Report on
Preliminary Geotechnical Assessment

Extension to Proposed Residential Subdivision
Lot 9765 Roystonea Avenue, Durack, NT

Prepared for
CIC Australia Limited

Project 48229.01
February 2011
# Document History

## Document details

<table>
<thead>
<tr>
<th>Project No.</th>
<th>Document No.</th>
<th>Document title</th>
<th>Site address</th>
<th>Report prepared for</th>
<th>File name</th>
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<tr>
<td>48229.01</td>
<td>1</td>
<td>Report on Preliminary Geotechnical Assessment, Extension to Proposed Residential Subdivision</td>
<td>Lot 9765 Roystonea Avenue, Durack, Northern Territory</td>
<td>CIC Australia Limited</td>
<td>48229.01 CDU Extension Report text.docx</td>
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## Document status and review

<table>
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<th>Revision</th>
<th>Prepared by</th>
<th>Reviewed by</th>
<th>Date issued</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>D S Ford, J Derrien &amp; A Gane</td>
<td>T J Wiesner</td>
<td>15 February 2011</td>
</tr>
</tbody>
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## Distribution of copies

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<th>Electronic</th>
<th>Paper</th>
<th>Issued to</th>
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<td>CIC Australia Limited</td>
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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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**Appendix A:**

Notes and Drawings

About this Report

Drawing 1 – Site Locality Plan
Appendix B: Field Test Results
Table B1 - Test Pit Locations and Estimated Surface Levels
Plates 1 to 10 - Subsurface Conditions
Test Pit Logs (TP101 to TP111)
Symbols and Abbreviations
Soil Descriptions

Appendix C: Laboratory Test Results
1. Introduction

This report presents the results of a preliminary geotechnical assessment carried out for the extension of a proposed residential subdivision on Lot 9765 Roystonea Avenue, Durack, Northern Territory. The work was carried out by Douglas Partners (DP) at the request of CIC Australia Limited on behalf of Charles Darwin University (CDU), the owner of the lot.

A residential subdivision with internal roads is proposed, and this preliminary geotechnical assessment was carried out to provide subsurface information for delineation of terrain units, assessing the soils in these units and determining the viability of Lot 9765, or parts thereof, for residential subdivision.

The investigation comprised a review of existing terrain unit information, soil types, geology and aerial photographs, followed by a site walkover survey, excavation of test pits, then laboratory testing of representative soil samples. Details of the field and laboratory work are given in this report together with comments relating to geotechnical aspects of design and construction practice.

2. Previous Investigation and Assessment

A preliminary geotechnical assessment was carried out by Douglas Partners in 2009 for the majority of Lot 9765. The aims of the study were to identify known constraints to infrastructure provision including the location of areas subject to flooding, seasonal waterlogging, or unsuitable soils (heavy clays or acid sulphate soils) based on available mapping. The results of this previous assessment were presented in a report entitled “Report on Preliminary Geotechnical Assessment, Proposed Residential Subdivision, Lot 9765 Roystonea Avenue, Durack, NT”, prepared for Charles Darwin University, DP Project 48229.00, dated July 2009.

Reference has been made to this previous report during the preparation of the present report.

3. Site Description

Lot 9765 is located to the west of the intersection of Roystonea Avenue and Stuart Highway and occupies an irregular shaped area with maximum plan dimensions of about 1.7 km by 0.5 km, and an approximate area of 80 ha as shown on Drawing 1 in Appendix A. Lot 9765 is bounded by Tiger Brennan Drive Extension to the north, Roystonea Avenue to the northeast, the CDU Palmerston Campus to the southeast and by Fairway Waters subdivision to the south and southwest.
The extension to the site area comprises a small parcel of land in the southeast corner of Lot 9765 as shown on Drawing 1. This parcel of land has maximum plan dimensions of about 500 m by 300 m and an area of approximately 10 ha.

Reference to the Town of Palmerston 1:2,500 Series Durack Photoimage Map indicates that the site is divided into two drainage catchments by a ridge which runs northeast-southwest across the site from the Stuart Highway in the northeast to the University Campus lake in the southwest.

In the north-western catchment, ground surface levels fall from about RL26 AHD on the north-eastern site boundary to RL21 AHD at the northern end of the lake. In the south-eastern catchment, ground surface levels fall from about RL31 AHD in the eastern corner of the site adjacent to Roystonea Avenue to RL21 AHD on the drainage swale towards the south-western corner of the site.

At the time of the present investigation in December 2010, the site was primarily covered in sparse to moderately dense vegetation consisting of grass, cycads, pandanus palms and semi-mature to mature eucalyptus trees. Gravel tracks leading from Roystonea Avenue and Fairway Waters subdivision allowed 4WD vehicle access to the site.

4. Geology and Terrain

Reference to the Bynoe 1:100 000 Geological Series map (Sheet 5072) indicates that the site is underlain by Tertiary age soils comprising unconsolidated sand; ferruginous, clayey, sandy and gravelly soil commonly containing limonite pisoliths; or pisolithic and mottled laterite. In the lower lying areas, Quaternary age colluvial sediments comprising sand, silt and clay deposited by unconcentrated surface runoff predominate. These soils are underlain by Proterozoic age meta-sediments of the South Alligator Group, which consist of steeply dipping metamorphosed siltstone, shale and phyllite, commonly carbonaceous and pyritic with bands of quartzite.

Review of the Photoimage maps and the Greater Darwin Area Land Unit Map (Sheet 8) indicate that three distinct terrain units (1c, 2b2, and 6b) are present across the site ranging from rugged hills and slopes (Unit 1c), to low rounded hills and gentle sideslopes (Unit 2b2), to broad lowland plains (Unit 6b). A description of each terrain unit is given in Section 6.

5. Methods of Investigation and Assessment

5.1 Terrain Unit Mapping

The terrain units for Lot 9765 Durack which were originally mapped from stereo photos at a scale of 1:15,000 were published by the Department of Lands Planning and Environment (DLPE) on sheets at a scale of 1:25,000. Cautionary notes on DLPE Sheet 8 indicate that “land unit boundaries are in the process of being refined as additional data are collected” and that although “preliminary land requirements of specific land development proposals can be assessed from the general information derived from land unit information on this map”; “development should not proceed without site-specific investigation of relevant land data”.

Sheet 8 has therefore been used in conjunction with the Photoimage Map titled Holtze at a scale of 1:2,500 to refine the terrain unit boundaries and thus prepare a terrain unit map for this report at a scale of approximately 1:4000. The revised terrain map is presented on Drawing 2 in Appendix A.

It should be noted that a terrain unit is a relatively homogeneous portion of terrain in terms of landform, soils and vegetation, however, these features will vary continuously across the landscape and terrain units tend to merge with each other over a finite distance rather than being delineated by a narrow line on a map.

### 5.2 Land Capability

The proposed land uses in the extended Lot 9765 Roystonea Avenue subdivision will include Urban Residential and Public Open Spaces. Each terrain unit has been rated based on the physical properties of the unit, and classified into three classes corresponding to four levels of capability for the above uses. The classes are C1 (high capability), C2 (moderate capability) and L or N (low or no capability).

However, factors other than physical characteristics may determine the suitability of some terrain units for specific land uses. Furthermore, limitations of some terrain units, such as steep slopes (Unit 1), seepage (Unit 2) and imperfectly drained soils (Unit 6) may be overcome by the adoption of engineering solutions such as retaining walls, subsoil drains and subgrade replacement, respectively.

The capability ratings for the proposed land use in the extension area of Lot 9765 are expressed in terms of “Factors Affecting Land Use” in the following Table 1. These ratings are for the broad subdivision areas only, and do not take into consideration engineering intervention which may be required to mitigate drainage, seepage or slope problems for roadworks, single residential lots, or groups of residential lots.

