15 May 2015

195 FIFTEENTH AVENUE, WEST HOXTON

Geotechnical Investigation for Commercial Precinct

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REPORT

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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation conducted by Golder Associates Pty Ltd (Golder) for the proposed Fifteenth Avenue Commercial Precinct at West Hoxton, which is a State Significant Development (SSD 6407) being assessed by Western Sydney Parklands Trust (WSPT).

The proposed development is approximately 8 km to the west of the Liverpool CBD. Based on the supplementary information that you supplied with your RFP and your draft report comments received by email on 13/04/2015, the study area comprises five separate lots (Lot 346 DP 2475, Lots 304-306 DP 2475, Lot 2 DP 307334) and is approximately 8 hectares. The site area (Lots 345-346 DP 2475, Lot 2 DP 307334) has a total area of 4 hectares. For reference, SSD 6407 spans both 185 Fifteenth Avenue and 195 Fifteenth Avenue, and is currently intended to include the following development:

Service Station:	250 sqm
Retail Pad Site:	400 sqm
Supermarket:	1,500 sqm
Large Format Retail:	1,500 sqm
Retail/commercial:	1,200 sqm
Child Care:	500 sqm
TOTAL:	5,350 sqm

A sketch of the proposed SSD provided by WSPT (Ref: 2014-4330 -u/c, dated 04/02/15) is included in this report as Figure 2.

This report describes a preliminary geotechnical investigation of 195 Fifteenth Avenue (Lot 345-346 DP 2475 and Lot 2 DP 307334), herein referred to as 'the *Site*', which forms the western portion of the commercial precinct. The location of the Site in relation to the surrounding area is shown on the site location plan, included as Figure 1.

The objective of the investigation was to assess the subsurface conditions, including soil/rock profiles across the *Site*, to provide preliminary geotechnical recommendations for development, and to address the Director General Recommendation (DGR) #13 to consider the suitability of the site for the proposed development. A Preliminary Environmental Assessment of the *Site* is has also been conducted, and is described in Golder report 147622023_R_001_Rev2 dated May 2015.

Golder Associates also completed a geotechnical and environmental investigation on behalf of WSPT for the adjacent 185 Fifteenth Avenue (Golder report references: 147622023_004_R_Rev0 dated March 2015 and 147622023_005_R_Rev0 dated 23 April 2015).

The work was conducted in accordance with our proposal P147622044-001-P-Rev0 dated 23 May 2014, as authorised by Tim Ireson of WSPT in an email dated 19 June 2014.

2.0 SITE CONDITIONS & GEOLOGY

The Site is predominately grassland and is lightly to moderately vegetated in the northern portion of the site. The highest point on the site is the north and north eastern portion and the land grades towards a dam in the south western corner. The site is mostly undeveloped with a residence and light commercial/industrial development in the southern portion. It appears some areas of the Site have previously been used for market gardens and possibly some landfilling in the vicinity of the existing large dam. Two dams were observed with the largest being in the southern portion of the site, another small dam to the north west of the larger dam.

The Site is currently occupied by a construction contractor and manure packaging business. The area behind the existing residence appears to be used by the construction contractor for the storage of formwork and concreting equipment. An area on the middle part of the site contains stockpiles of manure and other organic material.

The 1:25000 scale Sydney Geological Map (S1 56-5) indicates that the site is underlain by rocks belonging to the Bringelly Shale Formation which generally comprises shale with some sandstone beds. Outcrops of Potts Hill Sandstone are shown in the north eastern portion of the site.

An on-line search of acid sulfate soil (ASS) risk maps on the Australian Soil Resource Information System (ASRIS) performed in June 2014, maintained by CSIRO, showed the site as being in an area of "No Known Occurrence" of ASS. ASS are generally only expected at elevations of less than 5 m AHD in coastal areas (RTA, 2005), and are not expected at the site due to its elevation of approximately 90 to 100 m AHD.

3.0 FIELD WORK

Field work was carried out between 27 June and 3 July 2014, and comprised the following work.

- Drilling geotechnical boreholes at three locations, BH01 to BH03, using a truck-mounted drilling rig using a tungsten carbide bit (TC bit). Boreholes were extended to depths ranging between 7.1 and 7.6 m with borehole BH02 advanced using NMLC coring techniques from 5.4 m to 7.4 m. Standard Penetration Tests (SPTs) were carried out to assess strength and gather samples for laboratory testing. Bulk samples and thin walled tube (U50) samples were also collected for laboratory testing.

- The excavation of ten test pits using a backhoe, extending up to 3 m depth or prior practical refusal. Dynamic Cone Penetrometer (DCP) testing was undertaken adjacent to all test pits. Upon completion, all test pits were backfilled with the excavated material and compacted using the backhoe bucket and wheel rolled.

- Environmental sampling comprising three water and sediment samples taken from the two farm dams on the property (Location 1 and Location 2). Three samples were also collected, two from TP07 and one from TP10, and tested for the presence of Acid Sulfate Soil.

- The weather was generally fine during the investigation, with little rain in the week prior to works being carried out.

An engineer from Golder positioned the test locations, observed the drilling and excavation, logged the materials encountered and collected the samples. Borehole and test pit reports as well as explanation sheets used in their preparation are presented in APPENDIX A.

Each test location was positioned using a hand held GPS accurate to about ±5 m horizontally and levels were inferred from the contour plans provided. The investigation locations are shown on Figure 1 and a summary of the locations and details of the testing are provided below in Table 1. The soil and rock units encountered in the borehole are described below in Section 3.1 and summarised.

Table 1: Summary of Field Work

Test Location	Coordinates (MGA94 zone 56 ±5 m)		Termination Depth (m)	Termination Level (m AHD)	Termination Reason	Completion Remark
BH01	299430	6244725	7.6	82.1	Target Depth	Backfilled
BH02	299588	6244756	7.4	88.8	Target Depth	Backfilled
BH03	299586	6244583	7.14	81.55	Target Depth	Backfilled
TP01	299401	6244796	3.0	92.5	Target Depth	Backfilled
TP02	299484	6244774	2.2	94.4	Refusal	Backfilled
TP03	299634	6244746	1.4	97.7	Refusal	Backfilled
TP04	299442	6244653	3.0	82.7	Target Depth	Backfilled
TP05	299538	6244620	2.7	85.55	Refusal	Backfilled
TP06	299556	6244534	3.0	85.4	Refusal	Backfilled
TP07	299420	6244563	2.1	82.6	Refusal	Backfilled
TP08	299547	6244693	3.2	88.0	Refusal	Backfilled

Test Location	Coordinates (MGA94 zone 56 ±5 m)		Termination Depth (m)	Termination Level (m AHD)	Termination Reason	Completion Remark
TP09	299618	6244669	2.2	92.9	Refusal	Backfilled
TP10	299462	6244536	2.6	84.4	Refusal	Backfilled

3.1 Subsurface Conditions

Unit 1 - Topsoil

Topsoil, generally comprising silty clay and sandy clay was encountered in all boreholes and test pits. It generally extended to depths between 0.2 and 0.4 m below the ground surface. In situ density testing (DCPs) indicated that the topsoil was generally of soft to firm consistency. Fill was also noted in TP08 from 0 to 0.4 m.

Unit 2 - Colluvium

Colluvium was found in the test locations on the northern and eastern sides of the site. The colluvium generally comprised medium to high plasticity clay. In situ density testing (DCPs and SPTs) indicated that the colluvium is generally of a firm to stiff consistency, with some zones of very stiff material.

Unit 3- Residual Soil

Residual soil was found at all test locations and comprised silty clay. In situ density testing (DCPs and SPTs) indicated that the residual is generally of a very stiff to hard consistency.

Unit 4 – Class V Shale

Shale was extremely weathered and extremely low strength, some ironstone bands were noted based on our investigation.

Unit 5 – Class IV Shale

Shale was highly weathered and low strength, with some medium strength bands.

The subsurface conditions outlined above are summarised below in
Table 2.

Table 2: Summary of Subsurface Conditions

Test Location	Depth Range (Thickness) (m)				
	Unit 1 - Topsoil	Unit 2 - Colluvium	Unit 3 - Residual Soil	Unit 4 - Class V Shale	Unit 5 - Class IV Shale
BH01	0 – 0.2	0.2 – 1.0	1.0 – 1.83	1.83 – 3.2	3.2 – 7.6 *
BH02	0 – 0.4	0.4 – 0.8	0.8 – 2.5	2.5 – 3.2	3.2 - 7.4 *
BH03	0 – 0.4	-	0.4 – 2.3	2.3 – 2.8	2.8 – 7.1 *
TP01	0 - 0.2	0.2 – 0.6	0.6 – 2.8	2.8 – 3.0*	-
TP02	0 – 0.2	0.2 – 0.9	0.9 – 1.9	1.9 – 2.2*	-
TP03	0 – 0.2	-	0.2 – 1.3	1.3 – 1.4*	-
TP04	0 – 0.18	0.18 – 1.3	1.3 – 2.6	2.6 – 3.0*	-
TP05	0 - 0.4	0.4 - 1.8	1.8 - 2.7*	-	-
TP06	0 - 0.4	0.4 - 0.7	0.7 - 1.4	1.4 - 3.0*	-
TP07	0 – 0.2	-	0.2 – 1.7	1.7 – 2.1*	-
TP08	0 - 0.4	0.4 - 0.7	0.7 - 2.9	2.9 - 3.2*	-
TP09	0 – 0.3	-	0.3 – 1.75	1.75 – 2.1*	-
TP10	0 - 0.2	-	0.2 – 1.7	1.7 - 2.6*	-

* Limit of investigation

Variations to the above generalised profile occur. The individual borehole reports, included in Appendix A, should be referred to for further information.

3.2 Groundwater

Groundwater was not encountered at any of the investigation locations. Groundwater conditions could change seasonally or in response to infiltration.

4.0 LABORATORY TESTING

4.1 Earthworks

Bulk and disturbed samples recovered from selected boreholes and test pits were forwarded to the NATA accredited, Macquarie Geotech laboratory at Alexandria for testing. A summary of the results of the geotechnical laboratory testing is provided in Table 3 and laboratory test certificates are provided in APPENDIX B. The test methods followed are noted on the reports.

Table 3: Results of Geotechnical Laboratory Testing

Test Location	Depth (m)	Field Moisture Content (%)	Liquid Limit (%)	Plastic Limit (%)	Plastic Index	Linear Shrinkage (%)	Shrink /Swell (I_{ss})	Emerson Crumb	CBR (%)
		AS1289 2.1.1	AS1289 3.2.1	AS1289 3.1.1	AS1289 3.3.1	AS1289 3.4.1	AS1289 7.1.1	AS1289 3.8.1	AS1289 5.5.1
BH01-002	1.6-1.83m	21.8	-	-	-	-	2.8	-	-
BH01-003	2.5-2.95m	-	-	-	-	-	-	2	-
BH02-001	0.6-0.92m	20.4	-	-	-	-	3.2	-	-
BH03-001	0.4-0.78m	29.0	-	-	-	-	1.9	-	-
BH03-004	4.0-4.09m	-	-	-	-	-	-	5	-
TP02-001	0.9-1.0m	-	66	23	43	15	-	-	3
TP04-001	0.4-0.6m	-	61	18	43	14.5	-	-	4
TP08-001	2.4-2.6 m	-	48	16	32	13.5	-	-	1

4.2 Acid Sulfate Soil

Samples from TP7 and TP10 were transported under chilled conditions to Envirolab's Chatswood laboratory for ASS screening. Screening consisted of the detection of Potential Acid Sulfate Soil (PASS) in hydrogen peroxide solution using a standard procedure derived from laboratory test methods 21Af and 21Bf in the ASSMAC Acid Sulfate Soil Manual. The screening results are included in APPENDIX B.

Three samples were selected for screening tests (TP7 0.1 m-0.3 m, TP7 0.3m-0.5 m and TP10 0.3 m-0.5 m). Table 4 provides a summary of the ASS screening results.

Table 4: Acid Sulfate Soil laboratory results

Analyte	Units	Limit of reporting	ASSMAC Assessment Guidelines 1-1000 tonnes disturbed, medium texture	ASSMAC Assessment Guidelines 1-1000 tonnes disturbed, fine texture	TP07	TP07	TP10
					0.1-0.3	0.3-0.5	0.3-0.5
pH kcl	pH units				4.7	4.6	5.3
s-TAA pH 6.5	%w/w S	0.01			0.02	0.03	<0.01
TAA pH 6.5	moles H+/t	5	36	62	10	17	5
Chromium Reducible Sulfur	%w/w	0.005	0.06	0.1	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H+/t	3			<3	<3	<3
S KCl	%w/w S	0.005			0.058	0.061	0.049
ANC BT	% CaCO3	0.05			<0.05	<0.05	<0.05
s-ANC BT	%w/w S	0.05			<0.05	<0.05	<0.05
s-Net Acidity	%w/w S	0.01			0.02	0.03	0.01
a-Net Acidity	moles H+/t	10			12	19	<10
Liming rate	kg CaCO3/t	0.75			0.93	1.4	<0.75
a-Net Acidity without ANCE	moles H+/t	10			12	19	<10
Liming rate without ANCE	kg CaCO3/t	0.75			0.93	1.4	<0.75

5.0 DISCUSSION AND RECOMMENDATIONS

The subsurface conditions revealed by the boreholes are consistent with the published geological information in the area. Rock quality in the Bringelly Shale, is relatively variable and significant depths of poor quality rock were observed in the boreholes. The presence of very low strength Class V and IV Shale could impact on support requirements for excavations and foundation design parameters.

Parameters for excavation support and foundation design are provided below for preliminary design. Only one cored borehole was completed during this investigation and additional site specific investigations will be required to further assess the soil and rock conditions, once building layouts and excavation depths are known.

5.1 General Site Preparation and Earthworks

The following comments and recommendations are presented for earthworks and general site preparation:

- Prior to construction of roads or placement of compacted fill, the proposed pavement or fill areas should be stripped to remove vegetation, topsoil and root affected or other potentially deleterious material. These materials should be stockpiled and used for landscaping purposes only;
- Following stripping the exposed subgrade soils should be proof-rolled to detect any wet, cohesive or other materials that deflect excessively under rolling. All such areas should be over-excavated and backfilled with approved compacted granular fill. The farm dams will require dewatering, removal of soft, loose or wet soil and proof rolling prior to filling;
- Trafficability of the highly plastic soils will be poor when wet. Surface improvement such as placement of a gravel layers would need to be considered.
- Residual soil and weathered shale may be suitable for reuse in construction of the site, but may require blending or drying and should be assessed by a geotechnical engineer prior to reuse;
- Any additional filling over currently unfilled areas on site should be placed and compacted in accordance with Liverpool City Council's engineering guidelines for filling, and as described in Australian Standards AS3798-2007 *Guidelines on Earthworks for Commercial and Residential Developments*. Filling on site should be compacted under Level 1 Monitoring and Testing as described in Australian Standards AS3798-2007.

5.2 Excavation Conditions

Unit 1 to Unit 3 soils should be able to be excavated using a hydraulic excavator or bulldozer. The upper Unit 4 shale rock should also be able to be excavated using a hydraulic excavator or bulldozer. As excavations into the Unit 5 shale rock progress, dozers fitted with a ripper may be required for economic excavation, together with rock breakers for detailed trimming or for ironstone or higher strength bands within the rock mass. Contractors should be provided with the borehole logs and core photographs and make their own assessment of the suitability and productivity of specific plant.

Plant used for excavation could produce vibrations with the potential to impact adjacent properties. If existing structures are near to excavations we suggest that an assessment be made of the proximity of vibration sensitive structures and the potential need for dilapidation surveys and vibration management plans.

5.3 Dewatering

Groundwater seepage was not observed during the investigation. Dewatering, if required, should be able to be achieved using standard sump and pump methods.

5.4 Excavation / Retention Requirements

We understand that the final site building arrangements have not been finalised at this stage, but that development may involve excavations up to 4 m deep for buildings. Depending on the space available on the site and the final building layout these excavations could either be formed using permanent batter slopes or using retaining structures. Recommendations for each of these are discussed below.

5.4.1 Temporary Batter Slopes

Temporary or permanent batter slopes may be required for the site. The Workcover Code of Practice (March 2000) indicates that soil excavations greater than 1.2 m deep with personnel working at the toe require lateral support, unless there is "no reasonable likelihood" that material from the excavation walls will fall. Temporary shallow excavations may be excavated with vertical sides to a maximum depth of 1.2 m and must consider the potential impact to adjacent footings or infrastructure within its zone of influence. The zone of influence behind the crest of an excavation is approximately equivalent to twice its depth. For deeper excavations open for a short period of time (i.e. a few weeks), we recommend that maximum temporary batter slopes of 1(H):1V) be adopted for the site. We also recommend that the following practices be adopted with respect to temporary batters:

- The time during which temporary excavations are open should be limited. Some loss of material may be expected from the exposed face due to wetting and drying;
- Water should be not allowed to pond at the crest or toe of the excavations. Temporary surface drainage should be installed where practical; and
- No heavy surcharge loading, such as construction plant or material stockpiles should be allowed within a distance from the crest of the batter equal to the height of the excavation.

At locations where temporary batter slopes cannot be accommodated the excavation will need to be supported by shoring/retention. The adopted approach will need to consider allowable movements behind the crest of the excavation.

5.4.2 Permanent Batter Slopes

Recommendations for permanent batter slopes are presented in Table 4, below

Table 5: Recommended Permanent Batter Slopes

Unit	Permanent Batter Angles*
Unit 1: Topsoil (or fill)	1V : 2H
Unit 2: Colluvium	1V : 2H
Unit 3: Residual Soil	1V : 2H
Unit 4: Class V Shale	1V : 2H
Unit 5: Class IV Shale	1V : 1.5H

* Batters will require vegetation to reduce erosion

In Bringelly Shale there is a risk that relatively shallow dipping discontinuities (30° to 40° from the horizontal) daylight within batter slopes forming unstable wedges. We recommend installation of shored walls for deep vertical excavations in the Shale on this site and inspection of excavations by a geotechnical engineer.

5.4.3 Retaining Structures

The proposed buildings may require retaining structures as part of the development. Design of temporary and permanent retention systems will need to take into account the following factors as a minimum:

- Surcharge loads from adjacent buildings;
- Wall movement induced by excavations;
- Ground movements induced by excavation; and
- An allowance for over-excavation.

Where a retaining structure is to be located in close proximity to adjacent buildings, services, pavements or other sensitive structures and facilities, consideration must be given to establishing appropriate installation procedures when selecting a suitable retaining system.

Suggested design parameters for retaining structures are presented in Table 6. These parameters are applicable for long term (permanent) structures and assume horizontal ground behind the wall. If an inclined slope is proposed behind the wall, or additional surcharge loads from traffic or structures are imposed during or after construction, then these additional loadings should be allowed for in the design.

Retaining structures should be designed in accordance with AS 4678-2002 “Earth-retaining structures”. Retaining walls should be designed to limit lateral movement when in close proximity to existing buildings/ structures, basements, services, pavements and transformers. For preliminary design of temporary and permanent support we recommend the following:

- For flexible walls such as cantilever walls a triangular earth pressure distribution can be used. Assuming that there are no significant constraints on tolerable ground movements, relatively flexible shoring systems may be used in the design, based on active (k_a) pressures.
- For a propped retaining wall, where adjacent buildings or movement sensitive services are not within the zone of influence, the lateral earth pressure is a uniform pressure of 4H kPa, where H is the total height of the wall in metres. Where adjacent buildings or movement sensitive services are within the zone of influence, a uniform pressure of 6H kPa should be adopted. The zone of influence is taken as a zone lying above a plane, sloping up at 40 degrees above the horizontal from the base of the excavation.

We recommend the following geotechnical parameters for the design of retaining walls:

Table 6: Recommended Earth Pressure Coefficients

Soil Unit	Unit 1 or 2: Topsoil/ Colluvium	Unit 3: Residual Soil	Unit 4: Class V Shale	Unit 5: Class IV to III Shale
At rest Earth Pressure, k_o	0.53	0.53	0.6	0.8
Passive Earth Pressure, k_p	2.8	2.8	3.3	4.0
Active Earth Pressure, k_a	0.36	0.36	0.3	0.25

Notes:

1. These earth pressures are provided on the assumption that the ground behind the retaining wall is flat.
2. For the purposes of the assessments provided in Table 6, we have assumed no wall friction.
3. A geotechnical engineer should be consulted in the design of retaining walls using the above parameters.

Compactive effort can increase the lateral pressure on retaining structures and this may need to be accounted for in design. We recommend that hand held compaction equipment should be used within 2 m behind retaining structures.

Adequate drainage systems should be installed to prevent the possible build-up of water behind the wall due to water infiltration from the surface. It should be noted that hydrostatic pressures may still develop behind retaining walls during periods of heavy rainfall and should be accounted for in the design of retaining walls.

5.5 Foundations

5.5.1 Preliminary Site Classification

Structures that are lightly loaded and less sensitive to differential settlement may be supported on a slab-on-ground or shallow footings on engineered fill or residual soils. Laboratory test results indicate the residual soils to have a liquid limit of between 48% and 66% and a plasticity Index of between 32% and 43%. These values are indicative of a generally highly plastic soil.

Should lightly loaded structures be supported by slabs-on-ground they should be designed based on a site classification of 'Class H' (highly reactive site) as defined by AS 2870-1996. Some areas of the site with thinner depths of clay are also likely to be 'Class M', but this will need to be confirmed based on the location of each structure and depth of clay at each location.

Once more details of the proposed development are available it may be necessary to re-classify areas of the Site depending on actual cut and fill levels as set out in Section 2.4 of AS 2870-1996. To limit shrinkage and swelling of the foundation materials, particular care should be taken to reduce potential variations in soil moisture content, such as by the inclusion of site drainage in the design. Detailed design studies should conduct further testing for the shrink-swell potential of natural clays on the site.

5.5.2 Preliminary Foundation Options

Foundations for lightly loaded structures are expected to comprise shallow pad/ strip footings or slabs-on-ground. Heavier structures could be constructed on either shallow footings or bored piles founded in the weathered shale, depending on the depth of excavation for basements or site levelling operations. The foundations of new buildings should be founded on the same strata to reduce the potential for differential settlement. Foundation design parameters are provided in .

Table 7: Preliminary Foundation Design Parameters

Unit	Serviceability Bearing Pressure for Shallow Footings (kPa) [1, 4]	Ultimate Bearing Pressure for Bored Piles (kPa) [2, 4]	Ultimate Shaft Adhesion For Bored Piles (kPa) [2, 3, 4]	Drained Elastic Modulus, E'_s
Unit 1 – Topsoil or Unit 2 - Colluvium	N/A	N/A	N/A	15
Unit 3 - Residual	125	N/A	30	20
Unit 4 – Class V Shale	700	2500	50	100
Unit 5 – Class IV Shale	1,000	4000	150	300

Notes:

1) Serviceability bearing pressure for shallow footings is given with a factor of safety of about 3 on ultimate pressures. This is the factor of safety generally adopted in geotechnical practice to limit settlements to an acceptable level for conventional building structures.

2) A geotechnical strength reduction factor ϕ_g of 0.55 may be adopted for preliminary assessment of the Design Geotechnical Strength of piles in accordance with AS2159. This assumes that piles are embedded at least 2 pile diameters into the founding stratum.

3) Side adhesion given assumes there is intimate contact between the pile and foundation material.

4) N/A means that contribution to design load resistance is not recommended for these materials.

Footings designed using the parameters presented in should result in settlements less than 1% of the footing width or diameter.

Better quality shale rock may be present at depths greater than investigated. Higher bearing pressures may be feasible, but additional geotechnical investigation would be needed to confirm the rock class.

An experienced geotechnical engineer should observe footings and the boring of the piles in order to assess the rock levels and to confirm the rock is suitable for the adopted design parameters.

5.6 Pavement Earthworks

5.6.1 Design CBR and Youngs Modulus

New access roads and pavements are likely to be required as part of the redevelopment. Based on the investigation results, The results of the laboratory tests indicate the various materials to have the following CBR values and swell: potential after soaking:

- Unit 3: Residual Soil – CBR between 1% and 3% (based on two samples);
- Unit 2: Colluvium – CBR of 4% (based on one sample).

CBR test results from the adjoining site to the east (and part of the overall Fifteenth Avenue Commercial Precinct) indicated a CBR of 3.5% (one sample) for the Residual Soil and 6% for the Class V Shale (one sample).

Based on the lab testing results above and previous experience of residual soils derived from Bringelly Shale, we recommend that preliminary pavement design adopt a CBR value of 2%. This is likely to apply for residual soils as well as extremely weathered rock (which is likely to break-down on excavation and re-compaction). Detailed design investigations should conduct further CBR testing to refine this value. Knowledge of the extent of colluvium is too limited at this stage to provide a recommendation for delineation of site areas, and additional lab tests are required to provide a design CBR.

5.6.2 Subgrade Preparation

Loose gravel, oversized fill materials or deleterious material, such as topsoil, wood and refuse, should be stripped from the pavement footprint. Footings of existing structures should also be removed.

New pavements or roads for the site will be underlain by colluvial and residual soils. Given the low laboratory CBR values obtained for these materials and the relatively high swelling capacity of the soils it may be possible to modify their engineering properties, prior to constructing pavements. An improvement of the subgrade conditions could be achieved through addition of lime to the residual soils or alternatively subgrade replacement using a suitable granular fill material.

The cohesive nature of the residual soil or extremely weathered shale makes it susceptible to moisture variations. Therefore it should be anticipated that some moisture conditioning and drying back of the subgrade may be necessary prior to compaction and placement of pavement materials. The required time period to prepare the subgrade is likely to be dependent on the prevailing weather conditions at the time of construction. For lightly loaded pavements subgrade material beneath roads should be compacted to a minimum 98% Standard Maximum Dry Density (SMDD), or as required by Council or the specified pavement design (possibly 100% to 102% of SMDD).

5.6.3 Pavement Drainage

We recommend the inclusion of a network of subsurface drains around the perimeter and across the pavement subgrade, preferably 0.45m below subgrade level, to control water seepages in the vicinity of proposed pavements and consequently softening and swelling of the subgrade materials.

