

### **Appian Group**

### Wyong Hospital Redevelopment

Geotechnical Investigation

15 September 2014



Real potential is uncovered only when you scratch beneath the surface This page has been left intentionally blank

### **Wyong Hospital Redevelopment**

Prepared for Appian Group

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#### **Document authorisation**

Our ref: GEOTWARA22354AA-AB

Coffey Pty Ltd (Coffey) is pleased to present our Geotechnical Investigation Report on the proposed Wyong Hospital redevelopment. The report presents the findings of the investigation and recommendations based on the conditions encountered. A separate report for the environmental assessment is provided in Coffey report ref. GEOTWARA22354AA-AC.

Guidance on the uses and limitations of this report is presented in the attached sheet, 'Important Information about your Coffey Report', which should be read in conjunction with this report.

If you have any questions regarding this report or should you require further assistance on this project, please contact the undersigned.

For and on behalf of Coffey

Author land

Arthur Love Senior Principal Geotechnical Engineer

## **Quality information**

### **Revision history**

Revision	Description	Date	Authors	Reviewer	Signatory
v1	Preliminary Geotechnical Report	15/09/2014	James Rayner, Sasi Sasiharan	Arthur Love	Arthur Love

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## 1. Introduction

This report presents the results of a geotechnical investigation carried out by Coffey Pty Ltd (Coffey) on behalf of Health Infrastructure, NSW (the Principal) and Appian Group (Principal's representative) for the proposed additions to Wyong Hospital, NSW.

The Investigation was undertaken in general accordance with the scope of works presented in our proposal; reference GEOTWARA22354-AA, dated 01 July 2014. A separate report presenting the environmental assessment for the site is provided in Coffey report ref. GEOTWARA22354AA-AC.

It is understood that the project is currently at an early planning stage and that the results of this investigation will be used to further refine the proposed development and to assist with civil/structural design.

The following document was referred to by Coffey in preparation of this report:

 "Wyong Hospital Redevelopment Planning - Geotechnical and Environmental Testing Scope of Works".

Based on the above document provided by Appian, the proposed redevelopment is likely to comprise:

- Construction of a new 3-4 storey building to the south of the existing main building. A single storey basement level may also be required;
- Demolition of an existing building, and construction of a car park to the east of the existing main building;
- Expansion of the existing main building to the south;
- Expansion of the existing mental health unit building, to the east and west; and,
- Construction of a new on-ground car park to the west of the existing buildings, and south of existing car parks.

The location of the proposed buildings and car parks are shown on Figure 1.

Proposed investigation locations were identified by Health Infrastructure with basic layout drawings supplied to us as part of the brief.

The objectives of the geotechnical investigation are to assess subsurface conditions and to provide comments and recommendations on geotechnical aspects as set out in the brief.

## 2. Scope of Works

Our scope of work comprised the drilling of 12 boreholes and excavation of 10 test pits at predetermined locations across the site and preparation of a geotechnical investigation report to provide advice and recommendations on the following:

- Existing ground conditions;
- Likely groundwater conditions;
- Excavation characteristics;
- Preliminary advice on temporary/permanent support requirements;
- Retaining wall design parameters;
- Foundation design parameters and suitable footing types;
- Potentially reactive (shrink/swell) foundation soils;
- The geotechnical suitability of excavated material for re-use as fill;
- Potential for slope instability and need for shoring or retaining of excavations;

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- Mine subsidence provisions;
- Earthquake provisions; and
- Pavement design.

An environmental assessment has also been completed on this site and the results of this assessment will be provided in a separate report (Coffey ref. GEOTWARA22354AA-AC).

## 3. Site Information

### 3.1. Published Geology

With reference to the 1:100,000 scale Gosford-Lake Macquarie Geology series sheet, the site is judged to be underlain by Patonga Claystone of the Narrabeen Group. The Patonga claystone is described as red-brown and grey-green claystone and siltstone, grey siltstone and laminate, fine lithic sandstone.

## 3.2. Site Description

The site is located at Wyong Hospital and is bounded by bushland to the west, residential developments to the north, Wyong Health Centre to the south and the Pacific Highway to the east.

The site of the proposed 3-4 storey building is currently occupied by an asphalt paved car park with Reduced Levels (RL) of between 16.0m and 19.0m AHD.

Immediately to the east of the main car park is a slight slope of about 5°-10°, grading up towards the north-east to the previously existing emergency department. This site is proposed to be used as a car park and drop off area. RL's in this area range from approximately 20.0m AHD in the south-west corner to 27.0m AHD in the north-east corner of the site.

The site of the proposed additions to the mental health building lies on gently sloping grassy land of about 5° on the south-west side of the building to relatively flat land on the north-east side of the building with areas of asphalt paved car parking. RL's in the vicinity of this site range from 25.0m to 27.0m AHD.

The proposed car park area to the west of the main building comprises sloping bushy land of about 5° at the southern end of the site. The northern end of the site comprises a previously existing dam that has since been filled with earth fill. This portion of the site is currently used as temporary car parking. RL's in this area range from 17.0m AHD at the southern end of the site to 26.0m AHD at the northern end of the site.

## 3.3. Acid Sulfate Soils

Based on the published acid sulfate soils risk maps, the site is located in an area not known to contain acid sulfate soils.

### 3.4. Previous Investigations

Several geotechnical investigations have been undertaken for the Wyong Hospital site pertaining to various stages of the development. The following reports have been completed on the various areas of the site:

- Golder Associates (1977). Foundation Investigation For Proposed Wyong District Hospital (Ref No. 77264);
- Coffey (2001). Wyong Hospital Redevelopment Geotechnical Assessment (Ref. GO1237/1-AB);
- Douglas Partners (2003). Geotechnical Investigation Proposed Wyong Hospital Redevelopment (Ref. 34500A);
- RCA Australia (2011). Central Coast Regional Cancer Care Centres Wyong Hospital (Ref. 8296-202/0); and
- Coffey (2013). Wyong Emergency Medical Unit / Urgent Care Centre Geotechnical Report (Ref. GEOTWARA21956AA-AB).

## 4. Field Work

The fieldwork for this investigation was conducted between the 12 and 19 August 2014, and comprised the following:

- Twelve boreholes (BH01 to BH12) drilled using truck/track mounted drilling rigs; and
- Ten test pits (TP01 to TP10) excavated using an 8 tonne backhoe.

Figure 1 shows the approximate borehole and test pit locations.

A Coffey Geotechnical Engineer was present throughout the fieldwork to conduct;

- Geotechnical sampling and testing, record test results and log materials encountered;
- Environmental sampling/testing;
- Liaison with Principal's representatives and contractors; and
- Implementation of the Site Specific Health, Safety and Environmental Management Plans.

## 4.1. Borehole Drilling

The boreholes were drilled using truck and track mounted drilling rig. Each borehole was advanced using solid flight augers with either a "V-bit" or tungsten carbide (TC) drill bit until refusal on rock at depths between 1.6m and 10.0m.

Standard Penetration Testing (SPT) was carried out at selected depth intervals to assess soil strength and obtain samples for logging purposes. Environmental samples were also collected at selected depth intervals in the upper 1m at each borehole.

Following "V-bit" or TC bit refusal on rock the boreholes were cored using a core barrel to depths of between 4.55m and 13.0m.

Groundwater inflows and soil moisture observed during drilling in soil were recorded. Groundwater observations were not possible in the cored sections of the boreholes during drilling as water was used as a drilling fluid. All boreholes were backfilled with cuttings to the surface in grassed areas or in paved areas to about 0.1m below ground level, and the pavement repaired at surface with bitumen. Three groundwater monitoring wells were installed for the purpose of monitoring ground water levels across the site of the proposed 3-4 storey building.

## 4.2. Test Pitting

The test pits were excavated using an 8 Tonne Backhoe with a 450mm toothed bucket attachment to depths of up to 1.9m or until refusal in weathered sandstone. Environmental samples and bulk samples were collected at selected depth intervals.

Dynamic Cone Penetrometer (DCP) test were performed at each test pit location.

Borehole and test pit locations were marked on the site survey plan supplied by the client and approximate interpreted reduced levels noted on the logs.

## 5. Laboratory Testing

Soil samples obtained during the investigation were taken to our NATA registered laboratory. The following tests were carried out on selected samples:

- Standard Compaction and 4 days soaked California Bearing Ratio (CBR);
- Atterberg Limits;
- Shrink / Swell;
- Moisture Content;
- Soil Aggressivity for buried steel and concrete structures (pH, Sulfate, Chloride and Electrical Conductivity); and
- Point Load Index testing was carried out on rock cores.

## 6. Results

### 6.1. Subsurface Conditions

Engineering borehole logs from the current investigation are presented in Appendix A, together with Explanation Sheets defining the terms and symbols adopted in the borehole log preparation and photographs of the rock core recovered during the investigation.

Portions of the site are underlain by a variable thickness of fill overlying residual soils and weathered sandstone and siltstone. In some locations relatively deep fill was encountered. Such deep fill deposits may be associated with levelling of the site during construction of the main building and car parking area.

Based on the information obtained from the boreholes and test pits, four cross sections have been drawn through the site and are presented in Figures 2, 3, 4 and 5. Three geotechnical models have been developed pertaining to the proposed development immediately south of the existing main building and another for the area in the vicinity of the proposed car parking to the west of the main building.

Table 6.1 provides a summary of the inferred geotechnical units encountered at the site.

Unit	Material / Origin	Description
1a	Fill - Pavement	Asphalt overlying Base / Sub-Base materials comprising Gravelly Sand: fine, medium and coarse grained sand, pale grey: fine and medium grained sub angular gravel, trace fines.
1b	Fill	Generally Sandy Clay: medium to high plasticity, brown, fine and medium grained sand, trace fine and medium grained sub angular gravel. Some test pits contain sandstone cobbles and boulders. TP04 contained building rubble comprising concrete, bricks, timber and tiles.
2	Alluvial Soil	Sand / Clayey Sand: very loose to loose, fine and medium grained, brown.
3	Residual Soil	Sandy Clay / Clay: stiff to hard, high plasticity, pale grey and brown to orange / red, fine and medium grained sand. Clayey Sand: medium dense to very dense, fine and medium grained, brown to orange and pale grey.
4a	Weathered Rock	Very low to low strength Sandstone, Siltstone and Claystone. Moderately to extremely weathered. Fine to medium grained sand, pale brown and pale grey. Estimated Class IV and Class V Sandstone and Siltstone.
4b	Weathered Rock	Medium to high strength Sandstone and Siltstone. Moderately to slightly weathered. Fine to medium grained sand, pale brown and pale grey.
		Estimated Class III Sandstone and Siltstone.

#### Table 6.1 - Summary of Inferred Geotechnical Units Encountered

### 6.1.1. New 3-4 Storey Building

The interpreted subsurface conditions encountered in the vicinity of the new 3-4 storey building are summarised in Table 6.2.

Table 6.2 - Interpreted Subsurface Conditions in the Vicinity of the New 3-4 Storey Building

Borehole ID	Approximate Existing Surface RL (m AHD)	Depth to Top of Inferred Geotechnical Unit (m)					
		Unit 1a	Unit 1b	Unit 2	Unit 3	Unit 4a / Unit 4b	
BH04	21.0	-	0.0	-	1.75	4.35	
BH05	18.7	0.0	0.5	-	1.3	6.5	
BH06	17.8	0.0	-	-	0.5	4.15	
BH07	16.6	0.0	0.3	-	1.75	6.4	
BH08	17.2	0.0	-	-	0.3	4.61	
BH09	17.9	0.0	0.3	4.3	5.3	9.7	
BH10	16.2	0.0	0.6	2.0	3.5	6.2	

### 6.1.2. Existing Main Building

Table 6.3 presents a summary of the interpreted subsurface conditions encountered in the location of the existing main building.

Borehole ID	Approximate Existing Surface RL (m AHD)	Depth to Top of Inferred Geotechnical Unit (m)				
		Unit 1a	Unit 1b	Unit 3	Unit 4a / Unit 4b	
BH11	21.3	0.0	0.2	5.0	8.5	
BH12	19.1	-	0.0	3.8	11.1	

Table 6.3 - Interpreted Subsurface Conditions in the Vicinity of the Existing Main Building

### 6.1.3. Mental Health Building

The interpreted subsurface conditions encountered in the vicinity of the mental health building are summarised in Table 6.4Table 6.2.

Table 6.4 - Interpreted Subsurface Conditions in the Vicinity of the Mental Health Building

Test Pit ID	Approximate Existing Surface RL (m AHD)	Depth to Top of Inferred Geotechnical Unit (m)				
		Unit 1b	Unit 3	Unit 4a / Unit 4b		
TP01	24.4	-	0.2	1.4		
TP02	24.0	0.0	>1.95	-		

### 6.1.4. Car Park Areas

#### Car Park Area 1 (West of Main Building)

Table 6.5 presents a summary of the interpreted subsurface conditions encountered in the location of the proposed car park area west of the main building.

Test Pit ID	Approximate Existing	Depth to Top of Inferred Geotechnical Unit (m)				
	Surface RL (m AHD)	Unit 1b	Unit 3	Unit 4a / Unit 4b		
TP03	26.1	0.0	-	-		
TP04	25.3	0.0	-	-		
TP05	24.5	0.0	-	-		
TP06	24.4	0.0	-	+		
TP07	19.8	0.0	0.5	0.8		
TP08	20.8	0.0	0.5	1.2		
TP09	17.0	0.0	0.4	1.0		
TP10	17.7	-	0.3	0.9		

Table 6.5 - Interpreted Subsurface Conditions in the Vicinity of the Proposed Western Car Park Area

### Car Park Area 2 (East of Main Building)

The interpreted subsurface conditions encountered in the vicinity of the proposed car park area east of the main building are summarised in Table 6.6.

Table 6.6 - Interpreted Subsurface Conditions in the Vicinity of the Proposed Western Car Park and Drop off Area

Borehole ID	Approximate Existing Surface RL (m AHD)	Depth to Top of Inferred Geotechnical Unit (m)			
		Unit 1b	Unit 3	Unit 4a / Unit 4b	
BH01	27.0	-	0.15	1.6	
BH02	25.7	0.0	3.83	4.15	
BH03	21.3	0.0	2.0	5.0	

## 6.2. Groundwater

Groundwater inflows were only observed in two of the boreholes during drilling. Groundwater was observed at 4.9m below ground level (BGL) in BH07 and at 7.5m BGL in BH09. Water level monitoring was not possible during rock coring as water was used as a drilling fluid in the drilling process.

Three water level monitoring wells were installed in BH03, BH10 and BH12 for ongoing monitoring purposes. Water levels were monitored in these wells on the 10 September 2014, results are summarised in Table 6.7 below.

Borehole ID	Approximate Existing Surface RL (m AHD)	Groundwater Level (m BGL)
BH03	21.3	3.15
BH10	16.2	3.75
BH12	19.1	7.44

Table 6.7 - Monitoring Well Groundwater Levels (10 September 2014)

### 6.3. Laboratory Test Results

Results of laboratory testing outlined in Section 5 are summarised in Table 6.8 and Table 6.9 presents a summary of soil aggressivity test results.

Table 6.9.

Detailed laboratory test results are presented in Appendix B. In addition, axial and diametral point load index strength testing was carried out on the rock cores, with the test results presented on the individual borehole engineering logs presented in Appendix A.

Results of soil classification and CBR testing are summarised in Table 6.8 below.

Test ID	Depth (m) BGL	Material	Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (t/m <sup>3</sup> ) <sup>(1)</sup>	CBR (%) <sup>(2)</sup>	PI, Plasticity Index (%)	LL, Liquid Limit (%)	lss, Shrink Swell Index (%)
TP02	0.2 - 0.8	FILL	13.6	-	-	-	12	24	-
TP02	0.5 - 0.8	FILL	20.7	-	-	-	-	-	0.4
TP03	0.7 - 0.9	FILL	32.3	-	-	-	17	31	-
TP03	0.9 - 1.3	FILL	45.8	-	-	-	84	111	-
TP04	0.6 - 1.5	FILL	20.3	15.0	1.79	6	6	23	-
TP05	0.5 - 1.0	FILL	19.4	18.0	1.71	3.5	15	30	-
TP07	0.5 - 0.8	CLAY	19.2	21.5	1.62	2.5	14	43	-
TP08	0.5 - 1.0	SAND	19.7	16.5	1.69	4.5	-	-	-
TP10	0.3 - 0.8	CLAY	26.5	26.5	1.52	3.5	36	54	-
BH01	1.0 - 1.45	CLAY	10.7	-	-	-	10	27	-
BH02	1.0 - 1.45	CLAYEY SAND	10.3						
BH03	1.0 - 1.45	Sandy CLAY	13.0	-	-	-	-	-	-
BH03	4.0 - 4.45	CLAY	13.9	-	-	-	-	-	-
BH05	2.5 - 2.95	CLAY	15.4	-	-	-	17	31	-
BH06	2.5 - 2.95	CLAY	16.6	-	-	-	-	-	-

Table 6.8 - Soil Classification and CBR Laboratory Test Results

Test ID	Depth (m) BGL	Material	Moisture Content (%)	Optimum Moisture Content (%)	Maximum Dry Density (t/m <sup>3</sup> ) <sup>(1)</sup>	CBR (%) <sup>(2)</sup>	PI, Plasticity Index (%)	LL, Liquid Limit (%)	lss, Shrink Swell Index (%)		
BH07	4.0 - 4.45	CLAY	28.0	-	-	-	-	-	-		
BH08	1.0 - 1.45	Sandy CLAY	19.2	-	-	-	-	-	-		
BH09	0.8 - 1.18	FILL	13.8	-	-	-	-	-	0.9		
BH09	1.5 - 1.95	FILL	16.9	-	-	-	32	50	-		
BH09	7.5 - 7.95	Sandy CLAY	20.8	-	-	-	24	39	-		
BH10	1.0 - 1.45	FILL	12.2	-	-	-	-	-	-		
BH12	2.5 - 2.95	FILL	12.8	-	-	-	15	29	-		
BH12	8.5 - 8.95	Sandy CLAY	20.2	-	-	-	22	39	-		
Notes:	Notes:										

(1) - Dry density 100% standard compaction, by dry density moisture content relationship testing.

(2) - CBR results are based on 4 day soaked with 4.5kg surcharge.

Table 6.9 presents a summary of soil aggressivity test results.

Table 6.9 - Soil Aggressivity Laboratory Test Results

Test ID	Depth (m) BGL	Material	рН	Sulfates (SO₄) (ppm)	Chlorides (ppm)	Electrical Resistivity (ohm.cm)
TP02	0.2 - 0.8	FILL (Sandy CLAY)	6.9	24	20	28571
BH04	2.5 - 2.95	CLAY	5.4	17	67	11494
BH05	2.5 - 2.95	CLAY	4.9	27	21	38462
BH10	1.0 - 1.45	FILL (Sandy CLAY)	5.8	<10	16	40000
BH12	1.0 - 1.45	FILL (Sandy CLAY)	6.9	18	14	23256
BH12	8.5 - 8.95	Sandy CLAY	5.5	<10	6.2	50000

# 7. Discussion and Recommendations

## 7.1. Excavation Conditions

### 7.1.1. Excavatability

Excavations into fill, residual soils and weathered rock may be required depending on building and pavement design levels. Excavation in Units 1a, 1b, 2 and 3 should be possible using conventional earthmoving equipment such as tracked loaders and hydraulic excavators.

Where excavations extend into Unit 4a, it is expected that very low to low strength or fractured sandstone/siltstone should be able to be excavated using conventional earthmoving plant such as hydraulic excavators fitted with a rock bucket and dozers fitted with rippers. At depths where excavations encounter Unit 4b, the rock is expected to be medium to high strength, ripping or the use of rock hammers and rock saws may be required.

The following recommendations are provided in case excavation is required into Unit 4b rocks. Rock excavations can result in noise and vibrations that affect adjacent structures, particularly if hydraulic impact breakers are used. Selection of excavation plant will need to be carefully considered by the contractor as part of construction planning together with the preparation of a vibration monitoring plan if excavations are to be carried out in close proximity to existing structures. Rock saws may be required to reduce the lateral transmission of vibrations.

Excavation contractors should be required to consider the borehole logs and core photographs and make their own interpretation of the capacity and productivity of specific plant.

### 7.1.2. Vibrations during Excavation Works

If there are any buildings that may potentially be sensitive to vibrations (for example heritage buildings), consideration would need to be given to controlling construction vibrations in the vicinity of these buildings. We are not aware of any heritage buildings to be retained as part of the development.

The magnitudes of vibrations are dependent on the excavation equipment and methodology. Techniques such as rock sawing are often used to reduce lateral transmission of vibrations adjacent to sensitive structures.

Further geotechnical assessment would be required for the potential for damage to existing buildings as a result of proposed excavations. Such investigations would typically involve a desktop review of existing building foundations, review of proposed excavation methods and preparation of a vibration monitoring programme (if required).

### 7.1.3. Trafficability of Site Soils

It is assessed that on Units 1a, 1b and 3 soils that construction plants such as trucks and excavators can be allowed to travel without requiring a working platform. Where wet conditions exist, it may be required to provide a 100mm thick working platform comprising gravel material (Austroads Spec DBG20/DGB40). Where heavy plants such as piling rigs or mobile cranes are to traffic the site, specific analysis of working platform requirements will be required to assess working platform thickness.

### 7.1.4. Groundwater

Groundwater appears to be relatively deep within the vicinity of the proposed areas of development. The depth to groundwater appears to follow the natural gradient of the site and occurs close to the soil/rock interface. In areas containing fill, groundwater inflows and seepages may be apparent.

It is not anticipated that major groundwater inflows during excavations will occur however; ground water seepages are likely due to high rainfall events, local drainage conditions etc. and provision should be made for pumping from sumps.

## 7.2. Excavation Support Requirements

### 7.2.1. Unsupported Batters

It is recommended that temporary unsupported batter slopes of 1H:1V for excavations in Units 1a, 1b, 2 and 3 (provided excavation is above the groundwater table and surcharge loads are kept well clear of the crest of batters). If there is insufficient room to form temporary batters, or if excavations encounter groundwater, then retention system will be required. Further advice on retention systems is provided in Section 7.2.2. For permanent batters 2H:1V or flatter slopes are recommended.

As for Units 4a and 4b, vertical excavations should be practicable with support provided in the form of rock bolts, mesh and shotcrete, where required. An experienced geotechnical engineer or engineering geologist should be engaged to assess the excavation and support needs.

Where rock bolts are required to provide permanent support they should be galvanised and double encapsulated in grout and a polyethylene sheath. Proprietary systems such as "CT bolts" or equivalent have been accepted as having a design life of up to 100 years when double encapsulated. Recommended batter slopes for the various geotechnical units are presented in Table 7.1.

Geotechnical Unit	Temporary Cuts (Horizontal to Vertical Ratio) <sup>(1)</sup>	Permanent Cuts (Horizontal to Vertical Ratio) <sup>(1)</sup>
Unit 1a	1H:1V	2H:1V
Unit 1b	1H:1V	2H:1V
Unit 2	1H:1V	2H:1V
Unit 3	1H:1V <sup>(3)</sup>	2H:1V <sup>(3)</sup>
Unit 4a	Vertical <sup>(2)</sup>	Vertical <sup>(2)</sup>
Unit 4b	Vertical <sup>(2)</sup>	Vertical <sup>(2)</sup>

#### Table 7.1 - Unsupported Cut Batter Recommendations

Notes:

(1) - The above recommendations assume that:

- excavations are above the groundwater table;
- the ground surface at the crest of the excavation is horizontal;
- surcharge loads are set back an appropriate distance from the crest of excavations;
- All cuts are protected from erosion.

(2) - Vertical excavations should be feasible provided support requirements as detailed in Section 7.2.1 are assessed and installed.

(3) - Vertical excavations may be possible in Unit 3 in a deep excavation provided support as detailed in Section 7.2.1 is installed.

### 7.2.2. Retaining Structures and Shoring Systems

For the design of retaining walls a triangular earth pressure distribution can be adopted to calculate earth pressures for relatively flexible shoring systems such as cantilevered walls or walls supported by a single row of props or anchors. The horizontal earth pressure profile may be calculated using the following formula:

$$\mathbf{p} = \mathbf{K} \left( \gamma' \mathbf{z} + \mathbf{p}_{\mathrm{s}} \right)$$

where:

p = lateral earth pressure (kPa);

K = earth pressure coefficient, to be selected depending considering the amount of movement that can be tolerated;

 $\gamma'$  = effective unit weight (kN/m<sup>3</sup>);

Z = depth below top of excavation (m);

H = height of excavation at base of excavation (m);

 $p_s$  = design uniform surcharge pressure at ground level.

Flexible shoring systems such as cantilevered walls should be avoided where there is a risk of movements damaging structures or services adjacent to an excavation.

Design of braced shoring or permanent retaining structures walls, which are constrained at several levels, can be based on a trapezoidal earth pressure distribution. Where retention of a multi-layered material profile is required, modification of the distribution (including the definition of H) will be necessary.

Depth (m)	Horizontal Pressure (kPa)
0	K.p <sub>s</sub>
0.25H	K (0.8.ý.H + p <sub>s</sub> )
0.75H	K (0.8.7.H + p <sub>s</sub> )
Н	K.p <sub>s</sub>

Table 7.2 - Trapezoidal Pressure Distribution

In addition to lateral earth pressures and surcharge loads, consideration should be given to the possibility of a hydrostatic pressure due to build-up of water behind the wall (e.g. from broken services) unless permanent subsurface drainage can be provided.

Table 7.3 provides retaining wall design parameters.

Geotechnical Unit	Active Earth Pressure Coefficient (k <sub>a</sub> ) <sup>(1)</sup>	At Rest Earth Pressure Coefficient (K₀)	Passive Earth Pressure Coefficient K <sub>P</sub>	Bulk Density (kN/m³)	Drained Cohesion, c' (kPa)	Effective Friction, φ' (°)	Drained Elastic Modulus E'(MPa)
Unit 1b	0.33	0.5	3.0	19	0	30	10
Unit 3	0.33	0.5	3.0	19	5	28	20
Unit 4 <sup>2</sup>	0.25	0.5	4.0	20	10	30	120

#### Table 7.3 - Earth Pressure Coefficients for Retaining Wall Design

Notes:

(1) - Assumes no wall friction.

(2) - Values of better quality rock are variable and dependant on global effects of defects. Variability also occurs due to the in situ stress environment and geometry of the excavation. For design parameters, use should be made of the cohesion and friction angle parameters.

The earth pressure coefficients in Table 7.3 assume horizontal ground surface at the crest and toe of the retaining wall. If this is not the case then the coefficient should be modified or surcharges added, as necessary. Care will be required when compacting fill adjacent to retaining walls to avoid lateral pressures that exceed tabulated values.

Based on concept plan drawings, adjacent structures may be located within the nominal zone of influence of the excavation (a line extending at a gradient of 1H:1V upwards from the base of the proposed excavation). The excavation system will need to be designed to support the footing surcharge loads.

