Appendix 9
Preliminary Geotechnical Investigation

Douglas Partners

April 2008

Warner Industrial Park Concept Plan and Project Application

Precinct 14 WEZ

Sparks Rd and Hue Hue Rd
Warnervale
June 2008

80
TERRACE
TOWER
GROUP

Warner Business Park Pty Ltd
Part of the Terrace Tower Group

Peter Andrews + Associates Pty Ltd
architecture planning urban design

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REPORT
on
PRELIMINARY GEOTECHNICAL INVESTIGATION

PROPOSED WARNER INDUSTRIAL PARK
CORNER HUE HUE ROAD AND SPARKS ROAD
WARNERVALE

Prepared for
MM CONSULTANTS

Acting on Behalf of
WARNER BUSINESS PARK PTY LIMITED

PROJECT 41615
APRIL 2008

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Douglas Partners Pty Ltd
ABN 75 053 980 117

Unit D, 7 Donaldson Street
WYONG NORTH NSW 2259
Phone (02) 4351 1422
Fax (02) 4351 1410
wyong@douglaspartners.com.au

ACEA
The Association of Consulting Engineers Australia

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MPG:mpg
Project 41615
April 2008

REPORT ON PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED WARNER INDUSTRIAL PARK
CORNER OF HUE HUE ROAD AND SPARKS ROAD, WARNERVALE

1. INTRODUCTION

This report details the results of a preliminary geotechnical investigation for the proposed development of a parcel of land at the corner of Hue Hue Road and Sparks Road, Warnervale. It is understood that the site will be developed as an industrial park. The work was requested by MM Consultants Pty Ltd, acting on behalf of Warner Business Park Pty Limited, owners of the site.

The scope of geotechnical investigation comprised excavation of test pits, insitu testing and sampling, a walk over survey by a senior geotechnical engineer followed by laboratory testing, engineering evaluation and reporting.

The purpose of the investigation was to obtain subsurface information and provide engineering comment on the following geotechnical issues:

- Subsurface conditions at test locations;
- Suitability of the site soils to accept filling;
- Assessment of the presence of acid sulphate soils at the site of the proposed bridge over Buttonderry Creek;
- Excavation conditions in areas of cut;
- Safe batter slopes in areas of cut and fill;
- Recommended site preparation measures.
- Anticipated site classifications in accordance with AS2870 for the industrial sites;
- Geotechnical parameters for the design of foundations

- Design parameters for piled foundations for the proposed bridge across Buttonderry Creek;
- Flexible and rigid pavement thickness design for the proposed internal roads;
- Thickness design for a rigid (concrete) roundabout at the proposed intersection at Sparks Road; and
- Flexible pavement thickness design for Type C intersection with Hue Hue Road;

Several plans were provided by Trehy Ingold Neate, surveyor for the project, for the purposes of the investigation, including:

- A plan showing proposed site earthworks (Reference 19426 EA02 Revision C);
- Sections through the site with planned bulk earthworks levels (Reference 19426 EA03 to EA06, revision A); and
- Detailed survey plan of the site (Reference 19426, C06, Revision B)

Douglas Partners Pty Ltd is currently undertaking a contamination assessment at the site, the results of which will be provided in a report titled "Report on Targeted Phase 2 Contamination Assessment, Proposed Warner Industrial Park, Corner of Hue Hue Road and Sparks Road, Warnervale", Project 41615, May 2008.

For the purposes of the investigation, the client provided a copy of a report undertaken by Coffey titled "Wyong Employment Zone, Precincts 11, 13 and 14, and Airport Suppliers Park, Halloran, Updated Preliminary Contaminated Land Assessment and Acid Sulphate Soils Assessment", dated 15 May 2006. Reference was made to information in these other reports during preparation of the present report.

2. SITE DESCRIPTION

2.1 Land Area and Topography

The site comprises an irregular shaped parcel of land with an area of approximately 104 hectares. Three existing roads, namely Sparks Road, Hue Hue Road and Kiah Ridge Road, bound the site to the south-west, west and north respectively (refer Drawing 1). The F3 Sydney to Newcastle freeway bounds the site to the south-east. Existing rural land bounds the site to the east.

The parcel of land encompasses thirteen existing allotments, as follows:

- Lots 15 to 19 in DP259530;
- Lots 4 and 6 to 9 in DP239704;
- Lots 25 and 26 in DP259530; and
- Lot 5 in DP259531

Topography at the site is broadly summarised as rolling hills within the majority of the site, falling gently to the south-east. Generally two high points are located along the western boundary of the site and a further high point in the north-east corner. Slopes fall down from these high points at slopes of less than 5° to the north-east, east and south-east. The site has two distinct areas, which are roughly delineated by the RL 20 m AHD contour (refer Drawing 3). The land surface below this contour is mostly situated in the eastern area of the site and generally consists of low lying relatively flat ground. The area around Buttonderry Creek is also below this contour level and consists of relatively flat ground. The land surface above this contour is mostly situated in the western and northern area of the site and generally consists of gently sloping ground.

Based on review of the survey plan provided by the client and a site walkover by the project manager, the high points of the site and relevant elevations are located as follows:

- Broad elevated area within the south-western corner at the intersection of Hue Hue Road and Sparks Road with an elevation of approximately RL 25 m AHD;
- Broad rounded spur along the western frontages of Lots 6 and 7 in DP239704 with an elevation of approximately RL 32 m AHD; and
- Planar hill slope in the north-eastern corner of the site (Lot 9 in DP239704), with an elevation of approximately RL 40 m AHD.

The exception to this general topography is the large mound of filling located in the south-eastern corner of Lot 5, which is understood to have been placed there during the construction of the F3 freeway (refer Photo 6 in Section 2.2).

2.2 Site Features

The site mainly consists of either cleared pastoral land supporting grass and scattered timber or heavily timbered undeveloped rural land. Reference to Drawing 2, which is an aerial photo of the site retrieved from the Landinfo website that roughly shows the timbered and cleared areas of the site. It should be noted that the aerial photo is not current and land clearing may have taken place after the photo was taken. Generally, the majority of the northern part of the site has been cleared, together with the southern area of the site, with remnant bushland within the mid to southern central portion of the site (refer Photos 1 and 2 below – see photo locations on Drawing 4).

Photo 1 – Low lying cleared area in eastern section of Lot 18

Photo 2 – Heavily timbered low lying area in central area of Lot 19

Buttonderry Creek passes through the southern section of the site (refer Drawings 3 and 4) in a roughly north-south orientation. It is incised by up to 3 m into the surrounding landscape and has steep sided banks.

Numerous existing dwellings are located throughout the site predominantly within 100 m of the western boundary (refer Drawing 3). A number of existing residences and stables are located within the site in proximity to Kiah Ridge Road (refer Photo 3 below)

Photo 3 – Existing residence in vicinity of Kiah Ridge Road

Numerous farm dams (in excess of twenty) are located throughout the site (refer Drawing 3). The majority of these have been formed by a combination of cut and fill operations and are in the order of 10 m to 30 m in diameter (refer Photo 4 below).

Photo 4 – Existing farm dam on Lot 19 in DP 259530, looking south-west

Other developments throughout the site include a former heli-pad in the south-eastern corner (refer Photo 5).

Photo 5 – Former heli-pad

Filling platforms or stockpiles were observed in several areas throughout the site (refer Drawing 4), including the following:

- Within the south-eastern corner of Lot 5 in DP259531 where filling understood to have been won from excavations in connection with the construction of the F3 freeway has been placed (refer Photo 6 below);
- Surrounding a number of the existing residences, such as in Photo 7, located to the north of the residence in Lot 7; and
- Scattered throughout the bush in numerous locations throughout the site (refer Photo 8).

Photo 6 – Filling in south-eastern corner of Lot 5 (believed to be associated with construction of F3)

Photo 7 – Filling platform in Lot 7 – Looking north

Photo 8 – Rubbish and filling scattered throughout the bush

A number of unsealed access tracks are present throughout the site, mainly providing access to the rear (eastern) sections of the individual allotments. Photo 9 below show the access track for the former residence (now demolished) on Lot 4.

Photo 9 – Access track to former residence in Lot 4 – looking south

3. REGIONAL GEOLOGY, SOIL LANDSCAPE AND ACID SULPHATE SOILS

3.1 Regional Geology

Reference to the interim Wyong 1:25 000 Geological Series indicates that the site is underlain by rocks of the Tuggerah Formation, which is a member of the Clifton Subgroup and Narrabeen Group. The Tuggerah Formation typically comprises lithic sandstone, red-brown and grey-green claystone and siltstone, grey siltstone and laminate, rare conglomerate. Areas to the west of the site are mapped as being underlain by rocks of the Patonga Claystone formation.

An excerpt of the Wyong Geological sheet is presented on Drawing 5.

Conditions encountered in the pits included sand and clay soils underlain by sandstone or claystone bedrock. The soils were consistent with residual soils derived from the underlying bedrock.

3.2 Soil Landscape Mapping

Reference to the Department of Conservation and Land Management, Gosford-Lake Macquarie, Soil Landscape Series map indicates that the majority of the site is underlain by soils of the Wyong Soil Landscape Group.

The southern portion of the site (roughly Lots 15 to 17) and also the north eastern portion of the site (roughly the north-eastern areas of Lots 8 and 9) are shown to be underlain by soils of the Gorokan Soil Group, which is categorised as undulating low hills and rises of the Tuggerah Formation with slope gradients of less than 15%. Soils within this group are said to be between 0.5 m and 1.5 m deep. The limitations associated with these soils include extreme erosion hazard, rock outcrop, shallow highly permeable soils and very low soil fertility.

The mapping also shows that the south-western area of the site (isolated to the western part of Lots 16 and 17) is underlain by soils of the Woodburys Bridge Landscape Group. This soil group is characterised by gently undulating rises and rolling low hills on Patonga Claystone. Limitations within this soil unit include extreme erosion hazard, high foundation hazard, localised seasonal waterlogging, acid soil of very low fertility and low wet bearing strength.

An excerpt from the Gosford-Lake Macquarie, Soil Landscape Series map is presented on Drawing 6.

3.3 Acid Sulphate Soil Mapping

Reference to the Wyong Acid Sulphate Soil Risk map indicates that there is no known occurrence of acid sulphate soils at the site. An excerpt from the Wyong Acid Sulphate Soil Risk map is presented on Drawing 7.

Given the elevation of the site, above RL 17, and the underlying geology, it is unlikely that acid sulphate soils will be present at this site.

4. FIELD WORK

4.1 Methods

The field work was undertaken during the period between on 14 March 2008 and 3 April 2008 and comprised the excavation of twenty eight (28) test pits and the drilling of ten (10) test bores, as follows:

Test Pits throughout the site (Pits 1 to 27 and 6A)

Twenty eight (28) test pits (designated Pits 1 to 27 and Pit 6A) were excavated throughout the site in order to characterise the soil profile and enable sampling of representative soil samples for laboratory testing and identification purposes. The pits were excavated to depths ranging from 0.9 m to 2.5 m using a 4 tonne excavator fitted with a 450 mm bucket.

Test Bores along shoulder of Sparks Road (Bores 201 to 203)

Three test bores (designated Bores 201 to 203) were drilled along the shoulders of Sparks Road to depths ranging from 1.5 m to 1.9 m. The bores were drilled using an excavator fitted with a 225 mm diameter auger attachment. The purpose of the bores was to investigate the subgrade conditions at this location.

Test Bores along shoulder of Hue Hue Road (Bores 301 to 303)

Three test bores (designated Bores 301 to 303) were drilled along the eastern shoulder of Hue Hue Road in the vicinity of a proposed intersection. The bores were drilled to depths ranging from 0.8 m to 1.7 m using an excavator fitted with a 225 mm diameter auger attachment. The purpose of the bores was to investigate the subgrade conditions at this location.

Test Bores in the area of proposed cut (Bores 304 and 305)

Two test bores (designated Bores 304 and 305) were drilled to depths of 6.49 m and 4.8 m respectively in the location of a proposed cut, located at the western boundary of Lots 6 and 7.. Bore 304 was drilled using a combination of auger drilling within the soils and weak bedrock, followed by NMLC diamond coring techniques in the underlying bedrock. Bore 305 was drilled using auger drilling techniques, firstly to V-bit auger tip refusal and then tungsten carbide auger tip refusal.

Standard penetration testing (SPT) was undertaken at regular depth intervals within the overburden soils.

Photographs of the rock core samples retrieved from Bore 304 and 401 are included at the end of Appendix B.

Test Bore in location of proposed bridge over Buttonderry Creek (Bores 401 and 402)

Two bores (designated Bores 401 and 402) were drilled in the location of the proposed bridge of Buttonderry Creek (within Lot 18). The bores were drilled to V-bit auger tip refusal at depths of 6.7 m and 5.3 m respectively, using a utility mounted drilling rig fitted with 100 mm diameter augers. SPT testing was undertaken at regular depth intervals within Bores 401 and 402.

Test Pits in the area of the former heli-pad (Pits 101 to 108)

Eight test pits (designated Pits 101 to 108) were excavated in the vicinity of the former heli-pad site for the purposes of the Phase 2 targeted contamination assessment in order to characterise the soil profile and enable sampling of representative soil samples for laboratory testing. The pits were excavated to depths ranging from 1.6 m to 2.5 m using a 4 tonne excavator fitted with a 450 mm wide bucket.

General

The pit and bore locations were set out by a geotechnical engineer from Douglas Partners Pty Ltd (DP). The geotechnical engineer logged the subsurface profile in each pit and bore, and took representative disturbed and undisturbed samples for identification purposes and laboratory testing.

The location of all tests were pegged and labelled at the completion of field work for subsequent survey by the project surveyors. A summary of the position and elevation of the test pits and bores is provided in Table 1 below.

Table 1 – Summary of Test Location and Elevations

Pit/Bore	Easting	Northing	Elevation (m AHD)
1	352719.80	6322638.12	21.46
2	352953.24	6322630.77	18.94
3	353105.52	6322908.48	19.36
4	353271.05	6322844.65	18.2
5	353153.24	6323268.16	21.77
6	353294.96	3323032.87	19.94
7	353458.9	6323024.05	19.61
8	353597.86	6323153.59	18.99
9	353691.68	6323116.69	18.52
10	353607.28	6323401.47	19.79
11	353494.01	6323535.65	22.53
12	353539.68	6323764.77	22.97
13	353767.14	6323667.97	23.09
14	353748.44	6323432.62	19.80
15	353774.66	6323793.52	24.75
16	353842.30	6323136.58	18.41
17	353951.51	6323252.63	20.21
18	353713.93	6323288.84	19.09
19	353911.08	6323531.84	26.67
20	353899.45	6323656.88	28.71
21	353091.80	6323086.11	21.12
22	352776.00	6322727.32	21.12
23	352958.52	6322788.45	19.65
24	353020.63	6322889.58	19.97
25	352993.33	6322877.36	20.37
26	353371.05	6322985.23	19.05
27	353615.26	6322954.67	18.05
201	352646.17	6322509.76	24.95
202	352752.87	6322438.68	24.97
203	352673.39	6322472.51	24.94
301	353304.06	6323480.39	30.77
302	353344.45	6323522.58	31.53
303	353394.61	6323590.99	29.42
304	353337.28	6323483.81	32.38
305	353401.47	6323564.44	28.71
401	352992.58	6322880.43	20.38
402	353023.80	6322889.78	20.09

At the completion of field work, the pits and bores were backfilled with spoil from the excavation.

The locations of the tests are shown on Drawings 3 and 4, which is included in Appendix A. Drawing 3 shows the test locations in reference to the existing site survey, whereas Drawing 4 shows the test locations in reference to the proposed layout of the subdivision.

4.2 Results

Details of the subsurface conditions encountered in the test pits are presented in the test report sheets in Appendix B. These should be read in conjunction with the explanatory notes, which define the descriptive terms and classification methods.

A brief summary of the conditions encountered in the pits and bores is as follows:

Pits and Bores throughout subdivision

The conditions encountered within the pits and bores undertaken within the subdivision encountered fairly similar conditions. In general, the natural subsurface profile encountered included dark brown or brown clayey sandy silt topsoil, overlying brown or light grey silty sand or clayey silty sand, ranging in density from loose to medium dense, overlying in turn light grey mottled orange brown or orange brown silty clay, sandy clay or clay, ranging in strength from firm to hard. Siltstone and claystone bedrock was encountered in some pits and bores at depths ranging from 0.6 m to 3.0 m (RL 16.3 m AHD to RL 18.6 m AHD) within the western and northern areas of the site. A summary of subsurface conditions within the two distinct terrain areas of the site are presented below.

Eastern, lower area of the site

Weaker conditions, including soft to firm clays or silts, or loose sands were encountered within the lower eastern area of the site, within the upper 0.6 m to 1 m of the profile. Further discussion of the presence of weak soils is presented in Section 7.3.

The sand soils were generally limited to the upper 0.5 m of the soil profile. An exception to this included loose to medium dense orange brown clayey silty sand, silty sand or sand encountered in Pits 24 and 25 to depths of 2.3 m (limit of investigation) and 0.8 m respectively. These pits were drilled within the vicinity of Buttonderry Creek.

Extremely low strength bedrock was encountered in Bores 401 and 402 (located at the proposed bridge over Buttonderry Creek) below depths of 2.3 m and 3.5 m respectively. Tactile assessment of the core recovered from Bore 401 indicates that the bedrock consists of interbedded sandstone, siltstone and claystone, initially extremely low strength with some medium strength seams below approximately 5.81 m depth.

Groundwater was observed within a number of pits excavated within the lower eastern area of the site, at depths ranging from 0.4 m to 2.1 m. Further, elevated moisture contents were observed within the upper soils in a number of pits located in the lower eastern section of the site. The elevated moisture contents were generally noted within the weaker soils, as described in Section 7.3. It should be noted that groundwater levels are affected by recent climatic conditions and soil permeability and therefore can vary with time.

Western and northern, higher area of the site

Predominantly stiff or better clay soils and loose to medium dense sand soils were encountered within the pits and bores excavated within the higher western and northern areas of the site.

Extremely low strength siltstone and claystone bedrock was encountered in a number of pits and bores undertaken within the higher western and northern areas of the site. The bedrock was encountered within Pits 20 and 22 and Bores 301 to 304 at depths ranging from 0.6 m to 1.5 m and in Bore 305 at a depth of 3.0 m. Tactile assessment of the core recovered from Bore 304 indicates that the bedrock is initially extremely low to low strength sandstone and siltstone, and becoming medium strength sandstone from 1.41 m depth. Very low strength siltstone (Patonga Claystone) was encountered in Bore 304 below 3.21 m depth and continued to a depth of 5.12 m. Below 5.12 m depth, the core sample drilled was undersized and hence was not able to be retrieved by the catcher within the coring barrel. Measurement by tape down the open bore detected the presence of the core within the hole and hence it is anticipated that the core left down the bore was possibly also of very low strength.

Free groundwater was not observed in any of the pits within the higher western and northern area of the site (above RL 20 m AHD) during the time that they were open. It should be noted that groundwater levels are affected by recent climatic conditions and soil permeability and therefore can vary with time.

Filling

Filling, comprising brown sandy clay or silty clay was encountered within Pits 6 and 6A to a depth of 0.4 m and 0.7 m respectively, underlain by light grey mottled red and orange silty clay filling in Pit 6 to a depth of 1.7 m. This upper filling was generally free of building rubble or deleterious material. Further filling, comprising building rubble, broken bricks, plastic, fibrous sheeting within and sandy clay and silty clay matrix was encountered in Pits 6 and 6A at depths of 1.7 m and 0.7 m respectively. Stiff to very stiff grey mottled brown silty clay was encountered in Pit 6A at a depth of 1.7 m and continued to termination at a depth of 2.0 m. Termination of Pit 6A was due to strong inflow of groundwater into the pit and collapsing pit walls.

Groundwater seepage was observed at 1.4 m depth in Pit 6, which is possibly perched water trapped in the building rubble.

Filling, including sandy clay with gravel, tiles and isolated pieces of timber, was also encountered in the pits excavated around the former heli-pad (Pits 101 to 108) to depths ranging from 0.12 m to 1.3 m.

5. LABORATORY TESTING

Laboratory testing comprised the following:

- Eight California bearing ratio (CBR) tests on typical samples of the clay to enable estimation of anticipated subgrade CBR values;
- Ten instability index (shrink-swell) tests on samples of the clay soils for site classification purposes;
- Five Emerson Class Dispersion Tests on samples of the clay soils; and
- Five acid sulphate screening tests on samples of the soils recovered from the bores adjacent to Buttonderry Creek.

The results of the testing are summarised in Tables 2 to 5 below.

Table 2 - Summary of California Bearing Ratio Tests

Pit/Bore	Depth (m)	Description	Field Moisture Content (%)	MDD (t/m^3)	OMC (%)	CBR (%)
1	0.5 – 0.8	Grey mottled orange brown SILTY CLAY	24.9	1.61	21.5	3
7	0.5 – 0.8	Light grey mottled orange brown SANDY SILTY CLAY	17.4	1.76	16.5	6
11	0.5 – 1.0	Light grey mottled orange SANDY CLAY	20.8	1.80	16.4	3
13	0.5 – 0.8	Light grey mottled orange SANDY CLAY	20.9	1.71	17.3	4.5
20	0.5 – 0.8	Light brown mottled orange SANDY CLAY	21.4	1.76	17.6	2.5
21	0.5 – 0.8	Orange brown SILTY SANDY CLAY	12.6	1.88	12.5	16
203	0.9 – 1.2	Brown gravelly sand FILLING	13.0	1.92	12.3	8
303	0.5 – 0.8	Red brown mottled grey CLAY	21.2	1.64	19.5	2.5

Note: MDD = maximum dry density OMC = Optimum moisture content CBR = California bearing ratio

Table 3 – Results of Shrink-Swell Tests and Moisture Content Determination

Pit	Depth (m)	Description	FMC (%)	Iss (% per ΔpF)	Initial Pocket Penetrometer Reading (kPa)	Final Pocket Penetrometer Reading (kPa)
5	0.5 – 0.8	Light grey/orange/brown SANDY CLAY	19.3	1.5	190	130
8	0.4 – 0.8	Light grey orange brown CLAY	22.3	1.6	190	150
10	0.6 – 0.9	Light grey mottled orange/brown SILTY CLAY	22.3	1.7	200	150
14	0.5 – 0.6	Light grey mottled orange brown SILTY SANDY CLAY	20.6	1.7	200	130
15	0.5 – 0.8	Light grey mottled orange brown SANDY CLAY	17.7	1.2	230	160
17	0.6 – 0.9	Light grey mottled orange brown SILTY CLAY	23.8	3.5	230	180
19	0.5 – 0.8	Light brown mottled orange SANDY CLAY	17.1	2.1	200	130
23	0.5 – 0.8	Light grey mottled orange brown SILTY SANDY CLAY	18.5	1.1	150	70
26	0.45 – 0.8	Light grey mottled red brown SILTY CLAY	21.0	1.4	400	100
27	0.45 – 0.8	Light grey mottled orange brown SILTY CLAY	21.7	2.5	275	190

Legend: FMC – Field Moisture Content Iss – Shrink-swell value

The results of the shrink-swell testing indicate that the soils tested are slightly to moderately reactive. It should be noted that some softening occurred within the soaking phase of testing.

