subgrade and pavement materials to be compacted to the following Minimum Dry Density Ratios (AS1289 5.1.1, 5.2.1);

Material	**Relative Densities**	**Compactive Effort**
Base Course	98%	Modified
Sub-Base Course	98%	Modified
Subgrade	100%	Standard

5.4 Concrete Building Pad Stiffness

Our laboratory test results indicate the insitu clayey subgrade to have CBR values ranging from 2.5% to 8%. The following soil and fill parameters may be adopted;

Material	**Short Term**			**Long Term**		
	CBR (%)	**K (kPa/mm)**	**E (MPa)**	**CBR (%)**	**K (kPa/mm)**	**E (MPa)**
Compacted Fill: Clay	3.0 to 5.0	25 to 35	30 to 50	2.0 to 2.5	18 to 22	20 to 25
Compacted Fill: Ripped Shale	5.0 to 7.0	40 to 45	50 to 70	5.0 to 7.0	40 to 45	50 to 70
Natural Residual Clay	4.0 to 5.0	30 to 40	40 to 50	2.5 to 3.0	22 to 25	25 to 30

6. LIMITATIONS

The interpretation and recommendations submitted in this report are based in part upon data obtained from a limited number of boreholes. There is no investigation which is thorough enough to determine all site conditions and anomalies, no matter how comprehensive the investigation program is as site data is derived from extrapolation of limited test locations. The nature and extent of variations between test locations may not become evident until construction.

Groundwater conditions are only briefly examined in this investigation. The groundwater conditions may vary seasonally or as a consequence of construction activities on or adjacent to the site.

In view of the above, the subsurface soil and rock conditions between the test locations November be found to be different or interpreted to be different from those expected. If such differences appear to exist, we recommend that this office be contacted without delay.

The statements presented in this document are intended to advise you of what should be your realistic expectations of this report and to present you with recommendations on how to minimise the risk associated with groundworks for this project. The document is not intended to reduce the level of responsibility accepted by GeoEnviro Consultancy Pty Ltd, but rather to ensure that all parties who November rely on this report are aware of the responsibilities each assumes in to doing.

Your attention is drawn to the attached "Explanatory Notes" in Appendix D and this document should be read in conjunction with our report.

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18/11/2016 12:39 PM

REFERENCES

1. *Geotechnical and Salinity Investigation –Edmondson Park South Town Centre – Residential Lots Precinct, Soldiers Parade and Campbelltown Road Edmondson Park – GeoEnviro Consultancy Pty Ltd report referenced JC15942A-r2 dated February 2016*
2. *1:100,000 Geological Map of Penrith– Geological Series Sheet 9030 (Edition 1) 1991*
3. *1:100,000 Soil Landscape Map of Penrith – Soil Conservation Service of NSW; Sheet 9030*
4. *Pells, PJN, Mostyn, GM. And Walker, BF (1998) Foundation on shale and sandstone in the Sydney Region.*
5. *Department of Land and Water Conservation – "Site Investigation for Urban Salinity".2002*
6. *Salinity Code of Practice – Western Sydney Regional Organisation of Councils Ltd – 2002*
7. *What do all the numbers mean? A guide for the interpretation of soil test results. – Department of Conservation and Land Management, 1992*
8. *Australian Standard, AS 2159-2009 "Piling – Design and Installation"*
9. *Australian Standard, AS 3600 -2009 "Piling – Concrete"*
10. *Australian Standard, AS 3798 - 2007"Bulk Earthworks for Commercial and Residential Site"*
11. *Australian Standard, AS 2870-2011 "Residential Slabs and Footings*

Legend

BH 401 Borehole

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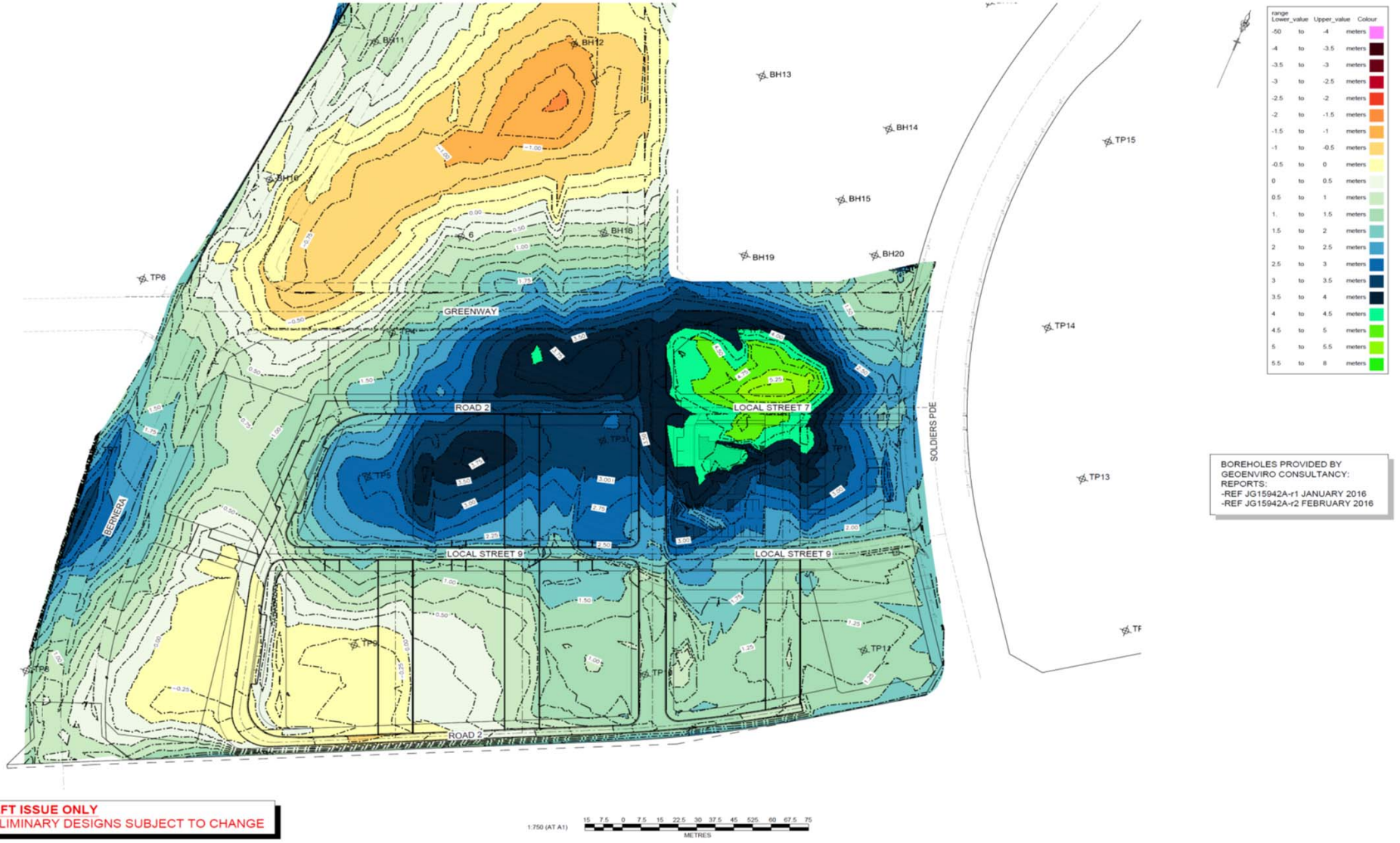
Drawn By: AT	Date: 18/11/2016	Frasers Property Edmondson Park South Town Centre Site Locality and Borehole Location Plan	
Checked By: SL	Date: 18/11/2016		
Revision By:	Date:		
Scale: Not to Scale	A3	Project No: JG15942A-r6	Drawing No: 1



DRAFT ISSUE ONLY
PRELIMINARY DESIGNS SUBJECT TO CHANGE

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Drawn By: AT	Date: 18/11/2016	**Frasers Property**	
Checked By: SL	Date: 18/11/2016	**Edmondson Park South Town Centre**	
Revision By:	Date:	**Indicative Depths to Shale At Designed Platform Level**	
Scale: Not to Scale	A3	**Project No: JG15942A-r6**	**Drawing No: 2**

APPENDIX A

Extracts of Previous Geotechnical Report

(Report Ref JC15942A-r2 dated February 2016

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Report

Geotechnical and Salinity Investigation
Edmondson Park South Town Centre – Residential Lots Precinct, Soldiers Parade & Campbelltown Road Edmondson Park NSW 2174

Prepared for

Frasers Australia
Level 3, 1C Homebush Bay Drive
RHODES NSW 2138

Ref: JG15942A-r2
February 2016

Legend

- Residential Lot Precinct
- Town Centre Precinct

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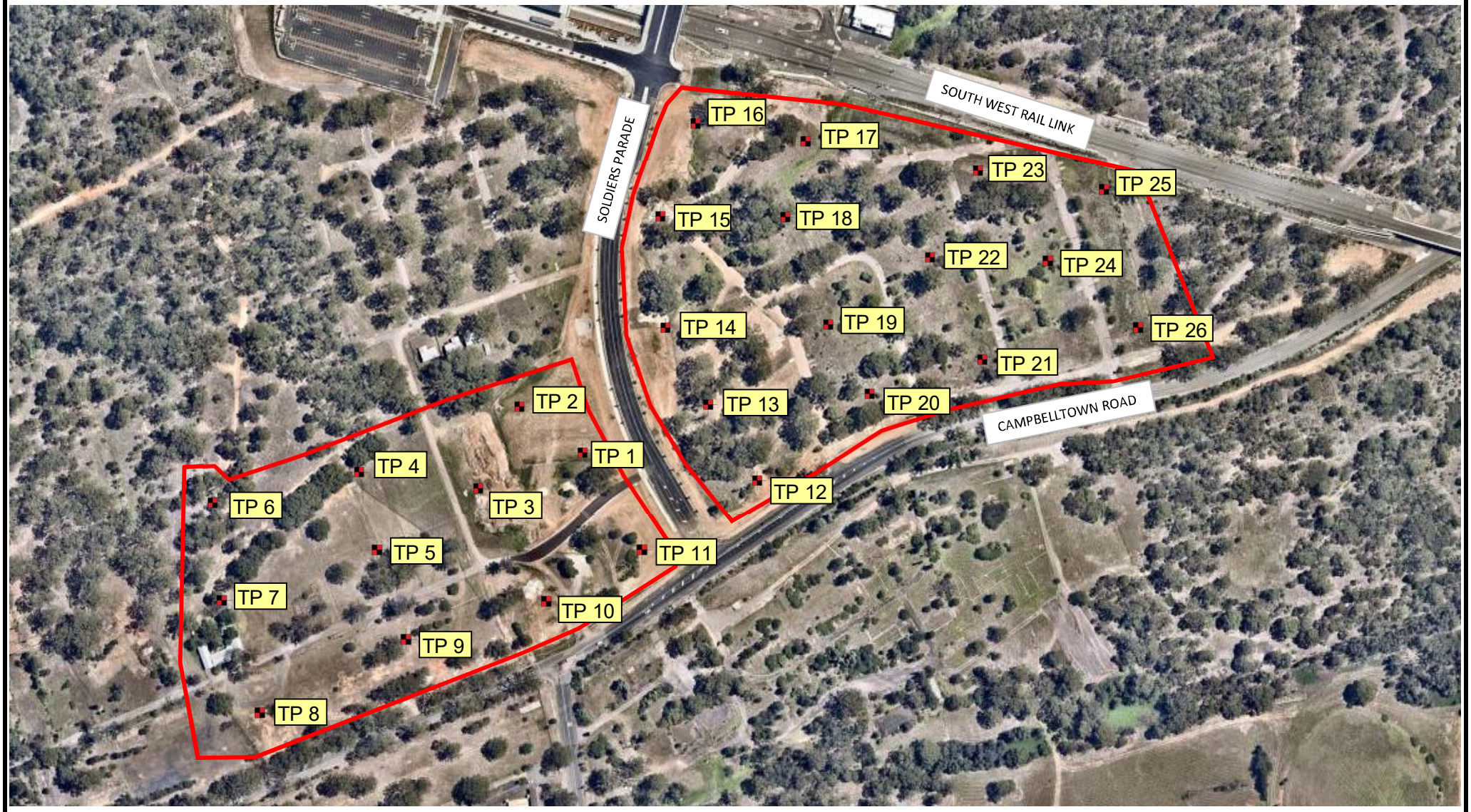
Drawn By: AT	Date: 15/01/2016	Fraser Property	
Checked By: SL	Date: 15/01/2016	Edmondson Park South Town Centre	
Revision By:	Date:	Site Locality and Proposed Development Plan	
Scale: Proportional	A3	Project No: JG15942A-r2	Drawing No: 1



Legend

Test Pit

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Drawn By: AT	Date: 15/01/2016	Fraser Property
Checked By: SL	Date: 15/01/2016	Edmondson Park South Town Centre
Revision By:	Date:	Test Pit Location Plan
Scale: Proportional	A3	Project No: JG15942A-r2 / Drawing No: 2

GeoEnviro Consultancy Pty Ltd
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Table A : Summary of Test Pit Profile

Client: Frasers Property — Job Number: JG15942A

Project: Edmondson Park South Town Centre — Logged By: SG/AT

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Date: 15-16/12/2015

Test Pit Number	Depth (m) From	Depth (m) To	Material Description
1	0	0.20	Topsoil: Silty Clay/Clayey Silt: low liquid limit, brown with gravel, dry
	0.20	0.70	Fill: Silty Clay: high plasticity, brown and red/brown with gravel, dry
	0.70	1.60	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	1.60	2.00	(CI) Silty Clay: medium plasticity, red and grey with fine to medium grained gravel, MC<PL, hard PP>600kPa
	2.00	2.40	(CI) Gravelly Silty Clay: medium plasticity, grey and red with fine to coarse grained gravel, MC<PL
	2.40	2.60	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
2	0	0.20	Fill: Gravelly Clayey Silt: low liquid limit, brown with fine to coarse grained shale gravel, dry
	0.20	0.70	Fill: Gravelly Silty Clay: low to medium plasticity, brown with fine to coarse grained shale gravel, dry
	0.70	1.40	Fill: Gravelly Silty Clay: medium plasticity, brown with a metal pipe and can, dry
	1.40	1.70	(CI-CH) Silty Clay; medium to high plasticity, brown and grey, MC<PL, hard PP>600kPa
	1.70	2.00	Shale: dark grey black, extremely low strength, extremely weathered
	2.00	2.40	(CI) Silty Clay: medium plasticity, grey with extremely weathered shale bands, MC<PL
	2.40	2.60	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
3	0	0.30	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.30	0.90	(CH) Silty Clay: high plasticity, red brown, MC=PL, hard PP=480kPa
	0.90	1.90	(CI) Silty Clay: medium plasticity, grey with gravel, MC=PL, very stiff PP=400kPa
	1.90	2.20	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
4	0	0.25	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.25	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP=280kPa
	0.90	1.60	(CI) Silty Clay: medium plasticity, grey with shale bands, MC<PL
	1.60	1.90	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
5	0	0.40	Topsoil/Fill: Clayey Silt: low liquid limit, brown with glass and terracotta fragments, dry
	0.40	0.60	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.60	1.10	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	1.10	1.30	(CI-CH) Silty Clay: medium to high plasticity, red and grey, MC<PL, hard PP>600kPa
	1.30	1.70	(CI) Silty Clay: medium plasticity, grey with shale gravel, MC<PL
	1.70	2.80	(CI) Shaley Clay: medium plasticity, grey brown with distinctly weathered shale gravel, MC<PL
	2.80	3.00	Shale: grey brown, low strength, extremely to distinctly weathered
6	0	0.20	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.20	0.90	(CH) Silty Clay: high plasticity, red brown, MC<=PL, hard PP=500kPa
	0.90	1.40	(CI) Silty Clay: medium plasticity, grey brown, MC<=PL, hard PP=500-550kPa
	1.40	1.60	(CI) Shaley Clay: medium plasticity, grey with distinctly weathered shale bands, MC<PL
	1.60	1.90	Shale: grey dark grey, low to medium strength, extremely weathered to distinctly weathered
			Notes:
			MC = Moisture Content.
			PL = Plastic Limit.
			PP = Pocket Penetrometer.

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Table A : Summary of Test Pit Profile

Client: Frasers Property — Job Number: JG15942A

Project: Edmondson Park South Town Centre — Logged By: SG/AT

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Date: 15-16/12/2015

Test Pit Number	Depth (m) From	Depth (m) To	Material Description
7	0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with 1 piece of rubbish, dry
	0.30	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL, dry
	0.70	0.80	(CI) Silty Clay: medium plasticity, grey brown, MC<=PL, hard PP=450kPa
	0.80	1.60	(CI) Shaley Clay: medium plasticity, grey with extremely to distinctly weathered shale gravel, MC<PL
	1.60	1.90	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
8	0	0.10	Topsoil: Clayey Silt: low liquid limit, brown with gravel, dry
	0.10	0.70	(CH) Silty Clay: high plasticity, red brown with fine to medium grained gravel, MC<=PL, very stiff to hard PP=380-500kPa
	0.70	1.20	(CI) Shaley Clay: medium plasticity, grey with extremely to distinctly weathered shale gravel, MC<PL
	1.20	1.50	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
9	0	0.20	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.20	0.60	(CH) Silty Clay: high plasticity, red brown with fine to coarse grained gravel, MC<PL, hard PP>600kPa
	0.60	1.00	(CI) Silty Clay: medium plasticity, grey brown with fine to coarse grained gravel, MC<PL
	1.00	1.20	Shale/Siltstone: grey brown, low to medium strength, extremely to distinctly weathered
10	0	0.50	Fill: Silty Clay/Clayey Silt: low plasticity, brown with brick fragments, dry
	0.50	0.90	(CH) Silty Clay: high plasticity, red brown, MC<=PL, very stiff PP=280kPa
	0.90	1.30	(CI-CH) Silty Clay: medium to high plasticity, red grey, MC<=PL, very stiff PP=300kPa
	1.30	1.50	(CI) Silty Clay: medium plasticity, grey with ironstaining and fine grained gravel, MC<=PL
	1.50	2.10	(CI) Shaley Clay: medium plasticity, grey with extremely to distinctly weathered shale gravel, MC<PL
	2.10	2.30	Shale/Siltstone: grey brown, low to medium strength, extremely to distinctly weathered
11	0	0.25	Fill: Gravelly Silty Clay: low plasticity, brown, dry
	0.25	0.80	(CH) Silty Clay: high plasticity, red brown, MC<=PL, hard PP=550kPa
	0.80	1.50	(CI) Silty Clay: medium plasticity, grey and brown, MC<=PL, hard PP=500-600kPa
	1.50	2.00	(CI) Shaley Clay: medium plasticity, grey with extremely to distinctly weathered shale gravel, MC<PL
	2.00	2.20	Shale/Siltstone: grey brown, low to medium strength, extremely to distinctly weathered (near refusal)
12	0	0.20	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.20	0.80	(CH) Silty Clay: high plasticity, red brown with fine grained gravel, MC<PP, hard PP>600kPa
	0.80	1.10	(CI) Silty Clay: medium plasticity, grey and brown with gravel, MC<PL, hard PP>600kPa
	1.10	2.50	(CI) Gravelly Silty Clay: medium plasticity, grey with ironstone gravel, MC<PL, hard PP>600kPa
	2.50	2.70	(CI) Shaley Clay: medium plasticity, grey with extremely to distinctly weathered shale gravel, MC<PL
	2.70	2.90	Shale: grey, low to medium strength, extremely to distinctly weathered
13	0	0.30	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.30	0.80	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	0.80	1.60	(CI) Silty Clay: medium plasticity, grey, MC<PL\
	1.60	2.00	(CI) Gravelly Silty Clay: medium plasticity, grey with ironstaining and ironstone gravel, MC<PL
			(refusal on ironstone at 2.00m)
			Notes:
			MC = Moisture Content.
			PL = Plastic Limit.
			PP = Pocket Penetrometer.

