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FORBES RIGBY PTY LTD

PROPOSED RESIDENTIAL AND COMMERCIAL DEVELOPMENT

THE WOOL ROAD AND NAVAL COLLEGE ROAD, VINCENTIA

MASTERPLANNING STUDY (GEOTECHNICAL)

REPORT G23085/1-D NOVEMBER 2003

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G23085/1-D GP:TC
16th December 2003

Forbes Rigby Pty Ltd
278 Kiera Street
WOLLONGONG NSW 2500

Attention: Mr Martin Wells

Dear Sir

Re: Proposed Residential and Commercial Development, The Wool Road and Naval College Road, Vincentia: Masterplanning Study

Find enclosed report covering geotechnical and related issues for the Masterplanning Study for the above project site.

This report presents the results of desk studies, field and laboratory testing and describes surface, subsurface, geophysical and geotechnical conditions at the site. The report provides an assessment of geotechnical, soil salinity, acid sulphate soil and contamination constraints and guidelines on pavements, footings and earthworks for a proposed multi-lot residential and commercial development.

Please contact Mr Gary Peake or the undersigned if you require further assistance.

For and on behalf of
Network Geotechnics Pty Ltd

for: R J King *BE (Civil)*
Principal Geotechnical Engineer

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DRAWING No. G23085/1-1 Site Plan

DRAWING No. G23085/1-2 Interpolation of the plan extent and depth of non saline soils

EXECUTIVE SUMMARY

Network Geotechnics Pty Ltd has carried out the geotechnical component of a masterplanning study for a proposed residential and commercial development at Lots 801 and 802 in DP1022286 at the northern corner of the intersection of The Wool Road and Naval College Road (Jervis Bay Road), Vincentia.

The site occupies an area of about 115 hectares and its topography includes three broad valleys draining to the north-east and two ridges trending in a similar direction. The northern flank of another similarly trending ridge forms the south-east portion of the site. The central and southern valleys converge at the site topographic low just beyond the northern site boundary. There is extensive sedgeland vegetation within the southern valley/creek. The other valley/creeks and ridges are vegetated with mainly wooded grassland.

This masterplanning study has considered major potential limitations in areas of soil salinity, pavements, AS2870 classifications, acid sulphate soils and contamination. The study has been based on review of land titles records and historical aerial photographs, review of soil landscape and geology maps of the area, a walk/drive over inspection, subsurface test pit and borehole investigations and extensive laboratory testing.

Salinity risk is essentially restricted to valley floor areas only typically below depths of 0.5 to 1.0m below existing surface levels. It is beneficial that these areas are to remain undeveloped habitat corridors.

Pavements could be designed for natural subgrade having soaked CBR in the range of about 2.5% to 5%. However there is likely to be the need for extensive replacement of excessively wet subgrade unless construction is undertaken following a period of extended dry weather. Indicative pavement thickness would be in the range of 300mm to 600mm plus subgrade replacement. Alternatively, it is considered that relatively thin pavements (250mm to 300mm) could be constructed on lime stabilised natural subgrade. A soaked CBR value of 10% could be considered for 3% added lime and a 300 to 350mm stabilisation depth subject to confirmatory testing.

It is anticipated that Class M (moderately reactive) would be the dominant classification at the site in accordance with AS2870-1996 "Residential Slabs and Footings". However, areas of Class H (highly reactive) should be anticipated.

It is considered unlikely that potential acid sulphate soils will be encountered at the site. Notwithstanding, acid sulphate soils should be considered for any specific structures founded below about RL3m.

Our studies have not identified any former land use that would be of concern in terms of contamination. Site inspection has identified localised possible broken asbestos sheeting and an abandoned car. It is considered likely that any contamination would be localised and could be managed or remediated in such a way as to permit future residential development of the site.

None of the above constraints are considered to represent major limitations for proposed development.

1.0 INTRODUCTION

As requested, Network Geotechnics Pty Ltd has carried out the geotechnical component of a masterplanning study for a proposed residential and commercial development at the northern corner of The Wool Road and Naval College Road (Jervis Bay Road), Vincentia. A plan of the site is shown on the attached Drawing No G23085/1-1.

Interim findings of this study were presented in our Constraints Report G23085/1-C of 22/9/03.

The site is identified as Lots 801 and 802 in DP1022286 Jervis Bay Road and occupies an area of about 115 hectares bound by The Bay and Basin Leisure Centre to the north-east, vacant land to the north, Public Reserve to the west, Jervis Bay Road to the south and The Wool Road to the east.

Proposed development is understood to comprise a shopping centre within Lot 801 either adjacent to the Bay and Basin Leisure Centre or fronting The Wool Road and about 900 residential dwellings over the balance of the site (Lot 802).

The aims of the study were to assess surface, subsurface and geotechnical conditions at the site in order to provide an assessment of soil salinity, acid sulphate soils, indicative pavement thickness designs, AS2870 classifications and preliminary contamination site assessment.

This report should be read in conjunction with the attached General Notes.

2.0 FIELDWORK

Fieldwork for this study was undertaken between 29-31/7/03 and comprised:

- A drive/walk over site inspection by our Principal Geotechnical Engineer and one of our Senior Geotechnical Engineers.
- Forty seven test pits/boreholes (TPA1, TPA2, TPB1, TPB3, TPC1, to TPC4, TPD1 to TPD5, TPE1 to TPE6, TPF1 to TPF8, BHF9, TPG1 to TPG9, TPH1 to TPH4, BHI1 to BHI3, BHJ1 and BHJ2) located by hand held GPS (reported sub 5m accuracy). Topographic settings for the test pits/boreholes included ridgetop (9), slope (26) and valley floor (12). Test depths ranged between about 1.5m and 3m. Four of the boreholes within a proposed commercial precinct in the eastern portion of the site were completed as standpipe piezometers.
- Dynamic cone penetrometer (DCP) soundings adjacent to most test locations to depths ranging from about 0.75m to 1.8m.
- Surface water sampling under dry weather conditions at three locations [SW1 – upstream (east), SW2 – upstream (west) and SW3 – downstream convergence of the east and west valleys just outside the northern boundary] within low lying wet valley floor areas.

The fieldwork was carried out by one of our Senior Geotechnical Engineers and three of our Engineers/Assistants who selected the test locations, carried out insitu testing and soil and water sampling and prepared field logs of the test pits/boreholes.

Engineering logs of the test pits/ boreholes are presented in Appendix A, together with an explanation sheet defining the terms and symbols used. The test locations are shown on the attached Drawing No G23085/1-1.

3.0 LABORATORY TESTING

Laboratory testing carried out on samples obtained during this study included the following:

- Textural Classification (45) and Electrical Conductivity (45) to aid assessment of salinity characteristics.
- Cation Exchange Capacity (15) to determine ratio of exchangeable sodium to total cations for assessment of sodicity. The ratio of calcium to magnesium exchangeable cations from this test can be used to aid assessment of soil dispersiveness.
- Emmerson Crumb (9) to aid assessment of soil dispersiveness.
- Sulphate (15) to aid assessment of soil aggression to concrete and steel structures.
- Atterberg Limits (9) and Gradings passing 75μm (4) and passing 2μm (4) to aid assessment of soil classification.
- California Bearing Ratio (9) to aid assessment of subgrade strength and pavement thickness requirements.
- Shrink-Swell (9) to aid assessment of soil volume change characteristics with changes in soil moisture (reactivity) and AS2870 classifications.
- pH in H_2O (47) to assess existing acidity, pH in H_2O_2 (20) to assess potential acidity and Chromium Reducible Sulphur (8) to aid assessment of acid sulphate soils and neutralising lime requirements.
- Chemical analysis of surface water (3) for a suite of analytes to aid assessment of surface water quality entering and leaving the site.

The test results are presented in Appendix B, summarised in the attached Tables 1 to 3 and are discussed in Section 6.0.

4.0 SITE CONDITIONS

4.1 Surface

Site topography includes three broad valleys draining to the north-east and two ridges trending in a similar direction. The northern flank of another similarly trending ridge forms the south-east portion of the site. The valleys are typically 350 to 450m apart and the east and west facing side slopes are typically 3 to 6°. The central and southern

valleys converge at the site topographic low (RL 1m to 3m AHD) just beyond the northern site boundary. The ridge tops generally range from about RL 20m to 15m AHD.

There is extensive sedgeland vegetation within the southern valley/creek. The other valley/creeks and ridges are vegetated with mainly wooded grassland.

Moona Creek Road (unformed) extends north from Jervis Bay Road through the central portion of the site (eastern portion of Lot 802). Colossus Avenue (sealed) provides access to the Bay and Basin Leisure Centre from The Wool Road through the south-east portion of the site (Lot 801).

An electricity easement lies close to the southern site boundary and a sewer rising main easement extends from The Wool Road to Moona Creek Road near the northern site boundary. The easements are mostly defined by bare access tracks. A bare unvegetated area up to about 50m wide extends along the north-west side of Colossus Avenue and is assessed to be the result of previous topsoil extraction. Several vehicle tracks extend from this area.

4.2 Subsurface

Geology maps of the area indicate the majority of the site to be underlain by Wandrawandian Siltstone. The low lying north-east portion of the site is underlain by Quaternary Alluvium. Subsurface conditions and soil salinity characteristics encountered at the test locations may be summarised as follows:

TOPOGRAPHY	LAYER	DESCRIPTION	Depth (m)	SALINITY
Ridges	Topsoil	Silty SAND, brown	0.1-0.3m	NS
	Residual	CLAY, Silty CLAY, Sandy CLAY, low to medium and high plasticity, orange-brown and yellow-brown	0.5-1.05m	NS
		Silty CLAY/Clayey SILT, pale grey	1.2-2.4m	NS
	Rock	SILTSTONE (west ridge) and SANDSTONE (east ridge), extremely to highly weathered		NS (MS below 1.6m at TPD4)
Side Slopes	Topsoil	Silty SAND to Silty CLAY from east to west, thickness generally increasing to valley floors and to north	0.1-0.6m	NS
	Slopewash	Silty SAND and Clayey SAND, yellow-brown, pale grey, pale brown, thickness generally decreasing to west	0.15-1.05m	NS
	Residual	CLAY/Sandy CLAY, low to medium and high plasticity, orange-brown and yellow-brown	0.6-3.0m	NS (Note 2)

		Sandy Silty CLAY, Clayey SAND, Clayey SILT, low to medium and high plasticity, pale grey		NS (Note 2)
	Rock	SILTSTONE & SANDSTONE, from west to east (generally), extremely to highly weathered	1.3-3.0m	NS
Valley Floors	Topsoil	Silty SAND, brown and grey-brown		NS
	Slopewash	Clayey Silty SAND, Silty SAND, Clayey SAND, yellow-brown, pale grey and pale brown	0.2-0.4m	NS (Note 3)
	Residual	Sandy Silty CLAY, Sandy CLAY, orange-brown and red-brown	0.25-1.2m	NS (Note 4)
		Sandy Silty CLAY, Clayey SAND, Clayey SILT, low to medium and high plasticity, pale grey	0.9-2.4m	NS-MS
	Rock	SILTSTONE to SANDSTONE from west to east (generally), extremely to highly weathered	1.3-3.0m	NS-MS

Note:

1. *NS/SS/MS denotes non, slightly, moderately saline.*
2. *MS below 0.5m at TPG7 close to valley floor.*
3. *SS below 0.5m depth at TPF8*
4. *becoming SS below about 0.5m and NS-MS below about 1m*

Groundwater was measured at depths of 1m to 1.5m in the four standpipe piezometers installed between the southern valley and The Wool Road in the south-eastern portion of the site. Over the balance of the site to the north and west, seepage inflows were encountered at depths of typically 1m to 3m in a further six test pits and at 0.4m depth in one test pit. Groundwater levels and seepages may vary with fluctuations in rainfall, temperature and other factors.

5.0 SITE HISTORY

5.1 Site Inspection

Observations of typical natural and developed site surface features were described in Section 4.1. Visible sources of possible existing contamination were limited and include an abandoned car on the ridgeline off Moona Creek Road near TPH2 and some building debris including some probable broken fibro sheeting (containing asbestos) within a small localised area some 50m east of the intersection of Moona Creek Road and the sewer easement track.

5.2 Land Title Search

Historical ownership and occupancy records of all or parts of current Lots 801 and 802 of DP1022286 revealed by our lands title search are as follows:

Date	Owners/Activity	Comments
Prior to 1835	Crown	
16/1/1835	Edward Deas Thomson (Portion1, Grant 2560 acres)	
1/3/1839	1st Part W W Burton & G K Holden 2nd Part E Deas Thomson & Annie Maria 3rd Part D Chambers 4th Part Thomas Jedy	Conveyance D Chambers to T Jedy & G K Holden
27&28/3/1840	1st Part G K Holden & T Jedy 2nd Part Edward Deas Thomson & Anne Marie 3rd Part W H Goddard 4th Part W Macpherson	Appointment of New Trustee by Lease and Release
29/7/1841	E Deas Thomson to G K Holden	New Trust
24/6/1857	W Mackay & S E D Thomson	Marriage Settlement
27/8/1869	1st Part G K Holden 2nd Part E Deas Thomson 3rd Part A M Deas Thomson 4th Part Henry Burton Bradley	Appointment New Trustee
3/7/1874	1st Part H B Bradley 2nd Part E D Thomson 3rd Part A M D Thomson 4th Part C Rolleston	Appointment
5/9/1874	Probate of Will of Sir Edward Deas Thomson	
1/7/1874	D H Stirling & H C Deas Thomson	Marriage Settlement
22/2/1881	W R Campbell & E J Deas Thomson	
10/2/1885	Appointment of New Trustee	
2&3/1/1887	1st Part W W Burton & G Macleay 2nd Part E Deas Thomson & Anne Maria Deas Thomson 3rd Part G K Holden 4th Part David Chambers	Appointment of New Trustee by Lease and Release
3&4/1/1887	4th Part D Chambers to W W Burton & G K Holden	Appointment of New Trustee by Lease and Release
18/12/1903	Probate of Will – Lady Mackay	
7/5/1907	Probate of Will – Mary Jane Deas Thomson	

	Owner/Activity	Comments
26/9/1919	Supreme Court – order	
26/8/1922	Perpetual Trustee Company Ltd No 23076 (1789 acres)	
1/7/1950	Addition of Roads (public)	
20/12/1951	Queanbeyan Investments	
5/3/1998	Wollong Pty Ltd	
1/7/2003	Trust Company of Australia Ltd	

The above ownership records do not indicate operations or contaminants of concern.

5.3 Aerial Photographs

Aerial photographs archived at the Department of Infrastructure, Planning and Natural Resources in Sydney were viewed to aid assessment of site history. Prints dated 1961, 1975, 1980, 1997 and 2002 were available.

In 1961, the site appeared vacant and undisturbed except for Moona Creek Road (unsealed) extending north from Naval College Road through the centre of the site.

In 1975, the electricity easement close to the southern boundary had been installed.

In 1980, the site appeared relatively unchanged.

In 1997, a track forming Colossus Avenue from The Wool Road and the adjacent bare unvegetated area and several surrounding tracks within Lot 801 and the part of the sewer rising main easement track within Lot 802 had appeared. As noted in Section 4.1, the bare area is assessed to be the result of topsoil extraction.

In 2002, the Bay and Basin Leisure Centre building and adjacent oval and dams had been constructed to the north-east of the site. The sewer rising main easement track near the northern boundary of Lot 801 had appeared. Possible test pit excavation markings were visible around the bare area. No noticeable changes were observed within the balance of the site.

6.0 SITE CHARACTERISATION

6.1 Geology

Our studies indicate that the geology of the site is generally laterally consistent, with a 0.1 to 0.6m thick A1 Horizon consisting of Silty SAND and Silty CLAY topsoil overlying an A2 Horizon consisting of Silty SAND and Clayey SAND slopewash (side slopes and valley floors) overlying B Horizon CLAYS derived from insitu weathering of the underlying R Horizon (Regolith) siltstone and sandstone bedrock. The B Horizon comprises generally B1 Horizon upper CLAY, Silty CLAY and Sandy CLAY which are generally orange-brown, yellow-brown and red-brown, over B2 Horizon Sandy Silty CLAY, Clayey SAND and Clayey SILT which are generally pale grey.

6.2 Geophysical & Geotechnical Soil Conditions

Geophysical properties of electrical conductivity (EC), cation exchange capacity (CEC) and sulphate analysis, pH and Chromium Reducible Sulphur (CRS) and geotechnical properties of Atterberg Limits, California Bearing Ratio (CBR), Shrink-Swell (S/S) , Grading and Emmerson Crumb were measured on a selection of representative Horizons. Results are presented in Appendix B, summarised in Tables 1 and 2 and discussed below.

6.2.1 Topsoil (All Horizons)

A1 Horizon material was found to be mostly slightly acidic and non saline.

Laboratory tests on samples from BHI1 (slope) and BHI2 (slope) indicated pH (in H_2O) 4.5 and 4.1, pH (in H_2O_2) 1.2 and 1.8 and CRS 0.018% and 0.009%. Current guidelines from the "Acid Sulphate Soil Management Committee" (ASSMAC) are that pH<4 in H_2O may indicate actual acid sulphate soils (AASS) and pH<3 in H_2O_2 may indicate potential acid sulphate soils (PASS). CRS test results greater than or equal to 0.1%S, 0.06%S or 0.03%S (for fine, medium or coarse textured soil) indicates that acid will be produced upon oxidation of the soil. In view of the low CRS results, it is assessed that the pH tests in H_2O_2 have been affected by non sulphidic acidity generated by organic and/or ferrous inclusions. On this basis, it is considered that pH 1.2 and 1.8 (H_2O_2) at BHI1 and BHI2 unlikely to indicate PASS and the A1 Horizon samples are not actual or potential acid sulphate soils.

6.2.2 Slopewash (A2 Horizon)

A2 Horizon material was found to be slightly acidic, non to slightly saline and marginally sodic. Testing on two samples from TPF1 and TPF 8 from a valley floor indicates presence of exchangeable cations as a percentage of the exchange capacity as follows: calcium 3 to 8%, potassium 1%, magnesium 43% to 59% and sodium 8%.

The important basic exchangeable cation is calcium which counteracts the dispersive effect of sodium and is present at around 65% to 80% of the exchangeable capacity in healthy topsoils and near surface soils. In this case, 3 to 8% exchangeable calcium indicates a soil in poor condition. Magnesium is above its optimum of 10% to 25% and sodium is at a level that would be considered marginally sodic.

An indicator of potential clay dispersiveness is the ratio of exchangeable calcium to exchangeable magnesium. The A2 Horizon with ca/mg ratios of 0.1 at the above two locations below optimum balance level of 4 to 6, is assessed to be highly susceptible to dispersion. Sodic and calcium deficient dispersive clay is a very unfavourable plant rooting environment and even if not saline, a wide variety of shrubs and trees may fail to establish and/or flourish within such subsoils.

A2 Horizon samples indicated generally low sulphate levels of 21 and 467 mg/kg (2 samples) which combined with the slightly acidic pH values suggests low aggression to concrete structures.

Laboratory tests on a sample from TPG5 (slope) have indicated the Silty Clayey SAND to be low plasticity (LL 28%, PI 16%), high subgrade strength (CBR 7% increasing to 60% with 3% added lime by dry mass) and dispersive (Emmerson Class 2). Field

moisture content of the CBR sample was 2.5% wet of Standard Optimum Moisture Content (SOMC).

Laboratory tests on samples from valley floor and slope areas indicated pH in H_2O of 3.9 to 5.9, pH in H_2O_2 of 1.8 to 2.9 and CRS 0.006% to 0.0037%. The soils at these sampled locations are assessed not to be in an actual or potential acid sulphate soil condition.

6.2.3 Subsoil (B1 and B2 Horizons)

B1 Horizon material was found to be slightly acidic, non to slightly saline (moderately saline at TPF6 - valley floor) and non sodic (highly sodic at TPF7 - slope). This layer shows sever calcium deficiency, with exchangeable calcium percentage values ranging from 1 to 5% (4 tests) and 47% (1 test). The B1 Horizon is also susceptible to dispersion, having calcium/magnesium ratios ≤0.9 within ridge, slope and valley floor areas.

B1 Horizon samples indicated low and high sulphate levels ranging from 64 to 1286 mg/kg which, combined with the slightly acidic pH values suggests low to high aggression to concrete structures.

Laboratory tests have indicated the B1 Horizon samples to be generally medium to high plasticity (LL 45 to 74%, PI 28 to 49%), low to medium subgrade strength (CBR 2.5 to 9% increasing to 35 to 60% with 3% added lime by dry mass) moderately to highly reactive (Shrink Swell Iss 0.5 to 3.1%) and non to slightly dispersive (Emmerson Class 4,3). Laboratory tests on a Clayey SAND/Sandy CLAY sample from TPA1 (slope) indicate low plasticity (LL 20%, PI 0%), high subgrade strength (CBR 60%) and non to slightly dispersive (Emmerson Class 4). Field moisture contents for CBR samples ranged from 2 to 7.5% wet of SOMC.

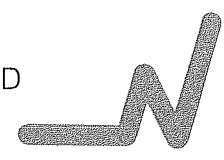
Laboratory tests on samples from BHF10 (valley) and BHI2 (slope) indicated pH (in H_2O) 4.8 and 4.9, pH (in H_2O_2) 2.9 and 3.2. The soils at these sampled locations are assessed not to be in an actual or potential acid sulphate condition.

B2 Horizon material was found to be slightly acidic, non to moderately saline and non to marginally sodic. This layer shows severe calcium deficiency with exchangeable calcium percentage values ranging from 1 to 13% (6 tests) and 30% (1 test). The B2 Horizon is also susceptible to dispersion, with calcium/magnesium ratios <0.5 within slope and valley floor areas.

B2 Horizon samples indicated low sulphate levels ranging from <5 to 358 mg/kg which, combined with the slightly acidic pH values, suggests low aggression to concrete structures.

Laboratory tests on samples from TPC4 (slope) indicated the B2 Horizon to be high plasticity (LL 62%, PI 40%), moderate subgrade strength (CBR 5%), low to moderately reactive (Shrink Swell Iss 1.3%) and non to slightly dispersive (Emmerson Class 4). Field moisture content of the CBR sample was 4.5% wet of SOMC.

Laboratory tests on samples from valley floor and slope areas indicate pH in H_2O of 4.7 to 5.0, pH in H_2O_2 of 2.1 to 3.3 and CRS 0.011 and 0.018%. The soil at these sampled locations is assessed not to be in an actual or potential acid sulphate condition.



6.2.4 Regolith (R Horizon)

R Horizon Siltstone and Sandstone was found to be slightly acidic, non to moderately saline and non sodic. Testing on a sample from TPD2 (ridge) shows a severe calcium deficiency, with exchangeable calcium percentage value of 1%. The R Horizon is susceptible to dispersion, with a calcium/magnesium ratio of about 0.0.

R Horizon sample from TPD2 indicates a low sulphate level of 214 mg/kg, which combined with the slightly acidic pH values suggests a low aggression to concrete structures.

Laboratory tests on samples from valley floor (BHF10) and slope (BHJ1) areas indicate pH (in H_2O) 5.2 and 4.7, pH (in H_2O_2) 2.9 and 3.0. The weathered rock at these sampled locations is assessed not to be in an actual or potential acid sulphate condition.

6.3 Groundwater & Surface Water

Groundwater was measured at depths of 1m to 1.5m in four standpipe piezometers installed between the southern valley and The Wool Road. This area includes the Bay and Basin Leisure Centre where shallow groundwater was known to be an issue during design and construction. Over the balance and major portion of the site to the north and west, minor seepage inflows were encountered at depths in a further six test pits and at 0.4m depth in another, although no standing groundwater was measured prior to backfilling.

Surface water samples (SW1, SW2 and SW3) have the following elevated analytes when compared to threshold levels indicated on Table 3; pH, colour, total hardness as C_aCO_3, magnesium, aluminium, chromium, lead, zinc and ammonia. Most of the above analytes except total hardness as C_aC0_3 and magnesium were elevated at the upstream locations which represent surface water entering the site. Surface water pH was slightly acidic at the downstream sampling location which could be expected due to its approximate RL 3m AHD.

7.0 IMPLICATIONS FOR DEVELOPMENT

7.1 Salinity

The "Final Draft Salinity Code of Practice" published recently by Western Sydney Regional Organisation of Councils Ltd (WSROC) notes that salinity may be an issue on mid to lower slopes in a shale landscape.

This study has indicated the ridges and slopes to generally comprise non saline A and B Horizon soils. At one lower slope location, moderately saline soil was encountered in the B1 and B2 Horizons. The valley floors generally comprise non saline A Horizon soils and non to moderately saline B Horizon soils. Non to moderately saline R Horizon regolith occurs in a range of topographic settings. Soils in a range of horizons and topographic settings are non to marginally sodic and susceptible to dispersion.

Analysis of 27 samples from nine locations on ridges/slopes and on 18 samples from 6 locations on valley floor areas indicates a mean depth between non saline and saline soils (and regolith) to be in the range of 0.5m to 1.0m generally within valley floor areas. Elsewhere, on ridges and slopes, the depth is generally >1.5m.

In order to aid preliminary assessment of salinity across the site interpreted depths of non saline soils are shown on the attached Drawing No G23085/1-2. The plan should be considered indicative only. Further detailed investigations may be required to refine/verify salinity distribution at the site for costing and or construction purposes.

The WSROC "code" suggests midslope high soil sulphate levels may be associated with deeply weathered shale profiles. Siltstone (shale) was present below depths of generally 1.3 to 3m within ridge and slope areas, mostly within the west portion of the site. Sulphates are aggressive to buried concrete, steel and brickwork.

The study indicates that A, B1, B2 and R Horizons generally have a low aggression to concrete structures (based on 13 tests), although 2 tests on samples of B1 Horizon at TPG7 (slope) and TPH4 (ridge) indicated high aggression.

It is assessed that soil salinity levels in the A and B1 Horizons on ridges and slopes at this site pose little or no risk in regards to i) plant growth and diversity, ii) chronic salt effects on porous media and iii) acute corrosive/aggressive effects on structures. The deeper B2 Horizon in valley floors may represent some risk to effects i) and ii) if exposed.

Based on the above, it is assessed that salinity risk is essentially restricted to valley floor areas only. It is beneficial that these areas are to remain undeveloped habitat corridors. Minor limitations imposed by salinity/sodicity would be the need for robust erosion control measures for stormwater flows entering valley floors/creeks and careful earthworks management adjoining such areas. Our current recommended practices for urban salinity include use of non saline soils won from road reserves on ridges/slopes as controlled fill to increase non saline cover in any lower lying building areas affected by shallow salinity.

In view of the above, the salinity levels are considered to not present a significant constraint to the proposed subdivision and residential development of the site unless there are proposed substantial cut/fill earthwork operations that cannot be managed effectively.

7.2 Pavements

Testing carried out on 9 samples of higher clay content mainly residual soils indicated soaked CBR values ranging from 2.5% to 9% (average about 4% and one outlier of 60%). The field moisture content of these samples was typically 2% to 7.5% wet of Standard Optimum. Three of the samples were also tested with 3% added lime and indicated soaked CBR values $\geq$40%.

Based on the above, pavements could be designed for natural subgrade having soaked CBR in the range of about 2.5 % to 5%. However, there is likely to be the need for extensive replacement of excessively wet subgrade unless construction is undertaken following a period of extended dry weather. Indicative pavement thickness would be in the range of 300mm to 600mm plus subgrade replacement.

Alternatively, it is considered that relatively thin pavements (250mm to 300mm) could be constructed on lime stabilised natural subgrade. A soaked CBR value of 10% could be considered for 3% added lime and a 300 to 350mm stabilisation depth subject to confirmatory testing. Two other benefits of lime stabilisation are decreased excavation

volumes (due to thinner pavements) and that lime effectively "dries" wet subgrade, ie the subgrade replacement should be avoided or significantly reduced.

7.3 AS2870 Classifications

Index testing of mainly residual clays indicates high and medium to high plasticity in six of nine samples. However, Shrink-Swell tests on the same/similar samples indicated Shrink-Swell Index (Iss) values ranging from 0.5% to 3.1%. Excluding the highest and lowest Iss results, the range is 0.9% to 2.6% and the average is about 1.5%.

Based on the above, it is anticipated that Class M (moderately reactive) would be the dominant classification in accordance with AS2870 – 1996 "Residential Slabs and Footings". However, areas of Class H (highly reactive) should be anticipated, particularly within areas that may undergo cut or fill during subdivision earthworks.

AS2870 classifications should be verified during subdivision development, probably on a stage by stage basis.

7.4 Acid Sulphate Soils

Indicator pH tests were carried out on 20 samples from 5 locations in the lower lying north-east portion of the site. One sample had pH <4.0 in H_20 and 17 samples had pH <3.0 in H_20_2. However, oxidisable sulfur based on nine Chromium Reducible Sulfur tests was low and indicated the soils to be non PASS (potential acid sulfate soil) if <1000 tonnes of soil are to be disturbed. One result from BHF9 (1.7 to 2.0m depth) was slightly elevated if >1000 tonnes of soil are to be disturbed.

Based on the above, it is considered unlikely that PASS soil will be encountered at the site. Notwithstanding, acid sulfate soils should be considered for any specific structures founded below about RL 3m. Projects that disturb >1000 tonnes of ASS with ≥0.03%S may require a detailed management plan.

7.5 Contamination

Based on land title records and historical aerial photographs, it is considered probable that there has been little previous site disturbance other than the formation of Moona Creek Road track, the electricity and sewer easements, the bare area of previous topsoil extraction and associated tracks along the north-west side of Collosus Avenue.

It is considered that timing of the appearance of the bare area may have coincided with the construction of the Bay and Basin Leisure Centre and/or Collosus Avenue. The topsoil may have been placed on nearby playing fields and/or the area may have been used as a storage for building materials.

Based on our site investigation, contaminants of concern relating to site use prior to residential construction would include possible localised hydrocarbons associated with an abandoned car on a ridge off the Moona Creek Road track near TPH2 and possible broken fibro sheets some 50m east of the intersection of the Moona Creek Road track and the sewer easement track.

Further studies may or may not identify contamination at this site. However, based on experience and the site history associated with this study, it is considered likely that any

contamination would be localised and could be managed/or remediated in such a way as to permit future development of the site.

8.0 CONCLUSION

This masterplanning study has considered major potential limitations in areas of soil salinity, pavements, AS2870 classifications, acid sulphate soils and contamination. The study has been based on review of land titles records and historical aerial photographs, review of soil landscape and geology maps of the area, a walk/drive over inspection, subsurface investigations and extensive laboratory testing.

Salinity risk is essentially restricted to valley floor areas only typically below depths of 0.5 to 1.0m below existing surface levels. It is beneficial that these areas are to remain undeveloped habitat corridors.

Pavements could be designed for natural subgrade having soaked CBR in the range of about 2.5% to 5%. However there is likely to be the need for extensive replacement of excessively wet subgrade unless construction is undertaken following a period of extended dry weather. Indicative pavement thickness would be in the range of 300mm to 600mm plus subgrade replacement. Alternatively, it is considered that relatively thin pavements (250mm to 300mm) could be constructed on lime stabilised natural subgrade. A soaked CBR value of 10% could be considered for 3% added lime and a 300 to 350mm stabilisation depth subject to confirmatory testing.

It is anticipated that Class M (moderately reactive) would be the dominant classification at the site in accordance with AS2870-1996 "Residential Slabs and Footings". However, areas of Class H (highly reactive) should be anticipated.

It is considered unlikely that potential acid sulphate soils will be encountered at the site. Notwithstanding, acid sulphate soils should be considered for any specific structures founded below about RL3m.

Our studies have not identified any former land use that would be of concern in terms of contamination. Site inspection has identified localised possible broken asbestos sheeting and an abandoned car. It is considered likely that any contamination would be localised and could be managed or remediated in such a way as to permit future residential development of the site.

None of the above constraints are considered to represent major limitations for proposed development.

For and on behalf of
Network Geotechnics Pty Ltd

Gary Peake *BE (Civil) GCE*
Senior Geotechnical Engineer

for

For and on behalf of
Network Geotechnics Pty Ltd

R J King *BE (Civil)*
Principal Geotechnical Engineer

Table 1 ~ Soil Test Results Summary

Topo-graphy	Loc-ation	Depth (m)	Layer	Hor.	AS1547 Textural Class	SALINITY DATA				pH (1:5)	EXCHANGEABLE CATIONS						ESP	Sod-icity	Ca/Mg Ratio	Sulf. (mg/kg)	Atterberg		CBR Data					S/S (Iss%)	Grad. %Pass 75μm/ %pass 2μm	Emm. Class No.	pH		C.R.S. (%)	PASS Class.
						EC (1:5)	Multi Fact.	ECe	Sal. Class		CEC	Na	K	Ca	Mg	Al					LL	PI	MDD	OMC	FMC	MV	CBR 2.5mm reading				H_2O	H_2O_2		
SLOPE	TPA1	0.0-0.1	Topsoil	A1	Sa. Loam	0.03	11	0.33	NS	5.3																								
	TPA1	0.45-0.55	Residual	B1	Sa. C Loam	0.03	10	0.03	NS	5.4											20	-	1.95	11	18.5	+7.5	60			4				
	TPA1	1-1.2	Residual	B2	Sa. Clay	0.04	9	0.36	NS	4.7	3.66	0.02	0.03	<0.2	0.44	3.15	0.5	NS	0.0	<5													
VALLEY	TPB1	0.65-0.75	Residual	B1	Sa. Clay	0.29	9	2.61	SS	4.5	10.31	0.67	0.1	<0.2	1.56	7.95	6.5	NS	0.0	64													
	TPB1	0.9-1.05	Residual	B2	L. Clay	0.49	9	4.41	MS	4.6																							
	TPB1	1.95-2.0	Rock	R	Si. Loam	0.63	10	6.3	MS	5.4																							
SLOPE	TPC2	0.7-0.88	Residual	B1																								2.7					
	TPC4	0.25-0.45	Residual	A2	Sa. Clay	0.03	9	0.27	NS	5.7																							
	TPC4	0.8-0.85	Residual	B2	L. M. Clay	0.04	8	0.32	NS	5.4																							
	TPC4	0.9-1.3	Residual	B2																								1.3					
	TPC4	1.0-1.1	Residual	B2																	62	40	1.67	19	23.5	+4.5	5			4				
	TPC4	1.9-1.95	Residual	B2	Sa. Clay	0.07	9	0.63	NS	4.5	15.22	0.43	0.09	<0.2	1.34	13.35	2.8	NS	0.0	150													
RIDGE	TPD2	0.0-0.1	Topsoil	A1	Si. C. Loam	0.04	9	0.36	NS	5.7																							
	TPD2	0.4-0.5	Residual	B1	L. Clay	0.05	9	0.45	NS	5.1																							
	TPD2	1.4-1.5	Rock	R	Si. C. Loam	0.06	9	0.54	NS	4.3	16.71	0.33	0.14	<0.2	1.08	15.15	2.0	NS	0.0	214													
	TPD4	0.1-0.15	Topsoil	A2	Sa. Loam	0.05	11	0.55	NS	5.8																							
	TPD4	0.65-0.7	Residual	B1	Sa. Clay	0.16	9	1.44	NS	5.2	19.02	0.51	0.12	<0.2	2.14	16.2	2.7	NS	0.0	79													
	TPD4	1.6-1.7	Rock	R	Si. Clay	0.46	9	4.14	MS	4.8																							
	TPD5	0.75-0.8	Residual	B1																	67	44	1.63	22	25	+3	6	3.1*	75/27	4				
SLOPE	TPE1	0.55-0.7	Residual	B1																	70	48	1.6	22.5	25.0	+2.5	3.5	0.9*		4				
	TPE3	0.4-0.45	Residual	B1	Si. C. Loam	0.04	9	0.36	NS	5.3																							
	TPE3	0.7-0.8	Residual	B2	L. Clay	0.14	9	1.26	NS	5.0																							
	TPE3	1.05-1.15	Residual	B2	L. Clay	0.08	9	0.72	NS	4.7	11.53	0.44	0.09	<0.2	2.72	8.25	3.82	NS	0.0	358													
	TPE4	0.4-0.55	Residual	B1																	45	28	1.72	18.5	20.5	+2	7/35***		72/29	4				
	TPE4	0.6-0.9	Residual	B1																								0.5					
	TPE6	0.35-0.45	Residual	B1	Sa. Clay	0.03	9	0.27	NS	5.5																							
	TPE6	1.2-1.3	Residual	B2	Sa. C. Loam	0.05	10	0.50	NS	5.1	10.38	0.25	0.07	<0.2	1.47	8.55	2.4	NS	0.0	95													
	TPE6	1.5-1.55	Rock	R	Sa. C. Loam	0.06	10	0.60	NS	5.3																							
VALLEY	TPF1	0.25-0.6	Slopewash	A2	Sa. Clay	0.08	9	0.72	NS	4.9	3.85	0.31	0.04	<0.2	1.66	1.73	8.1	MS	0.1	467													
	TPF1	0.6-1.0	Residual	B1	Li. Clay	0.24	9	2.16	SS	4.7																							
	TPF1	1.4-1.9	Rock	R	Li. Clay	0.24	9	2.16	SS	4.4																							
	TPF3	0.3-0.6	Slopewash	A2	Sa. Clay	0.17	9	1.53	NS	6.6																							
	TPF3	0.9-1.2	Residual	B1	Sa. C. Loam	0.42	10	4.2	MS	5.3	3.48	0.06	0.02	1.62	1.78	<0.02	1.7	NS	0.9	88													
	TPF3	2.0-2.3	Residual	B2	Sa. Clay	0.14	9	1.26	NS	5.3																							
	TPF5	0.0-0.5	Topsoil	A1	Li. Sa. C. Loam	0.14	11	1.54	NS																								
	TPF5	0.5-1.0	Alluvium	A2	C. Sand	0.17	17	2.89	SS																								
	TPF5	2.7-3.0	Residual	B2	H. Clay	0.21	6	1.26	NS		13.64	0.89	0.15	4.09	8.51	<0.02	6.5	MS	0.5	26													
	TPF6	0.1-0.4	Slopewash	A2	C. Sand	0.05	17	0.85	NS																								
	TPF6	0.7-1.0	Residual	B1	Si. Clay	0.09	9	0.81	NS																								
	TPF6	1.5-2.0	Residual	B2	Sa. Clay	0.13	9	1.17	NS		12.17	1.12	0.08	1.61	9.27	0.09	9.2	MS	0.2	147													
	TPF8	0.5-1.0	Slopewash	A2	Sa. Clay	0.39	9	3.51	SS		5.41	0.44	0.05	0.45	3.19	1.28	8.1	MS	0.1	21													
	TPF8	1.4-1.7	Residual	B2	H. Clay	0.32	6	1.92	NS																								
	TPF8	2.0-2.5	Residual	B2	Sa. Clay	0.19	9	1.71	NS																								
	BHF9	0.0-0.25	Slopewash	A2																											3.9	2.0		
	BHF9	0.75-1.0	Estuarine	A2																											5.8	2.4	0.022	NOT
	BHF9	1.0-1.5	Estuarine	A2																											5.5	2.4		
	BHF9	1.7-2.0	Estuarine	A2																											5.9	1.8	0.037	NOT*
	BHF9	2.0-2.5	Estuarine	A2																											5.3	1.9		
	BHF10	0.0-0.5	Slopewash	A2																											4.3	1.8		
	BHF10	0.5-1.0	Residual	B1																											4.8	2.9		
	BHF10	1.2-1.5	Residual	B2																											5.0	2.8		
	BHF10	2.0-2.5	Rock	R																											5.2	2.9		

Note:

** denotes remoulded sample*
*** denotes if<1000 tonnes disturbed PASS*
**** denotes without/with 3% lime by dry mass*

Abbrev. Descrip.	Description
C. Sand	Clayey Sand
Sa. Loam	Sandy Loam
Si. Loam	Silty Loam
Sa. C. Loam	Sandy Clay Loam
Si. C. Loam	Silty Clay Loam
L. Sa. C. Loam	Light Sandy Clay Loam
Sa. Clay	Sandy Clay
Si. Clay	Silty Clay
L. Clay	Light Clay
L. M. Clay	Light Medium Clay
H. Clay	Heavy Clay

Salinity
NS denotes non-saline (<2)
SS denotes slightly saline (2-4)
MS denotes moderately saline (4-8)

Sodicity
NS denotes non-sodic (<5)
MS denotes marginally sodic (5-10)
HS denotes highly sodic (>10)

Topo-graphy	Loc-ation	Depth (m)	Layer	Hor.	AS1547 Textural Class	SALINITY DATA				pH (1:5)	EXCHANGEABLE CATIONS						ESP	Sod-icity	Ca/Mg Ratio	Sulf. (mg/kg)	Atterberg		CBR Data					S/S (lss%)	Grad. %Pass 75μm/ %pass 2μm	Emm. Class No.	pH		C.R.S. (%)	PASS Class.
						EC (1:5)	Multi Fact.	ECe	Sal. Class		CEC	Na	K	Ca	Mg	Al					LL	PI	MDD	OMC	FMC	MV	CBR 2.5mm reading				H_2O	H_2O_2		
SLOPE	TPG2	0.3-0.7	Slopewash	A2	C. Sand	0.04	17	0.68	NS																									
	TPG2	0.7-1.1	Residual	B1	Si. Clay	0.05	9	0.45	NS												57	39	1.65/1.62	20.5/22	22.5/-	+3/-	9/40***		74/17	4				
	TPG2	0.7-1.1	Residual	B1																								2.4*						
	TPG2	1.9-2.4	Residual	B2	Li. M. Clay	0.06	8	0.48	NS		21.2	0.3	0.12	<0.2	2.62	18.15	1.4	NS	0.0	<5													
	TPG3	0.5-0.8	Residual	B1																								1.0						
	TPG5	0.3-0.7	Slopewash	A2																	28	16	1.68/1.63	12/15	14.5/-	+2.5/-	7/60***			2				
	TPG7	0.2-0.4	Slopewash	A2	Sa. Loam	0.04	11	0.44	NS																									
	TPG7	0.5-0.8	Residual	B1																								1.5						
	TPG7	0.5-1.0	Residual	B1	Li. Clay	0.29	9	2.61	SS		12.43	2.16	0.13	0.6	8.46	1.08	17.4	HS	0.1	928													
	TPG7	2.5-3.0	Residual	B2	Sa. Clay	0.37	9	3.33	SS																									
	TPG8	0.5-1.0	Residual	B1																	59	45	1.72	19	26.5	+7.5	2.5			3				
RIDGE	TPH2	0.5-0.8	Residual	B1																	74	49	1.62	20	25.5	+5.5	2.5	1.7	82/31	4				
	TPH4	0.15-0.9	Residual	B1	Si. Clay	0.04	9	0.36	NS		13.78	0.21	0.13	0.21	2.13	11.1	1.5	NS	0.1	1286													
	TPH4	0.9-1.1	Residual	B2	Si. Clay	0.04	9	0.36	NS																									
	TPH4	1.1-1.3	Rock	R	C. Sand	0.04	17	0.68	NS																									
SLOPE (lower commercial)	BHI1	0.2-0.5	Topsoil	A1																											4.5	1.2	0.018	NOT
	BHI1	0.7-1.0	Residual	B2																											4.5	2.1	0.018	NOT
	BHI1	1.5-2.0	Residual	B2																											4.3	2.3		NOT
	BHI2	0.2-0.5	Topsoil	A1																											4.1	2.8	0.009	NOT
	BHI2	0.7-1.0	Residual	B1																											4.9	3.2		
	BHI2	1.2-1.5	Residual	B2																											5.5	3.3	0.008	NOT
SLOPE	BHJ1	0.3-0.5	Slopewash	A2																											4.8	2.7		
	BHJ1	0.75-1.0	Slopewash	A2																											4.6	2.9	0.006	NOT
	BHJ1	1.25-1.5	Residual	B2																											4.7	2.9		
	BHJ1	1.7-2.0	Residual	B2																											4.8	3.0	0.011	NOT
	BHJ1	2.5-2.7	Rock	R																											4.7	3.0		

Note:

** denotes remoulded sample*
*** denotes if<1000 tonnes disturbed PASS*
**** denotes without/with 3% lime by dry mass*

Abbrev. Descrip.	Description
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Salinity
NS denotes non-saline (<2)
SS denotes slightly saline (2-4)
MS denotes moderately saline (4-8)

Sodicity
NS denotes non-sodic (<5)
MS denotes marginally sodic (5-10)
HS denotes highly sodic (>10)

TABLE 2 – SUMMARY OF SOIL SALINITY TESTING

Test Pit/Location	Sample Depths (m) grouped for salinity as characterised by soil texture factored electrical conductivity (ECe ~ ds/m)					
	Non Saline (ECe<2)		Slightly Saline (ECe 2 to 4)		Moderately Saline (ECe 4 to 8)	
TPA1	0.1, 0.55, 1.2		-		-	
TPB1	-		0.75		1.05, 2.0	
TPC4	0.45, 0.85, 1.95		-		-	
TPD2	0.1, 0.5, 1.5		-		-	
TPD4	0.15, 0.7		-		1.7	
TPE3	0.45, 0.8, 1.15		-		-	
TPE6	0.45, 1.3, 1.55		-		-	
TPF1	0.6		1.0, 1.9		-	
TPF3	0.6		2.3		1.2	
TPF5	0.5, 3.0		1.0		-	
TPF6	0.4, 1.0, 2.0		-		-	
TPF8	1.7, 2.5		1.0		-	
TPG2	0.7, 1.1, 2.4		-		-	
TPG7	0.4		1.0, 3.0		-	
TPH4	0.9, 1.1, 1.3		-		-	
	Shallowest Samples	Deepest Samples	Shallowest Samples	Deepest Samples	Shallowest Samples	Deepest Samples
	(14 results)	(14 results)	(6 results)	(6 results)	(3 results)	(3 results)
Range	0.1 to 1.7	0.4 to 2.4	0.75 to 2.3	0.75 to 3.0	1.05 to 1.7	1.2 to 2.0
Mean	0.53	1.49	1.18	1.66	1.32	1.63

Note:

1. *Test pits cover a wide range of topographic settings (ie: ridge, slopes, valley floor)*

2. *The ECe salinity scale used in the above Table has wide industry acceptance and is used by bodies such as NSW EPA and Department of Sustainable Natural Resources and is understood to be based on work by Abbott (1990) and Taylor (1999).*

Table 3 ~ Surface Water Quality Test Results Summary

Analysis	Units	SW1 (Upstream)	SW2 (Upstream)	SW3 (Downstream)	THRESHOLD LEVELS
pH		6.07	5.62	**4.47**	5.5-8.0[1]
Total Dissolved Solids (TDS)	mg/L	358	630	478	<650[1] (very low to low salinity)
Colour (True)	PCU	**150**	**70**	**5**	30-40[1]
Turbidity	NTU	70.0	2400	65.0	
Total Hardness as CaCO3	mg/L	71	39	**116**	20-100[1]
Calcium – Filtered	mg/L	11	5	11	<1000[1] (stock)
Magnesium- Filtered	mg/L	11	7	**21**	<15[1]
Sodium - Filtered	mg/L	54	45	102	
Potassium – Filtered	mg/L	3	1	2	
Bicarbonate as CaCO3	mg/L	10	12	<1	
Sulphate – Filtered	mg/L	24	5	53	250[2]
Chloride	mg/L	125	99	241	250[2]
Iron – Total	mg/L	4.42	29.2	7.08	-
Silver - Total	mg/L	<0.001	<0.001	<0.001	0.05[2]
Aluminium – Total	mg/L	0.75	**29.2**	1.69	5[1]
Arsenic – Total	mg/L	<0.001	0.008	<0.001	<0.05[2]
Boron – Total	mg/L	0.01	0.03	0.01	1.0[2]
Barium – Total	mg/L	0.020	0.161	0.059	1.0[2]
Cadmium – Total	mg/L	<0.001	0.001	<0.001	<0.0018[2]
Chromium – Total	mg/L	0.004	**0.024**	0.003	<0.02[1]
Copper – Total	mg/L	0.002	0.030	0.003	<0.005[1]
Manganese – Total	mg/L	0.004	0.162	0.020	-
Molybdenum – Total	mg/L	<0.001	<0.001	<0.001	0.05[1]
Nickel – Total	mg/L	0.001	0.011	0.001	<0.1[1]
Lead – Total	mg/L	<0.001	**0.072**	**0.006**	<0.001[1]
Antimony – Total	mg/L	<0.001	<0.001	<0.001	
Selenium – Total	mg/L	<0.01	<0.01	<0.01	0.01[2]
Zinc – Total	mg/L	0.007	**0.051**	**0.042**	<0.01[1]
Mercury - Total	mg/L	<0.0001	<0.0001	<0.0001	<0.001[1]
Total Cyanide	mg/L	<0.005	<0.005	<0.005	0.05[2]
Fluoride	mg/L	<0.1	<0.1	<0.1	1.5[2]
Ammonia as N	mg/L	**0.02**	**0.18**	<0.01	<0.01 (pH ≤8)
Nitrite as N	mg/L	<0.01	<0.01	<0.01	<0.1[1]

Notes:
1. *Denotes ANZ Guidelines for Fresh and Marine (Freshwater) July 1999*
2. *Denotes Clean Water Regulation 1972 schedule 2 ~ restricted substances in streams*
3. *Bolded Values in the above table exceed the nominated threshold levels*

Network Geotechnics Pty Ltd

GENERAL NOTES

GENERAL

Geotechnical reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). The report may not be relevant for other phases of the project (e.g. construction), or where project details change.

SOIL AND ROCK DESCRIPTIONS

Soil and rock descriptions are based on AS 1726 – 1993, using visual and tactile assessment except at discrete locations where field and / or laboratory tests have been carried out. Refer to the terms and symbols sheet for definitions.

GROUNDWATER

The water levels indicated on the logs are taken at the time of measurement and depending on material permeability may not reflect the actual groundwater level at those specific locations. Also, groundwater levels can vary with time due to seasonal or tidal fluctuations and construction activities.

INTERPRETATION OF RESULTS

The discussion and recommendations in the accompanying report are based on extrapolation / interpolation from data obtained at discrete locations. The actual interface between the materials may be far more gradual or abrupt than indicated. Also, actual conditions in areas not sampled may differ from those predicted.

CHANGE IN CONDITIONS

Subsurface conditions can change with time and can vary between test locations. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions.

REPRODUCTION OF REPORTS

 Where information from the accompanying report is to be included in contract documents or engineering specification for the project, the entire report should be included in order to minimise the likelihood of misinterpretation from logs.

FURTHER ADVICE

Network Geotechnics would be pleased to further discuss how any of the above issues could affect your specific project. We would also be pleased to provide further advice or assistance including:

- assessment of suitability of designs and construction techniques;
- contract documentation and specification;
- construction control testing (earthworks, pavement materials, concrete);
- construction advice (foundation assessments, excavation support).

APPENDIX A

FIELD INVESTIGATION RESULTS

Network Geotechnics Pty Ltd

TERMS AND SYMBOLS

SOIL DESCRIPTIONS

Moisture Condition

D	Dry
M	Moist
W	Wet
Wp	Plastic Limit
Wl	Liquid Limit
MC	Moisture Content

Consistency		Qu (kPa)
VS	Very Soft	<25
S	Soft	25 – 50
F	Firm	50 – 100
St	Stiff	100 – 200
VSt	Very Stiff	200 – 400
H	Hard	>400
Fb	Friable	

Density Index		I_D (%)
VL	Very Loose	< 15
L	Loose	15 – 35
MD	Medium Dense	35 – 65
D	Dense	65 – 85
VD	Very Dense	> 85

ROCK DESCRIPTIONS

Weathering

Rs	Residual Soil
XW	Extremely Weathered
HW	Highly Weathered
MW	Moderately Weathered
DW	Distinctly Weathered
SW	Slightly Weathered
FR	Fresh

(DW covers both HW & MW)

Strength		Is (50) MPa
EL	Extremely Low	< 0.03
VL	Very Low	0.03 – 0.1
L	Low	0.1 – 0.3
M	Medium	0.3 – 1
H	High	1 – 3
VH	Very High	3 – 10
EH	Extremely High	> 10

Structure	Spacing
Thinly Laminated	< 6mm
Laminated	6 – 20mm
Very thinly bedded	20 – 60mm
Thinly bedded	60 – 200mm
Medium bedded	0.2 – 0.6m
Thickly bedded	0.6 – 2.0m
Very thickly bedded	> 2.0m

NOTE: Soil And rock descriptions are based on AS 1726 - 1993

Natural Fractures

Type		Shape	
JT	Joint	pl	Planar
BP	Bedding plane	cu	Curved
SM	Seam	un	Undulose
FZ	Fractured zone	st	Stepped
SZ	Shear zone	ir	Irregular
VN	Vein		

Infill or Coating		Roughness	
Cn	Clean	pol	Polished
Cl	Clay	slk	Slickensided
Ca	Calcite	smo	Smooth
Fe	Iron oxide	rou	Rough
Mi	Micaceous	vro	Very rough
Qz	Quartz		

EXCAVATION/DRILLING METHOD AND CASING

BH	Backhoe/excavator bucket
NE	Natural exposure
HE	Hand excavation
AS	Auger Screwing *
AD	Auger Drilling *
R	Roller/Tricone
W	Washbore

** denotes bit shown by suffix*

B	Blank Bit
V	"V" Shaped Bit
T	Tungsten Carbide Bit

NMLC	NMLC Core Drilling
NQ/HQ	Wireline Core Drilling

C	Casing
M	Mud

SAMPLES/TESTS

B	Bulk sample
D	Disturbed sample
U50	Thin-walled tube sample (50mm diameter)
PP	Pocket penetrometer (kPa)
N*	SPT (blows per 300mm)

** denotes sample taken*

Nc	SPT with solid cone
R	SPT refusal

VANE SHEAR TESTS

s_u	Vane shear strength Peak/residual (kPa) and Vane size (mm)

WATER MEASUREMENTS

▼	Water level
▲–	Water inflow
–▲	Water outflow

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPA1 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285417E 6116463N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D			SM/ SP	Silty SAND/SAND, fine to medium grained, brown	M/W		TOPSOIL
		B	0.5		SC/ CL	Clayey SAND/Sandy CLAY, low plasticity, fine grained, brown/orange mottle	> Wp		RESIDUAL
		D	1.0		CL	Sandy CLAY, low to medium plasticity, pale grey mottled orange/brown and red, fine to medium sand, decreasing with depth, some extremely weathered SILTSTONE structure		(St)	
			1.5			increasing pale grey and trace fine sand from about 1.5m depth			
			2.0						
			2.5						
			3.0			TPA1 terminated at 3.0m depth			
			3.5						
			4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPA2 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285430E 6116646N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH		D			SM/ SC	Silty Clayey SAND, fine to medium grained, brown	M/W	L/F	TOPSOIL
		D	0.5		CL	Sandy CLAY, low plasticity, orange/brown, some pale grey mottle, fine to medium sand, trace fine to medium gravel below about 0.55m depth, roots to about 0.5m	> Wp	(St/ VSt)	RESIDUAL
		D	1.0			Gravelly Silty CLAY, low to medium plasticity, pale grey mottled red and some orange/brown, fine to medium gravel, slightly increasing with depth	≥ Wp	(VSt)	
			1.5						
			2.0						
			2.5			TPA2 terminated at 2.4m depth			
			3.0						
			3.5						
			4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
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Job No.	G23085/1
Pit No.	TPB1 (VALLEY)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285493E 6116338N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	0.0		CL	Sandy Silty CLAY, low plasticity, brown, fine sand	> Wp	F/ St	TOPSOIL
		D	0.5			Sandy CLAY, low plasticity, orange/brown mottled grey, increasing pale grey with depth from about 0.65m	> Wp	St/ VSt	RESIDUAL
		D	1.0			Silty CLAY, low plasticity, pale grey, trace orange/brown (some remnant rock structure)	≥ Wp	VSt	
		D	1.5			SILTSTONE, extremely weathered, excavates as Silty Gravelly CLAY, brown, laminar gravel	—	—	ROCK
			2.0						
			2.5			TPB1 terminated at 2.4m depth – machine refusal on siltstone			
			3.0						
			3.5						
			4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

Network Geotechnics Pty Ltd
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TEL: (02) 43516200
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Job No.	G23085/1
Pit No.	TPB3 (VALLEY)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285430E 6116646N
Logged	CB
Checked:	RJK
Equipment type:	6 TONNE EXCAVATOR
RL surface:	—
Bucket Size:	450mm
Datum	—

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	0.5		ML	Sandy SILT, low plasticity, brown, fine sand, some orange/brown mottling towards base of layer	> Wp	(F/ St)	SLOPEWASH
		D	1.0		CL	Silty CLAY, low plasticity, pale grey mottled orange/ brown, trace fine sand, some medium to coarse gravel (red) from about 1.4 to 1.5m	> Wp	(VSt)	RESIDUAL
			1.5						
			2.0						
			2.5			TPB3 terminated at 2.5m depth			
			3.0						
			3.5						
			4.0						

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Job No.	G23085/1
Pit No.	TPC1 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285682E 6116419N
Logged	CB
Checked:	RJK
Equipment type:	6 TONNE EXCAVATOR
RL surface:	—
Bucket Size:	450mm
Datum	—

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	2			CL	Silty CLAY, low plasticity, brown, trace fine sand, some grass roots	> Wp	F	TOPSOIL
			3				Silty CLAY, low plasticity, brown mottle orange/brown			RESIDUAL
		D	3							
			5	0.5			CLAY, low to medium plasticity, orange/brown, pale grey mottle from about 0.6m and trace red mottle	≈ Wp	ST	
		B & D	6							
			7							
			9	1.0						
			11						St/ VSt	
			20+				SILTSTONE, extremely weathered, excavates as Silty CLAY, low plasticity, pale grey with some orange/ brown and red mottle, some fine sand, becoming brown from about 1.6m	≤ Wp	VSt	ROCK
				1.5						
				2.0						
				2.5			TPC1 terminated at 2.3m depth — machine refusal on siltstone			
				3.0						
				3.5						
				4.0						

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Job No.	G23085/1
Pit No.	TPC2 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285656E 6116620N
Logged	CB
Checked:	RJK
Equipment type:	6 TONNE EXCAVATOR
RL surface:	—
Bucket Size:	450mm
Datum	—

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	1			CL	Silty CLAY, low plasticity, brown/grey, fine sand	> Wp	F	TOPSOIL/ SLOPEWASH
		D	2	0.5			Sandy CLAY/CLAY, low plasticity, pale grey mottle orange/brown, pale grey increasing with depth	> Wp	ST	RESIDUAL
		U50	4							
			5							
			5							
			9	1.0						
			9							
			9							
			16							
			20/100	1.5				≥ Wp	VST	
		D					SILTSTONE, extremely weathered; excavates as Clayey SILT, low plasticity, brown mottled pale grey, increasing brown with depth, trace orange and red mottle from about 2.7m depth	M		ROCK
				2.0						
				2.5						
				3.0						
							TPC2 terminated at 3.0m depth — machine refusal in Siltstone			
				3.5						
				4.0						

TEST PIT LOG

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Job No.	G23085/1
Pit No.	TPC3 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285754E 6116766N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	2			CL	Sandy CLAY, low plasticity, brown/grey becoming brown mottled brown/orange	< Wp	S/F	TOPSOIL/ SLOPEWASH
		D	2 3 5	0.5			CLAY, low plasticity, orange/brown, trace fine sand, some medium gravel at top of layer	> Wp	F/St	RESIDUAL
		D	7 8 9	1.0			Silty CLAY, lowplasticity, pale grey mottled orange & red, trace medium gravel increasing slightly with depth, some medium to coarse gravel from about 1.4m, some medium sand, crumbled when excavated	≤ Wp	St/ VSt	
			10 18 26							
		D		1.5			SILTSTONE, extremely weathered, excavates as Silty Gravelly CLAY, low plasticity, pale grey mottled orange-red			ROCK
				2.0						
				2.5			TPC3 terminated at 2.2m depth ~ machine refusal on siltstone			
				3.0						
				3.5						
				4.0						

TEST PIT LOG

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TUGGERAH NSW 2259
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Job No.	G23085/1
Pit No.	TPC4 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285940E 6116989N
Logged	CB
Checked:	RJK
Equipment type:	6 TONNE EXCAVATOR
RL surface:	—
Bucket Size:	450mm
Datum	—

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D			ML	Sandy SILT, low plasticity, brown, fine sand, organic matter	> Wp	St	TOPSOIL
		D	0.5		CL	Sandy CLAY/CLAY, low plasticity, orange/brown mottled brown, increasing orange/brown with depth, trace organic matter to about 0.4m depth		F/St ↓ St	SLOPEWASH
		D			CH	CLAY, high plasticity, pale grey mottled orange/brown and some red, increasing pale grey with depth, some silt fines	≥ Wp	VST	
		D	1.0						
		U50&B							
		D	1.5		CL	Silty CLAY/CLAY, low to medium plasticity, pale grey mottled orange, some fine sand from about 1.6m, slightly increasing silt fines with depth (some extremely weathered blocky SILTSTONE structure)	< Wp	(H)	RESIDUAL (with some remnant rock structure)
		D	2.0			becoming			
						SILTSTONE, extremely weathered			ROCK
			2.5			TPC4 terminated at 2.35m depth – near machine refusal on siltstone			
			3.0						
			3.5						
			4.0						

Dynamic Cone Penetrometer (blows/150mm): 4, 3, 3, 4, 6, 9, 8, 8, 9, 20+

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPD1 (RIDGE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285682E 6116419N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	Dynamic Cone Penetrometer (blows/150mm): 3, 2, 3, 5, 5, 6, 8, 11, 20, 25/75	0.5		CL	Sandy CLAY, low plasticity, brown mottled orange-brown, fine sand, trace silt	< Wp	F	TOPSOIL/ SLOPEWASH
		D, D			CL	CLAY, low plasticity, orange/brown, trace fine sand	> Wp	F/ St → St/ VSt	RESIDUAL
			1.0		CL/ ML	Silty CLAY/Clayey SILT, low plasticity, pale grey, some mottle orange/brown and red, some medium gravel increasing with depth	< Wp	VSt	
			1.5			SILTSTONE, extremely weathered, excavates as Silty Gravelly CLAY, brown, friable texture	D	—	ROCK
			2.0			TPD1 terminated at 1.7m depth – machine refusal on siltstone			
			2.5						
			3.0						
			3.5						
			4.0						

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
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Job No.	G23085/1
Pit No.	TPD2 (RIDGE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285758E 6116553N
Logged	CB
Checked:	RJK
Equipment type:	6 TONNE EXCAVATOR
RL surface:	—
Bucket Size:	450mm
Datum	—

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D			SM	Silty SAND, fine grained,brown/grey, low plasticity fines, some coarse gravel, roots to about 0.25m	M/D	(L)	TOPSOIL
		D	0.5		CL	CLAY, low plasticity, orange/brown with some red mottle, trace fine sand, pale grey mottle from about 0.55m,becoming orange/brown mottled pale grey from about 0.7m	> Wp	(St/ VSt)	RESIDUAL
		D	1.0			SILTSTONE, extremely weathered, excavates as Silty CLAY, low plasticity, pale grey mottled orange/brown and trace red,some brown from about 1.2m, medium to coarse gravel encountered from about 1.2m and increasing with depth			ROCK
			1.5						
						TPD2 terminated at 1.65m depth – machine refusal on siltstone			
			2.0						
			2.5						
			3.0						
			3.5						
			4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPD3 (RIDGE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 285831E 6116689N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None ncountered	D	1			CL	Silty CLAY, brown, roots to about 0.15m	> Wp	S/F	TOPSOIL
			2				CLAY, low plasticity, brown mottled orange/brown, trace medium gravel		F	RESIDUAL
			4				CLAY, low to medium plasticity, orange/brown, increasing pale grey mottle from about 0.7m depth, trace medium gravel		St	
			9	0.5						
		D	5						VSt	
			20							
		D	26	1.0			SILTSTONE, extremely weathered; excavates as Clayey SILT/Silty CLAY, low plasticity, pale grey mottled orange/ brown			ROCK
		D					SILTSTONE, extremely to highly weathered; excavates as Silty Gravelly CLAY, brown			
				1.5						
				2.0						
							TPD3 terminated at 2.0m depth – machine refusal on siltstone			
				2.5						
				3.0						
				3.5						
				4.0						

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPD4 (RIDGE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	30/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	30/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56285919E 6116799N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	5		SC	Clayey SAND, fine to medium grained, brown mottled orange/brown, low plasticity fines, tree roots to about 0.3m	D/M	MD	TOPSOIL
		D	3						
		D	3						
		D	5		CL	CLAY, low to medium plasticity, orange/brown, some fine sand, mottled pale grey increasing from about 0.6m depth, interbedded brown Clayey SILT, low plasticity encountered at 1.0 - 1.05m at one end of TP	≥ Wp	St/ VSt	RESIDUAL
		D	6						
		D	7						
		D	13						
			20/ 100			SILTSTONE, extremely weathered; excavates as Silty Gravelly CLAY, low plasticity, pale grey mottle, some orange/brown, medium to coarse gravel	D	—	ROCK
		D							
						TPD4 terminated at 1.7m depth – machine refusal on siltstone			

None encountered

0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
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Job No.	G23085/1
Pit No.	TPD5 (RIDGE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Project:	FEASIBILITY FOR DEVELOPMENT
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286057E 6116906N
Started:	29/7/03
Finished:	29/7/03
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	5			SC/CL	Clayey SAND/Silty Sandy CLAY, low plasticity, brown	> Wp		TOPSOIL
		D	4			CL	Sandy CLAY, low plasticity, brown mottle orange	> Wp	St/ VSt	RESIDUAL
			5			CH	CLAY, high plasticity, orange/brown, trace fine to medium gravel; becoming orange/brown mottle pale grey from about 0.6m depth, tree root encountered at 0.8m			
			5	0.5						
		CB	6							
		D	11							
			17	1.0		CL	Gravelly Silty CLAY, low to medium plasticity, pale grey mottled orange/brown and red, fine to medium gravel, some remnant rock structure with depth	≈ Wp	VSt/ H	
		D	17							
			20/ 80							
		D		1.5			SILTSTONE, extremely weathered, excavates as Silty Gravelly CLAY, low to medium plasticity, brown, trace fine to medium gravel (very weak)	—	—	ROCK
		D								
				2.0			TPD5 terminated at 1.95m depth — machine refusal on siltstone			
				2.5						
				3.0						
				3.5						
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPE1 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N
Logged	CB,DS
Checked:	RJK
Equipment type:	EXCAVATOR 8 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	4			SM/ SC	Silty Clayey SAND, fine grained, brown, roots to about 0.03m	M	MD/D	TOPSOIL
						SM	Silty SAND, fine grained, brown, low plasticity			SLOPEWASH
		D	10 7			CH	CLAY, highplasticity, orange/brown mottle, some red and pale grey becoming pale grey mottled orange/ brown from about 0.9m	≥ Wp	St/ VSt	RESIDUAL
		D	10 9	0.5						
			9 14	1.0						
		D	12			CL	Silty CLAY, low plasticity, orange/brown mottled pale grey, some medium to coarse gravel, some fine sand	≤ Wp	VSt/ H	some remnant rock structure below about 1.1m depth
		D	16+							
		D		1.5			SILTSTONE, extremely to highly weathered; excavates as Gravelly Clayey SILT/Gravelly Silty CLAY, low plasticity, pale grey mottle red/brown, trace fine sand, friable fine to medium gravel increasing red/brown from about 1.45m	—	—	ROCK
							TPE1 terminated at 1.75m depth ~ machine refusal on siltstone			
				2.0						
				2.5						
				3.0						
				3.5						
				4.0						

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Job No.	G23085/1
Pit No.	TPE2 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Project:	FEASIBILITY FOR DEVELOPMENT
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N
Started:	29/7/03
Finished:	29/7/03
Logged	CB,DS
Checked:	RJK
Equipment type:	EXCAVATOR 8 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	0.0		ML	Sandy SILT, low plasticity, dark brown	≥ Wp		TOPSOIL
					SM	Silty SAND, fine grained, brown, low plasticity	M		SLOPEWASH
		D 3			CL	Sandy CLAY, low to medium plasticity, orange/brown, mottled red, fine to medium sand, some medium gravel, pale grey mottle increasing from about 0.6m trace cobbles at 0.7m depth	≥ Wp	St	RESIDUAL
		D 3							
		8						VSt	
		D 14	0.5						
		D 20 +							
		D			ML/ CL	Clayey SILT/Silty CLAY, low to medium plasticity, pale grey mottle red/brown and orange, increasing pale grey with depth, trace fine to medium gravel from about 1.4m, trace of fine sand from about 1.7m	> Wp		
		D 4							
		10	1.0						
		11							
		D 9							
			1.5						
		D							
			2.0			SILTSTONE, extremely weathered, excavates as Silty Gravelly CLAY, low plasticity, pale grey mottled orange/ brown/red			ROCK
		D							
			2.5						
						TPE2 terminated at 2.55m depth – machine refusal on siltstone			
			3.0						
			3.5						
			4.0						

Dynamic Cone Penetrometer (blows/150mm)

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

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Job No.	G23085/1
Pit No.	TPE3 (SLOPE)
Sheet	1/1

Client:	FORBES RIGBY PTY LTD	Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT	Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N	Logged	CB
		Checked:	RJK
Equipment type:	EXCAVATOR 8 TONNE	RL surface:	
Bucket Size:	450mm	Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	2			CL	Sandy Silty CLAY, low plasticity, brown, fine sand, organic matter to about 0.1m	> Wp	F/ St	TOPSOIL
		D	5				Silty Sandy CLAY, low plasticity, brown, with trace orange mottle		St/ VSt	RESIDUAL
		D	5				Silty CLAY, low plasticity, brown, mottle orange/brown			
			5	0.5						
			5				CLAY, low to medium plasticity, orange/brown mottle pale grey becoming pale grey mottle orange/brown from about 0.95m, some fine sand			
		D	5							
			6	1.0						
		D	7			ML/ CL	Clayey SILT/Silty CLAY, medium plasticity, pale grey mottle orange/brown and red, some fine to medium laminar gravel, some fine to medium sand	≤ Wp	VSt	
			9							
		D	14				SILTSTONE, extremely weathered, excavates as Gravelly Silty CLAY	—	—	ROCK
			17	1.5			TPE3 terminated at 1.45m depth — machine refusal on siltstone			
				2.0						
				2.5						
				3.0						
				3.5						
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

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Job No.	G23085/1
Pit No.	TPE4 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 8 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	2			SC	Clayey SAND, fine grained, brown, low plasticity, clay increasing with depth from about 0.3m, trace roots	M/W	(L/ MD)	TOPSOIL
		D	4							
		B	4							
			6	0.5		CL	Sandy CLAY, low to medium plasticity, orange/brown mottle grey, increasing pale grey with depth	> Wp	(St/ VSt)	RESIDUAL
		B	5							
			5				Silty CLAY, medium plasticity, orange/brown mottle pale grey, trace fine sand			
			20 +	1.0						
		D				SM/ SC	Silty Clayey SAND, fine to medium grained, orange/ brown mottle pale grey, some medium to coarse gravel increasing gravel with depth, crumbled when excavated	M	(D)	some remnant rock structure below about 1.3m depth
				1.5			becoming			
							Silty SANDSTONE, extremely weathered	—	—	ROCK
				2.0			TPE4 terminated at 1.85m depth — machine refusal on sandstone			
				2.5						
				3.0						
				3.5						
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

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Job No.	G23085/1
Pit No.	TPE5 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N
Logged	CB
Checked:	RJK
Equipment type:	6 TONNE EXCAVATOR
RL surface:	—
Bucket Size:	450mm
Datum	—

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	D	4	0.0		CL	Gravelly Sandy CLAY, low plasticity, brown/orange-brown, fine to medium gravel, fine to coarse sand	≥Wp	St	RESIDUAL
			4				Sandy CLAY, low plasticity, brown mottled orange/brown, some fine to medium gravel			
			6				CLAY, low to medium plasticity, orange/brown, some fine sand		VSt	
		D	7	0.5			Gravelly CLAY, low to medium plasticity, orange/brown mottled pale grey, pale grey increasing from about 1.3m depth, medium to coarse gravel, trace sand becoming pale grey mottle orange/brown, increasing gravel with depth		H	
		D	25+	1.0						
		D		1.5						
		D		2.0			SILTSTONE, extremely to moderately weathered, excavates as Clayey SILT, low plasticity, pale orange-brown, est. very low to low rock strength	—	—	ROCK
				2.5			TPE5 terminated at 2.35m depth near machine refusal on siltstone			
				3.0						
				3.5						
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

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Job No.	G23085/1
Pit No.	TPE6 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N
Logged	CB
Checked:	RJK
Equipment type:	EXCAVATOR 6 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None encountered	Dynamic Cone Penetrometer (blows/150mm): 2, 4, 4, 5, 9, 23, 25 D, D, B, D, D	0.5, 1.0, 1.5		SM	Silty SAND, fine grained, brown/grey	> Wp	L	TOPSOIL
					CL	Sandy CLAY, low plasticity, brown/orange, fine sand becoming brown/grey mottle orange becoming CLAY, medium plasticity from about 0.65m, orange/brown mottlepale grey, increasing stiffness with depth		St → VSt	RESIDUAL
						Silty CLAY, low to medium plasticity, pale grey mottle orange /brown, some fine to medium gravel, gravel increasing with depth, crumbled when excavated	< Wp	VSt/ H	some remnant rock structure below about 0.85m depth
						becoming			
						SILTSTONE, extremely weathered, excavates as Gravelly Silty CLAY	—	—	ROCK
			2.0, 2.5, 3.0, 3.5, 4.0			TPE6 terminated at 1.55m depth – machine refusal on siltstone			

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Job No.	G23085/1
Pit No.	TPG1 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286106E 6115931N
Logged	GP
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None Encountered	D	3			SM	Silty SAND, fine to medium grained, grey-brown, some roots	M	MD	TOPSOIL
		D	4			CL	Sandy CLAY, medium plasticity, yellow-brown/pale grey, fine to medium sand, some tree roots	> Wp	St	RESIDUAL
			5	0.5						
		D	5							
			8			CL	Sandy Silty CLAY, low to medium plasticity, pale grey mottled yellow, fine to medium sand	< Wp	VSt	
			8	1.0						
				1.5						
		D					SANDSTONE, extremely weathered, fine grained, yellow-brown/pale grey, bands of interbedded SILTSTONE; brown, some fine gravel, est. very low rock strength	D	—	ROCK
				2.0						
				2.5			TPG1 terminated at 2.4m depth			
				3.0						
				3.5						
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

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TUGGERAH NSW 2259
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Job No.	G23085/1
Pit No.	TPG2 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286231E 6116057N
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None Encountered	D	4 9			SM	Silty SAND, fine to medium grained, grey-brown, some roots	M	MD/D	TOPSOIL
		D	6 7	0.5			Silty SAND, fine to medium grained, yellow-brown/ pale grey	M-W		PROBABLE SLOPEWASH
		B	4 4 5	1.0		CL/ CH	Sandy CLAY, medium to high plasticity, red-brown/ orange-brown/pale grey, fine to medium sand, trace fine gravel	≈ Wp	St	RESIDUAL
			5 9 9 15	1.5		SC	Clayey SAND, fine to medium grained, pale grey/red-brown/orange-brown, low plasticity, trace fine to medium gravel	M	D	
		D		2.0		ML	Clayey SILT, lowplasticity, pale grey mottled red-brown some fine to coarse SILTSTONE gravel, trace fine roots	< Wp	(H)	
				2.5			SANDSTONE, extremely weathered, red-brown, inter-bedded pale grey Clayey SILT, est very low rock strength	D	—	ROCK
							TPG2 terminated at 2.6m depth			
				3.0						
				3.5						
				4.0						

TEST PIT LOG

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Job No.	G23085/1
Pit No.	TPG3 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286323E 6116185N
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH		D	1			SM	Silty SAND, fine to medium grained, grey-brown becoming pale grey with depth, some roots	M-W	L	TOPSOIL
			2			GP	Sandy GRAVEL, fine to medium gravel, orange-brown, fine to medium sand	W	MD	SLOPEWASH
			8			CL	Sandy CLAY, low to medium plasticity, red-brown/ orange-brown/pale grey	≈ Wp	St	RESIDUAL
		D U50	4	0.5						
			4							
			5							
			5	1.0			Sandy CLAY, low to medium plasticity, pale grey/ orange-brown		St/ VSt	
			7							
			16	1.5						
		D				SM/ SC	SANDSTONE, extremely weathered, excavates as Silty SAND/Clayey SAND, fine to medium grained, pale grey/yellow-brown, est very low rock strength	M	—	ROCK/RESIDUAL
				2.0						
						ML	SILTSTONE, extremely weathered, excavates as Clayey SILT, low plasticity, brown/grey, M ≤ Wp, rock structure becoming more prominent with depth	D	—	ROCK
		D		2.5						
				3.0						
				3.5			TPG3 terminated at 3m depth			
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

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TUGGERAH NSW 2259
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Job No.	G23085/1
Pit No.	TPG4 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286496E 6116417N
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None Encountered	D	3 4 4	0.0		SM	Silty SAND, fine to medium grained, grey-brown, roots to about 0.2m depth	M-W	L/ MD	TOPSOIL
		D	2 1 2	0.5		SM-SC	Clayey Silty SAND, fine to medium grained, pale brown/yellow-brown, low plasticity fines	W	L	PROBABLE SLOPEWASH
		D	1 3 4 10 15	1.0 1.5		SC	Silty Clayey SAND, fine to medium grained, pale grey mottled red-brown, low plasticity, some fine to coarse gravel increasing below about 1.5m depth	M	MD D	RESIDUAL
		D		2.0 2.5			SANDSTONE, extremely weathered, excavates as (SM-SC) Clayey Silty SAND, fine grained, pale grey/ red-brown	D-M	—	ROCK/RESIDUAL
				3.0			TPG4 terminated at 3.0m depth			
				3.5 4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

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Job No.	G23085/1
Pit No.	TPG5 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286378E 6116511 N
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None Encountered	B & D	1, 3	0.0		SM	Silty SAND, fine to medium grained, grey-brown	W	L	TOPSOIL
		B & D	4, 6	0.5		SM-SC	Silty Clayey SAND, fine to medium grained, pale grey mottled yellow-brown	M-W	MD/D	PROBABLE SLOPEWASH
		D	4, 6, 7, 17	1.0		SC/CL	Silty Clayey SAND/Sandy Silty CLAY, low to medium plasticity, yellow-brown mottled pale grey	≤ Wp	D	RESIDUAL
		D		1.5			CONGLOMERATE, extremely to moderately weathered, fine to medium ironstone gravel, red-brown /orange-brown, some Silty CLAY, est very low to low rock strength	D	—	ROCK
		D		2.0		CH	Silty CLAY, high plasticity, pale grey mottled yellow-brown	> Wp	(VSt)	RESIDUAL
				2.5			SANDSTONE, extremely to moderately weathered, fine grained, yellow-brown/pale grey, est low rock strength	D		ROCK
				3.0			TPG5 terminated at 2.8m depth			
				3.5						
				4.0						

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED

TEST PIT LOG

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Job No.	G23085/1
Pit No.	TPG6 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286269E 6116541N
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None Encountered	Dynamic Cone Penetrometer (blows/150mm): 3, 2, 1, 4, 6, 7, 12, 10, 12, 13, 14	0.0		SM	Silty SAND, fine grained, grey, roots	W	L	TOPSOIL
		D	0.5		SM-SC	Silty Clayey SAND, fine to medium grained, pale grey mottled yellow-brown, low plasticity fines	M-W	L/ MD	PROBABLE SLOPEWASH
		D	1.0			Silty Clayey SAND, fine to medium grained, yellow-brown, low plasticity fines	W	D/ VD	RESIDUAL
		D	1.5		SC/ CL	Silty Clayey SAND/Sandy Silty CLAY, fine to medium grained, orange-brown/pale brown, some fine to medium ironstone gravel	M-W	(VSt)	
			2.0						
			2.5						
			3.0			TPG6 terminated at 3.0m depth			
			3.5						
			4.0						

TEST PIT LOG

Network Geotechnics Pty Ltd
ACN 069 211 561
6/6 Morton Close
TUGGERAH NSW 2259
TEL: (02) 43516200
FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPG7 (SLOPE)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Project:	FEASIBILITY FOR DEVELOPMENT
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286157E 6116468N
Started:	29/7/03
Finished:	29/7/03
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	Dynamic Cone Penetrometer (blows/150mm)	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH	None Encountered	D	4			SM	Silty SAND, fine grained, grey-brown, tree roots	M-W	MD	TOPSOIL
			4				Silty SAND, fine grained, pale grey, some roots			SLOPEWASH
		D	4							
		U50	5	0.5		CL	Sandy CLAY, medium plasticity, orange-brown/pale grey, fine to medium sand	> Wp	St/ VSt	RESIDUAL
		D	8							
			9							
			11	1.0					VSt	
			18							
				1.5						
				2.0						
						SC	Clayey SAND, fine to medium grained, pale grey/ yellow-brown	M-W	(D)	
		D		2.5						
				3.0						
							TPG7 terminated at 3.0m depth			
				3.5						
				4.0						

TEST PIT LOG

Network Geotechnics Pty Ltd
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6/6 Morton Close
TUGGERAH NSW 2259
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FAX: (02) 43516300

Job No.	G23085/1
Pit No.	TPG8 (slope)
Sheet	1/1
Client:	FORBES RIGBY PTY LTD
Started:	29/7/03
Project:	FEASIBILITY FOR DEVELOPMENT
Finished:	29/7/03
Location:	NAVAL COLLEGE ROAD & THE WOOL ROAD, VINCENTIA GPS (AUS 66) AMG: 56286040E 6116368N
Logged	GP/GV
Checked:	RJK
Equipment type:	EXCAVATOR 7 TONNE
RL surface:	
Bucket Size:	450mm
Datum	

method	water	samples, tests etc	depth (m)	graphic log	USCS symbol	Material description Soil type, particle characteristics or fines plasticity, colour, secondary and minor components	Moisture condition	Consistency/ relative density	comments notes, structure and additional observations
BH		D	0.0		SM	Silty SAND, fine grained, grey-brown, roots, some fine to medium gravel	M-W	L	TOPSOIL
		B & D	0.5		CL/ CH	Sandy Silty CLAY, medium to high plasticity, orange-brown mottled pale grey	M > Wp	F/St	RESIDUAL
			1.0					(St/ VSt)	
			1.5					VSt	
			2.0						
		D	2.5		SC	Clayey Gravelly SAND, fine to medium grained, pale grey/orange-brown, low to medium plasticity, fine to coarse siderite gravel	M	(D)	
			3.0			TPG8 terminated at 3.0m depth			
			3.5						
			4.0						

Dynamic Cone Penetrometer (blows/150mm): 2, 3, 4, 2, 3, 2, 3, 3, 6, 8, 13, 17

REFER TO EXPLANATION SHEETS FOR DESCRIPTION OF TERMS AND SYMBOLS USED