**Table 1 : Capability Ratings for Urban Subdivision**

<table>
<thead>
<tr>
<th>Factors Affecting Land Use</th>
<th>High Capability (C1)</th>
<th>Moderate Capability (C2)</th>
<th>Low or Nil Capability (L or N)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site Drainage</td>
<td>Moderate to Very Rapid</td>
<td>Moderate to Very Rapid</td>
<td>Slow or Very Slow</td>
</tr>
<tr>
<td>Soil Drainage</td>
<td>Moderate</td>
<td>Imperfect</td>
<td>Poor or Very Poor</td>
</tr>
<tr>
<td>Slope Gradient</td>
<td>0 to 4 %</td>
<td>4 to 6%</td>
<td>&gt; 6%</td>
</tr>
<tr>
<td>Soil Depth</td>
<td>&gt; 1 m</td>
<td>0.5 to 1.0 m</td>
<td>&lt; 0.5 m</td>
</tr>
<tr>
<td>Gravel and Stone Content</td>
<td>&lt; 20%</td>
<td>20 to 50%</td>
<td>&gt; 50%</td>
</tr>
<tr>
<td>Rock Outcrop</td>
<td>&lt; 5%</td>
<td>5 to 10%</td>
<td>&gt; 10%</td>
</tr>
</tbody>
</table>
5.3 Field Work Methods

Field work for the present investigation was carried out on 17 December 2010 and comprised a site walkover survey combined with excavation, logging, sampling and photographing of 11 test pits using a Hitachi 5t mini-excavator fitted with a 450 mm wide rock-toothed bucket.

The site walkover survey was carried out by a senior geotechnical engineer and a geo-environmental scientist to identify the terrain unit boundaries in the field as compared to those shown in the published information. Test pits were excavated at locations selected for "ground truthing" of subsurface strata. The test pits were excavated to depths of between 0.5 m and 1.8 m, logged and sampled by a geo-environmental scientist, photographed to record the soil profile at each test pit location, then backfilled with the test pit spoil.

The locations of all 11 test pits were surveyed for position to Datum GDA94 using a Garmin 60 hand held GPS, and ground surface levels to datum AHD were interpolated from the 1 m contours on the 1:2,500 Photoimage map.

6. Field Work Results

During this preliminary assessment, three terrain units (1c, 2b2 and 6b) were identified across the extended site area. Descriptions of each terrain unit, reproduced from the Greater Darwin Area Land Unit Map (Sheet 8), are given in Table 2. The test pit locations and estimated ground surface levels are listed in Table B1 in Appendix B. Detailed test pit reports are also presented in Appendix B, together with notes describing classification methods and descriptive terms.

The test pits encountered slightly different soil profiles, depending upon the terrain unit in which each pit was excavated. Photographs showing the typical soil profiles at each test pit location are presented on Plates 1 to 11 in Appendix B. The test pit numbers and associated terrain units are also presented in Table 2.

Table 2 : Terrain Unit Descriptions

<table>
<thead>
<tr>
<th>Unit</th>
<th>Landform</th>
<th>Test Pits</th>
<th>Slope</th>
<th>Drainage</th>
<th>Soils</th>
<th>Vegetation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1c</td>
<td>Low scarps &amp; short steep slopes</td>
<td>None</td>
<td>10 -15%</td>
<td>V Rapid</td>
<td>Shallow gravelly lithosols</td>
<td>Eucalypt woodland to minor open woodland</td>
</tr>
<tr>
<td>2b2</td>
<td>Gentle sideslopes</td>
<td>106 to 109, 111</td>
<td>2 – 5%</td>
<td>Rapid</td>
<td>Shallow gravelly massive earths and lithosols</td>
<td>Eucalypt low open to open woodland</td>
</tr>
<tr>
<td>6b</td>
<td>Broad lowland plains</td>
<td>101 to 105, 110</td>
<td>&lt; 0.5%</td>
<td>Slow</td>
<td>Moderately deep siliceous sands</td>
<td>Grevillea/melaleuca tall shrubland to minor open woodland</td>
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Groundwater was observed at 0.6 m depth in TP105, and minor groundwater seepage was observed at depths of between 0.4 m and 1.2 m in TP102, TP103, TP104, TP107, TP108, TP110 and TP111.
7. **Laboratory Testing**

Laboratory testing was carried out on one subsoil sample from the 6B terrain unit. The sample was tested for determination of field moisture content, particle size distribution, Atterberg limits including linear shrinkage, compaction properties (MMDD) and California bearing ratio (CBR). The MMDD and CBR tests were carried out at the NATA accredited laboratory Linitin Geotechnical. All other tests were carried out in the Douglas Partners Darwin laboratory. All tests were carried out in accordance with the procedures described in AS1289-2006, “Methods of Testing Soils for Engineering Purposes” (Ref 1). The results of laboratory testing are summarised in Table 3 and the laboratory test reports are presented in Appendix C.

<table>
<thead>
<tr>
<th>Test Pit</th>
<th>Depth (m)</th>
<th>Unified Soil Classification</th>
<th>FMC (%)</th>
<th>Fines (%)</th>
<th>LL (%)</th>
<th>PI (%)</th>
<th>LS (%)</th>
<th>OMC (%)</th>
<th>MMDD (t/m³)</th>
<th>CBR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>110</td>
<td>0.4 – 0.7</td>
<td>Gravelly Silty Clay (CH to MH)</td>
<td>9.1</td>
<td>63</td>
<td>55</td>
<td>29</td>
<td>10.0</td>
<td>11.0</td>
<td>2.079</td>
<td>10.0</td>
</tr>
</tbody>
</table>

Legend:
- FMC – Field Moisture Content
- Fines – % passing 75 µm sieve
- LL – Liquid Limit
- PI – Plasticity Index
- LS – Linear Shrinkage
- OMC – Modified Optimum Moisture Content
- MMDD – Maximum Modified Dry Density
- CBR – California Bearing Ratio @ 90% MMDD

8. **Comments**

8.1 **Proposed Development**

It is understood that it is proposed to subdivide Lot 9765 into a number of areas with land use designations varying from single urban dwelling and public open space. However, at the time of writing this report, no details were provided for the designation or preferred locations for each of these areas.

8.2 **Generalised Ground Conditions in Terrain Units**

Ground conditions across the 10 ha site extension and throughout the different terrain units were relatively consistent, with the major variations relating to the thickness and type of topsoil encountered, the thickness and degree of cementation of the underlying subsoils and the depth to refusal on the underlying low strength rock. The subsurface conditions encountered in each terrain unit are described in the following sections.

8.2.1 **Terrain Unit 2b2**

The topsoil encountered in the 2b2 unit was generally described as a grey clayey sandy gravel. The thickness of topsoil ranged from 0.1 m to 0.2 m with an average thickness of 0.2 m.
Subsoils were encountered in all 5 test pits in terrain unit 2b2 and these subsoils generally comprised clayey sandy lateritic gravel or clayey gravel. The subsoils ranged in thickness from 0.3 m (TP106) on the lower part of the site, up to 1 m (TP109) in the upper part of the site. Average thickness of subsoils from 5 test pits was 0.8 m.

Results of this and the previous investigation indicate that the excavated soils in Terrain Unit 2b2 should be suitable for general lot filling and that, after stripping of the topsoil, the unfilled residential lots, and lots with less than 0.4 m of controlled filling, could be classified as Class S or Class A when assessed in accordance with AS 2870 – 2011 (Ref 2).

Weathered siltstone bedrock was encountered in the base of all the test pits in Terrain Unit 2b2. The depth of mini-excavator penetration into the weathered siltstone ranged from 0.1 m to 0.6 m with an average depth of penetration of 0.25 m. The depth to mini-excavator refusal ranged from 0.7 m to 1.8 m with an average depth to refusal of 1.2 m.

### 8.2.2 Terrain Unit 6b

The topsoil encountered in the 6b unit was generally described as a very soft, grey, sandy clay. The thickness of topsoil averaged 0.2 m.

Subsoils were encountered in all 6 test pits and these subsoils generally comprised medium dense to firm sandy clay of medium to high plasticity. The subsoils ranged in thickness from 0.25 m up to 0.9 m with an average thickness of subsoils of 0.4 m. Due to the plasticity of the clay fraction, the 6b subsoils are considered unsuitable for general lot filling or for the construction of residential developments.

The subsoil sample tested in the laboratory classified as gravelly silty clay. The insitu moisture content (after early wet season showers) was about 2% dry of optimum moisture content for modified compaction. Soaked CBR for the subsoil recompacted to 95% MMDD was 10%. This relatively low value tends to confirm our previous assessment that “unsuitable subgrade” soils with a CBR less than 6%, will be encountered within the 6b terrain unit.

Weathered siltstone bedrock was encountered in the base of most test pits. The depth of mini-excavator penetration into the weathered siltstone ranged from 0.05 m to 0.4 m and the overall depth to mini-excavator refusal was relatively shallow in most pits, ranging from 0.5 m to 1.2 m.

