FACTUAL REPORT, NEARSHORE GEOTECHNICAL INVESTIGATION, DAMPIER CARGO BERTH EXPANSION PROJECT

Dampier Port Authority
Dampier

GEOTHERD08491AA-AE
21 October 2008
21 October 2008

Dampier Port Authority
c/- Evans & Peck Pty Ltd
Level 1, 28 Kings Park Road
West Perth WA 6005

Attention: Mr Craig Gardener

Dear Sir

RE: FACTUAL REPORT NEARSHORE GEOTECHNICAL INVESTIGATION, DAMPIER CARGO BERTH EXPANSION PROJECT

This letter presents our Factual Report (Ref: GEOTHERD08491AA-AE) on Nearshore Geotechnical Investigations carried out for the Dampier Cargo Berth Expansion Project, at Dampier in the North West Pilbara region of Western Australia. This investigation was carried out on behalf of Dampier Port Authority. The Factual Report is presented in two volumes, Volumes 1 and 2.

If you have any questions related to the report or we can be of further assistance, please do not hesitate in contacting the undersigned.

For and on behalf of Coffey Geotechnics Pty Ltd

NEILL BEATTIE

Distribution: Original held by Coffey Geotechnics Pty Ltd
1 hard copy Evans & Peck Pty Ltd
2 hard copies & 1 electronic copy Dampier Port Authority
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1 INTRODUCTION

This report presents the factual results of a Nearshore Geotechnical Investigation carried out by Coffey Geotechnics Pty Ltd (Coffey) on behalf of Dampier Port Authority (DPA). This work was carried out as part of the pre-feasibility assessment for the upgrade of the DPA port facilities at Dampier, in the NW Pilbara region of Western Australia.

The Report is presented in two volumes. Volume 1 encompasses the written report, figures, borehole logs and photographs. Volume 2 presents laboratory test information.

This work was commissioned by Mr Craig Gardiner in a Letter of Acceptance (Contract No. 17A100003), on behalf of Dampier Port Authority, dated 28 April 2008.

This report is prepared and is to be read subject to the terms and conditions contained in our tender document, (Ref: GEOTHERD08491AA-AB) dated 10th March 2008. Our advice is based on the information stated and on the assumptions expressed herein. Should that information or the assumptions be incorrect then Coffey Geotechnics Pty Ltd shall accept no liability in respect of the advice whether under law of contract, tort or otherwise.

2 PROPOSED DEVELOPMENT

It is understood that the current growth experienced in the Pilbara region has impacted on the DPA’s ability to meet the requirements, for the movement of general cargo through the PDA Public Wharf. In order to address future requirements the DPA commissioned a number of studies to assess short term and longer term general cargo berth requirements.

In accordance with the DPA’s ‘Dampier Port Development Plan 2007’, the Short Term Additional Berth Options Study, now referred to as the Dampier Cargo Berth Expansion Project, is to look at three berth options, each capable of handling 35,000 DWT vessels with a draft of -11.5m CD, for the expansion of the cargo berths at Dampier.

3 REGIONAL GEOLOGY

The Geology of Dampier 1:100,000 Geological Series Map and Explanatory Notes do not describe the exact geology of the nearshore work area as it is below sea level. However, the adjacent onshore geology indicates the work area overlays the boundary between porphyritic granite to granodiorite of the Dampier Granitoid Complex and the Gidley Granophyre. The geological map also indicates the presence of shelly sand in coastal dunes and old beach deposits in the area.

4 OBJECTIVES

The objectives of the geotechnical investigations were to:

- Provide information of sub seabed material properties and sub seabed profiles for each of the berth option areas (including areas of reclamation, berthing structures, dredge areas and breakwaters) based on the results of the drilling operations;

- Characterise the subsurface soil and rock conditions in the areas of proposed dredging and land reclamation; and,
• Evaluate the consistency and strength of the subsurface soil and rock, by laboratory testing, for use in the conceptual design of the jetty sub-structures/ foundations.

5 INFORMATION SUPPLIED BY OTHERS

Coffey has been provided with the following documentation:

• Dampier Port Authority – Consultancy and Procurement of Geotechnical Investigation Services for the Dampier Cargo Berth Expansion Project – Tender Documents.
• Drawing D20-SK-017 Rev 0, Proposed Wharf Option 2, Possible Future Expansion.
• Tender Documents - Addendum No.1.
• Drawing 42906759-007 Rev B, Geotechnical Investigation Borehole Location Plan

It is important to note that the information provided has been accepted on “face value” and therefore the veracity of the information has not been assessed by Coffey. Should the information be incorrect or be superseded after this report is issued, the information provided may no longer be valid and further advice should be sought from Coffey.

6 FIELDWORK

6.1 General

Fieldwork was carried out in the full time presence of Coffey personnel from 20th May 2008, the date of mobilisation, to 17th June 2008, the completion of demobilisation. On site drilling was undertaken between 21st May 2008 to 16th June 2008. The requirements given in Australian Standard AS 1726-1993 were used as a guide for carrying out the investigations.

6.2 Boreholes

The fieldwork consisted of 18 boreholes, drilled to depths varying from 1.8m (BH03) to 30.55m (BH08) below seabed at collar levels between -2.2mCD and -7.87mCD using a UDR 100 geotechnical investigation drilling rig with PQ and HQ wireline coring equipment. The drilling rig was mounted onto a 4 legged self elevated (jack up) platform (Sealift 1) with an overall leg length of 26m which was capable of operating in the water depths required for nearshore work off of Dampier. The drilling personnel and equipment were provided by Hagstrom Drilling Pty Ltd. The self elevating platform, Sealift 1, was provided by Australian Barge Hire (ABH).

A summary table of the ‘as drilled’ borehole locations, seabed level in chart datum (CD), and final borehole depth below seabed is provided as Table 1. The target borehole locations are shown on Drawing 42906759-007 Rev D provided by DPA, a copy of which is attached as Figure 1. Two borehole sections along the axes of the existing and proposed wharf alignments and one section normal to the axis of the wharves are provided as Figures 2 to 4.

Geotechnical logs of boreholes, together with colour core photographs are presented as Appendix A. Explanation sheets defining the classification system adopted, the terms and symbols used, and the process used, are also presented in this appendix.

It should be noted that BH03 was redrilled due to excessive casing settlement in soft ground preventing insitu testing from being undertaken in advance of the casing.
<table>
<thead>
<tr>
<th>Borehole Designation</th>
<th>Borehole Coordinates (As Drilled)</th>
<th>Seabed Level (m CD)</th>
<th>Borehole Depth (m)</th>
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<td>BH01</td>
<td>474246.4 7720619.3</td>
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6.3 Methodology

6.3.1 Set Up and Drilling Technique

In setting up the jack up barge on a nearshore borehole location, the barge was towed into position using the ABH operated support vessel, the Seacat. Once the barge was in position the barge master would jack down the legs to the sea bed. The position of the barge and drill rig was checked using the on-board Differential Global Positioning System (DGPS), and the position approved by the Coffey Site Representative. The barge would then be jacked up to operational height. Operational height was set by the barge master to allow sufficient air gap below the pontoons of the barge through all the tidal cycles that the barge would encounter whilst at that location.

In preparation for drilling, casing was lowered to a level just above the seabed and a deck to seabed measurement taken. The depth to seabed was checked using tidal information and on site measurements. Prior to the commencement of core drilling, and SPT was typically undertaken from seabed level. Once the SPT was complete the casing was lowered to the seabed and PQ coring commenced.

The drilling operation utilised both PQ and HQ coring equipment which allows the removal of the core barrel through the middle of the drill string using a wire-line, removing the need to extract the drill string after each run to obtain the core sample. The core barrel consists of an outer tube and inner split tube. When drill core enters the barrel it is held within the inner split tube.

Core runs were limited to 1.5m lengths in PQ and HQ. Insitu testing such as SPT’s (refer to Section 6.3.3) were undertaken at 1.5m centres, where possible, in unconsolidated sediments.

Following recovery of the core barrel at the end of each drill run, the inner split tube containing the core sample was pumped out of the outer tube or barrel using water pressure. The core sample was then removed from the split tube into a plastic split tube for transfer to the core tray for logging, testing and sampling.

6.3.2 Logging of Carbonate Soils and Rocks

The logging of the core recovered was undertaken in accordance with Coffey Geotechnical Field Manual Procedures and the Dampier Cargo Berth Expansion Project Quality Plan, which are broadly in agreement with AS1726-1993.

Calcareous sediments and sedimentary rocks were identified using the Clark and Walker classification system (Clark & Walker, 1977). Modifying adjectives, in line with AS1726, have been included as secondary descriptors in the material description text in order to add detail to the Clark and Walker classification system. Details of the Clark and Walker classification system are provided in the explanatory notes in Appendix A.

6.3.3 Sampling and Testing – Unconsolidated Sediments

The following sampling and testing was carried out on the unconsolidated sediments encountered in the boreholes:

- Sampling of the unconsolidated sediments was achieved using PQ3 coring techniques together with Standard Penetration Test (SPT) equipment;
• The SPT’s were carried out in accordance with AS1289.6.3.1 on mainly granular materials to assess the uncorrected SPT “N” value which can be used as a guide to estimate relative density. In gravelly materials a solid cone SPT was undertaken which prevents the collection of a soil sample, in accordance with AS1289.6.3.1 Details of the interpretation of the relative density of granular materials are described in the explanatory notes in Appendix A;

• Pocket Penetrometer (PP) tests were undertaken, as applicable, on the sides of the recovered PQ3 core. The pocket penentrometer test can provide an approximate assessment of the unconfined compressive strength (or inferred undrained shear strength) of a cohesive soil.

• Results of the SPT’s and PP tests are recorded on the Borehole Logs provided in Appendix A.

6.3.4 Sampling and Testing – Consolidated Sediments

Continuous PQ3 wire-line coring was carried out in the consolidated sediments, variably cemented materials, and sound rock to obtain nominal 83mm diameter core for laboratory examination and testing and for inspection by Tenderers/Contractors. In slightly weathered to fresh bedrock HQ coring was generally undertaken.

The recovered core from each core run was placed in semi circular PVC splits and then placed in nominally 1.0 m long core trays to maintain the natural moisture content and physical properties of the rock as close as was practical to their condition upon recovery from the core barrel. The core in the trays was logged and then covered with moistened cloth and placed in a shaded position to prevent drying out occurring while drilling continued. Despite frequent reapplication of sea water to the cloth, it should be noted that minor drying of the core may have inadvertently occurred during this process.

Following completion of logging of each tray, the core trays were photographed. Field strength testing of the core comprised point load strength index testing. A Point Load Machine was used on site to assess the Point Load Strength Index (Is50) values in general accordance with AS4133.4.1. It should be noted that the testing was conducted at the natural moisture content at the time of testing and some samples were tested axially but the ends were not saw cut. Furthermore, slightly higher Is50 results may have been obtained on axially loaded samples if they were saw cut.

To minimise moisture loss and disturbance during transportation, each 1m length of core and PVC split was wrapped in cling-film (glad wrap) and then completely enclosed in plastic sleeves and sealed at both ends. The wrapped core was placed into metal trays, covered with bubble wrap and a metal lid, fastened by screws. The full core trays were stored under shade in core cages until they were unloaded from the jack-up barge using a deck crane. Each full core cage corresponded to a batch and in total there were 4 batches of core trays. The core cages were then lowered onto the deck of a transfer vessel and transported to a nearby wharf for collection. The cages were then transferred to a truck for road freighting to a Perth laboratory for viewing, appropriate testing and storage.
6.3.5 Survey

All boreholes were initially positioned close to their target coordinates using the Differential Global Positioning System (DGPS) Survey equipment (ORION) supplied by GlobalPos and utilising the Coffey wireless, real time, navigation system, and backed up by a hand held Garmin GPS systems. After positioning and allowing time for the jack up barge to settle, the borehole location and seabed level was assessed using the ORION DGPS equipment operated by Coffey personnel. The ORION system is a stand alone system which requires the OmniSTAR HP signal and is rated by the supplier to an accuracy of approximately ±0.10m both horizontally and vertically (95% of the time). The approximate elevations of the boreholes were assessed relative to Australian Height Datum (AHD), which is 2.77m above Chart Datum (CD) as specified by Evans & Peck, then converted to CD. The borehole coordinates were recorded to GDA 94 (MGA Zone 50) coordinate system and all approximate levels in this report refer to CD.

Actual seabed levels were assessed by dropping a tape measure inside the borehole riser casing, prior to commencing drilling, and subtracting the depth to seabed level from the assessed deck elevation. In case the Orion GPS (+0.1m) could not be achieved, a back up system using predicted tidal levels in combination with measurements from the deck of the jack up to the seabed level was used to assess the seabed level to CD. Furthermore, given the approximate nature of assessing the seabed levels from the deck of the jack-up platform, some inaccuracies in the reported levels for the boreholes are possible.

The "as drilled" locations of the boreholes are listed in Table 1, with target locations shown on Figure 1. All boreholes were positioned within the 5m tolerance of the target borehole location, with the exception of BH01 which was positioned outside this tolerance, with Client permission, due to the proximity of outcropping rocks adjacent to the target borehole location.

It is recommended that if the approximate levels assessed and reported by Coffey are used by the client or any third party, an independent verification of the levels at the borehole locations should be carried out during the design stage, and prior to any construction works.

7 LABORATORY TESTING

7.1 Storage and Transport of Samples for Testing

Samples for laboratory testing were obtained from the drill core and Standard Penetration Testing (SPT). On site sample preparation and storage methods are described below. The requirements given in Australian Standard AS 1726-1993 were used as a guide for carrying out the investigations.

SPT samples were removed from the sample spoons following the measurement of sample recovery, and placed in small self sealing sample bags. These bags were then sealed using tape and/or using the sample bag's sealing mechanism and stored within a core tray for transport back to Perth.

Drill core was stored and transported in sealed core trays. In order to minimise moisture loss and disturbance to the drill core during transportation, each 1m length of core and PVC split was wrapped with cling film (glad wrap) and then completely enclosed in plastic sleeves and sealed at both ends. The wrapped core was placed into metal core trays with the metal lid fastened by screws in preparation for transport to Perth.
7.2 Description of Laboratory Testing

Laboratory testing was typically carried out in accordance with the general requirements of the latest edition of AS 1289 and AS 4133.

Where a test was not covered by an Australian standard, a local or International standard was adopted and noted on the laboratory test report.

The testing was carried out by the following laboratories:

- The University of Melbourne;
- Roger Townend and Associates;
- Western Geotechnics. (NATA registered)

The extent of laboratory testing undertaken is summarised in a Table 2. The results of the laboratory testing carried out on the samples, in the form of laboratory test certificates, are presented Appendix B.
Table 2 Laboratory Test Summary

<table>
<thead>
<tr>
<th>Laboratory Test</th>
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</tr>
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<td>Moisture Content</td>
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<tr>
<td>Particle Size Distribution (PSD)</td>
<td>18</td>
</tr>
<tr>
<td>Particle Size Distribution (PSD) to 2 micron</td>
<td>17</td>
</tr>
<tr>
<td>Atterberg Limits</td>
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<tr>
<td>Oedometer Consolidation tests</td>
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<tr>
<td>Unconsolidated Undrained Triaxial (UU)</td>
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</tr>
<tr>
<td>Consolidated Undrained Triaxial (CU)</td>
<td>4</td>
</tr>
<tr>
<td>Ultra Sonic Velocity</td>
<td>9</td>
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<tr>
<td>Indirect (Brazilian) Tensile Strength</td>
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</tr>
<tr>
<td>Point Load Strength Index</td>
<td>114</td>
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<tr>
<td>Calcium Carbonate (CaCO₃) Content</td>
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<tr>
<td>Rock Density and Porosity</td>
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<tr>
<td>Unconfined Compressive Strength (UCS)</td>
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<tr>
<td>Petrographic Analysis</td>
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</tr>
<tr>
<td>Cerchar Abrasivity</td>
<td>10</td>
</tr>
</tbody>
</table>

Graphical correlations between Unconfined Compressive Strength (UCS) and Point Load Strength Index (PLT) and Indirect Tensile Strength (Brazilian) are presented in Appendix B.