5.7 Material Reuse

Site levelling operations may produce fill comprising topsoil, colluvium, residual clay soil, weathered shale rock, or a variety of mixed soils from existing pavements and hardstands.

Topsoil and root affected or other foreign or potentially deleterious material would be unsuitable for re-use as engineered fill and should be stockpiled for use in landscaping only.

Residual soils or weathered rock will break down on compaction and provide an inferred CBR value of at least 2%, but are likely to have a moderate to high reactivity to moisture changes. While suitable for re-use as General Fill (with reference to AS3798-2007) the materials will be require close attention to moisture control during placement, and design will need to consider the potential implications of areas filled with relatively deep expansive clays (particularly on Site Classification to AS2870 and shrink-swell potential). Design and construction implications of the expansive clays could be reduced by adding lime as a stabilising agent prior to re-use as fill, but stabilisation trials would need to be conducted during detailed design.

A geotechnical professional should assess the suitability of the mixed materials at the site for re-use as engineered fill.

Site won materials are considered not to be suitable as pavement base or sub-base materials. Imported granular fill for pavements should comply with AS3798-2007 Section 4. In addition, for preliminary design, Roads and Maritime Services (RMS) specifications for pavement materials would provide suitable guidance.

5.8 Soil Dispersion and Erosion

Two soil samples, both from Unit 4 were tested for Emerson Class to assess the dispersivity of the materials present at the Site. The laboratory test results indicate that the materials have Emerson Class numbers of 2 and 5. Emerson Class Number 2 indicates a moderate to slight reaction to the test and Class number 5 constitutes non-dispersive behaviour. Further testing of the behaviour of Unit 4 and other soils is recommended at detailed design to further assess the potential for dispersive behaviour.

Remoulding of the soil at a moisture content near optimum (i.e. excavation and recompaction) may not increase potential for dispersive behaviour, however further breakdown of the soil may occur, by water turbulence or concentrated rapid water flow. We recommend that soils should not be subjected to concentrated water flow over or through the soil profile.

Permanent batter slopes will require vegetation to reduce erosion risk. Other slope protection measures (such as geofabrics) may also be required for temporary batters or until vegetation establishes.

5.9 Acid Sulfate Soil

Screening analysis did not indicate the presence of acid sulfate soils (ASS), which is consistent with ASS mapping of the area of the site. The Site is also situated at an elevation well above RL 10 m AHD and in geological setting not prone to ASS. On this basis we consider that the risk of ASS being present on Site is low.

During bulk earthworks, consideration should be given to additional sampling and testing of lower lying material to determine if the disturbed soil contains PASS.

6.0 LIMITATIONS

Your attention is drawn to the document “Limitations”, which is included in Appendix C of this report. The statements presented in this document are intended to advise you of what your realistic expectations of this report should be. The document is not intended to reduce the level of responsibility accepted by Golder Associates, but rather to ensure that all parties who may rely on this report are aware of the responsibilities each assumes in so doing.

Report Signature Page

GOLDER ASSOCIATES PTY LTD

Ben Seaford
Engineering Geologist

Craig Curnow
Principal

BMS/GF:JDM:CSC/bms

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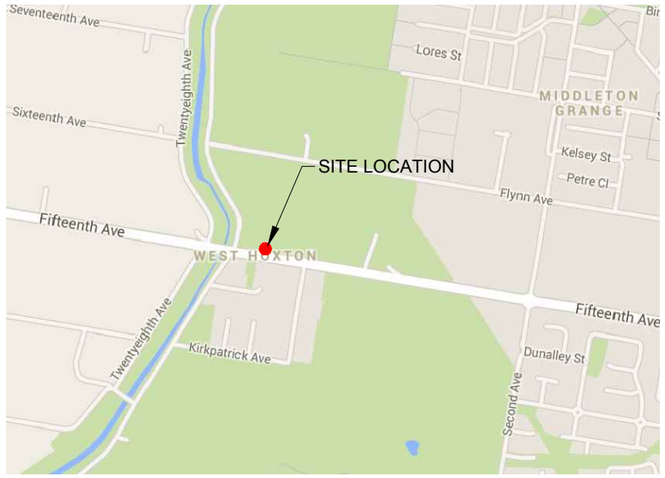


LOCALITY PLAN
NOT TO SCALE

LEGEND

- BOREHOLE LOCATIONS
- TEST PIT LOCATIONS
- ENVIRONMENTAL SAMPLE LOCATION
- EXISTING STUDY FOR 195 FIFTEENTH AVE.

REFERENCE

BASE SURVEY CONTOUR TAKEN FROM TOTAL SURVEYING SOLUTION DRAWING 15060_A.DWG, RECEIVED DATED 2015-02-10

IMAGE DATED 24-05-2014
SOURCED WITH PERMISSION FROM NEARMAP ON 17-06-2014
IMAGE GEOREFERENCED BY GOLDER AND INTENDED FOR INDICATIVE PURPOSES ONLY
www.nearmap.com.au

0 50 100
1:2,000 METRES

CLIENT
WESTERN SYDNEY PARKLANDS TRUST

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-04-21
PREPARED	EJJ
DESIGN	AS
REVIEW	BMS
APPROVED	CSC

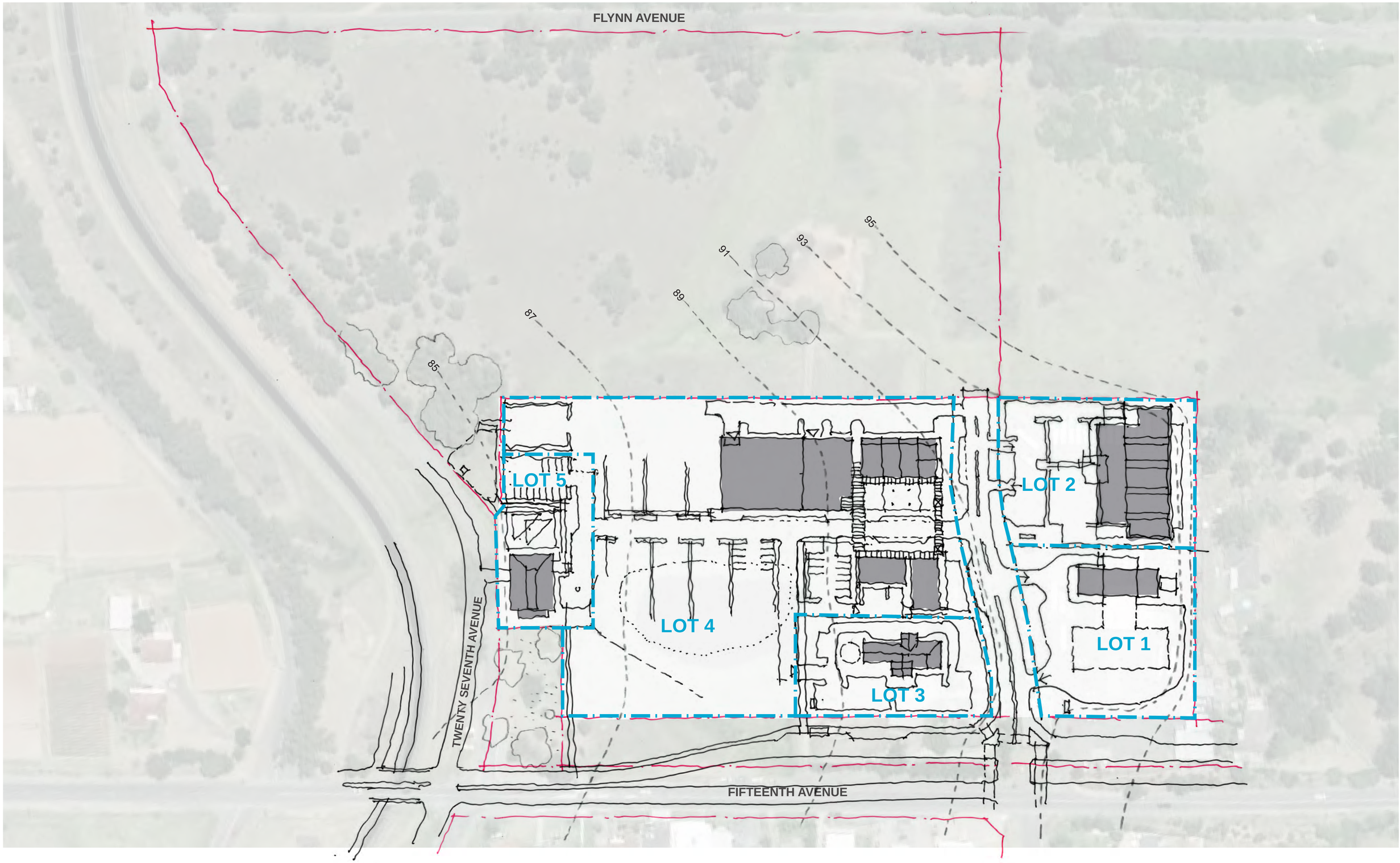
PROJECT
195 FIFTEENTH AVENUE, WEST HOXTON

TITLE
195 FIFTEENTH AVENUE, WEST HOXTON INVESTIGATION LOCATIONS

PROJECT No.	REPORT	Rev.	FIGURE
147622023	002 - R	1	FIGURE 1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ISO A3
0 25 mm

Path: \\golder.gds\gal\Sydney\Jobdgn\2014\147622023_WSPT_Site GI_West Hoxton\Technical Docs\CAD\FIGURES\ | File Name: 147622023-002-R-F001-REV1.dwg



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NOMINATED ARCHITECTS ALF LESTER NO.2128 STEPHEN ANDERS NO.5764

lot pattern sketch

2014-4330 -u/c
04 february 2015

0 10 20 50 100m

Scale 1:1,000 @ A2

west hoxton

schematic

Figure 2

APPENDIX A

Borehole and Test Pit Logs

EXPLANATION OF NOTES, ABBREVIATIONS & TERMS USED ON BOREHOLE AND TEST PIT REPORTS

DRILLING/EXCAVATION METHOD

AS*	Auger Screwing	RD	Rotary blade or drag bit	HQ	Diamond Core - 63 mm
AD*	Auger Drilling	RT	Rotary Tricone bit	NMLC	Diamond Core - 52 mm
*V	V-Bit	RAB	Rotary Air Blast	NQ	Diamond Core - 47 mm
*T	TC-Bit, e.g. ADT	RC	Reverse Circulation	BH	Tractor Mounted Backhoe
HA	Hand Auger	PT	Push Tube	EX	Tracked Hydraulic Excavator
DTC	Diatube Coring	CT	Cable Tool Rig	EE	Existing Excavation
WB	Washbore or Bailer	JET	Jetting	HAND	Excavated by Hand Methods

PENETRATION/EXCAVATION RESISTANCE

L **Low resistance.** Rapid penetration possible with little effort from the equipment used.

M **Medium resistance.** Excavation/possible at an acceptable rate with moderate effort from the equipment used.

H **High resistance** to penetration/excavation. Further penetration is possible at a slow rate and requires significant effort from the equipment.

R **Refusal or Practical Refusal.** No further progress possible without the risk of damage or unacceptable wear to the digging implement or machine.

These assessments are subjective and are dependent on many factors including the equipment power, weight, condition of excavation or drilling tools, and the experience of the operator.

WATER

⏚	Water level at date shown	◁	Partial water loss
▷	Water inflow	◀	Complete water loss

GROUNDWATER NOT OBSERVED	The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.
GROUNDWATER NOT ENCOUNTERED	The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

SAMPLING AND TESTING

SPT	Standard Penetration Test to AS1289.6.3.1-1993
4,7,11 N=18	4,7,11 = Blows per 150mm. N = Blows per 300mm penetration following 150mm seating
30/80mm	Where practical refusal occurs, the blows and penetration for that interval are reported
RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB	Hammer double bouncing on anvil
DS	Disturbed sample
BDS	Bulk disturbed sample
G	Gas Sample
W	Water Sample
FP	Field permeability test over section noted
FV	Field vane shear test expressed as uncorrected shear strength s_v
PID	Photoionisation Detector reading in ppm
PM	Pressuremeter test over section noted
PP	Pocket penetrometer test expressed as instrument reading in kPa
U63	Thin walled tube sample - number indicates nominal sample diameter in millimetres

Ranking of Visually Observable Contamination and Odour (for specific soil contamination assessment projects)

R = 0	No visible evidence of contamination	R = A	No non-natural odours identified
R = 1	Slight evidence of visible contamination	R = B	Slight non-natural odours identified
R = 2	Visible contamination	R = C	Moderate non-natural odours identified
R = 3	Significant visible contamination	R = D	Strong non-natural odours identified

ROCK CORE RECOVERY

TCR = Total Core Recovery (%)

$$= \frac{\textit{Length of core recovered}}{\textit{Length of core run}} \times 100$$

SCR = Solid Core Recovery (%)

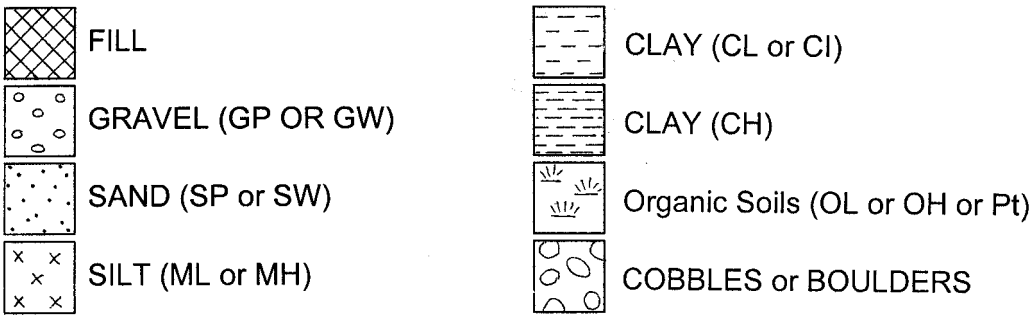
$$= \frac{\sum \textit{Length of cylindrical core recovered}}{\textit{Length of core run}} \times 100$$

RQD = Rock Quality Designation (%)

$$= \frac{\sum \textit{Axial lengths of core} > 100\ \textit{mm}}{\textit{Length of core run}} \times 100$$

METHOD OF SOIL DESCRIPTION USED ON BOREHOLE AND TEST PIT REPORTS

GRAPHIC LOG - TYPICAL SYMBOLS FOR SOILS



Combinations of these basic symbols may be used to indicate mixed materials such as sandy clay.

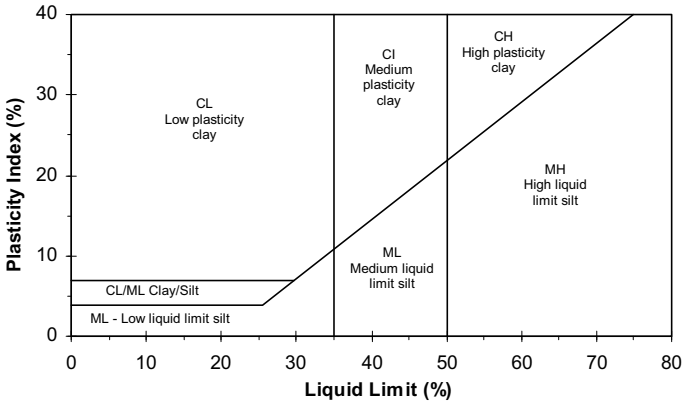
CLASSIFICATION AND INFERRED STRATIGRAPHY

Soil and Rock is classified and described in Reports of Boreholes and Test Pits using the preferred method given in AS1726 - 1993, Appendix A. The material properties are assessed in the field by visual/tactile methods.

Particle Size

Major Division	Sub Division	Particle Size
BOULDERS		> 200 mm
COBBLES		63 to 200 mm
GRAVEL	Coarse	20 to 63 mm
	Medium	6.0 to 20 mm
	Fine	2.0 to 6.0 mm
SAND	Coarse	0.6 to 2.0 mm
	Medium	0.2 to 0.6 mm
	Fine	0.075 to 0.2 mm
SILT		0.002 to 0.075 mm
CLAY		< 0.002 mm

Plasticity Properties



MOISTURE CONDITION

AS1726 - 1993

Symbol	Term	Description
D	Dry	Sands and gravels are free flowing. Clays & Silts may be brittle or friable and powdery
M	Moist	Soils are darker than in the dry condition & may feel cool. Sands and gravels tend to cohere
W	Wet	Soils exude free water. Sands and gravels tend to cohere.

CONSISTENCY AND DENSITY

AS1726 - 1993

Symbol	Term	Undrained Shear Strength
VS	Very Soft	0 to 12 kPa
S	Soft	12 to 25 kPa
F	Firm	25 to 50 kPa
St	Stiff	50 to 100 kPa
VSt	Very Stiff	100 to 200 kPa
H	Hard	above 200 kPa

Symbol	Term	Density Index %	SPT "N" #
VL	Very Loose	Less than 15	0 to 4
L	Loose	15 to 35	4 to 10
MD	Medium Dense	35 to 65	10 to 30
D	Dense	65 to 85	30 to 50
VD	Very Dense	above 85	Above 50

SPT correlations are not stated in AS1726 – 1993, and may be subject to corrections for overburden pressure and equipment type.
In the absence of test results, consistency and density may be assessed from correlations with the observed behaviour of the material.

TERMS FOR ROCK MATERIAL STRENGTH & WEATHERING AND ABBREVIATIONS FOR DEFECT DESCRIPTIONS

STRENGTH

Symbol	Term	Point Load Index, $Is_{(50)}$ (MPa)	Field Guide
EL	Extremely Low	< 0.03	Easily remoulded by hand to a material with soil properties.
VL	Very Low	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30 mm can be broken by finger pressure.
L	Low	0.1 to 0.3	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
M	Medium	0.3 to 1	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.
H	High	1 to 3	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken with pick with a single firm blow; rock rings under hammer.
VH	Very High	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
EH	Extremely High	>10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

ROCK STRENGTH TEST RESULTS

▼ Point Load Strength Index, $Is_{(50)}$, Axial test (MPa)

◀ Point Load Strength Index, $Is_{(50)}$, Diametral test (MPa)

ROCK MATERIAL WEATHERING

Symbol		Term	Field Guide
RS		Residual Soil	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.
EW		Extremely Weathered	Rock is weathered to such an extent that it has soil properties - i.e. it either disintegrates or can be remoulded, in water.
DW	HW	Distinctly Weathered	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
	MW		
SW		Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength relative to fresh rock.
FR		Fresh	Rock shows no sign of decomposition or staining.

ABBREVIATIONS FOR DEFECT TYPES AND DESCRIPTIONS

Defect Type

B	Bedding parting
X	Foliation
L	Cleavage
J	Joint
SZ	Sheared zone (Fault)
CS	Crushed seam (Fault)
DS	Decomposed seam
IS	Infilled seam
S	Schistocity
V	Vein

Coating or Infilling

Cn	Clean
Sn	Stain
Vr	Veneer
Ct	Coating

Planarity

Pl	Planar
Un	Undulating
St	Stepped

Roughness

Sl	Slickensided
Sm	Smooth
Ro	Rough

Vertical Boreholes – The dip (inclination from horizontal) of the defect is given.
Inclined Boreholes – The inclination is measured as the acute angle to the core axis.

DRAFT REPORT OF BOREHOLE: BH01

SHEET: 1 OF 1

CLIENT:	Western Sydney Parklands Trust	COORDS: 299430.0 m E 6244724.9 m N MGA94 56	DRILL RIG: Truck Mounted Drill Rig
PROJECT:	Fifteenth Avenue Commercial Precinct	SURFACE RL: 89.70 m DATUM: AHD	CONTRACTOR:
LOCATION:	West Hoxton	INCLINATION: -90°	LOGGED: HV DATE: 25/6/14
JOB NO:	147622023	HOLE DEPTH: 7.60 m	CHECKED: JDM DATE: 15/7/14

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
ADV			0	89.70					CLAY high plasticity, brown (TOPSOIL)			TOPSOIL
				0.20 89.50				CH	CLAY high plasticity, red brown			COLLUVIUM
	L		1	1.00 88.70	BH01-001 SPT 0.50-0.95 m 1, 3, 3 N=6 0.55 m PP =330 kPa 0.65 m PP =330 kPa			CH	CLAY high plasticity, red brown grey, with some silt, layered red brown and grey bands	M	F - St	RESIDUAL
				1.83	BH01-002 U 1.60-1.83 m							
	H		2	87.87					INTERBEDDED SHALE & CLAYSTONE brown grey, inferred extremely low strength, 30-50 mm shale layers, interbedded with 50-100 mm medium plasticity clay - very stiff			WEATHERED ROCK
	M				BH01-003 SPT 2.50-2.95 m 6, 10, 27 N=37					D - M		
	R	Groundwater Not Encountered	3	3.80								
ADT			4	85.90					SHALE pale brown, extremely low strength, horizontally bedded			
	M		5		BH01-004 SPT 5.00-5.45 m 10, 22, 22 N=44					D		
			6	6.00 83.70					grey			
					BH01-005 SPT 6.50-6.95 m 5, 8, 12 N=20							
			7	6.85 82.85					INTERBEDDED SHALE & CLAYSTONE orange grey			
				7.40					SHALE extremely weathered, inferred extremely low strength			
				82.10					END OF BOREHOLE @ 7.60 m TARGET DEPTH GROUNDWATER NOT ENCOUNTERED BACKFILLED			
			8									
			9									
			10									

This report of borehole must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01a
RL3

DRAFT REPORT OF BOREHOLE: BH02

SHEET: 1 OF 2

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299588.0 m E 6244756.0 m N MGA94 56
SURFACE RL: 96.20 m DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 7.40 m

DRILL RIG: Truck Mounted Drill Rig
CONTRACTOR: Nealings
LOGGED: HV DATE: 25/6/14
CHECKED: JDM DATE: 15/7/14

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0	96.20					TOPSOIL: CLAY high plasticity, brown, with some silt	M		TOPSOIL
				0.40								
				95.80				CH	CLAY high plasticity, red brown			COLLUVIUM
ADV	L			*0.80*	BH02-001 U 0.60-0.92 m							
				95.40				CH	CLAY high plasticity, orange grey			RESIDUAL
			1		BH02-002 SPT 1.00-1.45 m 7, 12, 14 N=26						VSt	
	H											
	L-M		2									
	H			*2.50*								
				93.70	BH02-003 SPT 2.50-2.71 m 25, 27/60mm HB N>27				INTERBEDDED SHALE & CLAYSTONE pale brown, extremely low strength			WEATHERED ROCK
	L-M			*2.80*								
				93.40					SHALE pale brown grey, inferred extremely low strength	D		
	M		3	*3.20*								
				93.00					inferred very low strength			
ADT		Groundwater Not Encountered										
	H		4		BH02-004 SPT 4.00-4.07 m 25/70mm HB N=R							
			5									
	R				BH02-005 SPT 5.38-5.40 m 25/20mm HB N=R							
			6									
			7									
			8									
			9									
			10									

This report of borehole must be read in conjunction with accompanying notes and abbreviations.

DRAFT REPORT OF BOREHOLE: BH02

SHEET: 2 OF 2

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299588.0 m E 6244756.0 m N MGA94 56
SURFACE RL: 96.20 m DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 7.40 m

DRILL RIG: Truck Mounted Drill Rig
CONTRACTOR: Nealings
LOGGED: HV DATE: 25/6/14
CHECKED: JDM DATE: 15/7/14

Drilling						Field Material Description				Defect Information	
METHOD	WATER	TCR	RQD (SCR)	DEPTH (metres)	DEPTH RL	GRAPHIC LOG	ROCK / SOIL MATERIAL DESCRIPTION	WEATHERING	INFERRED STRENGTH $Is_{(50)}$ MPa (EL 0.03, VL 0.1, L 0.3, M 1, H 3, VH 10, EH)	DEFECT DESCRIPTION & Additional Observations	AVERAGE DEFECT SPACING (mm) (10, 30, 100, 300, 1000, 3000)
NMLC	Groundwater Not Observed	35	10 (20)	0							
				1							
				2							
				3							
				4							
				5							
					5.40						
					5.60		SHALE fine grained, layered, grey, horizontally bedded	MW		5.53 m: B, 0°, Pl, Ro, Sn	
					90.60		CORE LOSS				
		100	95 (80)	6	5.94 90.26		SHALE fine grained, layered, grey			6.52 m: B, 0°, Pl, Ro, Sn 6.60 m: B, 0°, Pl, Ro, Sn 6.67-6.72 m: B, 0°, sp = 2-20 mm, Pl-Un, Ro, Sn	
					6.71 89.49		pale grey pale orange				
		100	75 (85)	7	7.08 89.12		grey			7.08 m: J, 45°, Un-St, Ro, Sn 7.17 m: DB 7.19 m: B, 5°, Pl, Sl, Sn 7.29 m: B, 10°, St, Ro, Sn	
					7.40 88.80		END OF BOREHOLE @ 7.40 m TARGET DEPTH				
				8							
				9							
				10							

This report of borehole must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F02a
RL3

DRAFT REPORT OF BOREHOLE: BH03

SHEET: 1 OF 1

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299586.0 m E 6244583.0 m N MGA94 56
SURFACE RL: 88.70 m DATUM: AHD
INCLINATION: -90°
HOLE DEPTH: 7.14 m

DRILL RIG: Truck Mounted Drill Rig
CONTRACTOR: Nealings
LOGGED: HV DATE: 26/6/14
CHECKED: JDM DATE: 15/7/14

Drilling					Sampling		Field Material Description				
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
			0	88.70					TOPSOIL: Silty CLAY high plasticity, dark brown	M - D		TOPSOIL
				0.40								
ADV	L		1	88.30	BH03-001 U 0.40-0.78 m PP =550 kPa BH03-002 SPT 1.00-1.45 m 4, 7, 13 N=20 PP >=600 kPa			CH	Silty CLAY high plasticity, pale grey red orange	M - D	VSt	RESIDUAL
	M		2									
	H			*2.30*								
	M	Groundwater Not Encountered		86.40	BH03-003 SPT 2.50-2.56 m 18/60mm N=R			CH	Sandy Silty CLAY high plasticity, pale brown, fine to medium grained sand			WEATHERED ROCK
				2.80								
ADT	H		3	85.90					SHALE grey, inferred extremely low strength	D	H	
			4		BH03-004 SPT 4.00-4.09 m 27/90mm N=R							
			5									
					BH03-005 SPT 5.50-5.64 m 30/140mm N=R							
			6									
			7		BH03-006 SPT 7.00-7.14 m 30/140mm N=R							
				81.56					END OF BOREHOLE @ 7.14 m TARGET DEPTH BACKFILLED			
			8									
			9									
			10									

This report of borehole must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01a
RL3

DRAFT REPORT OF TEST PIT: TP01

CLIENT:	Western Sydney Parklands Trust	COORDS: 299401.0 m E 6244796.0 m N MGA94 56	SHEET: 1 OF 1
PROJECT:	Fifteenth Avenue Commercial Precinct	SURFACE RL: 95.50 m DATUM: AHD	MACHINE: Backhoe
LOCATION:	West Hoxton		CONTRACTOR:
JOB NO:	147622023	PIT DEPTH: 3.00 m	LOGGED: HV DATE: 26/6/14
		BUCKET TYPE:	CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M	Groundwater Not Encountered	0	95.50	0.00-2.00 m				TOPSOIL: Silty CLAY			TOPSOIL	0 5 10 15 20 25
				0.20	PP =440 kPa				high plasticity, brown, with some rootlets				
				95.30				CH	CLAY	M (>PL)	St	COLLUVIUM	
					PP = 480 kPa				high plasticity, red brown				
				0.60	PP = 380 kPa								
				94.90	PP = 350 kPa			CI / CH	CLAY			RESIDUAL SOIL	
				0.90					medium to high plasticity, orange				
			1	94.60					red brown				
					PP = 400 kPa								26
				1.50						M (<PL)			
				94.00					red gravel present in grey clay				
			2								VSt		
				2.80						D		Ironstone band at 2.9-3.0m	
	M			92.70					SHALE			EXTREMELY WEATHERED ROCK	
			3	92.50					grey, extremely weathered, extremely low strength				
									TEST PIT DISCONTINUED @ 3.00 m				
			4										
			5										
			6										
			7										
			8										
			9										
			10										

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

DRAFT REPORT OF TEST PIT: TP02

CLIENT:	Western Sydney Parklands Trust	COORDS: 299483.8 m E 6244774.2 m N MGA94 56	SHEET: 1 OF 1
PROJECT:	Fifteenth Avenue Commercial Precinct	SURFACE RL: 96.60 m DATUM: AHD	MACHINE: Backhoe
LOCATION:	West Hoxton	PIT DEPTH: 2.20 m	CONTRACTOR:
JOB NO:	147622023	BUCKET TYPE:	LOGGED: HV DATE: 26/6/14
			CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	Groundwater Not Encountered	0	96.60					TOPSOIL: Silty CLAY low to medium plasticity, brown, with some rootlets			TOPSOIL	
				0.20 96.40				CH	CLAY high plasticity, red-brown	M (>PL)		COLLUVIUM	
				0.90									
			1	95.70	TP02-001 BDS 0.90-1.10 m PP = 350 kPa			CI / CH	Silty CLAY medium to high plasticity, orange grey, trace coarse gravel	M (<PL)	St - VSt	RESIDUAL SOIL	DB
	M			*1.90*									
	H		2	94.70					SHALE pale brown, extremely weathered, extremely low strength	D	H	EXTREMELY WEATHERED ROCK	
				94.40					TEST PIT DISCONTINUED @ 2.20 m REFUSAL				
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

DRAFT REPORT OF TEST PIT: TP03

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299634.2 m E 6244746.2 m N MGA94 56
SURFACE RL: 99.10 m DATUM: AHD
PIT DEPTH: 1.40 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: HV DATE: 26/6/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L-M	Groundwater Not Encountered	0	99.10 *0.20*					TOPSOIL: Silty CLAY Clayey SILT low plasticity, brown, trace ironstone gravel	D - M	L	TOPSOIL	0 5 10 15 20 25
				98.90 *0.50*	0.20-0.50 m PP = 240 kPa			CI / CH	CLAY medium to high plasticity, red-brown	M (>PL)	F - St	RESIDUAL SOIL	
				98.60 *0.70*	0.50-0.70 m PP = 290-350 kPa				with yellow grey mottling				
			1	98.40	TP03-001 BDS 0.90-1.10 m			CI / CH	Silty CLAY medium to high plasticity, brown-yellow mottled grey, trace fine to medium ironstone gravel	M (<PL)	St		
	M			*1.20* *1.30*					with extremely weathered, inferred extremely low streangth ironstone			EXTREMELY WEATHERED ROCK	
				97.70					SHALE grey, extremely weathered, inferred extremely low strength				
			2						TEST PIT DISCONTINUED @ 1.40 m REFUSAL				
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01i
RL3

DRAFT REPORT OF TEST PIT: TP04

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299441.9 m E 6244653.2 m N MGA94 56
SURFACE RL: 85.70 m DATUM: AHD
PIT DEPTH: 3.00 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: HV DATE: 26/6/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	Groundwater Not Encountered	0	0.18 / 85.52					TOPSOIL: Silty CLAY low to medium plasticity, brown, with some rootlets, trace sand	D		TOPSOIL	
					TP04-001 BDS 0.40-0.60 m			CH	CLAY high plasticity, red-brown and grey	M	St - VSt	COLLUVIUM	
			1		PP = 175-200 kPa								
				1.30 / 84.40				CH	Silty CLAY high plasticity, grey, red brown	M - D	VSt	RESIDUAL SOIL	
			2		PP = 350 kPa								
					TP04-002 BDS 2.40-2.60 m								
				2.60 / 83.10				CH	Silty CLAY medium to high plasticity, grey, with iron staining and coarse gravel	M - D		EXTREMELY WEATHERED ROCK	
			3	82.70	PP = 200 kPa				TEST PIT DISCONTINUED @ 3.00 m TARGET DEPTH				
			4										
			5										
			6										
			7										
			8										
			9										
			10										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01i
RL3

DRAFT REPORT OF TEST PIT: TP05

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299537.8 m E 6244620.5 m N MGA94 56
SURFACE RL: 88.25 m DATUM: AHD
PIT DEPTH: 2.70 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: IW DATE: 3/7/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	Groundwater Not Encountered	0	88.25					TOPSOIL: Sandy CLAY low plasticity, grey			TOPSOIL	
				0.35									
				87.90	0.40 m PP = 200 kPa			CH	CLAY high plasticity, red/grey/brown			RESIDUAL	
			1		0.80 m PP = 400 kPa					M (>PL)	St - VSt		
					1.20 m PP = 550 kPa								
					1.60 m PP = 500 kPa								
				1.80									
				86.45	TP05_2 2.00-2.20 m				white/red				
			2										
				2.50									
	H			85.75					SHALE grey, extremely weathered, inferred low strength	D		WEATHERED ROCK	
				85.55					TEST PIT DISCONTINUED @ 2.70 m REFUSAL				
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

DRAFT REPORT OF TEST PIT: TP06

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299555.6 m E 6244534.2 m N MGA94 56
SURFACE RL: 88.40 m DATUM: AHD
PIT DEPTH: 3.00 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: IW DATE: 3/7/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L	Groundwater Not Encountered	0	88.40					TOPSOIL: Sandy CLAY low plasticity, grey		F	TOPSOIL	
				0.40									
				88.00	0.40 m PP = 300 kPa			CH	CLAY high plasticity, red/brown/grey	M (>PL)	St - VSt	RESIDUAL	
				0.70	TP06_01 0.50-0.70 m								
			1	87.70	0.60 m PP = 300 kPa				white/red				29
					1.00 m PP = 400 kPa								
				1.40	1.20 m PP = 550 kPa								
	H		2	87.00					SHALE grey/brown, extremely weathered, inferred extremely low strength	D		EXTREMELY WEATHERED ROCK	
			3	85.40					TEST PIT DISCONTINUED @ 3.00 m REFUSAL Target depth				
			4										
			5										
			6										
			7										
			8										
			9										
			10										

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01i
RL3

DRAFT REPORT OF TEST PIT: TP07

Golder Associates

CLIENT:	Western Sydney Parklands Trust	COORDS: 299419.7 m E 6244563.1 m N MGA94 56	SHEET: 1 OF 1
PROJECT:	Fifteenth Avenue Commercial Precinct	SURFACE RL: 84.70 m DATUM: AHD	MACHINE: Backhoe
LOCATION:	West Hoxton	PIT DEPTH: 2.10 m	CONTRACTOR:
JOB NO:	147622023	BUCKET TYPE:	LOGGED: IW DATE: 3/7/14
			CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L	Groundwater Not Encountered	0	84.70					TOPSOIL: Sandy CLAY			TOPSOIL	0 5 10 15 20 25
				0.20					low plasticity, grey				
				84.50	0.20 m PP = 500 kPa			CH	CLAY high plasticity, red/brown			RESIDUAL	
			1		0.80 m PP = 250 kPa TP07_001 1.00-1.20 m PP = 175 kPa 1.40 m PP = 150 kPa					W	St - VSt		30 35 42
				1.70									
	H		2	83.00					Weathered SHALE grey	D		EXTREMELY WEATHERED ROCK	
				82.60					TEST PIT DISCONTINUED @ 2.10 m REFUSAL				
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01i
RL3

DRAFT REPORT OF TEST PIT: TP08

Golder Associates

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299546.7 m E 6244693.0 m N MGA94 56
SURFACE RL: 91.20 m DATUM: AHD
PIT DEPTH: 3.20 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: IW DATE: 3/7/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
EX	L	Groundwater Not Encountered	0	91.20	0.20 m PP = 300 kPa				FILL: Gravelly SAND rounded, white	D		FILL	
				0.40									
	L			90.80	0.40 m PP = 400 kPa			CL	Sandy CLAY low plasticity, brown			COLLUVIUM	
				0.70									
				90.50	0.60 m PP = 400 kPa			CH	CLAY high plasticity, red/brown/grey			RESIDUAL	
			1		0.80 m PP = 250 kPa								
					1.00 m PP = 300 kPa								
					1.20 m PP = 300 kPa								
					1.40 m PP = 300 kPa					W			
					1.60 m PP = 300 kPa								
			2										
				2.50	TP08-001								
				88.70	2.40-2.60 m PP = 350 kPa				white/red/grey				
				2.90									
	H		3	88.30					SHALE grey/brown, extremely weathered, inferred extremely low strength	D		EXTREMELY WEATHERED ROCK	
				88.00					TEST PIT DISCONTINUED @ 3.20 m REFUSAL Target depth				
			4										
			5										
			6										
			7										
			8										
			9										
			10										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25; 32

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01i
RL3

DRAFT REPORT OF TEST PIT: TP09

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299617.6 m E 6244669.1 m N MGA94 56
SURFACE RL: 95.10 m DATUM: AHD
PIT DEPTH: 2.20 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: HV DATE: 26/6/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description						
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS	DCP TEST (AS1289.6.3.2) Blows per 100 mm
BH	L	Groundwater Not Encountered	0	95.10					Silty CLAY medium plasticity, brown, with some rootlets			TOPSOIL	
				0.30									
				94.80	TP09-001 BDS 0.40-0.60 m PP = 250 kPa			CH	CLAY high plasticity, pale brown	M (>PL)	St - VSt	RESIDUAL	
			1		TP09-002 1.10-1.30 m PP = 400 kPa								
				1.30									
				93.80				CH	Silty CLAY pale brown, pale grey	M (<PL)	H	EXTREMELY WEATHERED ROCK	
				1.75									
	M			93.35					SHALE pale grey with red staining, extremely weathered, extremely low strength				
			2	*2.10*									
	H			93.00					low strength				
				92.90					TEST PIT DISCONTINUED @ 2.20 m REFUSAL				
			3										
			4										
			5										
			6										
			7										
			8										
			9										
			10										

DCP TEST (AS1289.6.3.2) Blows per 100 mm: 0 5 10 15 20 25

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

DRAFT REPORT OF TEST PIT: TP10

CLIENT: Western Sydney Parklands Trust
PROJECT: Fifteenth Avenue Commercial Precinct
LOCATION: West Hoxton
JOB NO: 147622023

COORDS: 299462.4 m E 6244536.1 m N MGA94 56
SURFACE RL: 87.00 m DATUM: AHD
PIT DEPTH: 2.60 m
BUCKET TYPE:

SHEET: 1 OF 1
MACHINE: Backhoe
CONTRACTOR:
LOGGED: IW DATE: 3/7/14
CHECKED: JDM DATE: 15/7/14

Excavation					Sampling		Field Material Description					
METHOD	EXCAVATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	L	Groundwater Not Encountered	0	87.00					TOPSOIL: Sandy CLAY low plasticity, grey			TOPSOIL
				0.20 86.80					CLAY red/brown/grey	W	VSt	RESIDUAL
			1		0.40 m PP = 300 kPa 0.60 m PP = 300 kPa 0.80 m PP = 150 kPa 1.00 m PP = 400 kPa TP10-001 1.20-1.40 m PP = 400 kPa 1.60 m PP = 600 kPa							
	H		2	1.70 85.30					SHALE grey, extremely weathered, inferred extremely low strength	D		EXTREMELY WEATHERED ROCK
				84.40					TEST PIT DISCONTINUED @ 2.60 m REFUSAL			
			3									
			4									
			5									
			6									
			7									
			8									
			9									
			10									

DCP TEST (AS1289.6.3.2) Blows per 100 mm
0 5 10 15 20 25
30
32

This report of test pit must be read in conjunction with accompanying notes and abbreviations.

GAP gINT FN. F01i
RL3

APPENDIX B

Laboratory Test Certificates

SHRINK SWELL INDEX REPORT

AS1289 7.1.1

Client:	Golder Associates	**Source:**	BH01-002 (1.6-1.83m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No.:**	S0063-SS
Job No.:	14-466	**Lab No.:**	S0063

Test Procedure: ☑ AS1289 7.1.1 Soil reactivity tests- Determination of the shrinkage index of a soil - Shrink-swell index

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		

Swell Test:

Swell on Saturation(E_{SW}):	4.08
Moisture Content Before Test (%):	21.8
Moisture Content After Test (%):	27.0

Shrink Test:

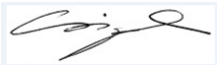
Shrinkage on Drying (E_{SH}%):	2.9
Estimated Inert Material Present (%):	0
Extent of Crumbling During Shrinkage:	None
Extent of Cracking During Shrinkage:	Mild
Moisture Content (%)	19.4

Shrink Swell Index:

Iss: 2.8

NATA Accredited Laboratory Number: 14874

Authorised Signatory:



Chris Lloyd

14/07/2014

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

EMERSON CLASS NUMBER REPORT

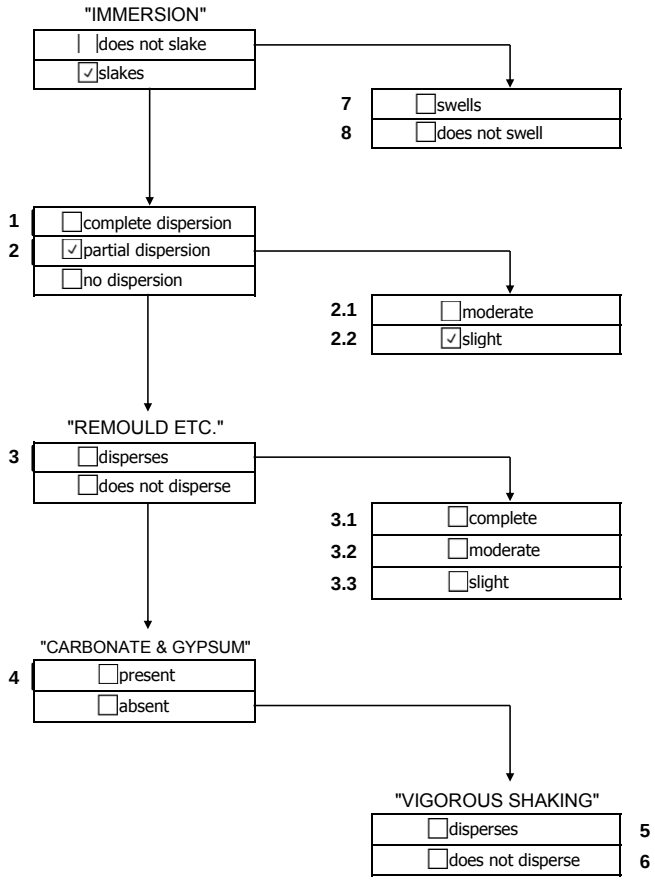
AS1289 3.8.1

Client:	Golder Associates	**Source:**	BH01-003 (2.5-2.95m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No:**	S0064-ECN
Job No:	14-466	**Lab No:**	S0064

Test Procedure: ☑ AS1289 3.8.1 Soil classification tests - Dispersion - Determination of Emerson class number of a soil

Sampling: Sampled by Client **Date Sampled:** 26.06.14

Preparation: Prepared in accordance with AS1289 1.1



Water Type	**Distilled**
Water Temperature (°c)	**20**

RESULT:

Emerson Class No.	**2**

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025. This document shall not be reproduced, except in full.

Authorised Signatory:

14/07/2014

Date:

NATA Accredited Laboratory Number: 14874

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

SHRINK SWELL INDEX REPORT

AS1289 7.1.1

Client:	Golder Associates	**Source:**	BH02-001 (0.6-0.92m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No.:**	S0065-SS
Job No.:	14-466	**Lab No.:**	S0065

Test Procedure: ☑ AS1289 7.1.1 Soil reactivity tests- Determination of the shrinkage index of a soil - Shrink-swell index

Sampling: Sampled by Client **Date Sampled:** 26.06.14

Preparation: Prepared in accordance with AS1289 1.1

Swell Test:

Swell on Saturation(E_{SW}):	0.11
Moisture Content Before Test (%):	20.4
Moisture Content After Test (%):	22.8

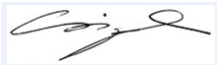
Shrink Test:

Shrinkage on Drying (E_{SH}%):	5.8
Estimated Inert Material Present (%):	0
Extent of Crumbling During Shrinkage:	None
Extent of Cracking During Shrinkage:	Mild
Moisture Content (%)	27.1

Shrink Swell Index:

Iss: **3.2**

Authorised Signatory:



Chris Lloyd

14/07/2014

Date:

NATA Accredited Laboratory Number: 14874

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

SHRINK SWELL INDEX REPORT

AS1289 7.1.1

Client:	Golder Associates	**Source:**	BH03-001 (0.4-0.78m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No.:**	S0066-SS
Job No.:	14-466	**Lab No.:**	S0066

Test Procedure: ☑ AS1289 7.1.1 Soil reactivity tests- Determination of the shrinkage index of a soil - Shrink-swell index

Sampling: Sampled by Client **Date Sampled:** 26.06.14

Preparation: Prepared in accordance with AS1289 1.1

Swell Test:

Swell on Saturation(E_{SW}):	1.12
Moisture Content Before Test (%):	29.0
Moisture Content After Test (%):	31.2

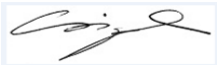
Shrink Test:

Shrinkage on Drying (E_{SH}%):	2.9
Estimated Inert Material Present (%):	0
Extent of Crumbling During Shrinkage:	None
Extent of Cracking During Shrinkage:	Mild
Moisture Content (%)	28.5

Shrink Swell Index:

Iss: 1.9

Authorised Signatory:



Chris Lloyd

14/07/2014

Date:

NATA Accredited Laboratory Number: 14874

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

EMERSON CLASS NUMBER REPORT

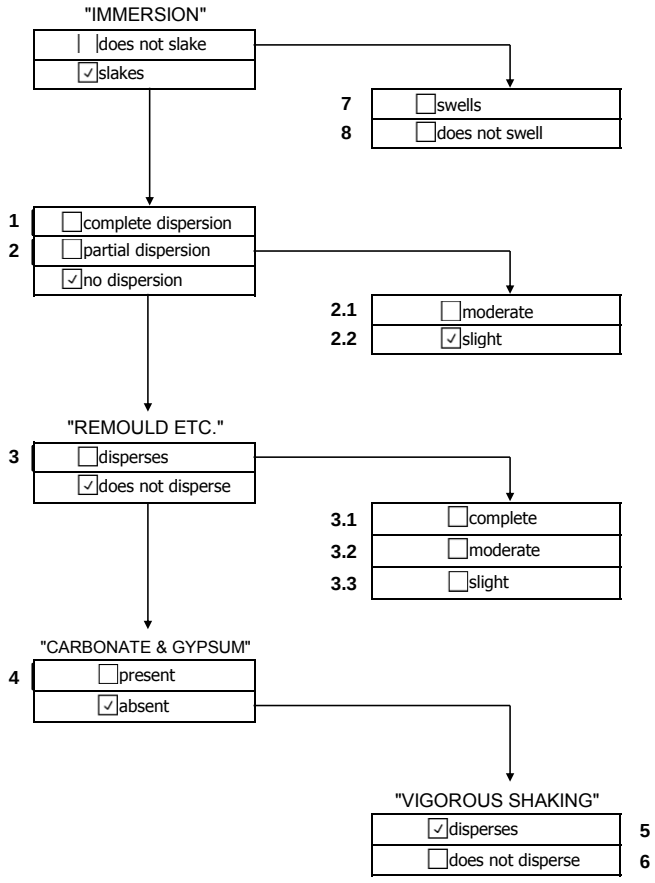
AS1289 3.8.1

Client:	Golder Associates	**Source:**	BH03-004 (4.0-4.09m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No:**	S0067-ECN
Job No:	14-466	**Lab No:**	S0067

Test Procedure: ☑ AS1289 3.8.1 Soil classification tests - Dispersion - Determination of Emerson class number of a soil

Sampling: Sampled by Client **Date Sampled:** 26.06.14

Preparation: Prepared in accordance with AS1289 1.1



Water Type	**Distilled**
Water Temperature (°c)	**20**

RESULT:

Emerson Class No.	**5**

Authorised Signatory:

14/07/2014

Date:

NATA Accredited Laboratory Number: 14874

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

SOIL CLASSIFICATION REPORT

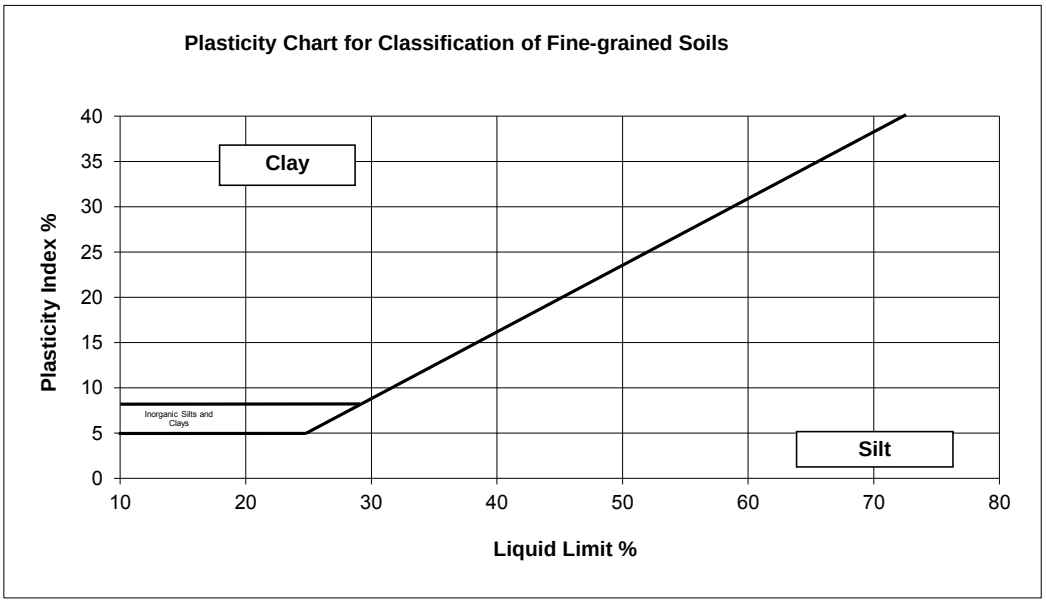
Client:	Golder Associates	**Source:**	TP02 (0.9-1.0m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No:**	S0068-PI
Job No:	14-466	**Lab No:**	S0068

Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☐ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☑ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☑ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		

Liquid Limit (%):	66	**Linear Shrinkage (%):**	15.0
Plastic Limit (%):	23	**Field Moisture Content (%):**	-
Plastic Index:	43		



Soil Preparation Method: Wet Sieved
Soil History: Natural State
Soil Condition: Linear

NATA

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

14/07/2014

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Location: 8/10 Bradford St, Alexandria NSW 2015
Site No.: 22365

Facility

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

CALIFORNIA BEARING RATIO REPORT

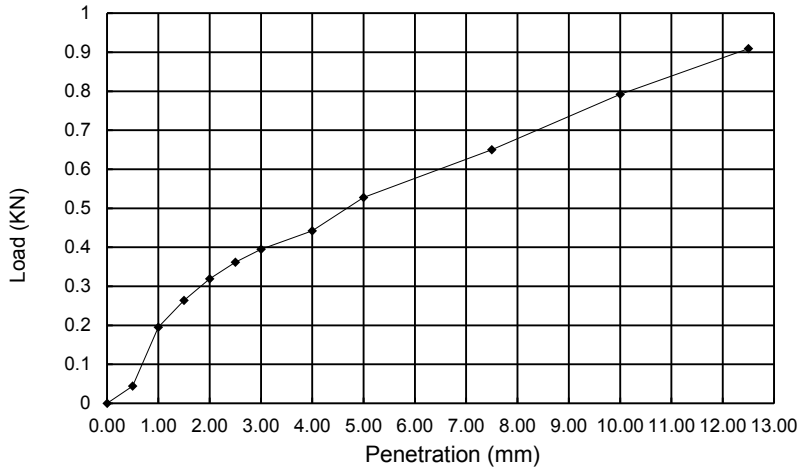
AS1289 6.1.1

Client:	Golder Associates	**Source:**	TP02 (0.9-1.0m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	147622023	**Report No.:**	S0068-CBR
Job No.:	14-466	**Lab No.:**	S0068

Test Procedure:

- ☑ AS1289 6.1.1 Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort
- ☑ AS1289 2.1.1 Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (standard method

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		



Compaction and Placement Data

Compaction Used	Standard	Dry Density				
Maximum Dry Density t/m3	1.61	At Compaction	1.62 t/m3	101.0 % Comp.		
Optimum Moisture Content %	23.0	After Soaking	1.62 t/m3	101.0 % Comp.		
No. of Layers	3	Moisture Content				Moisture Ratio (%)
Blows per Layer	53	At Compaction		%	24.9	108
Drop of Rammer mm	300	After Soaking		%	25.9	113
Mass of Rammer kg	2.7	After Penetration (Top 30mm)		%	31.9	138
Surcharge Used kg	4.5	After Penetration (Entire Depth)		%	25.9	113
% Ret. 19mm Sieve	0	Swell After 4 Days Soaking		%	1.6	

Note: material coarser than +19mm Sieve was discarded (as per test method)

California Bearing Ratio

CBR (4-day Soaked) = 3.0 % 2.5 mm Penetration

Notes:

Authorised Signatory:

14/07/2014

Date:

NATA Accredited Laboratory Number: 14874

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

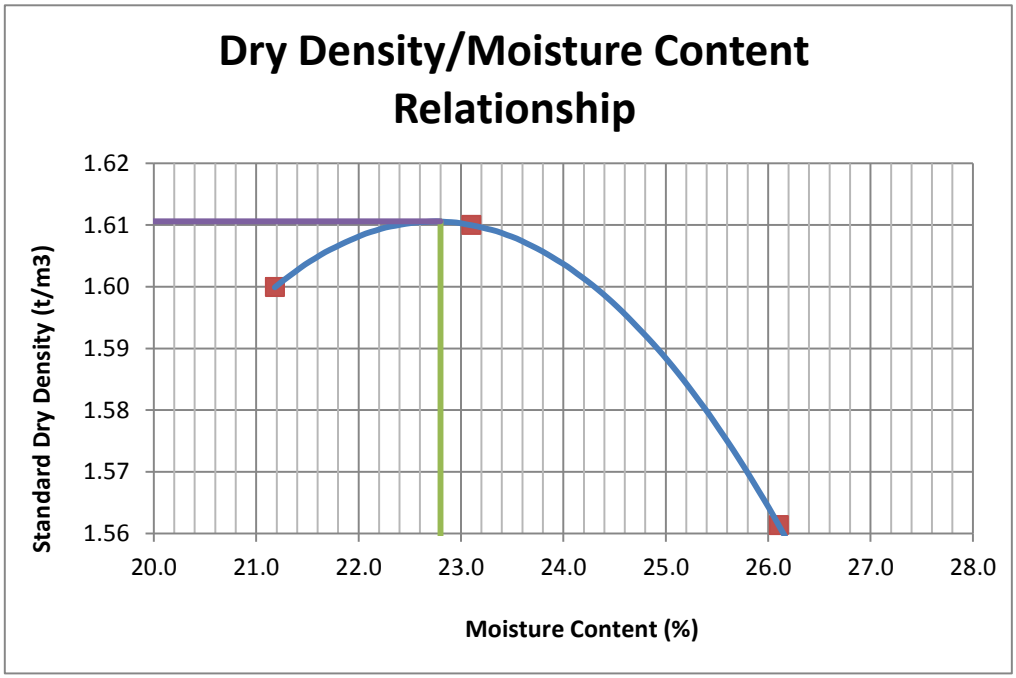
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

AS1289 5.1.1

Client:	Golder Associates	**Source:**	TP02 (0.9-1.0m)
Project:	West Hoxton (147622023)	**Report No:**	S0068-MDD
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Job No:	14-466	**Lab No:**	S0068

Test Procedure:
- ☑ AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
- ☑ AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		



Maximum Dry Density (t/m^3)	1.611
Optimum Moisture Content (%)	23.0
Percentage Oversize on 19mm sieve (%)	0
Percentage Oversize on 37.5mm sieve (%)	0

NATA

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MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Maquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

SOIL CLASSIFICATION REPORT

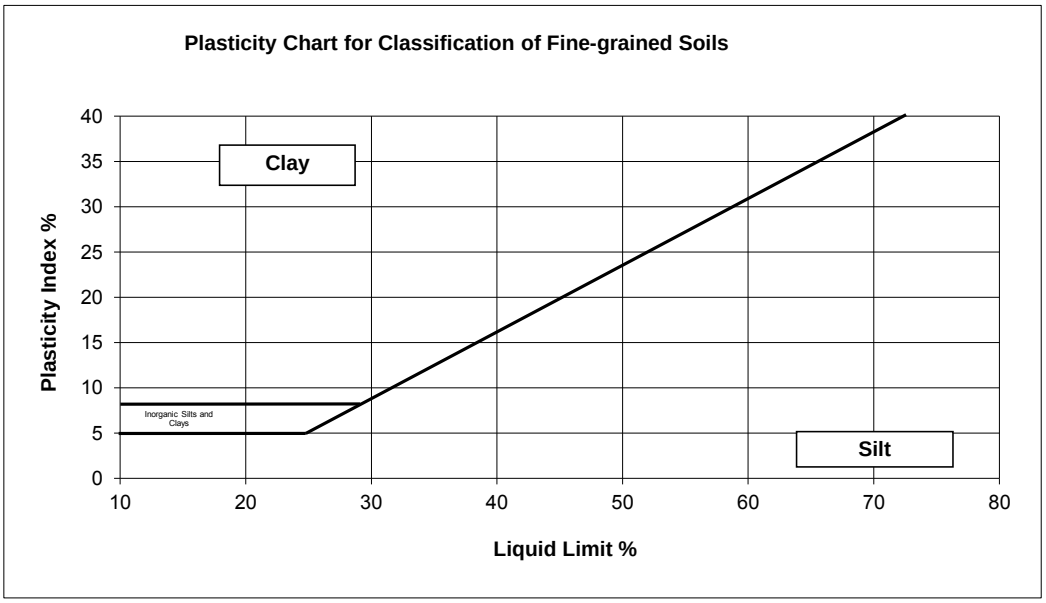
Client:	Golder Associates	**Source:**	TP04 (0.4-0.6m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	West Hoxton (147622023)	**Report No:**	S0069-PI
Job No:	14-466	**Lab No:**	S0069

Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☐ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☑ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☑ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		

Liquid Limit (%):	61	**Linear Shrinkage (%):**	14.5
Plastic Limit (%):	18	**Field Moisture Content (%):**	-
Plastic Index:	43		



Soil Preparation Method: Wet Sieved
Soil History: Natural State
Soil Condition: Curling Occuring

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

14/07/2014

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MACQUARIE GEOTECH

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Location: 8/10 Bradford St, Alexandria NSW 2015
Site No.: 22365

Facility

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

CALIFORNIA BEARING RATIO REPORT

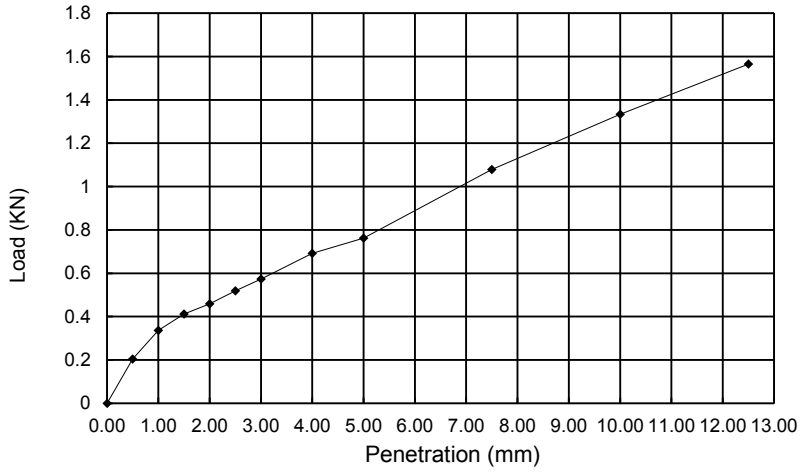
AS1289 6.1.1

Client:	Golder Associates	**Source:**	TP04 (0.4-0.6m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Project:	147622023	**Report No.:**	S0069-CBR
Job No.:	14-466	**Lab No.:**	S0069

Test Procedure:

- ☑ AS1289 6.1.1 Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort
- ☑ AS1289 2.1.1 Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (standard method

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		



Compaction and Placement Data

Compaction Used	Standard	Dry Density				
Maximum Dry Density t/m3	1.66	At Compaction	1.66 t/m3	100.0 % Comp.		
Optimum Moisture Content %	21.0	After Soaking	1.66 t/m3	100.0 % Comp.		
No. of Layers	3	Moisture Content				Moisture Ratio (%)
Blows per Layer	53	At Compaction		%	20.1	96
Drop of Rammer mm	300	After Soaking		%	19.6	93
Mass of Rammer kg	2.7	After Penetration (Top 30mm)		%	29.4	140
Surcharge Used kg	4.5	After Penetration (Entire Depth)		%	19.6	93
% Ret. 19mm Sieve	0	Swell After 4 Days Soaking		%	0.9	

Note: material coarser than +19mm Sieve was discarded (as per test method)

California Bearing Ratio

CBR (4-day Soaked) = 4.0 % 2.5 mm Penetration

Notes:

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Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

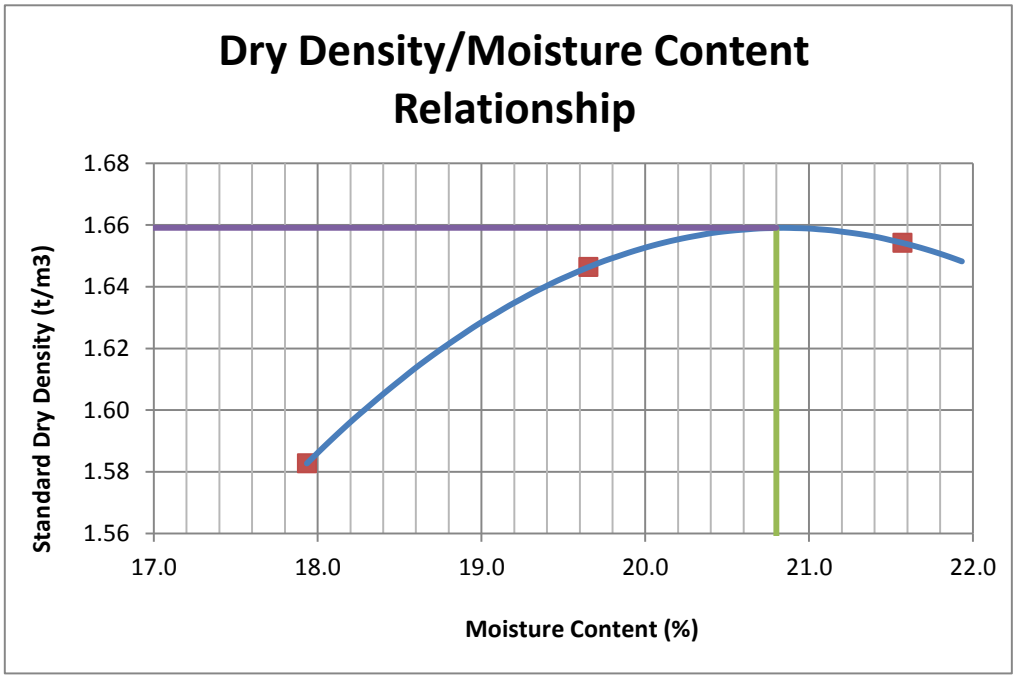
DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

AS1289 5.1.1

Client:	Golder Associates	**Source:**	TP04 (0.4-0.6m)
Project:	West Hoxton (147622023)	**Report No:**	S0069-MDD
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	silty CLAY
Job No:	14-466	**Lab No:**	S0069

Test Procedure:
- ☑ AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort
- ☑ AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		



Maximum Dry Density (t/m^3)	1.659
Optimum Moisture Content (%)	21.0
Percentage Oversize on 19mm sieve (%)	0
Percentage Oversize on 37.5mm sieve (%)	0

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14/07/2014

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Maquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

SOIL CLASSIFICATION REPORT

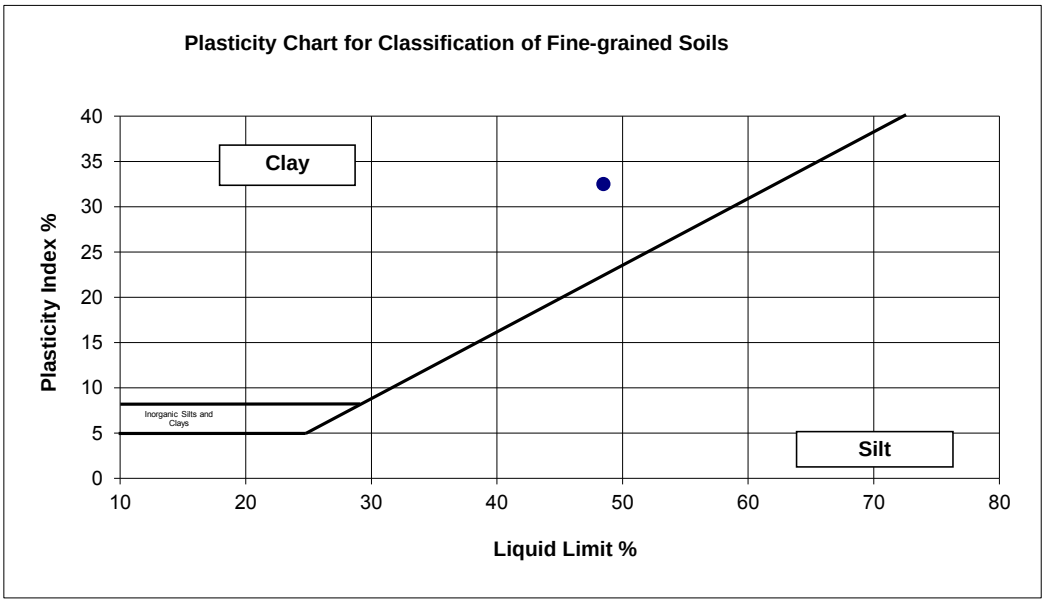
Client:	Golder Associates	**Source:**	TP08 (2.4-2.6m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	sandy CLAY
Project:	West Hoxton (147622023)	**Report No:**	S0070-PI
Job No:	14-466	**Lab No:**	S0070

Test Procedure:

- ☐ AS1289 2.1.1 Soil moisture content tests (Oven drying method)
- ☐ AS1289 3.1.1 Soil classification tests - Determination of the liquid limit of a soil - Four point casagrande method
- ☑ AS1289 3.1.2 Soil classification tests - Determination of the liquid limit if a soil - One point Casagrande method (subsidiary method)
- ☑ AS1289 3.2.1 Soil classification tests - Determination of the plastic limit of a soil - Standard method
- ☑ AS1289 3.3.1 Soil classification tests - Calculation of the plasticity Index of a soil
- ☑ AS1289 3.4.1 Soil classification tests - Determination of the linear shrinkage of a soil - Standard method

Sampling:	Sampled by Macquarie Geotechnical Staff in accordance with AS1289 1.1	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		

Liquid Limit (%):	48	**Linear Shrinkage (%):**	13.5
Plastic Limit (%):	16	**Field Moisture Content (%):**	-
Plastic Index:	32		



Soil Preparation Method: Wet Sieved
Soil History: Natural State
Soil Condition: Linear

NATA

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NATA Accredited Laboratory Number: 14874

Authorised Signatory:

Chris Lloyd

14/07/2014

Date:

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Location: 8/10 Bradford St, Alexandria NSW 2015
Site No.: 22365

Facility

Macquarie Geotechnical
3 Watt Drive
Bathurst NSW 2795

CALIFORNIA BEARING RATIO REPORT

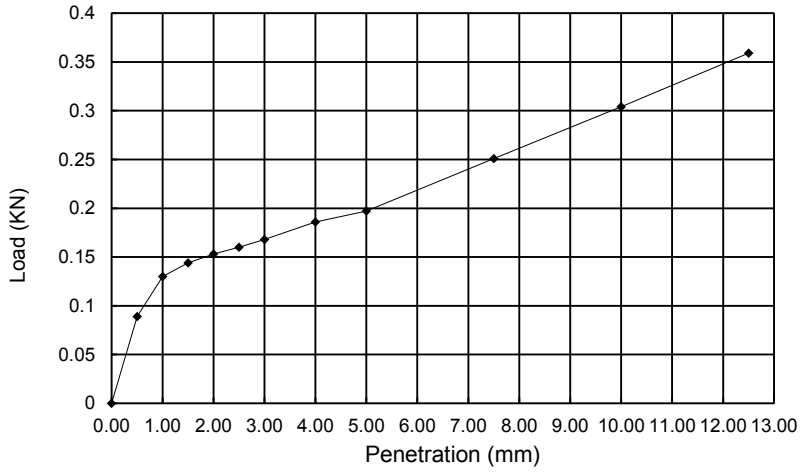
AS1289 6.1.1

Client:	Golder Associates	**Source:**	TP08 (2.4-2.6m)
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	sandy CLAY
Project:	147622023	**Report No.:**	S0070-CBR
Job No.:	14-466	**Lab No.:**	S0070

Test Procedure:

- ☑ AS1289 6.1.1 Soil strength and consolidation tests - Determination of the California Bearing Ratio of a soil - Standard laboratory method for a remoulded specimen
- ☑ AS1289 5.1.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using standard compactive effort
- ☐ AS1289 5.2.1 Soil compaction and density tests - Determination of the dry density/moisture content relationship of a soil using modified compactive effort
- ☑ AS1289 2.1.1 Soil moisture content tests - Determination of the moisture content of a soil - Oven drying method (standard method

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		



Compaction and Placement Data

Compaction Used		Standard	Dry Density			
Maximum Dry Density t/m3		1.68	At Compaction	1.68 t/m3	100.0	% Comp.
Optimum Moisture Content %		20.0	After Soaking	1.63 t/m3	97.0	% Comp.
No. of Layers		3	Moisture Content			Moisture Ratio (%)
Blows per Layer		53	At Compaction	%	21.4	107
Drop of Rammer	mm	300	After Soaking	%	22.4	112
Mass of Rammer	kg	2.7	After Penetration (Top 30mm)	%	32.7	163
Surcharge Used	kg	4.5	After Penetration (Entire Depth)	%	22.4	112
% Ret. 19mm Sieve		0	Swell After 4 Days Soaking	%	0.8	

Note: material coarser than +19mm Sieve was discarded (as per test method)

California Bearing Ratio

CBR (4-day Soaked) = 1.0 % 5.0 mm Penetration

Notes:

Authorised Signatory:

14/07/2014

Date:

NATA Accredited Laboratory Number: 14874

MACQUARIE GEOTECH

Facility Name: Sydney Branch Site
Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Macquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

DRY DENSITY / OPTIMUM MOISTURE CONTENT REPORT

AS1289 5.1.1

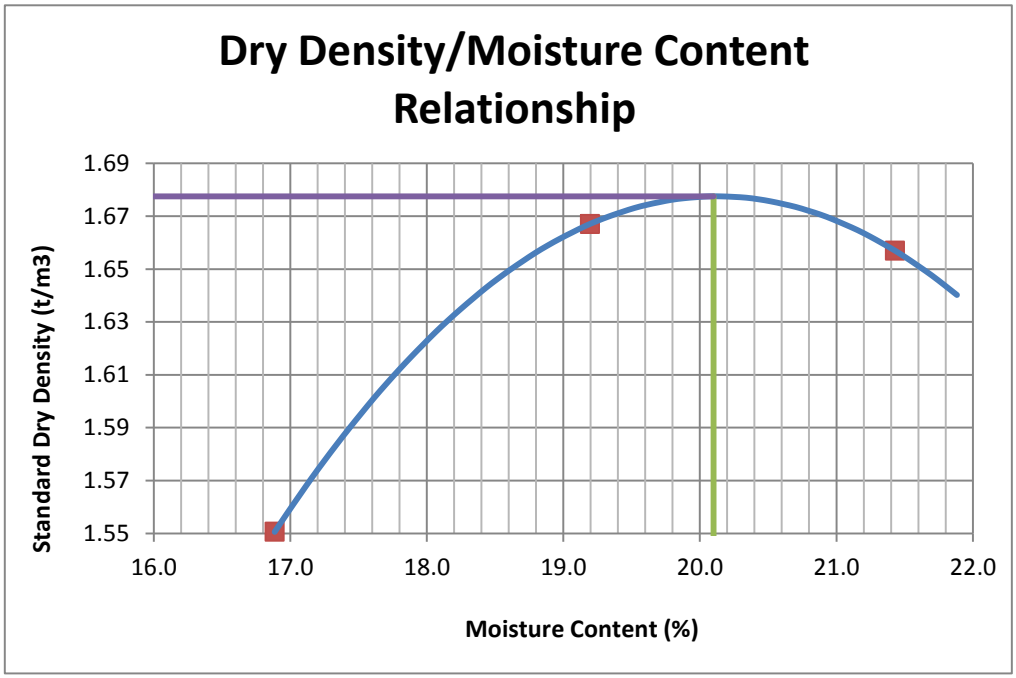
Client:	Golder Associates	**Source:**	TP08 (2.4-2.6m)
Project:	West Hoxton (147622023)	**Report No:**	S0070-MDD
Address:	124 Pacific Highway St Leonards NSW 2065	**Sample Description:**	sandy CLAY
Job No:	14-466	**Lab No:**	S0070

Test Procedure:

☑ AS1289.5.1.1 Determination of the dry density/moisture content relation of a soil using standard compactive effort

☑ AS1289.2.1.1 Determination of the moisture content of a soil - Oven drying method (Standard method)

Sampling:	Sampled by Client	**Date Sampled:**	26.06.14
Preparation:	Prepared in accordance with AS1289 1.1		



Maximum Dry Density (t/m^3)	1.678
Optimum Moisture Content (%)	20.0
Percentage Oversize on 19mm sieve (%)	0
Percentage Oversize on 37.5mm sieve (%)	0

NATA

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14/07/2014

Date:

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MACQUARIE GEOTECH

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Facility Location: 8/10 Bradford Street, Alexandria NSW 2015
Site No.: 22365

Maquarie Geotechnical
3 Watt Drive
BATHURST NSW 2795

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
enquiries@envirolabservices.com.au
www.envirolabservices.com.au

CERTIFICATE OF ANALYSIS 112656

Client:
Golder Associates Pty Ltd
124 Pacific Highway
St Leonards
NSW 2065

Attention: Ivan Ward

Sample log in details:

Your Reference:	**147622023, Hoxton Park**
No. of samples:	3 Soils
Date samples received / completed instructions received	07/07/2014 / 07/07/2014

Analysis Details:
Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	15/07/14 / 15/07/14
Date of Preliminary Report:	Not Issued

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Results Approved By:

Jacinta Hurst
Laboratory Manager

Chromium Suite				
Our Reference:	UNITS	112656-1	112656-2	112656-3
Your Reference	----------	TP07	TP07	TP10
Depth	----------	0.3-0.5	0.1-0.3	0.3-0.5
Date Sampled		7/07/2014	7/07/2014	7/07/2014
Type of sample		Soil	Soil	Soil
pH $_{kcl}$	pH units	4.6	4.7	5.3
s-TAA pH 6.5	%w/w S	0.03	0.02	<0.01
TAA pH 6.5	moles H^+/t	17	10	5
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+/t	<3	<3	<3
S_{KCl}	%w/w S	0.061	0.058	0.049
ANC_{BT}	% $CaCO_3$	<0.05	<0.05	<0.05
s-ANC_{BT}	%w/w S	<0.05	<0.05	<0.05
s-Net Acidity	%w/w S	0.03	0.02	0.01
a-Net Acidity	moles H^+/t	19	12	<10
Liming rate	kg $CaCO_3$/t	1.4	0.93	<0.75
a-Net Acidity without ANCE	moles H^+/t	19	12	<10
Liming rate without ANCE	kg $CaCO_3$/t	1.4	0.93	<0.75

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL Chromium Suite	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
pH_{kcl}	pH units		Inorg-068	[NT]	[NT]	[NT]	LCS-1	95%
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	[NT]	[NT]	[NR]	[NR]
TAA pH 6.5	moles H^+/t	5	Inorg-068	<5	[NT]	[NT]	LCS-1	96%
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	LCS-1	105%
a-Chromium Reducible Sulfur	moles H^+/t	3	Inorg-068	<3	[NT]	[NT]	[NR]	[NR]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NR]	[NR]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	LCS-1	113%
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NR]	[NR]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	[NT]	[NT]	[NR]	[NR]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	[NT]	[NT]	[NR]	[NR]
s-Net Acidity	%w/w S	0.01	Inorg-068	<0.01	[NT]	[NT]	[NR]	[NR]
a-Net Acidity	moles H^+/t	10	Inorg-068	<10	[NT]	[NT]	[NR]	[NR]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NR]	[NR]
a-Net Acidity without ANCE	moles H^+/t	10	Inorg-068	<10	[NT]	[NT]	[NR]	[NR]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NR]	[NR]

Report Comments:

Asbestos ID was analysed by Approved Identifier:	Not applicable for this job
Asbestos ID was authorised by Approved Signatory:	Not applicable for this job

INS: Insufficient sample for this test	PQL: Practical Quantitation Limit	NT: Not tested
NA: Test not required	RPD: Relative Percent Difference	NA: Test not required
<: Less than	>: Greater than	LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics and 10-140% for SVOC and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

APPENDIX C

Limitations

LIMITATIONS

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