### 8.3 Land Use Evaluation – Capability Ratings

Land use evaluation for urban residential subdivision suitability for each of the terrain units identified in the extension area of Lot 9765 has been derived by combining the Land Capability Ratings in Table 1 with the Terrain Unit descriptions in Table 2 to arrive at the Land Use Capability rating for each terrain unit presented in Table 4. Also shown in Table 4 is the limiting physical characteristics of the terrain unit that principally determines the Capability Rating for that unit.
Table 4: Land Use Capability Rating for Each Terrain Unit

<table>
<thead>
<tr>
<th>Unit</th>
<th>Landform</th>
<th>Slope</th>
<th>Drainage</th>
<th>Urban Subdiv’n</th>
<th>Limiting Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>1c</td>
<td>Low scarps &amp; short steep slopes</td>
<td>10-15%</td>
<td>V Rapid</td>
<td>L</td>
<td>Surface stone and outcrop</td>
</tr>
<tr>
<td>2b2</td>
<td>Gentle sideslopes</td>
<td>2–5%</td>
<td>Rapid</td>
<td>L</td>
<td>Shallow gravelly soils and laterite outcrop</td>
</tr>
<tr>
<td>6b</td>
<td>broad lowland plains</td>
<td>&lt; 0.5%</td>
<td>Wet season inundation</td>
<td>N</td>
<td>Site drainage</td>
</tr>
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</table>

The Land Use Capability ratings for the three terrain units listed above are either L or N, which indicate low or nil capability for urban residential subdivision purposes. In the 1c and 2b2 terrain units, the capability ratings can be modified by engineering intervention to improve site drainage and soil drainage, to stabilise slopes, to protect natural slopes from further erosion, to provide suitable subgrades for pavement construction and to mitigate possible seepage problems. The engineering intervention that may be required in some areas of the extension to Lot 9765 to raise the capability ratings by one or two levels (from L to C₁ or C₂) are discussed briefly in the following sections.

8.4 Engineering Intervention to Modify Capability Ratings

Based on the type and distribution of the terrain units encountered on the site, and the proposed broad land use of “urban residential development”, the following additional site works could be undertaken to raise the capability ratings in areas of terrain units 1c and 2b2.

8.4.1 Intervention in Terrain Unit 1c

Terrain unit 1c on the north-eastern boundary of the extension to Lot 9765 as shown on Drawing 2, comprises a ridge with relatively steep slopes and will exhibit very rapid drainage. However, as a result of the low permeability of the shallow rock and rock outcrop, springs may occur under road pavements and on building lots at the footslopes of this unit for periods of up to two months or more in the early dry season. These springs may only be detectable after construction is completed and a full wet season rainfall has saturated the shallow rock in this terrain unit. Intrusive site investigation including boreholes and test pits will not necessarily reveal spring areas, even if the holes are drilled or excavated at the end of the wet season.

If springs are noted at the toe of cuttings for roads or on building lots after construction, corrective measures, including the installation of subsurface drains discharging to the stormwater system, may be required to mitigate the near surface flows. The installation of targeted subsurface drains, combined with the recontouring of cemented lateritic soils or low strength siltstone rock outcrop, can raise the capability rating of the 1c terrain unit from L up to C₁ or C₂. Residential lots on natural soils, or with less than 0.4 m of controlled filling, are likely to be classified as Class A or Class S sites when assessed in accordance with AS 2870-1996 “Residential Slabs and Footings – Construction”.

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February 2011
8.4.2 Seepage Affecting Unit 2b2 Downslope of Unit 1c

After heavy wet season rainfall, and particularly towards the end of the wet season, seepage lines may form parallel to the ground surface contours at or below the boundary of the 1c terrain unit within the adjacent downslope 2b2 terrain unit. If these seepage lines produce significant surface flows, subsurface drains will be required along road kerbs to prevent a buildup of pore pressures under sealed pavements and subsequent softening and failure of the pavement gravels and sealed surface.

It may also be necessary to install relatively deep (up to about 1.2 m) subsoil drains on any individual lots or groups of lots below the 1c terrain unit so that groundwater seepage is intercepted and directed to the stormwater drainage system before the seepage water can saturate and soften soils around building foundations. Unfortunately, the seepage areas are difficult to predict or accurately delineate because the extent and location of seepage will also depend on site earthworks carried out for roads, services and building lots during construction. The seepage areas can usually only be detected at the end of the first wet season after the subdivision civil works are completed, and when surface water has evaporated and shallow groundwater continues to flow downslope.

8.4.3 Intervention in Terrain Unit 2b2

A significant area of terrain unit 2b2 was delineated in the central part of the extension of Lot 9765. No laterite outcrop was noted during the site walkover survey and it is not expected that high strength laterite rock will be encountered in this area.

If low strength laterite outcrop is encountered at shallow depth in the 2b2 terrain unit, this issue can be addressed during road construction by excavation of the laterite, compaction of the exposed loosened surface and construction of the road pavement. However, although laterite outcrop may be an impediment to lot development on some sites, laterite rock and lateritic soils can be readily contoured and capped with topsoil from the adjacent 6b areas of the site to raise the capability rating from L up to a minimum of C2.

8.4.4 Construction Across Terrain Unit 6b

Terrain unit 6b occurs over significant areas in the southern and western parts of the site. Due to the low lying nature of this land unit, the propensity for flooding or waterlogging, the depth of soft clay topsoil and clayey subsoils, it is not expected that more than the very fringes of the central 6b land unit could be developed for urban residential land.

The Land Use Capability of small fringe areas of the 6b terrain unit soils can be raised by excavating and stockpiling the topsoil, replacing any underlying loose sandy or clay loam subsoils with engineered filling, then replacing the topsoil. The adoption of this “excavate and replace” method of site development will ensure that the capability rating of small areas adjacent to the 2b2 unit will be raised from N up to at least L or C2.

Provided there is control over the placement and testing of filling to a Level 1 standard in accordance with AS3798-2008 (Ref 3), earthworks will ensure that the final lots with <0.4 m controlled filling are likely to be classified as Class S, whilst those lots with >0.4 m controlled filling are likely to be classified as equivalent to Class S.
When the subdivision is designed, roads and services will need to cross the 6b land unit to link other higher sections of the subdivision. Roads crossing these broad drainage swales could be constructed either with reinforced floodway pavements or as engineered earthfill embankments with culvert drainage structures as required.

8.5 Pavement Design

The CBR test carried out on a sample of the existing subgrade soils encountered in Terrain Unit 6b during this investigation (Table 4) indicated a soaked CBR value of 10%, when re-compacted to 95% of the Modified maximum dry density at optimum moisture content.

Taking into consideration this test and the testing of our previous investigation, it is suggested that for preliminary design of road pavements, a preliminary design CBR value of 20% be adopted for terrain units 1c and 2b2, and a preliminary design CBR of 10% be adopted for terrain unit 6b, assuming “unsuitable subsoils” are removed and replaced and that pavement subgrade preparation is carried out in accordance with standard engineering practice.

When the suburb layout is finalised, additional CBR testing will be required on samples from subgrade level on actual road alignments which, in combination with the above results, may confirm higher CBR values for the detailed design of the subdivision roads. If imported selected filling is placed to a thickness greater than 0.5 m over the plan area of any road pavements, particularly in the 6b terrain unit, then the CBR of the selected filling (>30%) could be used for design of the road pavement in these filled areas.

8.6 Groundwater

Groundwater and groundwater seepage was observed in 8 of the 11 test pits during field work for this investigation which was carried out in the early wet season. Site vegetation and surface conditions across the 6b terrain unit indicate that groundwater levels could be close to the natural surface level and water levels could be above ground level during the wet season. The relatively flat nature of terrain unit 6b and the current land uses to the southwest of the site may also restrict drainage off site towards the southwest. Therefore, careful attention should be paid to the location, design and installation of roadways and open and subsurface stormwater drains in these 6b terrain unit areas.

9. Further Investigation

When the layout of the subdivision is finalised, further geotechnical investigation and laboratory testing will be required to confirm design parameters for detailed road pavement design, to investigate the subsurface conditions for any significant drainage structures, such as culverts, bridge crossings over drains and stormwater retention structures, and to test soils for aggressivity to concrete structures.
10. References


11. Limitations

Douglas Partners (DP) has prepared this report on preliminary geotechnical assessment for the extension of a proposed residential subdivision on Lot 9765 Roystonea Avenue, Durack, NT for CIC Australia Limited in accordance with Douglas Partners (DP’s) fee proposal dated 10 November 2010. The report is provided for the exclusive use of CIC Australia Limited for this project only and for the purpose(s) described in the report. It should not be used for other projects or by a third party. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The assessments provided in the report are indicative of the sub-surface conditions only at the specific sampling or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of anthropogenic influences. Such changes may occur after the field testing has been completed.

DP's advice is based upon the data assembled from investigations and reports carried out by others. The accuracy of the advice provided by DP in this report will be limited by undetected variations in ground conditions between sampling locations. The advice may also be limited by constraints on access to historical information which is mostly in hard copy format.

This report must be read in conjunction with all of the attached notes and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion given in this report.

Douglas Partners Pty Ltd
Appendix A
Notes and Drawings

About this Report
Drawing 1 – Site Location Plan
Drawing 2 – Location of Test Pits
Introduction
These notes have been provided to amplify DP’s report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

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

Copyright
This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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

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

Groundwater
Where groundwater levels are measured in boreholes there are several potential problems, namely:

- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

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

Reports
The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

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

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.
**About this Report**

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

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

**Site Inspection**
The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.
TITLE: SITE LOCALITY PLAN
EXTENSION TO PROPOSED RESIDENTIAL SUBDIVISION AREA
LOT 9765 ROYSTONEA AVENUE, DURACK, NT

CLIENT: CIC AUSTRALIA LIMITED
DRAWN BY: DSF
APPROVED BY: DSF
DATE: January 2011

DOUGLAS PARTNERS
Geotechnics · Environment · Groundwater

Brisbane, Canberra
Darwin, Melbourne
Perth, Sydney
Cairns, Gold Coast
Minto, Newcastle
Sunshine Coast, Townsville
Wollongong, Wyong

SCALE: NTS
PROJECT No: 48229.01
DRAWING No: 1
Appendix B
Field Test Results

Table B1 – Test Pit Locations and Estimated Surface Levels
Plates 1 to 21 – Subsurface Conditions
Test Pit Logs (TP101 to TP111)
Symbols and Abbreviations
Soil Descriptions
Rock Descriptions
## TABLE B1

**TEST PIT LOCATIONS AND ESTIMATED SURFACE LEVELS**

<table>
<thead>
<tr>
<th>Test Pit No.</th>
<th>Easting (m)</th>
<th>Northing (m)</th>
<th>Surface Level (m) AHD</th>
</tr>
</thead>
<tbody>
<tr>
<td>101</td>
<td>714 931</td>
<td>8 620 640</td>
<td>24.5</td>
</tr>
<tr>
<td>102</td>
<td>714 889</td>
<td>8 620 529</td>
<td>23.0</td>
</tr>
<tr>
<td>103</td>
<td>715 006</td>
<td>8 620 529</td>
<td>24.5</td>
</tr>
<tr>
<td>104</td>
<td>715 082</td>
<td>8 620 529</td>
<td>26.5</td>
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<td>105</td>
<td>714 870</td>
<td>8 620 408</td>
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<td>106</td>
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<td>715 023</td>
<td>8 620 364</td>
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<td>108</td>
<td>715 133</td>
<td>8 620 333</td>
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<td>8 620 236</td>
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</tr>
<tr>
<td>111</td>
<td>715 187</td>
<td>8 620 252</td>
<td>26.5</td>
</tr>
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</table>
PLATE 1: Test Pit 101 ground conditions (Terrain Unit 6b)

PLATE 2: Test Pit 102 ground conditions (Terrain Unit 6b)
PLATE 3: Test Pit 103 ground conditions (Terrain Unit 6b)

PLATE 4: Test Pit 104 ground conditions (Terrain Unit 6b)
PLATE 5: Test Pit 105 ground conditions (Terrain Unit 6b)

PLATE 6: Test Pit 107 ground conditions (Terrain Unit 2b2)
PLATE 7: Test Pit 108 ground conditions (Terrain Unit 2b2)

PLATE 8: Test Pit 109 ground conditions (Terrain Unit 2b2)
PLATE 9: Test Pit 110 ground conditions (Terrain Unit 2b2)

PLATE 10: Test Pit 111 ground conditions (Terrain Unit 2b2)
## TEST PIT LOG

**CLIENT:** CIC Australia Limited  
**PROJECT:** Additional Geotechnical Investigation  
**LOCATION:** CDU Campus Lot 9765 Roystonea Avenue, Durack, NT

**SURFACE LEVEL:** 24.5m AHD  
**EASTING:** 714931  
**NORTHING:** 8620640  
**DATE:** 17/12/2010

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
<th>Graphic Log</th>
<th>Sampling &amp; In Situ Testing</th>
<th>Dynamic Penetrometer Test (blows per mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>TOPSOIL - very soft, grey brown, sandy clay, minor roots, moist</td>
<td>(D) 0.05</td>
<td>5 10 15 20</td>
<td></td>
</tr>
<tr>
<td>0.5</td>
<td>SANDY CLAY / CLAYEY SAND - firm / medium dense, orange brown, sandy clay / clayey sand, moist</td>
<td>(D) 0.3</td>
<td>5 10 15 20</td>
<td></td>
</tr>
<tr>
<td>0.9</td>
<td>META-SILTSTONE - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded</td>
<td>(C) 0.4</td>
<td>5 10 15 20</td>
<td></td>
</tr>
</tbody>
</table>

Pit discontinued at 0.9m, Refusal

**RIG:** Hitachi 5 tonne mini-excavator  
**LOGGED:** JMD  
**SURVEY DATUM:**

**WATER OBSERVATIONS:** No free groundwater observed  
**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map

**SAMPLING & IN SITU TESTING LEGEND**

- A: Auger sample  
- B: Bulk sample  
- BLK: Block sample  
- C: Cone drilling  
- D: Disturbed sample  
- E: Environmental sample  
- G: Gas sample  
- P: Piston sample  
- PL(D): Point load diametral test (kPa)  
- PL(A): Point load axial test (kPa)  
- PP: Pocket penetrometer (kPa)  
- V: Shear vane (kPa)  
- W: Water sample  
- W5: Water level

- **Sand Penetrometer AS1289.6.3.3**  
- **Cone Penetrometer AS1289.6.3.2**
<table>
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<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
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<tbody>
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<td>0.1</td>
<td>TOPSOIL - very soft, grey brown, sandy clay, minor roots, wet</td>
</tr>
<tr>
<td>0.3</td>
<td>SANDY CLAY - firm, red brown, orange brown and grey, sandy clay, moist</td>
</tr>
<tr>
<td>0.5</td>
<td>META-SILTSTONE - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded</td>
</tr>
<tr>
<td>0.8</td>
<td>...minor seepage observed at 0.7m Pit discontinued at 0.8m, Refusal</td>
</tr>
</tbody>
</table>

**Dynamic Penetrometer Test (blows per mm)**

- 5
- 10
- 15
- 20

**Sampling & In Situ Testing**

- Water
- Soil
- Gas
- Core drilling
- Environmental sample

**Surface Level:** 23.0m AHD

**Easting:** 714889

**Nordthing:** 8620529

**Date:** 17/12/2010

**Pit No:** TP102

**Rig:** Hitachi 5 tonne mini-excavator

**Logged:** JMD

**Surface Level estimated from Durack 1:2500 Topographic Map**
### TEST PIT LOG

**CLIENT:** CIC Australia Limited  
**PROJECT:** Additional Geotechnical Investigation  
**LOCATION:** CDU Campus Lot 9765 Roystonea Avenue, Durack, NT  
**SURFACE LEVEL:** 24.5m AHD  
**EASTING:** 715006  
**NORTHING:** 8620529  
**DATE:** 17/12/2010  
**PIT No:** TP103  
**PROJECT No:** 48229.01  

**LOGGED:** JMD  
**SURVEY DATUM:**

### Sampling & In Situ Testing

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<th>Type</th>
<th>Depth</th>
<th>Sample</th>
<th>Results &amp; Comments</th>
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<tbody>
<tr>
<td>Water</td>
<td>0.05</td>
<td>(D)</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>0.2</td>
<td>(D)</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>0.3</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Dynamic Penetrometer Test (blows per mm)

<table>
<thead>
<tr>
<th>Dynamic Penetrometer Test</th>
<th>5</th>
<th>10</th>
<th>15</th>
<th>20</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Description of Strata

- **TOPSOIL** - very soft, grey brown, sandy clay, minor roots, moist
- **SANDY CLAY** - firm, orange brown and grey brown, sandy clay, moist
- **META-SILTSTONE** - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded
  - Minor seepage observed at 0.45m
  - Pit discontinued at 0.5m, Refusal

### WATER OBSERVATIONS

- Minor seepage observed at 0.45m

### REMARKS

- Surface Level estimated from Durack 1:2500 Topographic Map

### RIG:

- Hitachi 5 tonne mini-excavator

### SURFACE LEVEL:

- 24.5m AHD

### EASTING:

- 715006

### NORTHING:

- 8620529

### DATE:

- 17/12/2010

### RIG:

- Hitachi 5 tonne mini-excavator

### LOGGED:

- JMD

### SURVEY DATUM:

- **Sand Penetrometer AS1289.6.3.3**
- **Cone Penetrometer AS1289.6.3.2**
<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
<th>Graphic Log</th>
<th>Sampling &amp; In Situ Testing</th>
<th>Results &amp; Comments</th>
<th>Water</th>
<th>Dynamic Penetrometer Test (blows per mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>TOPSOIL - very soft, grey brown, sandy clay, minor roots, moist</td>
<td>(D)</td>
<td>0.05</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.3</td>
<td>SANDY CLAY - firm, red brown, orange brown and grey, sandy clay, moist</td>
<td>(D)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>META-SILTSTONE - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded</td>
<td>(D)</td>
<td>0.7</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>0.8</td>
<td>Pit discontinued at 0.8m, Refusal</td>
<td>(D)</td>
<td>0.8</td>
<td></td>
<td></td>
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RIG: Hitachi 5 tonne mini-excavator
LOGGED: JMD
SURVEY DATUM:
- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2

WATER OBSERVATIONS: Minor seepage observed at 0.7m
REMARKS: Surface Level estimated from Durack 1:2500 Topographic Map
<table>
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<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
<th>Graphic Log Type</th>
<th>Sampling &amp; In Situ Testing</th>
<th>Dynamic Penetrometer Test (blows per mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
<td>TOPSOIL - firm, grey brown, sandy clay, minor roots, wet</td>
<td>(D) 0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.2</td>
<td>SANDY CLAY - stiff, grey brown, sandy clay, wet</td>
<td>(D) 0.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>CLAYEY SANDY GRAVEL - dense, orange brown, red brown and off-white, clayey sandy gravel, laterised siltstone gravel, wet</td>
<td>(D) 0.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.8</td>
<td>...seepage observed at 0.6m</td>
<td>(D) 0.8</td>
<td></td>
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</tr>
<tr>
<td>1.0</td>
<td>Pit discontinued at 1.2m, Refusal</td>
<td>(D) 1.0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Pit discontinued at 1.2m, Refusal</td>
<td></td>
<td></td>
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</tbody>
</table>

**TEST PIT LOG**

**CLIENT:** CIC Australia Limited  
**PROJECT:** Additional Geotechnical Investigation  
**LOCATION:** CDU Campus Lot 9765 Roystonea Avenue, Durack, NT  
**SURFACE LEVEL:** 21.0m AHD  
**EASTING:** 714870  
**NORTHING:** 8620408  
**DIP/AZIMUTH:** 90°/--  
**PIT No:** TP105  
**PROJECT No:** 48229.01  
**DATE:** 17/12/2010  
**SURVEY DATUM:**

**WATER OBSERVATIONS:** Seepage observed at 0.6m  
**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map  
**LOGGED:** JMD  
**RIG:** Hitachi 5 tonne mini-excavator  
**SURVEY DATUM:**

**SAMPLING & IN SITU TESTING LEGEND**

- A Auger sample  
- B Bulk sample  
- BLK Block sample  
- C Cone drilling  
- D Disturbed sample  
- E Environmental sample  
- G Gas sample  
- PID Photo-ionisation detector (ppm)  
- PL(A) Point load axial test (kN) (MPa)  
- PL(D) Point load diametral test (kN) (MPa)  
- PP Pocket penetrometer (kPa)  
- PW Water sample  
- U Tube sample (x mm dia.)  
- V Shear vane (kPa)  

- Sand Penetrometer AS1289.6.3.3  
- Cone Penetrometer AS1289.6.3.2
### TEST PIT LOG

**CLIENT:** CIC Australia Limited  
**PROJECT:** Additional Geotechnical Investigation  
**LOCATION:** CDU Campus Lot 9765 Roystonea Avenue Durack, NT  
**SURFACE LEVEL:** 22.0m AHD  
**DATE:** 17/12/2010  
**PIT No:** TP106

#### Sampling & In Situ Testing Legend

- **A** Auger sample  
- **B** Bulk sample  
- **BLK** Block sample  
- **C** Core drilling  
- **D** Disturbed sample  
- **E** Environmental sample  
- **G** Gas sample  
- **P** Piston sample  
- **PID** Photo ionisation detector (ppm)  
- **PLA** Point load axial test (kN) (MPa)  
- **PLD** Point load diametral test (kN) (MPa)  
- **PP** Pocket penetrometer (kPa)  
- **S** Standard penetration test  
- **V** Shear vane (kPa)  
- **W** Water sample  
- **WP** Water level  

#### Dynamic Penetrometer Test (blows per mm)

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Type</th>
<th>Sample</th>
<th>Results &amp; Comments</th>
<th>Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.1</td>
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<td></td>
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</tr>
<tr>
<td>0.3</td>
<td>(D)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>(D)</td>
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</tr>
<tr>
<td>0.7</td>
<td></td>
<td></td>
<td>Pit discontinued at 0.7m, Refusal</td>
<td></td>
</tr>
</tbody>
</table>

#### Description of Strata

- **TOPSOIL** - loose, grey brown, clayey sandy gravel, minor roots, wet
- **CLAYEY GRAVEL** - dense, orange brown, clayey gravel, laterised siltstone gravel
- **META-SILTSTONE** - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded
- Pit discontinued at 0.7m, Refusal

---

**RIG:** Hitachi 5 tonne mini-excavator  
**LOGGED:** JMD  
**SURVEY DATUM:**
- **EASTING:** 714943  
- **NORTHING:** 8620419  
- **DIP/AZIMUTH:** 90°/--

**SURFACE LEVEL estimated from Durack 1:2500 Topographic Map**

**WATER OBSERVATIONS:** No free groundwater observed

**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map

---

**SAMPLING & IN SITU TESTING LEGEND**

- **Sand Penetrometer AS1289.6.3.3**  
- **Cone Penetrometer AS1289.6.3.2**
**TOPSOIL** - loose, grey brown, clayey sandy gravel, minor roots, moist

**CLAYEY SANDY GRAVEL** - dense, orange brown, clayey sandy gravel, lateritic gravel, moist

**CLAYEY GRAVEL** - dense, red brown, orange brown and off-white, clayey gravel, laterised siltstone gravel, moist

**GRAVELLY CLAY** - stiff, red brown, orange brown and off-white, gravelly clay, wet

**META-SILTSTONE** - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded

Minor seepage observed at 0.9m

Pit discontinued at 1.0m, Refusal

---

**RIG:** Hitachi 5 tonne mini-excavator

**LOGGED:** JMD

**SURVEY DATUM:**

**WATER OBSERVATIONS:** Minor seepage observed at 0.9m

**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map
# TEST PIT LOG

**CLIENT:** CIC Australia Limited  
**PROJECT:** Additional Geotechnical Investigation  
**LOCATION:** CDU Campus Lot 9765 Roystonea Avenue Durack, NT  
**SURFACE LEVEL:** 25.5m AHD  
**EASTING:** 715133  
**NORTHING:** 8620333  
**DIP/AZIMUTH:** 90°/--

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<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
<th>Graphic Log</th>
<th>Sampling &amp; In Situ Testing</th>
<th>Dynamic Penetrometer Test (blows per mm)</th>
</tr>
</thead>
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<tr>
<td>0.2</td>
<td>TOPSOIL - loose, grey brown, clayey sandy gravel, minor roots, moist</td>
<td><img src="image1" alt="Graphic Log" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.6</td>
<td>CLAYEY SANDY GRAVEL - dense, orange brown, red brown and off-white, clayey sandy gravel, laterised siltstone gravel, moist</td>
<td><img src="image2" alt="Graphic Log" /></td>
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<tr>
<td>0.7</td>
<td>...becoming cemented from 0.7m</td>
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<tr>
<td>1.2</td>
<td>...minor seepage observed from 1.0m</td>
<td><img src="image4" alt="Graphic Log" /></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2</td>
<td>Pit discontinued at 1.2m, Refusal</td>
<td><img src="image5" alt="Graphic Log" /></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RIG:** Hitachi 5 tonne mini-excavator  
**LOGGED:** JMD  
**SURVEY DATUM:**

- **EASTING:** 715133  
- **NORTHING:** 8620333  
- **DIP/AZIMUTH:** 90°/--

**SURVEY DATUM:**

- **SURFACE LEVEL:** 25.5m AHD  
- **DATE:** 17/12/2010  
- **SHEET:** 1 OF 1

**WATER OBSERVATIONS:** Minor seepage observed at 1.0m

**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map

---

**SAMPLES & IN SITU TESTING LEGEND**

- **A:** Auger sample  
- **B:** Bulk sample  
- **BLK:** Block sample  
- **C:** Core drilling  
- **D:** Disturbed sample  
- **E:** Environmental sample  
- **G:** Gas sample  
- **P:** Piston sample  
- **U:** Tube sample (x mm dia.)  
- **W:** Water sample  
- **Z:** Water level  
- **PID:** Photo-ionisation detector (ppm)  
- **PL(A):** Point load axial test (x(50) (MPa)  
- **PL(D):** Point load diametral test (x(50) (MPa)  
- **pp:** Pocket penetrometer (kPa)  
- **S:** Standard penetration test  
- **V:** Shear vane (kPa)  

---

**Douglas Partners**

Geotechnics | Environment | Groundwater
TOPSOIL - loose, grey brown, clayey sandy gravel, minor roots, damp

CLAYEY SANDY GRAVEL - dense, red brown, orange brown and off-white, clayey sandy gravel, laterised siltstone gravel

META-SILTSTONE - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded

Pit discontinued at 1.4m, Refusal

RIG: Hitachi 5 tonne mini-excavator
LOGGED: JMD

WATER OBSERVATIONS: No free groundwater observed

REMARKS: Surface Level estimated from Durack 1:2500 Topographic Map

CLIENT: CIC Australia Limited
PROJECT: Additional Geotechnical Investigation
LOCATION: CDU Campus Lot 9765 Roystonea Avenue
Durack, NT

SURFACE LEVEL: 27.5m AHD
EASTING: 715242
NORTHING: 8620292
DIP/AZIMUTH: 90°/--

PIT No: TP109
PROJECT No: 48229.01
DATE: 17/12/2010

TEST PIT LOG

Depth (m) | Description of Strata | Sampling & In Situ Testing | Dynamic Penetrometer Test (blows per mm)
--- | --- | --- | ---
0.2 | TOPSOIL - loose, grey brown, clayey sandy gravel, minor roots, damp | | |
0.5 | CLAYEY SANDY GRAVEL - dense, red brown, orange brown and off-white, clayey sandy gravel, laterised siltstone gravel | | |
0.7 | META-SILTSTONE - low strength, moderately weathered, orange brown and grey, meta-siltstone, sub-vertically bedded | | |
1.4 | Pit discontinued at 1.4m, Refusal | | |

SAMPLING & IN SITU TESTING LEGEND:
A Auger sample
B Bulk sample
BLK Block sample
C Core drilling
D Disturbed sample
E Environmental sample
G Gas sample
P Piston sample
PL(A) Point load axial test Is(50) (MPa)
PL(D) Point load diametral test Is(50) (MPa)
PPD Photo-ionisation detector (ppm)
S Standard penetration test
SPT Standard penetration test
SPTn Standard penetration test
T Time
V Shear vane (kPa)
W Water sample
WP Water level
X Tube sample (x mm dia.)

SURVEY DATUM:
- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2
### Test Pit Log

**Client:** CIC Australia Limited  
**Project:** Additional Geotechnical Investigation  
**Location:** CDU Campus Lot 9765 Roystonea Avenue, Durack, NT

**Surface Level:** 23.5m AHD  
**Easting:** 715073  
**Northing:** 8620236  
**Datum:** NZVD 90

**Pit No:** TP110  
**Project No:** 48229.01  
**Date:** 17/12/2010  
**Sheet:** 1 of 1

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
<th>Sampling &amp; In Situ Testing</th>
<th>Dynamic Penetrometer Test (blows per mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>0.0</td>
<td>Sandy Clay - soft, grey brown, sandy clay, minor roots to 0.2m, moist</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| 0.3       | Gravelly Silty Clay - stiff, orange brown, red brown and grey brown, gravelly silty clay, laterised siltstone gravel, moist  
...minor seepage observed at 0.4m |                             |   |    |    |    |
|           | ...becoming weakly cemented and wet from 1.2m |                             |   |    |    |    |
| 1.5       |                             |                             |   |    |    |    |
| 1.8       | Pit discontinued at 1.8m, Refusal |                             |   |    |    |    |

**Rig:** Hitachi 5 tonne mini-excavator  
**Logged:** JMD

**Water Observations:** Minor seepage observed at 0.4m

**Remarks:** Surface Level estimated from Durack 1:2500 Topographic Map

<table>
<thead>
<tr>
<th>Sampling &amp; In Situ Testing</th>
<th>Type</th>
<th>Depth</th>
<th>Sample</th>
<th>Results &amp; Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Auger sample</td>
<td>G</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B Bulk sample</td>
<td>P</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C Core drilling</td>
<td>U</td>
<td>Tube sample (x mm dia.)</td>
<td>PL(D)</td>
<td>Point load diametral test (kPa)</td>
</tr>
<tr>
<td>D Disturbed sample</td>
<td>W</td>
<td>Water sample</td>
<td>PID</td>
<td>Photo-ionisation detector (ppm)</td>
</tr>
<tr>
<td>E Environmental sample</td>
<td>V</td>
<td>Water level</td>
<td>PL(A)</td>
<td>Point load axial test (k50) (MPa)</td>
</tr>
</tbody>
</table>

**Survey Datum:**
- Sand Penetrometer AS1289.6.3.3
- Cone Penetrometer AS1289.6.3.2
### TEST PIT LOG

**CLIENT:** CIC Australia Limited  
**PROJECT:** Additional Geotechnical Investigation  
**LOCATION:** CDU Campus Lot 9765 Roystonea Avenue, Durack, NT  
**SURFACE LEVEL:** 26.5mAHD  
**EASTING:** 715187  
**NORTHING:** 8620252  
**DATE:** 17/12/2010  
**PIT No:** TP111

---

**Rent:** Hitachi 5 tonne mini-excavator  
**LOGGED:** JMD  
**SURVEY DATUM:**

**WATER OBSERVATIONS:** Minor seepage observed at 1.2m  
**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map

---

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description of Strata</th>
<th>Sampling &amp; In Situ Testing</th>
<th>Dynamic Penetrometer Test (blows per mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>TOPSOIL - very soft, grey brown, sandy clay, minor roots, damp</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.4</td>
<td>CLAYEY SANDY GRAVEL - dense, red brown, orange brown and grey brown, clayey sandy gravel, laterised siltstone gravel, moist</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Pit discontinued at 1.3m, Refusal</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

---

**COMMENTS:**
- ...becoming cemented from 1.1m
- ...minor seepage observed at 1.2m

---

**SAMPLING & IN SITU TESTING LEGEND**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Auger sample</td>
</tr>
<tr>
<td>B</td>
<td>Bulk sample</td>
</tr>
<tr>
<td>BLK</td>
<td>Block sample</td>
</tr>
<tr>
<td>C</td>
<td>Core drilling</td>
</tr>
<tr>
<td>D</td>
<td>Disturbed sample</td>
</tr>
<tr>
<td>E</td>
<td>Environmental sample</td>
</tr>
<tr>
<td>F</td>
<td>Field test</td>
</tr>
<tr>
<td>G</td>
<td>Gas sample</td>
</tr>
<tr>
<td>H</td>
<td>High speed sample</td>
</tr>
<tr>
<td>I</td>
<td>Impaction sample</td>
</tr>
<tr>
<td>J</td>
<td>JMD sample</td>
</tr>
<tr>
<td>K</td>
<td>KMD sample</td>
</tr>
<tr>
<td>L</td>
<td>LMD sample</td>
</tr>
<tr>
<td>M</td>
<td>MDD sample</td>
</tr>
<tr>
<td>N</td>
<td>NMD sample</td>
</tr>
<tr>
<td>O</td>
<td>OMD sample</td>
</tr>
<tr>
<td>P</td>
<td>Piston sample</td>
</tr>
<tr>
<td>PL(A)</td>
<td>Point load axial test Is(50) (MPa)</td>
</tr>
<tr>
<td>PL(D)</td>
<td>Point load diametral test Is(50) (MPa)</td>
</tr>
<tr>
<td>PPL</td>
<td>Photo ionisation detector (ppm)</td>
</tr>
<tr>
<td>Q</td>
<td>Quartz sample</td>
</tr>
<tr>
<td>R</td>
<td>Rock sample</td>
</tr>
<tr>
<td>S</td>
<td>Standard penetration test</td>
</tr>
<tr>
<td>T</td>
<td>Swab sample</td>
</tr>
<tr>
<td>U</td>
<td>Tube sample (x mm dia.)</td>
</tr>
<tr>
<td>V</td>
<td>Shear vane (kPa)</td>
</tr>
<tr>
<td>W</td>
<td>Water sample</td>
</tr>
<tr>
<td>X</td>
<td>Water level</td>
</tr>
<tr>
<td>Y</td>
<td>YMD sample</td>
</tr>
<tr>
<td>Z</td>
<td>ZMD sample</td>
</tr>
</tbody>
</table>

---

**Dynamic Penetrometer Test**

<table>
<thead>
<tr>
<th>Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>(D)</td>
<td>Cone Penetrometer AS1289.6.3.2</td>
</tr>
<tr>
<td>(D)</td>
<td>Sand Penetrometer AS1289.6.3.3</td>
</tr>
</tbody>
</table>

---

**SURFACE LEVEL:** 26.5mAHD  
**EASTING:** 715187  
**NORTHING:** 8620252  
**DATE:** 17/12/2010  
**PIT No:** TP111

---

**RIG:** Hitachi 5 tonne mini-excavator  
**LOGGED:** JMD  
**SURVEY DATUM:**

---

**WATER OBSERVATIONS:** Minor seepage observed at 1.2m  
**REMARKS:** Surface Level estimated from Durack 1:2500 Topographic Map
Introduction
These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods
- C  Core Drilling
- R  Rotary drilling
- SFA  Spiral flight augers
- NMLC  Diamond core - 52 mm dia
- NQ  Diamond core - 47 mm dia
- HQ  Diamond core - 63 mm dia
- PQ  Diamond core - 81 mm dia

Water
- Z  Water seep
- V  Water level

Sampling and Testing
- A  Auger sample
- B  Bulk sample
- D  Disturbed sample
- E  Environmental sample
- U50  Undisturbed tube sample (50mm)
- W  Water sample
- pp  Pocket penetrometer (kPa)
- PID  Photo ionisation detector
- PL  Point load strength (50) MPa
- S  Standard Penetration Test
- V  Shear vane (kPa)

Description of Defects in Rock
The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type
- B  Bedding plane
- Cs  Clay seam
- Cv  Cleavage
- Cvz  Crushed zone
- Ds  Decomposed seam
- F  Fault
- J  Joint
- Lam  Lamination
- Pt  Parting
- Sz  Sheared Zone
- V  Vein

Orientation
The inclination of defects is always measured from the perpendicular to the core axis.
- h  horizontal
- v  vertical
- sh  sub-horizontal
- sv  sub-vertical

Coating or Infilling Term
- cln  clean
- co  coating
- he  healed
- inf  infilled
- stn  stained
- ti  tight
- vn  veneer

Coating Descriptor
- ca  calcite
- cbs  carbonaceous
- cly  clay
- fe  iron oxide
- mn  manganese
- slt  silty

Shape
- cu  curved
- ir  irregular
- pl  planar
- st  stepped
- un  undulating

Roughness
- po  polished
- ro  rough
- sl  slickensided
- sm  smooth
- vr  very rough

Other
- fg  fragmented
- bnd  band
- qtz  quartz

July 2010
Graphic Symbols for Soil and Rock

General
- Asphalt
- Road base
- Concrete
- Filling

Soils
- Topsoil
- Peat
- Clay
- Silty clay
- Sandy clay
- Gravelly clay
- Shaly clay
- Silt
- Clayey silt
- Sandy silt
- Sand
- Clayey sand
- Silty sand
- Gravel
- Sandy gravel
- Cobble, boulders
- Talus

Sedimentary Rocks
- Boulder conglomerate
- Conglomerate
- Conglomeratic sandstone
- Sandstone
- Siltstone
- Laminate
- Mudstone, claystone, shale
- Coal
- Limestone

Metamorphic Rocks
- Slate, phyllite, schist
- Gneiss
- Quartzite

Igneous Rocks
- Granite
- Dolerite, basalt, andesite
- Dacite, epidote
- Tuff, breccia
- Porphyry
Description and Classification Methods
The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types
Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

<table>
<thead>
<tr>
<th>Type</th>
<th>Particle size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulder</td>
<td>&gt;200</td>
</tr>
<tr>
<td>Cobble</td>
<td>63 - 200</td>
</tr>
<tr>
<td>Gravel</td>
<td>2.36 - 63</td>
</tr>
<tr>
<td>Sand</td>
<td>0.075 - 2.36</td>
</tr>
<tr>
<td>Silt</td>
<td>0.002 - 0.075</td>
</tr>
<tr>
<td>Clay</td>
<td>&lt;0.002</td>
</tr>
</tbody>
</table>

The sand and gravel sizes can be further subdivided as follows:

<table>
<thead>
<tr>
<th>Type</th>
<th>Particle size (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coarse gravel</td>
<td>20 - 63</td>
</tr>
<tr>
<td>Medium gravel</td>
<td>6 - 20</td>
</tr>
<tr>
<td>Fine gravel</td>
<td>2.36 - 6</td>
</tr>
<tr>
<td>Coarse sand</td>
<td>0.6 - 2.36</td>
</tr>
<tr>
<td>Medium sand</td>
<td>0.2 - 0.6</td>
</tr>
<tr>
<td>Fine sand</td>
<td>0.075 - 0.2</td>
</tr>
</tbody>
</table>

The proportions of secondary constituents of soils are described as:

<table>
<thead>
<tr>
<th>Term</th>
<th>Proportion</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>And</td>
<td>Specify</td>
<td>Clay (60%) and Sand (40%)</td>
</tr>
<tr>
<td>Adjective</td>
<td>20 - 35%</td>
<td>Sandy Clay</td>
</tr>
<tr>
<td>Slightly</td>
<td>12 - 20%</td>
<td>Slightly Sandy Clay</td>
</tr>
<tr>
<td>With some</td>
<td>5 - 12%</td>
<td>Clay with some sand</td>
</tr>
<tr>
<td>With a trace of</td>
<td>0 - 5%</td>
<td>Clay with a trace of sand</td>
</tr>
</tbody>
</table>

Definitions of grading terms used are:
- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils
Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

<table>
<thead>
<tr>
<th>Description</th>
<th>Abbreviation</th>
<th>Undrained shear strength (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very soft</td>
<td>vs</td>
<td>&lt;12</td>
</tr>
<tr>
<td>Soft</td>
<td>s</td>
<td>12 - 25</td>
</tr>
<tr>
<td>Firm</td>
<td>f</td>
<td>25 - 50</td>
</tr>
<tr>
<td>Stiff</td>
<td>st</td>
<td>50 - 100</td>
</tr>
<tr>
<td>Very stiff</td>
<td>vst</td>
<td>100 - 200</td>
</tr>
<tr>
<td>Hard</td>
<td>h</td>
<td>&gt;200</td>
</tr>
</tbody>
</table>

Cohesionless Soils
Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

<table>
<thead>
<tr>
<th>Relative Density</th>
<th>Abbreviation</th>
<th>SPT N value</th>
<th>CPT qc value (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very loose</td>
<td>vl</td>
<td>&lt;4</td>
<td>&lt;2</td>
</tr>
<tr>
<td>Loose</td>
<td>l</td>
<td>4 - 10</td>
<td>2 - 5</td>
</tr>
<tr>
<td>Medium dense</td>
<td>md</td>
<td>10 - 30</td>
<td>5 - 15</td>
</tr>
<tr>
<td>Dense</td>
<td>d</td>
<td>30 - 50</td>
<td>15 - 25</td>
</tr>
<tr>
<td>Very dense</td>
<td>vd</td>
<td>&gt;50</td>
<td>&gt;25</td>
</tr>
</tbody>
</table>
Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.
**Rock Descriptions**