It should be noted that not all scheduled tests could be undertaken due to variations in the strength of samples, sample volumes, the presence of microfractures or voids within the test section, etc. In some cases, tests have been moved from the scheduled test location to the nearest sample that is suitable for testing, or the test changed to a more suitable test on the sample specimen.

8 IMPORTANT INFORMATION ABOUT YOUR COFFEY REPORT

The reader's attention is drawn to the important information about this report which follows the main text.
9 REFERENCES

The following standards and references were used in the preparation of this report.

AS 1289 Methods of Testing Soils For Engineering Purposes.

AS 1726-1993 SAA Geotechnical Site Investigations.

AS 4133 Methods of Testing Rocks for Engineering Purposes.

The Geological Survey of Western Australia (Bulletin 127) – Geology of the Pilbara Block and its Environs, (1983)

The Geology of the Dampier 1:100,000 Sheet Geological Series Explanatory Notes, (2001)
Important information about your Coffey Report

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

Your report is based on project specific criteria

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

Subsurface conditions can change

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

Interpretation of factual data

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

Your report will only give preliminary recommendations

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

Your report is prepared for specific purposes and persons

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

**Interpretation by other design professionals**

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

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

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way.

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

**Geoenvironmental concerns are not at issue**

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

**Rely on Coffey for additional assistance**

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

**Responsibility**

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

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* For further information on this aspect reference should be made to "Guidelines for the Provision of Geotechnical information in Construction Contracts" published by the Institution of Engineers Australia, National headquarters, Canberra, 1987.
Figures
FIGURE 4

- CORE LOSS
- CLAY
- CONSOLERATIC
- LIMESTONE
- CALCAREOUS
- CONGLOMERATE
- CLAYEY SAND
- CLAYEY SAND
- SAND
- SEDIMENTARY
- CALCAREOUS
- SANDSTONE
- POROUS SAND
- CONCRETE
- KNAPPIE
- CRUSHED STONE
Appendix A

Geotechnical Logs of Boreholes and Core Photographs
### NOTES RELATING TO BOREHOLE LOGS AND CORE PHOTOGRAPHS

<table>
<thead>
<tr>
<th>Description</th>
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<tr>
<td>Rock Description Explanation Sheet</td>
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EXPLANATORY NOTES

B1.0 Classification System

The principal classification system used to describe the soils and rocks intersected in the boreholes for this investigation is a system generally consistent with the Soil Classification System from AS1726-1993 and summarised on the Explanation Sheets included in this appendix. In accordance with AS1726-1993, the Clark and Walker Carbonate Classification system, presented as Table B1, was used to name rocks that contained 10% or more calcium carbonate content. Soils and rocks with less than 10% calcium carbonate content were named according to AS1726-1993, with some additional descriptive terms in accordance with the Clark and Walker system.

Some cementation of the materials was encountered, in which case additional descriptive terms were added to the rock description to describe the degree of cementation as presented in Table A2. Note that the cementation term was mainly assigned based on the visual and field assessment of the degree of cementation.

The strength of the soils has been described on the basis of the conventional density and consistency levels for cohesionless and cohesive materials contained in AS1726-1993. Rock strength was described in accordance with AS1726-1993. In accordance with this standard, the description of rock strength was based on a combination of Point Load Strength Index, where such tests were carried out, and qualitative field tests / observations as described in the field guide in Table A8 of AS1726-1993. Occasionally the point load tests indicated a different strength than the field guide. In such cases, the point load sample, the relevant section of core and / or the core photographs were reviewed to determine the appropriate strength classification and appropriate adjustments were made to the logs, having regard to the review. If the point load test appeared to have failed prematurely on a weak plane, then the higher strength determined from the field guide was recorded on the log. Naturally occurring defects in the soil and rock encountered have been recorded on the borehole logs. When it is unclear if a defect is natural or caused by the drilling activities it is recorded and a note made in the defect column regarding this.

In the description of the materials encountered, some terminology has been used that is clarified as follows:

<table>
<thead>
<tr>
<th>Trace</th>
<th>In accordance with AS1726 “a trace of” fines in a coarse grained soil implies &lt;5% and in a fine grained soil “a trace of” sand or gravel implies up to 15%.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some</td>
<td>In accordance with AS1726 “with some” fines in a coarse grained soil implies 5% - 12% and in a fine grained soil “with some” sand or gravel implies 15% - 30%.</td>
</tr>
<tr>
<td>Modifying Adjectives</td>
<td>In accordance with AS1726 modifying adjectives were used in front of the primary soil/rock name when an additional component is present in greater than 12% for coarse grained soils and 30% for fine grained soils.</td>
</tr>
</tbody>
</table>

B2.0 Borehole Logs

The borehole logs contained in Appendix B represent the final product of the following process.

The borehole logs were initially compiled on site by hand during the drilling operations (These being the field logs).

The field logs were entered into the computer in Perth after completion of the drilling operation. All of the borehole logs contained in Appendix B need to be reviewed in full. Copies of the original field logs by Coffey have been retained on file and can be made available for review.
NOTES RELATING TO BOREHOLE LOGS AND CORE PHOTOGRAPHS

Borehole log abbreviations:

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RW</td>
<td>Rod Weight</td>
</tr>
<tr>
<td>HW</td>
<td>Hammer Weight</td>
</tr>
<tr>
<td>HB</td>
<td>Hammer Bouncing</td>
</tr>
<tr>
<td>N</td>
<td>SPT result with no recovered sample</td>
</tr>
<tr>
<td>N*</td>
<td>SPT result with recovered sample</td>
</tr>
<tr>
<td>R</td>
<td>Refusal</td>
</tr>
<tr>
<td>ES</td>
<td>Environmental sample</td>
</tr>
<tr>
<td>VSp</td>
<td>Vane Shear</td>
</tr>
<tr>
<td>HP</td>
<td>Hand Penetometer</td>
</tr>
<tr>
<td>ls(50) a</td>
<td>Laboratory axial point load test</td>
</tr>
<tr>
<td>ls(50) d</td>
<td>Laboratory diametral point load test</td>
</tr>
<tr>
<td>ls(50) i</td>
<td>Laboratory irregular point load test</td>
</tr>
<tr>
<td>ls(50) af</td>
<td>Field axial point load test</td>
</tr>
<tr>
<td>ls(50) df</td>
<td>Field diametral point load test</td>
</tr>
<tr>
<td>ls(50) if</td>
<td>Field irregular point load test</td>
</tr>
</tbody>
</table>

B3.0 Photographs of Core

After completion of logging, each full core tray was photographed such that the camera was held directly above the centre of the core box (after allowance for the position of the sun) and at a consistent distance to provide uniform photographs.

The photographs were regularly downloaded from the camera onto the field engineer’s site lap top computer. At the completion of the fieldwork, all the photographs were downloaded to the Coffey server. Adobe Photoshop software was used to reduce spherical and parallaxis distortion of the photos of the core trays. The core photos were then imported into AUTOCAD for pasting on standard Coffey Templates.

Original photos can be made available for viewing if required.
**Soil Description** Explanation Sheet (1 of 2)

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

**CLASSIFICATION SYMBOL & SOIL NAME**
Soils are described in accordance with the Unified Soil Classification (USCS) as shown on the table on Sheet 2.

**PARTICLE SIZE DESCRIPTIVE TERMS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>SUBDIVISION</th>
<th>SIZE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boulders</td>
<td></td>
<td>&gt;200 mm</td>
</tr>
<tr>
<td>Cobble</td>
<td>63 mm to 200 mm</td>
<td></td>
</tr>
<tr>
<td>Gravel</td>
<td>coarse</td>
<td>20 mm to 63 mm</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>6 mm to 20 mm</td>
</tr>
<tr>
<td></td>
<td>fine</td>
<td>2.36 mm to 6 mm</td>
</tr>
<tr>
<td>Sand</td>
<td>coarse</td>
<td>600 μm to 2.36 mm</td>
</tr>
<tr>
<td></td>
<td>medium</td>
<td>200 μm to 600 μm</td>
</tr>
<tr>
<td></td>
<td>fine</td>
<td>75 μm to 200 μm</td>
</tr>
</tbody>
</table>

**MOISTURE CONDITION**

Dry  Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.

Moist Soil feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.

Wet As for moist but with free water forming on hands when handled.

**CONSISTENCY OF COHESIVE SOILS**

<table>
<thead>
<tr>
<th>TERM</th>
<th>UNDRAINED STRENGTH $\sigma_u$ (kPa)</th>
<th>FIELD GUIDE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Soft</td>
<td>$&lt;12$</td>
<td>A finger can be pushed well into the soil with little effort.</td>
</tr>
<tr>
<td>Soft</td>
<td>12 - 25</td>
<td>A finger can be pushed into the soil to about 25% depth.</td>
</tr>
<tr>
<td>Firm</td>
<td>25 - 50</td>
<td>The soil can be indented about 5mm with the thumb, but not penetrated.</td>
</tr>
<tr>
<td>Stiff</td>
<td>50 - 100</td>
<td>The surface of the soil can be indented with the thumb, but not penetrated.</td>
</tr>
<tr>
<td>Very Stiff</td>
<td>100 - 200</td>
<td>The surface of the soil can be marked, but not indented with thumb pressure.</td>
</tr>
<tr>
<td>Hard</td>
<td>$&gt;200$</td>
<td>The surface of the soil can be marked only with the thumbnail.</td>
</tr>
<tr>
<td>Friable</td>
<td>–</td>
<td>Crumbles or powders when scraped by thumbnail.</td>
</tr>
</tbody>
</table>

**DENSITY OF GRANULAR SOILS**

<table>
<thead>
<tr>
<th>TERM</th>
<th>DENSITY INDEX (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very loose</td>
<td>Less than 15</td>
</tr>
<tr>
<td>Loose</td>
<td>15 - 35</td>
</tr>
<tr>
<td>Medium Dense</td>
<td>35 - 65</td>
</tr>
<tr>
<td>Dense</td>
<td>65 - 85</td>
</tr>
<tr>
<td>Very Dense</td>
<td>Greater than 85</td>
</tr>
</tbody>
</table>

**MINOR COMPONENTS**

<table>
<thead>
<tr>
<th>TERM</th>
<th>ASSESSMENT GUIDE</th>
<th>PROPORTION OF MINOR COMPONENT IN:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trace of</td>
<td>Presence just detectable by feel or eye, but soil properties little or no different to general properties of primary component.</td>
<td>Coarse grained soils: $&lt;5%$ Fine grained soils: $&lt;15%$</td>
</tr>
<tr>
<td>With some</td>
<td>Presence easily detected by feel or eye, soil properties little different to general properties of primary component.</td>
<td>Coarse grained soils: 5 - 12% Fine grained soils: 15 - 30%</td>
</tr>
</tbody>
</table>

**SOIL STRUCTURE**

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

**GEOLOGICAL ORIGIN**

**WEATHERED IN PLACE SOILS**


**TRANSPORTED SOILS**

 Aeolian soil Deposited by wind. Alluvial soil Deposited by streams and rivers. Colluvial soil Deposited on slopes (transported downslope by gravity). Fill Man made deposit. Fill may be significantly more variable between tested locations than naturally occurring soils. Lacustrine soil Deposited by lakes. Marine soil Deposited in ocean basins, bays, beaches and estuaries.
# Soil Description Explanation Sheet (2 of 2)

## SOIL CLASSIFICATION INCLUDING IDENTIFICATION AND DESCRIPTION

<table>
<thead>
<tr>
<th>FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 60 mm and focusing on estimated mass)</th>
<th>USC</th>
<th>PRIMARY NAME</th>
</tr>
</thead>
</table>
| **Coarse Grained Soils**
- More than 50% of particles larger than 60 mm
  - COARSE GRAINED SOILS (larger than 0.075 mm)
  - SANDS (Material passing through 0.075 mm sieve)
    - More than half of coarse fraction visible to naked eye
      - Wide range in grain size and substantial amounts of all intermediate particle sizes. Predominantly one size or a range of sizes with more intermediate sizes missing.
      - Plastic fines (for identification procedures see CL below).
    - Predominantly one size or a range of sizes with some intermediate sizes missing.
    - Non-plastic fines (for identification procedures see CL below).
  - CLAYES & CLAYS (less than 0.075 mm)
    - More than half of coarse fraction visible to naked eye
      - Wide range in grain size and substantial amounts of all intermediate particle sizes.
      - Plastic fines (for identification procedures see CL below).
  - IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.
    - DRY STRENGTH: None to Low
    - DILATANCY: Quick to slow
    - TOUGHNESS: None
  - HIGHLY ORGANIC SOILS
    - Readily identified by colour, odour, sponge and frequent fibrous texture.

| **Fine Grained Soils**
- More than 50% of particles larger than 0.005 mm
  - SILTS & CLAYS (less than 0.005 mm)
    - More than half of coarse fraction visible to naked eye
      - Wide range in grain size and substantial amounts of all intermediate particle sizes.
      - Plastic fines (for identification procedures see CL below).
  - IDENTIFICATION PROCEDURES ON FRACTIONS <0.2 mm.
    - DRY STRENGTH: None to Low
    - DILATANCY: Quick to slow
    - TOUGHNESS: None
  - HIGHLY ORGANIC SOILS
    - Readily identified by colour, odour, sponge and frequent fibrous texture.

### USC PRIMARY NAME

- **GW** GRAVEL
- **GP** GRAVEL
- **GM** SILTY GRAVEL
- **GC** CLAYEY GRAVEL
- **SW** SAND
- **SP** SAND
- **SM** SILTY SAND
- **SC** CLAYEY SAND
- **ML** SILT
- **CL** CLAY
- **OL** ORGANIC SILT
- **MH** SILT
- **CH** CLAY
- **OH** ORGANIC CLAY
- **Pt** PEAT

### COMMON DEFECTS IN SOIL

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

*Low plasticity – Liquid Limit W<sub>L</sub> less than 35%. *Medium plasticity – W<sub>L</sub> between 35% and 50%.
The descriptive terms used by Coffey are given below. They are broadly consistent with Australian Standard AS1726-1993.

**DEFINITIONS:** Rock substance, defect and mass are defined as follows:
- **Rock Substance:** In engineering terms rock substance is any naturally occurring aggregate of minerals and organic material which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Effectively homogenous material, may be isotropic or anisotropic. Discontinuity or break in the continuity of a substance or substances.
- **Defect:** Any body of material which is not effectively homogenous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

<table>
<thead>
<tr>
<th>SUBSTANCE DESCRIPTIVE TERMS:</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROCK NAME</strong></td>
</tr>
<tr>
<td><strong>PARTICLE SIZE</strong></td>
</tr>
<tr>
<td>Coarse grained</td>
</tr>
<tr>
<td>Medium grained</td>
</tr>
<tr>
<td>Fine grained</td>
</tr>
<tr>
<td><strong>FABRIC</strong></td>
</tr>
<tr>
<td>Massive</td>
</tr>
<tr>
<td>Indistinct</td>
</tr>
<tr>
<td>Distinct</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CLASSIFICATION OF WEATHERING PRODUCTS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Term</strong></td>
</tr>
<tr>
<td>Residual Soil</td>
</tr>
<tr>
<td>Extremely Weathered Material</td>
</tr>
<tr>
<td>Highly Weathered Rock</td>
</tr>
<tr>
<td>Moderately Weathered Rock</td>
</tr>
<tr>
<td>Slightly Weathered Rock</td>
</tr>
<tr>
<td>Fresh Rock</td>
</tr>
</tbody>
</table>

**ROCK SUBSTANCE STRENGTH TERMS**

<table>
<thead>
<tr>
<th>Term</th>
<th>Abbreviation</th>
<th>Load Index Index</th>
<th>(MPa)</th>
<th>Field Guide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very Low</td>
<td>VL</td>
<td>Less than 0.1</td>
<td>Material crumbles under firm blows with sharp end of pick; can be peeled with a knife; pieces up to 30mm thick can be broken by finger pressure.</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>L</td>
<td>0.1 to 0.3</td>
<td>Easily scored with a knife; indentations 1mm to 3mm show with firm bows of a pick point; has a dull sound under hammer. Pieces of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.</td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>M</td>
<td>0.3 to 1.0</td>
<td>Readily scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>H</td>
<td>1 to 3</td>
<td>A piece of core 150mm long by 50mm can not be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.</td>
<td></td>
</tr>
<tr>
<td>Very High</td>
<td>VH</td>
<td>3 to 10</td>
<td>Hand specimen breaks after more than one blow of a pick; rock rings under hammer.</td>
<td></td>
</tr>
<tr>
<td>Extremely High</td>
<td>EH</td>
<td>More than 10</td>
<td>Specimen requires many blows with geological pick to break; rock rings under hammer.</td>
<td></td>
</tr>
</tbody>
</table>

**Notes on Rock Substance Strength:**
1. In anisotropic rocks the field guide to strength applies to the strength perpendicular to the anisotropy. High strength anisotropic rocks may break readily parallel to the planar anisotropy.
2. The term "extremely low" is not used as a rock substance strength term. While the term is used in AS1726-1993, the field guide therein makes it clear that materials in that strength range are soils in engineering terms.
3. The unconfined compressive strength for isotropic rocks (and anisotropic rocks which fall across the planar anisotropy) is typically 10 to 25 times the point load index (PLI). The ratio may vary for different rock types. Lower strength rocks often have lower ratios than higher strength rocks.
# Rock Description Explanation Sheet (2 of 2)

## COMMON DEFECTS IN ROCK MASSES

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>Diagram</th>
<th>Map Symbol</th>
<th>Graphic Log (Note 1)</th>
<th>DEFECT SHAPE</th>
<th>TERMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Parting</td>
<td>A surface or crack across which the rock has little or no tensile strength. Parallel or sub parallel to layering (e.g. bedding) or a planar anisotropy in the rock substance (e.g. cleavage). May be open or closed.</td>
<td><img src="image1.png" alt="Diagram" /></td>
<td><img src="image2.png" alt="Bedding Symbol" /></td>
<td><img src="image3.png" alt="Cleavage Symbol" /></td>
<td>Planar</td>
<td>The defect does not vary in orientation</td>
</tr>
<tr>
<td>Joint</td>
<td>A surface or crack across which the rock has little or no tensile strength, but which is not parallel or sub parallel to layering or planar anisotropy in the rock substance. May be open or closed.</td>
<td><img src="image4.png" alt="Diagram" /></td>
<td><img src="image5.png" alt="Junction Symbol" /></td>
<td></td>
<td>Curved</td>
<td>The defect has a gradual change in orientation</td>
</tr>
<tr>
<td>Sheared Zone (Note 3)</td>
<td>Zone of rock substance with roughly parallel near planar, curved or undulating boundaries cut by closely spaced joints, sheared surfaces or other defects. Some of the defects are usually curved and intersect to divide the mass into lenticular or wedge shaped blocks.</td>
<td><img src="image6.png" alt="Diagram" /></td>
<td><img src="image7.png" alt="35° Symbol" /></td>
<td></td>
<td>Undulating</td>
<td>The defect has a wavy surface</td>
</tr>
<tr>
<td>Sheared Surface (Note 3)</td>
<td>A near planar, curved or undulating surface which is usually smooth, polished or slickensided.</td>
<td><img src="image8.png" alt="Diagram" /></td>
<td><img src="image9.png" alt="40° Symbol" /></td>
<td></td>
<td>Stepped</td>
<td>The defect has one or more well defined steps</td>
</tr>
<tr>
<td>Crushed Seam (Note 3)</td>
<td>Seam with roughly parallel almost planar boundaries, composed of disoriented, usually angular fragments of the host rock substance which may be more weathered than the host rock. The seam has soil properties.</td>
<td><img src="image10.png" alt="Diagram" /></td>
<td><img src="image11.png" alt="50° Symbol" /></td>
<td></td>
<td>Irregular</td>
<td>The defect has many sharp changes of orientation</td>
</tr>
<tr>
<td>Infilled Seam</td>
<td>Seam of soil substance usually with distinct roughly parallel boundaries formed by the migration of soil into an open cavity or joint, in filled seams less than 1mm thick may be described as veneer or coating on joint surface.</td>
<td><img src="image12.png" alt="Diagram" /></td>
<td><img src="image13.png" alt="65° Symbol" /></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Extremely Weathered Seam</td>
<td>Seam of soil substance, often with gradational boundaries. Formed by weathering of the rock substance in place.</td>
<td><img src="image14.png" alt="Diagram" /></td>
<td><img src="image15.png" alt="32° Symbol" /></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Notes on Defects:**
1. Usually borehole logs show the true dip of defects and face sketches and sections the apparent dip.
2. Partings and joints are not usually shown on the graphic log unless considered significant.
3. Sheared zones, sheared surfaces and crushed seams are faults in geological terms.
Additional descriptive terms based on origin of constituent particles

<table>
<thead>
<tr>
<th>NOT DISCERNIBLE</th>
<th>BIOCLASTIC ORGANIC</th>
<th>OOLITE INORGANIC</th>
<th>SHELL ORGANIC</th>
<th>CORAL ORGANIC</th>
<th>ALGAL ORGANIC</th>
<th>PISOLITES INORGANIC</th>
</tr>
</thead>
</table>

Increasing grain size of particulate deposits

**Total carbonate content (%)**

<table>
<thead>
<tr>
<th>0.002mm</th>
<th>0.06mm</th>
<th>2mm</th>
<th>50mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carbonate Mud</td>
<td>Carbonate Silt</td>
<td>Carbonate Sand</td>
<td>Carbonate Gravel</td>
</tr>
</tbody>
</table>

**Additional descriptive terms**
- **Carbonate Mud**
- **Siliceous Carbonate Silt (i)**
- **Calcite Carbonate Sand (i)**
- **Calcite Silica Sand (i)**
- **Mixed carbonate and non-carbonate Gravel (ii)**

**Notes:**
- Notes: (i) The strength categories on this chart are not consistent with AS 1726-1993.
- Notes: (ii) In description the rough proportions of carbonate and non-carbonate constituents should be quoted and details of both the particle minerals and matrix minerals should be included.
- Notes: (iii) The preferred lithological nomenclature has been shown in capitals, alternatives have been given in brackets and these may be substituted in description if the need arises.
- Notes: (iv) Calcareous is suggested as a general term to indicate the presence of unidentified carbonate. Where applicable, when mineral identification is possible, calcareous referring to calcite or alternative adjectives such as dolomitic, oolagritic, sideritic etc, should be used.
## Cementation Correlation with Approximate UCS

<table>
<thead>
<tr>
<th>Term</th>
<th>Approximate UCS</th>
</tr>
</thead>
<tbody>
<tr>
<td>VERY WEAKLY CEMENTED (VWc)</td>
<td>250 to 400 kPa</td>
</tr>
<tr>
<td>Marginal soil-rock strength,</td>
<td></td>
</tr>
<tr>
<td>collapsing feel under light</td>
<td></td>
</tr>
<tr>
<td>finger pressure, cement seen</td>
<td></td>
</tr>
<tr>
<td>on some washed grains</td>
<td></td>
</tr>
<tr>
<td>WEAKLY CEMENTED (Wc)</td>
<td>300 kPa to 1 MPa</td>
</tr>
<tr>
<td>Collapsing feel under light</td>
<td></td>
</tr>
<tr>
<td>finger pressure, breaks down</td>
<td></td>
</tr>
<tr>
<td>to individual grains or with</td>
<td></td>
</tr>
<tr>
<td>some grains cemented together,</td>
<td></td>
</tr>
<tr>
<td>cement seen on many washed</td>
<td></td>
</tr>
<tr>
<td>grains.</td>
<td></td>
</tr>
<tr>
<td>MODERATELY WEAKLY CEMENTED (MWc)</td>
<td>700 kPa to 1.2 MPa</td>
</tr>
<tr>
<td>Cement on nearly all grains,</td>
<td></td>
</tr>
<tr>
<td>breaks down to lumps and some</td>
<td></td>
</tr>
<tr>
<td>individual grains under finger</td>
<td></td>
</tr>
<tr>
<td>pressure, can crush</td>
<td></td>
</tr>
<tr>
<td>to individual grains under a</td>
<td></td>
</tr>
<tr>
<td>knife blade.</td>
<td></td>
</tr>
<tr>
<td>MODERATELY CEMENTED (Mc)</td>
<td>1.0 to 1.5 MPa</td>
</tr>
<tr>
<td>WELL CEMENTED (Hc)</td>
<td>1.2 to 2.0 MPa</td>
</tr>
<tr>
<td>Very WELL CEMENTED (VHc)</td>
<td>&gt;2 MPa</td>
</tr>
</tbody>
</table>

**TABLE B2**

Note: This correlation has been developed from the results of investigations and subsequent laboratory testing of carbonate sediments encountered on the North West Shelf.
Borehole Logs
**Engineering Log - Cored Borehole**

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Position:** E: 474246.446, N: 7720619.3 (50 MGA94)  
**Rig type:** UDR100  
**Rig type:** UDR100  
**Logging by:** NW/SPN  
**Checked by:** NB

### Drilling Information

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>BH01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date started:</td>
<td>22/5/08</td>
</tr>
<tr>
<td>Date completed:</td>
<td>22/5/08</td>
</tr>
<tr>
<td>Project No.</td>
<td>GEOTHERD08491AA</td>
</tr>
<tr>
<td>Sheet No.</td>
<td>1 of 1</td>
</tr>
<tr>
<td>Hole Diameter:</td>
<td></td>
</tr>
</tbody>
</table>

#### Surfaces

- **Surface Elevation:** -2.196m (CD)

#### Drilling method & casing

- **Casing method:** wireline core (47.6mm), SW/MW, FR
- **Casing method:** wireline core (63.5mm), SW/MW, FR

#### Material Substance

- **Material Substance:** coral (limestone), white, many radiating coral growths. Trace shells and shell fragments up to 50mm. Trace voids up to 50mm

#### Drilling Information

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>Depth (m)</th>
<th>graphic log / core recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>2.6</td>
<td>2.6</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>3.0</td>
<td>3.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>3.6</td>
<td>3.6</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>4.0</td>
<td>4.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>4.5</td>
<td>4.5</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>5.0</td>
<td>5.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>5.5</td>
<td>5.5</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>5.6</td>
<td>5.6</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>5.8</td>
<td>5.8</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>6.0</td>
<td>6.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>6.2</td>
<td>6.2</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>6.3</td>
<td>6.3</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>6.5</td>
<td>6.5</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>6.7</td>
<td>6.7</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>7.0</td>
<td>7.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>7.5</td>
<td>7.5</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>8.0</td>
<td>8.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>8.5</td>
<td>8.5</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>9.0</td>
<td>9.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>9.5</td>
<td>9.5</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
<tr>
<td>10.0</td>
<td>10.0</td>
<td>core recovered + graphic symbols indicate material</td>
</tr>
</tbody>
</table>

#### Water

- **Water type:** 10 Oct., 73 Water Level on Date shown: Water inflow

#### Cementation

- **Cementation:** VWC, v. weakly cemented

#### Weathering & Strength

- **Weathering:** VL, very low
- **Strength:** EL, extremely low

#### Planarity & Roughness

- **Planarity:** irregular
- **Roughness:** smooth

#### Defect Type & Coating

- **Defect Type:** highly fractured
- **Coating:** smooth

---

**NOTE:**  
- Water pressure test result: 0.95-1.20 highly fractured  
- Additional data: description, orientation, infilling or coating, shape, roughness, thickness, etc.
Engineering Log - Cored Borehole

Client: DAMPIER PORT AUTHORITY
Project: DAMPIER CARGO BERTH EXPANSION PROJECT
Location: PORT DAMPIER

Position: E: 474425.398, N: 7720868.1 (50 MGA94)

Project No.: GEOTHERD08491AA

Sheet No.: 1 of 3

Date started: 23/5/08
Date completed: 24/5/08
Logged by: TW
Checked by: NB

Drilling method & casing

<table>
<thead>
<tr>
<th>Material Substance</th>
<th>Rock Type</th>
<th>Grain Size</th>
<th>Texture</th>
<th>Fabric</th>
</tr>
</thead>
<tbody>
<tr>
<td>(SC) CLAYEY SAND</td>
<td>Fine to coarse grained, grey brown; over 80% grains of shell fragments; loose</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORE LOSS 0.55m</td>
<td>(0.45-1.00)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(SW) SAND</td>
<td>Fine to coarse grained, grey brown; with some clay, over 80% grains of shell fragments; dense</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORE LOSS 0.80m</td>
<td>(1.45-2.25)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Drilling details

- SPT Recovery: 0.3 m
- SPT Recovery: 0.4 m
- SPT Recovery: 0.3 m

Core details

- Rock Type: CLAYEY SAND
- Grain Size: Fine to coarse grained
- Texture: Grey brown

Weathering

- Fresh Rock
- Slightly Weathered
- Moderately Weathered
- Highly Weathered
- Extremely Weathered

Coating

- Residual Soil
- Fresh Rock
- Irregular

Cementation

- Weakly cemented
- Moderately cemented
- Well cemented

Additional data

- Core length: 0.80m
- Core diameter: 1.45-2.25m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m
- Core diameter: 0.45-1.00m

Note: The diagram includes a detailed log of the borehole with various geological features and their descriptions.
**Engineering Log - Cored Borehole**

**Client**: DAMPIER PORT AUTHORITY  
**Principal**:  
**Project**: DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location**: PORT DAMPIER

**Rig type**: UDR100  
**Surface Elevation**: -5.243m (CD)  
**Angle from horizontal**: 90°

### drilling information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>material substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.5</td>
<td>CALCAREOUS CONGLOMERATE, brown red, 40-50% angular to subrounded, fine to coarse grained gravel and trace cobble sized clast of very high to extremely high strength igneous rock in a matrix of siliceous dolomitic limestone, locally becoming weakly to moderately strong (continued)</td>
</tr>
<tr>
<td>14.0</td>
<td>GRANITE, coarse grained, grey white / pale red, weathered to weakly cemented daysey sand with some fine to coarse grained angular quartz gravel. Clay is high plasticity. Locally of moderate strength. Some calcite replacement/ cementation.</td>
</tr>
<tr>
<td>14.5</td>
<td>GRANITE, coarse grained, pale red white / grey, (up to 15mm) at 11.10m 50m thick Calcite replacement, medium strength</td>
</tr>
<tr>
<td>15.0</td>
<td>GRANITE, pink grey, Phenocrysts up to 50mm at 12.40m Calcite replacement, layer firm clay strength</td>
</tr>
<tr>
<td>15.5</td>
<td>from 14.80m to 15.91m becoming coarser grained (up to 30mm) with more (60%) pink Quartz</td>
</tr>
</tbody>
</table>

### core details

- **graphic log**

- **material description**
  - ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)

- **graphic symbols**
  - indicate material

- **additional data**
  - joints, partings, seams, zones, etc
  - description, orientation, infilling or coating, shape, roughness, thickness, etc

### core recovery

- **core recovered**
  - graphic symbols

- **no core recovered**

### water

- **level on date shown**
- **water inflow**
- **water pressure test result**

### cementation

- **VWC**: very weakly cemented
- **Wc**: weakly cemented
- **Mw**: moderately cemented
- **Hc**: well cemented

### weathering

- **XW**: Extremely Weathered
- **SW**: Slightly Weathered

### strength

- **R**: Residual Soil
- **X**: Extremely Weathered
- **H**: Highly Weathered

### planarity

- **VR**: VR very rough
- **VR**: VR rough

### roughness

- **SN**: Smooth
- **S**: Smooth

### coating

- **CT**: CT coating
- **P**: POL polished

---

**Surface Elevation**: -5.243m (CD)  
**Position**: E 474425.398, N 7720868.1 (50 MGA94)  
**Checked by**: NB  
**Logged by**: TW  
**Date started**: 23/5/08  
**Date completed**: 24/5/08  
**Sheet No.**: 2 of 3  
**Project No.**: GEOTHERD08491AA  
**Hole No.**: BH02  
**Hole Diameter**: 426.7mm  
**Mounting**: Jack up Barge  
**Rig type**: UDR100  
**Location**: PORT DAMPIER
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

**Position:** E: 474425.398, N: 7720868.1 (50 MGA94)  
**Surface Elevation:** -5.243m (CD)  
**Angle from horizontal:** 90°

**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Hole Diameter:**

### Drilling Information

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>BH02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet No.</td>
<td>3 of 3</td>
</tr>
<tr>
<td>Project No.</td>
<td>GEOTHERD08491AA</td>
</tr>
<tr>
<td>Date started:</td>
<td>23/5/08</td>
</tr>
<tr>
<td>Date completed:</td>
<td>24/5/08</td>
</tr>
<tr>
<td>Logged by:</td>
<td>TW</td>
</tr>
<tr>
<td>Checked by:</td>
<td>NB</td>
</tr>
</tbody>
</table>

**Core recovered**

<table>
<thead>
<tr>
<th>Material Substance</th>
<th>Description</th>
<th>Core Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROCK TYPE</td>
<td>Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</td>
<td></td>
</tr>
<tr>
<td>defect</td>
<td>spacing (mm)</td>
<td></td>
</tr>
<tr>
<td>defect type</td>
<td>description, orientation, infilling or coating, shape, roughness, thickness, other</td>
<td></td>
</tr>
<tr>
<td>joint(s), partings, seams, zones, etc.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Additional Data**

- 16.34: JT 10° PR RF VN traces of soft white clay
- 16.87: JT 5° PR RF VN traces of soft white clay

**Defect Type**

- Bedding parting
- Crack
- Crushed seam
- Sheared zone
- Irregular

**Cementation**

- VWC: Very weakly cemented
- Wc: Weakly cemented
- Me: Moderately cemented
- Hc: Well cemented
- VHc: Very well cemented

**Weathering**

- Residual Soil
- Extreme Weathered
- Highly Weathered
- Moderately Weathered
- Slightly Weathered
- Fresh Rock

**Rig type**

- UDR100

**Surf. Elevation**

- -5.243m (CD)

**Hole Diameter**

- 17.25 m

**Drilling Method & Coating**

- Water
- Water inflow
- Water outflow

**Graphic Log**

- Core recovered
- Graphic symbols indicate material

**Graphical Symbols**

- Core recovered
- Water inflow
- Water outflow

**Rock Quality Designation (RQD)**

- 100%
- 90%
- 80%
- 70%
- 60%
- 50%
- 40%
- 30%
- 20%
- 10%
- 5%
- 0%

**Core Details**

- TCR = Total Core Recovery (%)
- SCR = Solid Core Recovery (%)
- RQD = Rock Quality Designation (%)

**Chemical Analysis**

- VWC: Very weakly cemented
- Wc: Weakly cemented
- Me: Moderately cemented
- Hc: Well cemented
- VHc: Very well cemented

**Sample Details**

- 16.0
- 17.0
- 18.0
- 19.0
- 20.0
- 21.0
- 22.0
- 23.0
- 24.0
- 25.0
- 26.0
- 27.0
- 28.0
- 29.0
- 30.0

**Core Run Details**

- 23/5/08
- 24/5/08
- 25/5/08

**Position**

- E: 474425.398, N: 7720868.1 (50 MGA94)
- Surface Elevation: -5.243m (CD)
- Angle from horizontal: 90°

**Hole Diameter**

- 17.25 m

**Logging Details**

- Hole No.
- Sheet No.
- Project No.
- Client:
- Principal:
- Project:
- Location:
- Date started:
- Date completed:
- Logged by:
- Checked by:

**Logging Method & Coating**

- Water
- Water inflow
- Water outflow

**Material Substance**

- ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc. as applicable)

**Core Details**

- TCR = Total Core Recovery (%)
- SCR = Solid Core Recovery (%)
- RQD = Rock Quality Designation (%)

**Defect Type**

- Bedding parting
- Crack
- Crushed seam
- Sheared zone
- Irregular

**Cementation**

- VWC: Very weakly cemented
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**Weathering**

- Residual Soil
- Extreme Weathered
- Highly Weathered
- Moderately Weathered
- Slightly Weathered
- Fresh Rock

**Rig Type**

- UDR100

**Surf. Elevation**

- -5.243m (CD)

**Hole Diameter**

- 17.25 m

**Logging Details**

- Hole No.
- Sheet No.
- Project No.
- Client:
- Principal:
- Project:
- Location:
- Date started:
- Date completed:
- Logged by:
- Checked by:

**Logging Method & Coating**

- Water
- Water inflow
- Water outflow

**Material Substance**

- ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc. as applicable)

**Core Details**

- TCR = Total Core Recovery (%)
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**Weathering**

- Residual Soil
- Extreme Weathered
- Highly Weathered
- Moderately Weathered
- Slightly Weathered
- Fresh Rock

**Rig Type**

- UDR100

**Surf. Elevation**

- -5.243m (CD)

**Hole Diameter**

- 17.25 m

**Logging Details**

- Hole No.
- Sheet No.
- Project No.
- Client:
- Principal:
- Project:
- Location:
- Date started:
- Date completed:
- Logged by:
- Checked by:

**Logging Method & Coating**

- Water
- Water inflow
- Water outflow

**Material Substance**

- ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc. as applicable)

**Core Details**

- TCR = Total Core Recovery (%)
- SCR = Solid Core Recovery (%)
- RQD = Rock Quality Designation (%)

**Defect Type**

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**Weathering**

- Residual Soil
- Extreme Weathered
- Highly Weathered
- Moderately Weathered
- Slightly Weathered
- Fresh Rock

**Rig Type**

- UDR100

**Surf. Elevation**

- -5.243m (CD)

**Hole Diameter**

- 17.25 m

**Logging Details**

- Hole No.
- Sheet No.
- Project No.
- Client:
- Principal:
- Project:
- Location:
- Date started:
- Date completed:
- Logged by:
- Checked by:
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date started:** 24/5/08  
**Date completed:** 27/5/08  
**Logged by:** TW  
**Checked by:** NB  

### Drilling Information

<table>
<thead>
<tr>
<th>Rig type</th>
<th>UDR100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>E: 474113.4996, N: 7720871.7 (50 MGA94)</td>
</tr>
<tr>
<td>Surface Elevation</td>
<td>-5.015m (CD)</td>
</tr>
<tr>
<td>Angle from horizontal</td>
<td>90°</td>
</tr>
<tr>
<td>Hole Diameter</td>
<td></td>
</tr>
</tbody>
</table>

### Water Pressure Test Result

- **Date:** 10 Oct., 73 Water Level on Date shown
- **Test:** Water Pressure Test Result
- **Depth:** 4.5m

### Core Details

- **Core Recovery:** 90%
- **Rock Quality Designation:** 90%
- **Solid Core Recovery:** 90%
- **Total Core Recovery:** 90%

### Core Description

- **Material:** SAND
- **Texture:** fine to medium grained, grey
- **Fabric:** dense to very dense

### Additional Data

- **ırkeness:** 0.35m (0.45-0.80)  
- **SPT Recovery:** 0.45 m  
- **SPT Recovery:** 0.45 m

### Rock Type

- **Strength:** v. weakly cemented  
- **Estimated Strength:** Is(50)

### Defects

- **Spacing:** (mm)
- **Type:** none
- **Material:** none
- **Orientation:** none
- **Infilling:** none

### Drilling Information

- **Method:** auger screwing
- **Drill Depth:** 1.80m
- **Rig:** UDR100
- **Surface Elevation:** -5.015m (CD)

### Water Inflow

- **Type:** none
- **Flow:** none

### Water Outflow

- **Type:** none
- **Flow:** none

### Cementation

- **Type:** none

### Weathering

- **Type:** none

### Strength

- **Type:** none

### Defect Type

- **Type:** none

### Graphic Log / Core Recovery

- **Material Description:** ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alternate, cementation, etc as applicable)

### Additional Data

- **Description:** orientation, infilling, or coating, shape, roughness, thickness, etc

### Core Loss

- **Type:** 0.35m (0.45-0.80)
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date started:** 27/5/08  
**Date completed:** 28/5/08  
**Logged by:** TW  
**Checked by:** NB

#### Position:
- E: 474108.7905, N: 7720870.3 (50 MGA94)

#### Project No.:
- Engineering Log - Cored Borehole

#### Drilling information:
- Drilling Method:
  - SPT  
  - PQ  
  - NQ  
  - CB  
  - AS  
  - DT  

#### Material substance:
- Material Description:
  - ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)

#### Defect type:
- cementation  
- sheared seam  
- fresh rock  
- weathering  
- planarity  
- coating  

#### Additional data:
- (joints, partings, seams, zones, etc)  
- description, orientation, infilling or coating, shape, roughness, thickness, etc

####icone log / core recovery:
- graphic log  
- core recovery  
- core recovered  
- core not recovered

#### Water pressure test result:
- water inflow  
- water outflow

#### Rock type:
- Calcarenite
- Conglomeratic Calcirudite

#### Water test:
- SPT

#### Data:
- Is(50) = 0 MPa
- HP = 250 kPa

#### Water inflow:
- 10 Oct., 73 Water
- Level on Date shown
- Water inflow
- Water outflow

#### Weathering:
- Residual Soil
- Moderately Weathered
- Highly Weathered
- Extremely Weathered

#### Strength:
- Residual Soil
- Moderately Weathered
- Highly Weathered
- Extremely Weathered

#### Planarity:
- Polished
- Smooth
- Rough

#### Roughness:
- Very rough
- Rough
- Clean

#### Coating:
- Stained
- Veneer
- Slickensided

#### Defect type:
- Bedding parting
- Crushed seam
- Fracture, Joint
- Sheared surface
- Sheared zone

#### Core recovery:
- Core recovered
- Core not recovered

#### Additional data:
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m
- SPT Recovery: 0.45 m

#### Notes:
- From 2.70 m to 3.0 m poor recovery, non-intact some clay; very loose
- From 4.30 m to 4.50 m poor recovery
- From 7.73 m to 7.83 m layer of low to medium strength calcarenite
- Water inflow
- Water outflow
- Water pressure test result

#### Core details:
- Core recovered
- Core not recovered

#### Graphical log:
- Graphic symbols indicate material

#### Core undisturbed:
- Core undisturbed
- Core disturbed

#### Additional data:
- (joints, partings, seams, zones, etc)

#### Mounting:
- Jack up Barge

#### Rig type:
- UDR100

#### Surface Elevation:
- -5.0223 m (CD)

#### Graphic log / core recovery:
- Graphic log
- Core recovery
- No core recovered

#### Core details:
- Core recovered
- Core not recovered

#### Core description:
- Rock type, grain size, texture, fabric, colour, structure (mineral composition, hardness, alteration, cementation, etc as applicable)

#### Note:
- Revisions to the document are possible.
**Engineering Log - Cored Borehole**

**Client**: DAMPIER PORT AUTHORITY

**Project**: DAMPIER CARGO BERTH EXPANSION PROJECT

**Location**: PORT DAMPIER

**Rig type**: UDR100  
**Surface Elevation**: -5.0223m (CD)  
**Angle from horizontal**: 90°

**Position**: E: 474108.7905, N: 7720870.3 (50 MGA04)

**Logbook**

**Date started**: 27/5/08  
**Date completed**: 28/5/08  
**Logged by**: TW  
**Checked by**: NB

**Hole No.**: BH03A  
**Sheet No.**: 2 of 3  
**Project No.**: GEOOTHERD08491AA

---

**Drilling information**

- **Drilling method**:  
  - Water  
  - Core  
  - Wireline Core

- **Casing**:  
  - Water  
  - Core

- **Rigging**:  
  - Water  
  - Core

**Material Substance**

- **Material**: 
  - Rock Type: Gravitational, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)

**Defects**

- **Type**: Core Recovered, Graphic Symbols, Indicate Material, No Core Recovered

---

**Core Details**

- **Core Recovery (%)**: TCR = Total Core Recovery
- **Rock Quality Designation (%)**: RQD

**Water**

- **Water Pressure Test Result**: Lugeons for Depth intervals shown

---

**Rock Characteristics**

- **RQD = Rock Quality Designation (%)**:  
  - 100%
  - 90%
  - 80%
  - 60%
  - 50%
  - 25%

- **SCR = Slickensided Coating (%):**  
  - 100%
  - 90%
  - 80%
  - 60%
  - 50%
  - 25%

- **VH = Very High**:  
  - Very high
  - High
  - Medium
  - Low
  - Extremely Low

- **Wc = Water Cemented**:  
  - Very Weakly Cemented
  - Weakly Cemented
  - Moderately Cemented
  - Well Cemented
  - Very Well Cemented
  - Residual Soil

- **Weathering**:  
  - Fresh Rock
  - Very Slightly Weathered
  - Slightly Weathered
  - Moderately Weathered
  - Highly Slightly Weathered
  - Highly Weathered
  - Very Highly Weathered
  - Extremely Weathered

- **Cementation**:  
  - Very Weakly Cemented
  - Weakly Cemented
  - Moderately Cemented
  - Well Cemented
  - Very Well Cemented

- **SEM**:  
  - Sealed
  - Fissured

---

**Graphic Log / Core Recovery**

- **Graphic Symbols**: Core Recovered, Graphic Symbols, Indicate Material, No Core Recovered

---

**Additional Data**

- **Drainage**: Borehole Diameter, Effective Drainage Diameter

---

**Surface Elevation**: -5.0223m (CD)

---

**Checked by**: NB
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date started:** 27/5/08  
**Date completed:** 28/5/08  
**Logged by:** TW  
**Checked by:** NB  
**Position:** E: 474108.7905, N: 7720870.3 (50 MGA94)  
**Hole Diameter:**  
**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Date started:** 28/5/08  
**Date completed:** 28/5/08  
**Logged by:** TW  
**Checked by:** NB

### BOREHOLE BH03A TERMINATED AT 19.05 m

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Water inflow</th>
<th>Water outflow</th>
<th>Core Recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.0</td>
<td></td>
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<tr>
<td>17.0</td>
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<td>18.0</td>
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<td>49.0</td>
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<tr>
<td>50.0</td>
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</tbody>
</table>

### Additional Data
- **Method:** core details
- **Core recovery:** core recovered
- **Rock Type:** sample and field tests
- **Material substance:** material description
- **Estimated strength:** Is(50)

### Water Pressure Test Result
- **Lugon depth:** 25
- **Infilling:** water inflow

### Core Run Details
- **Depth (m):** 16.0 to 35.0
- **Water inflow:** 10 Oct., 73 Water Level on Date shown
- **Water outflow:** 10 Oct., 73 Water Level on Date shown
- **Coating:** no core recovered

### Core Run Details
- **Depth (m):** 16.0 to 35.0
- **Water inflow:** 10 Oct., 73 Water Level on Date shown
- **Water outflow:** 10 Oct., 73 Water Level on Date shown
- **Coating:** no core recovered

### Additional Data
- **Method:** defect type
- **Defect spacing:** 0.0000 mm
- **Defects:** no defects

### Water Pressure Test Result
- **Lugon depth:** 25
- **Infilling:** water inflow

---

*COFFEY GEOTECHNICS*  
*COFFEE_02.GLB  Log  CORED BOREHOLE  DAMPIER_NEARSHORE_BOREHOLE_LOGS.GPJ  <<DrawingFile>>  15/10/2008 13:59*
**Engineering Log - Cored Borehole**

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  

**Graphical Log / Core Recovery**

- **Material Substance**
  - ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)
  - Core description
  - Defect description
  - Defect type
  - Core recovery
  - Additional data

- **Material Substance Details**
  - CORE LOSS 0.45m (0.00-0.45)
  - CORE LOSS 0.30m (0.45-0.75)
  - (SW) SAND, fine to coarse grained, pale brown; with some clay; trace shell fragments up to 10mm
  - (GP) GRAVEL (RECOVERED AS), coarse grained, rounded to sub-rounded, with some cobbles, rounded, very high to extremely high strength, trace of carbonate, growth on rims of clasts. Possible fines lost during drilling
  - GRANITE, white pale grey brown, recovered as moderately weakly to moderately cemented; clayey gravel with some sand. Clay is high plasticity
  - GRANITE, grey white / pale red, trace discontinuous defects with white clay infill; trace calcite replacement/cementation

- **Drilling Information**
  - Hole No.: BH04
  - Sheet No.: 1 of 2
  - Project No.: GEOTHERD08491AA
  - Date started: 29/5/08
  - Date completed: 30/5/08
  - Logged by: TW
  - Checked by: NB
  - Mounting: Jack up Barge
  - Angle from horizontal: 90°
  - Hole Diameter: 

- **Logging Method & casing**
  - Water
  - Core recovered
  - Core spacing
  - Graphic symbology

- **Additional Data**
  - Water inflow (lugeons) for depth
  - Water pressure test result (lugeons) for depth
  - Planarity: SPT, 2, 4, 8 N=12
  - Core recovered
  - Graphic symbols

- **Core Details**
  - TCR = Total Core Recovery (%)
  - RQD = Rock Quality Designation (%)
  - SCR = Solid Core Recovery (%)

- **Cementation**
  - VC = v. well cemented
  - Wc = well cemented
  - Hc = moderately cemented
  - VC = v. weakly cemented
  - Wc = weakly cemented
  - Hc = moderately cemented

- **Weathering**
  - Residual Soil
  - Fresh Rock

- **Strength**
  - Residual Soil
  - Fresh Rock

- **Coating**
  - Residual Soil
  - Fresh Rock

- **Defect Type**
  - Bedding parting
  - Planar
  - Undulating
  - Slickensided

- **SPT**
  - Number of blow counts
  - Penetration resistance

- **MTR**
  - Resistivity
  - Conductivity

- **Logging Symbols**
  - Core recovered
  - No core recovered

- **Additional Notes**
  - Rock quality designation
  - Total core recovery
  - Solid core recovery
  - Water inflow
  - Water pressure test result (lugeons) for depth
  - Planarity: SPT, 2, 4, 8 N=12
  - Graphic symbols

- **Core Information**
  - Material substance
  - Defect type
  - Core recovery
  - Additional data

- **Hole Diameter**
  - 29/5/08
  - 2, 4, 8 N=12
  - Graphic symbols

- **Additional Data**
  - Water inflow (lugeons) for depth
  - Water pressure test result (lugeons) for depth
  - Planarity: SPT, 2, 4, 8 N=12
  - Graphic symbols

- **Weathering**
  - Residual Soil
  - Fresh Rock

- **Strength**
  - Residual Soil
  - Fresh Rock

- **Coating**
  - Residual Soil
  - Fresh Rock

- **Defect Type**
  - Bedding parting
  - Planar
  - Undulating
  - Slickensided

- **SPT**
  - Number of blow counts
  - Penetration resistance

- **MTR**
  - Resistivity
  - Conductivity

- **Logging Symbols**
  - Core recovered
  - No core recovered

- **Additional Notes**
  - Rock quality designation
  - Total core recovery
  - Solid core recovery
  - Water inflow
  - Water pressure test result (lugeons) for depth
  - Planarity: SPT, 2, 4, 8 N=12
  - Graphic symbols
**Hole No.** BH04  
**Project No.** GEOGHER00491AA  
**Client:** DAMPIER PORT AUTHORITY  
**Location:** PORT DAMPIER  
**Date started:** 29/5/08  
**Date completed:** 30/5/08  
**Logged by:** TW  
**Checked by:** NB  
**Surface Elevation:** -3.7059m (CD)  
**Angle from horizontal:** 90°  

**Drilling information**

- **Rig type:** UDR100  
- **Mounting:** Jack up Barge  
- **Hole Diameter:**

**Material substance**

- **GRANITE:** coarse grained, white grey and pale red, trace flow banding. Trace incipient fractures. Trace pink phenocrysts of feldspar up to 50mm (continued)

**Core run details**

- **RL (m):**
  - 12.0  
  - 11.0  
  - 10.0  
  - 9.0  
  - 8.0  
  - 7.0  
  - 6.0  
  - 5.0  
  - 4.0  
  - 3.0  
  - 2.0  
  - 1.0  
  - 0.0

**Water pressure test result**

- **10 Oct., 73 Water outflow**

**Additional data**

- **Degree of weathering:**
  - Fresh Rock
  - Slightly Weathered
  - Moderately Weathered
  - Highly Weathered
  - Extremely Weathered

- **Residual Soil**
Rig type : UDR100
Location : PORT DAMPIER
Project : DAMPIER CARGO BERTH EXPANSION PROJECT
Rig type  :  UDR100
Location :  PORT DAMPIER
Project :  DAMPIER CARGO BERTH EXPANSION PROJECT

Drilling information:

- Drilling Method:
  - Wireline Core (85.0mm)
  - Wireline Core (63.5mm)
  - Wireline Core (47.6mm)
- NMLC Core
- Claw or Blade Bit
- Roller/tricone
- Auger drilling
- Diatube

Material Substance:

- Core Substance:
  - ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)

Material Description:

- SW SAND, fine to medium grained, grey, with some clay, medium dense
- CLAYEY SAND, fine to medium grained, grey, trace of clay, trace shells up to 40mm
- SILICEOUS CALCARENITE, fine to coarse grained, pale grey / pale grey brown, with trace disseminated clay and trace shell/shell fragments up to 30mm, with some pockets up to 50mm of fine to coarse grained sand
- (GW) CARBONATE GRAVEL, fine to coarse grained, rounded to angular, trace fine to coarse grained sand and cobbles. Gabros cobbles, rounded-angular, very high to extremely high strength; gravel in a soft to firm brown clay
- RHYODACITE (GRANOPHYRE), medium grained, grey, with Phenocrysts

Core Details:

- Rock Type: Core Substance
- Grain Size: Texture, Fabric
- Structure: Colour, Structure

Core Recovery:

- SPT Recovery: 0.15 m
- SPT Recovery: 0.2 m

Core Details:

- Fresh Rock
- Slightly Weathered
- Moderately Weathered
- Highly Weathered
- Extremely Weathered
- Residual Soil

Weathering:

- Residual Soil
- Extremely Weathered
- Moderately Weathered
- Highly Weathered
- Slightly Weathered
- Fresh Rock

Cementsation:

- VWC: v. weakly cemented
- Wc: weakly cemented
- MWc: moderately cemented
- HC: well cemented
- VHc: very well cemented

Cementation:

- Residual Soil
- Extremely Weathered
- Moderately Weathered
- Highly Weathered
- Slightly Weathered
- Fresh Rock

Coating:

- Residual Soil
- Extremely Weathered
- Moderately Weathered
- Highly Weathered
- Slightly Weathered
- Fresh Rock

Planarity:

- Discontinuous

Coating:

- Residual Soil
- Extremely Weathered
- Moderately Weathered
- Highly Weathered
- Slightly Weathered
- Fresh Rock

Notes:

- Core Substance: Material composition, hardness, alteration, cementation, etc.
- Core Recovery: SPT Recovery
- Weathering: Fresh Rock, Residual Soil
- Cementation: VWC, Wc, MWc, HC, VHc
- Coating: Residual Soil, Extremely Weathered
- Planarity: Discontinuous

Logs:

- Hole Diameter: 400mm
- Mounting: Jack up Barge
- Hole Diameter: 300mm
- Mounting: Jack up Barge
- Hole Diameter: 200mm
- Mounting: Jack up Barge
- Hole Diameter: 100mm
- Mounting: Jack up Barge
- Hole Diameter: 50mm
- Mounting: Jack up Barge
## Engineering Log - Cored Borehole

**Hole No.** BH05  
**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

**Position:** E: 473976.3603, N: 7720611.9 (50 MGA94)  
**Surface Elevation:** -6.6917m (CD)  
**Angle from horizontal:** 90°  
**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Hole Diameter:**

### Drilling Information & Core Details

<table>
<thead>
<tr>
<th>Drilling Method &amp; casing</th>
<th>Water</th>
<th>Core details</th>
<th>Material Description</th>
<th>Rock Type, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>auger drilling</td>
<td></td>
<td>TCR = Total Core Recovery (%)</td>
<td>RHYODACITE (GRANOPYRE), medium grained, grey, with Phenocrysts (continued)</td>
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<tr>
<td>diatube</td>
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<td>SCR = Solid Core Recovery (%)</td>
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<tr>
<td>auger screwing</td>
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<td>RQD = Rock Quality Designation (%)</td>
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<tr>
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<td>HQ wireline core (47.6mm)</td>
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<td>HQ wireline core (63.5mm)</td>
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<td>PQ wireline core (86.0mm)</td>
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<td>SPT standard penetrometer test</td>
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</tbody>
</table>

**Water Pressure Test Result (lugeons) for depth (m):**

- **8.0:** JT 0° PR RF CN
- **8.20:** JT 0° PR RF CN
- **8.70:** JT 0° PR RF CN
- **8.88:** JT 0° PR RF CN

**Borehole BH05 Terminated at 10.50 m**
BH06 TERMINATED AT 10.00 m

- SILICEOUS CALCARENITE, fine to coarse grained, pale brown, with some shell fragments (continued)
- FROM 9.30m TO 9.40m CORAL FRAGMENTS
- SILICEOUS DETRITAL LIMESTONE, fine to coarse grained, pale brown / brown, nodular
**Engineering Log - Cored Borehole**

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Surface Elevation:** -6.16m (CD)  
**Rig type:** UDR100  
**Position:** E: 474108.87, N: 7721085.1 (50 MGA94)  
**Angle from horizontal:** 90°  
**Surf. Elevation:** -6.16m (CD)  

---

**Drilling information**

<table>
<thead>
<tr>
<th>Hole Depth (m)</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00 - 0.30</td>
<td>SPT Recovery: 0.2 m</td>
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<tr>
<td>0.35 - 0.45</td>
<td>SPT Recovery: 0.15 m</td>
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<tr>
<td>0.50 - 0.60</td>
<td>SPT Recovery: 0.25 m</td>
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<tr>
<td>0.65 - 0.70</td>
<td>SPT Recovery: 0.10 m</td>
</tr>
</tbody>
</table>

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**Material Description**

- **SW SILICEOUS CARBONATE SAND**, fine to medium grained, brown / grey, with some clay, medium dense and shell fragments; dense
- **CORE LOSS 0.15m (0.45-1.60)**

---

**Rock Type & Grain Size**

- **SW SILICEOUS CARBONATE SAND**, fine to medium grained, brown / grey, trace of clay, and shell fragments, very loose; very loose
- **CORE LOSS 0.50m (2.45-3.00)**

---

**Rock Type & Description**

- **SW SILICEOUS CARBONATE SAND**, fine to medium grained, brown / grey, trace of clay, and trace shell fragments, very loose
- **CORE LOSS 0.21m (3.95-4.16)**

---

**Rock Type & Description**

- **SILICEOUS CARBONATE GRAVEL - Clayey**, fine to coarse grained, sub-rounded, brown; clay, low plasticity, very loose; very loose
- **CORE LOSS 0.33m (8.95-7.28)**

---

**Rock Type & Description**

- **CLAYEY CALCILUTITE, fine grained, white and pale brown; Dense**

---

**Weathering & Strength**

- **Fresh Rock**
- **Slightly Weathered**
- **Moderately Weathered**
- **Highly Weathered**
- **Extremely Weathered**

---

**Cementation**

- **VWC - v. weakly cemented**
- **Wc - weakly cemented**
- **NWC - mod. weakly cemented**
- **M - moderately cemented**
- **Hc - well cemented**
- **H - v. well cemented**

---

**Surface**

- **10 Oct., 73 Water Level on Date shown**
- **water inflow**
- **water outflow**
- **water pressure test result**

---

**Additional Data**

- **SPT Recovery**
- **SPT Recovery**
- **SPT Recovery**
- **SPT Recovery**
- **SPT Recovery**

---

**Checked by:** NB  
**Date started:** 7/6/08  
**Date completed:** 6/6/08  
**Sheet No.:** 1 of 4  
**Hole No.:** BH07  
**Project No.:** GEOTHERD08491AA
**Engineering Log - Cored Borehole**

**Client**: DAMPIER PORT AUTHORITY

**Principal**: DAMPIER CARGO BERTH EXPANSION PROJECT

**Location**: PORT DAMPIMER

**Position**: E: 474108.87, N: 7721085.1 (50 MGA94)  
Surface Elevation: -6.16m (CD)

**Rig type**: UDR100  
**Mounting**: Jack up Barge

**Hole Diameter**:

---

**Material Substance**

<table>
<thead>
<tr>
<th>drilling method</th>
<th>core details</th>
<th>water</th>
<th>cementation</th>
<th>weathering</th>
<th>strength</th>
<th>planarity</th>
<th>roughness</th>
<th>coating</th>
</tr>
</thead>
</table>
|                 | TCR = Total Core Recovery (%)  
SCR = Solid Core Recovery (%)  
RQD = Rock Quality Designation (%) | Level on Date shown  
water inflow  
water outflow | VWC v. weakly cemented  
Wc weakly cemented  
MC v. moderately cemented  
Hc well cemented  
VHc very well cemented | RW Residual Soil  
XW Extremely Weathered  
SW Slightly Weathered  
CL Cleaned | RL extremely low  
EL extremely low  
L low  
M medium  
H high  
X very high |

---

**Graphic Log / Core Recovery**

- core recovered  
- graphic symbols  
- indicate material  
- no core recovered

---

**Material Description**

- ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)

---

**Other Details**

- (joints, partings, seams, zones, etc)  
description, orientation, infilling or coating, shape, roughness, thickness, others

---

**Logging by**: SPN  
**Checked by**: NB

---

**Sheet No**: 2 of 4  
**Project No**: GEOTHERD08491AA

---

[graphic log diagram with core recovery and additional data]
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Rig type:** UDR100  
**Position:** E: 474108.87, N: 7721085.1 (50 MGA94)  
**Surface Elevation:** -6.16m (CD)  
**Angle from horizontal:** 90°  

#### drilling information

<table>
<thead>
<tr>
<th>Material Substance</th>
<th>Description</th>
<th>Defect Spacing (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SILICEOUS CALCARENITE</td>
<td>Fine to coarse grained, off white to brown red (continued)</td>
<td></td>
</tr>
<tr>
<td>CALCARCEOUS CONGLOMERATE</td>
<td>Fine to coarse grained, pale brown and grey, pyroclastic clast, matrix is fine to coarse grained</td>
<td></td>
</tr>
<tr>
<td>GRANITE</td>
<td>Coarse grained, pink and grey, 2mm</td>
<td></td>
</tr>
<tr>
<td>SILICEOUS CALCARENITE</td>
<td>Massive with pink/white phenocrysts</td>
<td></td>
</tr>
<tr>
<td>GRANITE</td>
<td>Coarse grained, pink and grey, 2mm</td>
<td></td>
</tr>
</tbody>
</table>

#### Additional Data

- **Drilling Breaks:**
  - 23.05: Drilling Break
  - 22.80: JT 45° PR RF CA VN
  - 22.27-22.85: JT 20° UN S CA VN
  - 21.40: JT 45° UN RF CA FILLED
  - 18.35: JT 10° PR S Clay VN
  - 18.00-20.67: Drilling Break
  - 17.50: Drilling Break
  - 17.22: JT 0° PR SL CA CT
  - 17.10: Drilling Break
  - 16.05-18.00: Drilling Break
  - 16.00: Drilling Break

- **Water Pressure Test Result:**
  - 21.40: JT 45° UN RF CA FILLED
  - 21.40-21.47: JT 10° PR S CA VN

- **Surface Elevation:** -6.16m (CD)
### Engineering Log - Cored Borehole

**Hole No.** BH07  
**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date started:** 6/6/08  
**Date completed:** 7/6/08  
**Logged by:** SPN  
**Checked by:** NB

**Position:** E 474108.87, N 7721085.1 (50 MGA84)  
**Surface Elevation:** -6.16m (CD)  
**Angle from horizontal:** 90°  
**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Hole Diameter:**

<table>
<thead>
<tr>
<th>Core Details</th>
<th>Water</th>
<th>Material Substance</th>
<th>Cementation</th>
<th>Weathering</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock Type:</td>
<td>Depth (m)</td>
<td>24.0</td>
<td>25.0</td>
<td>26.0</td>
<td>27.0</td>
</tr>
<tr>
<td>core covered:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- graphic symbols indicate material</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>core recovered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>no core recovered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-Oct-73 Water Level on Date shown</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water inflow</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>water outflow</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Is(50)</td>
<td></td>
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</tr>
<tr>
<td>cementation</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Vw, weakly cemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wrc, weakly cemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mw, moderately cemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mc, moderately cemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hc, well cemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vhc, very well cemented</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>weathering</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Xw, extremely weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HW, Highly weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SW, Slightly weathered</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FR, Fresh Rock</td>
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</tr>
<tr>
<td>strength</td>
<td></td>
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</tr>
<tr>
<td>EL, extremely low</td>
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</tr>
<tr>
<td>LR, low</td>
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</tr>
<tr>
<td>medium</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>high</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Drilling information**
  - **Method:** Diatube  
  - **Drilling method & casing:** water  
  - **Rig type:** UDR100  
  - **Mounting:** Jack up barge  
  - **Hole Diameter:**

- **Additional data**
  - **Joint:** 23.93-24.32, JT 10° UN RF CA VN closed and open to 0,3mm  
  - **Depth:** 24.32, Drilling Break  
  - **Core recovery:** 24.00: JT 80° UN CN  
  - **Void:** VO

- **Material description**
  - **Rock Type:** Granite, coarse grained, pink and grey, 2mm massive with pink/white phenocrysts (continued) below 24.0m grain size 1mm  
  - **Material substance:**
    - **Texture:** planar  
    - **Roughness:** very rough  
    - **Weathering:** Residual Soil

- **Graphic Log / Core Recovery**
  - **Core recovery:** core recovered  
  - **Symbols:** no graphic symbols  
  - **Interval shown:** 24.32m becoming red/brown  
  - **Borehole:** BH07 terminated at 24.32 m

- **Core Run Details**
  - **Hole run:** 47.6mm, 63.5mm, 85.0mm  
  - **Water Pressure Test Result:**
    - **LT (m):** 30.5  
    - **Sample & Field Test:**
      - **Dilution (mm):** 20  
      - **Hardness:** 40  
      - **Strength:** 100

- **Surface Elevation:** -6.16m (CD)  
- **Date started:** 10-Oct-73  
- **Date completed:** 7/6/08
### Engineering Log - Cored Borehole

**Client**: DAMPIER PORT AUTHORITY  
**Project**: DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location**: PORT DAMPIER

| Position | E: 473631.3503, N: 7720993.4 (50 MGA94) |
| Location | PORT DAMPIER |
| Project | DAMPIER CARGO BERTH EXPANSION PROJECT |
| Rig type | UDR100 |
| Hole Diameter | |

**Drilling Information**

<table>
<thead>
<tr>
<th>Method</th>
<th>Water Spacing (m)</th>
<th>Casing Spacing (m)</th>
<th>Core Recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>SPT</td>
<td>0.45</td>
<td>2.00</td>
<td>0.00</td>
</tr>
<tr>
<td>PQ</td>
<td></td>
<td>2.45</td>
<td>0.00</td>
</tr>
<tr>
<td>HQ</td>
<td></td>
<td>4.00</td>
<td>0.00</td>
</tr>
<tr>
<td>NMLC</td>
<td></td>
<td>6.00</td>
<td>0.00</td>
</tr>
</tbody>
</table>

**Material Substance**

- **SW SAND**, fine to medium grained, grey, with some clay, medium dense
- **CORE LOSS 0.65m (0.45-1.10)**
- **CLAYEY SAND**, fine to coarse grained, grey, trace shell fragments up to 10mm; medium dense...from 1.10m to 1.55m poor recovery
- **CALCILUTITE**, brown, rounded to subrounded gravel sized nodules in a soft clay matrix
- **CORE LOSS 0.55m (2.45-3.00)**
- **SW SAND**, fine to coarse grained, grey, with some clay, very loose...from 3.0m to 3.50m poor recovery
- **CORE LOSS 0.30m (3.95-4.30)**
- **GO MIXED CARBONATE AND NON-CARBONATE GRAVEL - Clayey, fine to coarse grained, sub-rounded, carbonate nodules; with some sand, fine-medium grained; with some clay; very loose...from 5.45m recovered as sand with some clay and gravel
- **CORE LOSS 0.15m (6.00-6.15)**
- **CALCAREOUS CONGLOMORATE, brown, rounded to subrounded gravel sized carbonate nodules in a firm sandy clay matrix...from 6.0m Clay, brown with trace sand and trace gravel of carbonate nodules, stiff to very stiff...from 6.9m Calcarenite, moderately strong
- **LIMESTONE**, fine grained, white
- **CONGLOMERIC CALCILUTITE, white brown red, recovered as gravel, angular quartz crystals and subangular to subrounded carbonate nodules with some sand and clay and some Calkere

**Additional Data**

- **SPT Recovery: 0.45m**
- **SPT Recovery: 0.25m**
- **SPT Recovery: 0.15m**
- **SPT Recovery: 0.45m**

**Other Details**

- **Rig type**: UDR100  
- **Mounting**: Jack up Barge  
- **Date started**: 1/6/08  
- **Date completed**: 31/5/08  
- **Hole Number**: BH08  
- **Sheet No.**: 1 of 4  
- **Project No.**: GEOTHERD08491AA
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

### Drilling Information

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>BH08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Date started</td>
<td>31/5/08</td>
</tr>
<tr>
<td>Date completed</td>
<td>1/6/08</td>
</tr>
<tr>
<td>Logged by</td>
<td>TW</td>
</tr>
<tr>
<td>Checked by</td>
<td>NB</td>
</tr>
</tbody>
</table>

### Drilling Method & Core Details

<table>
<thead>
<tr>
<th>Method</th>
<th>Core Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>DT</td>
<td>diabase</td>
</tr>
<tr>
<td>AS</td>
<td>auger screwing</td>
</tr>
<tr>
<td>AD</td>
<td>auger drilling</td>
</tr>
<tr>
<td>RR</td>
<td>roller cone</td>
</tr>
<tr>
<td>CB</td>
<td>claw or blade bit</td>
</tr>
<tr>
<td>HQ</td>
<td>wireline core (47.6mm)</td>
</tr>
<tr>
<td>PQ</td>
<td>wireline core (65.5mm)</td>
</tr>
<tr>
<td>SPT</td>
<td>standard penetration test</td>
</tr>
</tbody>
</table>

### Material Substance

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.00</td>
<td>CONGLOMERATIC CALCIRUITE, white brown red, recovered as gravel, angular quartz crystals and subangular to subrounded carbonate nodules with some sand and clay and some Calcrete (continued)</td>
</tr>
<tr>
<td>11.50</td>
<td>LIMESTONE, fine grained, pale brown</td>
</tr>
<tr>
<td>12.00</td>
<td>CALCAREOUS CONGLOMERATE, fine to coarse grained, brown red, gravel sized carbonate nodules in a cemented sandy clay matrix</td>
</tr>
</tbody>
</table>

### Water Pressure Test Result

<table>
<thead>
<tr>
<th>Pressure Test Result</th>
<th>10 Oct., 73 Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Inflow</td>
<td>Level on Date shown</td>
</tr>
<tr>
<td>Water Outflow</td>
<td>73 Water</td>
</tr>
</tbody>
</table>

### Additional Data

<table>
<thead>
<tr>
<th>Additional Data</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rock Type, Grain Size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)</td>
<td>Rock Quality Designation (%)</td>
</tr>
<tr>
<td>Water Inflow, Water Outflow</td>
<td>Is(50)</td>
</tr>
<tr>
<td>Water Pressure Test Result</td>
<td>Wc, Mc</td>
</tr>
</tbody>
</table>

### Geotechnical Parameters

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Type, Grain Size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>11.00</td>
<td>CONGLOMERATIC CALCIRUITE, white brown red, recovered as gravel, angular quartz crystals and subangular to subrounded carbonate nodules with some sand and clay and some Calcrete (continued)</td>
</tr>
<tr>
<td>11.50</td>
<td>LIMESTONE, fine grained, pale brown</td>
</tr>
<tr>
<td>12.00</td>
<td>CALCAREOUS CONGLOMERATE, fine to coarse grained, brown red, gravel sized carbonate nodules in a cemented sandy clay matrix</td>
</tr>
</tbody>
</table>

### Water Pressure Test Result

<table>
<thead>
<tr>
<th>Water Pressure Test Result</th>
<th>10 Oct., 73 Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water Inflow</td>
<td>Level on Date shown</td>
</tr>
<tr>
<td>Water Outflow</td>
<td>73 Water</td>
</tr>
</tbody>
</table>

### Weathering & Strength

<table>
<thead>
<tr>
<th>Weathering &amp; Strength</th>
<th>Rock Quality Designation (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residual Soil</td>
<td>RS</td>
</tr>
<tr>
<td>Moderately Weathered</td>
<td>MW</td>
</tr>
<tr>
<td>Highly Weathered</td>
<td>HW</td>
</tr>
<tr>
<td>Very High</td>
<td>VH</td>
</tr>
</tbody>
</table>

### Core Recovery

<table>
<thead>
<tr>
<th>Core Recovery</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Core recovered</td>
<td>Graphic Symbols</td>
</tr>
<tr>
<td>No core recovered</td>
<td>Indicate Material</td>
</tr>
</tbody>
</table>

### Planarity & Roughness

<table>
<thead>
<tr>
<th>Planarity &amp; Roughness</th>
<th>Coating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planar</td>
<td>Planar</td>
</tr>
<tr>
<td>Rough</td>
<td>Rough</td>
</tr>
<tr>
<td>Polished</td>
<td>Polished</td>
</tr>
</tbody>
</table>
### Engineering Log - Cored Borehole

**Client:** Dampier Port Authority  
**Principal:**  
**Project:** Dampier Cargo Berth Expansion Project  
**Location:** Port Dampier  
**Checking:** NB  
**Logged by:** TW  
**Date started:** 31/5/08  
**Date completed:** 1/6/08  
**Hole No.: BH08**  
**Sheet No.: 3 of 4**  
**Project No.: GEOTHERD08491AA**

### Drilling Information

<table>
<thead>
<tr>
<th>Drilling Method &amp; casing</th>
<th>Graphic log</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
<td></td>
<td>ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</td>
</tr>
<tr>
<td><strong>Casing</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wireline core (85.0mm)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Wireline core (63.5mm)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NMLC core</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Roller/drill bit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Auger drilling</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Core Details

<table>
<thead>
<tr>
<th>Core Details</th>
<th>Water</th>
<th>Cementation</th>
<th>Weathering</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCR = Total Core Recovery (%)</td>
<td>10 Oct., 73 Water Level on Date shown</td>
<td>Wc = weakly cemented</td>
<td>Extreme Weathered</td>
<td>Very low</td>
</tr>
<tr>
<td>SCR = Solid Core Recovery (%)</td>
<td>water inflow</td>
<td>Wc, mod. weakly cemented</td>
<td>Highly Weathered</td>
<td>Medium</td>
</tr>
<tr>
<td>RQD = Rock Quality Designation (%)</td>
<td>water outflow</td>
<td>Hc = well cemented</td>
<td>Moderately Weathered</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td></td>
<td>VHc = v. well cemented</td>
<td>Slightly Weathered</td>
<td>Very high</td>
</tr>
</tbody>
</table>

### Core Recovery

<table>
<thead>
<tr>
<th>Interval (m)</th>
<th>Graphic Symbols</th>
<th>Core details</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.00-21.50</td>
<td></td>
<td>no core recovered</td>
</tr>
<tr>
<td>21.50-22.00</td>
<td></td>
<td>no core recovered</td>
</tr>
<tr>
<td>22.00-22.50</td>
<td></td>
<td>no core recovered</td>
</tr>
<tr>
<td>22.50-23.00</td>
<td></td>
<td>no core recovered</td>
</tr>
<tr>
<td>23.00-23.50</td>
<td></td>
<td>no core recovered</td>
</tr>
</tbody>
</table>

### Additional Data

- Rock quality designation: RQD = Rock Quality Designation (%)  
- Total core recovery: TCR = Total Core Recovery (%)  
- Water inflow: water inflow  
- Water outflow: water outflow  
- Water pressure test result: water pressure test result (lugeons) for depth interval shown  
- Planarity: planarity  
- Roughness: roughness  
- Coating: coating  
- Defect type: defect type  
- Infilling: infilling  
- Orientation: orientation  
- Thickness: thickness  
- Other: other  
- Description: description  
- Veneer: Veneer  
- Polished: polished  
- Irregular: irregular  
- Circular: circular  
- Curved: curved  
- Slickensided: slickensided  
- Very rough: very rough  
- Medium: medium  
- High: high  
- Low: low  
- Extremely low: extremely low  
- Slightly Weathered: Slightly Weathered  
- Very low: very low  
- Low: low  
- Medium: medium  
- High: high  
- Very high: very high  

### Material Substance

<table>
<thead>
<tr>
<th>Interval (m)</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>21.00-21.50</td>
<td>CALCAREOUS CONGLOMERA TE, fine grained, very pale brown red / mottled white, clasts of fine to coarse grained gravel sized carbonate nodules locally fine grained limestone with trace sand, fine to coarse grained gravel of igneous rock locally clayey (continued)</td>
</tr>
<tr>
<td>21.50-22.00</td>
<td>CALCAREITE, brown red, some coarse gravel of igneous rock, trace cobbles of highly weathered igneous rock, locally cemented to siliceous detrital limestone</td>
</tr>
<tr>
<td>22.00-22.50</td>
<td>GRANITE, dark green, with pink phenocrysts. Trace veins of extremely weathered granite (daly/claystone) some calcite replacement/cementation</td>
</tr>
<tr>
<td>22.50-23.00</td>
<td>...below 21.60m some angular cobbles and boulders</td>
</tr>
<tr>
<td>23.00-23.50</td>
<td>...below 21.60m possible highly weathered granite</td>
</tr>
<tr>
<td>23.50-24.00</td>
<td>...from 21.60m to 21.80 granite boulder, fractured with calcite replacement</td>
</tr>
<tr>
<td>24.00-24.50</td>
<td>...below 21.60m possible highly weathered granite with calcite replacement</td>
</tr>
<tr>
<td>24.50-25.00</td>
<td>...from 21.60m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>25.00-25.50</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>25.50-26.00</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>26.00-26.50</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>26.50-27.00</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>27.00-27.50</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>27.50-28.00</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>28.00-28.50</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>28.50-29.00</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>29.00-29.50</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>29.50-30.00</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
<tr>
<td>30.00-30.50</td>
<td>...from 21.80m to 21.80 granite boulder, fractured</td>
</tr>
</tbody>
</table>

### Additional Notes

- Is(50) = 0.23 MPa  
- if = 0.57 MPa  
- Is(50) = 0.58 MPa  
- Is(50) = 3.8 MPa  
- Is(50) = 0.12 MPa  
- Is(50) = 0.27 MPa  
- Is(50) = 0.28 MPa  
- Is(50) = 1.67 MPa  
- Is(50) = 0.17 MPa  
- Is(50) = 0.57 MPa  
- Is(50) = 0.53 MPa  
- Is(50) = 0.03 MPa  
- Is(50) = 0.1 MPa  
- Is(50) = 0.3 MPa  
- Is(50) = 1 MPa  
- Is(50) = 3 MPa  
- Is(50) = 10 MPa  
- Is(50) = 20 MPa  
- Is(50) = 50 MPa  
- Is(50) = 100 MPa  

---

**Hole Diameter:** 100 mm  
**Angle from horizontal:** 90°  
**Rig type:** UDR100  
**Surface Elevation:** -6.7065 m (CD)  
**Position:** E: 473831.3503, N: 7720993.4 (50 MGA94)
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

### Drilling Information

<table>
<thead>
<tr>
<th>Rig type</th>
<th>UDR100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td>Jack up Barge</td>
</tr>
<tr>
<td>Surface Elevation</td>
<td>-6.7065m (CD)</td>
</tr>
<tr>
<td>Angle from horizontal</td>
<td>90°</td>
</tr>
</tbody>
</table>

### Material Substance

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>depth (m)</th>
<th>graphic log</th>
<th>core recovery</th>
</tr>
</thead>
<tbody>
<tr>
<td>30.55</td>
<td>24.0</td>
<td>+</td>
<td>core recovered</td>
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<td>31.0</td>
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<td>31.5</td>
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<td>33.5</td>
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<td>+</td>
<td></td>
</tr>
<tr>
<td>51.0</td>
<td></td>
<td>+</td>
<td></td>
</tr>
</tbody>
</table>

**graphic log / core recovery**

- core recovered
- graphic symbols
- no core recovered

**graphic log / core recovery**

**additional data**

- (joints, partings, seams, zones, etc)
- description, orientation, infilling or coating, shape, roughness, thickness, etc

**cementation**

- VWC = v. well cemented
- WC = well cemented
- MC = moderately cemented
- MWC = mod. weakly cemented
- Wc = weakly cemented
- VWc = v. weakly cemented

**weathering**

- RH = Residual Soil
- HW = Highly Weathered
- MW = Moderately Weathered
- SW = Slightly Weathered
- Fresh Rock
- Residual Rock
- Rock Mass

**strength**

- EL: extremely low
- L: low
- M: medium
- H: high
- VL: very low

**planarity**

- VR: very rough
- S: smooth
- L: medium
- C: clean

**roughness**

- R: rough
- S: smooth
- C: clean

**coating**

- SN: stained
- POL: polished
- CT: coating
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date Started:** 2/6/08  
**Date Completed:** 3/6/08  
**Logged by:** TW  
**Checked by:** NB

### Technical Details
- **Rig type:** UDR100  
- **Mounting:** Jack Up Barge  
- **Hole Diameter:**
- **Surface Elevation:** -6.9658m (CD)  
- **Angle from horizontal:** 90°

### Drilling Information

<table>
<thead>
<tr>
<th>Interval (m)</th>
<th>Depth (m)</th>
<th>Method</th>
<th>Core Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0 - 0.25</td>
<td>0.0</td>
<td>Water</td>
<td>Sand, fine to medium grained, grey, with some clay; medium dense</td>
</tr>
<tr>
<td>0.25 - 0.50</td>
<td>0.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>0.50 - 0.75</td>
<td>0.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>0.75 - 1.00</td>
<td>0.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>1.00 - 1.25</td>
<td>1.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>1.25 - 1.50</td>
<td>1.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>1.50 - 1.75</td>
<td>1.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>1.75 - 2.00</td>
<td>1.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>2.00 - 2.25</td>
<td>2.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>2.25 - 2.50</td>
<td>2.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>2.50 - 2.75</td>
<td>2.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>2.75 - 3.00</td>
<td>2.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>3.00 - 3.25</td>
<td>3.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>3.25 - 3.50</td>
<td>3.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>3.50 - 3.75</td>
<td>3.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>3.75 - 4.00</td>
<td>3.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>4.00 - 4.25</td>
<td>4.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>4.25 - 4.50</td>
<td>4.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>4.50 - 4.75</td>
<td>4.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>4.75 - 5.00</td>
<td>4.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>5.00 - 5.25</td>
<td>5.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>5.25 - 5.50</td>
<td>5.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>5.50 - 5.75</td>
<td>5.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
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<tr>
<td>5.75 - 6.00</td>
<td>5.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
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<tr>
<td>6.00 - 6.25</td>
<td>6.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>6.25 - 6.50</td>
<td>6.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>6.50 - 6.75</td>
<td>6.50</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
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<tr>
<td>6.75 - 7.00</td>
<td>6.75</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
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<tr>
<td>7.00 - 7.25</td>
<td>7.00</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
<tr>
<td>7.25 - 7.50</td>
<td>7.25</td>
<td>Water</td>
<td>Clay, brown, with some gravel, fine to coarse grained, carbonate nodules; medium dense</td>
</tr>
</tbody>
</table>

### Additional Data
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m
- **SPT Recovery:** 0.45 m

### Core Details
- **Core Type:**
- **Rock Type:**
- **Grain Size:**
- **Texture:**
- **Fabric:**
- **Structure:**
- **Mineral Composition:**
- **Hardness:**
- **Alternate:**
- **Cementation:**
- **Rigor:**
- **Orientation:**
- **Infilling:**

### Weathering & Defects
- **Weathering:**
- **Defect Type:**
- **Surface:**
- **Orientation:**
- **Coating:**

### Notes
- **Surface Elevation:** -6.9658m (CD)
- **Core Details:**
- **Additional Data:**
- **Sample & Field Tests:**

### Graphical Log
- **Sample Recovery:**
- **Core Recovery:**
- **Graphic Symbols:**
- **Indicate Material:**

### Additional Information
- **Hole Diameter:**
- **Surface Elevation:**
- **Angle from horizontal:**
- **Rig Type:**
- **Position:**
- **Location:**
- **Principal:**
- **Client:**
- **Project No.:**
- **Engineering Log - Cored Borehole**

---

**Note:** This log provides a detailed account of the drilling and core samples taken from the borehole, including geological descriptions, recovery rates, and defect types. The data is essential for understanding the subsurface conditions and planning the infrastructure development accordingly.
## Drilling Information

<table>
<thead>
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<th>Depth (m)</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
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<td>15.0</td>
<td>Core recovered, medium dense</td>
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<td>15.5</td>
<td>Core recovered, medium dense</td>
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<td>Core recovered, medium dense</td>
</tr>
<tr>
<td>16.5</td>
<td>Core recovered, medium dense</td>
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<tr>
<td>17.0</td>
<td>Core recovered, medium dense</td>
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<tr>
<td>17.5</td>
<td>Core recovered, medium dense</td>
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<tr>
<td>18.0</td>
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<tr>
<td>22.0</td>
<td>Core recovered, medium dense</td>
</tr>
<tr>
<td>22.5</td>
<td>Core recovered, medium dense</td>
</tr>
</tbody>
</table>

## Material Substance

- **CALCARENITE** - pale grey mottled brown red, with some pockets, up to 40mm, of well to moderately cemented sandy clay. Trace gravel of igneous rock; dense
- **CLAYEY CONGLOMERATIC CALCIRUDITE** - with some clay. Gravel is fine to coarse grained, subrounded gravel of calcrite nodules
- **CALCAREOUS GRAVEL** - fine to coarse grained, rounded to sub-angular, carbonate nodules, trace of gravel, subangular igneous rock (Gabbro); medium dense

### Additional Data

- **SPT Recovery**: 0.35 m at 10.0 m depth
- **SPT Recovery**: 0.45 m at 11.0 m depth
- **SPT Recovery**: 0.25 m at 12.0 m depth
- **SPT Recovery**: 0.20 m at 13.0 m depth
- **SPT Recovery**: 0.15 m at 15.0 m depth

### Engineering Log - Cored Borehole

**Client**: DAMPIER PORT AUTHORITY  
**Location**: PORT DAMPIER  
**Rig type**: UDR100  
**Mounting**: Jack up Barge  
**Hole Diameter**:  

### Drilling Method & Coating

- **Core details**:  
  - **TCR**: Total Core Recovery (%)  
  - **SCR**: Core Quality Designation (%)  
  - **RQD**: Rock Quality Designation (%)  

### Cementation

- **VWC**: Weakly cemented  
- **Wc**: Moderately cemented  
- **Hc**: Well cemented  
- **VHc**: Very well cemented  

### Weathering

- **RS**: Residual Soil  
- **XW**: Extremely Weathered  
- **HW**: Highly Weathered  
- **MW**: Moderately Weathered  

### Planarity

- **Planar**: Planar  
- **Non-planar**: Non-planar  

### Roughness

- **Rough**: Rough  
- **Smooth**: Smooth  

### Coating

- **Residual**: Residual  
- **Polished**: Polished  

---

**NOTE**: The above information is a partial representation of the full document. For comprehensive details, please refer to the full document.
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Rig type:** UDR100  
**Position:** E: 473835.2696, N: 7721214.44 (50 MGA94)  
**Surface Elevation:** -6.9658m (CD)  
**Mounted:** Jack up Barge  
**Hole Diameter:**  

**Hole No.:** BH09  
**Sheet No.:** 3 of 4  
**Project No.:** GEOTHERD08491AA  
**Date started:** 2/6/08  
**Date completed:** 3/6/08  
**Logged by:** TW  
**Checked by:** NB  

#### Drilling Information

<table>
<thead>
<tr>
<th>Water</th>
<th>graphic log</th>
<th>core recovered</th>
</tr>
</thead>
<tbody>
<tr>
<td>WV</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Wf</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>WP</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>Xf</td>
<td>+</td>
<td>+</td>
</tr>
<tr>
<td>XW</td>
<td>+</td>
<td>+</td>
</tr>
</tbody>
</table>

**Material Substance**

<table>
<thead>
<tr>
<th>ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</th>
<th>Defect &amp; Coating</th>
<th>Defect Spacing (mm)</th>
<th>Additional Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>CALCARENITE, pale grey mottled brown red, with some pockets, up to 40mm, of well to moderately cemented sandy clay, Trace fine to coarse grained sand of igneous rock (continued)</td>
<td></td>
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</tbody>
</table>
# Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

<table>
<thead>
<tr>
<th>Drilling Method &amp; casing</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</td>
</tr>
<tr>
<td></td>
<td>GRANITE, grey, with pink phenocrysts. Angular clasts 75% in a high strength matrix of highly weathered igneous rock (Claystone) with trace layers of clay</td>
</tr>
<tr>
<td></td>
<td>GRANITE, green grey, with pink phenocrysts</td>
</tr>
</tbody>
</table>

### Additional Data
- (joints, partings, seams, zones, etc) description, orientation, infilling or coating, shape, roughness, thickness, etc.

---

**Method**
- DT diatube
- AS auger screwing
- AD auger drilling
- RR roller/tricone
- CB claw or blade bit
- NMLC NMLC core
- HQ wireline core (47.6mm)
- PQ wireline core (85.0mm)
- SPT standard penetration test

**Core Details**
- TCR = Total Core Recovery (%)
- SCR = Solid Core Recovery (%)
- RQD = Rock Quality Designation (%)

**Graph Core Recovery**
- Core recovered
- Graphic symbols indicate material
- No core recovered

---

**Cementation**
- VWC v. weakly cemented
- WC weakly cemented
- MC moderately cemented
- HC well cemented

**Weathering**
- VS Residual Soil
- HW Highly Weathered
- MW Moderately Weathered
- SW Slightly Weathered
- HL Highly Leached

**Weakness**
- EL extremely low
- VL very low
- L low

**Strength**
- HL very high
- V high

---

**Surface Elevation:** -6.9658m (CD)  
**Position:** E: 473835.2696, N: 7721214.44 (50 MGA94)  
**Angle from horizontal:** 90°

---

**Hole No.** BH09  
**Date started:** 2/6/08  
**Date completed:** 3/6/08

---

**Checked by:** NB  
**Logged by:** TW  
**Date completed:** 2/6/08  
**Sheet No.:** 4 of 4  
**Project No.:** GEOHERD08491AA

---

**Borehole BH09 Terminated at 30.50 m**
## Engineering Log - Cored Borehole

### Client:
DAMPIER PORT AUTHORITY

### Principal:

### Project:
DAMPIER CARGO BERTH EXPANSION PROJECT

### Location:
PORT DAMPIER

### Position:
E: 473968.19, N: 7721208.6 (50 MGA94)

### Rig type:
UDR100

### Mounting:
Jack up Barge

### Surface Elevation:
-6.765m (CD)

### Angle from horizontal:
90°

### Graphic Log / Core Recovery:
- 

### Material Substance:

#### (SW) SILICEOUS CARBONATE SAND:
- Fine to medium grained, grey / brown; with some clay, very loose; very loose

#### (GC) CARBONATE GRAVEL - Clayey:
- Fine to coarse grained, sub-rounded, pale brown / orange; clay, high plasticity, medium dense; medium dense

#### (SW) SILICEOUS CARBONATE SAND:
- Fine to medium grained, grey / brown; with trace shell fragments; very loose

#### (GC) CARBONATE GRAVEL - Clayey:
- Fine to coarse grained, sub-rounded, pale brown / orange; clay, high plasticity, medium dense; medium dense

#### (GC) CARBONATE GRAVEL - Clayey:
- Fine to coarse grained, sub-rounded, pale brown / orange; clay, high plasticity, medium dense; medium dense

#### (CL) CALCAREOUS CLAY:
- Fine to coarse grained, sub-rounded, pale brown / orange; clay, high plasticity, medium dense; medium dense

#### (GC) CARBONATE GRAVEL - Clayey:
- Fine to coarse grained, sub-rounded, pale brown / orange; clay, high plasticity, medium dense; medium dense

#### (GC) CARBONATE GRAVEL - Clayey:
- Fine to coarse grained, sub-rounded, pale brown / orange; clay, high plasticity, medium dense; medium dense

### Core Loss:
- 0.21m (1.25-1.46)
- 1.00m (4.25-5.25)
- 0.36m (7.25-7.61)

### Additional Data:
- Water pressure test result
- Core recovered
- No core recovered

### Defect Type:
- Discontinuous
- Irregular
- POL polished

### Weathering:
- Low
- Medium
- Highly Weathered
- Extremely Weathered
- Very low

### Strength:
- Weak
- Medium
- High
- Extremely low

### Planarity:
- Rough
- Smooth
- Uneven

### Roughness:
- Slight
- Sharp
- Rough

### Coating:
- Residual Soil
- Highly Weathered
- Fresh Rock
- Not Varied

### Cementation:
- Weakly cemented
- Moderately cemented
- Well cemented

### Water:
- Inflow
- Outflow

### Foam:
- Water
- Oil

### Soil Samples:
- Clayey, high plasticity, medium dense; medium dense

### Core Description:
- Rock Type, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)

### Description:
- Orientation, infilling or coating, shape, roughness, thickness, other

### Core Details:
- TCR = Total Core Recovery (%)
- RQD = Rock Quality Designation (%)
- SCR = Solid Core Recovery (%)

### Drilling Information:
- Hole diameter
- Depth
- Core length

### Core Recovery:
- No core recovered
- Core recovered

### Geological Symbols:
- Core recovered
- Graphic symbols
- Indicate material

### Water Pressure Test Result:
- Luggage (s) for depth
- Interval shown

### Date:
- 12/6/08
- 13/6/08

### Checked by:
NB

### Logged by:
SPN

### Sheet No.:
1 of 2

### Hole No.:
BH10

### Project No.:
GEOTHERD08491AA
SILICEOUS CALCARENITE, fine to coarse grained, pale brown, with some clay and trace vugs

BOREHOLE BH10 TERMINATED AT 8.30 m
Engineering Log - Cored Borehole

Client: DAMPIER PORT AUTHORITY
Principal: DAMPIER CARGO BERTH EXPANSION PROJECT
Project: PORT DAMPIER
Location: PORT DAMPIER
Position: E: 474259.892, N: 7721082.7 (50 MGA94)
Rig type: UDR100

Date started: 10/6/08
Date completed: 10/6/08
Logged by: SPN
Checked by: NB

Hole No.: BH11
Sheet No.: 1 of 2
Project No.: GEOTHERD08491AA

Core details:
- ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)
- estimated strength, orientation, infilling or coating, shape, roughness, thickness, etc

Water recovery:
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose; very loose
  - CORE LOSS 0.5m (0.45-0.50)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.5m (0.45-0.50)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.81m (0.95-1.76)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.85m (2.45-3.30)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.95m (3.95-4.90)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.81m (0.95-1.76)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.85m (2.45-3.30)
- (SW) SILICEOUS CARBONATE SAND, fine to medium grained, grey and brown; trace of clay, very loose
  - CORE LOSS 0.95m (3.95-4.90)

Weathering:
- Fresh Rock
- Slightly Weathered
- Moderately Weathered
- Highly Weathered
- Residual Soil

Cementation:
- VWC, weakly cemented
- Wc, weakly cemented
- Mw, moderately cemented
- Hc, well cemented
- Vhc, very well cemented

Weathering:
- RS, Residual Soil
- EL, Extremely Weathered
- XV, Very Low
- HW, Highly Weathered
- LW, Moderately Weathered
- SW, Slightly Weathered
- WH, High
- HR, Fresh Rock
- RH, Very High

Coating:
- SN, Stained
- VN, Veneer
- PN, Polished

Detected features:
- discontinuous

Graphic symbols:
- core recovered
- - graphic symbols
- indicate material
- no core recovered

Core recovered:
- VWC, weakly cemented
- Wc, weakly cemented
- Mw, moderately cemented
- Hc, well cemented
- Vhc, very well cemented

Weathering:
- RS, Residual Soil
- EL, Extremely Weathered
- XV, Very Low
- HW, Highly Weathered
- LW, Moderately Weathered
- SW, Slightly Weathered
- WH, High
- HR, Fresh Rock
- RH, Very High

Coating:
- SN, Stained
- VN, Veneer
- PN, Polished

Detected features:
- discontinuous
## Engineering Log - Cored Borehole

### Hole No. BH11
### Sheet No. 2 of 2
### Project No. GEOTHERD08491AA

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date started:** 10/6/08  
**Date completed:** 10/6/08  
**Logged by:** SPN  
**Checked by:** NB

<table>
<thead>
<tr>
<th>Rig type</th>
<th>Jack up Barge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mounting</td>
<td></td>
</tr>
<tr>
<td>Hole Diameter</td>
<td></td>
</tr>
</tbody>
</table>

### Position
- E: 474258.892, N: 7721082.7 (50 MGA94)

### Surface Elevation
- -5.035m (CD)

### Hole Diameter
- 10/6/08

### Water Pressure Test Result
- 10 Oct., 73 Water Level on Date shown
- 10.00 Water inflow
- 9.50 Water outflow

### Additional Data
- TCR = Total Core Recovery (%)
- SCR = Solid Core Recovery (%)
- RQD = Rock Quality Designation (%)

### Material Substance Details

<table>
<thead>
<tr>
<th>ROCK TYPE</th>
<th>Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SILICEOUS CALCARENITE, fine to medium grained, pale brown, with shells and shell fragments and trace ryodacite clasts (continued)</td>
<td>...below 8.0m trace of ryodelcite gravel</td>
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<tr>
<td>...below 8.90m becoming off white/pale brown</td>
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</tr>
</tbody>
</table>

### Core Run Details

- **Borehole BH11 Terminated at 10.00 m**

### Drilling Method and Core Details

<table>
<thead>
<tr>
<th>Core Details</th>
<th>Water</th>
<th>Cementation</th>
<th>Weathering</th>
<th>Strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>TCR = Total Core Recovery (%)</td>
<td>SCR = Solid Core Recovery (%)</td>
<td>RQD = Rock Quality Designation (%)</td>
<td>Hc well cemented</td>
<td>VL extremely low</td>
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<tr>
<td>Hc well cemented</td>
<td>Wc v. weakly cemented</td>
<td>XW Extremely Weathered</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>Wc weakly cemented</td>
<td>MWc mod. weakly cemented</td>
<td>HW Highly Weathered</td>
<td>ML</td>
<td></td>
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<tr>
<td>MWc moderately cemented</td>
<td>Me. moderately cemented</td>
<td>HW Moderately Weathered</td>
<td>M</td>
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<tr>
<td>Me. moderately cemented</td>
<td>Hc v. well cemented</td>
<td>SW Slightly Weathered</td>
<td>H</td>
<td></td>
</tr>
<tr>
<td>Hc v. well cemented</td>
<td>Vh. v. well cemented</td>
<td>FR Fresh Rock</td>
<td>H</td>
<td></td>
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<tr>
<td>Vh. v. well cemented</td>
<td>Is(50)</td>
<td>EL extremely low</td>
<td>L</td>
<td></td>
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<tr>
<td>Is(50)</td>
<td>0.16MPa</td>
<td>low</td>
<td>medium</td>
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<tr>
<td>Is(50)</td>
<td>0.85MPa</td>
<td>low</td>
<td>medium</td>
<td></td>
</tr>
<tr>
<td>Is(50)</td>
<td>1.55MPa</td>
<td>high</td>
<td>very high</td>
<td></td>
</tr>
</tbody>
</table>

### Graphic Symbols
- **core recovered**
- **graphic symbols**
- **indicate material**

### Water Pressure Test Result
- **Water pressure test result**
- **lugeons** for depth interval shown

### Water Inflow
- **10.00 Water inflow**
- **9.50 Water outflow**

### Water Outflow
- **10 Oct., 73 Water Level on Date shown**
- **10.00 Water inflow**
- **9.50 Water outflow**

### Core Run Details
- **Borehole BH11 Terminated at 10.00 m**

### Additional Information
- **graphic log / core recovery**
- **material substance**
- **core details**
- **water pressure test result**
- **defect type**
- **coating**

---

**Graphic Log / Core Recovery**

- **graphic symbols**
- **material description**
- **core recovered**
- **graphic symbols**
- **indicate material**

---

**Drilling Method & Core Details**

- **core run details**
- **additional data**
- **material description**
- **graphic log / core recovery**
- **core recovered**
- **graphic symbols**
- **indicate material**

---

**Defect Type**

- **BP bedding parting**
- **PR planar**
- **RR crushed seam**
- **CU curved**
- **FC fracture, JT joint**
- **SM seam**
- **VO void**
- **DISVO discontinuous**

---

**Casting**

- **diatube**
- **auger screwing**
- **auger drilling**
- **roller/tricone**
- **claw or blade bit**

---

**Material Substance**

- **material description**
- **rock type**
- **grain size**
- **texture**
- **fabric**
- **colour**
- **structure**
- **mineral composition**
- **hardness alteration**
- **cementation**
- **etc as applicable**

---

**Weathering**

- **Residual Soil**
- **Extremely Weathered**
- **Highly Weathered**
- **Moderately Weathered**
- **Slightly Weathered**
- **Fresh Rock**

---

**Strength**

- **EL extremely low**
- **L low**
- **ML medium**
- **H high**
- **VH very high**
**Engineering Log - Cored Borehole**

- **Client**: DAMPIER PORT AUTHORITY
- **Principal**: DAMPIER PORT AUTHORITY
- **Project**: DAMPIER CARGO BERTH EXPANSION PROJECT
- **Location**: PORT DAMPIER

### Rig Information
- **Type**: UDR100
- **Surface Elevation**: -5.826m (CD)
- **Mounting**: Jack up Barge

### Core Details
- **Material Substance**
  - **SW SILICOCARBONATE SAND**: fine to medium grained, grey/brown; with some clay, medium dense; dense
  - **SW SILICOCARBONATE SAND**: fine to medium grained, grey/brown; medium dense; medium dense
  - **SW SILICOCARBONATE SAND**: fine to medium grained, grey/brown; medium dense; loose
  - **SW SILICOCARBONATE SAND-Clayey**: fine to medium grained, grey/brown; medium dense; medium dense
  - **SW SILICOCARBONATE SAND**: fine to medium grained, grey/brown; with some clay, medium dense; medium dense
  - **CALCAREOUS SAND**: fine to coarse grained, red/brown, clay, high plasticity, with some gravel, fine to coarse grained, carbonate, very loose
  - **CALCAREOUS SAND-Clayey**: fine to medium grained, with some sand, calcarenite and rhyolite growths
  - **CALCAREOUS SAND**: fine to coarse grained, red/brown, clay, high plasticity, with some gravel, fine to coarse grained, carbonate, very loose

### Weathering
- **Weathering Type**: Fresh Rock, Slightly Weathered, Highly Weathered, Very High Weathered

### Core Loss
- **Core Loss**: 1.05m (2.45-3.50)

### SPT Recovery
- **SPT Recovery**: 0.45 m

### Water Quality
- **Water Quality**: 10 Oct., 73 Water

### Additional Data
- **Description**: orientation, infilling, coating, shape, roughness, thickness, etc.
- **Water Pressure Test Result**: 7.0 to 7.5 m; VO IR 10mm-50mm infilled, (shell used) up to 25% total core volume

---

**Table Example**

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>Water</td>
</tr>
<tr>
<td>0.65</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>1.00</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>1.50</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>2.00</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>2.50</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>3.00</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>3.50</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>4.00</td>
<td>SW SILICOCARBONATE SAND</td>
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<td>4.50</td>
<td>SW SILICOCARBONATE SAND</td>
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<td>5.00</td>
<td>SW SILICOCARBONATE SAND</td>
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<tr>
<td>5.50</td>
<td>SW SILICOCARBONATE SAND</td>
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<tr>
<td>6.00</td>
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<tr>
<td>7.00</td>
<td>SW SILICOCARBONATE SAND</td>
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<tr>
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<tr>
<td>8.00</td>
<td>SW SILICOCARBONATE SAND</td>
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<tr>
<td>8.50</td>
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<tr>
<td>9.00</td>
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<tr>
<td>9.50</td>
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<tr>
<td>10.00</td>
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</tr>
<tr>
<td>11.50</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>12.00</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>12.50</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>13.00</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
<tr>
<td>13.50</td>
<td>SW SILICOCARBONATE SAND</td>
</tr>
</tbody>
</table>

---

**Core Recovery**

- **SPT Recovery**: 0.23 m
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

<table>
<thead>
<tr>
<th>Rig type</th>
<th>UDR100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Position</td>
<td>E: 474109.739, N: 7721268.6 (50 MGA94)</td>
</tr>
<tr>
<td>Surface Elevation</td>
<td>-5.826m (CD)</td>
</tr>
<tr>
<td>Location</td>
<td>PORT DAMPIER</td>
</tr>
<tr>
<td>Drilling method &amp; casing</td>
<td></td>
</tr>
</tbody>
</table>

#### Drilling information

| Depth (m) | 0.0 | 1.0 | 2.0 | 3.0 | 4.0 | 5.0 | 6.0 | 7.0 | 8.0 | 9.0 | 10.0 | 11.0 | 12.0 | 13.0 | 14.0 | 15.0 | 16.0 | 17.0 | 18.0 | 19.0 | 20.0 |
|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Core Details |  |
| Rock Type | Siliceous Calcarenite Clayey, fine to medium grained, off white and pale brown, with some shells (continued)  |
| Colour | Pale brown  |
| Structure | Medium to coarse grained, grey, rhyodacite clasts to 40mm diameter, angular  |

#### Core Substance

- **Siliceous Calcarenite Clayey:**  
  - Fine to medium grained, off white and pale brown, with some shells (continued).  
  - Below 8.0m becoming pale brown.  
  - From 6.0m to 8.20m rhyodacite clasts to 40mm diameter.  
  - From 8.75m to 8.80m rhyodacite clasts to 30mm diameter, angular.

- **Conglomeratic Calciudite:** Medium to coarse grained, grey, rhyodacite clasts to red/brown siliceous calcarenite matrix with some shells and shell fragments, matrix supported.

#### Additional Data

- **Rig type:** UDR100
- **Rig type:** Jack Up Barge
- **Surface Elevation:** -5.826m (CD)
- **Location:** PORT DAMPIER
- **Date started:** 8/6/08
- **Date completed:** 9/6/08
- **Logged by:** SPN
- **Checked by:** NB
- **Hole Diameter:**  
- **Water inflow:** 0.02MPa
- **Water outflow:** 0.05MPa  
- **RQD:** 100%
- **TCR:** 100%
- **RQD:** 100%
- **TCR:** 100%
- **RQD:** 100%
- **TCR:** 100%
- **RQD:** 100%
- **TCR:** 100%
- **RQD:** 100%
### Drilling Information

<table>
<thead>
<tr>
<th>Hole Diameter:</th>
<th>23.00 (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water inflow</td>
<td>21.50 (lugeons) for depth (m)</td>
</tr>
<tr>
<td>Water pressure test result</td>
<td>10 Oct., 73 Water Level on Date shown</td>
</tr>
<tr>
<td>Water outflow</td>
<td>10 Oct., 73 Water Level on Date shown</td>
</tr>
</tbody>
</table>

### Material Substance

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Grain size, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcereous Conglomerate</td>
<td>Medium to coarse grained, grey, subangular to subrounded, rhodochrosite clasts in red/brown siliceous calcarenite matrix, matrix supported</td>
</tr>
<tr>
<td>Siliceous Calcarenite</td>
<td>Fine to coarse grained, red/brown, with some shells and shell fragments, trace of rhodochrosite gravel, vuggy/voided, highly fractured</td>
</tr>
<tr>
<td>Calcereous Conglomerate</td>
<td>Medium to coarse grained, grey, subangular to subrounded, rhodochrosite clasts in red/brown siliceous calcarenite matrix, matrix supported, with trace grey marine clay pockets (palygorskite)</td>
</tr>
<tr>
<td>Calcereous Conglomerate</td>
<td>Medium to coarse grained, grey, subangular to subrounded, rhodochrosite clasts in red/brown siliceous calcarenite matrix, matrix supported, with trace grey marine clay pockets (palygorskite)</td>
</tr>
<tr>
<td>Granitoid</td>
<td>Off white/pale brown, calcite replaced, some extremely weathered zones of coarse grained, pink and grey relics, with calcite replacement/cementation</td>
</tr>
<tr>
<td>Calcareous Conglomerate</td>
<td>Medium to coarse grained, grey, subangular to subrounded, rhodochrosite clasts in red/brown siliceous calcarenite matrix, matrix supported, with trace grey marine clay pockets (palygorskite)</td>
</tr>
<tr>
<td>Granitoid</td>
<td>Off white/pale brown, calcite replaced, some extremely weathered zones of coarse grained, pink and grey relics, with calcite replacement/cementation</td>
</tr>
<tr>
<td>Granite</td>
<td>Off white/pale brown, calcite replaced, some extremely weathered zones of coarse grained, pink and grey relics, with calcite replacement/cementation</td>
</tr>
</tbody>
</table>

### Additional Data

- 17.00-17.80: JT IR RF
- 17.0-17.80: VO IR up to 30% of total core volume
- 18.15-18.47: Drilling Break
- 18.50-21.00: Drilling Break
- 21.63: JT 15° UN VR Clay CT
- 21.00-23.96: Drilling Break
- 21.00-23.96: Drilling Break
- 23.20-23.45: JT 5° PR VR Clay VN

### Engineering Log - Cored Borehole

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>BH12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet No.</td>
<td>3 of 4</td>
</tr>
<tr>
<td>Project No.</td>
<td>GEOETHER08491AA</td>
</tr>
<tr>
<td>Client</td>
<td>DAMPIER PORT AUTHORITY</td>
</tr>
<tr>
<td>Principal</td>
<td>8/6/08</td>
</tr>
<tr>
<td>Project</td>
<td>9/6/08</td>
</tr>
<tr>
<td>Location</td>
<td>PORT DAMPIER</td>
</tr>
<tr>
<td>Position</td>
<td>E: 474109.7, N: 772268.6 (50 MGA94)</td>
</tr>
<tr>
<td>Surface Elevation</td>
<td>-5.826 (CD)</td>
</tr>
<tr>
<td>Angle from horizontal</td>
<td>90°</td>
</tr>
<tr>
<td>Rig type</td>
<td>UDR100</td>
</tr>
<tr>
<td>Mounting</td>
<td>Jack up Barge</td>
</tr>
<tr>
<td>Hole Diameter</td>
<td>23.00 (m)</td>
</tr>
</tbody>
</table>

### Rig type

- UDR100

### Location

- PORT DAMPIER

### