

Appendix 11

**Geotechnical Investigation
prepared by
Alliance Geotechnical Pty Ltd**

Alliance Geotechnical

Engineering | Environmental | Testing

Geotechnical Investigation Report

Prepared for Lendlease

Proposed Retirement Village (51 Villas)
Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs,
NSW 2747



Project Number: 6715

Report Number: 6715-GR-1-2-Rev A

Report Date: 30th May 2018



We give you the right information to make the right decisions

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- Drawing: 6715-GR-1-2-A
- Borehole Logs (TP1 to TP5, BH101 & BH102 & BH1 to BH6,)
- DCP Test Result

1. INTRODUCTION

This report presents the findings of a supplementary geotechnical investigation undertaken by Alliance Geotechnical Pty Ltd (AG) at Jordan Springs Boulevard (Lot 3991 DP 1190132), Jordan Springs, NSW for Lendlease (Client), in accordance with AG's fee proposal No. 709, dated 26th February 2018.

The previous geotechnical investigations which were carried out in 2016 & 2018, were presented in AG's latest report No. 2715-GR-1-1, dated 26th February 2018.

As described in AG's report No. 2715-GR-1-1, a portion of the site was underlain by fill material. Referring to AG's site investigation in 2016, and the limited number of boreholes drilled in February 2018, the majority of the site was classified as Class P and a limited area was classified as Class H1 (as reported in report No. 2715-GR-1-1).

As per the client's request, AG planned for further investigation across this site to assess the fill material compaction ratio and re-classify the site. AG suggested to excavate a number of test pits across the site (instead the boreholes) to determine the extent of the area underlain by fill material. Therefore, a subsequent geotechnical investigation consisting of five (5) test pits was undertaken (as presented in this report).

AG were provided with concept layout plans and as such do not have final design levels after bulk earthworks. Moreover, AG were informed by the client that the site is subject to further fill placement which will be undertaken as a part of site preparation scheme.

AG were supplied with the following documents:

- The site survey plan with reference No. 7202, prepared by Land Development Solutions (SDG), dated 15/01/2018;¹
- Jordan Springs CD Site, drawing No. AND-28405, Sheet 1 & 2, prepared by A&N Design Group, dated 15/01/2018 which indicates the concept lots layout and the site analysis.

A previous geotechnical investigation was undertaken by AG in December 2016 on this same site, at the time the site was proposed for the construction of multi-storey developments as described in Section 2.3.

This report is prepared based on the geotechnical investigation findings during AG's previous site investigations (as reported in report No. 6715-GR-1-1, date 26th February 2018) and additional test pit investigation work described in Section 3 of this report.

1.1. Objectives

The objectives of the investigation were to assess the subsurface conditions and provide geotechnical engineering comments and recommendations relating to:

- Geotechnical subsurface and groundwater conditions;
- Re-classifying of the site from previous "P" classification;
- Certifying the existing fill material;
- Allowable bearing pressure for the preliminary footing design.

¹ All levels shown in this report are relative to AHD.

1.2. Scope of Work

In order to achieve the project objectives, the following scope of work was carried out for the investigation:

- Review of the site's geological setting, topographic maps and AG's previous geotechnical investigation report;
- Obtaining Dial Before You Dig (DBYD) plans;
- Site walkover inspection and documentation of the existing conditions and features;
- Excavation of five (5) test pits to 1.5m below the ground surface (bgs);
- Undertaking five (5) Dynamic Cone Penetrometer (DCP) tests to assess soil consistency;
- Collecting five (5) soil samples for laboratory Atterberg Limits tests;
- Preparing a subdivision geotechnical investigation report.

2. SITE SETTING

2.1. Site Description & History

The site is located in Jordan Springs, approximately 40m west of an existing man-made lake. The site is a section of a vacant land which is bounded by Jordan Springs Boulevard to the north and Lakeside Parade to the north and east. There is a sedimentation pond in the eastern portion of the site. Figure 1 shows the general site locality and geology.

The supplied survey plan indicates that the current surface levels over the site vary by approximately 5 m. The higher section of the site is at approximate RL 40.5m on the north-west corner and varies to approximate RL 35.5m on the south-east corner, adjacent to the existing sedimentation pond. The site has an approximate 1 % slope falling the south-east. The site is covered with asphalt at the northwest corner and the other parts are covered with grass and few trees.

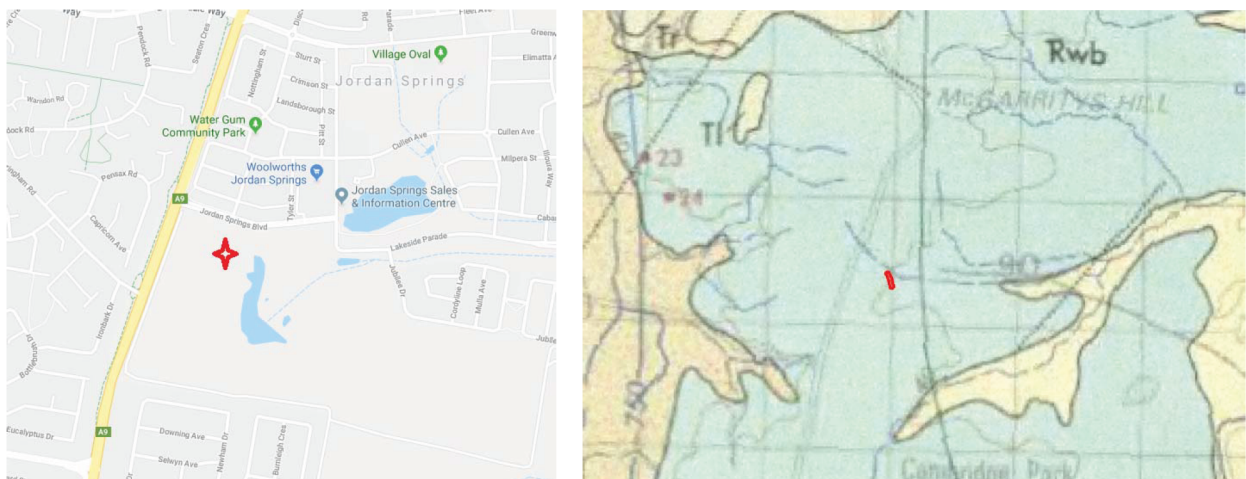


Figure 1- General Site Locality and the site geology

A portion of the site has been filled with fill material during the roadworks during the construction of Jordan Springs Bulverde. This area is marked with red line in Figure 2.



Figure 2- The earthwork in the site during Jordan Springs Bulverde construction in 2011– Extracted from Nearmap

2.2. Regional Geology

The 1:100,000 NSW Department of Mineral Resources Geological Map of the Penrith Region indicates the site is underlain by Bringelly Shale (Rwb) of the Mesozoic dating back to the middle Triassic period. The formation is generally described as *Shale, carbonaceous claystone, Claystone, laminate, fine to medium-grained lithic sandstone, rare coal and tuff.*

2.3. AG's Previous Geotechnical Investigations

AG's previous geotechnical site drilling investigations were carried out in November 2016 and February 2018. During the first investigation undertaken in 2016, AG supervised the drilling of six (6) boreholes (BH1 to BH6) which were drilled to a maximum depth of 12.5 m bgs for the proposed multi-storey buildings project. During the second investigation in 2018, AG drilled two (2) additional boreholes (BH101 & BH102) to indicate the site classification as reported in AG's report No. 6715-GR-1-1. A summary of the soil and rock profile are presented in Table 1 and the borehole locations are shown in drawing 6715-GR-1-2-A.

Table 1 - Summary of Subsurface Profile – AG’s Investigation 2016 & 2018

Soil Profile	BH1	BH2	BH3	BH4	BH5	BH6	BH101	BH102
Topsoil (m) Clayey SILT	0.0 – 0.2	0.0 – 0.1	0.0 – 0.2	0.0 – 0.2	0.0 – 0.2	0.0 – 0.2	0.0 – 0.1	0.0 – 0.1
Fill (m) Silty CLAY, medium plasticity	0.2 – 0.9	0.1 – 6.1	0.2 – 1.7	0.2 – 1.4	0.2 – 1.6	0.2 – 2.5	0.1 – 0.7	-
Alluvial (m) Silty CLAY, medium to high plasticity	-	-	1.7 – 3.8	1.4 – 1.9	1.6 – 2.4	2.5 – 4.0	0.7 – 2.7	0.1 – 1.3
Residual soil (m) silty CLAY, brown, high plasticity	0.9 – 5.1	-	3.8 – 4.6	1.9 – 5.0	2.4 – 4.7	4.0 – 6.6	2.7 – 4.0	1.3 – 4.0
Very Low Strength Shale (m)	5.1 – 7.5	6.1 – 7.5	4.6 – 8.4	5.0 – 7.2	4.7 – 7.6	6.6 – 8.8	-	-
Medium Strength Shale (m)	9.15 – 10.5	-	-	-	-	8.8 – 12.5	-	-
Groundwater Seepage (m)	-	-	-	-	5.6	6.4	-	-

3. FIELDWORK

3.1. Test Pit Excavation

AG’s geotechnical site investigation was carried out on 13th March 2018. During the investigation, AG supervised the excavation of five (5) test pits across the site (TP1 to TP5) to a maximum depth of 1.5m below the ground surface (bgs).

The test pits were excavated using a 15T Excavator operated by MatVel Excavations. The approximate locations of the test pit are shown on the attached sketch plan (refer Drawing No. 6715-GR-1-2-A).

Due to the limited site access, excavation of a test pit was not possible at the northern side of the site.

During the site investigation, the subsurface strata encountered were logged by an AG geotechnical engineer and the in-situ strength of the subsurface soils were recorded by either visual assessment and/or performing in situ Dynamic Cone Penetrometer (DCP) Test.

3.2. DCP Test Results

Field testing using a DCP was undertaken at the surface levels to provide additional data for an assessment of soil consistency and soil strength of the near-surface soils. The locations of the DCP tests are shown on attached Drawing No. 6715-GR-1-2-A. The results are presented in the appendix and indicate that the site is underlain by stiff to hard clay natural soils and well compacted fill material.

4. SUBSURFACE CONDITIONS

Detailed test pits logs (TP1 to TP5) are provided in the appendix. The inferred subsurface soil profiles at the borehole locations are summarised in Table 2.

Table 2 - Summary of Subsurface Profile

Soil Profile	TP1	TP2	TP3	TP4	TP5
Topsoil	0.0 – 0.2	0.0 – 0.3	0.0 – 0.25	0.0 – 0.25	0.0 – 0.2
Alluvium- Sandy/Silty CLAY	0.2 – 1.6	0.3 – 1.4	0.25 – 1.4	0.25 – 0.6	0.2 – 0.8
Residual soil – CLAY	-	-	-	0.6 – 0.8	0.8 – 1.5
Groundwater Seepage	The water seepage was not observed to the depth of drilling				

Based on the excavated test pits, the site is underlain by topsoil, very stiff to hard alluvial sandy /silty clay material and stiff to hard residual clay.

5. LABORATORY TESTS

The Atterberg limits tests were conducted in accordance with AS1289-2006 on selected samples from test pits. The results are summarised in Table 3 and the detailed results are presented in Appendix E. Based on the Atterberg limits tests, the site soil are mainly highly plastic silty clay.

Table 3 - Summary of Atterberg Limits Tests

Borehole No.	Depth (m)	LL (%)	LS (%)	PL (%)	PI (%)
TP 1	0.5 – 0.6	40	8.5	12	28
TP 2	1.0 – 1.1	69	18.5	19	50
TP3	1.0 – 1.5	41	14	10	31
TP4	0.7 – 1.0	41	13	14	27
TP 5	0.5 – 0.6	53	18	15	38

Notes:

LL Liquid Limit LS Linear Shrinkage
PL Plastic Limit PI Plastic Index

6. Existing Fill Material

Based on the subsurface profile encountered in the excavated test pits (as summarised in Section 4) and DCP tests, the preliminary assessment indicates the site is mainly underlain by alluvial and residual soils. It has been confirmed during test pit investigation that the area with fill material is just limited to the northern side of the site as is illustrated in Figure 2.

The existing fill which has been placed as a part of Jordan Spring Bulverde road construction works, has been assessed as a well-compacted fill referring to AG's DCP tests.

7. SITE CLASSIFICATION

Considering the geotechnical investigation findings, the whole site (excluding the marked area on Drawing 6715-GR-1-2-A) has been generally classified as **Class H2** and is described as highly reactive clay site, which may experience high ground movements from moisture changes with an estimated characteristic surface movement (y_s) to be in the range between 60mm and 75mm for the existing subsurface conditions.

As indicated on Drawing 6715-GR-1-2-A, there are two portions which have been classified as **Class E** (Extremely Reactive Clay Site), which may experience extreme ground movement from moisture changes with an estimated characteristic surface movement (y_s) to be more than 75mm for the existing subsurface conditions.

The site classification has been undertaken in accordance with AS2870-2011 "Residential Slabs and Footings".

It should be noted that, this site classification is subject to change if site levels change by more than 400mm of clayey fill and 800mm of sandy fill as a result of bulk earthworks. A geotechnical engineer should assess the site classification on completion of the subdivision earthworks, provided that the placed fill is an engineered fill and has been certified.

8. PRELIMINARY FOOTING DESIGN PARAMETER

Considering the site classifications (Class H2 & Class E) it is recommended that a site specific geotechnical investigation and assessment be undertaken for the proposed developments and the footings be designed based on engineering principles.

The standard footings appropriate to **Class H2** or an engineered designed slab may be used on this site. The wet or loose material, and topsoil should be selectively removed to provide a suitable founding base. An allowable bearing capacity of up to **150 kPa** under shallow footing founded on natural soils with a minimum embedment depth of 0.3m (not topsoil material) will be acceptable (provided that adequate drainage is installed on this site).

For a portion of the site, classified as E, the footings should be designed based on the engineering principles and site specific geotechnical recommendations.

Generally, considering the highly reactive clayey material in this site, it is recommended not to found the footings on the shallow foundations and pier footings founded on the bedrock may be considered.

The proposed developments may be founded on piers to take the load of the building to the bedrock. It is recommended the piers be founded and socketed in the underlying very low strength shale with an assumed maximum allowable bearing pressure of **700 kPa**. The pile footings should be designed in accordance with AS 2159-2009 Piling – Design and Installation

9. SITE PREPARATION

To prepare the site for the construction of structures and pavements, the following procedures are suggested:

- Strip topsoil and remove topsoil and soft material.
- Deeper stripping of soils underlying topsoil or where water softened soils are present. Prior to stripping of these materials a geotechnical engineer should be consulted to provide advice.
- Where fill is to be placed, a test roll to the exposed upper surface should be undertaken on the exposed subgrade with a smooth drum roller of at least 8 tonne static deadweight capacity, during the presence of a geotechnical engineer and a minimum of six passes of the roller.
- where soft spots or unacceptable subgrade conditions are encountered, remove the unsuitable material to a further 300 mm and inspect.

9.1. Fill Placement & Compaction

It may be necessary to place and compact fill materials to establish the ground levels. All fill should be placed in a controlled manner as defined in Australian Standard "AS 3798 – Earthworks for residential and commercial developments". All the fills should be a controlled fill for the later site re-classification.

Filling materials should not contain vegetation or other organic matter. It is recommended that all compaction control testing in areas that will support structures and pavements be undertaken under appropriate supervision by an approved GITA.

Filling material should be placed with density ratio and moisture content specified in Table .

Table 3 – Compaction specifications

Fill	Loose layer thickness (mm)	Minimum density ratio	Moisture
General filling	250	95%	± 2 % OMC
Engineered filling to support pavement, subgrades and structures	250	98%	± 2 % OMC

OMC – Optimum Moisture Content (for compaction)

General filling to form the platform with a compaction ratio of less than 98%, can't be relied on as appropriate foundation strata for the shallow footings.

Granular filling is preferred although clay soils may be suitable for general filling provided they are of low to medium plasticity. The maximum particle size for any placed fill should be 75mm nominal diameter. Shale, clay or sand materials may be used for general filling but are not suitable for upper pavement layers of select fill. Pavement fill layer properties, thicknesses and material requirements are not commented on in this report and should form part of the civil/structural drawings.

9.2. Cut & Fill Batters

The earthworks plan, sediment control and drainage plan should be prepared by a civil engineer. All designed fill batters should be constructed no steeper than 2.5:1 (horizontal: vertical). All batters must be protected against erosion by vegetating the exposed surface as soon as possible following construction and incorporate toe and spoon drains as means of controlling surface water flows on the batters. During earthworks operations, installation of silt fences, hay bales or equivalent sediment erosion controls should be undertaken where runoff will exit the site, to limit sediment runoff from the site during construction.

10. LIMITATIONS

Alliance Geotechnical Pty Ltd (AG) has prepared this report for the site located at Jordan Springs Boulevard (Lot 3991 DP 1190132), Jordan Springs, NSW, in accordance with AG's fee proposal and Terms of Engagement. This geotechnical report has been prepared for Lendlease for this project and for the purposes outlined in this report.

This preliminary site classification and the allowable bearing pressure for the footings are based on the current condition of the site and will need to be reviewed on completion of the any cut/fill earthworks and subdivision construction.

This report cannot be relied on for other projects, other parties on this site or any other site. The comments and recommendations provided in this report are based on the assumption that the geotechnical recommendations contained in this report will be fully complied with during the design and construction of the proposed site development

The borehole investigation and testing results provided in this report are indicative of the subsurface conditions at the site only at the specific sampling and testing locations, and to the depths drilled at the time of the investigation. Subsurface conditions can change significantly due to geological and human processes. Where variations in conditions are encountered further geotechnical advice should be sought from AG.

Reviewed



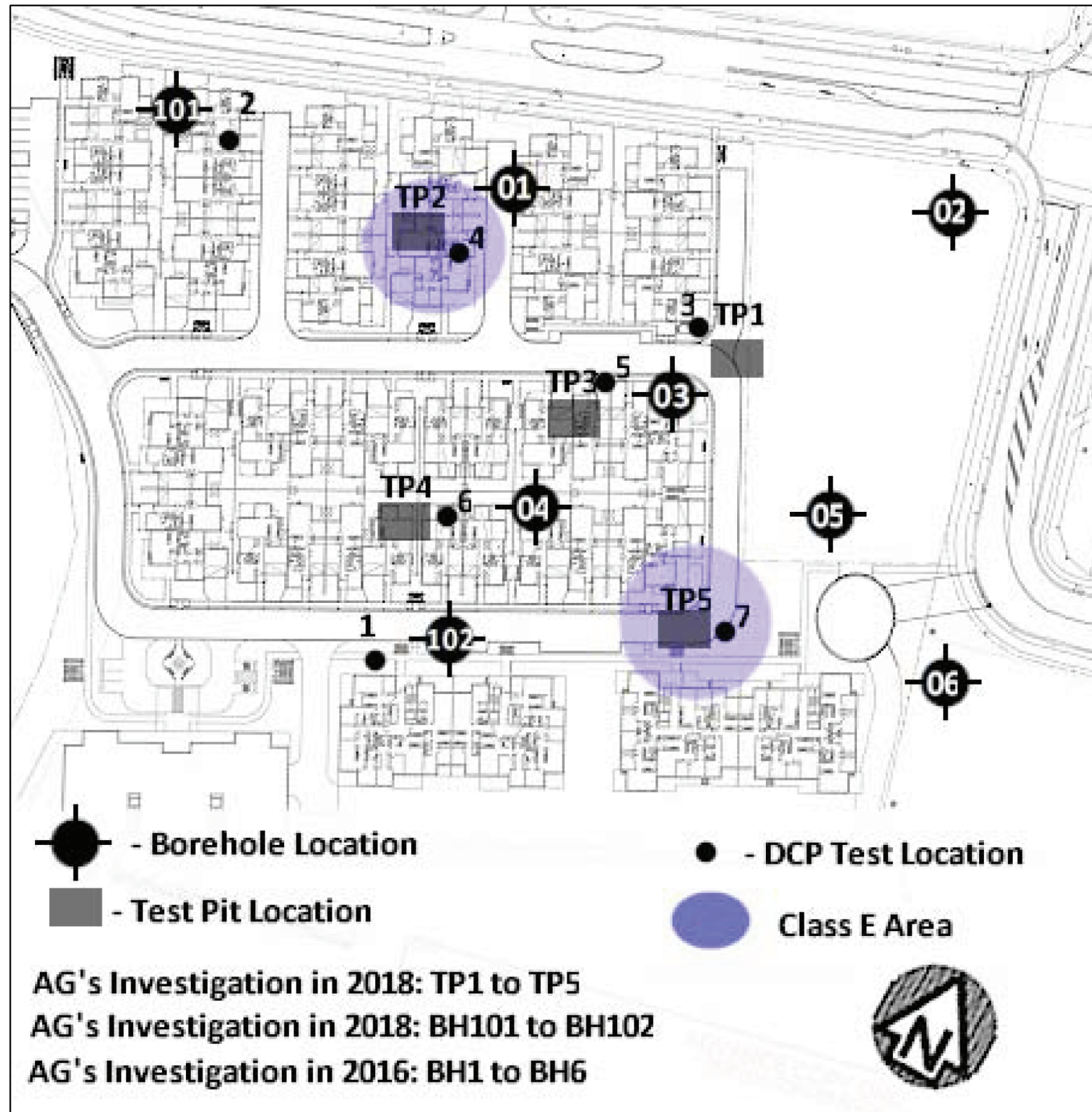
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References

- AS1726-1993 - Geotechnical Site Investigations
- AS 1289 – 2006 - Method of testing soils for engineering purposes
- AS 2159-2009 - Piling - Design and Installation
- AS2870-2011 - Residential slabs and Footings Construction
- AS 3798 – 2007 - Guidelines on Earthworks for Commercial and Residential Developments
- Pells et al "Foundations on Sandstone and Shale in the Sydney Region" AGJ, 1998
- The 1:100,000 NSW Department of Mineral Resources Geological Map of Penrith



Source: Site Grading (ref: 110487SK/SK07, prepared by J. Wyndham Price)

Not to Scale





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Dynamic Cone Penetrometer Test Report

Client:	Lendlease	Report Number:	6715-GR-1-2-Rev A
Project Name:	Proposed Retirement Village (51 Villas)	Report Date:	30/05/2018
Project Location:	Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs, NSW 2747	Date Tested:	13/03/2018
Test Method:	AS 1289 6.3.2		

Test Number	DCP-1	DCP-2	DCP-3	DCP-4	DCP-5
Test Location	Refer Drawing 6715-GR-1-2-A				
R.L (AHD)					
Depth (meters)					
0.00 – 0.15	17	16	2	2	5
0.15 – 0.30	17	21	3	8	15
0.30 – 0.45	24	24	17	8	21
0.45 – 0.60	>25	>25	19	10	25
0.60 – 0.75			14	8	11
0.75 – 0.90			12	4	25
0.90 – 1.05			10	8	25
1.05 – 1.20			9	12	15
1.20 – 1.35			17	21	16
1.35 – 1.50			21	>25 (Refusal)	12
1.50 – 1.65			21		11
1.65 – 1.80					8

Test Number	DCP-6	DCP-7
Test Location	Refer Drawing 6600-GR-1-A	Refer Drawing 6600-GR-1-A
R.L (AHD)		
Depth (meters)		
0.00 – 0.15	4	2
0.15 – 0.30	16	14
0.30 – 0.45	16	20
0.45 – 0.60	11	22
0.60 – 0.75	9	13
0.75 – 0.90	9	11
0.90 – 1.05	7	10
1.05 – 1.20	5	7
1.20 – 1.35	5	6
1.35 – 1.50	6	5
1.50 – 1.65	5	6
1.65 – 1.80	7	6
1.80 – 1.95	12	
1.95 – 2.10	16	
2.10 – 2.25	11	

Borehole Log

Client: Lendlease	Started: 13-3-18
Project: Proposed Retirement Village (51 Villas)	Finished: 13-3-18
Location: Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: N/A
Rig Type: 15T Excavator	Hole Location: Refer Drawing: 6715-GR-1-2-A
Driller: D. Vela	Logged: MS
RL Surface: 37.4	Contractor: MatVel Excavations
Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
E				No Groundwater Encountered		TOPSOIL: Clayey SILT, low plasticity, brown, with fine grained sand		SM		TOPSOIL
		37.0	0.5	CL	CL	Sandy CLAY, medium plasticity, orange and yellow brown, fine grained sand, with rootlets	Plasticity Index	SM	H	ALLUVIUM
		36.5	1.0	CI	CI	Silty CLAY, medium plasticity, red mottled grey and brown, trace fine grained sand, trace rootlets		M	VST	
		36.0	1.5	CI	CI	As above, with subrounded fine gravel		M	H	
						Borehole TP 1 terminated at 1.6m				End of Test Pit
		35.5	2.0							
		35.0	2.5							
		34.5	3.0							
		34.0	3.5							
		33.5	4.0							
		33.0	4.5							
		32.5	5.0							

BOREHOLE / TEST PIT 6715 TEST PITS 1-5.GPJ GINT STD AUSTRALIA.GDT 30-5-18

Borehole Log

Client: Lendlease	Started: 13-3-18
Project: Proposed Retirement Village (51 Villas)	Finished: 13-3-18
Location: Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: N/A
Rig Type: 15T Excavator	Hole Location: Refer Drawing: 6715-GR-1-2-A
Driller: D. Vela	Logged: MS
RL Surface: 39.3	Contractor: MatVel Excavations
Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
E	No Groundwater Encountered		39.0	0.0	CH	TOPSOIL: Silty CLAY, low plasticity, red-brown, trace subrounded fine gravel, with roots/rootlets		SM		TOPSOIL
			0.5	0.5	CH	Silty CLAY, high plasticity, red mottled brown, trace fine subrounded gravel, trace roots/rootlets		SM	VSt	ALLUVIUM
			38.5	1.0	CH	As above, red mottled grey, moist		M	VSt - H	
			38.0	1.5			Plasticity Index			
			37.5	2.0		Borehole TP 2 terminated at 1.4m				End of Test Pit
			37.0	2.5						
			36.5	3.0						
			36.0	3.5						
			35.5	4.0						
			35.0	4.5						
			34.5	5.0						

BOREHOLE / TEST PIT 6715 TEST PITS 1-5.GPJ GINT STD AUSTRALIA.GDT 30-5-18

Borehole Log




Client: Lendlease	Started: 13-3-18
Project: Proposed Retirement Village (51 Villas)	Finished: 13-3-18
Location: Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: N/A
Rig Type: 15T Excavator	Hole Location: Refer Drawing: 6715-GR-1-2-A
Driller: D. Vela	Logged: MS
RL Surface: 38.2	Contractor: MatVel Excavations
Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
E		38.0	0.0	[Graphic Log: Dotted pattern]		TOPSOIL: Clayey SILT, low plasticity, brown, with fine grained sand		M		TOPSOIL
	No Groundwater Encountered		0.5	[Graphic Log: Diagonal hatching]	CL	Silty CLAY, medium plasticity, yellow brown mottled brown, with fine grained sand, trace roots		SM	H	ALLUVIUM
		37.5	1.0	[Graphic Log: Dashed line]	CI-CH	Silty CLAY, medium to high plasticity, orange mottled grey, with fine grained sand		SM	H	
		37.0	1.4	[Graphic Log: Dashed line]	CI-CH	As above, red mottled grey, moist		M	VSt	
			1.5			Borehole TP 3 terminated at 1.4m				End of Test Pit
		36.5	2.0							
		36.0	2.5							
		35.5	3.0							
		35.0	3.5							
		34.5	4.0							
		34.0	4.5							
		33.5	5.0							

BOREHOLE / TEST PIT 6715 TEST PITS 1-5.GPJ GINT STD AUSTRALIA.GDT 30-5-18

Borehole Log

Client: Lendlease		Started: 13-3-18	
Project: Proposed Retirement Village (51 Villas)		Finished: 13-3-18	
Location: Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs, NSW 2747		Borehole Size: N/A	
Rig Type: 15T Excavator	Hole Location: Refer Drawing: 6715-GR-1-2-A	Driller: D. Vela	Logged: MS
RL Surface: 38.2	Contractor: MatVel Excavations	Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
E	No Groundwater Encountered	38.0	0.5		CI-CH	TOPSOIL: Silty CLAY, low plasticity, brown, with fine grained sand, with roots/rootlets		M		TOPSOIL
		37.5			CI-CH	Silty CLAY, medium to high plasticity, orange mottled brown, with fine grained sand, with subrounded gravel		SM	H	ALLUVIUM
		37.5			CH	CLAY, high plasticity, red mottled grey		M	St - Vst	RESIDUAL
			1.0			Borehole TP 4 terminated at 0.8m				End of Test Pit
		37.0	1.5							
		36.5	2.0							
		36.0	2.5							
		35.5	3.0							
		35.0	3.5							
		34.5	4.0							
		34.0	4.5							
		33.5	5.0							

BOREHOLE / TEST PIT 6715 TEST PITS 1-5.GPJ GINT STD AUSTRALIA.GDT 30-5-18

Borehole Log







Client: Lendlease	Started: 13-3-18
Project: Proposed Retirement Village (51 Villas)	Finished: 13-3-18
Location: Lot 3991 of DP 1190132, Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: N/A
Rig Type: 15T Excavator	Hole Location: Refer Drawing: 6715-GR-1-2-A
Driller: D. Vela	Logged: MS
RL Surface: 37.0	Contractor: MatVel Excavations
Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
E	No Groundwater Encountered		0.5	[Dotted Pattern]	CI	TOPSOIL: Silty CLAY, low plasticity, brown, with fine grained sand, trace fine subrounded gravel, with roots/rootlets		M		TOPSOIL
			1.0	[Diagonal Hatching]	CH	CLAY, high plasticity, red mottled grey	Plasticity Index	SM	H	ALLUVIUM
			1.5	[Diagonal Hatching]			M	St	RESIDUAL	
			2.0			Borehole TP 5 terminated at 1.5m				End of Test Pit
			2.5							
			3.0							
			3.5							
			4.0							
			4.5							
			5.0							

BOREHOLE / TEST PIT 6715 TEST PITS 1-5.GPJ GINT STD AUSTRALIA.GDT 30-5-18

Borehole Log

Client: Lendlease Pty Ltd		Started: 9-2-18	
Project: Proposed Retirement Village (51 Villas)		Finished: 9-2-18	
Location: Lot 3991, Jordan Springs Boulevard, Jordan Springs, NSW		Borehole Size: 125mm	
Rig Type: Hanjin D&B	Hole Location: Refer Drawing 6715-GR-1-A	Driller: B.S	Logged: DJ
RL Surface: 40.96	Contractor: Rockwell P/L	Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
ADT	None Observed	40	1		CI - CH	TOPSOIL/FILL: Clayey Sandy Silt, grey/brown, grass roots FILL: Silty Clay, medium to high plasticity, brown, with fine to medium gravel, organics (plant fibres, rootlets etc.). Appears well compacted		D	VSt - H	TOPSOIL/FILL FILL
					CI - CH	Silty CLAY, medium to high plasticity, brown mottled grey/red mottled grey		D	VSt - H	ALLUVIUM
					CI - CH	As above, but grey mottled red		D	VSt - H	
					CI - CH	As above, but red to red mottled grey		D	VSt - H	
		39	2		CH	Silty CLAY, high plasticity, red and grey, trace ironstone gravel and extremely weathered siltstone fragments		D	VSt - H	RESIDUAL
		38	3		CH	Silty CLAY, high plasticity, red and grey, trace ironstone gravel and extremely weathered siltstone fragments		D	VSt - H	RESIDUAL
		37	4			Borehole BH 101 terminated at 4m				
		36	5							
		35	6							
		34	7							

BOREHOLE / TEST PIT 6715-101-102.GPJ GINT STD AUSTRALIA.GDT 30-5-18

Borehole Log

Client: Lendlease Pty Ltd	Started: 9-2-18
Project: Proposed Retirement Village (51 Villas)	Finished: 9-2-18
Location: Lot 3991, Jordan Springs Boulevard, Jordan Springs, NSW	Borehole Size: 125mm
Rig Type: Hanjin D&B	Hole Location: Refer Drawing 6715-GR-1-A
Driller: B.S	Logged: DJ
RL Surface: 37.63	Contractor: Rockwell P/L
Bearing: ---	Checked: LM

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
ADT					Cl - CH	TOPSOIL: Silt/Clayey Silt, brown and grey, with grass roots Silty CLAY, medium to high plasticity, brown/dark brown, trace of fine to medium sand, trace fine to medium subrounded to subangular gravel, organics (plant fibres, rootlets etc.)		D	Vst - H	TOPSOIL ALLUVIUM
	None Observed	37	1		Cl - CH	Silty CLAY, medium to high plasticity, grey and brown/grey, trace of fine to medium sand, trace fine to medium subrounded to subangular gravel		D	Vst - H	RESIDUAL
		36	2		Cl - CH	As above, but grey/brown and red/brown		D	Vst - H	
		35	3		Cl - CH	Silty CLAY, medium to high plasticity, grey, trace of ironstone gravel and extremely weathered siltstone fragments		D	Vst - H	
		34	4			Borehole BH 102 terminated at 4m				
		33	5							
		32	6							
		31	7							

BOREHOLE / TEST PIT 6715-101-102.GPJ GINT STD AUSTRALIA.GDT 30-5-18



Borehole Log

Client: Investor Property Holdings Pty Ltd				Started: 29/11/16						
Project: Proposed Mixed-Use Development - Stage 1				Finished: 29/11/16						
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747				Borehole Size: 110mm						
Rig Type: MD300 Drill		Hole Location:		Driller: HD		Logged: LM				
RL Surface: 38.5		Contractor: AG P/L		Bearing: ---		Checked: SM				
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition Consistency/Density Index	Additional Observations	
ADT	Dry Before Coring	38	0			TOPSOIL/FILL: Clayey Silt, brown, with gravel, grass roots		D	TOPSOIL/FILL	
						FILL: Mixture of Silty Clay high plasticity, with Gravelly Shaley Clay, brown/grey and red, fine to coarse gravel, with some sand. Appears well compacted	CBR Sample SPT 6, 10, 9 N=19	D	FILL	
			2			CH	Silty CLAY, red and brown, high plasticity	Aggressivity Sample	M	Vst H
								SPT 9, 8, 10 N=18		
			36			CH	Silty CLAY, grey and red, high plasticity, trace of fine gravel		M	H
								SPT 10, 11, 12 N=23		
			34			CI	Shaley CLAY/Gravelly Silty CLAY, grey and red/brown, medium plasticity, fine to coarse ironstone and shale gravel	Aggressivity Sample	M	H
										BEDROCK
			6				SHALE, grey and brown, extremely to highly weathered, extremely low to very low strength, with some clay bands. Moderate TC bit resistance			
			32				SHALE, grey and dark grey, highly weathered, very low to low strength. High TC bit resistance			
						SHALE, grey and brown/light brown, extremely to highly weathered, extremely low strength, with clay bands. Low to moderate TC bit resistance				
						SHALE, grey and brown, highly weathered, very low strength, with clay bands. Low TC bit resistance				
		8				Borehole BH 1 continued as cored hole				
		30								
			10							
		28								
			12							
		26								

BOREHOLE / TEST PIT GINT LOGS BH1TOBH6_JORDANSPRINGS.GPJ_GINT STD AUSTRALIA.GDT 8/12/16



Cored Borehole Log

Client: Investor Property Holdings Pty Ltd **Started:** 29/11/16
Project: Proposed Mixed-Use Development - Stage 1 **Finished:** 29/11/16
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747 **Borehole Size:** 110mm

Rig Type: MD300 Drill **Hole Location:** **Driller:** HD **Logged:** LM
RL Surface: 38.5 **Contractor:** AG P/L **Bearing:** --- **Checked:** SM

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength				Is ₍₅₀₎ MPa D- diam- etral A- axial	RQD %	Defect Spacing mm	Additional Data
							EL _{-0.0}	VL _{-0.0}	J _{-0.3}	W ₋₁				
		38												
			2											
		36												
			4											
		34												
			6											
		32												
					Continued from non-cored borehole									
NMLC			8		SHALE, grey and dark grey	HW				A 0.06			7.50m, EW Seam, 110mm 7.72m, Joint, 60°, Curved 7.85m, Joint, 45°, Planar 7.96m, Joint, 70°, Curved 8.06m, Clay Seam, 70mm 8.19m, Clay Seam, 40mm 8.36m, Joint, 70°, Curved 8.53m, EW Seam, 120mm 8.76m, Joint, 65°, Planar 8.80m, Joint, 85°, Planar 9.08m, Crushed Seam, 70mm with Joint 50° 9.15m, Clay Seam, 22mm 9.17m, Joint, 65°, Curved 9.28m, Joint, 80°, Curved 9.34m, EW Seam, 40mm	
	Full Return	30			SHALE/SILTSTONE, grey with dark grey laminations	HW/MW				D A 0.27 0.17	44			
			10							D A 0.85 0.56 D A 0.39 1.07 A 0.74				
		28			BH 1 terminated at 10.48m					D A 0.5 1.09 A 3.41			End of BH1	
			12											
		26												

CORED BOREHOLE GINT LOGS BH1TOBH6 JORDANSPRINGS GPJ GINT STD AUSTRALIA GDT 8/12/16



Borehole Log

Client: Investor Property Holdings Pty Ltd	Started: 1/12/16		
Project: Proposed Mixed-Use Development - Stage 1	Finished: 1/12/16		
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: 110mm		
Rig Type: MD300 Drill	Hole Location:	Driller: HD	Logged: LM
RL Surface: 36.5	Contractor: AG P/L	Bearing: ---	Checked: SM

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
ADT			36				FILL: Mixture of Silty Clay and Gravelly Shaley Clay, medium to high plasticity, dark grey and brown, with fine to coarse shale gravel. Appears well compacted	CBR Sample SPT 7, 9, 9 N=18	M		FILL
				2			FILL: Gravelly Silty and Shaley Clay, medium plasticity, mixed with some fine to coarse shale gravel and some sand, dark brown and grey. Appears well compacted		M		
			34								
				4			FILL: Silty Clay medium plasticity, grey/dark grey and brown/yellow, with fine to coarse shale gravel and some fine to coarse sand. Appears well compacted	SPT 4, 6, 7 N=13 Aggressivity Sample	M		
			32								
				6				SPT 3, 6, 6 N=12 Aggressivity Sample			
			30				SHALE, grey and dark grey/brown, extremely to highly weathered, very low strength, with frequent clay bands. Moderate TC bit resistance				BEDROCK
				8			Borehole BH 2 terminated at 7.5m				TC Bit Refusal
			28								
				10							
			26								
				12							
			24								

BOREHOLE / TEST PIT GINT LOGS BH1TOBH6_JORDANSPRINGS.GPJ_GINT STD AUSTRALIA.GDT 8/12/16



Borehole Log

Client: Investor Property Holdings Pty Ltd				Started: 29/11/16												
Project: Proposed Mixed-Use Development - Stage 1				Finished: 29/11/16												
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747				Borehole Size: 110mm												
Rig Type: MD300 Drill		Hole Location:		Driller: HD		Logged: LM										
RL Surface: 37.5		Contractor: AG P/L		Bearing: ---		Checked: SM										
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations						
ADT		36	2		CI - CH	TOPSOIL/FILL: Clayey Silt, light brown, with gravel, grass roots	CBR Sample SPT 5, 5, 10 N=15	D		TOPSOIL/FILL						
						FILL: Mixed Silty Clay of medium to high plasticity with Sandy Clay of low to medium plasticity, brown/red and grey, with some gravel and fine to coarse sand. Appears well compacted				M	FILL					
						After 24hrs ~ 4m Depth Below Surface		34	4		CH	Silty CLAY, orange/grey mottled brown, medium to high plasticity, with fine to coarse (dark red bands) ironstone gravel	SPT 4, 6, 8 N=14	M	VS	ALLUVIUM
												Silty CLAY, red/brown and grey, high plasticity, with some fine to coarse ironstone and shale gravel				
						Dry on Completion		32	6			SHALE, grey and brown, extremely to highly weathered, extremely to very low strength, with frequent clay bands. Low to moderate TC bit resistance				BEDROCK
SHALE, light grey and brown, highly weathered, very low strength. Moderate TC bit resistance																
		30	8			SHALE, light grey and brown, highly weathered, very low strength. Moderate TC bit resistance										
		28	10			Borehole BH 3 terminated at 8.4m				TC Bit Refusal						
		26	12													

BOREHOLE / TEST PIT GINT LOGS BH1TOBH6 JORDANS SPRINGS.GPJ GINT STD AUSTRALIA.GDT 8/12/16



BH No: BH 4
Sheet: 1 of 1
Job No: 2625

Borehole Log

Client: Investor Property Holdings Pty Ltd				Started: 1/12/16											
Project: Proposed Mixed-Use Development - Stage 1				Finished: 1/12/16											
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747				Borehole Size: 110mm											
Rig Type: MD300 Drill		Hole Location:		Driller: HD		Logged: LM									
RL Surface: 37.7		Contractor: AG P/L		Bearing: ---		Checked: SM									
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations					
ADT	After 4hrs ~ 3.5m Depth Below Surface	36	2			TOPSOIL/FILL: Clayey Silt, grey/brown, with gravel, grass roots	SPT 8, 8, 12 N=20	D		TOPSOIL/FILL					
						FILL: Mixture of Silty Clay high plasticity with some Gravelly Shaley Clay, brown/red and grey, fine to coarse gravel, with some fine to coarse sand. Appears well compacted				D	FILL				
						CH	Silty CLAY, red and orange/brown, high plasticity, with fine to coarse ironstone gravel	SPT 7, 7, 14 N=21	M	VSI	ALLUVIUM				
						CH	Silty CLAY, red/brown and grey, high plasticity				H	RESIDUAL			
							34	4		CI	Shaley CLAY/Gravelly Silty CLAY, grey and red/brown, medium plasticity, fine to coarse ironstone and shale gravel		M	H	
							32	6			SHALE, grey and brown, extremely to highly weathered, extremely to very low strength, with some fine grained sandstone and clay bands/layers. Extremely low to low TC bit resistance				BEDROCK
											SHALE, grey and dark grey, highly weathered, very low strength, with occasional clay bands. Moderate to high TC bit resistance				
		30	8			Borehole BH 4 terminated at 7.2m				TC Bit Refusal					
		28	10												
		26	12												

BOREHOLE / TEST PIT GINT LOGS BH10BH6_JORDANSPRINGS.GPJ_GINT STD AUSTRALIA.GDT 8/12/16



Borehole Log

Client: Investor Property Holdings Pty Ltd	Started: 30/11/16		
Project: Proposed Mixed-Use Development - Stage 1	Finished: 30/11/16		
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: 110mm		
Rig Type: MD300 Drill	Hole Location:	Driller: HD	Logged: LM
RL Surface: 36.5	Contractor: AG P/L	Bearing: ---	Checked: SM

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition	Consistency/Density Index	Additional Observations
ADT	After 24hrs & After 48hrs	Slight Seepage	36	0			TOPSOIL/FILL: Clayey Silt, brown, with gravel, grass roots FILL: Mixed Silty Clay high plasticity with Gravelly Sandy Clay medium plasticity, brown/red and grey, with fine to coarse sand. Appears well compacted	CBR Sample SPT 7, 12, 11 N=23	D - M		TOPSOIL/FILL FILL
			2	2		CH	Silty CLAY, red and orange/brown, high plasticity, with fine to coarse ironstone gravel		M	Vst	ALLUVIUM
			34	4		CH	Silty CLAY, red/brown and grey, high plasticity, with fine to coarse ironstone gravel		M	Vst	RESIDUAL
			4	4		CI	Gravelly Shaley CLAY/Shale and Sandstone layers, medium plasticity, with some red ironstone gravel bands		M	Vst - H	RESIDUAL/ROCK
			32	4			SHALE, grey and brown, extremely weathered, extremely low strength, with frequent clay bands. Extremely low TC bit resistance				BEDROCK
			6	6			SHALE, grey and brown, highly weathered, very low strength, with occasional shaley clay bands. Moderate TC bit resistance				
			30	6				Aggressivity Sample			
			28	8			Borehole BH 5 terminated at 7.6m				TC Bit Refusal
			26	10							
			24	12							

BOREHOLE / TEST PIT GINT LOGS BH10BH6_JORDANSPRINGS.GPJ_GINT STD AUSTRALIA.GDT 8/12/16



Borehole Log

Client: Investor Property Holdings Pty Ltd				Started: 30/11/16						
Project: Proposed Mixed-Use Development - Stage 1				Finished: 30/11/16						
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747				Borehole Size: 110mm						
Rig Type: MD300 Drill		Hole Location:		Driller: HD		Logged: LM				
RL Surface: 36.2		Contractor: AG P/L		Bearing: ---		Checked: SM				
Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Samples Tests Remarks	Moisture Condition Consistency/Density Index	Additional Observations	
ADT		36				TOPSOIL/FILL: Clayey Silt, brown, with gravel, grass roots		D	TOPSOIL/FILL	
						FILL: Mixed Silty Clay of medium to high plasticity with Silty Sandy Clay, high plasticity, brown/red and grey, with fine to coarse sand. Appears well compacted	CBR Sample	D - M	FILL	
						FILL: Silty Clay of high plasticity, mixed with some gravel, red and grey, trace of sand. Appears well compacted	SPT 6, 8, 8 N=16	M		
		34	2		CI	Silty CLAY, orange/grey mottled brown, medium to high plasticity, with fine to coarse ironstone gravel	SPT 3, 5, 8 N=13	M	VSI	ALLUVIUM
						Silty CLAY, red/brown and grey, high plasticity, with some fine to coarse ironstone and shale gravel	SPT 6, 8, 12 N=20	M	H	RESIDUAL
		32	4		CI	Gravelly Silty CLAY/Shaley CLAY, grey and brown/red, medium plasticity, fine to coarse ironstone and shale gravel		M	H	
						SHALE, grey and brown, extremely weathered, extremely low strength, with frequent clay bands. Low TC bit resistance				BEDROCK
			8			SHALE, grey and brown, highly weathered, very low strength, interlayered with shaley clay bands of medium plasticity. Extremely low to moderate TC bit resistance				
			26			Borehole BH 6 continued as cored hole				
			24							

BOREHOLE / TEST PIT GINT LOGS BH10BH6 JORDANS SPRINGS.GPJ GINT STD AUSTRALIA.GDT 8/12/16

Slight Seepage



Cored Borehole Log

Client: Investor Property Holdings Pty Ltd	Started: 30/11/16
Project: Proposed Mixed-Use Development - Stage 1	Finished: 30/11/16
Location: Jordan Springs Boulevard, Jordan Springs, NSW 2747	Borehole Size: 110mm
Rig Type: MD300 Drill	Hole Location:
RL Surface: 36.2	Contractor: AG P/L
	Driller: HD
	Bearing: ---
	Logged: LM
	Checked: SM

Method	Water	RL (m)	Depth (m)	Graphic Log	Material Description	Weathering	Estimated Strength			Is ₍₅₀₎ MPa D- diam- etral A- axial	RQD %	Defect Spacing mm	Additional Data
							EL _{-0.00}	VL _{-0.00}	WL _{-0.3}				
		36											
			2										
		34											
			4										
		32											
			6										
		30											
			8										
		28											
NMLC	Full Return		10		Continued from non-cored borehole SHALE, grey and dark grey, with brown bands	HW/MW						0.00m, Fragmented core, 100mm with 2 clay seams 22mm and 24mm 9.00m, EW Seam, 28mm 9.16m, Joint, 35°, Curved	
					SANDSTONE, fine grained, light grey	MW							9.83m, Joint, 30°, Curved 9.95m, Joint, 45°, Curved
					SHALE, grey and dark grey, with brown bands	HW/MW							10.25-10.38m, SANDSTONE Band (fine grained)
					SHALE, grey and dark grey	HW							10.97m, Fragmented core, 80mm with clay seam
					SHALE, dark grey with grey laminations	HW/MW							11.24m, Joint, 45°, Planar 11.34m, EW Seam, 28mm 11.65m, EW Seam, 14mm 11.70m, EW Seam, 12mm
		24			BH 6 terminated at 12.53m							End of BH6	

CORED BOREHOLE GINT LOGS BH1 TO BH6 JORDANSPRINGS.GPJ GINT STD AUSTRALIA.GDT. 8/12/16

EXPLANATORY NOTES - DRILL & EXCAVATION LOGS

GENERAL

Information obtained from site investigations is recorded on log sheets. The "Cored Drill Hole Log" presents data from an operation where a core barrel has been used to recover material - commonly rock. The "Non-Core Drill Hole - Geological Log" presents data from an operation where coring has not been used and information is based on a combination of regular sampling and insitu testing. The material penetrated in non-core drilling is commonly soil but may include rock. The "Excavation - Geological Log" presents data and drawings from exposures of soil and rock resulting from excavation of pits, trenches, etc.

The heading of the log sheets contains information on Project Identification, Hole or Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material substance description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The common depth scale is 8m per drill log sheet and about 3-5m for excavation logs sheets.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classifications are based on SAA Site Investigation Code AS 1726 - 1993 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

DRILLING

Drilling & Casing

AS	Auger Screwing
AD/V	Auger Drilling with V-Bit
AD/T	Auger Drilling with TC Bit
WB	Wash-bore drilling
RR	Rock Roller
NMLC	NMLC core barrel
NQ	NQ core barrel
HMLC	HMLC core barrel
HQ	HQ core barrel

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage.



Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Date of measurement is shown.

	Standing water level measured in completed borehole
	Level taken during or immediately after drilling

Samples/Tests

D	Disturbed
U	Undisturbed
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (*sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Device
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer Test

EXCAVATION LOGS

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the "Structure and other Observations" column. The depth of the base of excavation (for the logged section) at the appropriate depth in the "Material Description" column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added.

MATERIAL DESCRIPTION - SOIL

Classification Symbol - In accordance with the Unified Classification System (AS 1726-1993, Appendix A, Table A1)

Material Description - In accordance with AS 1726-1993, Appendix A2.3

Moisture Condition

D	Dry, looks and feels dry
M	Moist, No free water on remoulding
W	Wet, free water on remoulding

Consistency - In accordance with AS 1726-1993, Appendix A2.5

VS	Very Soft	< 25kPa
S	Soft	25 - 50kPa
F	Firm	50 - 100kPa
St	Stiff	100 - 200kPa
VSt	Very Stiff	200 - 400kPa
H	Hard	≥ 400kPa

Strength figures quoted are the approximate range of Unconfined Compressive Strength for each class.

Density Index. (%) is estimated or is based on SPT results. Approximate N Value correlation is shown in right column.

VL	Very Loose	< 15%	0 - 4
L	Loose	15 - 35%	4 - 10
MD	Medium Dense	35 - 65%	10 - 30
D	Dense	65 - 85%	30 - 50
VD	Very Dense	> 85%	> 50

MATERIAL DESCRIPTION -ROCK

Material Description

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-1993, Appendix A3.1-A3.3 and Tables A6a, A6b and A7.

Core Loss

Is shown at the bottom of the run unless otherwise indicated.

Bedding

Description	Spacing (mm)
Thinly Laminated	< 6
Laminated	6 - 20
Very Thinly Bedded	20 - 60
Thinly Bedded	60 - 200
Medium Bedded	200 - 600
Thickly Bedded	600 - 2000
Very Thickly Bedded	> 2000

Weathering - No distinction is made between weathering and alteration. Weathering classification assists in identification but does not imply engineering properties.

Fresh (F)	Rock substance unaffected by weathering
Slightly Weathered (SW)	Rock substance partly stained or discoloured. Colour and texture of fresh rock recognisable.
Moderately Weathered (MW)	Staining or discolouration extends throughout rock substance. Fresh rock colour not recognisable.
Highly Weathered (HW)	Stained or discoloured throughout. Signs of chemical or physical alteration. Rock texture retained.
Extremely Weathered (EW)	Rock texture evident but material has soil properties and can be remoulded.

Strength - The following terms are used to describe rock strength:

Rock Strength Class	Abbreviation	Point Load Strength Index, $I_s(50)$ (MPa)
Extremely Low	EL	< 0.03
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	≥ 10

Strengths are estimated and where possible supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

- Diametral Point Load Test
- Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown.

MATERIALS STRUCTURE/FRACTURES

ROCK

Natural Fracture Spacing - A plot of average fracture spacing excluding defects known or suspected to be due to drilling, core boxing or testing. Closed or cemented joints, drilling breaks and handling breaks are not included in the Natural Fracture Spacing.

Visual Log - A diagrammatic plot of defects showing type, spacing and orientation in relation to core axis.

Defects		
	—————	Defects open in-situ or clay sealed
	-----	Defects closed in-situ
	Breaks through rock substance

Additional Data - Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS 1726-1993, Appendix A Table A10, notes and Figure A2.

Type		
	BP	Bedding Parting
	JT	Joint
	SM	Seam
	FZ	Fracture Zone
	SZ	Shear Zone
	VN	Vein
	FL	Foliation
	CL	Cleavage
	DL	Drill Lift
	HB	Handling break
	DB	Drilling break

Orientation - angle relative to the plane normal to the core axis.

Infilling	CN	Clean
	X	Carbonaceous
	Clay	Clay
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
	MS	Secondary Mineral
	MU	Unidentified Mineral
	Shape	PR
CU		Curved
UN		Undulose
ST		Stepped
IR		Irregular
DIS		Discontinuous
Roughness	POL	Polished
	SL	Slickensided
	S	Smooth
	RF	Rough
	VR	Very Rough

SOIL

Structures - Fissuring and other defects are described in accordance with AS 1726-1993, Appendix A2.6, using the terminology for rock defects.

Origin - Where practicable an assessment is provided of the probable origin of the soil, eg fill, topsoil, alluvium, colluvium, residual soil.

24 November 2008



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Dynamic Cone Penetrometer Test Report

Client:	Lendlease	Report Number:	6715-GR-1-1
Project Name:	Proposed Retirement Village (51 Villas)	Report Date:	26/02/2018
Project Location:	Lot 3991 of DP 1190132, Jordan Springs, Boulevard, Jordan Springs, NSW 2747	Date Tested:	07/02/2018
Test Method:	AS 1289 6.3.2		

Test Number	DCP-1	DCP-2
Test Location	Refer Drawing 6715-GR-1-A	
R.L (AHD)		
Depth (meters)		
0.00 – 0.15	17	16
0.15 – 0.30	17	21
0.30 – 0.45	24	24
0.45 – 0.60	>25	>25
0.60 – 0.75		
0.75 – 0.90		