The amount of movement that will be experienced by a retaining wall will depend on various factors including the earth pressures that exist, groundwater conditions and the excavation and construction sequence, including the tensioning sequence of anchors. Detailed soil structure interaction analysis should be carried out if movement sensitive structures are located within close proximity to the retaining wall. In particular, if movement sensitive services are located close to the excavation the design should consider the need to limit movements. In such situations the earth pressures calculated using coefficients in Table 7.2 may need to be modified to assess the impact on predicted movements.

### 7.3. Foundations

### 7.3.1. Foundation Options

There is a variable depth of fill across the site, possibly as a result of site levelling works during car park construction. We recommend piled foundations for the new 3-4 storey building development with piles founded on bedrock due to relatively high building loads and small differential movement tolerances. A piled raft could be considered as an alternate foundation option.

For lightly loaded structures it may be possible to adopt shallow foundations. The footings can be founded within stiff to hard residual clay or weathered sandstone. Unless records are available to confirm that fill has been placed and compacted to an engineering specification it should be treated as uncontrolled and should not be used to support building loads. If assessed to be suitable for reuse, existing fill could be excavated and recompacted to form a foundation for raft slabs. Fill should be

compacted to at least 98% Standard Compaction at moisture content within 2% of Standard Optimum Moisture Content.

### 7.3.2. Shrink / Swell Potential

In areas where existing fill occurs a site classification of 'P' as defined in AS2870-2011 should be adopted. If the fill is excavated and recompacted it may be possible to found a pad footing on the fill. Reclassification of the site would depend on the nature and thickness of the compacted fill and foundation recommendations should be developed based on AS2870-2011.

Where residual soils are relatively shallow and would form the bearing stratum for a pad footing a classification of other than 'P' could be adopted. Pad foundations could be adopted for buildings with similar scale and building loads to residential structures, based on the guidelines in AS2870-2011. Sites underlain by residual soils can be classified as 'M' as defined in AS2870-2011.

### 7.3.3. Pad Footings

Footings founded within the very stiff to hard residual clay soils (Unit 3) shown on the borehole logs may be proportioned for an allowable bearing pressure of 200kPa. Footing founded within weathered sand stone (Unit 4) may be proportioned for an allowable bearing pressure of 500kPa. Settlements of these footings should be assessed adopting an elastic modulus of 15MPa and 150MPa for Units 3 and 4 respectively.

A geotechnical engineer should observe pad footing excavations to confirm that a competent bearing stratum exists to a depth of at least 1.5 times the footing width below the base of footings.

### 7.3.4. Piled Foundations

Where a piled foundation is required the piles should penetrate the fill and residual soil layers and found within Unit 4a and 4b bedrock.

Open bored piles may be feasible but would require temporary liners when penetrating granular materials such as the sand fill encountered at some locations. In clay fill or clay residual soils open bored piles may still require temporary liners if groundwater seepage occurs as seepage will tend to soften the pile shaft if left open.

Continuous flight auger (CFA) piles should be practicable and do not require temporary casing. However, a high capacity CFA piling rig will be required to socket the piles into the bedrock if significant loads are to be carried in shaft adhesion or to take advantage of the parameters for the better quality Unit 4b rock. Advice should be sought from specialist CFA piling contractors regarding the length of socket in the Unit 4b that can be achieved with their piling rigs.

For the limit state design of piles the geotechnical parameters provided in Table 7.4, below, can be adopted.

Geotechnical Unit	Ultimate End Bearing (MPa) <sup>(2)</sup>	Serviceability End Bearing (MPa) <sup>(2)</sup>	Ultimate Shaft Adhesion (kPa) <sup>(3)</sup>	Elastic Modulus (MPa) <sup>(4)</sup>
Unit 3 – Residual Soil	0.5	0.2	60	30
Unit 4a – Class IV and V Sandstone and Siltstone <sup>(1)</sup>	3	1.2	300	200
Unit 4b – Class III Sandstone and Siltstone <sup>(1)</sup>	15 <sup>(5)</sup>	4	1000	500

#### Table 7.4 - Recommended Limit State Design Parameters for Piles on Rock

Notes:

(1) - Rock classified in accordance with Pells et al (1998) "Foundations on Sandstone and Shale in the Sydney Region" Aust. Geomech. Jnl, Dec 1998.

(2) - Assumes a minimum embedment of at least 0.3m into the relevant bearing stratum.

(3) – Socket roughness R2 or greater.

(4) - Serviceability should be assessed using the tabulated modulus value to check that settlements are within tolerable limits.

(5) - To adopt this value further assessment of rock quality will be required as discussed below.

It is recommended that a geotechnical strength reduction factor,  $\Phi_g$ , of 0.65 is adopted for footings bearing on rock where a suitable program of verification is undertaken. If piles are required to resist uplift of the shaft adhesion, a  $\Phi_g$  of 0.6 should be adopted and the values in Table 7.4 should be multiplied by 0.6 and a cone pull out check should be carried out assuming a cone angle of 70°.

Where ultimate end bearing pressures of 4MPa or greater are adopted it is recommended that additional cored boreholes be drilled at representative column locations to assess the uniformity and quality of the bearing stratum. The number of additional boreholes will be dependent on the piling layout. Cores may be required at 25% to 50% of pile locations to assess provide adequate information for the assessment of rock quality to justify the upper end of the recommended ultimate end bearing values.

To take full advantage of the ultimate geotechnical strength, the rock sockets should be designed using a method that includes the rock mass properties and the applied mechanics of pile/ground interactions.

A geotechnical engineer should be engaged to review piling records to confirm that piles have penetrated to the appropriate rock class. Pile dynamic integrity testing should be carried out particularly, if CFA piles are adopted. At least 5% of all piles should be subjected to integrity testing.

The base of open bored piles should be clean of loose debris and water. CFA piles should be carefully controlled to ensure integrity.

### 7.3.5. Site Preparation

Site preparation and earthworks suitable for structure and pavement support should consist of:

- Proposed building and pavement areas should be stripped to remove existing vegetation and topsoil, root affected or other potentially deleterious materials:
- Following stripping, exposed pavement subgrade should be observed to help identify any softer ground. Proof rolling can be helpful to supplement observation in pinpointing wet or excessively deflecting material. Such areas might require to be over excavated and backfilled with approved select material similar to any specified for general fill across the site. Care must be taken to prevent the proof rolling exercise from damaging the subgrade;
- Approved fill beneath structures and pavements should be compacted in horizontal layers not exceeding 300mm loose thickness to a minimum density ratio of 98% Standard Compaction in accordance with AS1289 5.1.1 or equivalent within +/- 2% of Standard Optimum Moisture Content (SOMC) beneath structures and at 60% to 90% of SOMC beneath pavements;
- The top 300mm of natural subgrade below pavements or the final 300mm of road subgrade fill should be compacted to a minimum density ratio of 100% Standard Compaction or equivalent within the above stated moisture range; and
- Exposed subgrade (and foundations soils beneath footings or slabs) must be protected from damage by drying, wetting (e.g. from ponded runoff) and from traffic loading. Exposed clay foundations for structures and pavements should not be used as haul routes during construction.

Earthworks should be carried out in accordance with the recommendations outlined in AS3798-2007 'Guidelines for Earthworks for Commercial and Residential Developments'.

## 7.4. Soil Aggressivity to Buried Structures

Based on results of laboratory testing as summarised in Table 6.9 presents a summary of soil aggressivity test results.

Table 6.9, the soils have been compared to exposure classifications given in AS2159-2009 and are summarised in Table 7.5 below.

Test ID	Depth (m) BGL	Material	Exposure Classification for Concrete Piles	Exposure Classification for Steel Piles
TP02	0.2 - 0.8	FILL (Sandy CLAY)	Non-aggressive	Non-aggressive
BH04	2.5 - 2.95	CLAY	Mild	Mild
BH05	2.5 - 2.95	CLAY	Mild	Non-aggressive
BH10	1.0 - 1.45	FILL (Sandy CLAY)	Non-aggressive	Non-aggressive
BH12	1.0 - 1.45	FILL (Sandy CLAY)	Non-aggressive	Non-aggressive
BH12	8.5 - 8.95	Sandy CLAY	Mild	Non-aggressive

Table 7.5 - Soil Aggressivity Exposure Classifications

Soils have been classified as "non-aggressive to mild" exposure classifications for both concrete and steel piles.

## 7.5. Suitability of Site Soils for Use as Fill

The majority of soils encountered on site will likely be suitable for use on site as landscaping material and with suitable grading and treatment as controlled fill for use beneath pavement and structural areas.

Any near surface topsoil / colluvium is not considered suitable for reuse as controlled fill and should be stockpiled for landscaping purposes.

Unit 1a materials are considered appropriate for use as fill provided the asphalt surfacing is first removed. Unit 1b, 2 and 3 materials are considered suitable for reuse as controlled fill provided any foreign materials such as building rubble are removed and the material is graded to remove any 'oversize' materials. As outlined in Section 7.3.5, the maximum loose layer thickness allowed is 300mm, the maximum particle size shall not exceed 2/3 of this (i.e. 200mm).

If any ripped rock is anticipated, it may be suitable for use as fill provided the material is crushed to reduce oversize material.

## 7.6. Articulation of Masonry Walls

The articulation spacing of masonry walls should be designed in accordance with AS3700-2011, the spacing of articulation joints should be designed with reference to the site classifications provided in Section 7.3.2 of this report.

## 7.7. Earthquake Design

The site is classified as Class  $C_e$  in accordance with the site sub-soil classes defined in AS1170.4-2007 Part 4, Earthquake Actions in Australia. In the event, the entire building footprint is excavated and founded on Unit 4b then the site could be classified as  $B_e$ .

A hazard factor of 0.10 is suggested based on AS1170.4-2007. Liquefaction potential is considered to be low in view of the limited thicknesses of sandy deposits and low groundwater table level.

## 7.8. Mine Subsidence Provisions

The Wyong Hospital site is located within a mine subsidence district and thus the Mine Subsidence Board (MSB) is a consent authority for any development on the site. Mining has not been carried out beneath the Wyong Hospital site but there is a possibility that mining could be carried out in the area at some time in the future. The site is subject to mine subsidence conditions and all structures should be designed to conform to the constraints provided by the MSB. The following preliminary ground movement and strain parameters for the site have been provided by the MSB:

- Subsidence 150 mm;
- Compressive Strain 1.5 mm/m;
- Tensile Strain 1.0 mm/m; and
- Tilt 1.5 mm/m.

## 7.9. Slope Stability Assessment

Consideration has been given to the Australian Building Codes Board (ABCB) guideline "Landslide Hazards 2006" when assessing slope stability.

In the proposed car park area west of the main building, uncontrolled fill is present, including an embankment that might be associated with a former 'agricultural dam'. This uncontrolled fill may be susceptible to a localised landslide on a 30° face. The fill is estimated to extend to no more than 4m depth.

In the area south of the existing main building, the existing car park comprises terraced ground. This is also assessed to comprise uncontrolled fill, rising to a maximum height of 4m in the south-west corner. The overall slope of the existing car park is very shallow. It is unclear how the fill may have been "keyed" in to the underlying natural slopes and creep of the overall fill is a possibility.

In terms of importance, no structures are considered at risk, simply surface car parking. An importance level of L1 may be adopted for the proposed car park areas. Where appropriate earthworks are undertaken to re-shape the landscape for new car parking (on anticipated terraces) the hazard would represent a very low or negligible risk to persons or property.

For an appropriately constructed earthworks terracing, it is possible to design for a landslide event to be barely credible (Likelihood level F). At risk is a car park and users of the car park. Limited damage only is possible (Consequence Level 4). The risk level implications can be designed to reflect very low risk conditions.

In the area south of the main building, an importance level of L4 may be adopted for the proposed 3-4 storey building. The existing car park is planned to be extensively redeveloped. The new building design must take into account the presence of uncontrolled fill that will not form a foundation suitable for support of new structures. New buildings can be designed to allow very low risk implication conditions to prevail.

## 7.10.Pavement Design

### 7.10.1. Design Parameters

Design traffic loadings have been assumed based on the car parks being utilised primarily for light vehicles. Pavement thickness designs have been provided for an assumed traffic loading of  $1 \times 10^5$  ESA's, which we consider typical for a lightly trafficked car park.

Based on the results of the field work, laboratory testing, and experience in the surrounding area, we recommend a design subgrade California Bearing Ratio (CBR) value of 3% for the pavements constructed upon a residual clay or sandy clay subgrade and a CBR value of 6% for the pavements constructed on clayey sand or weathered rock subgrade. Design CBR and short term Young's Modulus subgrade values are presented in Table 7.6.

Material	Design CBR (%)	Short Term Young's Modulus (MPa)
Unit 1b / Unit 3	3	30
Unit 4a / Unit 4b	6	60

The long term Young's Modulus of the subgrade is not considered appropriate for this type of pavement. However, if required, the long term modulus values of the subgrade can be calculated if the loading conditions are provided.

### 7.10.2. Pavement Design

Flexible pavement thickness designs have been based on the procedures outlined in Austroads "Guide to Pavement Technology 2012" and with reference to ARRB Special Report No 41.

The recommended material, construction specification and pavement make-up are presented on the attached Pavement Thickness Design Summary (PTDS) sheet in Appendix C.

Site preparation for pavement construction should be in accordance with Section 7.3.5 and the PTDS provided in Appendix C.

If wet subgrades exist at the time of construction or deleterious fill materials are encountered at subgrade level, these materials should be over-excavated and be replaced with a minimum depth of 250mm of well graded granular select material with CBR of 15% or greater. The requirement for, and extent of subgrade replacement should be confirmed by the geotechnical authority at the time of construction.

Where rock subgrade materials are encountered, the rock should be ripped and re-compacted for a minimum depth of 300mm to break-up preferential drainage paths and provide a dense homogenous surface on which to construct the pavement.

Where existing fill lies at subgrade level it should be excavated and recompacted, if suitable, or replaced with a good quality material. Fill that is to form the subgrade for pavements should be compacted to at least 100% Standard Compaction at moisture content within 2% of Standard Optimum Moisture Content. If existing fill is deeper than about 1m below final subgrade level it may be possible to leave the fill in place provided it is assessed to be suitable by a geotechnical engineer and proof rolled.

It is recommended that each construction length be boxed out to the minimum subgrade level required by the relevant pavement thickness design. Prior to pavement construction, the exposed subgrade should be assessed by the geotechnical authority to confirm the pavement thickness requirement for that section.

### 7.10.3. Drainage

Preliminary pavement designs assume the provision of adequate surface and subsurface drainage of pavements and adjacent areas. It is suggested subsurface drainage is provided uphill for pavements cutting across natural slopes and on both sides for pavements running down natural slopes. Drainage needs should be confirmed during construction.

## 8. Limitations

The findings within this report are the result of discrete/specific investigations methodologies used in accordance with normal practices and standards. Subsurface conditions can change over relatively short distances and the subsurface conditions revealed at the test locations may not be representative of subsurface conditions across the site. We recommend that a geotechnical engineer be engaged during construction to confirm the subsurface conditions are consistent with design assumptions.

Further discussion on the uses and limitations of this assessment is presented in the attached sheet, *'Important Information about your Coffey Report'*, in conjunction with which this report should be read.

For and on behalf of Coffey

Author lare

Arthur Love Senior Principal Geotechnical Engineer

## References

Austroads (2012). Guide to Pavement Technology Part 2: Pavement Structural Design. *Austroads Publication No. AGPT02-12.* 

Pells, P.J.N (1999). State of Practice for the Design of Socketed Piles in Rock. *Proceedings, 8<sup>th</sup> Australia New Zealand Conference on Geomechanics.* 

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Standards Australia (AS 2159-2009). Piling – Design and Installation. *Standards Australia Publication No. AS 2159-2009.* 

Standards Australia (AS 2870-2011). Residential Slabs and Footings. *Standards Australia Publication No. AS 2870-2011.* 

Standards Australia (AS 3700-2011). Masonry Structures. *Standards Australia Publication No. AS 3700-2011.* 



### Important information about your Coffey Report

As a client of Coffey you should know that site subsurface conditions cause more construction problems than any other factor. These notes have been prepared by Coffey to help you interpret and understand the limitations of your report.

# Your report is based on project specific criteria

Your report has been developed on the basis of your unique project specific requirements as understood by Coffey and applies only to the site investigated. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the client. Your report should not be used if there are any changes to the project without first asking Coffey to assess how factors that changed subsequent to the date of the report affect the report's recommendations. Coffey cannot accept responsibility for problems that may occur due to changed factors if they are not consulted.

#### Subsurface conditions can change

Subsurface conditions are created by natural processes and the activity of man. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Because a report is based on conditions which existed at the time of subsurface exploration, decisions should not be based on a report whose adequacy may have been affected by time. Consult Coffey to be advised how time may have impacted on the project.

#### Interpretation of factual data

Site assessment identifies actual subsurface conditions only at those points where samples are taken and when they are taken. Data derived from literature and external data source review, sampling and subsequent laboratory testing are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist, because no professional, no matter how gualified, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. For this reason, owners should retain the services of Coffey through the development stage, to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

# Your report will only give preliminary recommendations

Your report is based on the assumption that the site conditions as revealed through selective point sampling are indicative of actual conditions throughout an area. This assumption cannot be substantiated until project implementation has commenced and therefore vour report recommendations can only be regarded as preliminary. Only Coffey, who prepared the report, is fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report there is a risk that the report will be misinterpreted and Coffey cannot be held responsible for such misinterpretation.

# Your report is prepared for specific purposes and persons

To avoid misuse of the information contained in your report it is recommended that you confer with Coffey before passing your report on to another party who may not be familiar with the background and the purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

# Interpretation by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, retain Coffey to work with other project design professionals who are affected by the report. Have Coffey explain the report implications to design professionals affected by them and then review plans and specifications produced to see how they incorporate the report findings.



### Important information about your Coffey Report

#### Data should not be separated from the report\*

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, drawings, etc. are customarily included in our reports and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel) and laboratory evaluation of field samples. These logs etc. should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

#### Geoenvironmental concerns are not at issue

Your report is not likely to relate any findings, conclusions, or recommendations about the potential for hazardous materials existing at the site unless specifically required to do so by the client. Specialist equipment, techniques, and personnel are used to perform a geoenvironmental assessment. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Coffey for information relating to geoenvironmental issues.

#### Rely on Coffey for additional assistance

Coffey is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction. It is common that not all approaches will be necessarily dealt with in your site assessment report due to concepts proposed at that time. As the project progresses through design towards construction, speak with Coffey to develop alternative approaches to problems that may be of genuine benefit both in time and cost.

#### Responsibility

Reporting relies on interpretation of factual information based on judgement and opinion and has a level of uncertainty attached to it, which is far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Coffey to other parties but are included to identify where Coffey's responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Coffey closely and do not hesitate to ask any questions you may have.

\* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.

Figures

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?	INTERPRETED GEOLOGICAL BOUNDARY
	UNIT 1a/1b — FILL

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- UNIT 1a/1b FILL
- UNIT 3 ALLUVIAL SOIL
- UNIT 4 RESIDUAL SOIL
- UNIT 5 WEATHERED ROCK

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	UNIT 3 – ALLUVIAL SOIL
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	UNIT 5 - WEATHERED ROCK

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Appendix A - Engineering Logs and Photographs

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## Soil Description Explanation Sheet (1 of 2)

#### **DEFINITION:**

In engineering terms soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

#### **CLASSIFICATION SYMBOL & SOIL NAME**

Soils are described in accordance with the Unified Soil Classification (UCS) as shown in the table on Sheet 2.

#### PARTICLE SIZE DESCRIPTIVE TERMS

NAME SUBDIVISION		SIZE		
Boulders		>200 mm		
Cobbles		63 mm to 200 mm		
Gravel coarse		20 mm to 63 mm		
medium		6 mm to 20 mm		
fine		2.36 mm to 6 mm		
Sand	coarse	600 μm to 2.36 mm		
	medium	200 μm to 600 μm		
fine		75 μm to 200 μm		
1				

#### **MOISTURE CONDITION**

- Dry Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
- **Moist** Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
- Wet As for moist but with free water forming on hands when handled.

#### CONSISTENCY OF COHESIVE SOILS

TERM	UNDRAINED STRENGTH S <sub>U</sub> (kPa)	FIELD GUIDE				
Very Soft	<12	A finger can be pushed well into the soil with little effort.				
Soft	12 - 25	A finger can be pushed into the soil to about 25mm depth.				
Firm	25 - 50	The soil can be indented about 5mm with the thumb, but not penetrated.				
Stiff	50 - 100	The surface of the soil can be indented with the thumb, but not penetrated.				
Very Stiff	100 - 200	The surface of the soil can be marked, but not indented with thumb pressure.				
Hard	>200	The surface of the soil can be marked only with the thumbnail.				
Friable	_	Crumbles or powders when scraped by thumbnail.				

#### DENSITY OF GRANULAR SOILS

TERM	<b>DENSITY INDEX (%)</b>
Very loose	Less than 15
Loose	15 - 35
Medium Dense	35 - 65
Dense	65 - 85
Very Dense	Greater than 85

#### MINOR COMPONENTS

TERM	ASSESSMENT GUIDE	PROPORTION OF MINOR COMPONENT IN:			
Trace of	Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.	Coarse grained soils: <5% Fine grained soils: <15%			
With some	Presence easily detected by feel or eye, soil properties little different to general properties of primary component.	Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%			

#### SOIL STRUCTURE

	ZONING	CEMENTING				
Layers	Continuous across exposure or sample.	Weakly cemented	Easily broken up by hand in air or water.			
Lenses	Discontinuous layers of lenticular shape.	Moderately cemented	Effort is required to break up the soil by hand in air or water.			
Pockets	Irregular inclusions of different material.					

GEOLOGICAL ORIGIN WEATHERED IN PLACE SOILS							
Extremely weathered material	Structure and fabric of parent rock visible.						
Residual soil	Structure and fabric of parent rock not visible.						
TRANSPORTE	D SOILS						
Aeolian soil	Deposited by wind.						
Alluvial soil	Deposited by streams and rivers.						
Colluvial soil	Deposited on slopes (transported downslope by gravity).						
Fill	Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils.						
Lacustrine soil	Deposited by lakes.						
Marine soil	Deposited in ocean basins, bays, beaches and estuaries.						

# coffey **>**

# Soil Description Explanation Sheet (2 of 2)

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and basing fractions on estimated mass)						USC	PRIMARY NAME		
		arse 2.0 mm	EAN /ELS ttle no es)	Wide amou	range in grain size a Ints of all intermediat	nd substantial e particle sizes.	GW	GRAVEL	
3 mm is		/ELS If of co	CLE GRANE (Lit	Predo with r	ominantly one size or more intermediate siz	a range of sizes es missing.	GP	GRAVEL	
SOILS than 60	eye)	GRAV than ha is large	/ELS FINES ciable unt nes)	Non- proce	plastic fines (for ident	tification )	GM	SILTY GRAVEL	
AlINED ials less 0.075 m	e naked	More	GRAN WITH I (Appre amo of fir	Plasti see C	c fines (for identificat L below)	ion procedures	GC	CLAYEY GRAVEL	
ARSE GF of mater jer than	ble to th	trse .0 mm	AN DS S) S)	Wide amou	range in grain sizes a ints of all intermediat	and substantial e sizes	SW	SAND	
COA an 50% larç	ticle visi	IDS If of coa er than 2	CLE SAN (Litt or r	Predo with s	Predominantly one size or a range of sizes with some intermediate sizes missing.		SP	SAND	
More the	out the smallest part	SAN than ha s smalle	VDS FINES eciable ount nes)	Non-plastic fines (for identification procedures see ML below).			SM	SILTY SAND	
		More	SAI WITH (Appre amo	Plastic fines (for identification procedures see CL below).			SC	CLAYEY SAND	
			IDENTIFICAT	ION PI	I PROCEDURES ON FRACTIONS <0.2 mm.				
uan nan	s ab		DRY STREN	GTH	DILATANCY	TOUGHNESS			
01LS less th 075 mr	rticle i	TS & CLAYS Liquid limit ss than 50	None to Low	1	Quick to slow	None	ML	SILT	
ED SC aterial an 0.0	nm pa		TS & juid	TS & Judia	Medium to H	ligh	None	Medium	CL
BRAIN of m aller th	.075 r	10 1 9	Low to medi	um	Slow to very slow	Low	OL	ORGANIC SILT	
FINE O n 50% is sma	(A O	LAYS nit tin 50	Low to medium		Slow to very slow	Low to medium	MH	SILT	
re tha 3 mm		S & Cl quid lir ter the	High		None	High	СН	CLAY	
Mc 66		SILT Lic grea	Medium to H	ligh	None	Low to medium	ОН	ORGANIC CLAY	
HIGHL' SOILS	HIGHLY ORGANIC Readily identified by colour, odour, spongy feel and frequently by fibrous texture.					gy feel and	Pt	PEAT	
• Low plasticity – Liquid Limit WL less than 35%. • Medium plasticity – WL between 35% and 50%.									

## SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

COMMON DEFECTS IN SOIL

TERM	DEFINITION	DIAGRAM	TERM	DEFINITION	DIAGRAM
PARTING	A surface or crack across which the soil has little or no tensile strength. Parallel or sub parallel to layering (eg bedding). May be open or closed.		SOFTENED ZONE	A zone in clayey soil, usually adjacent to a defect in which the soil has a higher moisture content than elsewhere.	AND DESCRIPTION OF THE OWNER OF T
JOINT	A surface or crack across which the soil has little or no tensile strength but which is not parallel or sub parallel to layering. May be open or closed. The term 'fissure' may be used for irregular joints <0.2 m in length.		TUBE	Tubular cavity. May occur singly or as one of a large number of separate or inter-connected tubes. Walls often coated with clay or strengthened by denser packing of grains. May contain organic matter	
SHEARED ZONE	Zone in clayey soil with roughly parallel near planar, curved or undulating boundaries containing closely spaced, smooth or slickensided, curved intersecting joints which divide the mass into lenticular or wedge shaped blocks.		TUBE CAST	Roughly cylindrical elongated body of soil different from the soil mass in which it occurs. In some cases the soil which makes up the tube cast is cemented.	
SHEARED SURFACE	A near planar curved or undulating, smooth, polished or slickensided surface in clayey soil. The polished or slickensided surface indicates that movement (in many cases very little) has occurred along the defect.		INFILLED SEAM	Sheet or wall like body of soil substance or mass with roughly planar to irregular near parallel boundaries which cuts through a soil mass. Formed by infilling of open joints.	

72810-03/02/2009



# Rock Description Explanation Sheet (1 of 2)

The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.									
DEFINITIONS: Rock Substance	Rock s In engi disinte homog	Rock substance, defect and mass are defined as follows: In engineering terms roch substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic.							
Defect Mass	Discor Any bo more s	ntinuity or break in the continuity of a substance or sub ody of material which is not effectively homogeneous. It c substances with one or more defects.	Ibstances. can consist of two or more substances without defects, or one or						
SUBSTANCE D	DESCR	IPTIVE TERMS:	ROCK SI	JBSTA	NCE STRE	NGTH TERMS			
ROCK NAME	Simpl geolog	e rock names are used rather than precise gical classification.	Term A i	bbrev- ation	Point Load Index, I <sub>s(50)</sub> (MPa)	Field Guide			
PARTICLE SIZE Coarse grained Medium grained Fine grained	Grain s Mainly Mainly Mainly	size terms for sandstone are: 0.6mm to 2mm 0.2mm to 0.6mm 0.06mm (just visible) to 0.2mm	Very Low	VL	Less than 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces un to 30mm thick can			
FABRIC	Terms cleava	for layering of penetrative fabric (eg. bedding, age etc. ) are:				be broken by finger pressure.			
Massive	No lay	ering or penetrative fabric.	Low		01 to 03	Fasily scored with a knife.			
Indistinct	Layering	g or fabric just visible. Little effect on properties.	LOW	-	0.1 10 0.0	indentations 1mm to 3mm			
Distinct	Layerii easily	ng or fabric is easily visible. Rock breaks more parallel to layering of fabric.				pick point; has a dull sound under hammer. Pieces of			
CLASSIFICATIO	ON OF eviation	ON OF WEATHERING PRODUCTS eviation Definition				diameter may be broken by hand. Sharp edges of core may be friable and break during bandling			
Residual F Soil	10	mass structure and substance fabric are no longer evident; there is a large change in volume but the soil has not been significantly transported.	Medium	м	0.3 to 1.0	Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be			
Extremely X Weathered Material	w	Material is weathered to such an extent that it has soil properties, ie, it either disintegrates or can be remoulded in water. Original rock fabric still visible	High	н	1 to 3	broken by hand with difficulty. A piece of core 150mm long			
Highly H Weathered Rock	iw	Rock strength is changed by weathering. The whole of the rock substance is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Some minerals are decomposed	g.			by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.			
		to clay minerals. Porosity may be increased by leaching or may be decreased due to the deposition of minerals in pores.	Very High	VH	3 to 10	Hand specimen breaks after more than one blow of a pick; rock rings under			
Moderately M Weathered Rock	/W	The whole of the rock substance is discoloured, usually by iron staining or bleaching, to the extent that the colour of the fresh rock is no longer recognisable.	Extremely	ЕН	More than 10	hammer. Specimen requires many			
Slightly S Weathered Rock	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance (usually by limonite) has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance		High Notes on F	Rock Su	Ibstance Stree	blows with geological pick to break; rock rings under hammer.			
Fresh Rock	FR	Rock substance unaffected by weathering	perpendicu	lar to the	anisotropy. High	strength anisotropic rocks may			
Notes on Weathe 1. AS1726 suggests substance weathe not practical to de advantage in mak given in AS1726. 2. Where physical ar associated with ig "weathering" to g "weathering" to g	<ol> <li>2. The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.</li> <li>3. The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index I<sub>s</sub>(50). The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.</li> </ol>								



# Rock Description Explanation Sheet (2 of 2)

COMMON ROCK MA Term	I DEFECTS IN SSES Definition	Diagram	Map G Symbol	iraphic Log (Note 1)	DEFECT SHAPE Planar	<b>TERMS</b> The defect does not vary in orientation
Parting	A surface or crack across which the rock has little or no tensile strength.		20		Curved	The defect has a gradual change in orientation
	Parallel or sub parallel to layering (eg bedding) or a planar anisotropy		Beddir 20	g	Undulating	The defect has a wavy surface
	in the rock substance (eg, cleavage). May be open or closed.		Cleava	<sup>ge</sup> (Note 2)	Stepped	The defect has one or more well defined steps
Joint	A surface or crack across which the rock has little or no tensile strength.				Irregular	The defect has many sharp changes of orientation
	but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance.		60	(Note 2)	Note: The assess influenced	sment of defect shape is partly by the scale of the observation.
	May be open or closed.			(10016-2)	ROUGHNESS Slickensided	<b>TERMS</b> Grooved or striated surface, usually polished
Sheared Zone	Zone of rock substance with roughly parallel near planar, curved or				Polished	Shiny smooth surface
(1006 3)	undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of		35		Smooth	Smooth to touch. Few or no surface irregularities
	the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.	1.1.1		<i>*</i> *	Rough	Many small surface irregularities (amplitude generally less than 1mm). Feels like fine to coarse sand paper.
Sheared Surface (Note 3)	A near planar, curved or undulating surface which is usually smooth, polished or slickensided.		40	10/201	Very Rough	Many large surface irregularities (amplitude generally more than 1mm). Feels like, or coarser than very coarse sand paper.
Crushed Seam	Seam with roughly parallel almost planar boundaries, composed of	log	50		COATING TER Clean	<b>MS</b> No visible coating
(1016-3)	disoriented, usually angular fragments of the host rock substance which may be more			· · · · · · · · · · · · · · · · · · ·	Stained	No visible coating but surfaces are discoloured
	seam has soil properties.			17 1	Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Infilled Seam	Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, infilled seams less than 1mm thick may be described as veneer or coating on joint surface.				Coating	A visible coating up to 1mm thick. Thicker soil material is usually described using appropriate defect terms (eg, infilled seam). Thicker rock strength material is usually described as a vein.
Extremely	Seam of soil substance, often with		. 32		BLOCK SHAPE Blocky	<b>TERMS</b> Approximately equidimensional
Weathered Seam	gradational boundaries. Formad by weathering of the rock substance in place.		TINDER		Tabular	Thickness much less than length or width
		` Seam		~	Columnar	Height much greate than cross section
Notes on D	efects: Iy borehole logs show the true dip of defects a	and face sketch	es and sections t	he apparent dip		

2. Partings and joints are not usually shown on the graphic log unless considered significant.

<sup>3.</sup> Sheared zones, sheared surfaces and crushed seams are faults in geological terms.



**APPIAN GROUP** client:

## principal:

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

1 of 2 sheet: GEOTWARA22354AA project no. date started: 12 Aug 2014 date completed: 12 Aug 2014 logged by: JR ABL checked by:

BH 01

Borehole ID.

ро	position: E: 358474; N: 6318770 (MGA94 drill model: Patrol FG102						6A94 Z	4 Zone 56) surface elevation : 27.00m (AHD) angle from horizontal: 90°								
dri	ll mod	lel: P	atrol	FG102				mount	nting: Light Vehicle hole diameter : 100 mm							
d	rilling	infor	mati	on			mate	erial sub	ubstance							
nethod &	support	penetration	vater	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description     Arr Signed point     Arr Signed point     Arr Signed point       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components     Dispersive secondary and minor components     Dispersive secondary and minor components     Image: Component secondary and minor components     Image: Component secondary and minor component secondary							
	<u> </u>	3	_	E	- 27 - -	-		SP	TOPSOIL: SAND: fine grained, brown to pale       M       IIIII       TOPSOIL         brown, trace fines. Trace rootlets.       M       IIIII       RESIDUAL SOIL         SAND: fine and medium grained, pale brown to orange, trace fines.       IIIIII       IIIIIII							
AD/V				E SPT 5, 7, 16 N*=23	-26	- 1.0— -		SC	CLAYEY SAND: fine and medium grained, pale brown to orange mottled grey.  CLAYEY SAND: fine and medium grained, pale MD IIIII IIIII IIIII IIIII IIIII IIIIIIII	-  - - - -						
•					-25	2.0-		СП	Sand.     Sands       Borehole BH 01 continued as cored hole     IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII							
<b>'2014 15:41</b>					- -24	3.0-										
<pre>c<drawingfile>&gt; 15/09/</drawingfile></pre>					-23	4.0-										
WARA22354AA.GPJ 🤞					- -22		-									
: NON CORED GEOI					21	-										
Log COF BOREHOLE					_	-										
CDF_0_9_04BA.GLB					-20	7.0-										
m Al A R W C H D B V T * e.	ethod D au S au R roll / wa T cal A ha Dla U bla V t C bit g. AC	ger dril ger scr ler/trica shbore ble too nd aug atube ank bit bit showr D/T	ling* ewin one l er er	g* uffix	sup M C pen wat	port mud casing metration ser er € ↓ 10- lev wat	no ree rangir refusa Oct-12 w el on date ær inflow ær outflow	nil sistance og to al ater e shown	samples & field tests     classification symbol & soil description     consistency / relative density       B     bulk disturbed sample     soil description     VS     very soft       D     disturbed sample     classification symbol & soil description     VS     very soft       E     environmental sample     classification System     F     firm       V##     undisturbed sample ##mm diameter     F     firm       HP     hand penetrometer (kPa)     D     dry     H     hard       N     standard penetrometer (kPa)     M     moisture     VL     very soft       N*     SPT - sample recovered     W     wet     VL     very loose       VS     vare shear; peak/remouded (kPa)     WI     liquid limit     MD     medium dense       R     refusal     VD     urget dense     VD     urget dense							



	5		Borehole ID.	BH 01
Enai	incoring Log Core	d Darahala	sheet:	2 of 2
Engi	ineering Log - Core	a Borenole	project no.	GEOTWARA22354AA
client:	APPIAN GROUP		date started:	12 Aug 2014
principal:			date completed:	12 Aug 2014
project:	WYONG HOSPITAL REDEVEL	OPMENT	logged by:	JR
location:	WYONG		checked by:	ABL
position:	E: 358474; N: 6318770 (MGA94 Zone 56)	surface elevation: 27.00m (AHD)	angle from horizontal: 90°	
drill model:	Patrol FG102 mounting: L	ight Vehicle hole diameter :	100 mm	

	drilli	ng iı	nform	ation	mate	rial substance	rock mass defects								
	method & support	water	ảRL (m)	depth (m)	graphic log	material descriptic ROCK TYPE: grain charac colour, structure, minor cor	n xterisics, nponents	weathering & alteration	estimated strength & Is50 ×= axial; O= diametral ⊐ _ ∞ ⊥ <sup>↓</sup>	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm)	additional obs defect de (type, inclination, planar thicknes particular	ervations and scriptions ity, roughness, coating, s, other) general	
			- 			start coring at 1.60m				E	-				
			-25	- 2.0— -		Sandy CLAY: high plasticity, pal grained sand. Extremely weathe SANDSTONE: fine grained, pale bedding (5-15°).	e brown, fine red sandstone. / brown, distinct	XW MW		a=0.60 d=0.42	72%		JT, 5°, UN, VR, iron S JT, 15°, ST, RO, iron S JT, 40°, PL, RO, iron S JT, 10°, PL, RO, CN PT, 0°, PL, RO, CN PT, 5°, CU, RO, CN PT, 10°, PL, RO, CN JT x2, 30°, PL, RO, iro	N SN - SN - N N	
9/2014 15:43	NMLC		-24			INTERLAMINATED SILTSTONE SANDSTONE: SILTSTONE (709 and pale brown; SANDSTONE ( grained, pale brown, laminated t bedded. SANDSTONE: fine and medium gray, massive	AND 6), pale grey 30%), fine o very thinly grained, pale			a=0.10 d=0.20			PT, 5°, UN, RO, iron S PT, 5°, PL, RO, clay, P pale grey, 5mm PT, 5°, CU, RO, CN PT, 10°, PL, RO, clay, P pale grey, 10mm PT, 5°, PL, RO, clay, P pale grey, 20mm PT, 9°, PL, RO, clay, P	<ul> <li>N, closed</li> <li>iigh plasticity,</li> <li>high plasticity,</li> <li>nigh plasticity,</li> <li>N</li> </ul>	
<ul> <li>&lt;<drawingfile>&gt; 15/0</drawingfile></li> </ul>	V		-23	4.0		INTERLAMINATED SILTSTONE SANDSTONE: SILTSTONE (60° and pale brown; SANDSTONE ( grained, pale brown, laminated t bedded. SANDSTONE: fine and medium brown and pale grey, distinct bec	IE AND 0%), pale grey : (40%), fine to very thinly n grained, pale edding (0-5%.			a=0.10	79%		PT, 0°, PL, RO, CN PT, 10°, PL, RO, CN PT, 5°, PL, RO, iron S PT, 0°, PL, RO, iron S PT, 5°, PL, RO, iron S PT, 5°, PL, RO, iron S	N	
RED GEOTWARA22354AA.GI			-22	- 5.0 — - -		Borehole BH 01 terminated at 4.	55 m			d=0.10			(11,0,01,10,00	- - - - -	
3 Log COF BOREHOLE: COI			-21	6.0 — - - -										-	
CDF_0_9_04BA.GLE			-20	7.0											
	met DT AS AD RR CB W NMI NQ HQ PQ SPT	hod & d a c c c C N w w s t t	diatube auger screwing auger screwing roller/tricone claw or blade bit washbore C MMLC core (51.9 mm wireline core (47.6 mm wireline core (45.0 mm standard penetration test			& support       water         diatube auger screwing auger drilling roller/tricone claw or blade bit washbore NMLC core (51.9 mm) wireline core (47.6mm) wireline core (63.5mm) wireline core (63.5mm) standard penetration test       10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss       core reco (graphic symb core reco (graphic symb no core reco (graphic symb no co			e recover covered nbols indicate recovere ithdrawn ality Des	ry <sup>material</sup> ) ed ignation (%)	weathering RS residu XW extrem HW highly DW distinc MW moder SW slightly FR fresh "W replaced w strength VL very lov L low M medium H high VH very hig EH extrem	& altera al soil hely weat weathe thy weat ately we weathe ith A for a w n gh	attion* athered hered eathered eathered ered literation	defect type PT parting JT joint SZ shear zone SS shear surface CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity PL planar CU curved UN undulating ST stepped IR Irregular <b>coating</b> CN clean SN stain VN veneer CO coating



client: APPIAN GROUP

### principal:

## project: WYONG HOSPITAL REDEVELOPMENT

location: WYONG

sheet:1 of 2project no.GEOTWARA22354AAdate started:12 Aug 2014date completed:12 Aug 2014logged by:JRchecked by:ABL

BH 02

Borehole ID.

pos	ition: model: F	E: 3 Patrol	58434; N: 6 FG102	53186	83 (MG	6A94 Z	one 56) mount	surface elevation : 25.70m (AHD)	angle mm	from ho	orizont	al: 9	90°
dr	illing info	rmat	ion			mate	erial sub						
ethod &	penetration <b>6</b>	ater	samples & field tests	(m)	epth (m)	aphic log	assification	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	oisture	nsistency / lative density	han penet mete (kPa	d tro- er a)	structure and additional observations
CDF_0_9_04BA GLB Log COF BOREHOLE: NON CORED GEOTWARA22354AA GPJ < <drawingfile>&gt; 1509/2014 15.41</drawingfile>		wate	E SPT 8,11,13 N*=24	-25 -24 -23 -22 -22 -21 -20 -19 -18			SP SC SC	Colour, secondary and minor components TOPSOIL: SAND: fine grained, pale brown, trace fine and medium grained subrounded gravel. Trace rootlets. FILL: SAND: fine, medium and coarse grained, pale brown, trace fines. FILL: CLAYEY SAND fine and medium grained. At 1.2m, CLAY, high plasticity, brown, trace fine grained sand, 100mm. Borehole BH 02 continued as cored hole		MD			FILL / TOPSOIL
me AE AS RF V CT AD D V T	ethod auger dr auger sc roller/tric washbor cable too hand au diatube blank bit V bit TC bit bit show AD/T	illing* rewin one e ol ger	g* suffix	sup M C pen wat	port mud casing etration er ■ 10- wat wat wat	no reservation reservatio reservation reservation reservation reservation reservation rese	nil sistance ig to ater e shown	samples & field tests     c       B     bulk disturbed sample       D     disturbed sample       E     environmental sample       SS     split spoon sample       U##     undisturbed sample ##mm diameter       HP     hand penetrometer (kPa)       N     standard penetration test (SPT)       N*     SPT - sample recovered       VC     SPT with solid cone       VS     vane shear; peak/remouded (kPa)       R     refusal	lassificat soil de based Classifica drustifica dry moist wet plastic li liquid lir	iion sym escriptio on Unific ation Sys	<b>bol &amp;</b> n ed stem		consistency / relative density       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very loose       L     loose       MD     medium dense       D     dense



	5		Borehole ID.	BH 02
		d Derehele	sheet:	2 of 2
Eng	ineering Log - Core	ed Borenole	project no.	GEOTWARA22354AA
client:	APPIAN GROUP		date started:	12 Aug 2014
principal:			date completed:	12 Aug 2014
project:	WYONG HOSPITAL REDEVEL	OPMENT	logged by:	JR
location:	WYONG		checked by:	ABL
position:	E: 358434; N: 6318683 (MGA94 Zone 56)	surface elevation : 25.70m (AHD)	angle from horizontal: 90°	
drill model:	Patrol FG102 mounting:	Light Vehicle hole diamet	ter : 100 mm	
drilling inf	ormation material substance		rock mass defects	

L	drill	ing iı	nform	ation	mate	erial substance	ubstance				rock	mass defe	fects	
	ethod & Ipport	ater	- (m)	apth (m)	aphic log	material descriptic ROCK TYPE: grain charac colour, structure, minor cor	n cterisics, nponents	eathering & teration	estimated strength & Is50 X = axial; O = diametral	samples, field tests & Is(50) (MPa) a = axial;	re run RQD	defect spacing (mm)	additional obs defect des (type, inclination, planar thickness	ervations and scriptions ity, roughness, coating, s, other)
	E S	>	- -25	   1.0 	<u>6</u>			<u></u> ज ≤	± 2 ± 2 ∞ 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 × 2 ×	a = damerrai	<u>5</u> w		particular	geneta - - - - -
-		•	-24 -	2.0-		FILL: CLAYEY GRAVEL; fine to coarse grained, sub-angular, bro medium grained sand, trace bou of siltstone and sandstone. (FILL	wn, some fine to Iders / cobbles .)				0%			- - - -
File>> 15/09/2014 15:43	NMLC		- -22	3.0		NO CORE: 0.34 m FILL: CLAYEY GRAVEL: fine to coarse grained, sub-angular, bro medium grained sand, trace bou of siltstone and sandstone. (FILL At 3.8m, SAND (Alluvium), fine t arginad argu trace fine 2000	wn, some fine to Iders / cobbles .) o medium /				0%			- - - - - -
TWARA22354AA.GPJ < <drawing< td=""><td></td><td></td><td>-21</td><td>- - - 5.0-</td><td></td><td>CLAY: high plasticity, pale brown firm, =Wp. SANDSTONE: fine and medium brown and pale grey, indistinct b</td><td>n to pale grey,</td><td>MW - HW</td><td>+                                      </td><td>a=0.50 d=0.40</td><td>80%</td><td></td><td>← PT, 5°, PL, RO, CN PT, 10°, PL, RO, CN JJT, 5°, UN, RO, CN − JT, 10°, UN, VR, CN</td><td>- - - -</td></drawing<>			-21	- - - 5.0-		CLAY: high plasticity, pale brown firm, =Wp. SANDSTONE: fine and medium brown and pale grey, indistinct b	n to pale grey,	MW - HW	+	a=0.50 d=0.40	80%		← PT, 5°, PL, RO, CN PT, 10°, PL, RO, CN JJT, 5°, UN, RO, CN − JT, 10°, UN, VR, CN	- - - -
F BOREHOLE: CORED GEOT			-20	- - 6.0		Borehole BH 02 terminated at 5.	40 m							  
CDF_0_9_04BA.GLB Log CO			-19 -	- 7.0- - -										-
	Mel DT AS AD RR CB W NM NQ HQ PQ SP	thod & support auger screwing auger drilling roller/tricone claw or blade bit washbore LC NMLC core (51.9 mr wireline core (47.6mr wireline core (85.0mr wireline core (85.0mr tristandard penetration test		-18       -18       graphic log / cr         I & support       water       graphic log / cr         diatube       auger drilling       level on date shown         auger drilling       complete drilling fluid loss       core run         vashbore       model       partial drilling fluid loss         NMLC core (51.9 mm)       water pressure test result       core run         water pressure test result       uger cr       barrel         I & water pressure test result       core run       RQD = Rock (Interval shown			graphic log / core core rec (graphic syn no core core run & RQD barrel w RQD = Rock Qu	e recover overed hols indicate recovere ithdrawr ality Des	e material) ed signation (%)	weathering RS residua XW extrem HW highly DW distinct MW moder SW slightly FR fresh Wreplaged wi strength VL very low L low M medium H high VH very high H extreme	& altera al soil lely wea weathe weathe weathe th A for a w h h	attion* atthered red hered asthered asthered ered	defect type PT parting JT joint SZ shear surface CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity         PL       planar         CU       curved         UN       undulating         ST       stepped         IR       Irregular         coating         CN       clean         SN       stain         VN       veneer         CO       coating



APPIAN GROUP client:

#### principal:

W

CT

HA

DT

В

ν V bit

Ţ TC bit

washbore

cable tool

diatube

blank bit

AD/T e.a

hand auger

bit shown by suffix

#### WYONG HOSPITAL REDEVELOPMENT project:

logged by: JR WYONG ABL location: checked by: position: E: 358423; N: 6318653 (MGA94 Zone 56) surface elevation : 21.30m (AHD) angle from horizontal: 90° drill model: Geoprobe mounting: Track hole diameter : 100 mm drilling information material substance consistency / relative density material description hand structure and classification penetratio g penetro meter samples & additional obs ations Ê SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition field tests method a support graphic symbol Ē depth ( water (kPa) RL 0 0 0 0 TOPSOIL: CLAYEY SAND fine and W FILL / TOPSOIL St medium grained, brown, trace medium grained =Wp FILL -21 subangular gravel. Trace rootlets. |||||E Sandy CLAY: high plasticity, brown mottled pale ||||||grey, fine and medium grained sand. | | | |Sandy CLAY: medium plasticity, brown to orange Fb <Wp F |||||1.0 mottled pale grey, fine and medium grained sand, SPT 4, 5, 4 N\*=9 ||||||some fine and medium grained subangular gravel (sandstone / siltstone). |||||20 |||||||||||2.0 WEATHERED SILTSTONE / SC D - VD CLAYEY SAND: fine and medium grained, brown Μ | | | | |SANDSTONE to orange and pale grey. 19 PDT ||||||SPT | | | |\25/140mm N\*=R ||||||СН CLAY: high plasticity, pale grey and pale brown, <Wp н |||||3.0 trace fine grained sand. |||||| | | |18 ||||||СН CLAY: high plasticity, pale grey and brown, trace fine grained sand. 4.0 SPT |||> 15, 20, 25 N\*=45 17 1 111 DEOTIMAD 5.0 Borehole BH 03 continued as cored hole 11 | | | |16 ||||||11 |||||||||||1111 6.0 BODEHOIE ||||||15 SOF |||||||||11 20 ||||||MABA GLB 7.0 ||||||||||-14 Ę 11 1111 classification symbol & samples & field tests consistency / relative density method support soil description auger drilling\* N nil AD Μ mud bulk disturbed sample very soft В vs based on Unified AS RR auger screwing\* C casing D disturbed sample S soft Classification System roller/tricone environmental sample F St firm E netration

SS

U##

HP

Ν

N\*

Nc

VS

R

HB

no resistance ranging to refusal

10-Oct-12 water level on date showr

vater inflow

water outflow

V

split spoon sample

hammer bouncing

refusal

hand penetrometer (kPa)

SPT - sample recovered SPT with solid cone

undisturbed sample ##mm diameter

standard penetration test (SPT)

vane shear; peak/remouded (kPa)

moisture D dry M mois W wet

Wp

W

dry moist

plastic limit

liquid limit

Borehole ID.

sheet:

project no.

date started: date completed: BH 03 1 of 2

19 Aug 2014

19 Aug 2014

stiff

hard

friable

loose

dense

very loose

very dense

medium dense

very stiff

VSt

H Fb

VL

MD

L

D

חע

GEOTWARA22354AA



# **Engineering Log - Cored Borehole**

client: APPIAN GROUP

#### principal:

## project: WYONG HOSPITAL REDEVELOPMENT

location: WYONG

# Borehole ID.BH 03sheet:2 of 2project no.GEOTWARA22354AAdate started:19 Aug 2014date completed:19 Aug 2014logged by:JRchecked by:ABL

positio	on:	E	3584	23; N:	6318653 (MGA94 Zone 56)	surface elevation	n:21.	30m (AHD)		angl	e from horiz	ontal: 90°	
drill mo	rill model: Geoprobe mounting: Track hole diameter : 100 mm rilling information material substance rock mass defects material description additional observations and												
drillin	ng info	orma	tion	mate	rial substance			a attacate d		rock	mass defe	cts	and the second
nethod & upport	vater	KL (m)	lepth (m)	Jraphic log	ROCK TYPE: grain charac colour, structure, minor com	n terisics, ponents	veathering & Ilteration	estimated strength & Is50 X= axial; O= diametral	samples, field tests & Is(50) (MPa) a = axial; d = dametral	ore run & RQD	spacing (mm)	ddittonal obs defect de (type, inclination, planal thicknes	ervations and scriptions ity, roughness, coating, s, other) general
	-2	21		5					<u> </u>	-			-
	-2	20											-
	-1	19											-
	-1	18	3.0										-
	-1	17	4.0										- - - -
A	-1	16	<del>5.0</del> - - -		SANDSTONE: fine and medium g brown, distinct bedding (0-5%).	rained, pale	MW DW		a=0.50 d=0.20			— JT, 5°, PL, RO, iron SI	- - - N -
	-1	15	6.0		CLAYSTONE brown, massive.	ve.		DW		a=1.10 d=1.00	52%		JT, 15, PL, RO, CN JT, 15; PL, RO, CN PT, 10; PL, RO, CN JT, 30; PL, VR, CN JT, 15; PL, RO, CN JT, 15; PL, RO, CN JT, 15; PL, SO, CN
	-1	14	7.0		SILTSTONE: pale grey to green, distinct bedding (0 <sup>°</sup> ). CLAYSTONE: brown, distinct bed	some brown, Iding (0°).			a=0.10			<ul> <li>SZ, 5°, IR, VR, Clayey medium grained, 60m</li> <li>PT, 0°, PL, SO, CN</li> <li>PT, 0°, PL, SO, CN</li> </ul>	Gravel, fine to - m - -
metho DT AS AD RR CB W NMLO NQ HQ PQ PQ SPT	diat diat aug aug rolle clav was C NM wire wire star test	suppo tube ger sci ger dri er/trice w or b shbore LC co eline c eline c eline c aline c	ort rewing lling one lade bir e bre (51. core (47 core (63 core (85 penetr	t 9 mm) 7.6mm) 3.5mm) 5.0mm) ation	Restehole BH 03 terminated at 7.9 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss partial drilling fluid loss water pressure test result (lugeons) for depth interval shown	Core run & RQD = Rock Qua	e recove overed bols indicate recovere ithdrawn ality Des	e material) ed signation (%)	desult10           weathering           RS         residu:           XW         extrem           HW         highly           DW         distinc           MW         moder           SW         slightly           FR         fresh           *W replaced with         VL           VL         very low           L         low           M         medium           H         hight           VH         very hig           EH         extremediation	& altera al soil hely weather thy weather weather weather th A for a w h hely high	athered red thered eathered ered ilteration	defect type PT parting JT joint SZ shear zone SS shear surface CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity       PL     planar       CU     curved       UN     undulating       ST     stepped       IR     Irregular       coating       CN     clean       SN     stain       VN     veneer       CO     coating



APPIAN GROUP client:

#### principal:

position:

method & support

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

drilling information

penetration

water

logged by: JR ABL checked by: E: 358402; N: 6318688 (MGA94 Zone 56) surface elevation : 21.00m (AHD) angle from horizontal: 90° drill model: Patrol FG102 mounting: Light Vehicle hole diameter : 100 mm material substance consistency / relative density classification symbol material description hand structure and samples & field tests graphic log penetro meter additional obse vations depth (m) SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition ŝ (kPa) RL 40 3 2 10 40 3 2 10 E FILL: Sandy CLAY: medium plasticity, pale brown, D **RESIDUAL SOIL / FILL?** ||||||fine grained sand. Μ 1111 At 0.4m, trace fine and medium grained subangular E |||||gravel. |||||| | | ||||||1.0 -20 FILL: Sandy CLAY: medium plasticity, brown, fine and medium grained sand, trace fine and medium SPT 5, 7, 3

Borehole ID.

project no.

date started:

date completed:

sheet:

BH 04

12 Aug 2014

12 Aug 2014

GEOTWARA22354AA

1 of 1

		N*=10	-	-			grained subangular gravel.					
			-19	2.0-		СН	CLAY: high plasticity, pale grey mottled brown red, trace fine grained sand.	to =Wp	St		RESIDUAL S	OIL
		SPT 3, 4, 6 N*=10	-18							 **        **  		
			-17	- - 4.0		 CL	Sandy CLAY: medium plasticity, pale grey and pale brown, fine grained sand.		VSt - H			
<u>*</u>		SPT 20/50mm N*=R	-	-			Borehole BH 04 terminated at 4.35 m			>>>>         	<	
			-16	5.0-								
			_	-								
			-15	6.0-								
			-	-								
			-14 -	7.0								
				-								
metho AD a AS a RR r W v	od auger drilling* auger screwing roller/tricone washbore	g*	sup Mr Cc pen	port mud casing etration	N	l nil	samples & field tests       B     bulk disturbed sample       D     disturbed sample       E     environmental sample       SC     environmental sample	classifica soil c based Classific	tion symbol lescription I on Unified cation System	<b>&amp;</b>	consistency VS S F	y / relative density very soft soft firm etiff
VV V CT c HA h DT c B b V \ T T * b e.g. A	washbore cable tool hand auger diatube blank bit V bit TC bit bit shown by si AD/T	uffix	wate	er	Oct-12 wa er inflow er outflow	sistance ng to al ater e shown	SS     split spoon sample       U##     undisturbed sample ##mm diameter       HP     hand penetrometer (kPa)       N     standard penetration test (SPT)       N*     SPT - sample recovered       Nc     SPT with solid cone       VS     vane shear; peak/remouded (kPa)       R     refusal       HB     hammer bouncing	moisture D dry M moist W wet Wp plastic WI liquid li	limit mit		St VSt H Fb VL L MD D VD	stiff very stiff hard friable very loose loose medium dense dense very dense



client: APPIAN GROUP

#### principal:

position:

## project: WYONG HOSPITAL REDEVELOPMENT

E: 358380; N: 6318653 (MGA94 Zone 56)

location: WYONG

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checked by: surface elevation : 18.70m (AHD) angle from horizontal: 90°

Borehole ID.

sheet:

project no.

logged by:

date started:

date completed:

**BH 05** 1 of 1

JR

ABL

14 Aug 2014 14 Aug 2014

GEOTWARA22354AA

Ľ	drill n	nodel: Is	uzu	FG101			Ť.	mount	ng: Light Vehicle hole diamete	er : 100 n	nm					
L	drill	ing info	mati	on			mate	rial sub	stance							
	method & support	2 penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic colour, secondary and minor components	·,	moisture condition	consistency / relative density	h per m (H	and netro- leter (Pa)	structure and additional observations	
Ŀ	<b>A</b>			E					<b>FILL: ASPHALT</b> : angular, black, 10mm.		D		Ţ	ΪŤ	FILL - ASPHALT	-
				E	-	-			FILL: Gravelly SAND: fine, medium and coars grained, pale grey, fine and medium grained subangular gravel, trace fines.	;;e	D - M M				FILL - BASE / SUB-BASE MATERIAL FILL	
				E SPT 4, 4, 7	- 10	- 1.0—			fine and medium grained sand, trace fine and medium grained subrounded to subangular gracontains a brick.	avel,						-
				N*=11	-17	-		СН	CLAY: high plasticity, brown to red, trace fine grained sand, some zones of Sandy CLAY, hig plasticity, fine and medium grained sand.		=Wp	St - VSt		 	RESIDUAL SOIL	
				SDT	-	2.0-		СН	CLAY: high plasticity, brown to red mottled pal grey, trace fine and medium grained sand.	ie – – –	<wp< td=""><td>VSt - H</td><td></td><td>                       </td><td></td><td></td></wp<>	VSt - H		             		
014 15:41				7, 12, 16 N*=28	-16	3.0-										
JFIIe> 15/09/21					-15	-										
GPJ <<บr>				SPT 3, 6, 11 N*=17	-	4.0-		сн	Sandy CLAY: high plasticity, pale grey mottled pale brown to orange, fine grained sand.			Н			< < *	
NAKAZZ354MM					-14	- - 5.0-										
CORED GEOL				SPT	-13	-			grained sand.					                 ¥		-
SEHULE: NUN				4, 16, 23 N*=39	-	- 6.0-		СН	CLAY: high plasticity, pale grey, trace fine grai sand.	ned					XWEATHERED SILTSTONE / XSANDSTONE	
CUF BU	¥					-		Сп	brown, fine grained sand. Borehole BH 05 terminated at 6.5 m	ie						-
GLB LOY					-12	7.0-										-
904BA					_	-										
- L L					-11	-	-									-
┢	meth	nod			sun	port			samples & field tests	Cla	assificat	ion syml	ool 8	<u> </u>	consistency / relative density	_
	AD AS	auger dri	lling* rewin	q*	M C	mud	Ν	nil	B bulk disturbed sample		<b>soil d</b> e based	escription on Unifie	n d		VS very soft	
	RR W	roller/tric washbor	one	5	pen	etration	n		E environmental sample	C	Classific	ation Sys	tem		F firm	
	CT HA	cable too	l aer		Ď	- 0 0 	no res rangin	istance q to	U## undisturbed sample ##mm diameter	mois	ture drv				VSt very stiff	
	DT B	diatube blank bit	,		wat	er	l⊲ refusa	Ĭ	N standard penetration test (SPT)	M	moist wet				Fb friable	
	V T	V bit				<b>▼</b>  10-	Oct-12 wa el on date	ater shown	NC SPT with solid cone	Wp WI	plastic I liquid lir	imit nit			L loose	
	*	bit show	n by s	uffix		wat	ter inflow	,	VS vane shear; peak/remouded (kPa) R refusal			-			MD medium dense D dense	
	e.g.	bit shown by suffix AD/T			·	HB hammer bouncing						VD very dense				



client: APPIAN GROUP

#### principal:

## project: WYONG HOSPITAL REDEVELOPMENT

location: WYONG

sheet:1 of 1project no.GEOTWARA22354AAdate started:14 Aug 2014date completed:14 Aug 2014logged by:JRchecked by:ABL

BH 06

Borehole ID.

	positio	on: E: 358365; N: 6318685 10del: Isuzu FG101			18685 (MGA94 Zone 56)     surface elevation : 17.80m (AHD)     angle from horizontal:						90°				
	drill m	odel: Is	suzu l	FG101				mount	ing: Light Vehicle hole diamet	er : 100	mm				
I	drilli	ng info	rmati	on			mate	erial sul	ostance						
ſ	nethod & support	penetration	vater	samples & field tests	SL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic colour, secondary and minor components	2,	noisture condition	consistency / elative density	ha pen me (kl	and etro- eter Pa) 8 8	structure and additional observations
ł	4	32	-	E		<u> </u>			FILL: ASPHALT: angular, black, 10mm.		\ D		- A	0.4	FILL - ASPHALT
				E	-	-			FILL: Gravelly SAND: fine, medium and coars grained, pale grey, fine and medium grained Subangular gravel. trace fines.	se	D - M				FILL - BASE / SUB-BASE MATERIAL
					-17	- - 1.0-		СН	Sandy CLAY: high plasticity, brown, fine and medium grained sand, trace fine grained subangular gravel.		>vvp	S-F			RESIDUAL SOIL
				3, 9, 9 N*=18	- -16	-		СН	Sandy CLAY: high plasticity, pale grey and brown to red, fine and medium grained sand, some z of Clayey SAND, fine and medium grained, brown red.	own cones rown to	<wp< td=""><td>St - VSt</td><td></td><td>* *      </td><td></td></wp<>	St - VSt		* *     	
	— AD/V —			срт	_	2.0		СН	CLAY: high plasticity, pale grey and brown to			н			
14:01 +107/R0				25/130mm N*=R	-15	3.0-									* * 
vingrile>> i v					-14	-		 СН	CLAY: high plasticity, pale brown and pale gre with some brown to red, some fine grained so	 ey					WEATHERED SILTSTONE /
	•			SPT 25 /		4.0-	¥////	1		nu.					
444.GFu <				<u>N*=R</u>	-	-			Borehole BH 06 terminated at 4.15 m						
VARAZZOU					-13	- 5.0—									
עבה פבסו					-	-	-								-
					-12	-									
						6.0-									
BCNE					_	-									
500						-									-
					-11	7.0-									-
9.404						-									
0 0					Γ	-									-
3					-10	-								ii	
	meth AD AS RR W CT HA DT B V T *	od auger dr auger sc roller/tric washbor cable too hand au diatube blank bit V bit TC bit bit show	illing* crewing cone e ol ger n by s	g* uffix	sup M r C c pend wate	port mud casing etration er er ₽r lev wat	no ree rangir refusa Oct-12 wel el on date ter inflow	l nil sistance ng to al ater e shown	samples & field tests       B     bulk disturbed sample       D     disturbed sample       E     environmental sample       SS     split spoon sample       U##     undisturbed sample ##mm diameter       HP     hand penetrometer (kPa)       N     standard penetration test (SPT)       N*     SPT - sample recovered       Nc     SPT with solid cone       VS     vane shear; peak/remouded (kPa)       R     refusal	moi D M W Wp WI	lassifica soil d based Classific sture dry moist wet plastic liquid li	tion syml escriptio on Unifie ation Sys imit mit	n tem		consistency / relative density       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very loose       L     loose       MD     medium dense       D     dense



client: APPIAN GROUP

WYONG

### principal:

location:

position:

## project: WYONG HOSPITAL REDEVELOPMENT

E: 358343; N: 6318655 (MGA94 Zone 56)

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checked by: angle from horizontal: 90°

Borehole ID.

sheet:

project no.

logged by:

date started:

date completed:

**BH 07** 1 of 3

15 Aug 2014

15 Aug 2014

JR

ABL

GEOTWARA22354AA

drill model: Isuzu FG101 mo drilling information material							mount	ng: Light Vehicle hole diameter : 100 mm
dril	ing info	mati	on			mate	rial sul	stance
method & support	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description     And penetro- meter     hand penetro- meter     structure and additional observations       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components
		~	E 				СН	FILL: ASPHALT: angular, black, 10mm.       D       D       D       D       D       D       FILL - ASPHALT         FILL: Gravelly SAND: fine, medium and coarse grained, fine and medium grained subangular gravel, trace fines.       M - D       M       FILL - BASE / SUB-BASE         FILL: Sandy CLAY: high plasticity, brown and grey, fine and medium grained sand, trace fine grained subrounded to subangular gravel.       FILL: CLAY: high plasticity, pale grey mottled brown to red, trace fine and medium grained sand, trace fine grained subrounded to subangular gravel (weathered sandstone fragments).       =Wp       St - VSt       IIIII       RESIDUAL SOIL
CURED GEOLWARKK2004AANGF9 <<		15/08/14, 11:00am	SPT 3, 6, 10 N*=16	-13 - - -12 - -11	4.0		SC	At 3.7m, colour change to pale grey mottled brown to orange.       I I I I I I I I I I I I I I I I I I I
			7, 15, 11 N*=26	-10	6.0- 			Borehole BH 07 continued as cored hole              1             1
meti AD AS RR W CT HA DT B V T	auger dri auger dri augerscri roller/tric washbor cable too hand aug diatube blank bit V bit TC bit bit shown AD/T	lling* rewing one e l ger	g* uffix	sup M I C O pen Wate	port mud casing etration er er ∎ ∎ lev wat	N no resi rangin refusal Oct-12 wa el on date ter inflow ter outflow	nil istance g to iter shown	samples & field tests       B     bulk disturbed sample       D     disturbed sample       E     environmental sample       U##     undisturbed sample       U##     undisturbed sample       U##     undisturbed sample       U##     undisturbed sample       V##     undisturbed sample ##mm diameter       HP     hand penetration test (SPT)       N*     SPT - sample recovered       Nc     SPT with solid cone       VS     vare shear, peak/remouded (kPa)       R     refusal

surface elevation : 16.60m (AHD)



# **Engineering Log - Cored Borehole**

client: APPIAN GROUP

#### principal:

## project: WYONG HOSPITAL REDEVELOPMENT

location: WYONG

# Borehole ID.BH 07sheet:2 of 3project no.GEOTWARA22354AAdate started:15 Aug 2014date completed:15 Aug 2014logged by:JRchecked by:ABL

	posit	ion:	E	: 3583	43; N:	6318655 (MGA94 Zone 56)	surface elevation	on: 16.	60m (AHD)		angle	e from horiz	ontal: 90°	
L	drill r	node	el: Isu	zu FG1	01	mounting: Lig	nt Vehicle		hole diar	meter : 100	mm			
L	drill	ing i	nform	ation	mate	rial substance	rock	mass defe	cts					
	ethod & upport	ater	r (m)	epth (m)	aphic log	material descriptio ROCK TYPE: grain charac colour, structure, minor con	<b>n</b> cterisics, nponents	eathering & teration	estimated strength & Is50 × = axial; O = diametral	samples, field tests & Is(50) (MPa) a = axial;	bre run k RQD	defect spacing (mm)	additional obs defect de (type, inclination, plana thicknes	servations and escriptions rity, roughness, coating, ss, other)
┢	ຣີລ	ž	R	Ψ	g			ਡਾ ਵ	╡┘ॾェ≩毌	d = diametral	<u>8</u> ∞8	30,000	particular	general
<drawingfile>&gt; 15/09/2014 15:43</drawingfile>			-16 							E				
REHOLE: CORED GEOTWARA22354AA.GPJ <	-12 - -12 - - - - -11 - - 6.0 -					start coring at 6 40m								
CDF_0_9_04BA.GLB Log COF BO	-10 - -7.0- -7.0- - -9 - -9 -				X	NO CORE: 0.16 m SANDSTONE: fine and medium brown and pale grey, distinct bed	grained, pale dding (5-15°).	HW XW MW		a=0.10 d=0.10 a=0.90 d=0.70	83%		PT, 5°, UN, RO, CN PT, 10°, UN, RO, CO, 4mm PT, 15°, UN, RO, CN CS, 5°, PL, RO, Sand plasticity, brown and angular gravel JT x2, 15°, IR, RO, irro PT, 5°, PL, RO, irron S	, (clayey sand), y CLAY, high grey, some on SN N
	met DT AS AD RR CB W NM NQ HQ PQ SP1	thod a a a rr c c LC N v v v r s t	& supp liatube luger s luger d oller/tri law or vashbo IMLC o vireline vireline tandar est	crewing rilling cone blade bi re core (51 core (4 core (6 core (8 d penetri	it .9 mm) 7.6mm) 3.5mm) 5.0mm) ration	water Io/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss partial drilling fluid loss partial drilling fluid loss	graphic log / cor core rec (graphic syr no core core run & RQD barrel w RQD = Rock Qu	e recover covered mbols indicate recovere rithdrawn uality Des	ny material) d ignation (%)	weathering & alteration*     PT, 5°, PL, RO, iron SN       RS     residual soil     PT parting       XW     extremely weathered     PT parting       HW     highly weathered     JT joint       DW     distinctly weathered     SS shear surface       SW     slightly weathered     SS shear surface       SW     slightly weathered     SS shear surface       FR     fresh     B       'W replaced with A for alteration     SL       VL     very low     SL       L     low     SO smooth       M     medium     SO smooth       N     Neereer     SO smooth       VH     very low     VL very low       L     low     SO smooth       M     Neereer     SO smooth       YH     very rough     VR very rough			planarity PL planar CU curved UN undulating ST stepped IR Irregular <b>coating</b> CN clean SN stain VN veneer CO coating	



	J		Borehole ID.	BH 07
Enai	neering Log Cor	ad Darahala	sheet:	3 of 3
Engi	ineering Log - Cor	ed Borenole	project no.	GEOTWARA22354AA
client:	APPIAN GROUP		date started:	15 Aug 2014
principal:			date completed:	15 Aug 2014
project:	WYONG HOSPITAL REDEVEL	.OPMENT	logged by:	JR
location:	WYONG		checked by:	ABL
position:	E: 358343; N: 6318655 (MGA94 Zone 56)	surface elevation : 16.60m (AHD)	angle from horizontal: 90°	
drill model:	Isuzu FG101 mounting	: Light Vehicle hole diameter :	100 mm	
drilling info	ormation material substance		rock mass defects	

l	drill	ing iı	nform	nation	mate	rial substance					rock	mass defe	cts	
	ethod & pport	tter	(m) -	pth (m)	aphic log	material descriptio ROCK TYPE: grain charac colour, structure, minor cor	<b>n</b> xterisics, nponents	athering & eration	estimated strength & Is50 ×= axial; O = diametral	samples, field tests & Is(50) (MPa)	re run RQD	defect spacing (mm)	additional ob defect de (type, inclination, plana thicknes	servations and escriptions rity, roughness, coating, ss, other)
	- NMLC - su	8M	- - 8	de	иб	SANDSTONE: fine and medium brown and pale grey, distinct bec (continued) SANDSTONE: fine and medium grey, indistinct bedding (0-5%).	grained, pale dding (5-15°). grained, pale	MW - SW - SW - FR	₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩ ₩	d = diametral	80%		particular           ► PT, 5°, PL, RO, Iron S           ► PT, 10°, PL, RO, CN           ■ PT x8, 5°, PL, RO, iron S           ■ PT x2, 5°, PL, CN, iron S	general N
			_	9.0 —	· · · · ·					a=2.60			→ JT x2, 5°, PL, RO, iro	n SN
			-7			Borehole BH 07 terminated at 9.	12 m			d=2.00				
15:44			-6	- - - - 11.0 -										-
<pre>cDrawingFile&gt;&gt; 15/09/2014</pre>			-5											
OTWARA22354AA.GPJ <			-4	- - 13.0 — -										- - - -
REHOLE: CORED GE			-3	- - 14.0— -										- - -
9_04BA.GLB Log COF BO			-2											
CDF_0_			-1	-										-
	Met DT AS AD RR CB W NM NQ HQ PQ SPT	hod & d a rc c c u LC N w w s t t	supp satube uger s uger d bller/tri law or vashbo iMLC o vireline vireline tineline tandar est	crewing drilling cone blade bi pre core (51. e core (41 e core (63 e core (88 d penetr	t 9 mm) 7.6mm) 3.5mm) 5.0mm) ation	water 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss partial drilling fluid loss partial drilling fluid loss	graphic log / cor core rec (graphic syr no core core run & RQD barrel w RQD = Rock QU	re recover covered recovered recovered vithdrawn uality Des	ry material) ed	weathering           RS         residu           XW         extrem           HW         highly           HW         bisting           MW         modeus           SW         slightl           FR         fresh           *W replaced w         strength           VL         very loc           L         low           M         mediur           H         high           VH         very high	& altera & altera al soil nely weather weather y weather y weather weather weather weather y meather y meather w	tition* athered red hered bathered pred Iteration	defect type PT parting JT joint SZ shear zone SS shear zone CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity PL planar CU curved UN undulating ST stepped IR Irregular <b>coating</b> CN clean SN stain VN veneer CO coating



APPIAN GROUP client:

### principal:

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

Borehole ID. BH 08 sheet: 1 of 2 GEOTWARA22354AA project no. date started: 13 Aug 2013 date completed: 13 Aug 2014 logged by: JR checked by: ABL

	positio	sition: E: 358348; N: 6318687 (MGA94 Zon II model: Patrol FG102 rr							surface elevation : 17.20m (AHD) angle from horizontal: 90°	
drill model: Patrol FG102     mounting: Light Vehicle     hole diameter : 100 mm       drilling information     material substance										
ŀ	drilli	ng info	mati	on			mate	erial sub		
	nethod & support	penetration	vater	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description     And     structure and       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components     9 5 10 10 10 10 10 10 10 10 10 10 10 10 10	
ł	1	3 5 7	-	E					FILL: ASPHALT: angular, black, 10mm.     Image: Comparison of the second s	
				E	-17	-		CL	FILL: Gravelly SAND: fine, medium and coarse       D - M         grained, pale grey, fine and medium grained       Wp         Subangular gravel, trace fines.       Wp	
					-	-			Sandy CLAY: medium plasticity, brown, fine and nedium grained sand.	
				SPT 2, 3, 7 N*=10	-16	1.0— - -		СН	Sandy CLAY: high plasticity, pale grey mottled brown to red, fine and medium grained sand.     St - VSt     IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	
	<pre></pre>				-15	2.0-				
	- AD			SPT 3, 6, 13	_	-			At 2.5m, no sand.	
5/09/2014 15:42				11 - 13	-14	3.0		SC	CLAYEY SAND: fine and medium grained, pale       M - D       D - VD       I I I I       WEATHERED SILTSTONE / SANDSTONE         brown and orange mottled pale grey, some zones of clay, high plasticity, pale grey.       M - D       D - VD       I I I I       I I I I	
wingFile>> 15					-	-				
AA.GPJ < <dra< td=""><td>¥</td><td></td><td></td><td>SPT</td><td>-13</td><td>-</td><td></td><td></td><td></td></dra<>	¥			SPT	-13	-				
22354/				N*=R	-	_			Borehole BH 08 continued as cored hole	
BOTWARA					-12	5.0				
I CORED					_	-				
S Z	MLC –					60-				
SOREHOL	Ē				-11	-				
Log COF					  -	-				
9_04BA.GLB					-10	7.0				
CDF_0	1				_	-				
	meth AD AS RR W CT HA DT B V T *	od auger dri auger sc roller/tric washbor cable toc hand aug diatube blank bit V bit TC bit bit shown AD/T	lling* rewing one e l ger	g* uffix	sup M r C c pena wate	port mud casing etration - < ∞ ∞ er Pr leve wat wat	N no reserrangin refusa Oct-12 wa el on date er inflow er outflov	nil sistance ig to ater shown	classification symbol & soil description     consistency / relative density       B     bulk disturbed sample     soil description     VS     very soft       D     disturbed sample     based on Unified     S     soft       E     environmental sample     Classification System     F     firm       V##     undisturbed sample ##mm diameter     D     dry     F     firm       HP     hand penetrometer (kPa)     D     dry     H     hard       N*     SPT - sample recovered     M     wet     VL     very loose       VS     vare shear; peak/remouded (kPa)     WI     liquid limit     MD     medium dense       R     refusal     UD     work     VD     dense	



# **Engineering Log - Cored Borehole**

APPIAN GROUP client:

#### principal:

#### WYONG HOSPITAL REDEVELOPMENT project:

date completed: 13 Aug 2014 JR logged by:

Borehole ID.

sheet:

project no.

date started:

BH 08 2 of 2

13 Aug 2013

GEOTWARA22354AA

#### WYONG location:

ABL checked by: position: E: 358348; N: 6318687 (MGA94 Zone 56) surface elevation : 17.20m (AHD) angle from horizontal: 90° drill model: Patrol FG102 mounting: Light Vehicle hole diameter : 100 mm drilling information material substance rock mass defects material description estimated samples defect additional observations and field tests & Is(50) defect descriptions (type, inclination, planarity, roughness, coating, strength & Is50 spacing (mm) weathering 8 ROCK TYPE: grain characterisics, Ê alteration core run & RQD method graphic colour, structure, minor components Ē X = axial; O = diametra (MPa) thickness, other) depth water a = axial; d = diametr 30 300 300 300 300 RL particular genera 」≥ ェ 못 ᇤ Е 17 1 1 1 1 1 1 1 1 1 1 1 1 1 ||||||||||||||||||||||| | | | | || | | | | |||||||||||||||| | | | |10 |||||||||||||-16 ||||||| | | | |||||||||||||||| | | | | |||||||||||||||2.0 ||||||||||||||||15 1 1 1 1 1 |||||||||||||||||||||||||1 1 1 1 1 ||||||||||| | | | ||||||||||||||| | | | |3.0 |||||||-14 ||||||||||||||||||||||||||||||||||||||||||||. . . . . ||||||||4.0 |||||||||||||||1 | | | | ||||||||-13 ||||||1111 start coring at 4.61m GP SANDSTONE: fine and medium grained, pale grey and pale brown, distinct bedding (5<sup>°</sup>). At 4.70-4.95m, cross bedded (5-25<sup>°</sup>). MW VD A77354A A a=0.10 d=0.20 5.0 PT, 5°, PL, RO, iron SN -12 ||||94% ||||− PT, 5°, PL, VR, CN ∼ PT, 5°, PL, VR, clay, high plasticity, C 111 hΙ pale grey, 4mm BOREHOLE: CORED 111 - NMLC 6.0 11 HW JT, 20°, PL, RO, CN PT, 15°, PL, RO, iron SN PT, 5°, PL, RO, CO, clay, low -11 11 ← PT, 5°, PL, RO, CO, clay, low plasticity, 2mm ← PT, 5°, PL, RO, CN ← JT x3, 10°, UN, RO, iron SN ← PT, 5°, PL, RO, CN ← PT, 5°, PL, RO, iron SN ← JT, 45°, CU, VR, iron SN ← JT, 5 ← ST, IR, RO, iron SN ← PT, 0°, PL, RO, iron SN ← PT, 5°, PL, SO, CN ← JT, 20°, PL, SO, CN ← JT, 20°, PL, SO, CN 11 SOF a=0.70 d=0.90 g 75% Шi At 6.84m, siltstone, pale grey, distinct bedding 04BA.GLB 7.0 (0-5°), 90mm. I 1 -10 1 bx a=1.50 4\_1.20 - JT, 20°, PL, SO, CN, (closed) - PT, 0°, PL, RO, CN - JT, 30°, UN, VR, CN Borehole BH 08 terminated at 7.54 m Ę ||weathering & alteration defect type planarity method & support graphic log / core recovery water residual soil extremely weathered highly weathered parting joint shear zone PL planar CU curved UN undulating RS PT diatube auger screwing пτ XW JT SZ 10/10/12, water HW DW core recovered AS AD RR CB W DW distinctly weathered DW distinctly weathered MW moderately weathered SW slightly weathered FR fresh W replaced with A for alteration strength level on date shown auger drilling roller/tricone claw or blade bit SS shear surface ST stepped water inflow CS crushed seam IR Irregular SM seam DB drilling break complete drilling fluid loss no core recovered washbore partial drilling fluid loss NMLC NMLC core (51.9 mm) core run & RQD roughness coating NQ HQ PQ SPT wireline core (47.6mm) wireline core (63.5mm) wireline core (85.0mm) very low low medium SL slickensided POL polished CN clean SN stain VL barrel withdrawn M H VH water pressure test result VN 25uL SO RO smooth veneer standard penetration RQD = Rock Quality Designation (%) CO coating high very high rough very rough (lugeons) for depth test interval shown VR

hiah



APPIAN GROUP client:

WYONG

#### principal:

location:

#### project: WYONG HOSPITAL REDEVELOPMENT

checked by: angle from horizontal 90°

Borehole ID.

sheet:

project no.

logged by:

date started:

date completed:

BH 09 1 of 2

13 Aug 2013

13 Aug 2014

JR

ABL

GEOTWARA22354AA

ро	ositio	n:	E: 3	58301; N: 6	318690	(MGA	\94 Zor	ne 56)	surface elevation : 17.90m (AHD) angle from horizontal: 90°	
dr	drill model: Patrol FG102 drilling information ma							mounti	ing: Light Vehicle casing diameter : 100 mm	
d	Irillin	rilling information mater							ostance	
nethod &	upport	penetration	/ater	samples & field tests	(m)	epth (m)	raphic log	lassification ymbol	material description     And penetro- meter       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	structure and additional observations
Ā	s	- ~ ~	>					0 0	T FILL: ASPHALT: angular. black. 10mm. /\ D / IIII	- ASPHALT +
				E E	-				FILL: Gravely SAND: fine and medium grained, pale grey, fine and medium grained, gravel, trace fines.     M       FILL: Sandy CLAY: medium plasticity, brown, fine     IIIII	- BASE / SUB-BASE FERIAL
				U50 E	-17 1				And medium grained sand.  FILL: CLAY: high plasticity, brown, some fine and  Medium grained sand.  The sector of the matrix to the sector of	
				SPT 6, 4, 2 N*=6	- 16 2	2.0			orange mottled pale grey, fine and medium grained sand, some clasts of weathered rock, low strength sandstone, fine and medium grained.               IIIIIIIIIIIIIIIIIIIIIIIII	
10/08/2014 10:42				SPT 2, 4, 5 N*=9	-15 3				FILL: Sandy CLAY: medium plasticity, grey                         mottled brown, fine and medium grained sand,                       some clasts of weathered rock, low strength                       sandstone, fine and medium grained.	
					-14 4	+.0 +.0 - - - - - - - - -		SC	CLAYEY SAND: fine and medium grained, pale         VL         VL         IIIII	UVIUM
				SPT 2, 1, 1 N*=2	-13 5	- - - 5.0 - - - - -		SC	brown.       IIIII         CLAYEY SAND: fine grained, pale grey mottled       IIIII         pale brown.       IIIIII         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	
				SPT	-12 6			CL	Sandy CLAY: medium plasticity, pale grey, fine and medium grained sand.       =Wp       St - VSt	SIDUAL SOIL
			Q.	4, 7, 7 N*=14	-11 7	- - - - - - - - - - - - - - - - - - -		CL	Sandy CLAY: medium plasticity, pale grey mottled <wp< td="">         VSt - H         IIIII           pale brown, fine grained sand.         <iv< td="">         VSt - H         IIIII</iv<></wp<>	
			13/08/14 10	SPT 4, 11, 12 N*=23	-10					
n A F V C H D B V T , e	netho ND a NS a NR r V v NT c HA h DT d NDT d N NT b N NT b N NT b N NT b N NT b N NT b N NT b N N N N N N N N N N N N N N N N N N N	d uuger dr uuger sc oller/tric vashbor able too and au liatube lank bit / bit 'C bit it show \D/T	illing* rewing one e bl ger n by s	g* uffix	suppor M muc C casi penetra water	rt d ation 4 co level - vater water	N no resis ranging refusal ct-12 wate on date s r inflow r outflow	nil tance to er shown	samples & field tests     classification symbol & soil description     cd v       B     bulk disturbed sample     based on Unified     v       D     disturbed sample     classification System     F       E     environmental sample     Classification System     F       S     split spoon sample     v     V       U##     undisturbed sample ##mm diameter     M     S       HP     hand penetrometer (kPa)     M     M       N     standard penetration test (SPT)     W     W       N*     SPT - sample recovered     W     W       VS     vane shear; peak/remouded (kPa)     M     M       R     refusal     D     D       HB     hammer bouncing     V     V	onsistency / relative density S very soft soft firm t stiff St very stiff hard b friable L very loose loose ID medium dense 0 dense D very dense



APPIAN GROUP client:

principal:

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

Borehole ID. BH 09 2 of 2 sheet: GEOTWARA22354AA project no. date started: 13 Aug 2013 date completed: 13 Aug 2014 logged by: JR checked by: ABL

р	ositio	on:	E: 3	858301; N: 6	63186	90 (MG	6A94 Zo	one 56)	surface elevation : 17.90m (AHD)	:	angle	from ho	rizon	tal: 9	90°
d	rill m	odel: F	atrol	FG102				mounti	ng: Light Vehicle casing dian	neter : 100 i	mm				
	drilli	ng info	rmati	ion	_		mate	erial sub	stance						
athod &	upport	penetration	ater	samples & field tests	L (m)	epth (m)	raphic log	lassification	material description SOIL TYPE: plasticity or particle characteristi colour, secondary and minor components	ic,	loisture andition	onsistency / slative density	har pene met	nd etro- ter a)	structure and additional observations
0_9_04BA.GLB Log COFBOREHOLE: NON CORED GEOTWARA22354AA.GPJ < <drawingfile>&gt; 15/09/2014 15:42</drawingfile>	troddins		water	SPT 6, 18, 25/70mm N*=R	(E) 12 9 9 8 7 7 7 6 7 7 7 7 7 7			Classificati	SolL TYPE: plasticity or particle characteristic colour, secondary and minor components	c,	and a condition different	P relative den	beate         design of the second secon	$\begin{array}{c} \operatorname{tro-trial}_{00} \\ \operatorname{is}_{00} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \end{array} \\ \begin{array}{c} \operatorname{br}_{00} \\ \end{array} \\ $	additional observations
	neth AD AS R W CT HA DT HA DT S J ( * *	od auger dr auger sc roller/tric washbor cable too hand au, diatube blank bit V bit TC bit bit show AD/T	illing* rewin one e bl ger	g* suffix	_2 Sup C d pen Wat	port mud ≿asing etration er er vat leve wat	N no res rangin refusa Oct-12 wa el on date er inflow er outflov	nil sistance ig to ater e shown	samples & field tests       B     bulk disturbed sample       D     disturbed sample       E     environmental sample       SS     split spoon sample       U##     undisturbed sample ##mm diameter       HP     hand penetrometer (kPa)       N     standard penetration test (SPT)       N*     SPT - sample recovered       Nc     SPT with solid cone       VS     vane shear; peak/remouded (kPa)       R     refusal	clas Cla D dri M m W w Wp pl Wl lic	<b>ssificat</b> <b>soil de</b> based assifica ry noist ret lastic li quid lin	ion symboscription on Unified ation Syst	                                 		consistency / relative density         VS       very soft         S       soft         F       firm         St       stiff         VSt       very stiff         H       hard         Fb       friable         VL       very loose         L       loose         MD       medium dense         D       dense



client: APPIAN GROUP

#### principal:

position:

## project: WYONG HOSPITAL REDEVELOPMENT

E: 358317; N: 6318663 (MGA94 Zone 56)

location: WYONG

 sheet:
 1 of 3

 project no.
 GEOTWARA22354AA

 date started:
 14 Aug 2014

 date completed:
 14 Aug 2014

 logged by:
 JR

 checked by:
 ABL

BH 10

Borehole ID.

L	drill m	ill model: Isuzu FG101 Irilling information					mount	ng: Truck hole diameter : 100 mm	
	drilli	ng infor	mati	on			mate	erial sul	ostance
	method & support	2 penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description     Air State     hand penetro- meter     structure and additional observations       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components     0 15 00 00 00 00 00 00 00 00 00 00 00 00 00
	A	<u></u>		E E SPT 4, 6, 4 N*=10	-16				FILL: ASPHALT: angular, black, 10mm.       D       D       FILL: Gravelly SAND: fine, medium and coarse grained, pale grey, fine and medium grained subangular gravel, trace fines.       D - M       H               FILL - ASPHALT         At 0.3m, some fines.       M       W       H               FILL: Sandy CLAY: medium plasticity, brown, fine and medium grained subrounded to subangular gravel. A piece of concrete / volcanic rock at 0.6m.       M       H               FILL: ASPHALT
14.15:42	AD/V			SPT 4, 2, 2 N*=4	-14	2.0-		SP SP SC	SAND: fine and medium grained, brown, some fines.       L       I       I       ALLUVIUM         Clayey SAND: fine and medium grained, brown.       I       I       I       I       I
JrawingFile>> 15/09/20				SPT	-	4.0-		 СН	CLAY: high plasticity, pale brown, trace fine grained sand.       =Wp       VSt - H
4KAZZ354AA.GPJ < <i< td=""><td></td><td></td><td></td><td>8, 12, 14 N*=26</td><td>-12</td><td></td><td></td><td></td><td>brown to orange, fine and medium grained sand.              1   1   1   1</td></i<>				8, 12, 14 N*=26	-12				brown to orange, fine and medium grained sand.              1   1   1   1
NUN COKED GEOLW				SPT 15, 17, 13 N*=30	-11			SC	Clayey SAND: fine and medium grained, pale grey and brown to orange.          M - D       D       I   I   I   I   I   I   I   I   I   I
CUF_U_9_04EA.GLE LOG CUF DUREMULE	¥				-9 -	7.0-			Borehole BH 10 continued as cored hole         I
	metho AD AS RR W CT HA DT B V T *	od auger dri auger sc roller/tric washborr cable too hand aug diatube blank bit V bit TC bit bit showr AD/T	lling* rewing one e I ger	g* uffix	sup M r C c penv wate	port mud casing etratior er er ∎ lev wa lev wa	N no ress rangin refusa Oct-12 wa el on date ter inflow ter outflow	nil iistance ig to ater e shown	classification symbol & consistency / relative density         B       bulk disturbed sample       soil description       VS       very soft         D       disturbed sample       based on Unified       S       soft       S         E       environmental sample       based on Unified       S       soft       S       soft         U##       undisturbed sample ##mm diameter       based on Unified       S       soft       S       soft         HP       hand penetrometer (kPa)       moisturbe       D       dry       H       hard         N       standard penetration test (SPT)       M       moist       VL       very loose         VS       vane shear; peak/remouded (kPa)       W       Wit liquid limit       L       loose         VS       vane shear; peak/remouded (kPa)       W       Wit liquid limit       U/D       very dense



# **Engineering Log - Cored Borehole**

client: APPIAN GROUP

#### principal:

## project: WYONG HOSPITAL REDEVELOPMENT

location: WYONG

# Borehole ID.BH 10sheet:2 of 3project no.GEOTWARA22354AAdate started:14 Aug 2014date completed:14 Aug 2014logged by:JRchecked by:ABL

po	sition: E: 358317; N: 6318663 (MGA94 Zone 56) surface elevation : 16.20m (AHD) I model: Isuzu FG101 mounting: Truck hole diameter : 10										angle from horizontal: 90° leter : 100 mm				
dri	l mo	odel	: Isu	zu FG1	01	mounting: Tru	uck	mm							
dr	illin	g in	form	ation	mate	rial substance			and an et al.		rock	mass defe	cts		
method &	lioddns	water	RL (m)	depth (m)	graphic log	material descriptio ROCK TYPE: grain charac colour, structure, minor con	n cterisics, nponents	weathering & alteration	estimated strength & Is50 X=axial; O=diametral	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm)	additional obs defect de (type, inclination, plana thicknes particular	servations and escriptions rity, roughness, coating, ss, other) general	
		-	-16 -	- - - 1.0 -						E				- - - - - - - - - - - - - 	
											-  - - -				
15/09/2014 15:44		-	-13	3.0 —										-  - -	
AA.GPJ < <drawingfile>&gt;</drawingfile>		-	-12	- 4.0 - -										- - - - -	
ORED GEOLWARA2235		-	-11	5.0 — - - -										 - - -	
JLE: C				6.0 —		start coring at 6 20m								-	
Т Т	+		10		$\geq$	NO CORE: 0.14 m	_						-		
		-9	- - 7.0-		SANDSTONE: fine and medium grey, with zones of brown to orar bedding.	grained, pale nge, indistinct	HW			14%		<ul> <li>JT, 90°, UN, RO, San rootlets, (partings thro JT, 70°, PL, RO, iron : JT, 15°, UN, VR, iron</li> </ul>	- 		
CDF_0_9			-	-		<b>SANDSTONE</b> : fine and medium to orange and pale grey, distinct (5°15°).	grained, brown bedding	MW		a=0.50 d=0.50	52%		PT, 5°, PL, RO, CN PT, 10°, PL, RO, CN PT, 0°, UN, RO, CO, (	_  clay, high	
r DAARCVN N H PS	method & support DT diatube AS auger screwing AD auger drilling RR roller/tricone CB claw or blade b W washbore WMLC NMLC core (51 NQ wireline core (4 HQ wireline core (6 SPT standard penet test				it .9 mm) 7.6mm) 3.5mm) 5.0mm) ration	water 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss partial drilling fluid loss Tage water pressure test result (lugeons) for depth interval shown	graphic log / corr         core rec         (graphic syn         no core         core run & RQD         barrel w         RQD = Rock Qu	e recover overed not indicate recovere ithdrawn ality Des	ry <sup>material</sup> ) id ignation (%)	d=0.50 52%			defect type PT parting JT joint SZ shear zone SS shear surface CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity       PL     planar       CU     curved       UN     undulating       ST     stepped       IR     Irregular       coating       CN     clean       SN     stain       VN     veneer       CO     coating	



						Borehole ID.	BH 10
Enai	nearing Lag Cared Paral					sheet:	3 of 3
Engi	neering Log - Corea Borei	noie				project no.	GEOTWARA22354AA
client:	APPIAN GROUP					date started:	14 Aug 2014
principal:						date completed	14 Aug 2014
project:	WYONG HOSPITAL REDEVELOPMENT					logged by:	JR
location:	WYONG					checked by:	ABL
position:	E: 358317; N: 6318663 (MGA94 Zone 56) surface elevati	ion : 16.2	20m (AHD)		angle	from horizontal: 90	0°
drill model:	Isuzu FG101 mounting: Truck		hole diar	neter : 100 i	mm		
drilling info	ormation material substance				rock	mass defects	
	material description	ø	estimated	samples,		defect	additional observations and

	nethod & upport	ater	L (m)	epth (m)	raphic log	material descriptio ROCK TYPE: grain charac colour, structure, minor con	<b>n</b> eterisics, nponents	eathering & Iteration	estimated strength & Is50 ×= axial; o= diametral	samples, field tests & Is(50) (MPa) a = axial;	ore run k RQD	de sp (I	efec acin mm)	t g	additional obs defect des (type, inclination, planar thicknes	ervations and scriptions rity, roughness, coating, s, other)
┟	5 3	Š	R	ğ	6		analise of the second	≥ <del>.</del>	~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~ ~	d = diametral	<u>ॅ</u> ∾	¦ 8 ₽́	₿₽ T	2 8	particular _ plasticity, pale brown)	general
			-8	-		to orange and pale grey, distinct	bedding	IVIVV				l i i	Į į	į	_	NS NS
	- LC			-	· · · · ·	8.23 m: Some siltstone lenses up	o to 8mm wide,									- SO, irc
	NN 		-		· · · · ·	grey.				a=1.40	52%	먉				- desc
				9.0 —						d=0.70		쿻	ij	ļ		- 15°, "Twise"
ŀ	*		-7	-		Borehole BH 10 terminated at 9.	17 m									s othe
				-												are:F
			-									lii	ij	ļ		- efectt
				10.0 —												Δ
			-6	-												-
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			-	-												-
				11.0												-
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ngFile>				12.0 —								l i i	ij	Ì		-
cDrawi			-4	-												-
sPJ ≪				-												-
54AA.C			-	-								l i i	İİ	į		-
RA223			2	13.0 —												_
OTWA			-3	-												-
Ð G				-												-
CORE				-								[ į į	ij	į		-
HOLE			-2	14.0												
BORE			_	-												-
J COF			_	-								l i i	İİ	Ì		-
LD LO				15.0-												-
4BA.G			-1	-												-
0_9_0				-												-
CDF			-	-								l i i	İ			-
╞		haili	8			water	manhie to a fa			weathering	& alter:	ation*			defect type	planarity
	DT AS AD RR CB W NM NQ HQ PQ	method & support DT diatube AS auger screwing AD auger drilling RR roller/tricone CB claw or blade bit W washbore NMLC NMLC core (51.9 mm) NQ wireline core (63.5mm PQ wireline core (63.5mm PQ wireline core (65.0mm)			it .9 mm) 7.6mm) 3.5mm) 5.0mm)	Vater Va	core run & RQD	overed bols indicate recovere thdrawn	r y material) ed	RS residu XW extrem HW highly DW distinc MW moder SW slightly FR fresh 'W replaced w strength VL very lov L low M mediun	al soil nely weat weathe ately weat y weathe ith A for a w	athere red therec eather ered	ed d red		PT parting JT joint SZ shear zone SS shear surface CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth	PL planar CU curved UN undulating ST stepped IR Irregular <b>coating</b> CN clean SN stain VN veneer
	0F	te	standard penetration test		30011	interval shown	RQD = Rock Qua	ality Des	ignation (%)	H high VH very hig EH extreme	gh elv hiah				RO rough VR very rough	CO coating



**APPIAN GROUP** client:

#### principal:

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

	posit	ion:	E: 3	58330; N: (	63187	24 (MG	GA94 Zo	one 56)	surface elevation : 21.30m (AHD) angle from horizontal: 90°	
	drill r	nodel: (	Зеорі	obe				mount	ing: Track hole diameter : 100 mm	
	drill	ling info	rmati	ion			mate	erial sul	ostance	
	lethod & upport	penetration	ater	samples & field tests	L (m)	epth (m)	raphic log	assification /mbol	material description     hand     structure and       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components     organisation (kPa)     (kPa)     (kPa)	
	E 15	0 N →	>		~	ō	<u> </u>	S CI		_
				E	- -21 -	-			FILL: Sarvely SAND: fine, medium and coarse       M         If JLL: Gravely SAND: fine, medium and coarse       IIIIII         (subangular gravel, trace fines.       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	
				SPT 1, 1, 1 N*=2	-20	- 1.0 - - - -			FILL: Sandy CLAY: high plasticity, pale brown, fine     IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	
				SPT 1, 1, 2	-19	2.0				-
ile>> 15/09/2014 15:42				N°=3	-18	3.0			FILL: Sandy CLAY: high plasticity, brown mottled       IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	
2354AA.GPJ < <drawingf< td=""><td>- AD/T</td><td></td><td></td><td>SPT 7, 11, 15 N*=26</td><td>-17</td><td>4.0</td><td></td><td></td><td></td><td>-</td></drawingf<>	- AD/T			SPT 7, 11, 15 N*=26	-17	4.0				-
CORED GEOTWARA2:				SPT	-16	5.0		SC	Clayey SAND: fine and medium grained, brown to orange.	
COF BOREHOLE: NON				0, 0, 0 N*=11	-15	- 6.0— - -		 СН	Sandy CLAY: high plasticity, brown to orange mottled pale grey, fine and medium grained sand. <wp< td="">       St - VSt       I   洋洋         IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII</wp<>	
0F_0_9_04BA.GLB Log				SPT 5, 7, 7 N*=14	-14	- 7.0-			At 7.0m, colour change to pale grey mottled brown to orange.	
CE				8, 7, 15 N*=22	-	-				-
	metil AD AS RR W CT HA DT B V T * e.g.	hod auger d auger s roller/tri washbo cable to hand au diatube blank bi V bit TC bit bit show AD/T	rilling* crewin cone re ol ger	g* uffix	sup M r C c pen wate	port mud casing etration er er ₩ 10- levi wat wat	N no ress rangin refusa Oct-12 wa el on date ter inflow ter outflow	nil istance ig to ater shown	classification symbol & soil description       consistency / relative density         B       bulk disturbed sample       soil description       VS       very soft         D       disturbed sample       based on Unified       S       soft       S         E       environmental sample       Classification System       VS       very soft         SS       split spoon sample       Classification System       VS       very soft         H##       undisturbed sample ##mm diameter       Moisture       VSt       very stiff         N       standard penetration test (SPT)       D       dry       H       hard         N*       SPT - sample recovered       W       wet       VL       very loose         VS       vane shear; peak/remouded (kPa)       R       refusal       D       dense         HB       hammer bouncing       VD       very very dense       VD       very dense	

Borehole ID. BH 11 1 of 2 sheet: GEOTWARA22354AA project no. date started: 19 Aug 2014 date completed: 19 Aug 2014 logged by: JR checked by: ABL



APPIAN GROUP client:

principal:

9

GEOTINA D

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bit shown by suffix

AD/T e.a

#### WYONG HOSPITAL REDEVELOPMENT project:

WYONG ABL location: checked by: position: E: 358330; N: 6318724 (MGA94 Zone 56) surface elevation : 21.30m (AHD) angle from horizontal: 90° drill model: Geoprobe hole diameter : 100 mm mounting: Track drilling information material substance consistency / relative density material description hand structure and classification penetration samples & field tests g penetro meter additional obs ations method & support ŝ SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition graphic symbol ŝ depth ( water (kPa) RL 0 0 0 0 2 SPT Fb **RESIDUAL SOIL** 17, 21, 25/100mm N\*=R SC Clayey SAND: fine and medium grained, brown to D - M 88 AD/T -13 orange mottled pale grey. 11 |||||||||||Borehole BH 11 terminated at 8.5 m | | || | | || | | || | | |9.0 11 ||||||| | ||||||12 |||||||||||10.0 111 1111 -11 111 ||||||||||| | | |||||||||||11.0 |||||||||||||| | | |10 ||||||||||12.0 1111 9 ||||||||||||| | | ||||||||||||||||13.0 ||||||||||||||| | | |-8 ||||||NON CORED | | | |||||||1 | | | 14.0 |||||||COF BOREHOLE: |||||-7 |||||||||||||||| | | ||||||5g ||||||04BA.GLB 15.0 | | ||||||||||| | | |-6 ||||||||||||||||classification symbol & method support samples & field tests consistency / relative density soil description auger drilling\* N nil AD Μ mud bulk disturbed sample В vs very soft based on Unified AS RR auger screwing\* C casing D disturbed sample S soft Classification System roller/tricone environmental sample F St firm E netration W washbore SS split spoon sample stiff moisture D dry M mois W wet СТ cable tool no resistance ranging to refusal U## undisturbed sample ##mm diameter VSt very stiff HA DT hand auger dry moist wet plastic limit H Fb HP hand penetrometer (kPa) hard diatube standard penetration test (SPT) Ν friable B V blank bit SPT - sample recovered SPT with solid cone 10-Oct-12 water level on date showr N\* VL very loose V Wp V bit Nc loose L MD wi İiquid limit Ť TC bit

VS

R

HB

refusal

hammer bouncing

vater inflow

water outflow

vane shear; peak/remouded (kPa)

Borehole ID. BH 11 2 of 2 sheet: project no. GEOTWARA22354AA 19 Aug 2014 date started: 19 Aug 2014 date completed: logged by: JR

medium dense

dense

very dense

D

VD



client: APPIAN GROUP

#### principal:

## project: WYONG HOSPITAL REDEVELOPMENT

location: WYONG

Borehole ID.BH 12sheet:1 of 3project no.GEOTWARA22354AAdate started:15 Aug 2014date completed:18 Aug 2014logged by:JRchecked by:ABL

ſ	positi	on: E: 358293; N: 6318733 (MGA94 Zo iodel: Geoprobe				33 (MG	6A94 Zo	94 Zone 56) surface elevation : 19.10m (AHD) angle from horizontal: 90°							
	drill m	nodel: G	eopr	obe				mount	ng: Track hole diameter : 100 mm						
ļ	drilli	ng info	mati	on			mate	rial sub	stance						
	method & support	penetration	vater	samples & field tests	3L (m)	depth (m)	graphic log	classification symbol	material description     And penetro- penetro- meter     hand penetro- meter       SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components     9 5 10 10 10 10 10 10 10 10 10 10 10 10 10 10 1						
ł	4	3 5 7	-	E	-19			0 0	TOPSOIL: SAND: fine, medium and coarse M FILL / TOPSOIL						
				E		- - - 10-			grained, brown, trace fines. Trace rootlets.       IIII         FILL: Sandy CLAY: high plasticity, brown, fine and medium grained sand, trace fine and medium grained subangular gravel.       IIIII						
				SPT 14, 20, 14 N*=34	-18				Colour change to brown mottled grey.						
014 15:42	AD/V			SPT 10, 23, 20 N*=43	- 16	- - - 3.0									
<pre>&lt;<drawingfile>&gt; 15/09/2</drawingfile></pre>				SPT 18 10 12	-15	- - 4.0		 sc	At 3.3m, sandstone fine and medium grained, pale grey and pale brown, 500mm.						
/ARA22354AA.GPJ <				N*=22	-	- - 5.0—		SP	SAND: fine and medium grained, brown to grey, trace fines.						
: NON CORED GEOTM	*			SPT 8, 25/130mm N*=R	-14 - -			SC	CLAYEY SAND fine and medium grained, brown to orange and pale grey.       D - VD       I I I I I         I I I I I       I I I I I         I I I I I       I I I I I         I I I I I       I I I I I         I I I I I       I I I I I         I I I I I       I I I I I						
3 Log COF BOREHOLE	AD/T				-13	- 0.0									
CDF_0_9_04BA.GLF				SPT 5, 6, 6 N*=12	-12	7.0— - - -			Sandy CLAY: medium plasticity, pale grey and brown to orange, fine grained sand. <wp< td="">       St       I</wp<>						
	meth AD AS RR W CT HA DT B V T * e.g.	od auger dri auger sc roller/tric washbor cable toc hand aug diatube blank bit V bit TC bit bit shown AD/T	lling* rewing one e l ger	g* uffix	sup M   C   pen wate	port mud casing etration etration er er leve wat wat	no res rangin ◄ refusa Oct-12 wa el on date er inflow er outflow	nil istance g to ater shown	samples & field tests     classification symbol &       B     bulk disturbed sample     soil description     vs     very soft       D     disturbed sample     based on Unlified     S     soft       E     environmental sample     based on Unlified     S     soft       SS     split spoon sample     based on Unlified     S     soft       U##     undisturbed sample ##mm diameter     moisture     VS     very stiff       HP     hand penetrometer (kPa)     D     dry     H     hard       N     standard penetration test (SPT)     W     wet     VS     very sloft       N     SPT vith solid cone     W     W     VL     very loose       VS     vane shear; peak/remouded (kPa)     W     Iliquid limit     L     loose       HB     hammer bouncing     VD     very dense						



**APPIAN GROUP** client:

principal:

position:

#### project: WYONG HOSPITAL REDEVELOPMENT

mounting: Track

material substance

E: 358293; N: 6318733 (MGA94 Zone 56)

WYONG location:

drill model: Geoprobe

drilling information

date started: 15 Aug 2014 18 Aug 2014 date completed: logged by: JR ABL checked by: surface elevation : 19.10m (AHD) angle from horizontal: 90° hole diameter : 100 mm - <sup>A</sup> material description structure and

Borehole ID.

sheet:

project no.

BH 12 2 of 3

GEOTWARA22354AA

	sthod & pport	samples & true tration field tests but (m) & seldment after assification		material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components			nisture ndition ndition sistency meter sist sistency kba kba kba kba kba kba kba kba kba kba		structure and additional observations					
ł	an line	3 P	wa			de	gre	CL Syr	Sandy CLAY: medium plasticity, pale grey a	nd	ë ō ⊲Wp	St	400 400	RESIDUAL SOIL -
	AD/T			SPT 3, 6, 10 N*=16	-10	  9.0   			brown to orange, fine grained sand. (continu	ied)		VSt		
ł	<u> </u>				-9	10.0	(/////		Borehole BH 12 continued as cored hole					
awingFile>> 15/09/2014 15:42					-8									
4AA.GPJ < <dr< th=""><td></td><td></td><td></td><td></td><td>-7</td><td>-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></dr<>					-7	-								
GEOTWARA2235					-6	- 13.0— -								
<b>NON CORED</b>					_	-								
OF BOREHOLE: N					-5	14.0								
CDF_0_9_04BA.GLB Log C					-4	- 15.0 - - -								
	meth AD AS RR W CT HA DT B V T * e.g.	od auger dri auger sc roller/tric washbord cable toc hand auc diatube blank bit V bit TC bit bit showr AD/T	llling* rewing one e ol ger	g* uffix	sup M I C C pen wate	port mud casing etration etration etration etration etration leve wate wate	N - no res rangin ◄ refusa Oct-12 wa el on date er inflow er outflow	nil istance g to ater shown	samples & field tests           B         bulk disturbed sample           D         disturbed sample           E         environmental sample           SS         split spoon sample           U##         undisturbed sample ##mm diamete           HP         hand penetrometer (kPa)           N         standard penetration test (SPT)           N*         SPT - sample recovered           Nc         SPT with solid cone           VS         vane shear; peak/remouded (kPa)           R         refusal           HB         hammer bouncing	r moi D M Wp WI	lassificat soil de based Classifica dry moist wet plastic li liquid lin	ion sym escriptio on Unifie ation Sys mit mit	bol & n rd tem	Consistency / relative density         VS       very soft         S       soft         F       firm         St       stiff         VSt       very stiff         H       hard         Fb       friable         VL       very loose         L       loose         MD       medium dense         D       dense         VD       very dense



			Borebole ID	DU 42
			Dorenole ID.	BN 12
Enai	incoring Log Core	sheet:	3 of 3	
Engi	ineering Log - Core	project no.	GEOTWARA22354AA	
client:	APPIAN GROUP		date started:	15 Aug 2014
principal:			date completed:	18 Aug 2014
project:	WYONG HOSPITAL REDEVEL	OPMENT	logged by:	JR
location:	WYONG		checked by:	ABL
position:	E: 358293; N: 6318733 (MGA94 Zone 56)	surface elevation: 19.10m (AHD)	angle from horizontal: 90°	
drill model:	Geoprobe mounting: 1	Frack hole diameter : 1	100 mm	

ľ	drilli	ing iı	nform	ation	mate	rial substance					rock mass defects							
	hod & bort	er	(m	(m)	hic log	material descriptio ROCK TYPE: grain charac colour, structure, minor con	<b>n</b> cterisics, nponents	thering & ation	estimated strength & Is50 ×= axial;	samples, field tests & ls(50) (MPa)	nun QD	defect spacing (mm)	additional obs defect des (type, inclination, planar thickness	ervations and scriptions ity, roughness, coating, s, other)				
	supp	wate	RL (	dept	grap			wea altei	이= diametral	a = axial; d = diametral	core & R	30 300 300 300 300	particular	general				
			-11 - -10	9.0		start coring at 10.00m												
ľ	A		-9	10.0		NO CORE: 1.10 m possibly Sar	ndy CLAY?.											
4AA.GPJ < <drawingfile>&gt; 15/09/2014 15:44</drawingfile>	NMLC					SANDSTONE: fine and medium brown and pale grey, indistinct b CLAYSTONE: pale grey, massive.	grained, pale edding (5°). e.	XW MW		a=0.20 d=0.40 a=2.20 d=2.40	41%		<ul> <li>PT, 0°, PL, RO, CN</li> <li>CS, 5°, PL, RO, fine to grained angular grave</li> <li>PT, 5°, CU, RO, iron S</li> <li>JT, 30°, UN, RO, iron S</li> <li>PT x2, 0°, PL, RO, iron S</li> <li>PT, 0°, PL, RO, CN</li> <li>PT, 0°, PL, SO, CN</li> </ul>					
42235	¥		-6	13.0		Borehole BH 12 terminated at 13	8 00 m							·				
CDF_0_9_04BA.GLB Log COF BOREHOLE: CORED GEOTWAR/		Borehole BH 12 terminated at												-				
	met DT AS AD RR CB W NMI NQ HQ PQ SPT	hod & d a rc c C W LC N w w s t e	diatube auger screwing auger drilling roller/tricone claw or blade bit washbore NMLC core (51.9 mm) wireline core (47.6mm) wireline core (85.0mm) standard penetration test			water 10/10/12, water level on date shown water inflow complete drilling fluid loss partial drilling fluid loss partial drilling fluid loss partial drilling fluid loss	graphic log / cor core rec (graphic syr no core core run & RQD barrel w RQD = Rock Qu	r core recovery RS XW e recovered HW white symbols indicate material DW core recovered FR RQD SV rel withdrawn L I M r k Quality Designation (%) H k VH w			& altera al soil hely weat weathe tly weat ately we weathe wheth A for a w	ation* thered hered aathered ared ilteration	defect type PT parting JT joint SZ shear zone SS shear surface CS crushed seam SM seam DB drilling break roughness SL slickensided POL polished SO smooth RO rough VR very rough	planarity PL planar CU curved UN undulating ST stepped IR Irregular <b>coating</b> CN clean SN stain VN veneer CO coating				





Start dept	h 10.00m		BH12 BOX 1		End depth 13.00m
	BHT.	L START COR	E AT 10.0	2m 18/8/14	111111
10	7	NO	CORE/(	1.10m)	
11					
12		-11	+		
drawn	JR		client:	Appian	Group
approved	RJ		project:	Wyong Hospital	Redevelopment
date	27/08/2014	coffey		Hamlyn Ter	race, NSW
scale	N/A	5	title:	Core Pho	tographs
original size	A4		project no:	GEOTWARA22354AA	borehole no: BH12



# **Engineering Log - Excavation**

APPIAN GROUP client:

#### principal:

position:

method support

#### WYONG HOSPITAL REDEVELOPMENT project:

WYONG location:

excavation information

water

Е

penetratior

logged by: HJS ABL checked by: E: 358422; N: 6318883 (MGA94 Zone 56) surface elevation : 24.40m (AHD) pit orientation: equipment type: Backhoe excavation method: excavation dimensions: 1.5 m long 0.4 m wide DCP id.: material substance classification symbol consistency / relative density DCP structure and additional observations material description hand samples & field tests penetro meter (blows/ 150 mm) graphic log depth (m) SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition Ê (kPa) RL 6 3 20 <del>1</del> TOPSOIL: Sandy CLAY: high plasticity, D TOPSOIL brown, fine and medium grained sand. Trace rootlets. 1111 

Excavation ID.

date excavated:

date completed:

sheet:

project no.

**TP01** 

GEOTWARA22354AA

12 Aug 2014

12 Aug 2014

1 of 1

		E BX2 U50	  	- - 0.5 <i>-</i> -		SC SC	CLAYEY SAND fine, medium and coarse grained, orange to brown, high plasticity clay. CLAYEY SAND fine, medium and coarse grained, orange to brown mottled pale grey to white, high plasticity clay, trace angular sandstone gravel.	M	MD			RESIDUAL SOIL
ıgFile>> 15/09/2014 15:36 - Ε -		E	-23.5	- - 1.0 -								- - - -
GEOTWARA22354AA.GPJ < <drawir< th=""><th>▼ · · · · · · · · · · · · · · · · · · ·</th><th></th><th>-23.0</th><th>- -<del>1.5 -</del></th><th></th><th></th><th>SANDSTONE: medium strength, orange to yellow to white, fine, medium and coarse grained, apparently massive, moderately weathered. Test pit TP01 terminated at 1.5 m Refusal</th><th>/</th><th></th><th></th><th></th><th>MODERATLEY WEATHERED SANDSTONE</th></drawir<>	▼ · · · · · · · · · · · · · · · · · · ·		-23.0	- - <del>1.5 -</del>			SANDSTONE: medium strength, orange to yellow to white, fine, medium and coarse grained, apparently massive, moderately weathered. Test pit TP01 terminated at 1.5 m Refusal	/				MODERATLEY WEATHERED SANDSTONE
1BA.GLB Log COF EXCAVATION + PSP/DCP			-22.5	- - 2.0 -								
CDF_0_9_0			-22.0	-								-
m N BI B R E SU S	method       N     natural exposure       X     existing excavation       BH     backhoe bucket       B     bulldozer blade       R     ripper       E     excavator       support     N       N     none       S     shoring		nod natural exposure existing excavation backhoe bucket bulldozer blade ripper excavator none shoring penetration ranging to refusal water 10-Oct-12 water level on date shown water outflow		tance to er hown	samples & field tests         U##       undisturbed sample         D       disturbed sample         B       bulk disturbed sample         E       environmental sample         HP       hand penetrometer (kPa)         N       standard penetration test (SPT)         N*       SPT - sample recovered         Nc       SPT with solid cone         VS       vane shearpeak/remouded         (uncorrected kPa)       R         R       refusal	class Cla Cla moistu D dry M mo W we W <sub>P</sub> pla W <sub>L</sub> liqu	sification soil descr ased on L ssification re ist t stic limit stic limit uid limit	symbol & ption Jnified System		consistency / relative density         VS       very soft         S       soft         F       firm         St       stiff         VSt       very stiff         H       hard         Fb       friable         VL       very loose         L       loose         MD       medium dense         D       dense         VD       very dense	



drawn	JR		client: Appian Group								
approved	RJ		project: Wyong Hospital Redevelopment								
date	27-Aug-14	cottey 🗸	Hamlyn Terrace, NSW								
scale	NTS	Concy	title:	Test Pit Photographs							
original	A4		project no:	GEOTWARA22354AA	Location: TP01						


APPIAN GROUP client:

#### principal:

#### WYONG HOSPITAL REDEVELOPMENT project:

WYONG location:

position: E: 358341; N: 6318836 (MGA94 Zone 56) surface elevation : 24.00m (AHD) pit orientation: DCP id.: equipment type: Backhoe excavation method: excavation dimensions: 1.5 m long 0.4 m wide excavation information material substance classification symbol consistency / relative density DCP structure and additional observations material description hand penetratior samples & field tests graphic log penetro meter (blows/ 150 mm) moisture condition depth (m) SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components method support ŝ water (kPa) R 40 30 2 10 30 30 1 A N Е FILL: CLAYEY SAND: fine, medium and Μ TOPSOIL / FILL coarse grained, brown, high plasticity clay, trace fine to medium grained angular gravel. 38日日 | | | |Trace rootlets. 11 | | | |t 3 | | | | | |38 H в FILL: Sandy CLAY: high plasticity, brown to FILL | | | |orange, fine, medium and coarse grained sand; some fine, medium and coarse grained (mixed overburden) |||||gravel of siltstone and sandstone, trace | | | |1111 cobbles. 

<u>`.</u>	L U
15/09/2014	
< <drawingfile>&gt;</drawingfile>	
CDF_0_9_04BA.GLB_L0g_COF EXCAVATION + PSP/DCP_GEOTWARA22354AA.GPJ_<	

Excavation ID.	TP02
sheet:	1 of 1
project no.	GEOTWARA22354AA
date excavated:	12 Aug 2014
date completed:	12 Aug 2014
logged by:	HJS
checked by:	ABL



**TP02** Profile

drawn	JR		client:	Appian G	Group	
approved	RJ	coffey	P	project:	Wyong Hospital R	edevelopment
date	27-Aug-14			Hamlyn Terra	ace, NSW	
scale	NTS	Concy	title:	Test Pit Pho	tographs	
original	A4		project no:	GEOTWARA22354AA	Location: TP02	



client: APPIAN GROUP

principal:

position:

# project: WYONG HOSPITAL REDEVELOPMENT

excavation method:

E: 358234; N: 6318886 (MGA94 Zone 56)

location: WYONG

equipment type: Backhoe

date excavated: 13 Aug 2014 date completed: 13 Aug 2014 MENT logged by: JR checked by: ABL surface elevation : 26.10m (AHD) pit orientation: nod: excavation dimensions: 2.3 m long 0.6 m wide DCP id.:

Excavation ID.

sheet:

project no.

**TP03** 1 of 1

GEOTWARA22354AA

	excavation information material s					mate	erial subs	stance	
	nethod	penetration	vater	samples field tests	s & %	lepth (m)	graphic log	symbol	material description And penetro- to structure and additional observations   SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
			>	D	-26.0	-			FILL: CLAYEY GRAVEL: fine to medium grained, dark grey, angular, some fine to coarse grained sand. M I I I   FILL: CLAY: medium plasticity, brown, some fine grained sand. M I I I I
				D	-25.5	0.5			FILL: CLAY: high plasticity, brown to orange, trace fine and medium grained sand. Trace rootlets.     Image: Note that the second se
GPJ < <drawingfile>&gt; 15/09/2014 15:36</drawingfile>				D	-25.0	- 1.0 - -			FILL: CLAY: high plasticity, pale grey to green, trace fine and medium grained sand, moisture content variable.           1         1
PSP/DCP GEOTWARA22354AA.	•			D	24.5	1.5			FILL: EXCAVATED AS CLAYEY GRAVEL:     fine to coarse grained, sub-angular to angular,     pale grey to green, trace fine grained sand,     material appears to be displaced weathered     rock from local origin.
CDF_0_9_04BA.GLB Log COF EXCAVATION +					-24.0	- 2.0 - - -			Target depth
	ma N BH B R E SU S	ethod natural e existing backhoe bulldoze ripper excavate pport none shoring	expos exca e buc er bla or	sure vation ket de	vater	10-Oc water water	no resis ranging refusal t-12 wat n date s inflow outflow	er er	samples & field tests   U## undisturbed sample   D disturbed sample   B bulk disturbed sample   HP hand penetrometer (kPa)   N standard penetration test (SPT)   N* SPT - sample recovered   Nc SPT with solid cone   VS vary soft   VS very soft   St stiff   VS very stiff   D dry   H hard   N* SPT - sample recovered   Nc SPT with solid cone   VS vare shearpeak/remouded   (uncorrected kPa) W   R refusal



**TP03** Profile

drawn	JR		client:	Appian G	Foup	
approved	RJ	coffev		project:	Wyong Hospital R	edevelopment
date	27-Aug-14			Hamlyn Terra	ace, NSW	
scale	NTS	concy	title:	Test Pit Pho	tographs	
original	A4		project no:	GEOTWARA22354AA	Location: TP03	



APPIAN GROUP client:

principal:

Ν none

S

shoring

water outflow

R

refusal

#### WYONG HOSPITAL REDEVELOPMENT project:

HJS logged by: WYONG ABL location: checked by: position: E: 358191; N: 6318891 (MGA94 Zone 56) surface elevation : 25.30m (AHD) pit orientation: DCP id.: equipment type: Backhoe excavation method: excavation dimensions: 2.0 m long 0.4 m wide excavation information material substance consistency / relative density DCP structure and additional observa material description hand classificatior penetratio samples & field tests g penetro meter (blows/ 150 mm) vations Ê moisture condition SOIL TYPE: plasticity or particle characteristic, method graphic support symbol ŝ depth ( water colour, secondary and minor components (kPa) RL 8 8 8 9 A N E FILL: CLAYEY SAND: fine, medium and D to M FILL coarse grained, brown, high plasticity clay, 20 (Mixed) some fine, medium and coarse grained angular to sub-angular gravel of sandstone and ||||||1111 |||||siltstone, building rubble comprising 10% of mass (concrete, timber, bricks, tiles). | | | || | | | | | 17 | | | | | | |-25.0 |||||| | | |111 0.5 E Sandstone boulder (1m long) BX2 FILL: Sandy CLAY: high plasticity, grey, some М (Mixed) fine, medium and coarse grained gravel of sandstone and siltstone throughout, building ||||||rubble makes up 10% of mass (concrete, bricks, timber and tiles). |||||-24.5 | | | | $\overset{|}{\ast}\overset{|}{}\overset{|}{}\overset{|}{}\overset{|}{}\overset{|}{}\overset{|}{}\overset{|}{}$ 1.0 <u>1111</u> E |||||T |||||1 -24.0 ||||||1111 ||||||||||11 1 |||||1 E 11  $|\times|$ 1.5 11 11 ||||||-23.5 COF EXCAVATION D 1.9 m: Possible undisturbed 'natural' material (highly weathered sandstone). | | | | 21 Test pit TP04 terminated at 2.0 m Refusa |||||5 |||||04BA.GLB |||||||||||-23.0 Ę 11 classification symbol & samples & field tests consistency / relative density penetration method soil description U## undisturbed sample ##mm diameter vs very soft 20 based on Unified Ν natural exposure D disturbed sample s soft no resistance Classification System existing excavation Х bulk disturbed sample B E F firm ā.\_\_ BH backhoe bucket ranging to St environmental sample stiff refusa moisture в bulldozer blade ΗP hand penetrometer (kPa) VSt very stiff standard penetration test (SPT) SPT - sample recovered dry moist R ripper Ν D H Fb hard friable Е excavator N' М 10-Oct-12 water ▼ W wet W<sub>P</sub> plastic limit Nc SPT with solid cone VL very loose level on date shown loose support VS vane shearpeak/remouded L water inflow

(uncorrected kPa)

W<sub>L</sub> liquid limit

MD

D

VD

medium dense

dense

very dense

Excavation ID.

date excavated:

date completed:

sheet:

project no.

**TP04** 1 of 1

12 Aug 2014 12 Aug 2014

GEOTWARA22354AA



**TP04** Profile

drawn	JR		client:	Appian G	iroup	
approved	RJ	coffey	P	project:	Wyong Hospital R	edevelopment
date	27-Aug-14			Hamlyn Terra	ace, NSW	
scale	NTS	Concy	title:	Test Pit Pho	tographs	
original	A4		project no:	GEOTWARA22354AA	Location: TP04	



APPIAN GROUP client:

principal:

R ripper

Е

Ν none

S

support

excavator

shoring

WYONG HOSPITAL REDEVELOPMENT HJS project: logged by: WYONG ABL location: checked by: position: E: 358189; N: 6318859 (MGA94 Zone 56) surface elevation : 24.50m (AHD) pit orientation: DCP id.: equipment type: Backhoe excavation method: excavation dimensions: 2.0 m long 0.4 m wide excavation information material substance consistency / relative density DCP structure and additional observa material description hand classificatior penetratio samples & field tests g penetro meter (blows/ 150 mm) rvations Ê moisture condition SOIL TYPE: plasticity or particle characteristic, method graphic support symbol Ê depth ( water colour, secondary and minor components (kPa) RL 8 8 8 9 A N E FILL: Sandy CLAY: medium to high plasticity, M to W FILL brown / grey / blue / orange / red, fine, medium (Mixed) and coarse grained sand, some fine, medium ||||||and coarse grained gravel of sandstone. Some |||||wet areas. | | | || | | || | | || | | |||||||||||||||-24.0 0.5 F BX2 |||||||||||||||||||3311 11 23.5 1.0 |||||||||||雞日日 |||||||||||||||||THE |||||1111 -23.0 1.5 |||||| | 20 | | ç |||||-22.5 2.0 |||||||||||8 |||||с С ||||||||||ĕ classification symbol & samples & field tests consistency / relative density method penetration soil description U## undisturbed sample ##mm diameter vs very soft - 01 0 based on Unified Ν natural exposure D disturbed sample s soft no resistance Classification System existing excavation bulk disturbed sample х B E F firm ā.\_\_ BH backhoe bucket ranging to St environmental sample stiff refusa moisture в bulldozer blade ΗP hand penetrometer (kPa) VSt very stiff

standard penetration test (SPT) SPT - sample recovered

(uncorrected kPa)

vane shearpeak/remouded

SPT with solid cone

refusal

Ν

N\*

Nc

VS

R

10-Oct-12 water

water inflow

water outflow

level on date shown

▼

W wet W<sub>P</sub> plastic limit

H Fb

VL

L

MD

D

VD

hard

friable

loose

dense

very loose

very dense

medium dense

Excavation ID.

date excavated:

date completed:

sheet:

project no.

**TP05** 1 of 2

12 Aug 2014 12 Aug 2014

GEOTWARA22354AA

W<sub>L</sub> liquid limit

D

М

dry moist



APPIAN GROUP client:

#### principal:

method

| ₩ ¥ Ν

¥

#### WYONG HOSPITAL REDEVELOPMENT project:

WYONG location:

position: E: 358189; N: 6318859 (MGA94 Zone 56) surface elevation : 24.50m (AHD) pit orientation: DCP id.: equipment type: Backhoe excavation method: excavation dimensions: 2.0 m long 0.4 m wide excavation information material substance consistency / relative density DCP structure and additional observa material description hand classificatior penetration samples & field tests g penetro meter (blows/ 150 mm) vations Ê SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition graphic support symbol ŝ depth ( water (kPa) Ч 8 8 8 9 M to W FILL 1111 1 ||||||Test pit TP05 terminated at 2.6 m |||||Target depth | || | | || | | |11 | | | |11 | | | || | | | || | | | ||||||-21.5 3.0 ||||||111 ||||||||||||111 |||||||||| | | |||||||| | | | |||||||| | | |||||||| | | |||||||-21.0 3.5 ||||||||||| | | || | | || | | | |||||||||||||||||||||||| | | |

15/09/2014 15:36 GEOTWARA22354AA.GPJ |||||| | | || | | |-20.5 4.0 ||||| | | ||||||||||| | | |||||| | | |||||||COF EXCAVATION + PSP/DCP |||||| | | |-20.04.5 | | | |||||| | | |||||||04BA.GLB Log | | | ||||||| | ||||||||||||||||| | | | |||||||Ä |||||classification symbol & samples & field tests consistency / relative density penetration method soil description U## undisturbed sample ##mm diameter vs very soft - 01 00 based on Unified Ν natural exposure ÷ D disturbed sample s soft no resistance Classification System existing excavation Х bulk disturbed sample B E F firm BH backhoe bucket ranging to St environmental sample stiff refusa moisture в bulldozer blade HP hand penetrometer (kPa) VSt very stiff standard penetration test (SPT) SPT - sample recovered dry moist R ripper Ν D H Fb hard friable Е excavator N\* М 10-Oct-12 water W wet W<sub>P</sub> plastic limit Nc SPT with solid cone VL very loose level on date shown support VS loose vane shearpeak/remouded L water inflow Ν none (uncorrected kPa) W<sub>L</sub> liquid limit MD medium dense water outflow R D refusal S shoring dense VD very dense

Excavation ID. **TP05** 2 of 2 sheet: GEOTWARA22354AA project no. date excavated: 12 Aug 2014 12 Aug 2014 date completed: HJS logged by: ABL checked by:



drawn	JR		client:	Appian G	iroup	
approved	RJ			project:	Wyong Hospital R	edevelopment
date	27-Aug-14	cottey 🗸		Hamlyn Terra	ace, NSW	
scale	NTS	Concy	title:	Test Pit Pho	tographs	
original	A4		project no:	GEOTWARA22354AA	Location: TP05	



APPIAN GROUP client:

principal:

#### WYONG HOSPITAL REDEVELOPMENT project:

WYONG location:

ABL checked by: position: E: 358239; N: 6318855 (MGA94 Zone 56) surface elevation : 24.40m (AHD) pit orientation: DCP id.: equipment type: Backhoe excavation method: excavation dimensions: excavation information material substance consistency / relative density DCP structure and additional observa material description hand classificatior penetratio samples & field tests g penetro meter (blows/ 150 mm) vations Ê SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition method graphic support symbol ŝ depth ( water (kPa) RL 8 8 8 9 A N FILL / TOPSOIL: fine to medium grained, Μ FILL / TOPSOIL brown. Trace rootlets. |||||||||||| | | || | | ||||||-24.0 | | | |D ||||||||||||0.5 |||||||||||||||||||1111 -23.5 FILL: Sandy CLAY: high plasticity, grey to dark grey, fine and medium grained sand. FILL 1.0 ||||||. In in D |||||||||||||||||-23.0 |||||||||||運動日日 1.5 |||||10 D FILL: SAND: medium to coarse grained, brown mottled orange, trace fines, some pockets of CLAYEY SAND, fine to medium 11 grained, brown to orange. COF EXCAVATION + Test pit TP06 terminated at 1.8 m Target depth -22.5 11 2.0 11 |||||g 11 |||||04BA.GLB |||||Ę -22.0 11 classification symbol & samples & field tests consistency / relative density penetration method soil description U## undisturbed sample ##mm diameter vs very soft - 01 00 based on Unified Ν natural exposure D disturbed sample s soft no resistance Classification System existing excavation Х bulk disturbed sample B E F firm ā.\_\_ BH backhoe bucket ranging to St environmental sample stiff refusa moisture в bulldozer blade HP hand penetrometer (kPa) VSt very stiff standard penetration test (SPT) SPT - sample recovered dry moist R ripper Ν D H Fb hard friable Е excavator N\* М 10-Oct-12 water ▼ W wet W<sub>P</sub> plastic limit Nc SPT with solid cone VL very loose level on date shown VS vane shearpeak/remouded loose support L water inflow Ν none (uncorrected kPa) W<sub>L</sub> liquid limit MD medium dense water outflow R D refusal S shoring dense

Excavation ID.

date excavated:

date completed:

sheet:

project no.

logged by:

**TP06** 1 of 1

JR

VD

very dense

GEOTWARA22354AA

13 Aug 2014

13 Aug 2014





APPIAN GROUP client:

principal:

position:

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

equipment type: Backhoe

excavation information

tion

ABL checked by: E: 358177; N: 6318814 (MGA94 Zone 56) surface elevation : 19.80m (AHD) pit orientation: excavation method: excavation dimensions: 1.5 m long 0.4 m wide DCP id.: material substance material description cy / insity DCP og tion hand structure and

Excavation ID.

date excavated:

date completed:

sheet:

project no.

logged by:

**TP07** 

GEOTWARA22354AA

12 Aug 2014

12 Aug 2014

1 of 1

HJS

thod	port enetratior	iter	samples & field tests	(m)	pth (m)	aphic log	Issificatior mbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	nisture ndition	nsistency / ative densit	hand penetro- meter (kPa)	(blows/ 150 mm)	structure and additional observations
₩ A	n s s s s s s s s s s s s s s s s s s s	wa	E	RL	- de	gre	cla syr	FILL: Sandy GRAVEL: fine, medium and coarse grained, angular gravel of volcanics, fine, medium and coarse grained sand, some low plasticity clay.	D	Le <sup>r</sup>			FILL -
				-19.5	-		SM	Silty SAND: fine and medium grained, brown. Some rootlets.	_	MD		21                   30	RELIC TOPSOIL
Ш			E BX2	-	0.5		СН	<b>CLAY</b> : high plasticity, orange to brown mottled pale grey to white, trace medium to coarse grained angular gravel of sandstone.	M	VSt to H			RESIDUAL SOIL
		000000000000000000000000000000000000000	B	-19.0	- - 1.0-			<b>SANDSTONE</b> : low to medium strength, fine and medium grained, orange / brown / white / grey, apparently massive, highly to moderately weathered.	D				HIGHLY TO MODERATELY WEATHERED SANDSTONE
¥	¥ 	200000000000000000000000000000000000000		-18 5	-			Test pit TP07 terminated at 1.2 m					-
					- 1.5—								-
				-18.0	-								
					2.0								-
				-17.5	-								-
n N X B	natural existin H backho bulldoz	expos g exca be buc zer bla	sure vation ket de	penetra	ntion	no resis ranging refusal	tance to	samples & field tests U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP band penetrometer (kPa)	clas t Cla moistu	sification soil desc based on ussification re	symbol & ription Unified n System		Consistency / relative density VS very soft S soft F firm St stiff VSt very stiff
R E S N S	ripper excava u <b>pport</b> none shoring	buildozer blade ripper excavator port none shoring → Telusal HP hand penet N standard pe 10-Oct-12 water level on date shown water outflow water outflow R refusal		N standard penetration test (NPa) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remouded (uncorrected kPa) R refusal	D dry M mo W we W <sub>P</sub> pla W <sub>L</sub> liqu	ist t stic limit uid limit			H hard Fb friable VL very loose L loose MD medium dense D dense VD very dense				



drawn	JR		client:	Appian C	Group	
approved	RJ			project:	Wyong Hospital F	Redevelopment
date	27-Aug-14	cottey 🗸		Hamlyn Terr	ace, NSW	
scale	NTS	Concy	title:	Test Pit Pho	tographs	
original	A4		project no:	GEOTWARA22354AA	Location: TP07	



APPIAN GROUP client:

#### principal:

ļ

#### WYONG HOSPITAL REDEVELOPMENT project:

WYONG location:

ABL checked by: position: E: 358206; N: 6318816 (MGA94 Zone 56) surface elevation : 20.70m (AHD) pit orientation: excavation dimensions: 1.5 m long 0.4 m wide DCP id.: equipment type: Backhoe excavation method: excavation information material substance consistency / relative density DCP structure and additional observat material description hand classification penetration samples & field tests g penetro meter (blows/ 150 mm) rvations ŝ SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components moisture condition method support graphic symbol ŝ depth ( water (kPa) RL 8888 A N E FILL: Silty SAND: fine to medium grained, D FILL / TOPSOIL brown. Some rootlets. ||||||||||20.5 FILL: CLAY: high plasticity, orange to brown mottled pale grey, some fine, medium and coarse grained angular gravel of sandstone, trace fine, medium and coarse grained sand. | | | |J |||Μ FILL | | | |111 |||||||||D | | | |¥ПП |||||0.5 COLLUVIUM / RESIDUAL SOIL E SP SAND: fine to medium grained, brown, some М high plasticity clay. <u> 1 | | |</u> BX2 |||||||-20.0 第日日 31111 |||||||| | | || | | | || | | |1.0 E |||||111 |||||19.5 E EXTREMELY TO HIGHLY WEATHERED SANDSTONE SANDSTONE: very low to low strength, D to M orange / yellow / brown / white, fine and

Excavation ID.

date excavated:

date completed:

sheet:

project no.

logged by:

**TP08** 1 of 1

HJS

GEOTWARA22354AA

very dense

12 Aug 2014

12 Aug 2014

<u>v</u> v		mealum grained, apparentity massive, extremely to highly weathered, differntially weathered to high plasticity clay, orange to brown mottled red to brown.		
	-19.0			
method   N natural exposure   X existing excavation   BH backhoe bucket   B bulldozer blade   R ripper   E excavator   support N   N none   S shoring	penetration	samples & field tests   U## undisturbed sample ##mm diameter   D disturbed sample   B bulk disturbed sample   E environmental sample   HP hand penetrometer (kPa)   N standard penetration test (SPT)   N* SPT - sample recovered   Nc SPT with solid cone   VS vane shearpeak/remouded   (uncorrected kPa)   R refusal	classification symbol & soil description based on Unified Classification System D dry M moist W wet W <sub>P</sub> plastic limit W <sub>L</sub> liquid limit	consistency / relative density       VS     very soft       S     soft       F     firm       St     stiff       VSt     very stiff       H     hard       Fb     friable       VL     very loose       L     loose       MD     medium dense       D     dense       VD     very dense



**TP08** Profile

drawn	JR		client:	Appian Group	
approved	RJ	coffey	۲ مع	project:	Wyong Hospital Redevelopment
date	27-Aug-14			Hamlyn Terrace, NSW	
scale	NTS	Concy	title:	Test Pit Photographs	
original	A4		project no:	GEOTWARA22354AA Location: TP08	



APPIAN GROUP client:

principal:

# WYONG HOSPITAL REDEVELOPMENT

logged by: HJS project: WYONG ABL location: checked by: position: E: 358169; N: 6318779 (MGA94 Zone 56) surface elevation : 17.00m (AHD) pit orientation: DCP id.: equipment type: Backhoe excavation method: excavation dimensions: 0.4 m wide excavation information material substance consistency / relative density DCP structure and additional observa material description hand classificatior penetration g penetro meter samples & (blows/ 150 mm) vations Ê moisture condition field tests SOIL TYPE: plasticity or particle characteristic, method graphic support symbol Ê depth ( water colour, secondary and minor components (kPa) R 8 8 8 9 A N E TOPSOIL: SAND: fine grained, brown mottled Μ TOPSOIL orange to brown, some high plasticity clay. (colluvium / residual) ||||||||||||||||11 1 |||||1 |||||11 |||||| | | |В St to VSt RESIDUAL SOIL CH CLAY: high plasticity, orange to brown Μ |||||mottled pale grey to yellow to white, trace fine grained sand. [][ 16.5 0.5 F 111 |||||11 11 |||||||9846 1 358  $|\!\!|$ 111 | | 1|4 | | | | |111 30/100 mm |||||16.0 1.0 F ||||||EXTREMELY TO HIGHLY WEATHERED SANDSTONE SANDSTONE: very low to medium strength, D 1111 orange to brown / pale grey to white, fine and medium grained apparently massive, extremely |||||||||to highly weathered. ||||||| | | ||||||| | | || | | |15.5 1.5 |||||GEOTWAF |||||Test pit TP09 terminated at 1.6 m ||||| | | |11 COF EXCAVATION + | | | | |11 ||||-15.0 2.0 11 |||||||||| | | | |||||||[og |||||04BA.GLB |||||||||||||||||||| | | |Ę |||||11 classification symbol & samples & field tests consistency / relative density penetration method soil description U## undisturbed sample ##mm diameter vs very soft - 01 00 based on Unified Ν natural exposure D disturbed sample s soft no resistance Classification System existing excavation bulk disturbed sample х B E F firm ā.\_\_ BH backhoe bucket ranging to St environmental sample stiff refusa moisture в bulldozer blade HP hand penetrometer (kPa) VSt very stiff standard penetration test (SPT) SPT - sample recovered dry moist R ripper Ν D H Fb hard friable Е excavator N' М 10-Oct-12 water ▼ W wet W<sub>P</sub> plastic limit

Nc

VS

R

level on date shown

water inflow

water outflow

support

shoring

Ν none

S

SPT with solid cone

refusal

vane shearpeak/remouded

(uncorrected kPa)

W<sub>L</sub> liquid limit

Excavation ID.

date excavated:

date completed:

sheet:

project no.

**TP09** 1 of 1

VL

L

MD

D

VD

very loose

very dense

medium dense

loose

dense

12 Aug 2014 12 Aug 2014

GEOTWARA22354AA



**TP09** Profile

drawn	JR		client:	Appian G	Group	
approved	RJ	ee 🍾	project:	Wyong Hospital R	edevelopment	
date	27-Aug-14	cottey 🗸	Hamlyn Terrace, NSW			
scale	NTS	concy	title:	Test Pit Pho	tographs	
original	A4		project no:	GEOTWARA22354AA	Location: TP09	



APPIAN GROUP client:

principal:

position:

s

shoring

water outflow

R

refusal

#### project: WYONG HOSPITAL REDEVELOPMENT

WYONG location:

E: 358210; N: 6318776 (MGA94 Zone 56) surface elevation: 17.70m (AHD) pit orientation: inmont type: Backhoo excavation method. excavation dimensions: 1.5 m long 0.4 m wide DCP id :

ļ	equipment type. Backhoe excavation method. excavation dimensions. 1.5 million					1011y 0.4	in wide								
	exc	avation	infor	mation			mate	erial sub	stance						
	method	penetration	water	samples & field tests	RL (m)	depth (m)	graphic log	classification symbol	material description SOIL TYPE: plasticity or particle characteristic, colour, secondary and minor components	moisture condition	consistency / relative density	hand penetro- meter (kPa) ≌ ≋ ≋ ∞ ∞	DCP (blows/ 150 mm	) 2	structure and dditional observations
				E	-17.5	-			<b>TOPSOIL: Silty SAND</b> fine grained, brown, trace fine, medium and coarse grained angular gravel of sandstone.	D - M				TOPS (collux	OIL /ium)
				BX2 E		0.5-		СН	CLAY: high plasticity, orange to brown mottled red / brown / white, trace fine and medium grained sand.	M	St to VSt			RESI	DUAL SOIL
	— Э				-17.0	-									-
5/09/2014 15:36				E		1.0-			<b>SANDSTONE</b> : very low to low strength, orange to brown / pale grey to white, fine and medium grained, apparently massive, extremely to highly weathered.	D				EXTR WEAT	EMELY TO HIGHLY HERED SANDSTONE
U < <drawingfile>&gt; 1</drawingfile>				В	-16.5	-									-
RA22354AA.GF	<u>,</u>					-	· · · · · ·		Test pit TP10 terminated at 1.5 m			                         			
N + PSP/DCP GEOTWA					-16.0	-									-
Log COF EXCAVATIO						2.0-									-
CDF_0_9_04BA.GLB					-15.5	-									-
	me N X BH B R E SU	ethod natural existing backho bulldoz ripper excava pport none	expos exca e buc er bla tor	sure vation ket de	water	ation	no resis ranging refusal t-12 wat n date s inflow outflow	stance to er shown	samples & field tests U## undisturbed sample ##mm diameter D disturbed sample B bulk disturbed sample E environmental sample HP hand penetrometer (kPa) N standard penetration test (SPT) N* SPT - sample recovered Nc SPT with solid cone VS vane shearpeak/remouded (uncorrected kPa)	Class class Cla moistu D dry M mo W we W <sub>P</sub> pla W <sub>L</sub> liqu	sification soil desc vased on ussification re vist t t stic limit uid limit	n symbol 8 cription Unified on System	•	Consiste VS F St VSt H Fb VL L MD	ncy / relative density very soft soft firm stiff very stiff hard friable very loose loose medium dense

Excavation ID.	TP10
sheet:	1 of 1
project no.	GEOTWARA22354AA
date excavated:	12 Aug 2014
date completed:	12 Aug 2014
logged by:	HJS
checked by:	ABL

dense

very dense

D

VD



drawn	JR		client:	Appian G	iroup
approved	RJ	ee 🌖	project:	Wyong Hospital R	edevelopment
date	27-Aug-14	cottey 🗸		Hamlyn Terra	ace, NSW
scale	NTS	Concy	title:	Test Pit Pho	tographs
original	A4		project no:	GEOTWARA22354AA	Location: TP10

Appendix B - Geotechnical Laboratory Test Results

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Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: .

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10812 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW Wyong Hospital BH01 1.0 - 1.45

TRN: -

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	10.7	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	27	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	10	
Date Tested		2/09/2014	

### Comments

N/A

Warabrook, Newcastle Laboratory

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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# Report No: WARA14S-10812-1

Issue No: 1

Accredited for compliance with ISO/IEC 17025.

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

Approved Signatory: Chris Blackford (Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 4/09/2014





Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

Phone: +61 2 4016 2300 Fax: +61 2 4016 2380

## Report No: WARA14S-10813-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10813 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH02 1.0 - 1.45 Test Results Description Method Result Limits Moisture Content (%) AS 1289.2.1.1 10.3



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### Report No: WARA14S-10814-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10814 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH03 1.0 - 1.45 Test Results Description Method Result Limits AS 1289.2.1.1 Moisture Content (%) 13.0



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## Report No: WARA14S-10815-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10815 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH03 4.0 - 4.45 Test Results Description Method Result Limits AS 1289.2.1.1 Moisture Content (%) 13.9



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: .

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10816 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW Wyong Hospital BH05 2.5 - 2.95

TRN: -

### Test Results

		/	
Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	15.4	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	
Mould Length (mm)		254	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	31	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	17	
Date Tested		2/09/2014	

### Comments

N/A

Form No: 18909, Report No: WARA14S-10816-1

Warabrook, Newcastle Laboratory

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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# Report No: WARA14S-10816-1

Issue No: 1

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# Report No: WARA14S-10817-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10817 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH06 2.5 - 2.95 Test Results Description Method Result Limits Moisture Content (%) AS 1289.2.1.1 16.6



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### Report No: WARA14S-10818-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10818 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH07 4.0 - 4.45 Test Results Description Method Result Limits AS 1289.2.1.1 Moisture Content (%) 28.0



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## Report No: WARA14S-10819-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10819 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH08 1.0 - 1.45 Test Results Description Method Result Limits AS 1289.2.1.1 19.2 Moisture Content (%)





Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: .

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10820 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW Wyong Hospital BH09 1.5 - 1.95

TRN: -

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	16.9	
Date Tested		1/09/2014	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	50	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	32	
Date Tested		2/09/2014	

### Comments

N/A

Form No: 18909, Report No: WARA14S-10820-1

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# Report No: WARA14S-10820-1

Issue No: 1

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Approved Signatory: Chris Blackford (Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 4/09/2014



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: .

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10821 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW Wyong Hospital BH09 7.5 - 7.95

TRN: -

## Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	20.8	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	39	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	24	
Date Tested		2/09/2014	

## Comments

N/A

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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# Report No: WARA14S-10821-1

Issue No: 1

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## Report No: WARA14S-10822-1 Issue No: 1 Material Test Report Accredited for compliance with ISO/IEC 17025. Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard The results of the tests, calibrations and/or Warabrook NSW 2304 measurements included in this document are traceable to Australian/national standards. NATA Principal: Approved Signatory: Chris Blackford Project No .: INFOWARA01805AA (Geotechnician) NATA Accredited Laboratory Number:431 Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment WORLD RECOGNISED Lot No.: TRN: -Date of Issue: 4/09/2014 Sample Details Sample ID: WARA14S-10822 Client Sample: Date Sampled: 19/08/2014 Source: **On-Site** Material: **Existing Ground** Specification: No Specification Sampling Method: Submitted by client Project Location: Wyong, NSW Sample Location: Wyong Hospital BH10 1.0 - 1.45 Test Results Description Method Result Limits AS 1289.2.1.1 12.2 Moisture Content (%)



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: .

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10823 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW Wyong Hospital BH12 2.5 - 2.95

TRN: -

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	12.8	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	29	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	15	
Date Tested		2/09/2014	

#### Comments

N/A



Warabrook, Newcastle Laboratory

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# Report No: WARA14S-10823-1

Issue No: 1

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(Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 4/09/2014

Form No: 18909, Report No: WARA14S-10823-1



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: .

# Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10824 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW Wyong Hospital BH12 8.5 - 8.95

TRN: -

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	20.2	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	39	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	22	
Date Tested		2/09/2014	

## Comments

N/A

Warabrook, Newcastle Laboratory

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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# Report No: WARA14S-10824-1

Issue No: 1

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





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Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: TRN: -.

### Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10706 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 02 0.2 - 0.8

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	13.6	
Date Tested		27/08/2014	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	4.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	24	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	12	
Plasticity Index (%)	AS 1289.3.3.1	12	
Date Tested		29/08/2014	

Warabrook, Newcastle Laboratory

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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# Report No: WARA14S-10706-1

Issue No: 1

Accredited for compliance with ISO/IEC 17025.

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



Approved Signatory: Chris Blackford (Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 4/09/2014

Comments

N/A




Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: TRN: -

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10707 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 03 0.7 - 0.9

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	32.3	
Date Tested		27/08/2014	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	31	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	17	
Date Tested		3/09/2014	

### Comments

N/A



Warabrook, Newcastle Laboratory

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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## Report No: WARA14S-10707-1

Issue No: 1

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(Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 4/09/2014

Form No: 18909, Report No: WARA14S-10707-1



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: TRN: -.

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10710 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 03 0.9 - 1.3

## Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	45.8	
Date Tested		27/08/2014	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	19.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		Yes	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	111	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	27	
Plasticity Index (%)	AS 1289.3.3.1	84	
Date Tested		1/09/2014	

Comments

N/A



Warabrook, Newcastle Laboratory

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## Report No: WARA14S-10710-1

Issue No: 1

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Approved Signatory: Chris Blackford (Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 4/09/2014



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: Project No.: INFOWARA01805AA Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.:

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10708 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 04 0.6 - 1.5

TRN: -

## Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	20.3	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	2.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	23	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	6	
Date Tested		29/08/2014	
Standard Maximum Dry Density (t/m <sup>3</sup> )	AS 1289.5.1.1	1.79	
Standard Optimum Moisture Content (%)		15.0	
Retained Sieve 19.0mm (%)		15	
Compactive Effort		Standard	
Date Tested		27/08/2014	
CBR At 5.0mm (%)	AS 1289.6.1.1	6	
Maximum Dry Density (t/m <sup>3</sup> )		1.79	
Optimum Moisture Content (%)		15.0	
Dry Density before Soaking (t/m <sup>3</sup> )		1.71	
Density Ratio before Soaking (%)		96	
Moisture Content before Soaking (%)		14.8	
Moisture Ratio before Soaking (%)		99	
Dry Density after Soaking (t/m <sup>3</sup> )		1.73	
Density Ratio after Soaking (%)		97	
Swell (%)		-1.0	
Moisture Content of Top 30mm (%)		18.0	

## Comments

N/A



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WORLD RECOGNISED

(Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 9/09/2014



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No.: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: TRN: -

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10708 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 04 0.6 - 1.5

#### Test Results

Description	Method	Result	Limits
Moisture Content of Remaining Depth (%)		16.8	
Compactive Effort		Standard	
Surcharge Mass (kg)		4.50	
Period of Soaking (Days)		4	
Oversize Material		Excluded	
Oversize Material (%)		14.9	
Date Tested		5/09/2014	

#### Comments N/A

### Warabrook, Newcastle Laboratory

Report No: WARA14S-10708-1

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## Report No: CBR:WARA14S-10708

Californ	ia Bearing Ratio Te	est Report		ISSUE NO. I
Client:	Coffey Geotechnics Pty Ltd (Warabrook 19 Warabrook Boulevard Warabrook NSW 2304	()	Accredited for compliance with IS The results of the tests, calibratio measurements included in this de to Australian/national standards.	O/IEC 17025. ns and/or ocument are traceabl
Principal: Project No.: Project Name: Lot No.: -	INFOWARA01805AA GEOTWARA22354AA - Wyong Hospita TRN: -	Il Redevelopment	WORLD RECOGNISED ACCREDITATION ACCREDITATION ACCREDITATION	ord nber:431
Sample Det	ails			
Sample ID:	WARA14S-10708	Sampling Me	ethod: Submitted by client	
Date Sampled:	19/08/2014	Material:	Existing Ground	
Date Submitted	: 25/08/2014	Source:	On-Site	
Date Tested:	5/09/2014	Specification	n: No Specification	
Project Locatio	n: Wyong, NSW			
Sample Locatio	on: On-Site, Exisiting Ground , TP 04, 0.0	6 - 1.5		
Load vs Pei	netration		Test Results	
2.4			AS 1289.6.1.1	0
-			CBR At 5.0mm (%):	6
2.2			Detimum Moisture Content (%):	1.79
	a a a a a a a a a 💒 a		Dry Density before Socking (t/m <sup>3</sup> ):	15.0
2.0	2 2 2 2 2 2 2 2 2 2 <b>2 2</b> 2 2		Density Batio before Soaking (%):	96
18	<u> </u>		Moisture Content before Soaking (%):	14.8
	E E E E E E E 🗡 E E E		Moisture Ratio before Soaking (%):	99
1.6	i − i − i − i − i − i − i <mark>/</mark> i − i − i − i −		Dry Density after Soaking (t/m <sup>3</sup> ):	1.73
<del>î</del>	1 1 1 1 1 <b>7</b> 1 1 1 1 1		Density Ratio after Soaking (%):	97
<u>ک</u> 1.4	······································		Swell (%):	-1.0
stor	E E E E <b>X</b> E E E E E E		Moisture Content of Top 30mm (%):	18.0
1.2			Moisture Content of Remaining Depth (%):	16.8
d or			Compactive Effort:	Standard
<b>0</b> 1.0			Surcharge Mass (kg):	4.50
-			Period of Soaking (Days):	4
u.a_			Oversize Material:	Excluded
0.6	<u>i</u>		Oversize Material (%):	14.9
- :	<b>7</b> 13 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 - 1 -		ΔS 1289 2 1 1	
0.4			Field Moisture Content (%):	20.3
0.0 1.0 2	2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 Penetration (mm)	12.0 13.0		



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: Project No.: INFOWARA01805AA Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.:

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10709 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 05 0.5 - 1.0

TRN: -

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	19.4	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	30	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	15	
Date Tested		1/09/2014	
Standard Maximum Dry Density (t/m <sup>3</sup> )	AS 1289.5.1.1	1.71	
Standard Optimum Moisture Content (%)		18.0	
Retained Sieve 19.0mm (%)		0	
Compactive Effort		Standard	
CBR At 2.5mm (%)	AS 1289.6.1.1	3.5	
Maximum Dry Density (t/m <sup>3</sup> )		1.71	
Optimum Moisture Content (%)		17.9	
Dry Density before Soaking (t/m <sup>3</sup> )		1.62	
Density Ratio before Soaking (%)		95	
Moisture Content before Soaking (%)		17.7	
Moisture Ratio before Soaking (%)		99	
Dry Density after Soaking (t/m <sup>3</sup> )		1.61	
Density Ratio after Soaking (%)		94	
Swell (%)		0.5	
Moisture Content of Top 30mm (%)		18.9	
Moisture Content of Remaining Depth (%)		19.5	

## Comments

N/A



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Date of Issue: 9/09/2014



# Material

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COIR	<b>=y</b>	Phone: +61 2 401 Fax: +61 2 4016 2	6 2300 2380	
Material	Test Report	Preliminary Rep This report repla	Report No: WARA14 port Issued - Issue No.:1 aces all previous issues of report no 'W.	S-10709-1 Issue No: 2 ARA14S-10709-1'
Client:	Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304	ΝΑΤΑ	Accredited for compliance with ISO/I The results of the tests, calibrations. measurements included in this docu to Australian/national standards.	EC 17025. and/or ment are traceable
Principal: Project No.: Project Name: Lot No.: -	INFOWARA01805AA GEOTWARA22354AA - Wyong Hospital Redevelopment TRN: -	WORLD RECOGNISED ACCREDITATION	Approved Signatory: Chris Blackford (Geotechnician) NATA Accredited Laboratory Number Date of Issue: 9/09/2014	l ər:431
Sample Det	ails			
Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Meth Project Locatio Sample Locatio	WARA14S-10709 - 19/08/2014 On-Site Existing Ground No Specification nod: Submitted by client on: Wyong, NSW on: On-Site Exisiting Ground TP 05 0.5 - 1.0			
Test Results	S			
Description	Method		Result	Limits
Surcharge Mass Period of Soakir Oversize Materi Date Tested	orr s (kg) ng (Days) ial (%)		Standard 4.50 4 0.0 8/09/2014	



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## Report No: CBR:WARA14S-10709

According for compliance with IRONEC 17825    According for compliance with IRONEC 17825    Troject No.: INFOWARA01805AA    Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment  Image: Colspan="2">Constantion Information Information Information    Sample Details    Sample Details    Sample ID: WARA145-10709    Date Sample ID: WARA145-10709    Sampling Method: Submitted by client    Date Sample ID: WARA145-10709    Date Sample ID: WARA145-10709    Sampling Method: Submitted by client    Date Sample ID: WARA145-10709    Date Sample ID: WARA145-10709    Date Tested: By09/2014    Date Sample ID: WARA145-10709    Date Tested: By09/2014    Date Tested: By09/2014    Date Tested: By09/2014    Date Tested: By09/2014    Sample ID: Cocation: Wyong, NSW    Sample ID: Cocation: On-Site, Exisiting Ground , TP 05, 0.5 - 1.0    Date Tested: By09/2014    Date Tested: By09/2014    Date Tested: By09/2014    Date Tested: By0	Californ	iia Bearing Ratio Test R	Report		Issue No: 1
Sample Details    Sample ID:  WARA14S-10709  Sampling Method: Submitted by client    Date Sampled:  19/08/2014  Material:  Existing Ground    Date Submitted:  25/08/2014  Source:  On-Site    Date Tested:  8/09/2014  Specification:  No Specification    Project Location:  Wyong, NSW  Sample Location:  No Specification    Sample Location:  On-Site, Existing Ground , TP 05, 0.5 - 1.0  Test Results    Image: Content Specification  AS 1289.6.1.1  CBR At 2.5mm (%):  3.5    Maximum Dry Density Ratio before Soaking (%):  91.71  Optimum Moisture Content before Soaking (%):  1.62    Density Ratio atler Soaking (%):  94  Swell (%):  0.5  Moisture Content before Soaking (%):  94    Swell (%):  0.0  0.5  Moisture Content of Top 30mm (%):  18.9    Moisture Content of Top 30mm (%):  18.9  Moisture Gasking (Cas):  4.50    Period of Soaking (Days):  4.00  Oversize Material (%):  0.0    Master Content (%):  19.4  Oversize Material (%):  19.4	Client: Principal: Project No.: Project Name: Lot No.: -	Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 INFOWARA01805AA GEOTWARA22354AA - Wyong Hospital Redeve TRN: -	əlopment	Accredited for compliance with IS The results of the tests, calibration measurements included in this do to Australian/national standards. WORLD RECOGNISED ACCREDITATION NATA Accredited Laboratory Num Date of Issue: 9/09/2014	O/IEC 17025. ns and/or cument are traceabl pord nber:431
Load vs Penetration    AS 1289.6.1.1      16	Sample Det Sample ID: Date Sampled: Date Submitted Date Tested: Project Locatio Sample Locatio	ails WARA14S-10709 19/08/2014 4: 25/08/2014 8/09/2014 on: Wyong, NSW on: On-Site, Exisiting Ground , TP 05, 0.5 - 1.0	Sampling Me Material: Source: Specification	ethod: Submitted by client Existing Ground On-Site n: No Specification	
	Load vs Per 1.6 1.5 1.4 1.3 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.2 1.1 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.4 1.5 1.5 1.4 1.5 1.5 1.4 1.5 1.5 1.5 1.5 1.5 1.5 1.5 1.5			Test Results   AS 1289.6.1.1    CBR At 2.5mm (%):    Maximum Dry Density (t/m³):    Optimum Moisture Content (%):    Dry Density before Soaking (t/m³):    Density Ratio before Soaking (%):    Moisture Content before Soaking (%):    Moisture Ratio before Soaking (%):    Dry Density after Soaking (t/m³):    Density Ratio after Soaking (%):    Swell (%):    Moisture Content of Top 30mm (%):    Moisture Content of Remaining Depth (%):    Compactive Effort:    Surcharge Mass (kg):    Period of Soaking (Days):    Oversize Material (%):   AS 1289.2.1.1    Field Moisture Content (%):	3.5 1.71 17.9 1.62 95 17.7 99 1.61 94 0.5 18.9 19.5 Standard 4.50 4 0.0 19.4



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No .: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.:

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10711 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 07 0.5 - 0.8

TRN: -

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	19.2	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.0	
Mould Length (mm)		255	
Crumbling		No	
Curling		No	
Cracking		Yes	
Liquid Limit (%)	AS 1289.3.1.1	43	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	29	
Date Tested		2/09/2014	
Standard Maximum Dry Density (t/m <sup>3</sup> )	AS 1289.5.1.1	1.62	
Standard Optimum Moisture Content (%)		21.5	
Retained Sieve 19.0mm (%)		0	
Compactive Effort		Standard	
Date Tested		29/08/2014	
CBR At 2.5mm (%)	AS 1289.6.1.1	2.5	
Maximum Dry Density (t/m <sup>3</sup> )		1.62	
Optimum Moisture Content (%)		21.5	
Dry Density before Soaking (t/m <sup>3</sup> )		1.54	
Density Ratio before Soaking (%)		95	
Moisture Content before Soaking (%)		21.9	
Moisture Ratio before Soaking (%)		102	
Dry Density after Soaking (t/m <sup>3</sup> )		1.51	
Density Ratio after Soaking (%)		93	
Swell (%)		1.5	
Moisture Content of Top 30mm (%)		29.6	

## Comments



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WORLD RECOGNISED

(Geotechnician) NATA Accredited Laboratory Number:431 Date of Issue: 9/09/2014



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No.: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: TRN: -

### Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10711 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 07 0.5 - 0.8

#### Test Results

Description	Method	Result	Limits
Moisture Content of Remaining Depth (%)		23.6	
Compactive Effort		Standard	
Surcharge Mass (kg)		4.50	
Period of Soaking (Days)		4	
Oversize Material (%)		0.0	
Date Tested		9/09/2014	

## Comments

N/A

### Warabrook, Newcastle Laboratory

Report No: WARA14S-10711-1

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## Report No: CBR:WARA14S-10711

Californ	nia Bearing Ratio Test F	Report		Issue No: 1
Client:	Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304		Accredited for compliance with IS The results of the tests, calibratio measurements included in this du to Australian/national standards.	O/IEC 17025. ns and/or ocument are traceabl
Principal: Project No.: Project Name: Lot No.: -	INFOWARA01805AA GEOTWARA22354AA - Wyong Hospital Redev TRN: -	elopment	WORLD RECOGNISED ACCREDITATION ACCREDITATION	ord nber:431
Sample Det	ails			
Sample ID:	WARA14S-10711	Sampling Me	ethod: Submitted by client	
Date Sampled:	19/08/2014	Material:	Existing Ground	
Date Submitted	1: 25/08/2014	Source:	On-Site	
Date Tested:	9/09/2014	Specification	n: No Specification	
Project Locatio	on: Wyong, NSW			
Sample Locatio	on: On-Site, Exisiting Ground , TP 07, 0.5 - 0.8			
Load vs Pe	netration		Test Results	
+ :	: : : : /: : : : : : : :		AS 1289.6.1.1	
1.2			CBR At 2.5mm (%):	2.5
-	/		Maximum Dry Density (t/m <sup>3</sup> ):	1.62
1.1+			Dry Donsity before Socking (t/m <sup>3</sup> ):	21.5
10			Density Ratio before Soaking (%)	95
			Moisture Content before Soaking (%):	21.9
0.9	······································		Moisture Ratio before Soaking (%):	102
-			Dry Density after Soaking (t/m <sup>3</sup> ):	1.51
2 0.8			Density Ratio after Soaking (%):	93
× ·			Swell (%):	1.5
stor			Moisture Content of Top 30mm (%):	29.6
			Moisture Content of Remaining Depth (%):	23.6
o do			Compactive Effort:	Standard
<b>0</b> 0.5			Surcharge Mass (kg):	4.50
-			Period of Soaking (Days):	4
0.4			Oversize Material (%):	0.0
03			AS 1289 2 1 1	
			Field Moisture Content (%):	19.2
0.2	· · · · · · · · · · · · · · · · · · ·			
† 🖌				
0.1				
0.0 1.0	2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0			
	Penetration (rm)			



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No.: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.:

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10712 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 08 0.5 - 1.0

TRN: -

### Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	19.7	
Standard Maximum Dry Density (t/m <sup>3</sup> )	AS 1289.5.1.1	1.69	
Standard Optimum Moisture Content (%)		16.5	
Retained Sieve 19.0mm (%)		1	
Compactive Effort		Standard	
Date Tested		28/08/2014	
CBR At 5.0mm (%)	AS 1289.6.1.1	4.5	
Maximum Dry Density (t/m <sup>3</sup> )		1.69	
Optimum Moisture Content (%)		16.7	
Dry Density before Soaking (t/m <sup>3</sup> )		1.60	
Density Ratio before Soaking (%)		95	
Moisture Content before Soaking (%)		16.8	
Moisture Ratio before Soaking (%)		101	
Dry Density after Soaking (t/m <sup>3</sup> )		1.60	
Density Ratio after Soaking (%)		95	
Swell (%)		0.0	
Moisture Content of Top 30mm (%)		19.9	
Moisture Content of Remaining Depth (%)		18.5	
Compactive Effort		Standard	
Surcharge Mass (kg)		4.50	
Period of Soaking (Days)		4	
Oversize Material		Excluded	
Oversize Material (%)		1.0	
Date Tested		5/09/2014	

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Comments

N/A



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## Report No: CBR:WARA14S-10712

Client:  Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Rollevalue Warabrook NSW 2304    Principal:  Project No::  INFOWARA01805AA    Project No::  INFOWARA22354AA - Wyong Hospital Redevelopment Lot No::  Ter students:    Sample Details  Sampling Method:  Submitted by client    Date Sample 10:  WARA14S-10712  Sampling Method:  Submitted by client    Date Sample 10:  WARA14S-10712  Sampling Method:  Submitted by client    Date Sample 10:  WARA14S-10712  Sampling Method:  Submitted:  Source:  On-Site    Date Sample 10:  WARA14S-10712  Sampling Method:  Submitted:  Source:  On-Site    Date Submitted:  25/08/2014  Source:  On-Site  St1289.6.1.1    Date Submitted:  25/08/2014  Source:  On-Site  4.5    Maximum Dry Dansity (/m <sup>3</sup> ):  1.60  Optimum Moisture Content boles Soaking (%):  95    Sample Location:  On-Site, Existing Ground , TP 08, 0.5 - 1.0  State Content boles Soaking (%):  16.7    Digg  10  As 1289.6.1.1  As 1289.6.1.1  State Content boles Soaking (%):  16.8    Density Ratio after Soaking (W <sup>2</sup> ): <th>California Bearing Ratio Test R</th> <th>eport Issue No: 1</th>	California Bearing Ratio Test R	eport Issue No: 1
Sample Details    Sample ID:  WARA14S-10712  Sampling Method: Submitted by client    Date Sampled:  19/08/2014  Material:  Existing Ground    Date Submitted:  25/08/2014  Source:  On-Site    Date Tested:  5/09/2014  Specification:  No Specification    Project Location:  Wong, NSW  Sample Location:  On-Site, Existing Ground, TP 08, 0.5 - 1.0    Test Results    30	Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: Project No.: INFOWARA01805AA Project Name: GEOTWARA22354AA - Wyong Hospital Redeve Lot No.: - TRN: -	Iopment    Accredited for compliance with ISO/IEC 17025.      The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.      WORLD RECOGNISED      ACCREDITATION      NATA Accredited Laboratory Number:431      Date of Issue: 9/09/2014
Load vs Penetration  AS 1289.6.1.1    30  AS 1289.6.1.1    30  GR At 5.0mm (%):    4.5  Maximum Dry Density (Um?):    169  Optimum Moisture Content (%):    167  Dry Density before Soaking (Vm?):    168  Moisture Content before Soaking (%):    95  Moisture Content before Soaking (%):    10  Dry Density after Soaking (%):    10  Dry Density after Soaking (%):    10  Optimum Moisture Content of Top 30mm (%):    10  Derive Content of Remaining Depth (%):    10  Oversize Material:    10  AS 1289.2.1.1    10  AS 1289.2.1.1    10  AS 1289.2.1.1    10  AS 1289.2.1.1	Sample DetailsSample ID:WARA14S-10712Date Sampled:19/08/2014Date Submitted:25/08/2014Date Tested:5/09/2014Project Location:Wyong, NSWSample Location:On-Site, Exisiting Ground , TP 08, 0.5 - 1.0	Sampling Method:Submitted by clientMaterial:Existing GroundSource:On-SiteSpecification:No Specification
AS 1289.6.1.1 CBR At 5.0mm (%): 4.5 Maximum Dry Density (t/m <sup>3</sup> ): 1.69 Optimum Moisture Content (%): 16.7 Dry Density before Soaking (%): 95 Moisture Content before Soaking (%): 95 Moisture Ratio before Soaking (%): 101 Dry Density after Soaking (%): 101 Dry Density after Soaking (%): 95 Swell (%): 0.0 Moisture Content of Top 30mm (%): 19.9 Moisture Content of Top 30mm (%): 19.9 Moisture Content of Remaining Depth (%): 18.5 Compactive Effort: Standard Surcharge Mass (kg): 4.50 Period of Soaking (Days): 4 Oversize Material: Excluded Oversize Material (%): 1.0 AS 1289.2.1.1 Field Moisture Content (%): 19.7	Load vs Penetration	Test Results
	30 () () () () () () () () () ()	AS 1289.6.1.1CBR At 5.0mm (%):4.5Maximum Dry Density (t/m³):1.69Optimum Moisture Content (%):16.7Dry Density before Soaking (t/m³):1.60Density Ratio before Soaking (%):95Moisture Content before Soaking (%):101Dry Density after Soaking (t/m³):1.60Density Ratio after Soaking (%):101Dry Density after Soaking (t/m³):1.60Density Ratio after Soaking (%):95Swell (%):0.0Moisture Content of Top 30mm (%):19.9Moisture Content of Remaining Depth (%):18.5Compactive Effort:StandardSurcharge Mass (kg):4.50Period of Soaking (Days):4Oversize Material:ExcludedOversize Material:1.0



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No.: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.:

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10713 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 10 0.3 - 0.8

TRN: -

## Test Results

Description	Method	Result	Limits
Moisture Content (%)	AS 1289.2.1.1	26.5	
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	54	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	36	
Date Tested		1/09/2014	
Standard Maximum Dry Density (t/m <sup>3</sup> )	AS 1289.5.1.1	1.52	
Standard Optimum Moisture Content (%)		26.5	
Retained Sieve 19mm (%)		0	
Compactive Effort		Standard	
Date Tested		28/08/2014	
CBR At 2.5mm (%)	AS 1289.6.1.1	3.5	
Maximum Dry Density (t/m <sup>3</sup> )		1.52	
Optimum Moisture Content (%)		26.6	
Dry Density before Soaking (t/m <sup>3</sup> )		1.45	
Density Ratio before Soaking (%)		96	
Moisture Content before Soaking (%)		25.9	
Moisture Ratio before Soaking (%)		98	
Dry Density after Soaking (t/m <sup>3</sup> )		1.46	
Density Ratio after Soaking (%)		96	
Swell (%)		-0.5	
Moisture Content of Top 30mm (%)		31.1	

## Comments



Warabrook, Newcastle Laboratory

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Date of Issue: 9/09/2014

WORLD RECOGNISED



Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: INFOWARA01805AA Project No.: Project Name: GEOTWARA22354AA - Wyong Hospital Redevelopment Lot No.: TRN: -

## Sample Details

Sample ID: Client Sample: Date Sampled: Source: Material: Specification: Sampling Method: Project Location: Sample Location:

WARA14S-10713 19/08/2014 **On-Site Existing Ground** No Specification Submitted by client Wyong, NSW On-Site **Exisiting Ground** TP 10 0.3 - 0.8

#### Test Results

Description	Method	Result	Limits
Moisture Content of Remaining Depth (%)		27.0	
Compactive Effort		Standard	
Surcharge Mass (kg)		4.50	
Period of Soaking (Days)		4	
Oversize Material (%)		0.0	
Date Tested		5/09/2014	

## Comments

N/A



Warabrook, Newcastle Laboratory

Coffey Testing Pty Ltd ABN 92 114 364 046 19 Warabrook Boulevard Warabrook NSW 2304

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## Report No: CBR:WARA14S-10713

California Bearing Ratio Test R	eport
Client: Coffey Geotechnics Pty Ltd (Warabrook) 19 Warabrook Boulevard Warabrook NSW 2304 Principal: Project No.: INFOWARA01805AA Project Name: GEOTWARA22354AA - Wyong Hospital Redeve Lot No.: - TRN: -	Iopment    Accredited for compliance with ISO/IEC 17025.      The results of the tests, calibrations and/or measurements included in this document are traceab to Australian/national standards.      WORLD RECOGNISED      ACCREDITATION      NATA Accredited Laboratory Number:431      Date of Issue: 9/09/2014
Sample DetailsSample ID:WARA14S-10713Date Sampled:19/08/2014Date Submitted:25/08/2014Date Tested:5/09/2014Project Location:Wyong, NSWSample Location:On-Site, Exisiting Ground , TP 10, 0.3 - 0.8	Sampling Method: Submitted by client Material: Existing Ground Source: On-Site Specification: No Specification
Load vs Penetration	Test Results
1.4	CBR At 2.5mm (%):    3.5      Maximum Dry Density (t/m³):    1.52
1.3	Optimum Moisture Content (%): 26.6
1.2	Dry Density before Soaking (t/m³): 1.45
	Moisture Content before Soaking (%): 25.9
	Moisture Ratio before Soaking (%): 98
1.0	Dry Density after Soaking (t/m <sup>3</sup> ): 1.46
Ş 09	Density Ratio after Soaking (%): 96
	Swell (%): -0.5
	Moisture Content of Jop 30mm (%): 31.1
	Compactive Effort: Standard
	Surcharge Mass (kg): 4.50
	Period of Soaking (Days): 4
0.5	Oversize Material (%): 0.0
0.4	
0.3	AS 1289.2.1.1 — Field Moisture Content (%): 26.5
0.2	
0.1	
0.0 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11.0 12.0 13.0	

## Comments

Penetration (mm)



## Certificate of Analysis

NATA Accredited Accreditation Number 1261 Site Number 1254

Coffey Environments Pty Ltd Newcastle Lot 101, 19 Warabrook Boulevard Warabrook NSW 2304



Accredited for compliance with ISO/IEC 17025. The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Atto	ntic	۱n	
Alle	inuc	,,,,,	

James Rayner

Report	
Client Reference	
Received Date	

**429989-S** GEOTWARA22354AA Aug 27, 2014

Client Sample ID			TP02 : 0.2-0.8M	BH05 : 2.5- 2.95M	BH12 : 1.0- 1.45M	BH10 : 2.5- 2.95M
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins   mgt Sample No.			M14-Au19061	M14-Au19062	M14-Au19063	M14-Au19064
Date Sampled			Aug 12, 2014	Aug 14, 2014	Aug 15, 2014	Aug 14, 2014
Test/Reference	LOR	Unit				
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	35	26	43	25
% Moisture	0.1	%	12	14	12	11
Eurofins   mgt Suite 18						
Chloride	5	mg/kg	20	21	14	16
pH (1:5 Aqueous extract)	0.1	pH Units	6.9	4.9	6.9	5.8
Sulphate (as S)	10	mg/kg	24	27	18	< 10

Client Sample ID Sample Matrix			BH12 : 8.5- 8.95M Soil	BH04 : 2.5- 2.95M Soil
Eurofins   mgt Sample No.			M14-Au19065	M14-Au19066
Date Sampled			Aug 18, 2014	Aug 12, 2014
Test/Reference	LOR	Unit		
Conductivity (1:5 aqueous extract at 25°C)	10	uS/cm	20	87
% Moisture	0.1	%	17	21
Eurofins   mgt Suite 18				
Chloride	5	mg/kg	6.2	67
pH (1:5 Aqueous extract)	0.1	pH Units	5.5	5.4
Sulphate (as S)	10	mg/kg	< 10	17



#### Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported. A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results (regarding both quality and NATA accreditation).

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Conductivity (1:5 aqueous extract at 25°C)	Melbourne	Aug 28, 2014	7 Day
- Method: LM-LTM-INO-4010			
% Moisture	Melbourne	Aug 29, 2014	14 Day
- Method: Method 102 - ANZECC - % Moisture			
Eurofins   mgt Suite 18			
Sulphate (as S)	Melbourne	Aug 28, 2014	28 Day
- Method: In house MGT1110A (SO4 by Discrete Analyser)			
Eurofins   mgt Suite 18			
Chloride	Melbourne	Aug 28, 2014	28 Day
- Method: MGT 1100A			
pH (1:5 Aqueous extract)	Melbourne	Aug 28, 2014	7 Day
- Method: LM-LTM-INO-4000			



Melbourne 3-5 Kingston Town Close Oakleigh VIC 3166 Phone : +61 3 8564 5000 NATA # 1261 Site # 1254 & 14271 **Sydney** Unit F6, Building F 16 Mars Road Lane Cove West NSW 2066 Phone : +61 2 9900 8400 NATA # 1261 Site # 18217 Brisbane 1/21 Smallwood Place Murarrie QLD 4172 Phone : +61 7 3902 4600 NATA # 1261 Site # 20794

Company Na Address: Client Job No	me: Coffey E Lot 101, Warabro NSW 23 D.: GEOTW	nvironments P/L 19 Warabrook E ok 04 ARA22354AA	. N'castle Boulevard		Order No.: Report #: Phone: Fax:		rder epor hone ax:	429989 02 4016 2300 02 4016 2380	Received: Due: Priority: Contact Name: Eurofins   mgt C	Aug 27, 2014 8:39 AM Sep 3, 2014 5 Day James Rayner
Sample Detail				% Moisture	Conductivity (1:5 aqueous extract at 25°C)	Eurofins   mgt Suite 18				
Laboratory who	ere analysis is c	onducted								
Melbourne Laboratory - NATA Site # 1254 & 14271		X	X	Х						
Sydney Laboratory - NATA Site # 1821/ Brisbane Laboratory - NATA Site # 20794										
External Laboratory										
Sample ID	Sample Date	Sampling Time	Matrix	LAB ID						
TP02 : 0.2- 0.8M	Aug 12, 2014		Soil	M14-Au19061	х	x	х			
BH05 : 2.5- 2.95M	Aug 14, 2014		Soil	M14-Au19062	х	х	х			
BH12 : 1.0- 1.45M	Aug 15, 2014		Soil	M14-Au19063	х	х	х			
BH10 : 2.5- 2.95M	Aug 14, 2014		Soil	M14-Au19064	х	х	х			
BH12 : 8.5- 8.95M	Aug 18, 2014		Soil	M14-Au19065	х	х	х			
BH04 : 2.5- 2.95M	Aug 12, 2014		Soil	M14-Au19066	х	х	х			

ABN - 50 005 085 521 e.mail : EnviroSales@eurofins.com.au web : www.eurofins.com.au



#### Eurofins | mgt Internal Quality Control Review and Glossary

#### General

- 1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples are included in this QC report where applicable. Additional QC data may be available on request.
- 2. All soil results are reported on a dry basis, unless otherwise stated.
- 3. Actual PQLs are matrix dependant. Quoted PQLs may be raised where sample extracts are diluted due to interferences.
- 4. Results are uncorrected for matrix spikes or surrogate recoveries.
- 5. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
- 6. Samples were analysed on an 'as received' basis. 7. This report replaces any interim results previously issued.

#### **Holding Times**

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the Sample Receipt Acknowledgment.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

\*\*NOTE: pH duplicates are reported as a range NOT as RPD

#### UNITS

mg/kg: milligrams per Kilogram	mg/I: milligrams per litre
ug/I: micrograms per litre	ppm: Parts per million
ppb: Parts per billion	%: Percentage
org/100ml: Organisms per 100 millilitres	NTU: Units
MPN/100ml · Most Probable Number of organisms per 100 millilitres	

#### TERMS

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery
CRM	Certified Reference Material - reported as percent recovery
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands.
	In the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
Batch Duplicate	A second piece of analysis from a sample outside of the clients batch of samples but run within the laboratory batch of analysis.
Batch SPIKE	Spike recovery reported on a sample from outside of the clients batch of samples but run within the laboratory batch of analysis.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
ASLP	Australian Standard Leaching Procedure (AS4439.3)
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
СР	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within
TEQ	Toxic Equivalency Quotient

#### **QC - ACCEPTANCE CRITERIA**

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries : Recoveries must lie between 50-150% - Phenols 20-130%.

#### QC DATA GENERAL COMMENTS

- 1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
- 2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
- 3. Organochlorine Pesticide analysis where reporting LCS data, Toxophene & Chlordane are not added to the LCS.
- 4. Organochlorine Pesticide analysis where reporting Spike data, Toxophene is not added to the Spike.
- 5. Total Recoverable Hydrocarbons where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
- 6. pH and Free Chlorine analysed in the laboratory Analysis on this test must begin within 30 minutes of sampling. Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
- 7. Recovery Data (Spikes & Surrogates) where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
- 8. Polychlorinated Biphenyls are spiked only using Arochlor 1260 in Matrix Spikes and LCS's.
- 9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
- 10. Duplicate RPD's are calculated from raw analytical data thus it is possible to have two sets of data.



### **Quality Control Results**

Test			Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank									
Conductivity (1:5 aqueous extract at 25°C) uS				< 10			10	Pass	
Method Blank									
Eurofins   mgt Suite 18									
Chloride			mg/kg	< 5			5	Pass	
LCS - % Recovery									
Eurofins   mgt Suite 18									
Chloride			%	95			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
Eurofins   mgt Suite 18				Result 1					
Chloride	M14-Au19062	CP	%	91			70-130	Pass	
Sulphate (as S)	M14-Au19062	CP	%	114			70-130	Pass	
Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Eurofins   mgt Suite 18				Result 1	Result 2	RPD			
Chloride	M14-Au19061	CP	mg/kg	20	18	9.7	30%	Pass	
Sulphate (as S)	M14-Au19986	NCP	mg/kg	11	12	5.1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
Conductivity (1:5 aqueous extract at 25°C)	M14-Au19063	СР	uS/cm	43	55	24	30%	Pass	
Duplicate									
Eurofins   mgt Suite 18				Result 1	Result 2	RPD			
pH (1:5 Aqueous extract)	M14-Au19063	CP	pH Units	6.9	7.0	pass	30%	Pass	



#### Comments

Sample Integrity	
Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

#### Authorised By

Tammy Lakeland Huong Le Client Services Senior Analyst-Inorganic (VIC)

Glenn Jackson Laboratory Manager Final report - this Report replaces any previously issued Report

- Indicates Not Requested

\* Indicates NATA accreditation does not cover the performance of this service

Uncertainty data is available on request

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**Appendix C - Pavement Thickness Design Summary** 

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paveme	ent thi	ckness design s	summ	ary				
client :	Appia	n Group	jot	job no : GEOTWARA22354AA				
principal :	Health	Infrastructure NSW	lat	laboratory : WARABROOK				
project:	Wyon	g Hospital Redevelopment	re	port date : 1	0/09/2014			
location :	Henry	Moore Drive, Hamlyn Terrace	de	signed by : J	IR			
council :	Wyon	g Shire Council	ch	ecked by : 🛛 🖌	ABL			
road name or type:		Residual Clay Subgrade		Weathered Rock Subgrade				
chainage interval:	(m)	-		-				
design traffic loading:	(ESA)	1 x 10 <sup>4</sup>		1 x 10 <sup>4</sup>				
wearing course thickne	ess: (mm)	30		30				
basecourse thickness:	: (mm)	100		100				
sub-base thickness:	(mm)	220		120				
select thickness:	(mm)	-		-				
total thickness:	(mm)	350		250				
CBR used for design:	(%)	3		6				
design traffic loadi	ing:	Design traffic loading is the number of design lane during the design period 'Pavement Design' AUSTROADS. Reference 2014.	equivalent star d. For definitio er GEOTWARA	ndard axles ( ns, refer Ap A22354AA-AB	ESA) in the opendix 1.1 3, dated 15			
material quality:								
wearing course: 30mm gap graded AC10 Conforming to Council requirements								
basecourse:		Conforming to ARRB Special Report No	RB Special Report No 41					
sub-base: Conforming to ARRB Special Report No 41								
select:	xt: well graded gravel CBR > 15%, PI <15%							
Note: Red	commended ma	terials types may vary from those of job speci	fication or statute	ory authority. R	efer covering letter/report.			
compaction require	ements:		Modified:	Minimum red	quired dry density ratio AS1280			
wearing course :		Conforming to council requirements	5.4.1-2007 determine	5.4.1-2007, calculated using field dry density ratio, AS 1289 determined by AS1289 5.3.1-2004 or equivalent and				
basecourse :	upper:	98% Modified	the maxim 2003 or ec	he maximum dry density obtained using AS1289 5.2 2003 or equivalent.				
lower:			Standard:	dard: As above, but maximum dry density				
sub-base :		95% Modified	obtained u	ed using AS1289 5.1.1-2003 or equivalent.				
select :		00% Standard Dens AS12		<b>Density Index:</b> Minimum required Density Index AS1289 5.6.1-1998, calculated using field dry density determined by AS1289 5.3.1-2004 or equivalent and laboratory values of maximum and minimum density				
subgrade :	100% Standard de		determine laboratory					
fill below:		100% Standard	obtained b	obtained by AS1289 5.5.1-1998 or equivalent.				
Note : Red	Recommendations for compaction may vary from those of job specification or statutory authority. Refer covering letter/report.							
Drainage: The area	The design assumes the provision of adequate surface and subsurface drainage of the pavement and adjacent areas. Refer GEOTWARA22354AA-AB, dated 15 September 2014.							