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Table A : Summary of Test Pit Profile

Client: Frasers Property — Job Number: JG15942A

Project: Edmondson Park South Town Centre — Logged By: SG/AT

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Date: 15-16/12/2015

Test Pit Number	Depth (m) From	Depth (m) To	Material Description
14	0	0.50	Fill: Gravelly Clayey Silt: low liquid limit, brown, dry
	0.50	0.90	(CI-CH) Gravelly Silty Clay: medium to high plasticity, red brown with fine to coarse grained ironstone gravel, MC<=PL hard PP>600kPa
	0.90	1.10	(CI) Gravelly Silty Clay: medium plasticity, red and grey with fine to coarse grained gravel, MC<PL, hard PP>600kPa
	1.10	2.20	(CI) Shaley Clay: medium plasticity, grey with distinctly weathered shale, MC<PL
	2.20	2.30	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered
15	0	0.40	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.40	0.60	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	0.60	0.80	(CI) Shaley Clay: medium plasticity, grey with distinctly weathered shale, MC<PL
	0.80	0.90	Shale: grey with ironstone bands and clay seams, low to medium strength, distinctly weathered (refusal)
16	0	0.25	Fill: Gravelly Clayey Silt: low liquid limit, brown, dry
	0.25	0.45	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
	0.45	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	0.90	1.10	(CI) Gravelly Silty Clay: medium plasticity, grey with ironstaining and fine to coarse grained ironstone gravel, MC<PL
	1.10	1.60	(CI) Silty Clay: medium plasticity, grey with ironstaining, MC<PL, hard PP=590kPa
	1.60	2.20	As above but with extremely weathered shale bands
	2.20	2.40	Shale: grey, low to medium strength, extremely to distinctly weathered (near refusal)
17	0	0.60	Fill: Gravelly Clayey Silt: low liquid limit, brown, dry
	0.60	0.80	Topsoil: Clayey Silt: low liquid limit, grey brown, dry
	0.80	1.30	(CH) Silty Clay: high plasticity, red brown with ironstone gravel, MC<PL, hard PP>600kPa
	1.30	1.60	(CH) Gravelly Silty Clay: high plasticity, red brown, MC<PL
	1.60	2.00	(CI) Gravelly Silty Clay: medium plasticity, red grey with fine to coarse grained gravel, MC<PL
	2.00	3.10	As above but grey with ironstaining and fine to coarse grained ironstone gravel, MC<PL, hard PP=500-570kPa
18	0	0.40	Fill: Gravelly Clayey Silt: low liquid limit, brown, dry
	0.40	2.00	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	2.00	2.40	(CI) Silty Clay: medium plasticity, red grey, MC<PL, hard PP>600kPa
	2.40	2.50	As above but with ironstone gravel (refusal on ironstone bands at 2.50m)
19	0	0.25	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.25	0.40	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kPa
	0.40	0.80	(CI) Silty Clay: medium plasticity, red grey, MC<PL, hard PP=470-600kPa
	0.80	1.60	(CI) Gravelly Silty Clay: medium plasticity, grey with ironstaining and fine to coarse grained ironstone gravel, MC<=PL very stiff PP=280-340kpa
	1.60	1.90	As above but with ironstone bands, MC<PL (refusal at 1.9m on ironstone band)
20	0	0.50	Topsoil/fill: Clayey Silt: low liquid limit, brown with gravel and terracotta pipe fragments, dry
	0.50	0.90	(CH) Silty Clay: high plasticity, red brown, MC<PL
	0.90	1.30	(CI) Silty Clay: medium plasticity, grey with ironstaining, MC<PL
	1.30	1.60	Shale/Siltstone: grey brown, low to medium strength, extremely to distinctly weathered
			Notes:
			MC = Moisture Content.
			PL = Plastic Limit.
			PP = Pocket Penetrometer.

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Table A : Summary of Test Pit Profile

Client: Frasers Property — Job Number: JG15942A

Project: Edmondson Park South Town Centre — Logged By: SG/AT

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Date: 15-16/12/2015

Test Pit Number	Depth (m) From	Depth (m) To	Material Description
21	0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown, dry
	0.30	0.90	Fill: Silty Clay: medium plasticity, brown grey, dry
	0.90	1.50	(CI) Silty Clay: medium plasticity, grey with ironstone gravel, MC<PL
	1.50	2.00	(CI) Shaley Clay: medium plasticity, grey with distinctly weathered shale, MC<PL
	2.00	2.10	Shale: grey, low to medium strength, distinctly weathered
22	0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with gravel, glass and ceramic fragments, dry
	0.30	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL hard PP>600kPa
	0.70	0.80	(CI) Silty Clay: medium plasticity, grey with gravel, MC<PL
	0.80	1.70	(CI) Gravelly Silty Clay: medium plasticity, grey with ironstaining and ironstone gravel, MC<=Pl
	1.70	1.90	(CI) Silty Clay: medium plasticity, dark grey, MC<=PL
	1.90	-	refusal on ironstone bands at 1.90m
23	0	0.35	Topsoil: Clayey Silt: low liquid limit, brown, dry
	0.35	0.70	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP>600kpa
	0.70	0.90	(CI) Silty Clay: medium plasticity, red grey with fine to coarse grained ironstone gravel, MC<PL, hard PP=480kPa
	0.90	1.20	As above but grey, MC<PL, hard PP=520kPa
	1.20	2.60	(CI) Gravelly Silty Clay: medium plasticity, grey with fine to coarse grained ironstone gravel, MC<PL
	2.60	2.70	Shale: grey, low to medium strength, extremely weathered
24	0	0.30	Topsoil/Fill: Clayey Silt: low liquid limit, brown with glass and pvc fragments, pavers and 3 bricks, dry
	0.30	0.70	(CH) Silty Clay: high plasticity, red brown, MC<=PL, hard PP=500kPa
	0.70	1.10	(CI) Silty Clay: medium plasticity, grey with fine to coarse grained ironstone gravel and ironstaining, MC<=PL
	1.10	1.50	(CI) Gravelly Silty Clay: medium plasticity, grey with ironstaining, MC<PL
	1.50	1.70	Ironstone band - refusal
25	0	0.40	Topsoil/Fill: Clayey Silt: low liquid limit, brown with gravel and some brick fragments, dry
	0.40	0.90	(CH) Silty Clay: high plasticity, red brown, MC<=PL
	0.90	1.00	(CI) Silty Clay: medium plasticity, grey with heavy ironstaining, MC<PL
	1.00	1.30	(CI) Gravelly Silty Clay: medium plasticity, grey with heavy ironstaining and fine to coarse grained ironstone gravel and distinctly weathered shale, MC<PL, hard PP=480kPa
	1.30	1.40	Shale: grey, low to medium strength, distinctly weathered
26	0	0.20	Topsoil/Fill: Clayey Silt: low liquid limit, brown, dry
	0.20	0.50	Fill: Gravelly Silty Clay: medium plasticity, brown, dry
	0.50	1.20	(CH) Silty Clay: high plasticity, red brown, MC<PL, hard PP=480-600kPa
	1.20	2.20	(CI) Gravelly Silty Clay: medium plasticity, grey with heavy ironstaining and fine to coarse grained ironstone gravel, MC<PL
	2.20	-	refusal on ironstone/siltstone band at 2.20m

Notes:
MC = Moisture Content.
PL = Plastic Limit.
PP = Pocket Penetrometer.

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Test Results - California Bearing Ratio

Client / Address: Frasers Property / Rhodes — Job No: JG15942A-r2

Project: Proposed Residential Subdivision Development — Date: 11/01/2016

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R01A

SAMPLE INFORMATION Test Methods

Lab Reference No.			SR10134	SR10136	SR10140	SR10142	SR10145
Date Sampled			16-Dec-15	16-Dec-15	16-Dec-15	16-Dec-15	16-Dec-15
Date Tested			11-Jan-16	11-Jan-16	11-Jan-16	11-Jan-16	11-Jan-16
Sample Identification			TP 4 (0.3-0.5m)	TP 8 (0.4-0.6m)	TP 13 (0.4-0.6m)	TP 16 (0.5-0.7m)	TP 22 (0.3-0.5m)
Laboratory Specimen Description			Silty Clay: red brown with trace of gravel	Silty Clay: red brown with trace of gravel	Silty Clay: red brown with trace of gravel	Silty Clay: red brown with trace of gravel	Silty Clay: red brown

TEST RESULTS

Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1

Maximum Dry Density t/m3			1.71	1.66	1.58	1.52	1.47
Optimum Moisture Content %			19.5	21.0	24.0	25.5	28.0
Field Moisture Content %			15.0	17.0	17.5	21.0	22.0
% Of Oversize 19mm			-	-	-	-	-
Replacement of Oversize (See note B)			-	-	-	-	-

California Bearing Ratio - Test Method AS1289 6.1.1

CBR Test	Dry Density t/m3	Before Soaking	1.69	1.67	1.57	1.53	1.45
		After Soaking	1.66	1.64	1.56	1.51	1.44
	Density Ratio %	Before Soaking	99.0	101.0	100.0	100.5	99.0
		After Soaking	97.0	98.5	99.0	99.5	98.5
	Moisture Content %	Before Soaking	19.5	21.0	24.0	26.0	28.5
		After Soaking	22.5	23.5	26.0	28.0	30.0
	Number of Days Soaked		4	4	4	4	4
	Surcharge kg		6.75	6.75	6.75	6.75	6.75
	Moisture Content After Test %	Top 30mm	27.0	27.0	29.0	31.0	32.0
		Whole Sample	22.5	23.5	26.0	28.0	30.0
	Swell After Soaking %		2.0	2.2	0.9	0.9	0.6
	Penetration mm		2.5	5.0	2.5	2.5	2.5
	CBR Value %		2.5	3.5	8.0	7.0	8.0

Notes: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)

(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

Remarks

Authorised Signatory _____ Allan Fong Date 02/02/2016

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Test Results - California Bearing Ratio

Client / Address: Frasers Property / Rhodes — Job No: JG15942A-r2

Project: Proposed Residential Subdivision Development — Date: 11/01/2016

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R02A

SAMPLE INFORMATION Test Methods						
Lab Reference No.			SR10148			
Date Sampled			16-Dec-15			
Date Tested			11-Jan-16			
Sample Identification			TP 26 (0.5-0.8m)			
Laboratory Specimen Description			Silty Clay: red brown with trace of gravel			
TEST RESULTS						
Laboratory Compaction & Moisture Content - Test Methods AS1289 5.1.1 Mould A and AS1289 2.1.1						
Maximum Dry Density t/m3			1.50			
Optimum Moisture Content %			27.0			
Field Moisture Content %			28.5			
% Of Oversize 19mm			-			
Replacement of Oversize (See note B)			-			
California Bearing Ratio - Test Method AS1289 6.1.1						
CBR Test	Dry Density t/m3	Before Soaking	1.49			
		After Soaking	1.47			
	Density Ratio %	Before Soaking	99.0			
		After Soaking	98.0			
	Moisture Content %	Before Soaking	27.5			
		After Soaking	30.5			
	Number of Days Soaked		4			
	Surcharge kg		6.75			
	Moisture Content After Test %	Top 30mm	31.0			
		Whole Sample	30.5			
	Swell After Soaking %		1.2			
	Penetration mm		2.5			
	CBR Value %		4.0			

Notes: (A) Test specimen was compacted to a target dry density of 100 percent standard (AS 1289 5.1.1)

(B) If specified the percentage of oversize retained on the 19mm may be replaced by an equal portion of –19mm to +4.75mm

Remarks

Authorised Signatory _____ Allan Fong Date 02/02/2016

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Test Results - Shrink/Swell Index

Client / Address: Frasers Property / Rhodes — Job No: JG15942A-r2

Project: Proposed Residential Subdivision Development — Date: 06/01/2016

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R03A

Test Procedure: AS 1289 7.1.1

Sample Identification	TP 6 (0.3-0.6m)	TP 10 (0.5-0.8m)	TP 12 (0.3-0.6m)	TP 17 (0.9-1.2m)
Sample Register No	SR10135	SR10138	SR10139	SR10143
Sample Date	16-Dec-15	16-Dec-15	16-Dec-15	16-Dec-15
Test Date	6-Jan-15	6-Jan-15	6-Jan-15	6-Jan-15
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)
Test Results				
Test Procedure	AS 1289 2.1.1	AS 1289 2.1.1	AS 1289 2.1.1	AS 1289 2.1.1
Moisture Content				
Initial %	16.5	19.5	18.5	15.0
Final %	21.0	25.5	24.5	17.0
Test Procedure	AS 1289 7.1.1	AS 1289 7.1.1	AS 1289 7.1.1	AS 1289 7.1.1
Estimated UCS				
Before Test kPa	>600	330	>600	>600
After Test kPa	300	300	>600	300
Swell %	3.9	2.0	3.4	2.0
Shrinkage %	2.5	3.3	2.2	1.7
Shrink/Swell Index %/pF	2.5	2.4	2.2	1.5
Material Description	Silty Clay: red brown grey with trace of gravel	Silty Clay: red brown gre with trace of gravel	Silty Clay: red brown with trace of gravel	Gravelly Silty Clay: red brown

Remarks

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Allan Fong Date 06/01/2016

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Test Results - Shrink/Swell Index

Client / Address: Frasers Property / Rhodes — Job No: JG15942A-r2

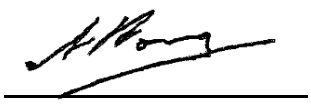
Project: Proposed Residential Subdivision Development — Date: 07/01/2016

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R04A

Test Procedure: AS 1289 7.1.1

Sample Identification	TP 21 (0.9-1.4m)			
Sample Register No	SR10144			
Sample Date	16-Dec-15			
Test Date	7-Jan-16			
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)			
Test Results				
Test Procedure	AS 1289 2.1.1			
Moisture Content Initial % Final %	 16.5 22.0			
Test Procedure	AS 1289 7.1.1			
Estimated UCS Before Test kPa After Test kPa	 >600 360			
Swell % Shrinkage %	5.5 2.7			
Shrink/Swell Index %/pF	3.0			
Material Description	Silty Clay: brown grey with gravel			

Remarks

Authorised Signatory  Allan Fong Date 07/01/2016

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Test Results - Atterberg Limits

Client / Address: Frasers Property / Rhodes — Job No: JG15942A-r2

Project: Proposed Residential Subdivision Development — Date: 21/01/2016

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R05A

Sample Identification	TP 2 (1.4-1.5m)	TP 9 (0.4-0.6m)	TP 15 (0.4-0.5m)	TP 22 (0.9-1.0m)
Sample Register No	SR10133	SR10137	SR10141	SR10146
Sample Date	16-Dec-15	16-Dec-15	16-Dec-15	16-Dec-15
Test Date	21-Jan-16	21-Jan-16	21-Jan-16	21-Jan-16
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)
Test Results				
Test Procedure:	AS 1289 3.1.2	AS 1289 3.1.2	AS 1289 3.1.2	AS 1289 3.1.2
Liquid Limit (%)	52	51	51	42
Test Procedure:	AS 1289 3.2.1	AS 1289 3.2.1	AS 1289 3.2.1	AS 1289 3.2.1
Plastic Limit (%)	21	21	21	17
Test Procedure:	AS 1289 3.3.1	AS 1289 3.3.1	AS 1289 3.3.1	AS 1289 3.3.1
Plasticity Index (%)	31	30	30	24
Test Procedure:	AS 1289 3.4.1	AS 1289 3.4.1	AS 1289 3.4.1	AS 1289 3.4.1
Linear Shrinkage (%)	14.0	14.5	14.5	11.5
Test Procedure:	AS 1289 2.1.1	AS 1289 2.1.1	AS 1289 2.1.1	AS 1289 2.1.1
Natural Moisture Content %	-	17.5	-	9.5
Material Description	Silty Clay: brown and grey	Silty Clay: red brown with gravel	Silty Clay: red brown	Gravelly Silty Clay: grey

Remarks

Authorised Signatory  Allan Fong Date 21/01/2016

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results - Atterberg Limits

Client / Address: Frasers Property / Rhodes — Job No: JG15942A-r2

Project: Proposed Residential Subdivision Development — Date: 21/01/2016

Location: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R05A

Sample Identification	TP 25 (0.4-0.5m)			
Sample Register No	SR10133			
Sample Date	16-Dec-15			
Test Date	21-Jan-16			
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)			
Test Results				
Test Procedure:	AS 1289 3.1.2			
Liquid Limit (%)	52			
Test Procedure:	AS 1289 3.2.1			
Plastic Limit (%)	21			
Test Procedure:	AS 1289 3.3.1			
Plasticity Index (%)	32			
Test Procedure:	AS 1289 3.4.1			
Linear Shrinkage (%)	14.0			
Test Procedure:	AS 1289 2.1.1			
Natural Moisture Content %	-			
Material Description	Silty Clay: brown and grey			

Remarks

Authorised Signatory _____ Allan Fong Date 21/01/2016

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number

Client / Address: Frasers Property / Rhodes	Job No: JG15942A-r2
Project: Proposed Residential Subdivision Development	Date: 15/01/2016
Location: Soldiers Parade and Campbelltown Road Edmondson Park	Report No: R07A

Sample Identification	TP 2 (1.4-1.5m)	TP 4 (0.3-0.5m)	TP 9 (0.4-0.6m)	TP 13 (0.4-0.6m)	TP 15 (0.4-0.5m)
Sample Register No	SR10133	SR10134	SR10137	SR10140	SR10141
Sample Date	16-Dec-15	16-Dec-15	16-Dec-15	16-Dec-15	16-Dec-15
Test Date	15-Jan-15	15-Jan-15	15-Jan-15	15-Jan-15	15-Jan-15
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)
Test Procedure	AS 1289 1.1, 1.2.1, 3.8.1				

Test Results

Air Dried crumbs					
Time in water:	8:14	9:05	9:08	8:14	8:29
Time dispersion starts:	-	-	-	-	-
Remoulded Soil					
Time in water	8:30	9:20	9:22	8:25	8:42
Time dispersion starts	8:33	9:25	-	-	8:45
Type of water	Distilled	Distilled	Distilled	Distilled	Distilled
Temp. of water	19°	19°	19°	19°	19°
Emerson Class Number					
Class No.	3	3	4	4	3

Remarks

Authorised Signatory  Allan Fong Date 15/01/2016

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Emerson Class Number

Client / Address: Frasers Property / Rhodes	Job No: JG15942A-r2
Project: Proposed Residential Subdivision Development	Date: 15/01/2016
Location: Soldiers Parade and Campbelltown Road Edmondson Park	Report No: R08A

Sample Identification	TP 22 (0.3-0.5m)	TP 22 (0.9-1.0m)	TP 25 (0.4-0.5m)		
Sample Register No	SR10145	SR10146	SR10147		
Sample Date	16-Dec-15	16-Dec-15	16-Dec-15		
Test Date	15-Jan-15	15-Jan-15	15-Jan-15		
Sample Procedure	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)	AS 1289 1.1, 1.2.1 (6.5.4)		
Test Procedure	AS 1289 1.1, 1.2.1, 3.8.1				
Test Results					
Air Dried crumbs					
Time in water:	9:05	7:49	9:08		
Time dispersion starts:	-	7:53	-		
Remoulded Soil					
Time in water	9:24	-	9:23		
Time dispersion starts	-	-	-		
Type of water	Distilled	Distilled	Distilled		
Temp. of water	19°	19°	19°		
Emerson Class Number					
Class No.	4	2	4		

Remarks

Authorised Signatory _____ Allan Fong Date 15/01/2016

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Atterberg Limits & Particle Size Distribution

Client / Address: Frasers Property / Rhodes	Job No: JG15942A-r2
Project: Proposed Residential Subdivision Development	Date: 22/01/2016
Location: Soldiers Parade and Campbelltown Road Edmondson Park	Report No: R09A

Lab Reference No: SR10133	Sample Identification: TP 2 (1.4-1.5m)

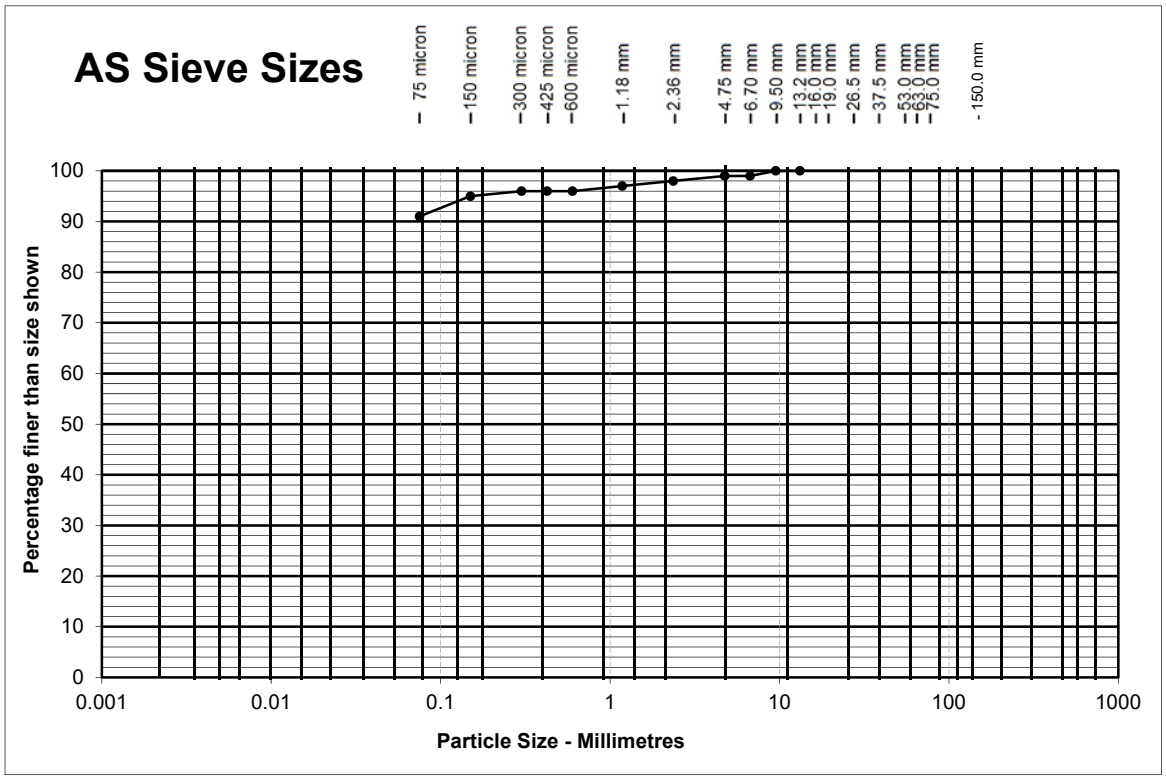
Laboratory Specimen Description: Silty Clay: brown and grey

Test Method	Test Results	Test Procedure
Liquid Limit (%)	52	AS 1289 3.1.1
Plasitc Limit (%)	21	AS 1289 3.2.1
Plasticity Index (%)	31	AS 1289 3.3.1
Linear Shrinkage (%)	14.0	AS 1289 3.4.1
Natural Moisture %	18.4	AS 1289 2.1.1
Sample History:	Air drier	
Preparation Method.	Dry sieved	
Condition of linear shrinkage.	Curling linear shrinkage.	
Linear shrinkage mould length.	250mm	

ND = not determined NO = not obtainable NP = non plastic

Test Procedure AS1289 2.1.1, 3.6.3

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63 mm		
53 mm		
37.5 mm		
26.5 mm		
19 mm		
16 mm		
13.2 mm	100	
9.5 mm	100	
6.7 mm	99	
4.75 mm	99	
2.36 mm	98	
1.18 mm	97	
600 um	96	
425 um	96	
300 um	96	
150 um	95	
75 um	91	



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	

Remarks:

Authorised Signatory Allan Fong Date 22/01/2016

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Tel: (02) 96798733 Fax: (02) 96798744

Atterberg Limits & Particle Size Distribution

Client / Address: Frasers Property / Rhodes	Job No: JG15942A-r2
Project: Proposed Residential Subdivision Development	Date: 22/01/2016
Location: Soldiers Parade and Campbelltown Road Edmondson Park	Report No: R10A

Lab Reference No: SR10141	Sample Identification: TP 15 (0.4-0.5m)

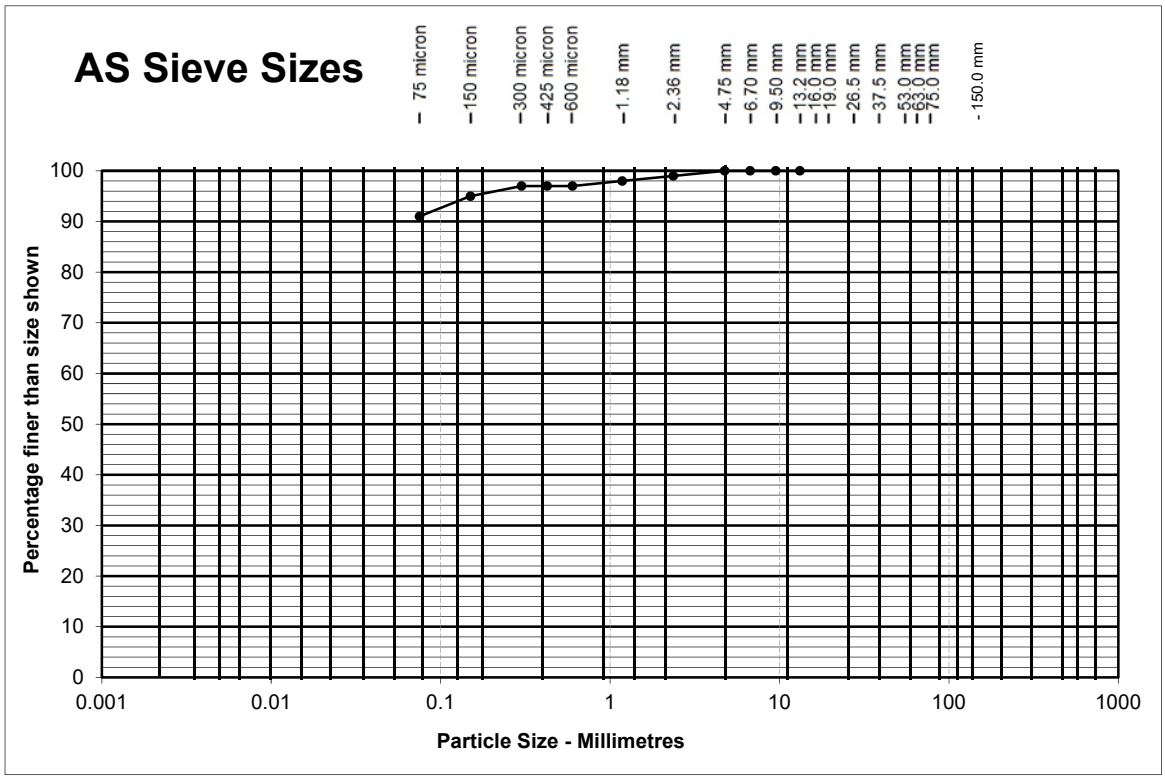
Laboratory Specimen Description: Silty Clay: red brown

Test Method	Test Results	Test Procedure
Liquid Limit (%)	51	AS 1289 3.1.1
Plasitc Limit (%)	21	AS 1289 3.2.1
Plasticity Index (%)	30	AS 1289 3.3.1
Linear Shrinkage (%)	14.5	AS 1289 3.4.1
Natural Moisture %	17.0	AS 1289 2.1.1
Sample History:	Air drier	
Preparation Method.	Dry sieved	
Condition of linear shrinkage.	Curling linear shrinkage.	
Linear shrinkage mould length.	250mm	

ND = not determined NO = not obtainable NP = non plastic

Test Procedure AS1289 2.1.1, 3.6.3

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63 mm		
53 mm		
37.5 mm		
26.5 mm		
19 mm		
16 mm		
13.2 mm	100	
9.5 mm	100	
6.7 mm	100	
4.75 mm	100	
2.36 mm	99	
1.18 mm	98	
600 um	97	
425 um	97	
300 um	97	
150 um	95	
75 um	91	



clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	

Remarks:

Authorised Signatory Allan Fong Date 22/01/2016

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Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Atterberg Limits & Particle Size Distribution

Client / Address: Frasers Property / Rhodes	Job No: JG15942A-r2
Project: Proposed Residential Subdivision Development	Date: 22/01/2016
Location: Soldiers Parade and Campbelltown Road Edmondson Park	Report No: R11A

Lab Reference No: SR10147	Sample Identification: TP 25 (0.4-0.5m)

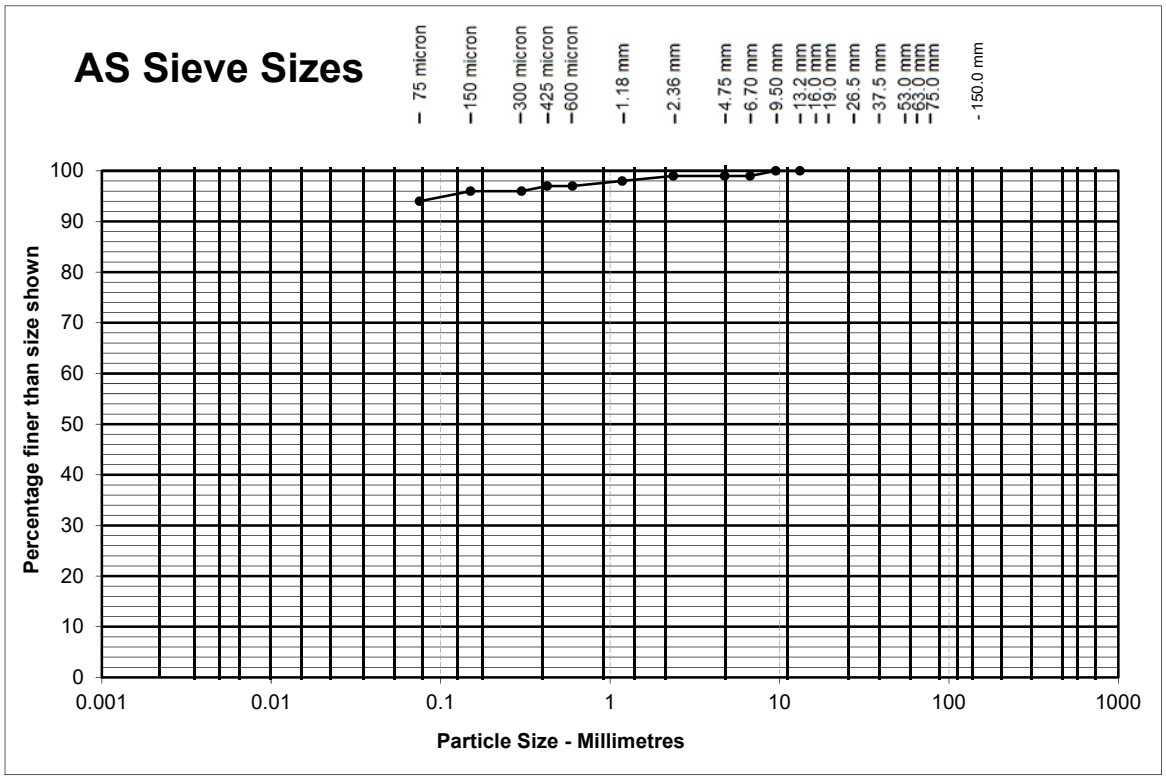
Laboratory Specimen Description: Silty Clay: red brown

Test Method	Test Results	Test Procedure
Liquid Limit (%)	60	AS 1289 3.1.1
Plasitc Limit (%)	23	AS 1289 3.2.1
Plasticity Index (%)	37	AS 1289 3.3.1
Linear Shrinkage (%)	14.0	AS 1289 3.4.1
Natural Moisture %	19.5	AS 1289 2.1.1
Sample History:	Air drier	
Preparation Method.	Dry sieved	
Condition of linear shrinkage.	Curling linear shrinkage.	
Linear shrinkage mould length.	250mm	

ND = not determined NO = not obtainable NP = non plastic

Test Procedure AS1289 2.1.1, 3.6.3

Sieve Size	% Passing	Specification
150 mm		
75 mm		
63 mm		
53 mm		
37.5 mm		
26.5 mm		
19 mm		
16 mm		
13.2 mm	100	
9.5 mm	100	
6.7 mm	99	
4.75 mm	99	
2.36 mm	99	
1.18 mm	98	
600 um	97	
425 um	97	
300 um	96	
150 um	96	
75 um	94	



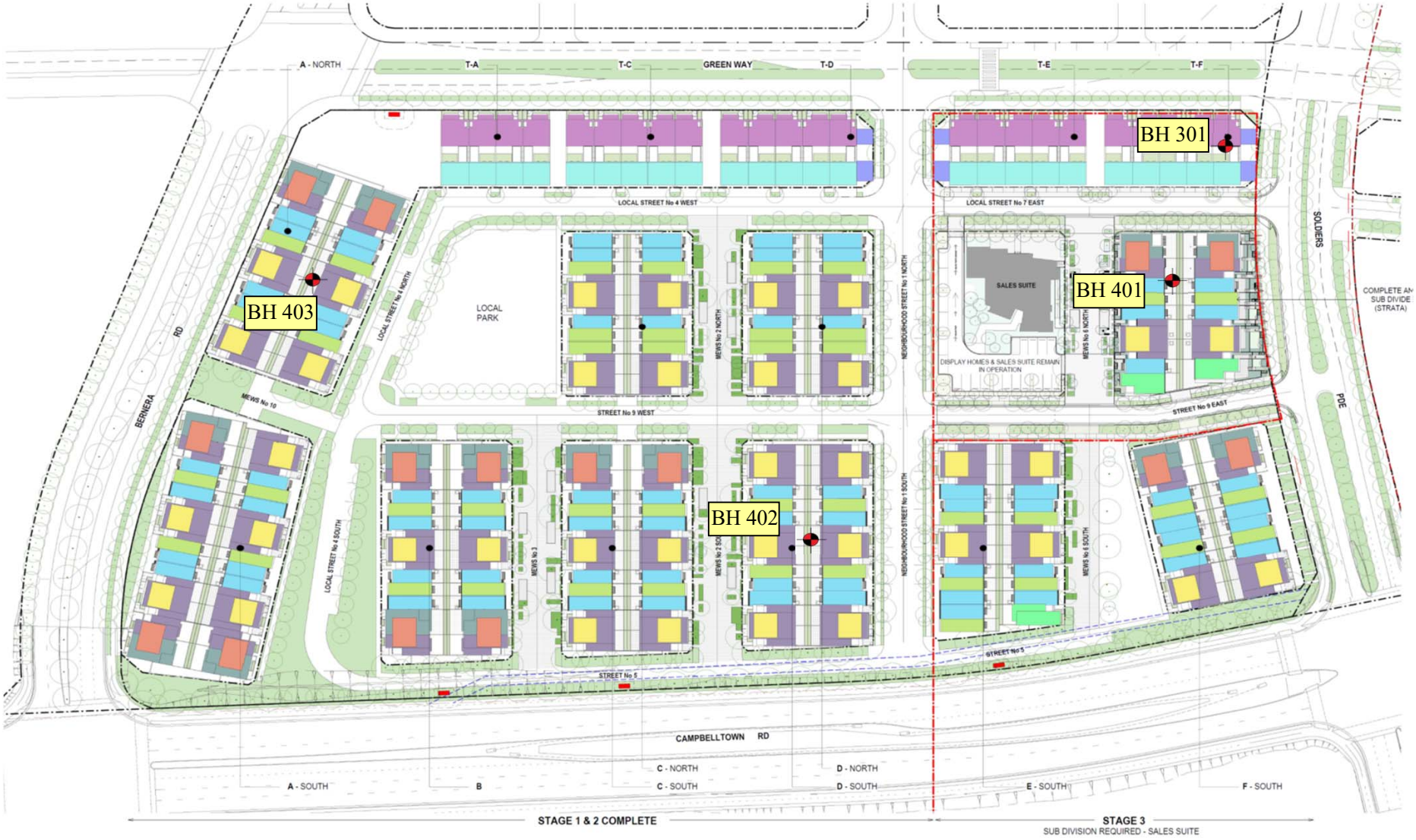
clay	silt			sand			gravel			cobbles
	fine	medium	coarse	fine	medium	coarse	fine	medium	coarse	

Remarks:

Authorised Signatory Allan Fong Date 22/01/2016

APPENDIX B

Additional Borehole and Cored Boreholes Reports
Borehole Location Plan



Legend

BH 401 Borehole

GeoEnviro Consultancy
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Drawn By: AT	Date: 18/11/2016	Frasers Property	
Checked By: SL	Date: 18/11/2016	Edmondson Park South Town Centre	
Revision By:	Date:	Borehole Location Plan - RP1	
Scale: Not to Scale	A3	Project No: JG15942A-r6	Drawing No: 3

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Borehole Report

Borehole no: 301

Client: Frasers Property Australia
Job no: JG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct
Date: 10/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park
Logged by: SG

Drill Model and Mounting: Hydrapower | Slope: 90° | R.L. Surface: 59.82m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
TC-BIT	NIL	DRY					Fill: Gravelly Clayey Silt: low liquid limit, brown with grave	D			
							Fill: Gravelly Silty Clay: low to medium plasticity, brown	D			
			7,10,15 N=25	1.0 2.0			Fill: Silty Clay: medium plasticity, grey and red with fine to medium grained ironstone gravel	D	H	>600	
						CH	Silty Clay: high plasticity, red brown	<=PL			
				3.0			Refer to Cored BH 301 below 2.69m				
				4.0 5.0 6.0 7.0 8.0							

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Cored Borehole Report

Borehole no: 301

Client: Frasers Property Australia

Job no: HG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct

Date: 17/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park

Logged by: AT

Drill Model and Mounting: Hydra | Slope: 90° | R.L Surface: 59.82m

Hole Diameter: 50mm | Bearing: Vertical | Datum: AHD

Method	Support	Barrel Lift	Water Loss/ Level	Depth(m)	Graphic Log	Core Description Rock type, grain characteristics, colour, structure, minor components.	Weathering	Strength	Point Load Index Strength Is(50) VL M VH EL L H EH	Defect Details Defect Spacing (mm) 300 50 10 500 100 30	Description type, inclination, thickness, planarity, roughness, coating
						Start Coring BH 301 at 2.69m					
N M L C	N I L		F U L L R E T U R N	3		(CH) Silty Clay: high plasticity, red brown					
						(Cl) Silty Clay: medium plasticity, grey with siltstone					
						(Cl) Shaley Clay: medium plasticity, grey brown					
				4		Shale: brown	EW	(VL -L)			CS; 20mm.t CR; 120mm.t CS 10mm.t
						Shale: dark grey brown with some ironstaining	EW - DW				Cr; 40mm.t CS; 70mm.t Cr; 30mm.t CS; 45mm.t Be; 3mm.t CS; 70mm.t Cr 40mm.t 8x XWS; Ave. 3mm.t
				5							
				6							
						End of BH 301 at 6.07m					
				7							
				8							
				9							
				10							

GeoEnviro

JG 15942A-r5 BH301 START AT 2.69m

3m

4m

5m

6m END OF BH301 AT 6.07m

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Borehole Report

Borehole no: 401

Client: Frasers Property Australia
Job no: JG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct
Date: 10/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park
Logged by: SG

Drill Model and Mounting: Hydrapower | Slope: 90° | R.L. Surface: 61.68m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
TC-BIT	NIL	DRY					Topsoil/Fill: Clayey Silt, brown with gravel	D			
							Fill: Gravelly Silty Clay low to medium plasticity, red brown with fine grained gravel	D			
						CH	Silty Clay: high plasticity, red brown	<PL			
				1.0		CI-CH	Silty Clay: medium to high plasticity, red and grey with trace of ironstone gravel	=PL	VSt	280 350	
			2,2,3 N=5			CI	Silty Clay: medium plasticity, grey with ironstaining and ironstone gravel	<=PL	(VSt)		
				2.0		CI	Silty Clay: medium plasticity, grey with ironstone gravel bands	<PL	H	>600	SPT bouncing at 2.55m
			N>15	3.0			Refer to Cored BH 401 below 2.9m				
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Cored Borehole Report

Borehole no: 401

Client: Frasers Property Australia

Job no: HG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct

Date: 17/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park

Logged by: AT

Drill Model and Mounting: Hydra | Slope: 90° | R.L Surface: 61.68m

Hole Diameter: 50mm | Bearing: Vertical | Datum: AHD

Method	Support	Barrel Lift	Water Loss/ Level	Depth(m)	Graphic Log	Core Description Rock type, grain characteristics, colour, structure, minor components.	Weathering	Strength	Point Load Index Strength Is(50) VL M VH EL L H EH	Defect Details Defect Spacing (mm) 300 50 10 500 100 30	Description type, inclination, thickness, planarity, roughness, coating
						Start Coring BH 401 at 2.9m					
N M L C	N I L		F U L L R E T U R N	3		Shale: brown grey with siltstone bands	EW	VL			Cr; 40mm.t CS; 25mm.t XWS; 70mm.t CS; 50mm.t CS; 65mm.t
				4				H	X		
								M	X		
				5					X		
						Shale: grey	DW		X		4x XWS; ave. 3mm.t Joint; 40°, 180mm.t
				6					X		
								M - H	X		XWS; 25mm.t
				7					X		Be; 3mm.t
									X		
				8					X		
						End of BH 401 at 8.43m					Mopst defects not described are Bedding Partings or Extremely Weathered Seams
				9							
				10							

GeoEnviro

JG15942A-16 BH401 START CORE AT 2.90M

3m

4m

5m

6m

7m

8m

END BH401 AT 8.43M

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Borehole Report

Borehole no: 402

Client: Frasers Property Australia
Job no: JG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct
Date: 10/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park
Logged by: SG