**Rock Strength**
Rock strength is defined by the Point Load Strength Index (Is(50)) and refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects. The test procedure is described by Australian Standard 4133.4.1 - 1993. The terms used to describe rock strength are as follows:

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Point Load Index Is(50), MPa</th>
<th>Approx Unconfined Compressive Strength MPa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely low</td>
<td>EL</td>
<td>&lt;0.03</td>
<td>&lt;0.6</td>
</tr>
<tr>
<td>Very low</td>
<td>VL</td>
<td>0.03 - 0.1</td>
<td>0.6 - 2</td>
</tr>
<tr>
<td>Low</td>
<td>L</td>
<td>0.1 - 0.3</td>
<td>2 - 6</td>
</tr>
<tr>
<td>Medium</td>
<td>M</td>
<td>0.3 - 1.0</td>
<td>6 - 20</td>
</tr>
<tr>
<td>High</td>
<td>H</td>
<td>1 - 3</td>
<td>20 - 60</td>
</tr>
<tr>
<td>Very high</td>
<td>VH</td>
<td>3 - 10</td>
<td>60 - 200</td>
</tr>
<tr>
<td>Extremely high</td>
<td>EH</td>
<td>&gt;10</td>
<td>&gt;200</td>
</tr>
</tbody>
</table>

* Assumes a ratio of 20:1 for UCS to Is(50)

**Degree of Weathering**
The degree of weathering of rock is classified as follows:

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely weathered</td>
<td>EW</td>
<td>Rock substance has soil properties, i.e. it can be remoulded and classified as a soil but the texture of the original rock is still evident.</td>
</tr>
<tr>
<td>Highly weathered</td>
<td>HW</td>
<td>Limonite staining or bleaching affects whole of rock substance and other signs of decomposition are evident. Porosity and strength may be altered as a result of iron leaching or deposition. Colour and strength of original fresh rock is not recognisable.</td>
</tr>
<tr>
<td>Moderately weathered</td>
<td>MW</td>
<td>Staining and discolouration of rock substance has taken place.</td>
</tr>
<tr>
<td>Slightly weathered</td>
<td>SW</td>
<td>Rock substance is slightly discoloured but shows little or no change of strength from fresh rock.</td>
</tr>
<tr>
<td>Fresh stained</td>
<td>Fs</td>
<td>Rock substance unaffected by weathering but staining visible along defects.</td>
</tr>
<tr>
<td>Fresh</td>
<td>Fr</td>
<td>No signs of decomposition or staining.</td>
</tr>
</tbody>
</table>

**Degree of Fracturing**
The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

<table>
<thead>
<tr>
<th>Term</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fragmented</td>
<td>Fragments of &lt;20 mm</td>
</tr>
<tr>
<td>Highly Fractured</td>
<td>Core lengths of 20-40 mm with some fragments</td>
</tr>
<tr>
<td>Fractured</td>
<td>Core lengths of 40-200 mm with some shorter and longer sections</td>
</tr>
<tr>
<td>Slightly Fractured</td>
<td>Core lengths of 200-1000 mm with some shorter and loner sections</td>
</tr>
<tr>
<td>Unbroken</td>
<td>Core lengths mostly &gt; 1000 mm</td>
</tr>
</tbody>
</table>
Rock Descriptions

Rock Quality Designation
The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

\[
\text{RQD} \% = \frac{\text{cumulative length of 'sound' core sections } \geq 100 \text{ mm long}}{\text{total drilled length of section being assessed}}
\]

where 'sound' rock is assessed to be rock of low strength or better. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing
For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

<table>
<thead>
<tr>
<th>Term</th>
<th>Separation of Stratification Planes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Thinly laminated</td>
<td>&lt; 6 mm</td>
</tr>
<tr>
<td>Laminated</td>
<td>6 mm to 20 mm</td>
</tr>
<tr>
<td>Very thinly bedded</td>
<td>20 mm to 60 mm</td>
</tr>
<tr>
<td>Thinly bedded</td>
<td>60 mm to 0.2 m</td>
</tr>
<tr>
<td>Medium bedded</td>
<td>0.2 m to 0.6 m</td>
</tr>
<tr>
<td>Thickly bedded</td>
<td>0.6 m to 2 m</td>
</tr>
<tr>
<td>Very thickly bedded</td>
<td>&gt; 2 m</td>
</tr>
</tbody>
</table>
Appendix C

Laboratory Test Results
## Results of Moisture Content, Plasticity and Linear Shrinkage Tests

<table>
<thead>
<tr>
<th>Test Location</th>
<th>Depth (m)</th>
<th>Description</th>
<th>Code</th>
<th>W_F</th>
<th>W_L</th>
<th>W_P</th>
<th>PI</th>
<th>LS %</th>
</tr>
</thead>
<tbody>
<tr>
<td>TP 110</td>
<td>0.5 – 0.7</td>
<td>Gravelly Silty Clay</td>
<td>1,6</td>
<td>-</td>
<td>55</td>
<td>26</td>
<td>29</td>
<td>10.0</td>
</tr>
</tbody>
</table>

### Legend:
- $W_F$: Field Moisture Content
- $W_L$: Liquid limit
- $W_P$: Plastic limit
- PI: Plasticity index
- LS: Linear shrinkage from liquid limit condition (Mould length 125mm)

### Test Methods:
- Moisture Content: AS 1289 2.1.1
- Liquid Limit: AS 1289 3.1.2
- Plastic Limit: AS 1289 3.2.1
- Plasticity Index: AS 1289 3.3.1
- Linear Shrinkage: AS 1289 3.4.1

### Code:
1. Air dried
2. Low temperature (<50°C) oven dried
3. Oven (105°C) dried
4. Unknown

### Method of preparation for plasticity tests:
5. Dry sieved
6. Wet sieved
7. Natural

*Specify if sample crumbled CR or curled CU

### Sampling Methods:
Sampled by Engineer

### Remarks:
Results of Particle Size Distribution

Client: Charles Darwin University
Project: Geotechnical Investigation
Location: Durack, NT
Test Location: TP 110
Depth/Layer: 0.5 - 0.7m

Date Sampled: 17/12/2010
Date of Test: 18/01/2011

Description: Gravelly Silty Clay
Test Method(s): AS 1289.3.6.1
Sampling Method(s): Sampled by Engineer

Andrew Gane
Associate
California Bearing Ratio Report (1 Point)

Client: Douglas Partners
Client address: 3/59 Winnellie Road Winnellie NT 820
Job Number: JN630
Project: Quality Control
Location: Darwin Area, Darwin

Lab No: TN 66616
Date Sampled: 14/01/2011
Date Tested: 25/01/2011
Sampled By: Client
Sample Method: As Received
Material Source: Natural
For Use As: Insitu
Remarks: -

Report Number: JN630 - 4
Report Date: 27/01/2011
Order Number: -
Page 1 of 1

Sample Location: DL10-73B
4R229.01
Sampled 17.12.10

Test Method: AS1289.6.1.1
Lot Number: -
Item Number: -

Maximum Dry Density - MDD (t/m³): 2.079
Optimum Moisture Content - OMC (%): 11.0
Compressive Effort: Modified
Nomimated % Maximum Dry Density Compaction: 95
Nomimated % Optimum Moisture Content Compaction: 100
Achieved Density before Soak (t/m³): 1.961
Achieved Percentage of Maximum Dry Density (%): 94
Achieved Moisture Content (%): 11.9
Achieved Percentage of Optimum Moisture Content (%): 108
Test Condition (Soaked/Unsoaked) / Soaking Period (Days): Soaked / 4 days
Swelled (% / Surcharge (kg): 3.2 / 4.75 kg

Dry Density after Soak (t/m³): 1.900
Moisture Content after Soak (%): 17.2
Density Ratio after Soak (%): 91
Field Moisture Content (%): 9.1
Moisture Content (Total) after Penetration (%): 18.9
Moisture Content (Total) after Penetration (%): 15.4
CBR 2.5mm (%): 9
CBR 5.0mm (%): 10
Minimum Specified CBR Value (%): -
Oversize (%): 0
CBR Value (%): 10.0

Soil Description: Insitu

This document is issued in accordance with NATA's accreditation requirements.

Approved Signatory
Tony Lindsey
NATA Accred No: 11869

Form Number: CBR_1_3-3-36