Table 4 – Results of Emerson Class Dispersion Testing

Pit	Depth (m)	Description	Emerson Class Number
2	0.5	Dark brown mottled grey SILTY CLAY	5
5	0.45	Light grey mottled orange brown SANDY CLAY	5
10	0.5	Dark brown SILTY CLAY	5
19	0.5	Light brown mottled orange SANDY CLAY	5
22	0.6	Grey mottled red brown CLAY	5

A total of eight acid sulphate screening tests were undertaken on samples retrieved from Bores 401 and 402, located adjacent to the banks of Buttonderry Creek. The results of the testing are summarised in Table 5 below.

Table 5 – Results of Acid Sulphate Soil Screening

Bore	Depth (m)	Description	pH in H_2O	pH in H_2O_2	pH in H_2O -pH in H_2O_2
401	0.5	Light brown SILTY SAND	5.2	4.0	***1.2***
	1.45	Light grey mottled orange brown slightly SILTY SANDY CLAY	4.3	3.7	0.6
	2.5	Light grey mottled orange brown SILTY CLAY with some gravel	6.4	6.4	0
	3.5	Orange brown mottled red SILTSTONE	6.4	6.3	0.1
402	1.0	Light brown SILTY SAND	4.4	3.8	0.6
	2.0	Light grey mottled orange SILTY SANDY CLAY	4.7	4.0	0.7
	3.5	Light grey CLAY with trace gravel	5.4	5.2	0.2
	4 – 4.45	Red brown SILTSTONE	6.3	6.3	0

Notes to Table 5:
Bold italicised results exceed ASSMAC action criteria

These results are discussed in more detail in Section 7.5.

6. PROPOSED DEVELOPMENT

At this stage, the proposed Warner Industrial Park development is in the concept stage and hence limited information has been provided to DP during the preparation of this report. Based on review of the drawings and cross sections provided, the development will include the following:

- A 91 lot industrial park subdivision with allotments ranging in size from 0.44 hectares to 2.51 hectares;
- Construction of six internal road pavements;
- Construction of a number of wetland areas or enhancement of existing wetland areas;
- Construction of a number of stormwater storage areas; and
- A new bridge for the crossing of Buttonderry Creek.

A concept layout of the subdivision is presented on Drawing 4. Site chainages, measured from the southern boundary of the site are shown on Drawing 4. These site chainages are referenced throughout this report.

Preparations for development of the site will require demolition of the existing residences on the site, clearing of some of the remnant timbered areas, removal of rubble and unsuitable filling and the rehabilitation of the existing farm dams, as well as broad ranging site works.

Based on review of the cross section drawings provided by the client, earthworks required to reshape the land surface includes:

- Bulk excavation from the western areas of the site and placement within the lower lying eastern areas of the site;
- Excavation of up to 5.2 m depth in the area of the proposed intersection with Hue Hue Road (approximately site Ch 1100 to Ch 1300);
- Excavation of up to 3 m depth in the area of proposed Lots 1 to 4, located near the intersection of Hue Hue Road and Sparks Road;
- Placement of up to 2 m of filling within the lower lying eastern area of the site. The area covered by the filling extends roughly from the southern to northern boundaries of the site and generally to the east of the proposed alignment of Road 1 (refer Drawing 4).

Bulk excavation and filling levels for the north-eastern area of the site (existing Lot 9 in DP239704 and Lot 5 in DP259531) were not known at the time of field work or draft report preparation.

Following submission of a draft report to the client, it is understood that the following additional proposed regrading of the site is proposed within Lots 5 and 9:

- Bulk excavation from the north-eastern area of the site and placement within the lower lying south-eastern area;
- Excavation of up to 6 m depth in the north-eastern area of the site (existing Lot 9);
- Placement of up to 2 m of filling within the lower lying south-eastern area of existing Lots 5 and 9.

As discussed above, these details of proposed earthworks within existing Lots 5 and 9 were not known at the time of field work for this project. Only shallow investigation, by means of test pits, was undertaken throughout these areas. Deeper investigation will be required in the area of the proposed 6 m cut to establish bedrock conditions and allow provision of comments on safe batter slopes.

Batter slopes of 3H:1V are indicated for the placed filling on the cross sections provided by the client.

Six internal roads are proposed at the site and are shown on the attached Drawing 4. The approximate length and location (including site chainages) of the pavements is as follows:

Road	**Location**	**Approximate length**
Road 1	Traversing from the intersection with Sparks Road to the north-eastern area of the site	1.2 km
Road 2	Aligned north-west to south-east at approximate Ch 130	0.23 km
Road 3	Loop road predominantly south-west to north-east from Ch500 to Ch900	0.63 km
Road 4	Large loop road extending from Ch900 to Ch1600	1.7 km
Road 5	Roughly east-west aligned at approximate Ch11100	0.45 km
Road 6	Loop road off Road 4 roughly aligned north-south and extending from Ch1000 to Ch 1600	0.87 km

A new intersection is proposed for the intersection of Sparks Road with Road 1, located along the south-western boundary of the site.

A new type C intersection is proposed for the intersection of Hue Hue Road and Road 5, located on the western boundary of the site at approximately site Ch1150.

Design traffic loadings for the internal and external roads are not known at this stage.

7. COMMENTS

7.1 Subsurface Conditions

The subsurface conditions encountered throughout the majority of the site include relatively shallow sand or silty sand (up to 0.7 m depth) overlying initially firm to stiff clay soils overlying stiff or stronger clay soils. Extremely low strength either claystone or sandstone bedrock is present at depths ranging from 1 m to 3 m approximately, particularly within the western and northern areas of the site. Weaker subsurface conditions, characterised by either firm clay soils or loose sand soils within the upper 0.4 m to 0.8 m depth were present within the majority of pits excavated within the lower lying areas of the site, below approximately RL 20 m AHD.

Localised filling is anticipated to be present in the area of the existing dwellings within the filling platforms placed during construction and also within the existing dam embankments. It is likely that silt will be present within the base of the existing dams.

Weaker soils, including possibly soft clay and silt are anticipated within the creek alignments, such as within the heavily wooded area in the south-east corner of the site. It is understood that development within this area is not proposed.

The stiff or stronger clay soils and underlying bedrock would be suitable for the support of spread footings. Support of structures of greater than two storeys would probably require piled foundations within the underlying bedrock.

7.2 Groundwater

Groundwater was not encountered in the majority of the pits during excavation. Free groundwater was observed at depths ranging from 0.4 m to 2.1 m in number of pits located within the lower eastern area of the site. Further, elevated moisture contents were observed within the upper soils in a number of pits located in the lower eastern section of the site. The elevated moisture contents were generally noted within the weaker soils, as described in Section 7.3 below. Hence control of surface stormwater should be considered during the design of construction activities.

No free groundwater was encountered within the pits and bores located within the higher sections of the site, where excavation is proposed. Provision of adequate surface and subsoil drainage for control of runoff and seepage, however, from a significant part of initial site development works due to susceptibility of the near surface soils to water softening which could lead to poor traffickability for construction plant.

7.3 Presence of Weak Soils

A number of pits located generally within the lower eastern area of the site encountered weak soils, including firm clay and loose sand. A summary of these weaker soils (where present to greater than 0.3 m depth) is presented in Table 6 below.

Table 6 – Presence of Weak Soils

Pit	Depth to base of strata (m)	Strata Description
2	0.5	Firm silty sandy clay filling over firm silty clay
3	0.6	Firm sandy clayey silt over firm silty clay
4	0.75	Firm clayey silt over firm clay
5	0.8	Loose clayey silty sand over firm sandy clay
9	0.45	Silty clay topsoil over firm silty clay
10	0.6	Silty clay topsoil over firm silty clay
11	0.9	Silty sand topsoil over firm silty sandy clay
14	0.45	Clayey topsoil over firm silty sandy clay
16	0.6	Clayey silty sand topsoil over firm sandy clay
18	0.6	Silty clay topsoil over firm silty clay
23	0.45	Clayey silty sand topsoil over firm clayey silty sand and firm silty sandy clay
24	1.1	Loose clayey silty sand

Reference to the test location plan and Table 6 above indicates that the majority of the lower lying areas of the site, below approximately RL 20 m AHD, are either firm clay soils or loose sand soils within the upper 0.4 m to 0.8 m depth.

Traffickability of earthworks machinery on these soils will be highly dependant on the prevailing moisture condition at the time of construction. Further, given the low lying terrain over a significant portion of the site, it is possible that significant areas of the site may become inundated with

surface water following rainfall events. Traffickability of the exposed soils after inundation will become difficult. Hence, it will be of critical importance to address surface water flows during construction. Therefore, it is suggested that the proposed open drain which is to extend from the northern boundary of the site and connect with Buttonderry Creek along the south-eastern boundary is constructed prior to stripping and placement of filling in the lower areas of the site. Other site drainage measures should also be installed early in the construction programme.

Placement of filling from working platforms pushed out over the weak soils may be required depending on the conditions at the time of construction.

Depending on the conditions exposed at the time of site stripping, consideration may be given to the placement of a suitable geofabric to allow compaction of the overlying filling. The requirement for such measures should be assessed by a geotechnical engineer at the time of construction.

7.4 Presence of Filling

The filling encountered in Pit 6 and 6A is considered unsuitable under proposed building areas for the support of engineered filling, footings or pavements and should be removed and replaced. It is noted that fibrous sheeting was present within the filling. No testing for the presence of asbestos was undertaken.

Filling platforms or stockpiles were observed in several areas throughout the site, including within the south-eastern corner of Lot 5 in DP259531 where filling, understood to have been won from excavations in connection with the construction of the F3 freeway, has been placed (refer Photo 6 below) and also surrounding a number of the existing residences, such as in Photo 7, located to the north of the residence in Lot 7. In absence of specific investigations of this filling, it is also considered unsuitable for the support of engineered filling, footings or pavements. Further assessment would be required to assess the suitability of the filling to either remain in place or for re-use as engineered filling elsewhere on site.

7.5 Acid Sulphate Soils

Reference to the Wyong Acid Sulphate Soil Risk map indicates that there is no known occurrence of acid sulphate soils at the site. An excerpt from the Wyong Acid Sulphate Soil Risk map is presented on Drawing 7.

Reference to the previous investigation undertaken by Coffey indicates that there is a low risk of acid sulphate soils along the margins of Buttonderry Creek. Hence, the scope of work for the assessment of acid sulphate soils at this site was limited to the location of the proposed bridge over Buttonderry Creek. It is understood that excavation within close proximity to Buttonderry Creek is not proposed elsewhere at the site. In the event that excavation is proposed within 20 m of the banks of the creek, it is suggested that additional assessment of the presence of acid sulphate soils at the location of the proposed excavation is undertaken prior to commencement.

The results of the acid sulphate screening tests undertaken on samples retrieved from Bores 401 and 402 (refer Table 5), located adjacent to the banks of Buttonderry Creek indicated that acid sulphate conditions are not present within these soils.

In summary, given the acid sulphate mapping indicates that there is no known occurrence of acid sulphate soils at the site, the elevation of the site (above RL 17 m AHD) and the results of the acid sulphate screening tests from Bores 401 and 402, it is considered that acid sulphate soil conditions are not present at this site for the proposed bridge.

7.6 Excavation Conditions

As discussed in Section 6, two areas of the site presently require bulk excavation during the earthworks for the proposed subdivision. Excavation of up to 5.2 m depth is required in the area of the proposed intersection with Hue Hue Road (Hue Hue Excavation) and excavation of up to 3 m depth is required in the area of proposed Lots 1 to 4, located near the intersection of Hue Hue Road and Sparks Road (southern excavation). Following the completion of the investigation programme, information on the proposed regrading of existing Lots 5 and 9 were made known to DP. Excavation of up to 6 m depth will be required along the northern boundary of existing Lots 5 and 9.

Bores 304 and 305 were drilled within the anticipated area of Hue Hue excavation. The conditions encountered in these bores included residual clayey sand and clay overlying either sandstone or claystone bedrock at a depth of 0.9 m and 3 m respectively. The strength of the bedrock retrieved in the cored section of Bore 304 ranged from extremely low to medium strength. Auger drilling within Bore 305 encountered v-bit auger tip refusal at 3.5 m depth, which may be indicative of low to medium strength bedrock, and tungsten carbide auger tip refusal at a depth of 4.8 m, which may be indicative of medium strength or stronger bedrock.

Pits 1 and 22 are located within the south-western corner of the site, within the general vicinity of the proposed southern excavation. Conditions encountered in these pits predominantly included residual sandy clay and clay soils of stiff to very stiff consistency. Medium dense silty sand was encountered in Pit 1 from 0.15 m to 0.4 m overlying the clay soils. Extremely low strength siltstone was encountered at a depth of 1.5 m in Pit 22, with 4 tonne excavator refusal encountered at 1.56 m, possibly within very low to low strength bedrock.

Based on these conditions, it is anticipated that the southern excavation will be through both residual soils to approximately 1.5 m to 2.5 m, and underlying bedrock. Investigation by drilling and retrieval of rock core has not been undertaken within the specific area of the proposed southern excavation and hence determination of the depth to and strength of the bedrock in this area has not been possible.

Excavation within the clayey sand, clays and extremely low strength to very low strength sandstone is anticipated to be relatively straightforward with conventional hydraulic excavators.

The excavation of low to medium strength rock, as encountered within Bore 304 from 1.41 m to 3.21 m depth, is likely to necessitate the use of heavy excavation equipment such as a 30 tonne excavator fitted with a narrow bucket and “tiger teeth” or possibly the use of a rock hammer.

Pit 15 was excavated within the northern section of the site, close to the north-west corner of existing Lot 9. Conditions encountered in Pit 15 included shallow sand overlying sandy clay to termination of the pit at 2 m depth. Conditions encountered in Pit 20, located approximately 50 m to the south-east, included sandy clay to 0.9 m depth, where refusal was encountered on sandstone bedrock. Hence, variable soil cover is anticipated within the area of the proposed 6 m cut. It is suggested that additional investigation is undertaken within the area of the proposed excavation to allow assessment of anticipated excavation conditions.

7.7 Excavation and Filling Batters

7.7.1 Excavation Batters

Where space permits, the maximum batter slopes outlined in Table 7 below are suggested for the site.

Table 7 – Suggested Safe Excavation Batter Slopes

Material	Safe Batter Slope (H:V)
Very stiff clay or better and extremely low strength bedrock	1.5:1
Very low strength sandstone or claystone	1:1
Low strength fractured sandstone or claystone	0.75:1
Medium and high strength slightly fractured sandstone	0.5:1

The batter slopes given above assume that there are no additional pressures due to surcharging from footings or vehicular loads, or ground surface sloping at greater than about 10^{o} above the cut face.

The adoption of the batter slopes for low, medium and high strength rock shown in Table 7 must be accompanied by geological inspection to assess any adverse jointing which could give rise to localised instability such as block fallout or wedge failure. The support of these locally unstable blocks and wedges, or extremely low and very low strength bands can then be provided by in-situ stabilisation techniques utilising dowelled mesh, rock bolts and/or sprayed concrete. It is noted that occasional high angle joints (above 30°) were noted in the retrieved core. Particular care and close inspection will be required if such discontinuities are exposed to assess support requirements.

For the excavation at the intersection of Road 5 and Hue Hue Road, where excavation of up to 5.2 m is required, a mid height bench of at least 1 m in width should be considered to minimise the fall height of any loose joint blocks. Additional investigation is recommended in the area of the proposed 6 m cut along the northern boundary of the site (existing Lots 5 and 9).

The results of the Emerson testing undertaken of typical samples of the clay soils indicates that they are generally have a low tendency to disperse. If the batter slopes are left bare, however, it is possible that minor erosion may occur.

If excavation faces are protected from weathering by sprayed concrete facing, then steeper batters than those shown Table 7 may be possible, provided excavation is accompanied by regular geotechnical inspection.

Notwithstanding the above comments on excavation stability, the contractor should comply with all statutory requirements for excavation support and worker safety.

7.7.2 Filling Batters

For batters on placed filling embankments, it is suggested that long term slopes of 3H:1V are suitable for controlled filling, provided such batters are protected from erosion.

Furthermore, batter slopes of 6H:1V are generally required to allow passage of mowing and maintenance equipment.

Notwithstanding the above comments on excavation stability, the contractor should comply with all statutory requirements for excavation support and worker safety.

7.8 Recommended Site Preparation Measures

The site preparation measures required during construction will be dependant on the design level, type of footing or pavement proposed and the soil conditions exposed at the time of construction. Based on the conditions encountered in the pits and bores, however, it is anticipated that site preparation measures for the placement of filling, the support of high level spread footings or pavements are likely to include the following:

- Excavation to design subgrade or formation level in areas of new construction or placement of filling;
- Removal of all existing topsoil or deleterious material;
- Proof rolling the subgrade to receive filling with at least six passes of a minimum 6 tonne deadweight roller, with a final proof rolling pass accompanied by careful visual inspection by an experienced geotechnical consultant to allow detection and treatment of any soft or compressible zones. In this regard, special measures such as placement of a geofabric prior

to placement of the first layer of bulk filling or placement of filling from fill platforms may be required (refer Section 7.3);

- Additional excavation and replacement with suitable select filling, if required, based on the results of the proof rolling and inspection of the exposed subgrade. Typically on the Central Coast, ripped sandstone is used as a select layer under pavements and preliminary design could then be based on an assumed CBR of 15% for this material;
- If weathered rock is encountered within 300 mm of subbase layer, then the upper 250 mm of rock should be scarified and compacted in order to destroy the rock structure and provide a relatively uniform subgrade stiffness.
- Moisture conditioning of the upper 300 mm of the exposed subgrade and compaction to 100% dry density ratio (Standard compaction). Additional layers of filling or replacement select filling (if required) should be placed in near horizontal layers no thicker than 250 mm (loose thickness) and each layer compacted to the 95% dry density ratio (Standard compaction) for general filling and 100% dry density ratio (Standard compaction) within the upper 0.5 m. Moisture contents of scarified subgrade and filling should be maintained within -3% (dry) to 1% (wet) of optimum moisture content (OMC) to OMC for Standard compaction;
- Protection of the area after subgrade preparation for both roads and areas of general filling to maintain moisture content as far as practicable. The placement of the select subgrade, subbase gravels or overlying filling would normally provide adequate protection.

During decommissioning of the existing farm dams, removal of the existing stored water, any accumulated silt and the embankment filling material will be required. The suitability of the embankment material for re-use as engineering filling should be assessed at the time of decommissioning. It is unlikely that the silt which may be present at the base of the dams will be suitable for reuse as engineered filling.

Geotechnical inspection and testing will be required during preparation of subgrades within areas to accept filling or in areas of pavement subgrades.

7.9 Reuse of Excavated Material

It is understood that some of the material excavated from the site will be re-used as filling in the lower areas of the site.

The suitability of the excavated material for re-use as filling is dependent upon the properties of the material excavated. The existing clay soil and weathered bedrock may be suitable for reuse as controlled filling, subject to geotechnical inspection at the time of excavation. The reactivity of the upper clay soils should be assessed in relation to the intended use at the site to receive the filling.

It is recommended that the upper 1 m of filling under the proposed allotments and road alignments be sourced from either the excavated bedrock at the site or imported filling (preferably granular).

It is noted that the Department of Environment and Conservation (formerly the NSW EPA) requires that soils excavated for off-site disposal be classified in accordance with the NSW EPA "Environmental Guidelines: Assessment, Management and Classification of Liquid and Non-Liquid Waste".

7.10 Anticipated Site Classification

Classification of residential sites as described in AS 2870 – 1996 *"Residential Slabs and Footings – Construction"* (Ref 2) is based on ground movement limits, which are defined by the characteristic surface movement (y_s). The parameter y_s represents the surface movement expected at a site between dry and wet periods, and can be estimated from soil shrinkage and instability indices, I_{PS} and I_{PT} respectively; and design suction change which provides an indication of the suction profile with depth within a soil, based on the climatic region of the site. Whilst site classification is generally intended for residential developments, it is useful for design purposes.

Laboratory testing indicates that the site soils have a characteristic shrink-swell index ranging from 1.1% to 3.5% per ΔpF. An in-house programme "Reactive" has been used to model soil behaviour and estimate characteristic free surface movements for the future allotments.

Owing to the presence of weak soils in the lower portions of the site, which are likely to have an allowable bearing pressure of less than 100 kPa, the majority of the site would be classified as Class P (Problem Site).

Following placement of filling, however, provided the filling has been placed under controlled conditions and with adequate geotechnical inspection and testing of layer thickness, moisture content and compaction achieved, reclassification of the site may be possible.