Drill Model and Mounting: Hydrapower | Slope: 90° | R.L. Surface: 66.39m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
TC-BIT	NIL	DRY					Topsoil/Fill: Clayey Silt: low liquid limit, brown with brick footings	D			
						CH	Silty Clay: high plasticity, red brown	<PL			
			4,6,12 N=18	1.0		CI	Silty Clay: medium plasticity, red and grey	<=PL	H	550	
				2.0			As above but grey brown with shale bands				
							Refer to Cored BH 402 below 2.05m				
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Cored Borehole Report

Borehole no: 402

Client: Frasers Property Australia

Job no: HG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct

Date: 17/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park

Logged by: AT

Drill Model and Mounting: Hydra | Slope: 90° | R.L Surface: 66.39m

Hole Diameter: 50mm | Bearing: Vertical | Datum: AHD

Method	Support	Barrel Lift	Water Loss/ Level	Depth(m)	Graphic Log	Core Description Rock type, grain characteristics, colour, structure, minor components.	Weathering	Strength	Point Load Index Strength Is(50) VL M VH EL L H EH	Defect Details Defect Spacing (mm) 300 50 10 500 100 30	Defect Details Description type, inclination, thickness, planarity, roughness, coating
						Start Coring BH 402 at 2.05m					
NMLC	NIL		FULL RETURN	3		(CL-CI) Silty Clay: low to medium plasticity, grey with ironstaining and shale shale bands					
				4		Shale: grey brown	EW	(VL L)			CS; 70mm.t 6x XWS; Ave. 4mm.t
				5		Shale/Siltstone: grey	DW	M - VH			Be; 3mm.t
				6		Shale: dark grey black	DW				
				7		Shale/Siltstone: grey	DW	H			XWS; 2mm.t Be; 3mm.t
				8		Shale: dark grey with siltstone bands	DW	M			Joint; 45°, 150mm.t
				9		End of BH 402 at 8.49m					Mopst defects not described are Bedding Partings or Extremely Weathered Seams
				10							

GeoEnviro

JG15942A
BH402, 1·05m

3m

4m

5m

6m

7m

8m

END OF BH402 AT 8·49m

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Borehole Report

Borehole no: 403

Client: Frasers Property Australia

Job no: JG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct

Date: 10/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park

Logged by: SG

Drill Model and Mounting: Hydrapower | Slope: 90° | R.L. Surface: 70.24m

Hole Diameter: 100mm | Bearing: Vertical | Datum: AHD

Method	Support	Water	Notes: Samples, Tests, etc	Depth(m)	Classification Symbol	Unified Soil Classification	Material Description (Soil Type, Plasticity or Particle Characteristic, colour, secondary and minor component)	Moisture Content	Consistency/Density Index	Hand Penetrometer kPa	Structure and Additional Observations
TC-BIT	NIL	DRY					Topsoil: Clayey Silt: low liquid limit, brown	D			
						CH	Silty Clay: high plasticity, red brown	<PL			
				1.0		CI	Silty Clay: medium plasticity, grey brown with gravel		(VSt)		
							Shale/Siltstone: brown and grey, very low to low strength, extremely weathered				
							Refer to Cored BH 403 below 1.5m				
				2.0							
				3.0							
				4.0							
				5.0							
				6.0							
				7.0							
				8.0							

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Cored Borehole Report

Borehole no: 403

Client: Frasers Property Australia

Job no: HG15942A-r6

Project: Proposed Edmondson Park Town Centre - Residential Precinct

Date: 17/11/2016

Location: Soldiers Parade and Campbelltown Parade Edmondson Park

Logged by: AT

Drill Model and Mounting: Hydra | Slope: 90° | R.L Surface: 70.24m

Hole Diameter: 50mm | Bearing: Vertical | Datum: AHD

Method	Support	Barrel Lift	Water Loss/ Level	Depth(m)	Graphic Log	Core Description Rock type, grain characteristics, colour, structure, minor components.	Weathering	Strength	Point Load Index Strength Is(50) VL M VH EL L H EH 500 100 30	Defect Details Defect Spacing (mm) 300 50 10	Description type, inclination, thickness, planarity, roughness, coating
						Start Coring BH 403 at 1.5m					
NMLC	NIL		FULL RETURN	2		Shale: grey	EW				
						(Cl) Silty Clay: medium plasticity, grey					
				3		Shale: grey with ironstaining	EW - DW	L	X		CS; 20mm.t XWS; 5mm.t CS; 60mm.t XWS; 4mm.t XWS; 5mm.t CS; 30mm.t CS; 30mm.t XWS; 3mm.t XWS; 3mm.t
				4					X X X		
				5				L - M	X X X		Be; 3mm.t CWS; 2mm.t XWS; 7mm.t XWS; 10mm.t
				6		End of BH 403 at 5.56m					
				7							
				8							
				9							

GeoEnviro

JG15942A-r6 BH403 START CORE AT 1·50m

2m

3m

4m

5m

END OF BH403 AT 5·56m

APPENDIX C

Laboratory Test Reports

GeoEnviro Consultancy Pty Ltd
Unit 5, 39-41 Fourth Avenue, Blacktown NSW 2148, Australia
Tel: (02) 96798733 Fax: (02) 96798744

Test Results

CLIENT: Frasers Property — Job Number: JG15942A-r6

PROJECT: Edmondson Park South Town Centre — Date: 18/11/2016

LOCATION: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R01A

Test Method : RTA T223

BH 401 Depth (m)	$I_{S(50)}$ MPa	ESTIMATED (U.C.S) MPa
4.20-4.25	1.47	29
4.60-4.65	0.64	13
4.95-4.10	0.84	17
5.25-5.31	0.54	11
5.50-5.55	0.86	17
6.30-6.35	0.63	13
6.75-6.80	0.83	17
7.10-7.15	0.74	15
7.50-7.55	0.74	15
7.85-7.90	1.16	23
8.10-8.15	0.99	20

Notes:

1. In the above table testing was completed in the Axial direction
2. The Estimated Unconfined Compressive Strength (Estimated U.C.S) was calculated from the point load strength Index by the following approximate relationship and rounded off to the nearest number:

   U.C.S = 20 $I_{S(50)}$

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Test Results

CLIENT: Frasers Property — Job Number: JG15942A-r6

PROJECT: Edmondson Park South Town Centre — Date: 18/11/2016

LOCATION: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R02A

Test Method : RTA T223

BH 402 Depth (m)	$I_{S(50)}$ MPa	ESTIMATED (U.C.S) MPa
4.80-4.85	2.49	50
5.30-5.35	3.59	72
5.70-5.76	0.95	19
6.20-6.25	0.61	12
6.55-6.60	1.56	31
6.95-7.00	1.03	21
7.20-7.25	1.56	31
7.60-7.65	0.71	14
7.90-7.96	0.40	8
8.35-8.40	0.84	17

Notes:

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   $U.C.S = 20\ I_{S(50)}$

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Test Results

CLIENT: Frasers Property — Job Number: JG15942A-r6

PROJECT: Edmondson Park South Town Centre — Date: 18/11/2016

LOCATION: Soldiers Parade and Campbelltown Road Edmondson Park — Report No: R03A

Test Method : RTA T223

BH 403 Depth (m)	$I_{S(50)}$ MPa	ESTIMATED (U.C.S) MPa
2.00-2.05	0.19	4
2.85-2.90	0.23	5
3.05-3.10	0.30	6
3.70-3.75	0.22	4
4.60-4.65	0.28	6
4.95-5.00	0.51	10
5.10-5.15	0.62	12
5.40-5.45	0.30	6

Notes:

1. In the above table testing was completed in the Axial direction
2. The Estimated Unconfined Compressive Strength (Estimated U.C.S) was calculated from the point load strength Index by the following approximate relationship and rounded off to the nearest number:

   $U.C.S = 20\ I_{S(50)}$

Appendix D

Explanatory Notes

Explanatory Notes – Rock Material

(In accordance with AS1726 – 1993)

Rock Material Weathering Classification

Term	Symbol	Definition
Residual soil	RS	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.
Extremely weathered rock	XW	Rock is weathered to such an extent that it has "soil"properties, i.e. it either disintegrates or can be remoulded, in water.
Distinctly weathered rock	DW	Rock strength usually changed by weathering. The rock may be highly discoloured , usually be ironstaining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Slightly weathered rock	SW	Rock is slightly discoloured but shows little or no change of strength from fresh rock.
Fresh rock	FR	Rock shows no sign of decomposition or staining.

Rock Strength

Term	Symbol	Is (50) MPa	Field Guide
Extremely Low	EL		Easily remoulded by hand to a material with soil properties
----------	----------	0.03	----------
Very Low	VL		May be crumbled in the hand. Sandstone is "sugary" and friable.
----------	----------	0.1	----------
Low	L		A piece of core 150mm long x 50mm dia. May be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
----------	----------	0.3	----------
Medium Strength	M		A piece of core 150mm long x 50mm dia. Can be broken by hand with difficulty. Readily scored with knife.
----------	----------	1	----------
High	H		A piece of core 150mm long x 50mm dia core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
----------	----------	3	----------
Very High	VH		A piece of core 150mm long x 50mm dia may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
----------	----------	10	----------
Extremely High	EH		A piece of core 150mm long x 50mm dia is very difficult to break with hand held hammer. Rings when struck with a hammer.

Rock Material Weathering Classification

Abbreviation	Description	Notes
Be	Bedding Plan Parting	Defect orientations measured to the normal to the long core axis (is relative to horizontal for vertical holes).
CS	Clay seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Ironstained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
600mm t	Thickness of defect in millimeters	

EXPLANATORY NOTES

Introduction

These notes have been provided to amplify the geotechnical report with regard to investigation procedures, classification methods and certain matters relating to the Discussion and Comments sections. Not all notes are necessarily relevant to all reports.

Geotechnical reports are based on information gained from finite sub-surface probing, excavation, boring, sampling or other means of investigation, supplemented by experience and knowledge of local geology. For this reason they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods
The methods the description and classification of soils and rocks used in this report are based on Australian standard 1726, the SSA Site investigation Code, in general descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions. Identification and classification of soil and rock involves to a large extent, judgement within the acceptable level commonly adopted by current geotechnical practices.

Soil types are described according to the predominating particle size, qualified by the grading or other particles present (eg sandy clay) on the following bases:

Soil Classification	Particle Size
Clay	Less than 0.002mm
Silt	0.002 to 0.6mm
Sand	0.6 to 2.00mm
Gravel	2.00m to 60.00mm

Soil Classification	Particle size
Clay	less than 0.002mm
Silt	0.002 to 0.06mm
Sand	0.06 to 2.00mm
Gravel	2.00mm to 60.00mm

Cohesive soils are classified on the basis of strength, either by laboratory testing or engineering examination. The strength terms are defined as follows:

Classification	Undrained Shear Strength kPa
Very Soft	Less than 12
Soft	12 - 25
Firm	25 - 50
Stiff	50 - 100
Very Stiff	100 - 200
Hard	Greater than 200

Non-cohesive soils are classified on the basis of relative density, generally from the results of standard penetration tests (SPT) or Dutch cone penetrometer test (CPT), as below:

Relative Dense	SPT 'N' Value (blows/300mm)	CPT Cone Value (q_c-Mpa)
Very Loose	Less than 5	Less than 2
Loose	5 - 10	2 - 5
Medium Dense	10 - 30	5 - 15
Dense	30 - 50	15 - 25
Very Dense	> 50	> 25

Rock types are classified by their geological names, together with descriptive terms on degrees of weathering strength, defects and other minor components. Where relevant, further information regarding rock classification, is given on the following sheet.

Sampling
Sampling is carried out during drilling to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provided information on plasticity, grained size, colour, type, moisture content, inclusions and depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin walled sample tube (normally know as U_{50}) into the soil and withdrawing a sample of the soil in a relatively undisturbed state. Such Samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Details of the type and method of sampling are given in the report.

Field Investigation Methods
The following is a brief summary of investigation methods currently carried out by this company and comments on their use and application.

Hand Auger Drilling
The borehole is advanced by manually operated equipment. The diameter of the borehole ranges from 50mm to 100mm. Penetration depth of hand augered boreholes may be limited by premature refusal on a variety of materials, such as hard clay, gravels or ironstone.

Test Pits
These are excavated with a tractor-mounted backhoe or a tracked excavator, allowing close examination of the insitu soils if it is safe to descend into the pit. The depth of penetration is limited to about 3.0m for a backhoe and up to 6.0m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Care must be taken if construction is to be carried out near, or within the test pit locations, to either adequately recompact the backfill during construction, or to design the structure or accommodate the poorly compacted backfill.

Large Diameter Auger (eg Pengo)
The hole is advanced by a rotating plate or short spiral auger generally 300mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 05m) and are disturbed, but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers and is usually supplemented by occasional undisturbed tube sampling.

Continuous Spiral Flight Augers
The hole is advanced by using 90mm - 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the augers flights, but they are very disturbed and may be highly mixed with soil of other stratum.

Information from the drilling (as distinct from specific sampling by SPT or undisturbed samples) is of relatively low reliability due to remoulding, mixing or softening of samples by ground water, resulting in uncertainties of the original sample depth.

Continuous Spiral Flight Augers (continued)
The spiral augers are usually advanced by using a V - bit through the soil profile refusal, followed by Tungsten Carbide (TC) bit, to penetrate into bedrock. The quality and continuity of the bedrock may be assessed by examination of the recovered rock fragments and through observation of the drilling penetration resistance.

Non - core Rotary Drilling (Wash Boring)
The hole is advanced by a rotary bit, with water being pumped down the drill rod and returned up the annulus, carrying the cuttings, together with some information from the "feel" and rate of penetration.

Rotary Mud Stabilised Drilling
This is similar to rotary drilling, but uses drilling mud as a circulating fluid, which may consist of a range of products, from bentonite to polymers such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg SPT and U_{50} samples).

Continuous Core Drilling
A continuous core sample is obtained using a diamond tipped core barrel. Providing full core recovery is achieved (which is not always possible in very weak rock and granular soils) this technique provides a very reliable (but relatively expensive) method of investigation. In rocks an NMLC triple tube core barrel which gives a core of about 50mm diameter, is usually used with water flush.

Portable Proline Drilling
This is manually operated equipment and is only used in sites which require bedrock core sampling and there is restricted site access to truck mounted drill rigs. The boreholes are usually advanced initially using a tricone roller bit and water circulation to penetrate the upper soil profile. In some instances a hand auger may be used to penetrate the soil profile. Subsequent drilling into bedrock involves the use of NMLC triple tube equipment, using water as a lubricant.

Standard Penetration Tests
Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils, as a means of determining density or strength and of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289 "Methods of testing Soils for Engineering Purpose"- Test F31.

The test is carried out in a borehole by driving a 50mm diameter split sample tube under the impact of a 63Kg hammer with a free fall of 769mm. It is normal for the tube to be driven in three successive 150mm increments and the "N" value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rocks, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

- In a case where full penetration is obtained with successive blows counts for each 150mm of, say 4, 6, and 7 blows.

  as 4, 6, 7
  N = 13

- In a case where the test is discontinued short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm.

  as 15,30/40mm

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally the test methods is used to obtain samples in 50mm diameter thin walled samples tubes in clays. In these circumstances, the best results are shown on the bore logs in brackets.

Dynamic Cone Penetration Test
A modification to the SPT test is where the same driving system is used with a solid 60^0 tipped steel cone of the same diameter as the SPT hollow sampler. The cone can be continuously driven into the borehole and is normally used in areas with thick layers of soft clays or loose sand. The results of this test are shown as 'N_c' on the bore logs, together with the number of blows per 150mm penetration.

Cone Penetrometer Testing and Interpretation
Cone penetrometer testing (sometimes referred to as Dutch Cone-CPT) described in this report, has been carried out using an electrical friction cone penetrometer and the test is described in Australian Standard 1289 test F5.1.

In the test, a 35mm diameter rod with cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig, which is fitted with a hydraulic ram system. Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130mm long sleeve, immediately behind the cone. Transducer in the tip of the assembly are connected by electrical wires passing through the centre of the push rods to an amplifier and recorder unit mounted on the control truck.

As penetration occurs (at a rate of approximately 20mm per second) the information is output on continuous chart recorders. The plotted results in this report have been traced from the original records. The information provided on the charts comprises:

- Cone resistance - the actual end bearing force divided by the cross sectional area of the cone, expressed in Mpa.
- Sleeve friction - the frictional force on the sleeve divided by the surface area, expressed in kPa.
- Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percentage.

There are two scales available for measurement of cone resistance. The lower "A" scale (0-5Mpa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main "B" scale (0-50Mpa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative frictions in clays than in sands. Friction ratios of 1% to 2% are commonly encountered in sands and very soft clays, rising to 4% to 10% in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

$$q_c \text{ (Mpa)} = (0.4 \text{ to } 0.6)\ N \text{ (blows per 300mm)}$$

In clays the relationship between undrained shear strength and cone resistance is commonly in the range:

$$q_c = (12 \text{ to} 18)\ C_u$$

Interpretation of CPT values can also be made to allow estimate of modulus or compressibility values to allow calculation of foundation settlements. Inferred stratification, as shown on the attached report, is assessed from the cone and friction traces, from experience and information from nearby boreholes etc.

Cone Penetrometer Testing and Interpretation continued
This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties and where precise information or soil classification is required, direct drilling and sampling may be preferable.

Portable Dynamic Cone Penetrometer (AS1289)
Portable dynamic cone penetrometer tests are carried out by driving a rod in to the ground with a falling weight hammer and measuring the blows per successive 100mm increments of penetration.

There are two similar tests, Cone Penetrometer (commonly known as Scala Penetrometer) and the Perth Sand Penetrometer. Scala Penetrometer is commonly adopted by this company and consists of a 16mm rod with a 20mm diameter cone end, driven with a 9kg hammer, dropping 510mm (AS 1289 Test F3.2).

Laboratory Testing
Laboratory testing is carried out in accordance with Australian Standard 1289 "Methods of Testing Soil for Engineering Purposes". Details of the test procedures are given on the individual report forms.

Engineering Logs
The engineering logs presented herein are an engineering and/or geological interpretation of the sub-surface conditions and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, however, this is not always practicable or possible to justify economically. As it is, the boreholes represent only a small sample of the total sub-surface profile. Interpretation of the information and its application to design and construction should take into account the spacing of boreholes, frequency of sampling and the possibility of other than "straight line" variations between the boreholes.

Ground water
Where ground water levels are measured in boreholes, there are several potential problems:
- In low permeability soils, ground water although present, may enter the hole slowly, or perhaps not at all, during the investigation period.
- A localised perched water table may lead to a erroneous indication of the true water table.
- Water table levels will vary from time to time, due to the seasons or recent weather changes. They may not be the same at the time of construction as indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole if any water observations are to be made.

More reliable measurements can be made by installing stand pipes, which are read at intervals over several days, or weeks for low permeability soils. Piezometers sealed in a particular stratum may be interference from a perched water table or surface water.

Engineering Reports
Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal is changed, say to a twenty storey building. If this occurs, the company will be pleased to review the report and sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of sub-surface conditions, discussions of geotechnical aspects and recommendations or suggestions for design and construction. However, the company cannot always anticipate or assume responsibility for:
- Unexpected variations in ground conditions. The potential for this will depend partly on bore spacing and sampling frequency.
- Changes in policy or interpretation of policy by statutory authorities.
- The actions of contractors responding to commercial pressures.

If these occur, the company will be pleased to assist with investigation or advice to resolve the matter.

Site Anomalies
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the company request immediate notification. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes
Attention is drawn to the document “Guidelines for the Provision of Geotechnical Information trader Documents”, published by the Institute of Engineers Australia. Where information obtained for this investigation is provided for tender purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or make additional copies of the report available for contract purpose, at a nominal charge.

Site Inspection

The Company will always be pleased to provide engineering inspection services for geotechnical aspect of work to which this report is related. This could range from a site visit to confirm that the conditions exposed are as expected, to full time engineering presence on site

Review of Design
Where major civil or structural developments are proposed, or where only a limited investigation has been completed, or where the geotechnical conditions are complex, it is prudent to have the design reviewed by a Senior Geotechnical Engineer.

Graphic Symbols For Soil and Rock

SOIL


Fill


Topsoil


Gravel (GW , GP)


Sand (SP, SW)


Silt (ML, MH)


Clay (CL, CH)


Clayey Gravel (GC)


Silty Sand (SM)


Clayey Sand (SC)


Sandy Silt (ML)


Gravelly Clay (CL, CH)


Silty Clay (CL, CH)


Sandy Clay (CL, CH)


Peat or Organic Soil

ROCK


Shale


Sandstone


Siltstone,Mudstone,Claystone


Granite, Gabbro


Dolerite, Diorite


Basalt, Andesite

Other Materials


Concrete


Bitumen, Asphaltic Concrete, Coal


Ironstone Gravel


Organic Material