Based on reuse of the residual clay and weathered bedrock to be excavated from the western area of the site, and the results of the shrink-swell testing, it is anticipated that the individual sites would be classified generally as follows:

- **Areas of Cut or placement of less than 0.4 m of filling**
  - Less than 0.9 m of clay over bedrock — Class S (Slightly Reactive)
  - Greater than 0.9 m of clay over bedrock — Class M (Moderately Reactive)

- **Areas of greater than 0.4 m of filling** — Class H (Highly Reactive)

The final classifications for the allotments at the site will be affected by the depth of excavation and filling placed on the lot, the reactive qualities of the filling used and the degree of control during placement. Individual site classification and assessment of suitable footings for the future buildings within each of the allotments should be undertaken at the completion of bulk earthworks.

As a guide, it is anticipated that the allotments to the west of the proposed Roads 1 and 4, where excavation or alternatively no reshaping of the land surface is proposed are likely to be classified as Class S or Class M sites.

The remainder of the site is likely receive greater than 0.4 m of engineering filling and is anticipated to be predominantly Class H sites.

7.11 Footings

Any existing filling, such as encountered in Pits 6 and 6A and the filling platform in Lot 7, or the soils associated with the embankments or interior of the existing dams on the site should not be relied upon for support of structural loads and all foundations should be constructed to derive uniform support from the underlying stiff to hard natural clay, controlled filling or bedrock.

The following comments are provided as a guide to the selection of footings based on the conditions encountered within the pits and bores undertaken during the present investigation. Site

specific investigation within each allotment, having regard to the nature of the proposed building, the location and layout of the building, and the loads being transferred to the footings, will be required at a later stage to assist with the planning and design of the future developments on each of the allotments.

Spread footings founded within the natural stiff to hard clay or underlying bedrock would be suitable for the support of the one to two storey buildings. Footings for residential structures founded on stiff or stronger clay should be designed for a maximum allowable bearing pressure of 100 kPa.

In areas of engineered filling, spread footings founded within Level 1 inspected and tested filling should be designed for a maximum allowable bearing pressure of 100 kPa.

Spread footings on extremely low strength or stronger bedrock should be designed for a maximum allowable bearing pressure of 500 kPa, unless the results of further specific investigation and assessment indicate that higher bearing pressures are appropriate.

For larger structures, such as three to four stories, or industrial structures with high column loads, piled foundations may be required.

For bored piles it is suggested that they be designed for a maximum allowable end bearing pressure of 500 kPa within the extremely low strength sandstone or claystone bedrock and with an allowable shaft adhesion of 30 kPa in stiff or stronger clay and 60 kPa in the extremely low strength sandstone or claystone. It is also suggested that the contribution to shaft adhesion of the upper 1.5 m of the pile profile is ignored to account for the effects of shrink-swell behaviour of the clay soil.

Settlements for foundations proportioned in accordance with the parameters outlined above are estimated to less than 0.5% of the footing width (or pile diameter) under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

All footing excavations (including bored piers should be inspected by an experienced geotechnical engineer prior to construction.

7.12 Proposed Bridge Foundations

It is understood that a bridge will be constructed over Buttonderry Creek, in the location of Bores 401 and 402 and Pits 24 and 25 (refer Drawings 3 and 4).

No design details, such as column loads, have been provided at this stage.

Conditions encountered in these pits and bores included loose to medium dense sand, silty sand or clayey sand to depths ranging from 0.8 m to 1.7 m, underlain by stiff to very stiff clay or sandy clay with extremely low strength sandstone or siltstone bedrock encountered at depths of 2.3 m and 3.5 m in Bores 401 and 402 respectively.

Owing to the presence of loose, watercharged sand, as encountered in Pit 24 below 1 m depth, bored piles may not be suitable for the support of the proposed bridge. Continuous flight auger (CFA) piles or driven treated timber of pre-cast concrete piles may be suitable founded within the extremely low strength or stronger bedrock.

For preliminary design purposes, it is suggested that piles founded at least 2 pile diameters into the extremely low strength or stronger bedrock should be designed for a maximum allowable end bearing pressure of 600 kPa, a maximum allowable shaft adhesion of 30 kPa within the stiff or stronger clay or 60 kPa within the extremely low strength or stronger bedrock. The contribution to shaft adhesion of the sand soils or the upper 1 m of the soil profile (whichever is deepest) should be ignored.

Further assessment of bridge foundations should be undertaken once the design has been progressed. Further investigation may be warranted particularly if the bridge location is moved significantly.

7.13 Pavements

Based on review of the conceptual drawings provided by the client, it is understood that a network of pavements is proposed throughout the site, as presented on Drawing 4, and discussed in Section 6.

In addition, a new intersection is proposed for the intersection of Sparks Road with Road 1, located along the south-western boundary of the site. At this stage, the type of intersection has not been finalised. For the purposes of the report, it has been assumed that a roundabout is likely. A new type C intersection is also proposed for the intersection of Hue Hue Road and Road 5, located on the western boundary of the site at approximately site Ch1150.

7.13.1 Assumed Design Traffic Loadings

Design traffic loading for the internal and external roads is not known at this stage.

Based on the requirements of Wyong Shire Council Development Control Plan No 57 “Engineering Requirements for Development”, for a commercial and industrial pavement, such as the internal pavements at the site, a design traffic loading of 5×10^6 ESA is considered appropriate.

For the intersection of Hue Hue Road and Proposed Road 5, a design traffic loading of 5×10^6 ESA is also considered appropriate.

Reference to Wyong Shire Councils DCP 67, indicates that the proposed intersection at the intersection for Sparks Road and Proposed Road 1, (if it is to be a roundabout) should consist of a rigid (concrete) pavement using steel fibre reinforced concrete over a lean mix concrete subbase. A design traffic loading of 5×10^6 HVAGs has been adopted for this intersection. In the event that an alternative intersection type is to be adopted, the pavement thickness presented in this report should be revised.

In the event that the final design traffic volumes alter from these values, the pavement thickness designs presented below should be revised.

7.13.2 Anticipated Subgrade Conditions and Design Subgrade CBR Values

A summary of the anticipated subgrade conditions within the internal and external pavements is provided below along with suggested design CBR values. Further laboratory testing of subgrade conditions would be required once the vertical and horizontal layout of the proposed pavements and design traffic loading is finalized.

Internal Roads

The conditions encountered in the pits and bores excavated or drilled within the vicinity of the alignment of the internal roads have been reviewed to assess the anticipated subgrade conditions along the various road alignments, as follows:

Road 1 (Pits 1, 5, 6, 24 and 25 and Bore 401 and 402)	Stiff orange brown silty clay or firm light grey sandy clay is anticipated throughout the majority of the alignment. Loose clayey silty sand is anticipated however, in the vicinity of Buttonderry Creek, as encountered in Pits 24 and 25. Sections of Road 1 (approximately site Ch200 to Ch700 and Ch1400 to Ch1500) will be formed on the bulk filling platform.
Road 2 (Pits 1 and 2)	Stiff to very stiff light grey mottled orange brown or grey mottled dark brown silty clay
Road 3 (Bore 402 and Pits 3, 4 and 7)	The majority of Road 3 (site Ch600 to Ch900) will be formed on the bulk filling platform. Very stiff to hard light grey mottled orange silty clay is anticipated over the remainder of the alignment with possible some loose clayey silty sand within proximity to Buttonderry Creek.
Road 4 (Pits 7, 9, 11 to 15 and 18)	The majority of Road 4 will be formed on the bulk filling platform. In isolated areas, generally firm to very stiff light grey mottled orange silty clay may also be encountered at subgrade level.

Road 5 (Bore 304, Pits 8 and 9) — Siltstone bedrock is anticipated within the western section of the alignment of Road 5. The eastern section of Road 5 (approximately half of the length) is anticipated to be formed on the bulk fill platform.

Road 6 (Pits 16, 17, 19 and 20) — Firm to very stiff grey brown or light brown mottled orange sandy clay or silty clay. Sandstone bedrock may be encountered at subgrade level within the northern area of the alignment of Road 6, such as encountered in Pit 20 at a depth of 0.9 m. The southern areas of Road 6 are anticipated to be formed on the bulk fill platform.

It should be noted that several of the existing dams located throughout the site lie within the proposed alignments of the internal pavements. Removal of the filling and sediments associated with these dams will be required as part of the subgrade preparation measures.

The laboratory testing on the samples of silty clay or sandy clay soil retrieved from the test pits within the proposed industrial park returned soaked CBR values ranging from 2.5% and 16% (predominantly between 2.5% and 6%).

For areas of pavement on the bulk fill platform, the design CBR value will be dependent on the quality of the filling placed. For preliminary design purposes, it has been assumed that the filling placed at subgrade level would be sourced from the western area of the site. Hence, it is likely to comprise a mixture of clay soils and excavated siltstone bedrock. Unless appropriate stockpiling of excavated bedrock and selective placement of won material can ensure that the upper 1 m of the filling platform comprises either bedrock won from site or granular filling imported from off site, the pavement should be designed using the CBR values obtained during testing of the natural site soils.

Given the range of results and the extensive nature of the clay cover at the site, and the difficulty in anticipating the constituents of the upper 1 m of the filling platform, it is suggested that a design subgrade CBR value of 3% is adopted for preliminary pavement thickness design for the internal pavements.

Alternatively, consideration should be given to the placement of a “select” layer, subgrade to Council approval. Wyong Shire Council typically requires the select filling to consist of granular material, such as “bottom ash” with a CBR value of greater than 15%. Based on the provision of a

0.5 m select layer, pavement thickness design could be based on an assumed CBR of 6% for the altered subgrade.

Further investigation and confirmation CBR testing will be required prior to construction to confirm that the subgrade exposed within the alignments are suitable for the design assumptions made in this report.

Hue Hue Road Intersection

Varying conditions were encountered at the anticipated subgrade level within Bores 301 to 304, drilled in the vicinity of the proposed Type C intersection of Hue Hue Road and Proposed Road 5.

The anticipated subgrade conditions include either brown clayey gravelly sand filling, sandy clay filling or natural red brown mottled grey clay overlying shallow siltstone bedrock (as encountered in Bores 301 to 304 at depths ranging from 0.6 m to 0.9 m.

The laboratory testing on a sample of red brown mottled grey clay retrieved from Bore 303 from 0.5 m to 0.8 m returned a soaked CBR value of 2.5%. Based on this result, and the presence of shallow bedrock within the bores drilled in the vicinity of the intersection, a design CBR of 4% is suggested.

Sparks Road and Road 1 Intersection

Filling was encountered to depths ranging from 1.25 m to 1.7 m within Bores 201 to 203, drilled in the location of the proposed roundabout intersection of Sparks Road and Road 1.

At the anticipated subgrade level (approximately 0.6 m), the existing filling comprised dark grey cobbly gravel, overlying clayey gravelly sand (possibly stabilized), which extended to depths ranging from 0.75 m to 0.9 m, which in turn was underlain by brown gravelly sandy clay filling.

The laboratory testing on a sample of the brown clayey gravelly sand filling retrieved from Bore 203 from 0.9 m to 1.2 m returned a soaked CBR value of 8%. Testing of the overlying filling was not possible owing to the coarse particles present within the filling. Based on this result, and the presence of the overlying filling, which contains significant clay content, a design CBR of 5% is suggested.

7.13.3 Pavement Thickness Design

Based on the procedures outlined in Austroads (Ref 2) and the requirements of Wyong Shire Council (Ref 3), the following pavement thickness designs presented in Tables 8 to 10 below are suggested for the construction of new pavement areas.

Table 8 – Flexible Pavement Thickness Design – Internal Pavements (5 x 10^6 ESA)

Subgrade Material	Subgrade CBR (%)	Pavement Thickness Design (mm)	Layer Component		
			AC Wearing Course (mm)	Basecourse (mm)	Subbase (mm)
Natural clay soils or general bulk fill platform	3	620	30	160	430
500 mm of select filling over clay or bulk fill platform	6	420	30	160	230
In-situ siltstone subgrade	10	300	30	160	110

Notes to Table 8: Where an AC wearing course is utilized a 7 mm primer seal will be required prior to placement of wearing course

Table 9 – Flexible Pavement Thickness Design – Hue Hue Road Intersection (5 x 10^6 ESA)

Subgrade Material	Subgrade CBR (%)	Pavement Thickness Design (mm)	Layer Component		
			AC Wearing Course (mm)	Basecourse (mm)	Subbase (mm)
Sandy clay	4	530	30	160	340

Notes to Table 9: Where an AC wearing course is utilized a 7 mm primer seal will be required prior to placement of wearing course

Consideration could be given to the use of recycled materials such as crushed concrete for the subbase layer, although this would be subject to approval from Wyong Shire Council. This material has performed satisfactorily in the past for light or moderately trafficked roads.

Table 10 – Rigid Pavement Thickness Design – Sparks Road Roundabout (5 x 10^6 HVAGs)

Subgrade Material	Subgrade CBR (%)	Pavement Thickness Design (mm)	Layer Component	
			Steel fibre reinforced concrete base* (mm)	Lean mix concrete (mm)
Existing Filling (deemed suitable to act as subgrade)	5	320	195	125

*Based on no provision of a shoulder for the pavement and a project reliability factor of 1.3.

A wax emulsion should be applied to the surface of the lean mix concrete subbase prior to the placement of the concrete base, to assist with the curing of the subbase and to prevent excessive bonding of the two layers.

Where the new pavement adjoins the existing pavement, each layer should be progressively stepped back into the existing pavement to avoid creating a vertical contact.

In accordance with Wyong Shire Council requirements, individual pavement layers must be presented for testing immediately after placement and compaction, and Benkelman beam deflection testing must be carried out prior to the placement of the wearing course. At the completion of construction works, the results of proof rolling and testing, together with any special drainage requirements and subgrade replacement (if applicable) may also have to be reported to Wyong Shire Council to demonstrate pavement construction compliance with the specification.

7.14 Material Quality and Compaction Requirements

Table 11 below presents the recommended material quality and compaction requirements for respective pavement layers.

Table 11– Material Quality and Compaction Requirements

Layer	Material Quality	Compaction
Wearing Course	Conform to RTA Spec R116	RTA Spec R116
Steel fibre reinforced concrete Basecourse	Minimum 36 MPa 28 day compressive strength with 4.5 MPa flexural strength	-
Basecourse	Conform to RTA Spec. 3051, minimum soaked CBR 80%, PI ≤ 6%	Minimum 98% Modified Compaction (AS 1289 5.2.1)
Subbase Course	Conform to RTA Spec. 3051 minimum soaked CBR 50%, PI ≤ 12%	Minimum 95% Modified Compaction (AS 1289 5.2.1)
Select Filling	Bottom Ash with a soaked CBR of at least 15%	Minimum 100% Standard (AS 1289.5.1.1)
Subgrade	Soaked CBR - Clay or sandy clay 3% - Bulk fill platform 3%	Minimum 100% Standard (AS 1289.5.1.1) for upper 500mm, 98% Standard otherwise

7.15 Pavement Drainage

Where new pavement is constructed, adequate surface and subsurface drainage should be provided to prevent moisture ingress into the pavement materials. It is suggested that subsoil drains be installed where appropriate.

It is common practice in the Central Coast region that subsoil drains with an invert level of 0.6 m below subgrade be used. Whilst drains at this level would provide drainage to the pavement gravels, they may also lead to fluctuations in the moisture content of the clay subgrade. These fluctuations may lead to shrinking and swelling of a natural clay subgrade, and hence consideration should be given to placing subsoil drains at the bottom of the subbase layer (rather than 0.6 m below subgrade level).

In the case of road widening, intra pavement drainage between new and old pavement construction should be provided by a subsoil drain installed at the interface. This drain should comprise a narrow trench backfilled with either 'no-fines' concrete or 14 mm aggregate and 100 mm diameter 'Ag' pipe wrapped in a geotextile. The drain should extend from the top of any select layer to 150 mm below the pavement surface and be connected to the subsurface drainage system, to ensure the release of any moisture trapped between the existing and new pavement materials.

7.16 Existing Dams

A number of existing dams are located within the area of proposed development, including within the proposed alignment of Roads 1 and 4 to 6. Decommissioning of these dams would be required as part of the development.

This would require removal of the existing stored water and the embankment filling material. The suitability of the embankment material for re-use as engineering filling should be assessed at the time of decommissioning.

Further assessment of the geotechnical properties of the sediments held within the dams and any requirement for treatment or reuse would also be required at the time of removal.

7.17 Existing Footings

A number of existing structures are present within the site. It is likely that future development will include construction of new structures in the location of existing buildings.

Care should be taken during the demolition of the existing structures at the site to remove all existing footings and ensure that footings for the new structures are founded within appropriate strata and not cast directly on previous buried footings.

8. LIMITATIONS AND RECOMMENDED ADDITIONAL INVESTIGATION

The scope of the site assessment activities and consulting services undertaken by Douglas Partners Pty Ltd (DP) in respect to the proposed Warner Industrial Park development located at the corner of Sparks Road and Hue Hue Road, Warnervale were limited to those agreed between Warner Business Park Pty Ltd and DP as detailed in the proposal No. 2258D dated 21 February 2008.

The investigation was intended as a preliminary geotechnical investigation to assist with the preliminary design of the proposed development. Owing to the topography and geomorphology of the site, it is anticipated that subsurface conditions will vary throughout the site. A detailed geotechnical investigation has not been completed and would be required once the design of the development has been progressed.

Further geotechnical investigation will be required prior to construction of the pavements to confirm that the conditions exposed at subgrade level are consistent with the design assumptions made during preparation of this report.

Separate, site specific geotechnical investigations will be required for the design of developments within the proposed allotments and once the design of the proposed bridge over Buttonderry Creek has been progressed.

Additional geotechnical investigation is also recommended in the area of the proposed 6 m cut, located along the northern boundary of the site (existing Lots 5 and 9).

Geotechnical inspection and testing will be required during earthworks at the site.

DOUGLAS PARTNERS PTY LTD Reviewed by

Michael Gawn
Geotechnical Engineer / Senior Associate

Terry Wiesner
Principal

References:

1. AS 2870 – 1996: *Residential Slabs and Footings – Construction*, Standards Australia.
2. Austroads 2004: "*Pavement Design – A Guide to the Structural Design of Road Pavements*"
3. Wyong Shire Council, "*Engineering Requirements for Development – Wyong Development Control Plan No 67*", April 1999

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NOTES RELATING TO THIS REPORT

Introduction

These notes have been provided to amplify the geotechnical report in regard to classification methods, specialist field procedures and certain matters relating to the Discussion and Comments section. Not all, of course, are necessarily relevant to all reports.

Geotechnical reports are based on information gained from limited subsurface test boring and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726, Geotechnical Site Investigations Code. In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

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

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

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

Classification	Undrained Shear Strength kPa
Very soft	less than 12
Soft	12—25
Firm	25—50
Stiff	50—100
Very stiff	100—200
Hard	Greater than 200

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

Relative Density	SPT "N" Value (blows/300 mm)	CPT Cone Value (q_c — MPa)
Very loose	less than 5	less than 2
Loose	5—10	2—5
Medium dense	10—30	5—15
Dense	30—50	15—25
Very dense	greater than 50	greater than 25

Rock types are classified by their geological names. Where relevant, further information regarding rock classification is given on the following sheet.

Sampling

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

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing with a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Details of the type and method of sampling are given in the report.

Drilling Methods.

The following is a brief summary of drilling methods currently adopted by the Company and some comments on their use and application.

Test Pits — these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descent into the pit. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (eg. Pengo) — the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling — the hole is advanced by pushing a 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength, etc. is only marginally affected.

Continuous Spiral Flight Augers — the hole is advanced using 90—115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow

sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling — the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling — similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling — a continuous core sample is obtained using a diamond-tipped core barrel, usually 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in very weak rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

Standard Penetration Tests

Standard penetration tests (abbreviated as SPT) are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, "Methods of Testing Soils for Engineering Purposes" — Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

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

  as 4, 6, 7
  N = 13

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

  as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil.

Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borelogs in brackets.

Cone Penetrometer Testing and Interpretation

Cone penetrometer testing (sometimes referred to as Dutch cone — abbreviated as CPT) described in this report has been carried out using an electrical friction cone penetrometer. The test is described in Australian Standard 1289, Test 6.4.1.

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

As penetration occurs (at a rate of approximately 20 mm per second) the information is plotted on a computer screen and at the end of the test is stored on the computer for later plotting of the results.

The information provided on the plotted results comprises: —

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

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

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

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

q_c (MPa) = (0.4 to 0.6) N (blows per 300 mm)

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

q_c = (12 to 18) c_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes, etc. This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on

soil classification is required, direct drilling and sampling may be preferable.

Hand Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150 mm increments of penetration. Normally, there is a depth limitation of 1.2 m but this may be extended in certain conditions by the use of extension rods.

Two relatively similar tests are used.

- Perth sand penetrometer — a 16 mm diameter flat-ended rod is driven with a 9 kg hammer, dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.
- Cone penetrometer (sometimes known as the Scala Penetrometer) — a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). The test was developed initially for pavement subgrade investigations, and published correlations of the test results with California bearing ratio have been published by various Road Authorities.

Laboratory Testing

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

Bore Logs

The bore logs presented herein are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable, or possible to justify on economic grounds. In any case, the boreholes represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes, the frequency of sampling and the possibility of other than 'straight line' variations between the boreholes.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems;

- In low permeability soils, ground water although present, may enter the hole slowly or perhaps not at all during the time it is left open.
- A localised perched water table may lead to an erroneous indication of the true water table.
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report.
- The use of water or mud as a drilling fluid will mask any ground water inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water observations are to be made.

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

Engineering Reports

Engineering reports are prepared by qualified personnel and are based on the information obtained and on current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal (eg. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (eg. to a twenty storey building). If this happens, the Company will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface condition, discussion of geotechnical aspects and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- unexpected variations in ground conditions — the potential for this will depend partly on bore spacing and sampling frequency
- changes in policy or interpretation of policy by statutory authorities
- the actions of contractors responding to commercial pressures.

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

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, the Company requests that it immediately be notified. Most problems are much more readily resolved when conditions are exposed than at some later stage, well after the event.

Reproduction of Information for Contractual Purposes

Attention is drawn to the document "Guidelines for the Provision of Geotechnical Information in Tender Documents", published by the Institution of Engineers,

Australia. Where information obtained from this investigation is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. The Company would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

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

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APPENDIX A

DRAWING 1– EXCERPT FROM UBD

DRAWING 2 – AERIAL PHOTO OF SITE

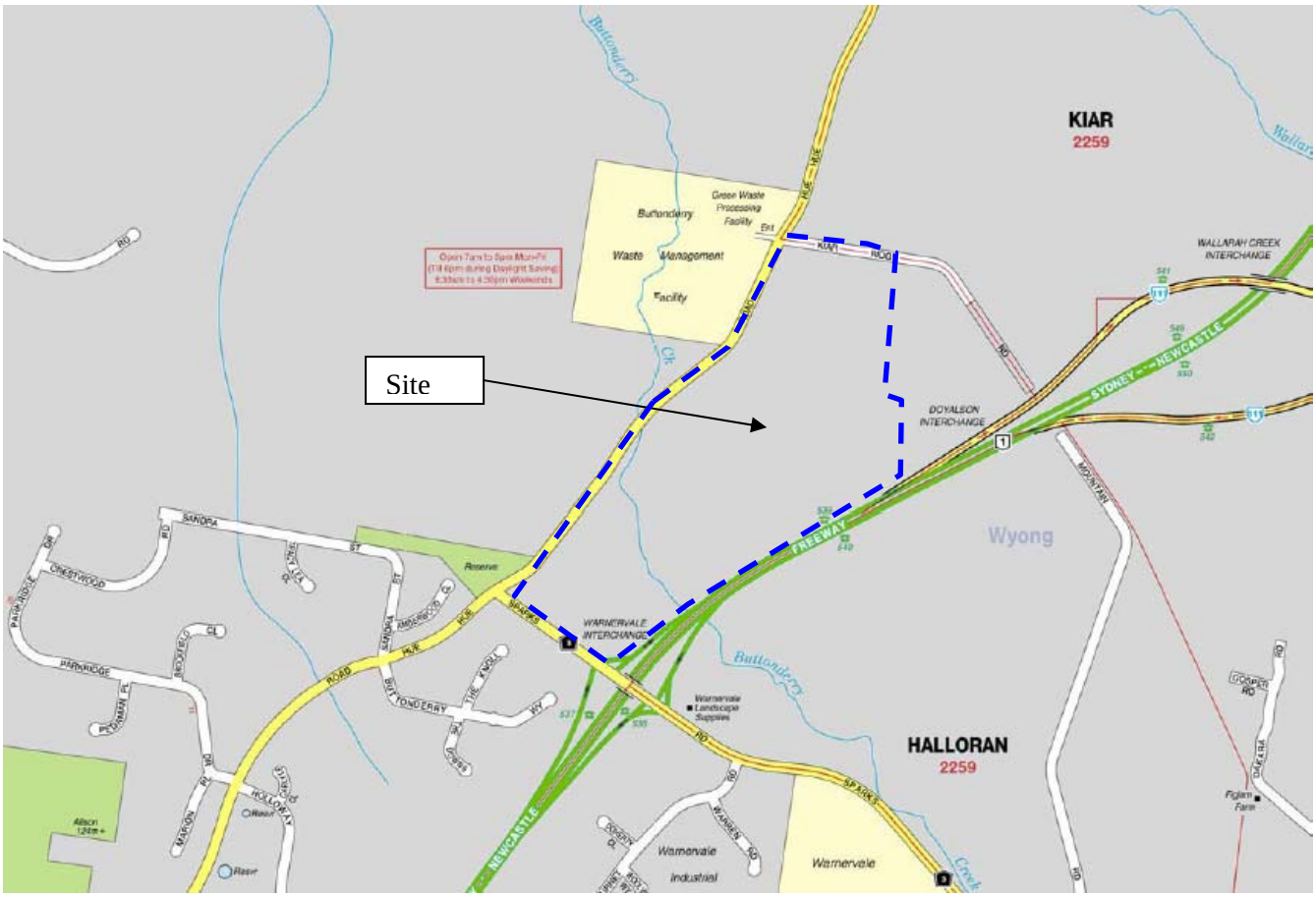
DRAWING 3 - TEST LOCATION PLAN ON SITE SURVEY

DRAWING 4 - TEST LOCATION PLAN ON PROPOSED LAYOUT

DRAWING 5 – EXCERPT FROM GEOLOGICAL SHEET

DRAWING 6 – EXCERPT FROM SOIL LANDSCAPE MAPPING

DRAWING 7 – EXCERPT FROM ACID SULPHATE MAPPING



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Sydney, Newcastle
Brisbane, Melbourne,
Perth, Wyong

Cairns, Campbelltown,
Darwin, Townsville

TITLE: Excerpt from UBD
Proposed Warner Industrial Park
Corner of Hue Hue Road and Sparks Road, Warnervale

CLIENT: Warner Business Park Pty Limited			OFFICE: Wyong
DRAWN BY: MPG	SCALE: NTS	PROJECT No: 41615	
APPROVED BY:		DATE: April 2008	DRAWING No: 1

Douglas Partners Geotechnics · Environment · Groundwater	*Sydney, Newcastle* *Brisbane, Melbourne,* *Perth, Wyong*	*Cairns, Campbelltown,* *Darwin, Townsville*

TITLE: Aerial Photo of Site (reproduced from Iplan)
Proposed Warner Industrial Park
Corner of Hue Hue Road and Sparks Road, Warnervale

CLIENT: Warner Business Park Pty Limited			OFFICE: Wyong
DRAWN BY: MPG	SCALE: NTS	PROJECT No: 41615	DRAWING No: 2
APPROVED BY:		DATE: April 2008	

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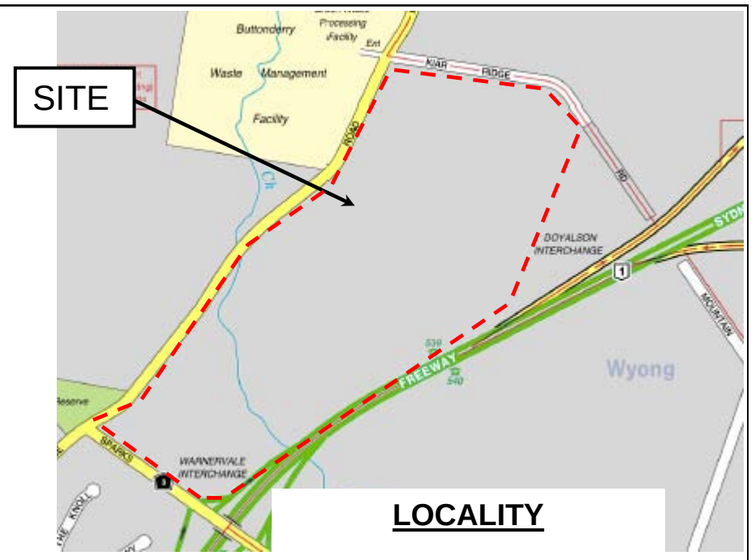

LOCALITY

NOTES

1. Test locations are approximate only and are shown with reference to existing site features.
2. Drawing adapted from plan provided by Trehy Ingold Neate.

LEGEND

- Approximate Test Bore Location
- Approximate Test Pit Locations
- Photos Direction and Number

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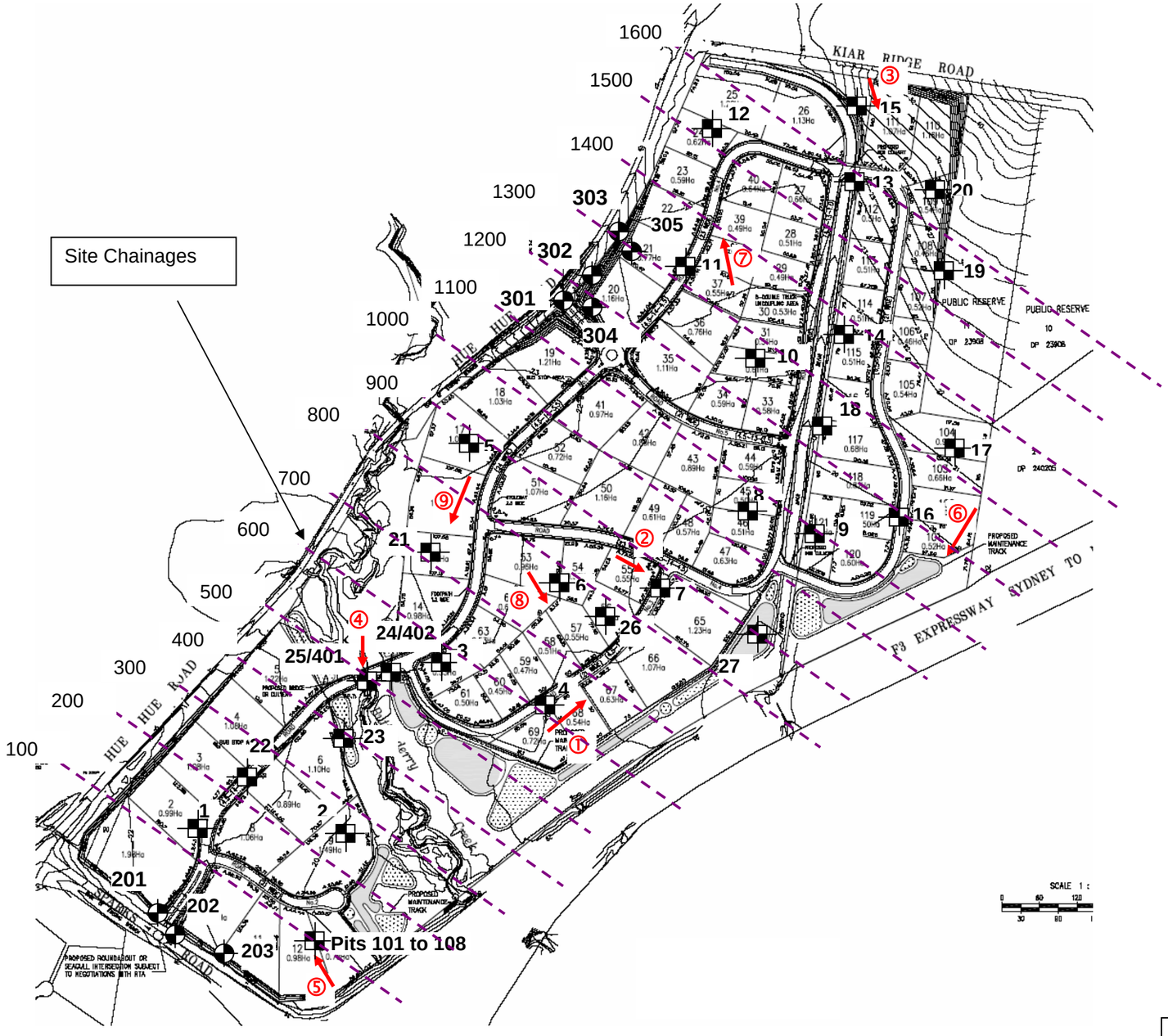
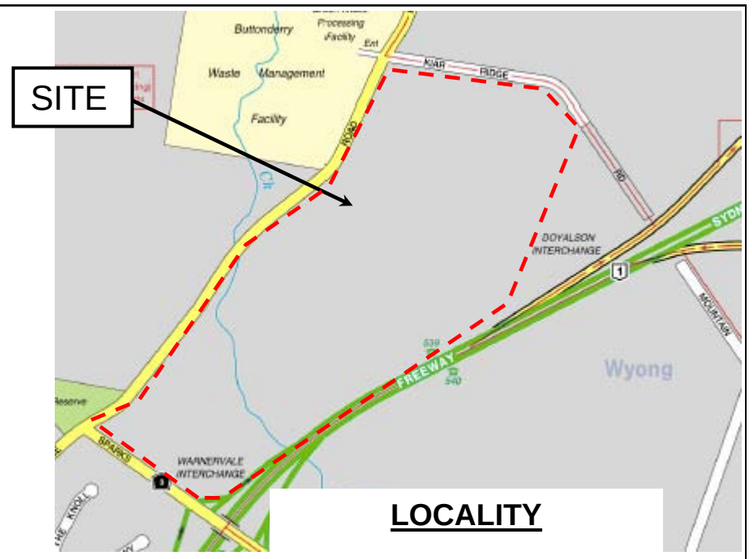
Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Singleton, Campbelltown, Townsville, Cairns, Darwin

TITLE: LOCATIONS OF TESTS
PROPOSED SUBDIVISION ASSOCIATED WITH WARNER INDUSTRIAL PARK
CNR HUE HUE ROAD AND SPARKS ROAD, WARNERVALE

CLIENT: WARNER BUSINESS PARK PTY LTD

DRAWN BY: JC	SCALE: 1:4000	PROJECT No: 41615	OFFICE: WYONG
APPROVED BY: MPG		DATE: MARCH 2008	DRAWING No: 3





N

NOTES

1. Test locations are approximate only and are shown with reference to existing site features based on surveyed positions supplied by Trehy Ingold and Neate.
2. Drawing adapted from plan provided by Trehy Ingold Neate.

LEGEND

- Approximate Test Bore Location
- Approximate Test Pit Location
- ④ Photos Direction and Number

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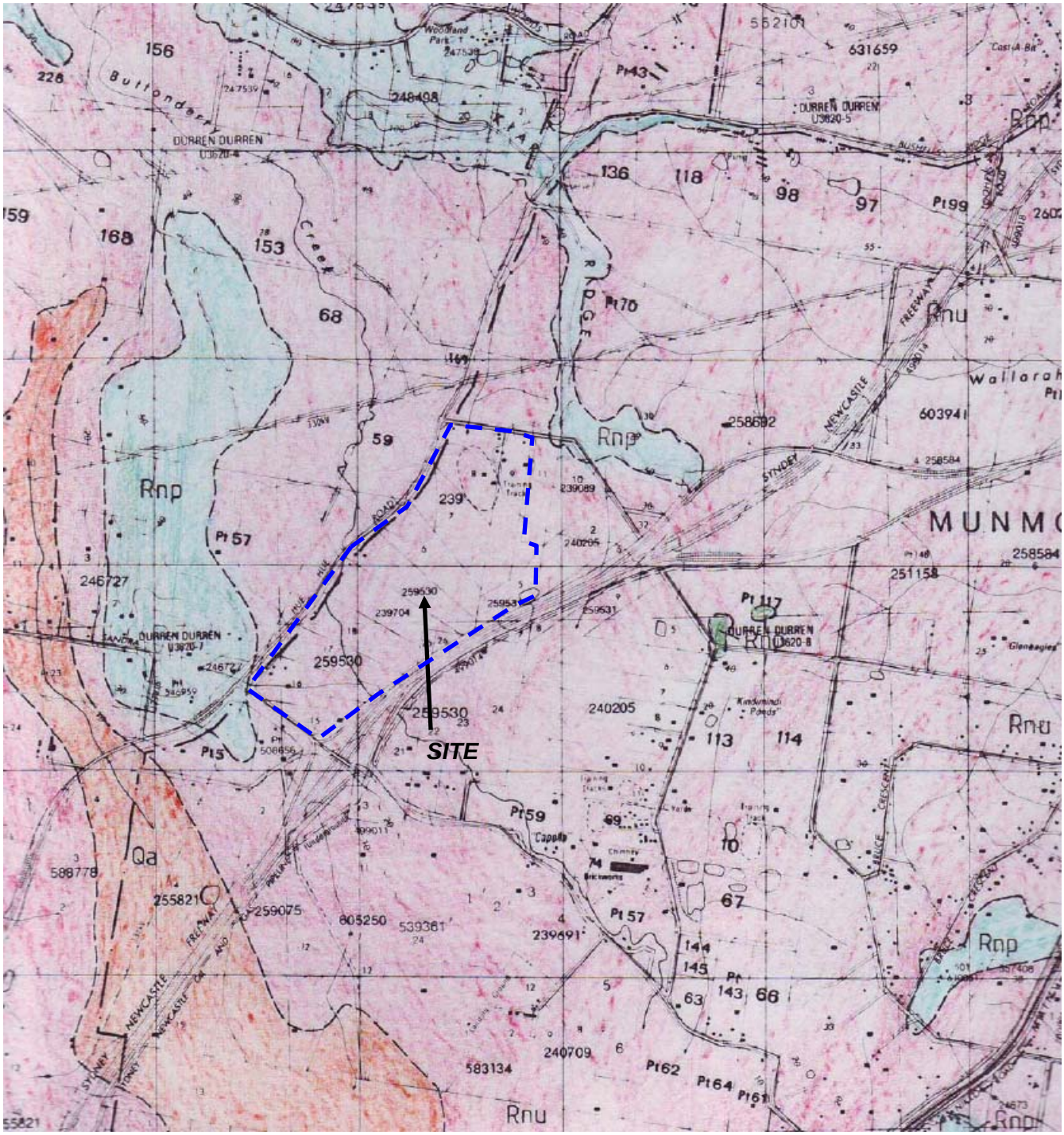
Sydney, Newcastle, Brisbane, Melbourne, Perth, Wyong, Singleton, Campbelltown, Townsville, Cairns, Darwin

TITLE: LOCATIONS OF TESTS
PROPOSED SUBDIVISION ASSOCIATED WITH WARNER INDUSTRIAL PARK
CNR HUE HUE ROAD AND SPARKS ROAD, WARNERVALE

CLIENT: WARNER BUSINESS PARK PTY LTD

DRAWN BY: JC	SCALE: 1:4000 @A3	PROJECT No: 41615	OFFICE: WYONG
APPROVED BY: MPG		DATE: MARCH 2008	DRAWING No: 4



LEGEND

- *Quaternary alluvium*
- *Patonga Claystone*
- *Tuggerah Formation*

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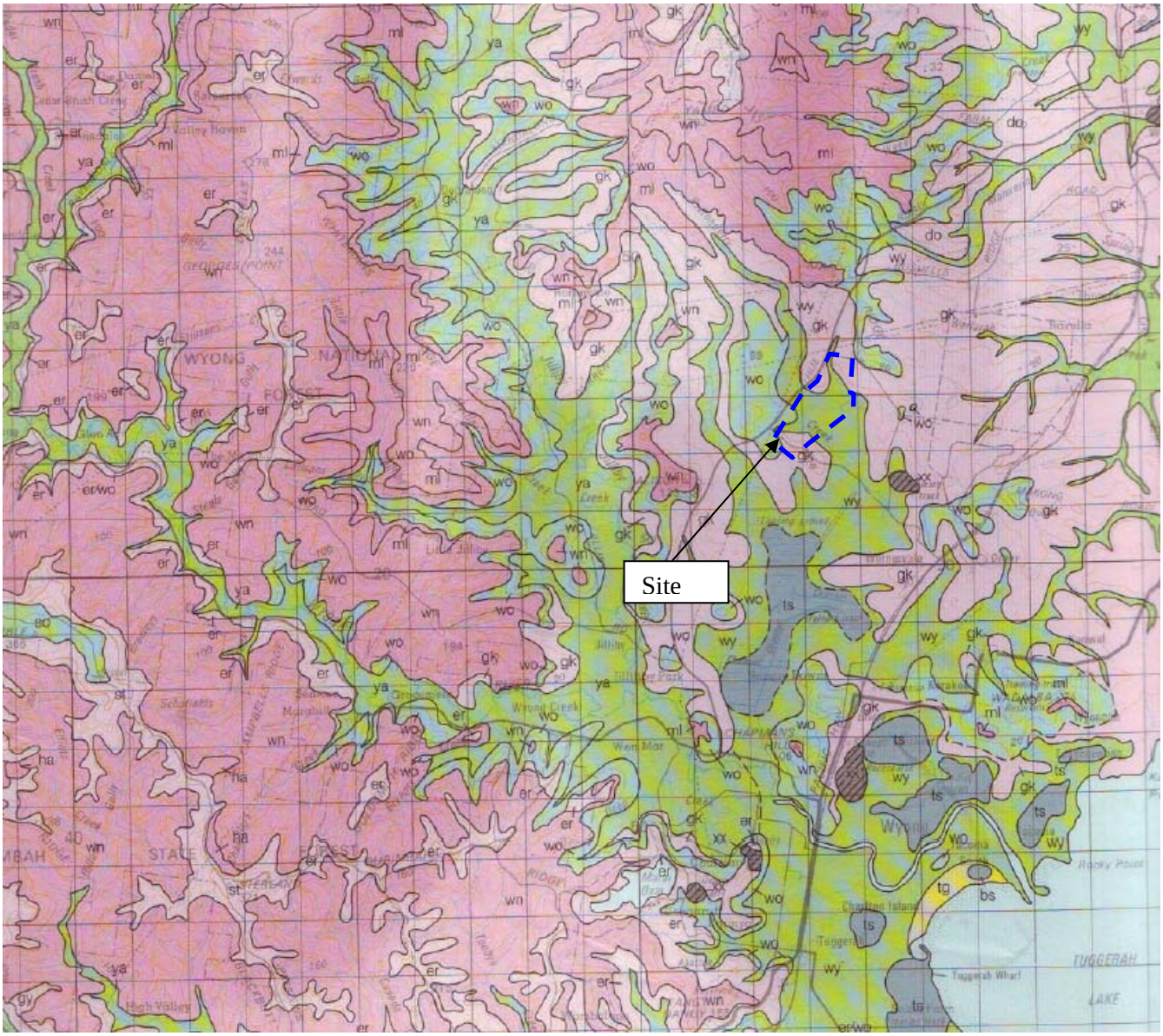
TITLE: Excerpt from Interim 1:25 000 Geological Series Sheet
Proposed Warner Industrial Park
Corner of Hue Hue Road and Sparks Road, Warnervale

CLIENT: Warner Business Park Pty Limited			OFFICE: Wyong
DRAWN BY: MPG	SCALE: NTS	PROJECT No: 41615	
APPROVED BY:		DATE: April 2008	DRAWING No: 5



LEGEND

- *Woodburys Bridge soil landscape group*
- *Wyong soil landscape group*
- *Gorokan soil landscape group*

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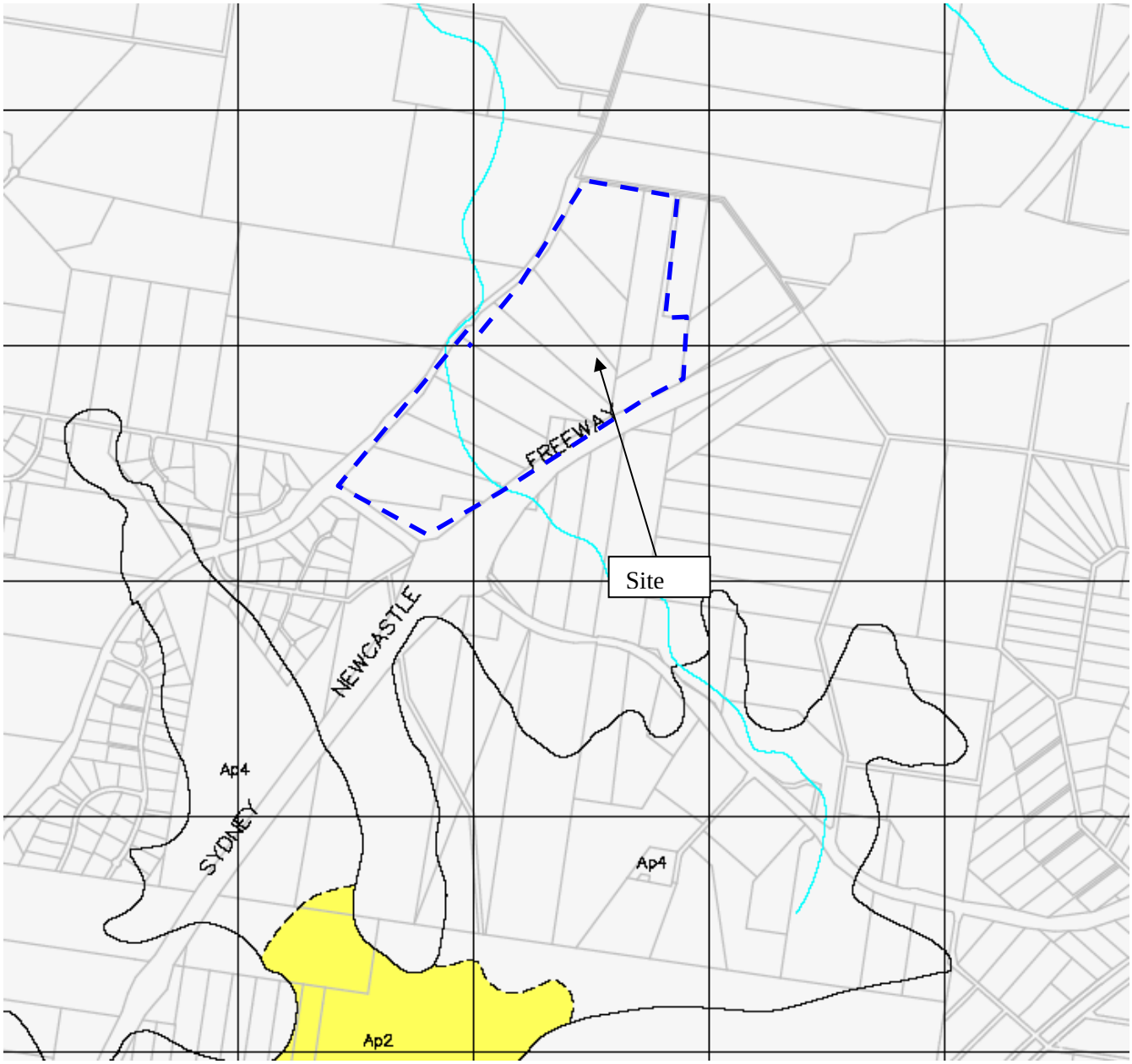
TITLE: Excerpt from Gosford-Lake Macquarie 1:100 000 Soil Landscape Sheet
Proposed Warner Industrial Park
Corner of Hue Hue Road and Sparks Road, Warnervale

CLIENT: Warner Business Park Pty Limited			OFFICE: Wyong
DRAWN BY: MPG	SCALE: NTS	PROJECT No: 41615	
APPROVED BY:		DATE: April 2008	DRAWING No: 6



LEGEND

- *No Known Occurrence of Acid Sulphate Soils*
- *Low Probability of Acid Sulphate Soils Wyong soil landscape group*

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Sydney, Newcastle
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Perth, Wyong

Cairns, Campbelltown,
Darwin, Townsville

TITLE: Excerpt from Dooralong Acid Sulphate Soil Risk Map
Proposed Warner Industrial Park
Corner of Hue Hue Road and Sparks Road, Warnervale

CLIENT: Warner Business Park Pty Limited			OFFICE: Wyong
DRAWN BY: MPG	SCALE: NTS	PROJECT No: 41615	DRAWING No: 7
APPROVED BY:		DATE: April 2008	

APPENDIX B

RESULTS OF FIELDWORK

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 1
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.15	TOPSOIL: Brown clayey sandy silt, M<Wp							
		SILTY SAND: Loose, brown slightly clayey silty sand, moist		D	0.2				
	0.4	SILTY CLAY: Very stiff, light grey, orange brown silty clay, M>Wp			0.5				
				B					
					0.8				
1				D/PP	1.0		pp = 220kPa		1
	1.1	CLAY: Very stiff, grey mottled red brown clay with some silt and trace of sand, M>Wp							
				D/PP	1.5		pp = 180kPa		
2		- becoming hard from 2.0m		D/pp	2.0		pp = >300 kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 2
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		FILLING: Brown silty sandy clay, M=Wp		D	0.1				
	0.15	SILTY CLAY: Firm, dark brown/grey silty clay, M>Wp							
		- stiff from 0.5m		D/PP	0.5		pp = 190kPa		
		- very stiff from 0.6m							
		- becoming light grey, orange brown from 0.7m							
	1	- M>Wp from 1.0m		D/PP	1.0		pp = 160kPa		
	1.4	CLAY: Very stiff, grey mottled orange brown clay with some silt, M=Wp		D/PP	1.5		pp = 250kPa		
	2			D	2.0				
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 3
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL: Brown sandy clayey silt with trace fine rootlets, M<Wp							
		SANDY CLAYEY SILT: Firm, light grey mottled orange sandy clayey silt with trace fine rootlets, M<Wp		D	0.2				
	0.3	SILTY CLAY: Firm, light grey orange brown silty clay, M>Wp							
					0.5				
		- stiff to very stiff from 0.6m		U_{50}					
				pp	0.8		pp = 300kPa		
1				D/PP	1.0		pp = 250kPa		1
	1.2	CLAY: Very stiff, light grey orange brown clay with trace silt and fine grained sand, M>Wp							
				D/PP	1.5		pp = 300kPa		
2				D/PP	2.0		pp = 200kPa		2
	2.15	Pit discontinued at 2.15m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 4
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.05	TOPSOIL: Grey clayey silt with some sand and trace fine rootlets, M<Wp							
		CLAYEY SILT: Firm, light grey orange brown clayey silt, M<Wp		D	0.2				
	0.4	CLAY: Firm to stiff, light grey orange brown clay with trace of silt and fine gained sand, M>Wp							
		- becoming more silty at 0.5m		B	0.5		pp = 150kPa		
		- stiff to very stiff from 0.75m			0.8				
	1	- very stiff from 1.0m		D/PP	1.0		pp = 220kPa		1
				D/PP	1.5		pp = 240kPa		
	2			D/PP	2.0		pp = >300 kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket
LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 5
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.15	TOPSOIL: Brown clayey sandy silt, M<Wp							
		CLAYEY SILTY SAND: Loose, light grey clayey silty sand with trace fine rootlets, moist/wet		D	0.2				
	0.45	SANDY CLAY: Firm, light grey mottled orange brown sandy clay wth trace fine rootlets, M>Wp		D	0.45				
					0.5				
				U_{50}					
	0.8	SILTY SANDY CLAY: Stiff, light grey silty fine grained sandy clay, M>Wp			0.8				
1				D	1.0				1
				D/PP	1.5		pp = 150kPa		
	1.7	CLAYEY SILTY SAND: Medium dense, light grey orange brown clayey slty sand, moist							
2				D/PP	2.0		pp = 150kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 6
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm)
		FILLING: Generally comprising brown silty sand clay mixture with some building rubble, moist		D	0.2				
	0.4	FILLING: Generally comprising light grey orange mottled red silty clay, M>Wp in a stiff condition		D/PP	0.5		pp = 150-200 kPa		
	1	- M>>Wp from 1.0m		D/PP	1.0		pp = 120-150 kPa		1
				D/PP	1.5		pp = 120kPa		
	1.7	FILLING: Generally comprising building rubble, broken bricks, masonite, fibrous sheeting, drums and plastic in a sand and clay matrix, saturated							
	2			D	2.0				2
	2.1	Pit discontinued at 2.1m. Due to pit collapse and strong water inflow							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Groundwater Seepage at 1.4m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 6A
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Generally comprising brown mottled orange silty clay with trace gravel, M=Wp							
	0.7	FILLING: Generally comprising timber, plastic, fibrous sheeting, bricks in a sandy clay and silty clay matrix. - strong seepage at 0.8m							
1									1
	1.7	SILTY CLAY: Stiff to very stiff grey mottled brown silty clay, M=Wp							
2	2.0	Pit discontinued at 2.0m. Due to strong inflow of groundwater							2

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Free Groundwater Observed at

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 7
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Light brown grey sandy clay silt with trace fine rootlets, moist		D	0.2				
	0.25	SANDY SILTY CLAY: Hard, light grey orange brown fine grained sandy silty clay, M<Wp		B	0.5				
				pp	0.8		pp = >300 kPa		
	1	- stiff from 1.0m, M>Wp		D/PP	1.0		pp = 150kPa		1
		- occasional sand lens from 1.5m, M>Wp		D/PP	1.5		pp = 120kPa		
	1.7	SILTY CLAYEY SAND: Very stiff to hard, slightly cemented, light gey mottled orange brown silty clayey sand, moist							
	2			D/PP	2.0		pp = >300 kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 8
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
									5 10 15 20
		TOPSOIL: Grey clayey silt with trace of sand and fine rootlets, M<Wp							
	0.2								
		CLAY: Stiff, light grey, orange and brown clay with trace of silt and some fine grained sand and a trace of fine rootlets, M=Wp							
				D	0.4				
				U_{50}	0.5				
	0.8				0.8				
		SILTY CLAY: Very stiff, light grey, orange and brown silty clay with some fine grained sand and fine rootlets, M<Wp							
1				D/pp	1.0		pp = 200kPa		1
				D/pp	1.5		pp = 210kPa		
	1.6								
		CLAY: Stiff to very stiff, grey mottled orange clay with trace of silt and sand							
		- ironstained gravel at 1.8m							
2				D/pp	2.0		pp = 200kPa		2
	2.1								
		Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 9
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Dark brown silty clay with trace of sand and some fine rootlets, M>>Wp							
	0.25	SILTY CLAY: Firm, light grey mottled orange brown silty clay, M>>Wp							
		- stiff to very stiff from 0.45m		D/pp	0.5		pp = 220kPa		
	1			D/pp	1.0		pp = 200kPa		1
		- M>Wp from 1.5m		D/pp	1.5		pp = 220kPa		
	1.6	CLAY: Very stiff, light grey clay with some silt, M>Wp							
	2			D/pp	2.0		pp = 230kPa		2
	2.1	Pit discontinued at 2.1m							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Groundwater Seepage from 2.1m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 10
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL: Dark grey brown silty clay with trace fine rootlets, M=Wp							
		SILTY CLAY: Firm, dark brown grey silty clay with trace fine rootlets, M>Wp		D	0.5				
	0.6	SILTY CLAY: Very stiff, light grey mottled orange brown silty clay, M>Wp			0.6				
				U_{50}					
		- with occasional sand lenses from 0.8m			0.9				
1				D/pp	1.0		pp = 220kPa		1
		- trace of ironstone gravel from 1.5m							
	1.5	CLAY: Very stiff, light grey mottled orange brown clay with trace sand and gravel, M=Wp		D/pp	1.5		pp = 260kPa		
2				D/pp	2.0		pp = 250kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 11
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Brown silty sand, moist							
	0.15	SILTY SANDY CLAY: Firm, light grey mottled orange brown silty sandy clay, M>Wp							
					0.5				
				B					
		- stiff from 0.9m							
	1	- occasional sand lens from 1.0m		D	1.0				1
		- very stiff, M=Wp from 1.5m		D/pp	1.5		pp = 250kPa		
		- hard with trace ironstone gravel, M=WP from 1.8m							
	2			D/pp	2.0		pp = >400 kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 12
PROJECT No: 41615
DATE: 24 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	FILLING: Brown grey silty clay with trace sand and fine rootlets, M>Wp							
	0.2	FILLING: Generally comprising light brown mottled grey silty clay with trace fine rootlets, M>Wp		D/PP	0.15		pp = 150kPa		
		SILTY CLAY: Stiff to very stiff, grey mottled orange brown silty clay, M>Wp		D/PP	0.3		pp = 220kPa		
		- becoming light grey orange brown from 0.7m							
	1			D	1.0				1
		- some fine grained sand and very stiff from 1.1m, M>Wp		pp	1.2		pp = 230-260 kPa		
	2	- light grey from 2.0m, M=Wp		D	2.0				2
	2.5	Pit discontinued at 2.5m. Limit of investigation							

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 13
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL: Brown silty sand, moist							
	0.2	SILTY SAND: Medium dense, brown silty sand with trace of clay, moist		D	0.3				
	0.5	SANDY CLAY: Very stiff, light grey mottled orange brown sandy clay, M=Wp		D	0.5				
				B	0.6				
					0.8				
	1	- trace of silt and becoming more sandy from 1.0m, M=Wp		D/pp	1.0		pp = 220kPa		1
		- hard, M<Wp from 1.5m		D/pp	1.5		pp = >400 kPa		
	2			D/pp	2.0		pp = >400 kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 14
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
		TOPSOIL: Dark grey brown clayey silt, M>Wp							
	0.15	SILTY SANDY CLAY: Firm, light grey mottled orange brown silty sandy clay, M>Wp							
		- firm to stiff from 0.45m			0.5				
				U_{50}					
		- very stiff from 0.75m			0.8				
	1			D/pp	1.0		pp = 220kPa		1
		- occasional sand lens observed from 1.5m, M>Wp		D/pp	1.5		pp = 230kPa		
	2			D/pp	2.0		pp = 250kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 15
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Brown silty sand with trace fine rootlets, moist							
	0.15	SILTY SAND: Loose to medium dense, brown silty sand with trace of clay and fine rootlets							
	0.4	SANDY CLAY: Very stiff light grey mottled orange brown sandy clay, M=Wp							
				U_{50}	0.5				
					0.8				
1				D/pp	1.0		pp = 230kPa		1
		- hard, light grey and red/orange with occasional sand lense from 1.5m, M<Wp		D/pp	1.5		pp = >300 kPa		
2	2.0	Pit discontinued at 2.0m. Limit of investigation							2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 16
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Brown grey, clayey silty sand with trace fine rootlets, moist/wet		D	0.1				
	0.3	CLAYEY SAND/SANDY CLAY: Firm, grey brown, clayey sand/sandy clay with some silt, M>Wp, wet			0.5				
		- firm to stiff from 0.6m		B					
	0.7	SANDY CLAY: Stiff, light grey mottled orange brown, sandy clay with trace of silt, M>Wp			0.8				
1				D/pp	1.0		pp = 150kPa		1
				D/pp	1.5		pp = 100kPa		
	1.7	SILTY SANDY CLAY: Stiff to very stiff, light grey mottled orange brown, silty sandy clay, M>Wp							
		- trace of fine grained sand lens and ironstoned gravel from 1.8							
2				D/pp	2.0		pp = 170kPa		2
	2.4	Pit discontinued at 2.4m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Groundwater Seepage from 2.1m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 17
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	FILLING: Brown grey silty sandy clay, M<Wp							
		SANDY SILTY CLAY: Firm to stiff, grey brown sandy silty clay with some fine rootlets, M>Wp		D	0.4				
	0.6	SILTY CLAY: Stiff, light grey mottled orange brown silty clay with some fine grained sand, M>Wp		U_{50}	0.6				
		- becoming less sandy from 0.8m		D	0.8				
	1				0.95				1
	1.1	CLAY: Stiff to very stiff, grey speckled orange brown clay with some silt and a trace of fine grained sand, M>Wp		D/pp	1.5		pp = 220kPa		
	2			D	2.0				2
	2.7	Pit discontinued at 2.7m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧩ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 18
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Dark brown grey silty clay with some sand and trace fine rootlets, M>Wp							
	0.15	SILTY CLAY: Firm, dark grey silty clay with trace fine grained sand and some rootlets, M>>Wp		D	0.2				
	0.4	SILTY CLAY: Firm, light grey mottled orange brown silty clay, M>>Wp		D	0.5				
		- firm to stiff from 0.6m							
		- stiff to very stiff from 0.75m							
	1			D/pp	1.0		pp = 220-280 kPa		1
		- trace gravel and ironstained from 1.5m, M>Wp		D/pp	1.5		pp = 300kPa		
		- trace fine grained sand from 1.8m							
	2			D/pp	2.0		pp = 270kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Groundwater Seepage from 1.8m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 19
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Brown silty sand with trace of fine rootlets, moist		D	0.1				
	0.2	SANDY CLAY: Stiff, light brown, orange brown sandy clay, M<Wp			0.3				
		- very stiff from 0.45m		U_{50} D/pp	0.5		pp = 320kPa		
					0.7				
	0.8	SANDSTONE: Extremely low strength, extremely weathered fine grained orange brown sandstone							
	0.9	SILTSTONE/MUDSTONE: Extremely low strength, extremely weathered light grey mottled maroon siltstone with soil like properties		D	1.0				
1									1
				D	1.5				
	1.6	Pit discontinued at 1.6m. Refusal on mudstone							
2									2

RIG: 4 tonne excavator with 450mm bucket
LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 20
PROJECT No: 41615
DATE: 19 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Brown clayey silty sand with trace of fine rootlets, moist		D	0.2				
	0.3	SANDY CLAY: Stiff, light brown orange fine grained sandy clay with trace of silt, M=Wp			0.5		pp = 220kPa		
		hard from 0.6m		B					
				D	0.8				
	0.9	Pit discontinued at 0.9m. Refusal on rock							
	1								1
	2								2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket
LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 21
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Grey clayey silty sand, moist							
	0.15	CLAYEY SILTY SAND: Medium dense, grey orange brown clayey silty sand, moist		D	0.2				
	0.4	SILTY SANDY CLAY: Very stiff, orange brown silty sandy clay, M=Wp		B	0.5				
		- becoming more sandy from 0.8		D	0.8				
1					1.0				1
	1.3	SILTY CLAY: Hard, grey mottled orange brown silty clay, M<Wp		D/PP	1.5		pp = >300 kPa		
2	2.0	Pit discontinued at 2.0m. Limit of investigation		D/PP	2.0		pp = >300 kPa		2

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator with 450mm bucket
LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 22
PROJECT No: 41615
DATE: 26 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
		TOPSOIL: Grey silty sandy clay with trace fine rootlets, M<Wp							
	0.15	SILTY SANDY CLAY: Stiff to very stiff, light grey orange brown silty fine grained sandy clay, M>Wp		D/PP	0.3		pp = 210kPa		
	0.45	CLAY: Very stiff, grey mottled red brown clay with some fine grained sand, M>Wp		pp	0.5		pp = 300kPa		
				D	0.6				
	1			pp	1.0		pp = 300kPa		1
		- less andy and a trace of silt, light grey orange brown from 1.2m							
				D	1.4				
	1.5			D	1.51				
	1.56	SILTSTONE: Extremely low strength, extremely weathered, light grey siltstone with soil like properties							
		Pit discontinued at 1.56m. Refusal on siltstone							
	2								2

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 23
PROJECT No: 41615
DATE: 20 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL: Clayey silty sand with trace fine rootlets, moist							
		CLAYEY SILTY SAND: Firm, brown clayey silty sand, moist		D	0.2				
	0.3	SILTY SANDY CLAY: Firm, light grey orange brown silty sandy clay, M=Wp							
		- firm to stiff from 0.45m			0.5				
				U_{50}					
					0.8				
		- stiff to very stiff from 0.9m							
1				D/PP	1.0		pp = 200kPa		1
	1.4	CLAY: Very stiff, light grey clay with orange brown silty sandy lenses, M>Wp		D/PP	1.5		pp = 220kPa		
2				D/PP	2.0		pp = 230kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 24
PROJECT No: 41615
DATE: 21 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL: Orange brown slightly clayey silty sand, moist							
		CLAYEY SILTY SAND: Loose, orange brown slightly clayey silty sand, moist		D	0.2				
				D	0.5				
	1	- wet from 1.0m		D	1.0				1
	1.1	SAND: Loose to medium dense, orange brown fine to medium grained sand with some clay and trace of silt, wet		D	1.5				
	1.7	SANDY CLAY: Stiff, orange brown slightly silty sandy clay, moist/wet							
	2			D	2.0				2
	2.3	Pit discontinued at 2.3m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Free Groundwater Observed at 1.0m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 25
PROJECT No: 41615
DATE: 26 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		TOPSOIL: Brown clayey silty sand, moist							
	0.1	SILTY SAND: Loose to medium dense, orange brown clayey silty sand, moist		D	0.2				
				D	0.5				
	0.8	SANDY CLAY: Very stiff, orange brown sandy clay, 40:60, M>Wp							
1				D	1.0				1
		- becoming more silty from 1.5m, M>Wp		D/PP	1.5		pp = 230kPa		
	1.7	SILTY CLAY: Very stiff, light grey orange brown silty clay, M=Wp							
2	2.0	Pit discontinued at 2.0m. Limit of investigation		D/PP	2.0		pp = 270kPa		2

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 26
PROJECT No: 41615
DATE: 26 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Dark brown sandy clayey silt with some rootlets, M>Wp							
	0.2	SANDY SILTY CLAY: Stiff, light grey fine grained sandy silty clay, M>Wp		D	0.2				
	0.4	CLAY: Very stiff to hard, light grey orange brown clay with some silt, M=Wp			0.45				
				D	0.5				
				U_{50}					
					0.85				
1				D/PP	1.0		pp = >400 kPa		1
				D/PP	1.5		pp = 300kPa		
		- dark grey mottled red orange from 1.6m							
2	2.0	Pit discontinued at 2.0m. Limit of investigation		D/PP	2.0		pp = >400 kPa		2

RIG: 4 tonne excavator with 450mm bucket

LOGGED: Hickman

WATER OBSERVATIONS: Seepage observed at 0.4m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 27
PROJECT No: 41615
DATE: 26 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		TOPSOIL: Grey clayey silt with trace sand and fine rootlets, moist		D	0.2				
	0.25	SILTY CLAY: Very stiff, light grey orange brown silty clay, M>Wp			0.45				
				D/PP	0.5		pp = 230kPa		
				U_{50}					
					0.85				
	1			D/PP	1.0		pp = 260kPa		1
		- M>Wp from 1.2m							
		- becoming less silty from 1.5m		D/PP	1.5		pp = 270kPa		
	2			D/PP	2.0		pp = 270-300 kPa		2
	2.1	Pit discontinued at 2.1m. Limit of investigation							

RIG: 4 tonne excavator with 450mm bucket
LOGGED: Hickman

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 41615
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
	0.1	FILLING: Asphaltic Cement							
		FILLING: Generally comprising brown slightly clayey gravell sand (base), moist		D	0.1				
	0.22	FILLING: Generally comprising dark grey cobbly gravel (ballast) (graded basalt), moist							
	0.6	FILLING: Generally comprising brown slightly clayey gravelly sand (stabilised), moist		D	0.7				
	0.8	FILLING: Generally comprising brown gravelly sandy clay, M>Wp		D	0.9				
1									1
	1.3	SILTY CLAY: Very stiff, medium plasticity, light grey silty clay with trace sandstone gravel, M>Wp		D/PP	1.4		pp = 230kPa		
	1.6	Bore discontinued at 1.6m. Limit of investigation							
2									2

RIG: 4 tonne excavator **DRILLER:** Credere **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: 225mmϕ auger

WATER OBSERVATIONS: Water Seepage into pit at 1.3m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED	
Initials:	
Date:	

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 41615
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
	0.05	ASPHALTIC CONCRETE		D	0.05				
	0.15	FILLING: Generally comprising light brown sandy gravel filling, moist							
		FILLING: Generally comprising dark grey cobbley gravel (ballast), moist		D	0.3				>>
	0.55	FILLING: Generally comprising brown slightly clayey gravelly sand (stabilised), dry/moist		D	0.6				
	0.75	FILLING: Generally comprising red/brown silty sandy clay with some gravel and trace sandstone cobbles, M=Wp		D	0.8				
1									1
	1.25	CLAY: Very stiff, medium plasticity, light grey mottled red brown clay with trace silt, M=Wp		B/pp	1.3		pp = 250kPa		
	1.5	Bore discontinued at 1.5m			1.5				
2									2

RIG: 4 tonne excavator **DRILLER:** Credere **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: 225mm ϕ auger

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 41615
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm) 5 10 15 20
		ASPHALTIC CONCRETE							
	0.1	FILLING: Generally comprising brown slightly clayey gravelly sand, moist							
	0.18	FILLING: Generally comprising dark grey cobbly gravel (generally 20-75mm agg grain size) ballast, moist							
	0.66	FILLING: Generally comprising brown slightly clayey gravelly sand, moist (stbilised, cement)		D	0.7				
	0.9	FILLING: Generally comprising brown clayey gravelly sand (mixture sandstone and sandy clay), M>Wp		D B	0.9 1.0 1.2				1
	1.7	CLAY: Stiff, high plasticity, light grey red brown clay with trace sand and silt, M>Wp		pp D	1.75 1.8		pp = 120kPa		
	1.9	Bore discontinued at 1.9m. Limit of investigation							2

RIG: 4 tonne excavator **DRILLER:** Credere **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: 225mmϕ auger

WATER OBSERVATIONS: Water Seepage at 0.66m under side ballast

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 301
PROJECT No: 41615
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL: Brown slightly clayey silty sand with some gravel and fine rootlets, moist							
		FILLING: Generally comprising fine crushed rock, grey slightly clayey sandy gravel (roadbase), moist		D	0.2				
	0.4	FILLING: Generally comprising brown gravelly sandy clay (ripped sandstone), M>Wp		D/PP	0.5		pp = 120-200 kPa		
	0.7	SILTSTONE: Extremely low to low strength, extremely weathered grey siltstone		D	0.8				
	0.9	Bore discontinued at 0.9m. Refusal on siltstone							
	1								
	2								

Dynamic Penetrometer Test (blows per 150mm) scale: 5, 10, 15, 20

RIG: 4 tonne excavator **DRILLER:** Credere **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: 225mmϕ auger

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 302
PROJECT No: 41615
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
		FILLING: Generally comprising fine crushed rock, grey brown slightly clayey sandy gravel, moist		D	0.2				
	0.35	FILLING: Generally comprising brown clayey gravelly sand, moist		D	0.4				
	0.6	SANDSTONE: Low strength, slightly weathered, orange brown sandstone, moist		D	0.7				
	0.8	Bore discontinued at 0.8m. Refusal on rock							
	1								
	2								

Dynamic Penetrometer Test (blows per 150mm): 5, 10, 15, 20

RIG: 4 tonne excavator **DRILLER:** Credere **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: 225mmϕ auger

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 303
PROJECT No: 41615
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per 150mm)
	0.1	TOPSOIL: Brown silty sand with trace fine rootlets, moist							
		SILTY SAND: Medium dense, brown fine grained silty sand trace gravel and clay, moist		D	0.15				
	0.45	CLAY: Hard, red brown mottled grey clay with some silt and trace ironstained gravel, M<Wp		B/pp	0.5		pp = >300 kPa		
					0.8				
	0.9	SILTSTONE/MUDSTONE: Extremely low strength, extremely weathered red brown mottled grey siltstone/mudstone with soil like properties, M<Wp		D	1.0				
1		- low to medium strength, light grey siltstone from 1.4m		D	1.5				1
	1.7	Bore discontinued at 1.7m. Limit of investigation							
2									2

RIG: 4 tonne excavator **DRILLER:** Credere **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: 225mmϕ auger

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☒ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 304
PROJECT No: 41615
DATE: 03 Apr 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.08	FILLING: Crushed recycled concrete predominantly (20-80mm)							D			
	0.9	CLAYEY SAND: Brown slightly clayey sand with a trace of sandstone gravel, moist						0.85m: NMLC Coring from 1.02m				
	1.12	CORE LOSS: 1000mm						1.02m: CORE LOSS: 100mm				
		SANDSTONE: Low strength, highly weathered, orange brown fine grained sandstone										
		- extremely low strength, extremely weathered, light grey mottled orange from 1.16m						1.73m: P,5°, un, ro	C	95	75	
		- very low strength, highly weathered from 1.43m						2.05m: P, 5°, un, ro				
								2.28m: J, 45°, ti, un				
		- extremely low strength seam 50mm thick at 2.5m						2.5m: P, sh, un, ro				
		- very low to low strength, moderately weathered from 2.55m										
	3.39	CLAYSTONE: Very low strength, highly weathered, red brown mottled grey claystone						3.23m: P, sh, un, ro	C	100	100	
								4.1m: J, 60°, un ti	C	100	100	
	5.12	CORE LOSS: 1370mm						5.12m: CORE LOSS: 1370mm	C	0	0	
	6.49	Bore discontinued at 6.49m. V-bit refusal at 0.9m. Unable to retrieve siltstone/mudstone										

RIG: Nissan Patrol **DRILLER:** Mark **LOGGED:** Hickman **CASING:** HW to 0.9

TYPE OF BORING: NMLC Coring from 1.02m

WATER OBSERVATIONS: No Free Groundwater Observed while augering, introduction of drilling fluids precluded graoundwater measurements

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 305
PROJECT No: 41615
DATE: 03 Apr 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
		TOPSOIL: Brown clayey silty sand										
	0.1	CLAY: Stiff, light brown orange brown clay with trace fine grained sand, M=Wp							D			
	1								D			
	1.2	SILTY CLAY: Stiff, light grey silty clay with a trace of ironstained gravel, M=Wp							S/pp			pp = 230kPa 2,4,8 N = 12
	2								D			
	3											
	3.0	SANDSTONE: Extremely low strength orange sandstone - V-bit refusal at 3.5m - low strength from 3.5m							S			12,25 refusal
	4								D			
	4.8	Bore discontinued at 4.8mTC-bit refusal at 4.8m										

RIG: Nissan Patrol **DRILLER:** Hickman **LOGGED:** Hickman **CASING:** Uncased
TYPE OF BORING: SFA
WATER OBSERVATIONS: No Free Groundwater Observed
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 401
PROJECT No: 41615
DATE: 04 Apr 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, D - Drill Break)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	0.15	TOPSOIL: Brown silty sand with trace of fine rootlets, moist							D			
		SILTY SAND: Loose to medium dense, light brown silty fine to medium grained sand, moist										
1	1.0	CLAY: Stiff, light grey mottled orange brown slightly silty sandy clay, M>Wp							S/pp			1,4,6 N = 10 pp = 150-200 kPa
		- very stiff from 1.4m										
	1.6	SILTY CLAY: Very stiff, light grey mottled orange brown silty clay with some fine grained sand, M=Wp							D			
2												
	2.3	SANDSTONE: Extremely low strength, extremely weathered, light grey orange brown fine grained sandstone							S			30/100 refusal
3												
	3.3	SILTSTONE/PATONGA MUDSTONE: Orange brown, red brown siltstone/Patonga mudstone							D			
4	4.0	CORE LOSS: 310mm						4.01m: CORE LOSS: 310mm				
	4.32	CLAYSTONE: Very low strength, highly weathered, slightly fractured, red brown claystone							C	72	71	
5												
	5.42	CORE LOSS: 180mm						5.42m: CORE LOSS: 180mm				
	5.6	CLAYSTONE: Very low strength, highly weathered, slightly fractured, red brown claystone							C	89	89	
	5.75	SANDSTONE: Medium strength, moderately weathered, factured, light brown fine grained sandstone						6.41m: P,5°, un, ro				
6		- very low strength claystone seam 110mm thick at 5.98m						6.54m: P, 5°, un, ro				
	6.7	- medium to high strength, moderately weathered from 6.09m - very low to low strength, highly weathered from 6.29m - medium strength, moderately weathered from 6.45m Bore discontinued at 6.7m. V-bit refusal at 4.0m										
7												
8												
9												

RIG: Nissan Patrol **DRILLER:** Mark **LOGGED:** Hickman **CASING:** HW to 3.5

TYPE OF BORING: NMLC Coring from 4.0 m

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED
Initials:
Date:

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BOREHOLE LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Warnervale Business and Industrial Park
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

BORE No: 402
PROJECT No: 41615
DATE: 04 Apr 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.15	TOPSOIL: Brown silty sand with trace fine rootlets, moist							
		SILTY SAND: Loose, light brown silty sand with a trace of clay, moist		D	0.5				
	1				1.0		1,1,2 N = 3		
	1.2	SILTY SANDY CLAY: Firm, light grey mottled orange brown siltys andy clay, M>Wp		D/S					
					1.45				
	2			D	2.0				
	2.0	CLAY: Very stiff, light grey clay with a trace of fine grained sand, M>Wp							
					2.5		2,5,7 N = 12 pp = 220-270 kPa		
				S/pp					
	3				2.95				
	3.5	SILTSTONE: Extremely low strength, extremely weathered, siltstone with occasional sandstone lens		D	3.5				
	4				4.0		4,8,20 N = 28		
				S					
					4.45				
	5	- red/brown mudstone from 5.0m		D	5.0				
	5.3	Bore discontinued at 5.3m. V-bit refusal at 5.3m							

RIG: Nissan Patrol **DRILLER:** Mark **LOGGED:** Hickman **CASING:** Uncased

TYPE OF BORING: SFA

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 101
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
	0.1	FILLING: Brown topsoils mixed with small gravels and roof tiles (fragments), moist		D/PID	0.1		PID = 0 ppm		
		SILT: Light brown silt with trace rootlets, moist		D/PID	0.2		PID = 0 ppm		
	0.3	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID/pp	0.5		PID = 0 ppm/pp = 120-160 kPa		
	1			D/PID/pp	1.0		PID = 0 ppm/pp = 160-180 kPa		1
				pp	1.5		pp = 180-230 kPa		
	1.55	SANDSTONE: extremely low strength, extremely weathered, light grey sandstone		D/PID	1.6		PID = 0 ppm		
	1.7	Pit discontinued at 1.7m. Refusal							
	2								2

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

Douglas Partners
Geotechnics · Environment · Groundwater

TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 102
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Light grey gravelly sand filling, moist		D/PID(QA	0.1		PID = 0.3 ppm		
	0.2	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID	0.3		PID = 0 ppm		
				pp	0.5		pp = 180-220 kPa		
		- ironstone gravels at 0.8m							
	1			D/PID/pp	1.0		PID = 0 ppm/pp = 200-220 kPa		1
				D/PID/pp	1.5		PID = 0 ppm/pp = 320-350 kPa		
	1.6	SILTY CLAY: Hard, light grey, medium to high plasticity, silty clay with red brown ironstone cobbles and gravels							
	1.75	Pit discontinued at 1.75m. Refusal							
	2								2

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

Douglas Partners
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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 103
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Apparently well compacted, gravel surface cover underlain by light yellow, grey, brown sandy clay with some gravel and silt (single piece of timber and metal)		D/PID	0.1		PID = 0 ppm		
				D/PID	0.5		PID = 0 ppm		
	0.55	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp							
	1			D/PID/pp	1.0		PID = 0 ppm/pp = 150-180 kPa		1
				pp	1.6		pp = 180-220 kPa		
	2 2.0	Pit discontinued at 2.0m. Near refusal		D/PID/pp	2.0		PID = 0 ppm/pp = 350-400 kPa		2

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

Douglas Partners
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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 104
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Grass cover underlain by mixture of apparently moderate to well compacted brown clayey silt and yellow, brown, grey silty clay with rootlets, M>Wp		D/PID	0.1		PID = 0 ppm		
				D/PID/pp	0.5		PID = 0 ppm/pp = 250-300 kPa		
				pp	0.7		pp = 250-300 kPa		
	0.9	CLAYEY SILT: Dark grey brown clayey silt with rootlets							
1				D/PID	1.0		PID = 0 ppm		1
	1.4	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp							
2	2.0	Pit discontinued at 2.0m. Limit of investigation		D/PID/pp	2.0		PID = 0 ppm/pp = 150-200 kPa		2

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 105
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Grass surface cover underlain by apparently moderately to well compacted, yellow, brown, grey sandy clay/clayey sand filling with sandstone gravels and cobbles, M~Wp		D/PID	0.1		PID = 0 ppm		
				D/PID	0.5		PID = 0 ppm		
1	1.0	SANDY SILT: Medium dense, grey brown, fine grained, sandy silt with trace rootlets and clay, moist		D/PID	1.1		PID = 0 ppm		1
	1.4	SANDY CLAY: Brown and grey, low to medium plasticity, sandy clay with trace rootlets, M>Wp		D/PID/pp	1.5		PID = 0 ppm/pp = 80-120 kPa		
	1.8	SILTY CLAY: Red brown mottled grey, medium to high plasticity, silty clay, M>Wp							
2				D/PID/pp	2.0		PID = 0 ppm/pp = 150-200 kPa		2
	2.3	Pit discontinued at 2.3m. Limit of investigation							

RIG: Russell

LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⧗ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 106
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Grass cover underlain by brown sandy silt with rootlets		D/PID	0.1		PID = 0 ppm		
	0.15	FILLING: Grass surface cover underlain by apparently moderately to well compacted, yellow, brown, grey sandy clay/clayey sand filling with sandstone gravels and cobbles, M~Wp		D/PID	0.5		PID = 0 ppm		
	1								1
	1.3	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID/pp	1.5		PID = 0 ppm/pp = 120-150 kPa		
	2			pp	2.0		pp = 140-180 kPa		2
		- ironstone gravels at 2.4m							
	2.5	Pit discontinued at 2.5m. Limit of investigation		D/PID/pp	2.5		PID = 0 ppm/pp = 200-250 kPa		

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ▼ Water level

CHECKED	
Initials:	
Date:	

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 107
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Light grey and brown gravelly sand mixed with clayey silt, moist		D/PID	0.1		PID = 0 ppm		
	0.15	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp		pp	0.2		pp = 180-200 kPa		
				D/PID	0.3		PID = 0 ppm		
				pp	0.6		pp = 200-250 kPa		
	1	- ironstone gravels and cobbles from 1.0m		pp	1.0		pp = 350-400 kPa		1
				D/PID	1.5		PID = 0 ppm		
	1.6	Pit discontinued at 1.6m. Refusal on extremely weathered sandstone							
	2								2

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: No Free Groundwater Observed

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⫧ Water level

CHECKED
Initials:
Date:

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TEST PIT LOG

CLIENT: Warner Business Park Pty Ltd
PROJECT: Contamination Assessment
LOCATION: Cnr Hue Hue & Sparks Roads, Warnervale

SURFACE LEVEL: --
EASTING:
NORTHING:
DIP/AZIMUTH: 90°/--

PIT No: 108
PROJECT No: 41615.01
DATE: 25 Mar 08
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Dynamic Penetrometer Test (blows per mm) 5 10 15 20
		FILLING: Grass cover underlain by brown, medium plasticity, silty sandy clay		D/PID	0.1		PID = 0 ppm		
	0.25	SILTY CLAY: Grey mottled red brown, high plasticity, silty clay, M>Wp		D/PID/pp	0.5		PID = 0 ppm/pp = 180-210 kPa		
	0.7	FILLING: Grey brown, high plasticity, silty clay, M>Wp		D/PID	1.0		PID = 0 ppm		
1	1.3	FILLING: Clayey silt mixed with waste materials including FC pipe, timber rail ballast and plastic		D/PID	1.5		PID = 0 ppm		1
	1.7	Pit discontinued at 1.7m. Refusal on hard object							
2									2

RIG: Russell
LOGGED: Kerry

WATER OBSERVATIONS: Groundwater Seepage inflow at 1.3m

REMARKS:

☐ Sand Penetrometer AS1289.6.3.3
☐ Cone Penetrometer AS1289.6.3.2

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	PID	Photo ionisation detector
B	Bulk sample	S	Standard penetration test
U_x	Tube sample (x mm dia.)	PL	Point load strength Is(50) MPa
W	Water sample	V	Shear Vane (kPa)
C	Core drilling	▷	Water seep ⊻ Water level

CHECKED
Initials:
Date:

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Bore 304 from 1.02 m to 5.14 m

Proposed Business and Industrial Park Warnervale	PROJECT: 41615	Date April 2008	PLATE 1

Bore 401 from 4.01 m to 6.7 m

Proposed Business and Industrial Park Warnervale	PROJECT: 41615	Date April 2008	PLATE 2

APPENDIX C

RESULTS OF LABORATORY TESTING

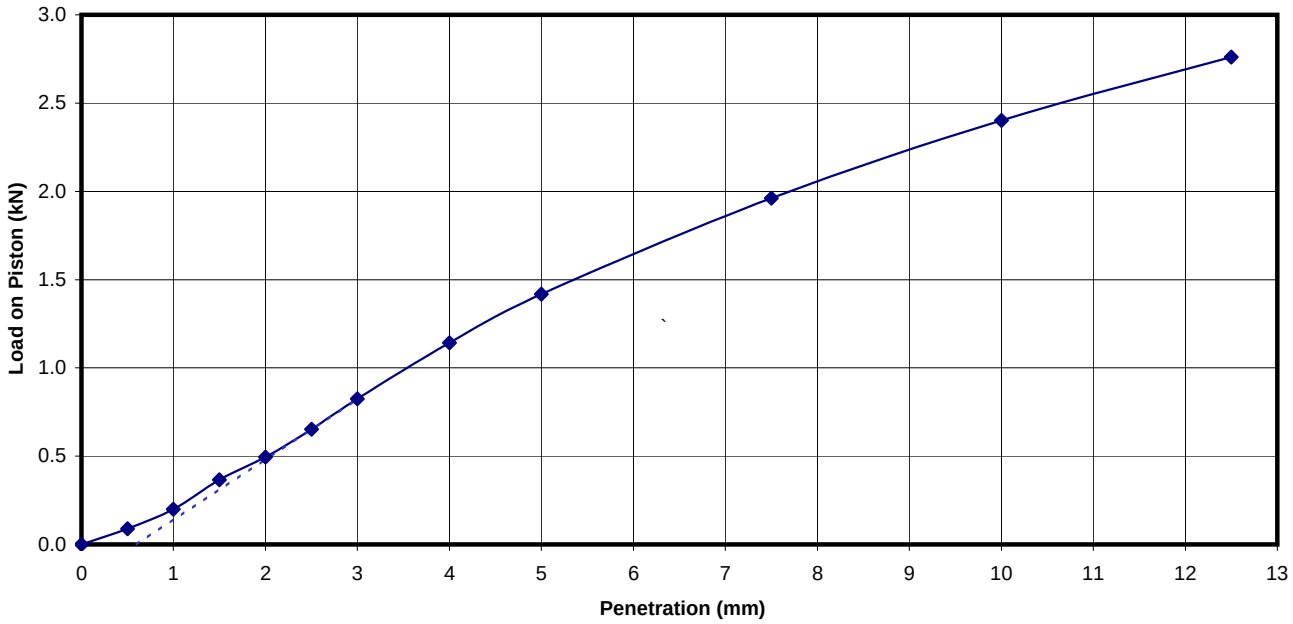
Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 073
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	BH 203		
Depth / Layer :	0.9 - 1.2m	**Page:**	1 of 1



Description: CLAYEY GRAVELLY SAND - brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 99% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.5%
MOISTURE RATIO: 98% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		12.0	1.91
After soaking		15.1	1.88
After test	Top 30mm of sample	15.7	-
	Remainder of sample	15.3	-
Field values		13.0	-
Standard Compaction		12.3	1.92

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**6**
	5.0 mm	**8**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory:

Tested:	BWO
Checked:	AW

Adam Wellings
Laboratory Manager

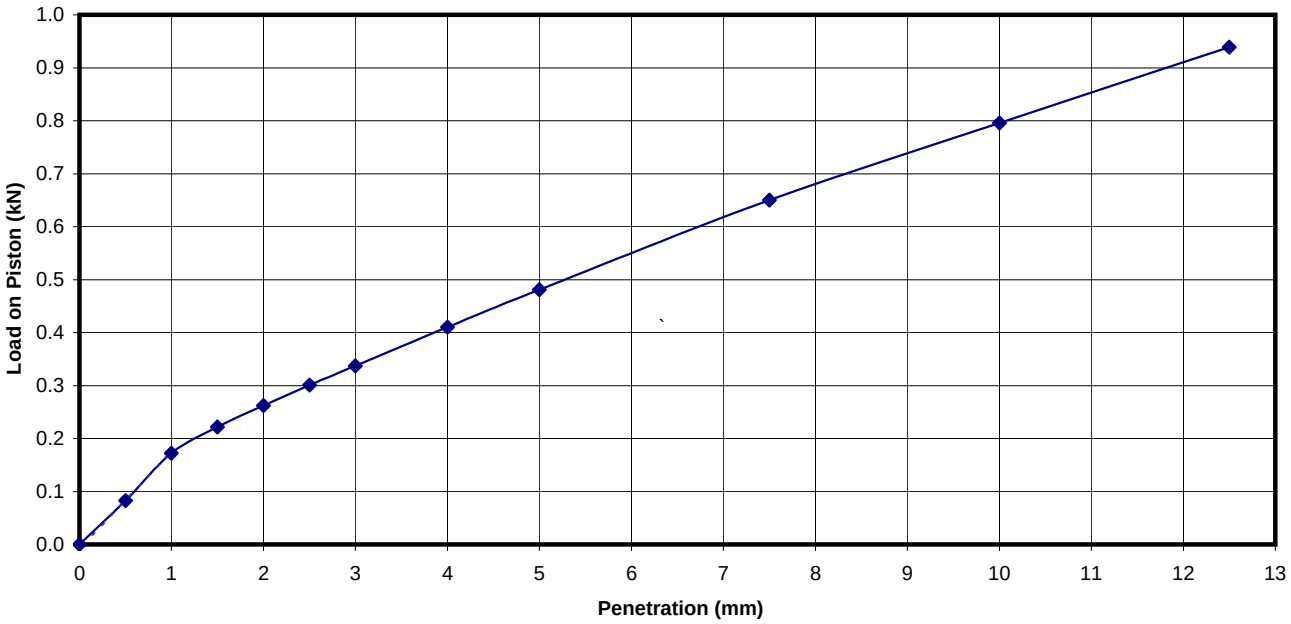
Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 072
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	BH 303		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1



Description: CLAY - red brown grey

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 101% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.8%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		19.6	1.65
After soaking		24.4	1.62
After test	Top 30mm of sample	22.9	-
	Remainder of sample	22.4	-
Field values		21.2	-
Standard Compaction		19.5	1.64

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**2.5**
	5.0 mm	**2.5**

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Approved Signatory:

Tested:	BWO
Checked:	AW

Adam Wellings
Laboratory Manager

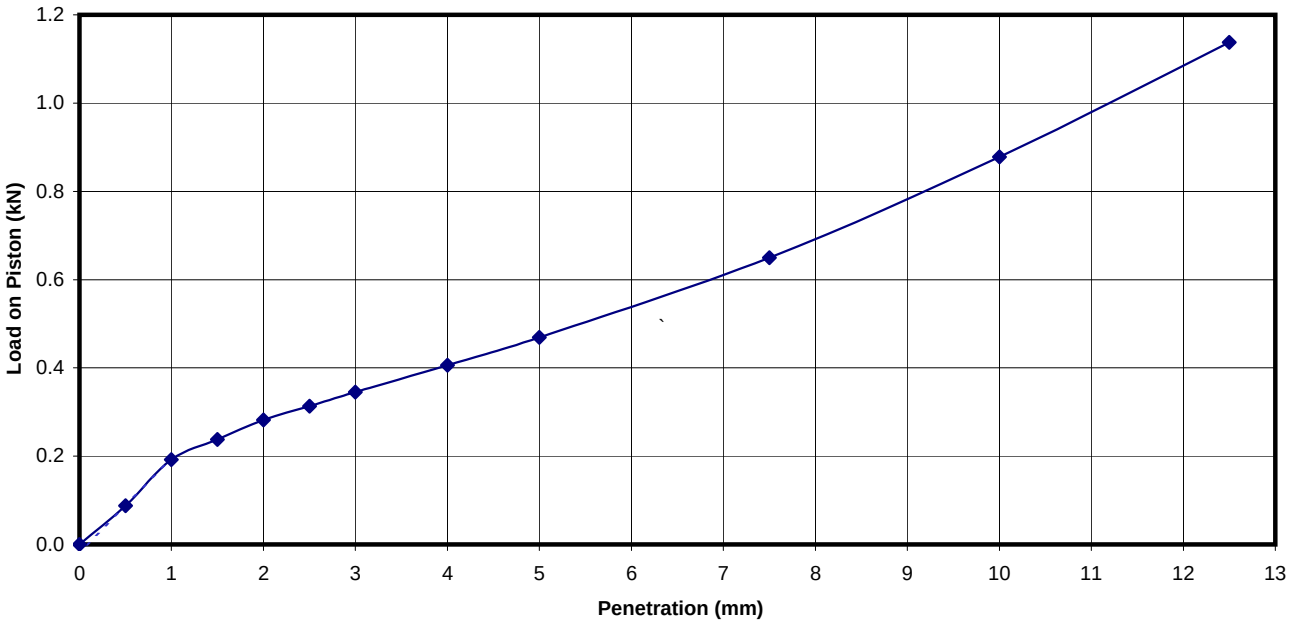
Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 071
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	Pit 20		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1



Description: SANDY CLAY - light brown mottled orange

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 99% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.6%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		17.8	1.75
After soaking		19.7	1.72
After test	Top 30mm of sample	19.3	-
	Remainder of sample	18.9	-
Field values		21.4	-
Standard Compaction		17.6	1.76

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**2.5**
	5.0 mm	**2.5**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828
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Accredited for compliance with ISO/IEC 17025

Approved Signatory:

Tested:	BWO
Checked:	AW

Adam Wellings
Laboratory Manager

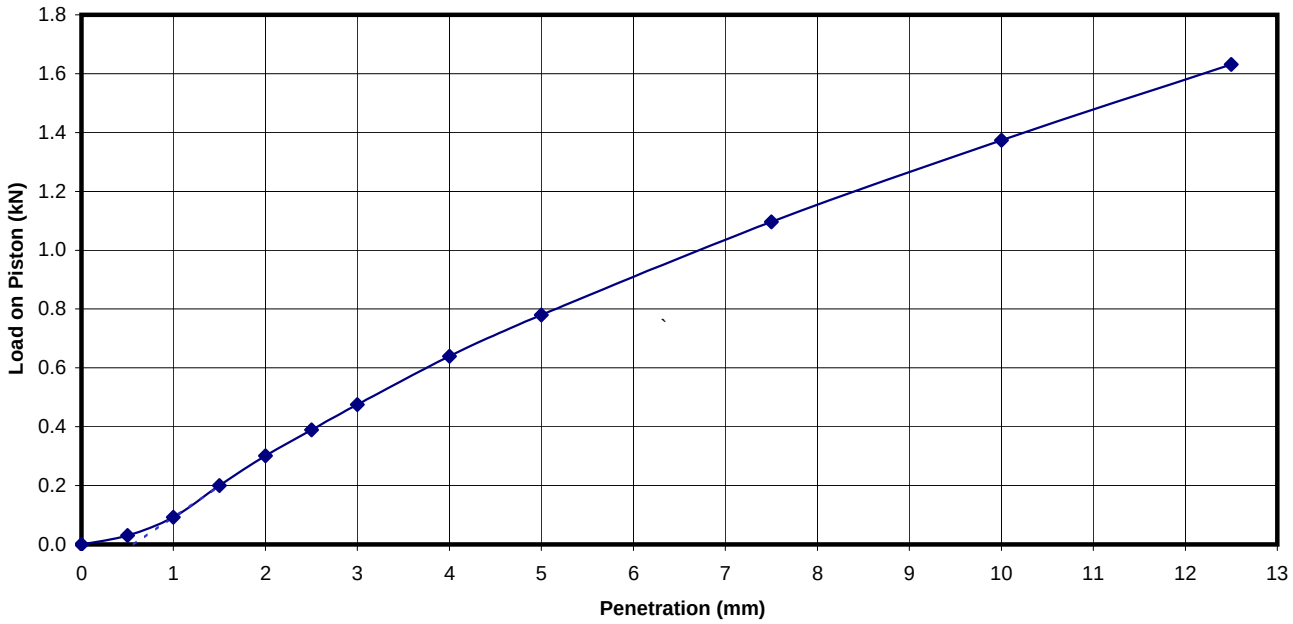
Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 070
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	Pit 13		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1



Description: SANDY CLAY - light grey mottled orange

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 101% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.8%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		17.1	1.72
After soaking		19.9	1.71
After test	Top 30mm of sample	18.8	-
	Remainder of sample	18.9	-
Field values		20.9	-
Standard Compaction		17.3	1.71

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**3.5**
	5.0 mm	**4.5**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
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Approved Signatory:

Tested:	BWO
Checked:	AW

Adam Wellings
Laboratory Manager

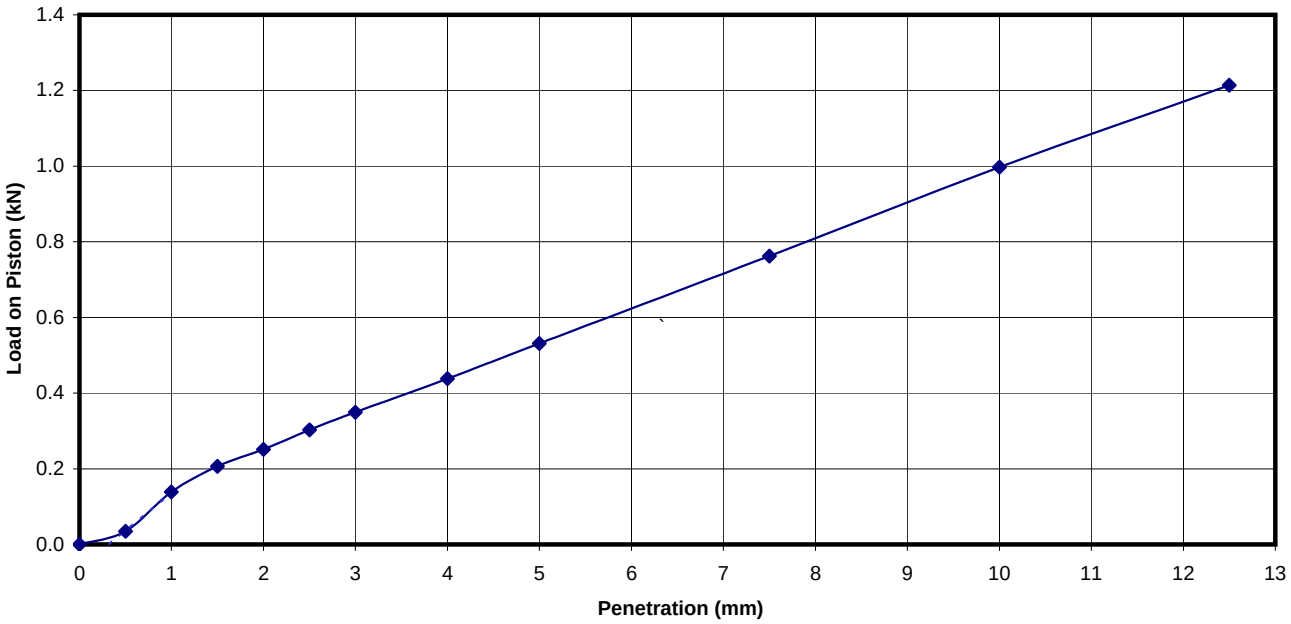
Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 069
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	Pit 11		
Depth / Layer :	0.5 - 1.0m	**Page:**	1 of 1



Description: SANDY CLAY - light grey mottled orange

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 1.6%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		16.2	1.80
After soaking		18.1	1.77
After test	Top 30mm of sample	17.4	-
	Remainder of sample	17.0	-
Field values		20.8	-
Standard Compaction		16.4	1.80

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**2.5**
	5.0 mm	**3.0**

NATA ACCREDITED FOR TECHNICAL COMPETENCE

NATA Accredited Laboratory Number: 828
This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory:

Tested:	BWO
Checked:	AW

Adam Wellings
Laboratory Manager

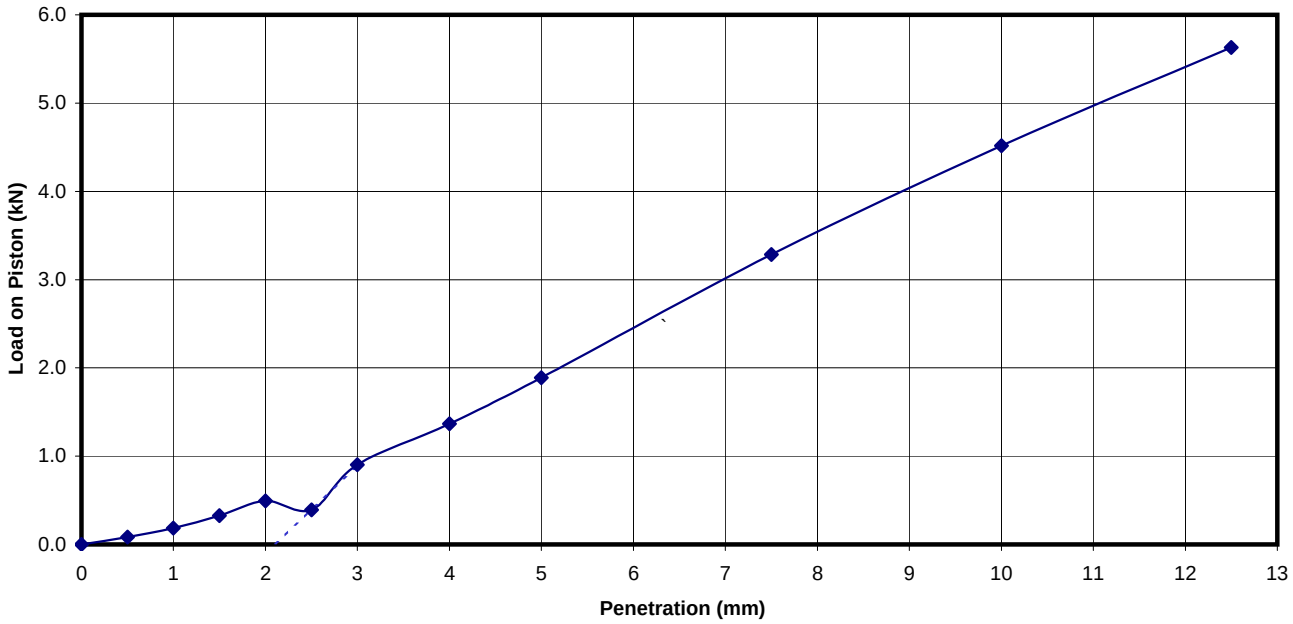
Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 068
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	Pit 21		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1



Description: SILTY SANDY CLAY - orange brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 100% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.3%
MOISTURE RATIO: 99% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		12.3	1.89
After soaking		14.3	1.88
After test	Top 30mm of sample	13.4	-
	Remainder of sample	13.6	-
Field values		12.6	-
Standard Compaction		12.5	1.88

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**13**
	5.0 mm	**16**

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Adam Wellings
Laboratory Manager

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Geotechnics · Environment · Groundwater

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ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

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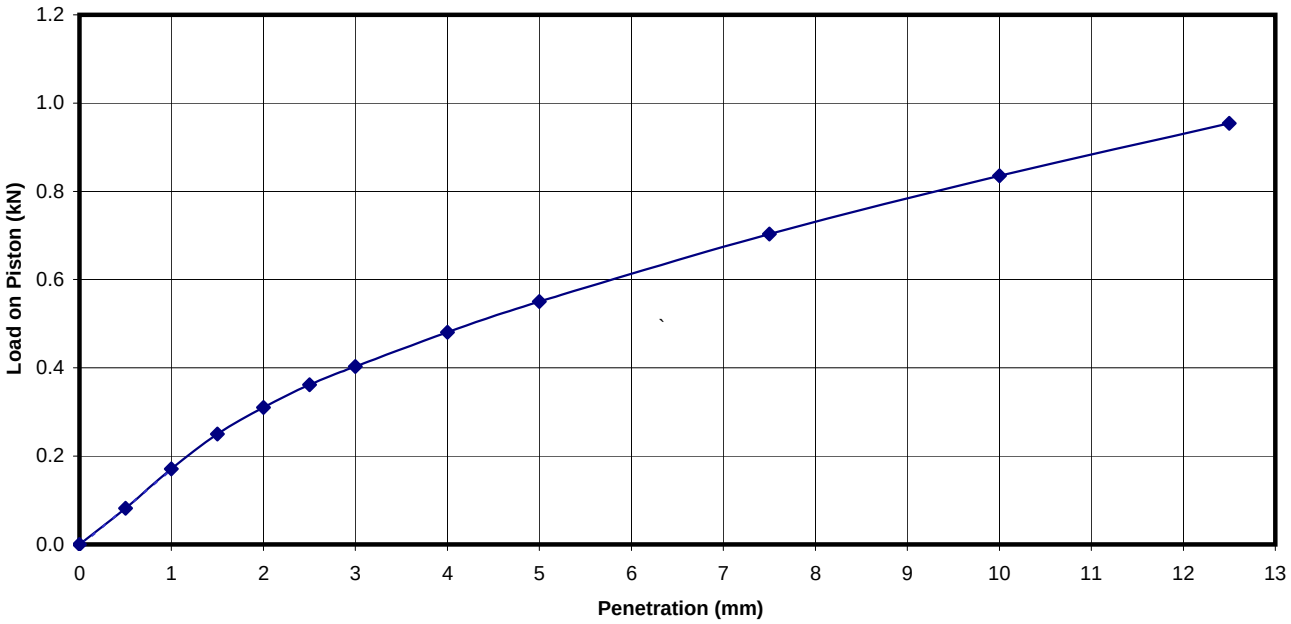
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 067
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	Pit 1		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1



Description: SILTY CLAY - grey orange brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 99% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.9%
MOISTURE RATIO: 101% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		21.7	1.59
After soaking		24.6	1.58
After test	Top 30mm of sample	23.9	-
	Remainder of sample	23.2	-
Field values		24.9	-
Standard Compaction		21.5	1.61

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**3.0**
	5.0 mm	**3.0**

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Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

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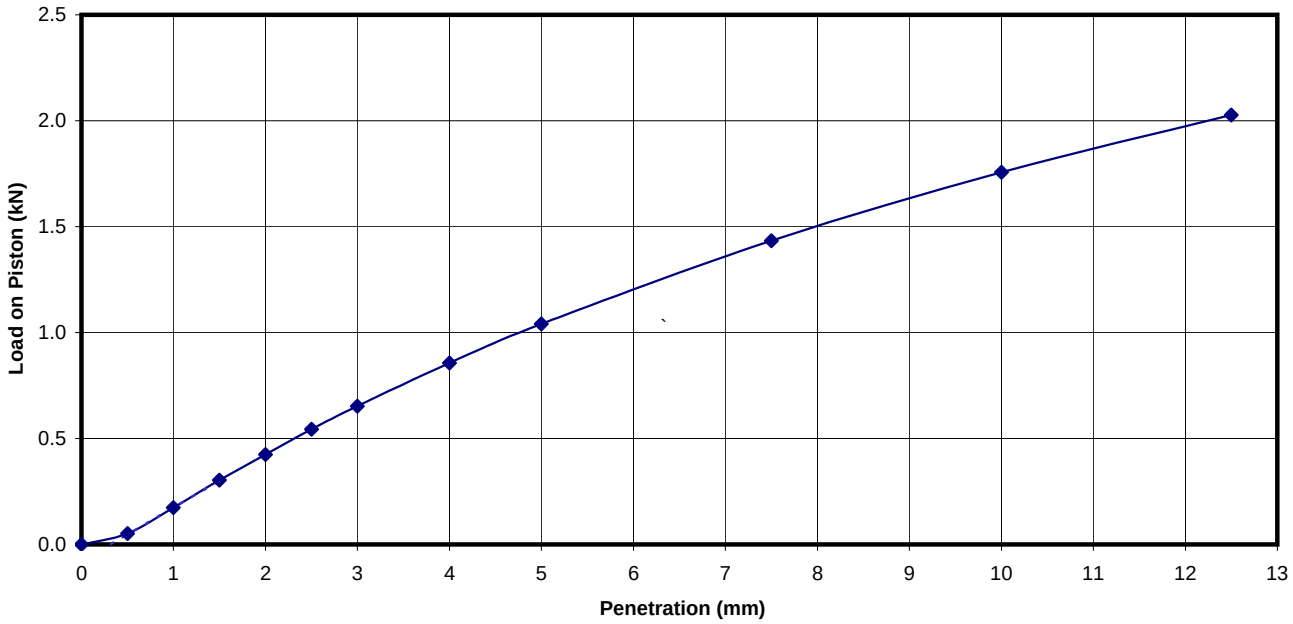
ABN 75 053 980 117
Unit D/7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D/7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 4351 1410
wyong@douglaspartners.com.au

RESULT OF CALIFORNIA BEARING RATIO TEST

Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 074
Project :	Geotechnical Investigation	**Report Date :**	14.4.08
		Date Sampled :	21.4.08
Location :	Warnervale	**Date of Test:**	8.4.08
Test Location :	Pit 7		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1



Description: SANDY SILTY CLAY - light grey orang brown

Test Method(s): AS 1289.6.1.1-1998, AS 1289.2.1.1-2005

Sampling Method(s): SAMPLED BY FIELD ENGINEER **Percentage > 19mm:** 0.0%

LEVEL OF COMPACTION: 101% of STD MDD **SURCHARGE:** 4.5 kg **SWELL:** 0.8%
MOISTURE RATIO: 98% of STD OMC **SOAKING PERIOD:** 4 days

CONDITION		MOISTURE CONTENT %	DRY DENSITY t/m^3
At compaction		16.2	1.77
After soaking		18.6	1.76
After test	Top 30mm of sample	18.6	-
	Remainder of sample	17.0	-
Field values		17.4	-
Standard Compaction		16.5	1.76

RESULTS		
TYPE	**PENETRATION**	**CBR (%)**
TOP	**2.5 mm**	**4.5**
	5.0 mm	**6**

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Adam Wellings
Laboratory Manager

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Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

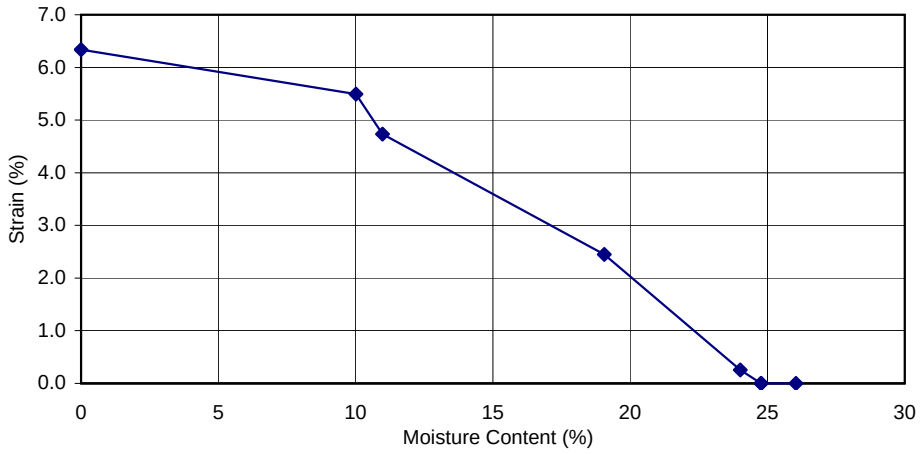
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 081
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	3.4.08
Test Location :	Pit 17		
Depth / Layer :	0.6 - 0.9m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	5.5 %
Shrinkage - oven dried	6.3 %
Significant inert inclusions	Nil %
Extent of cracking	UC
Extent of soil crumbling	Nil %
Moisture content of core	24.8 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	230 kPa
Pocket penetrometer reading at final moisture content	180 kPa
Initial Moisture Content	23.8 %
Final Moisture Content	26.0 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 3.5% per Δ pF

Description: SILTY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	AW
Checked:	BWO

Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

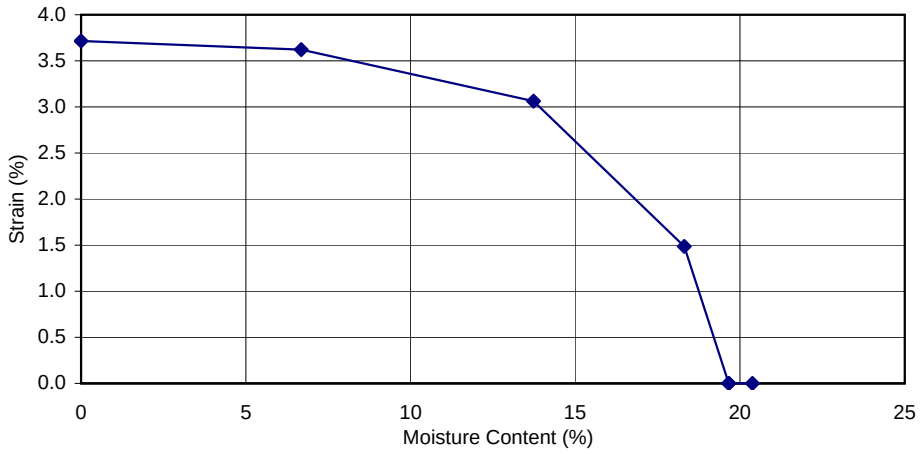
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 080
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	3.4.08
Test Location :	Pit 19		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	3.6 %
Shrinkage - oven dried	3.7 %
Significant inert inclusions	Nil %
Extent of cracking	SC
Extent of soil crumbling	Nil %
Moisture content of core	19.7 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	200 kPa
Pocket penetrometer reading at final moisture content	130 kPa
Initial Moisture Content	17.1 %
Final Moisture Content	20.4 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 2.1% per Δ pF

Description: SANDY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
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Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

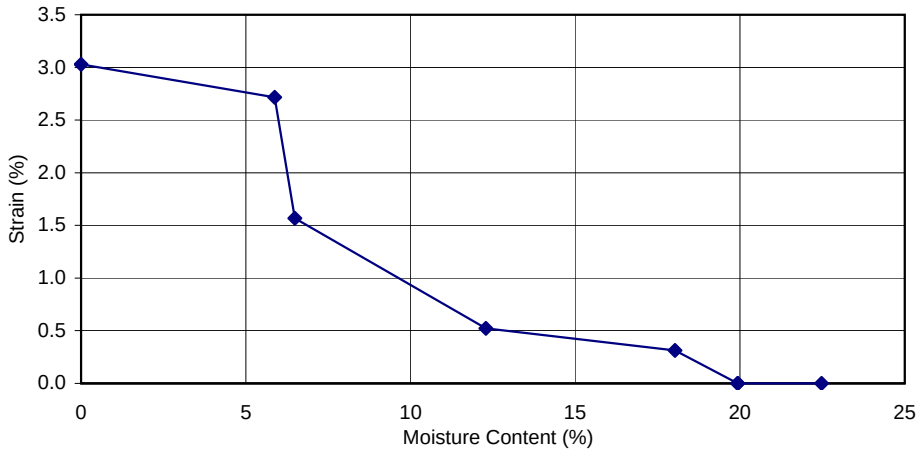
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 079
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 14		
Depth / Layer :	0.5 - 0.6m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.7 %
Shrinkage - oven dried	3.0 %
Significant inert inclusions	2.0 %
Extent of cracking	SC
Extent of soil crumbling	2.0 %
Moisture content of core	19.9 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	200 kPa
Pocket penetrometer reading at final moisture content	130 kPa
Initial Moisture Content	20.6 %
Final Moisture Content	22.5 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.7% per Δ pF

Description: SILTY SANDY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	AW
Checked:	BWO

Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

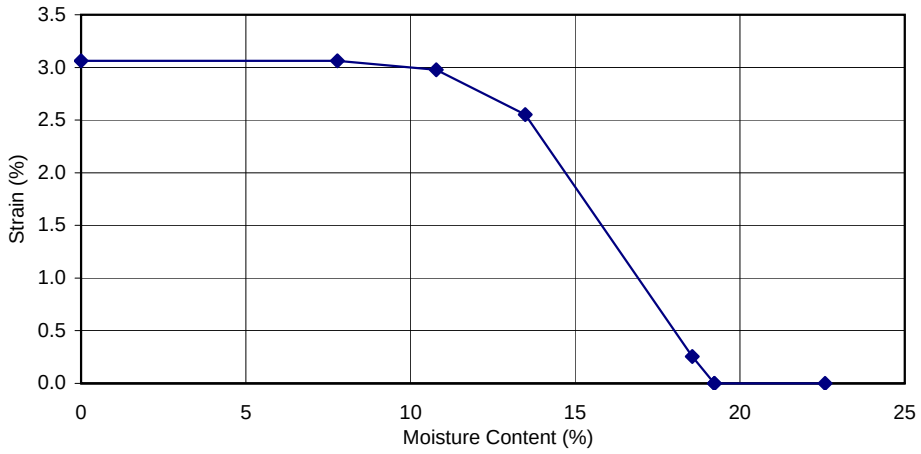
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 078
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 10		
Depth / Layer :	0.6 - 0.9m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	3.1 %
Shrinkage - oven dried	3.1 %
Significant inert inclusions	2.0 %
Extent of cracking	SC
Extent of soil crumbling	2.0 %
Moisture content of core	19.2 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	200 kPa
Pocket penetrometer reading at final moisture content	150 kPa
Initial Moisture Content	22.3 %
Final Moisture Content	22.6 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.7% per Δ pF

Description: SILTY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828

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Approved Signatory:

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Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

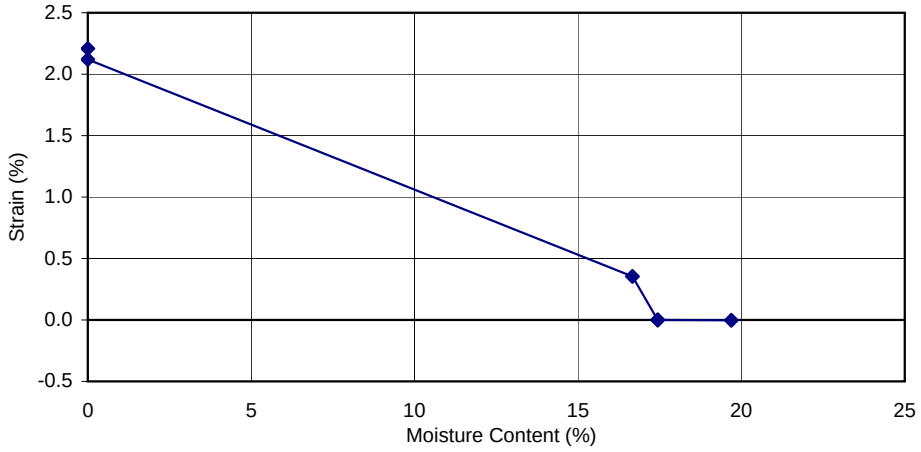
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 077
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 15		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.1 %
Shrinkage - oven dried	2.2 %
Significant inert inclusions	2.0 %
Extent of cracking	SC
Extent of soil crumbling	2.0 %
Moisture content of core	17.4 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	230 kPa
Pocket penetrometer reading at final moisture content	160 kPa
Initial Moisture Content	17.7 %
Final Moisture Content	19.7 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.2% per Δ pF

Description: SANDY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
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Approved Signatory:

Tested:	AW
Checked:	BWO

Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

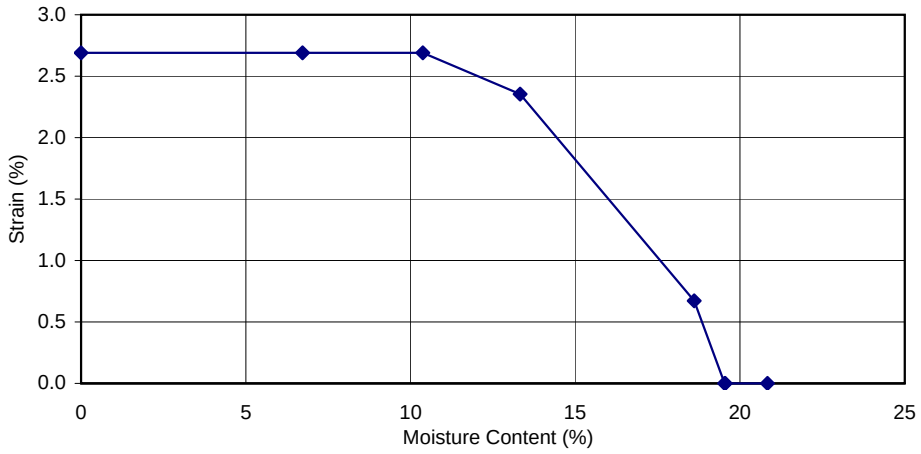
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 076
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 5		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.7 %
Shrinkage - oven dried	2.7 %
Significant inert inclusions	2.0 %
Extent of cracking	SC
Extent of soil crumbling	2.0 %
Moisture content of core	19.5 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	190 kPa
Pocket penetrometer reading at final moisture content	130 kPa
Initial Moisture Content	19.3 %
Final Moisture Content	20.8 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.5% per Δ pF

Description: SANDY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
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Approved Signatory:

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Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

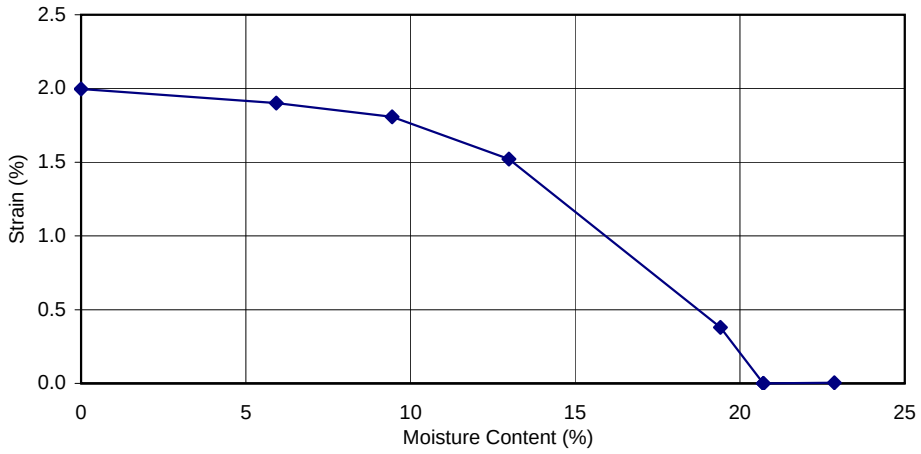
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 075
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 23		
Depth / Layer :	0.5 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	1.9 %
Shrinkage - oven dried	2.0 %
Significant inert inclusions	Nil %
Extent of cracking	UC
Extent of soil crumbling	Nil %
Moisture content of core	20.7 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	150 kPa
Pocket penetrometer reading at final moisture content	70 kPa
Initial Moisture Content	18.5 %
Final Moisture Content	22.9 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.1% per Δ pF

Description: SILTY SANDY CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828

This Document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025

Approved Signatory:

Tested:	AW
Checked:	BWO

Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

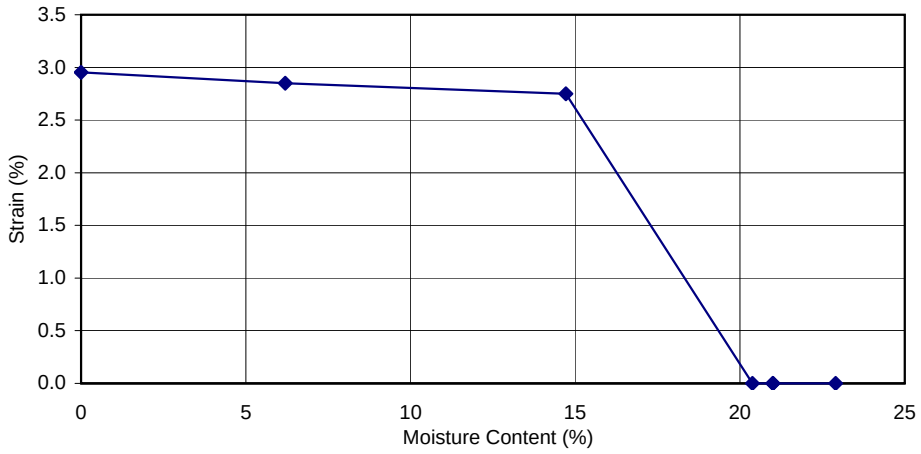
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 082
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	3.4.08
Test Location :	Pit 8		
Depth / Layer :	0.4 - 0.8m	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.9 %
Shrinkage - oven dried	3.0 %
Significant inert inclusions	Nil %
Extent of cracking	UC
Extent of soil crumbling	Nil %
Moisture content of core	21.0 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	190 kPa
Pocket penetrometer reading at final moisture content	150 kPa
Initial Moisture Content	22.3 %
Final Moisture Content	22.9 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 1.6% per Δ pF

Description: CLAY - light grey orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

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Unit D7 Donaldson Street
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RESULT OF SHRINK-SWELL INDEX DETERMINATION

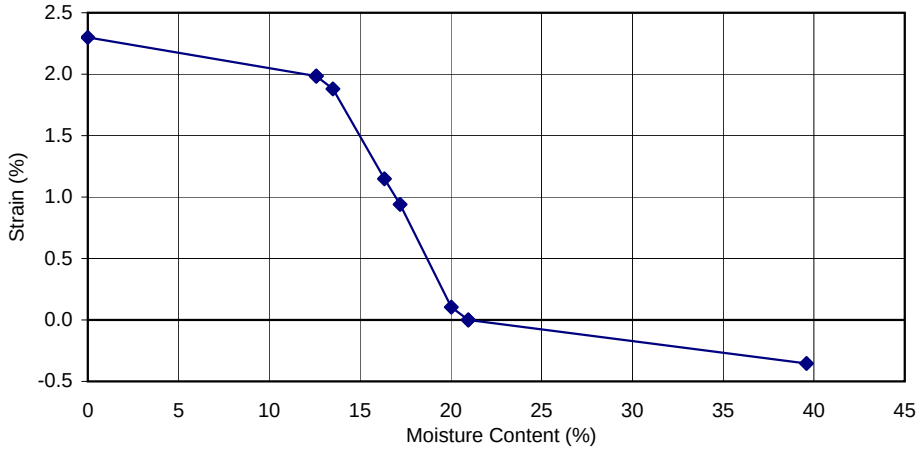
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 075
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 26		
Depth / Layer :	0.45 - 0.8	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	2.0 %
Shrinkage - oven dried	2.3 %
Significant inert inclusions	Nil %
Extent of cracking	UC
Extent of soil crumbling	Nil %
Moisture content of core	21.0 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	400 kPa
Pocket penetrometer reading at final moisture content	100 kPa
Initial Moisture Content	20.2 %
Final Moisture Content	39.6 %
Swell under 25kPa	0.4 %



SHRINK-SWELL INDEX Iss 1.4% per Δ pF

Description: SILTY CLAY - Light grey mottled red brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

NATA Accredited Laboratory Number: 828
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Accredited for compliance with ISO/IEC 17025

Approved Signatory:

Tested:	AW
Checked:	BWO

Adam Wellings
Laboratory Manager

Douglas Partners
Geotechnics · Environment · Groundwater

Douglas Partners Pty Ltd
ABN 75 053 980 117
Unit D7 Donaldson Street
North Wyong NSW 2259
Australia

Unit D7 Donaldson Street
North Wyong NSW 2259
Phone (02) 4351 1422
Fax: (02) 43511410
wyong@douglaspartners.com.au

RESULT OF SHRINK-SWELL INDEX DETERMINATION

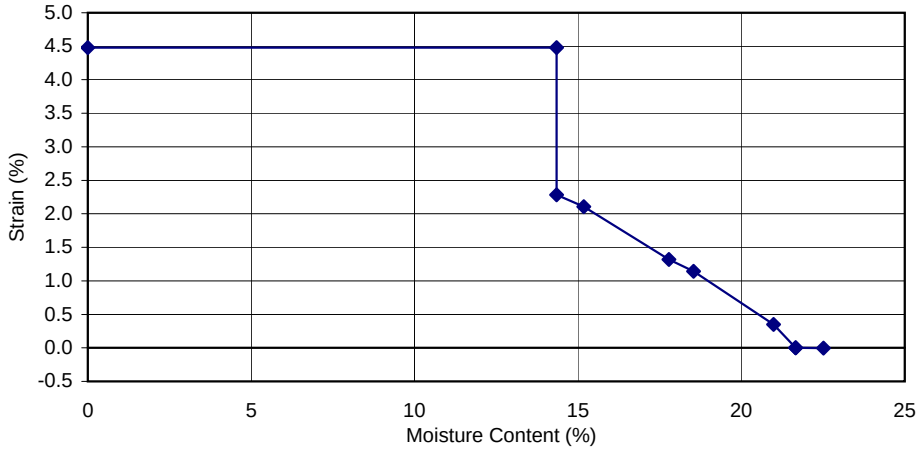
Client :	Warner Business Park Pty Ltd	**Project No. :**	41615
		Report No. :	CC08 - 075
Project :	Geotechnical Investigation	**Report Date :**	11.4.08
		Date Sampled :	21.3.08
Location :	Warnervale	**Date of Test:**	1.4.08
Test Location :	Pit 27		
Depth / Layer :	0.45 - 0.8	**Page:**	1 of 1

CORE SHRINKAGE TEST

Shrinkage - air dried	4.5 %
Shrinkage - oven dried	4.5 %
Significant inert inclusions	Nil %
Extent of cracking	UC
Extent of soil crumbling	Nil %
Moisture content of core	21.7 %

SWELL TEST

Pocket penetrometer reading at initial moisture content	275 kPa
Pocket penetrometer reading at final moisture content	190 kPa
Initial Moisture Content	18.5 %
Final Moisture Content	22.5 %
Swell under 25kPa	0.0 %



SHRINK-SWELL INDEX Iss 2.5% per Δ pF

Description: SILTY CLAY - Light grey mottled orange brown

Test Method(s): AS 1289.7.1.1 - 2003, AS 1289.2.1.1 - 2005

Sampling Method(s): Sampled By Douglas Partners Engineering Department

Extent of Cracking:
UC - Uncracked
SC - Slightly cracked
MC - Moderately cracked
HC - Highly cracked
FR - Fractured

Remarks:

Note that NATA accreditation does not cover the performance of pocket penetrometer readings

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Approved Signatory:

Tested:	AW
Checked:	BWO

Adam Wellings
Laboratory Manager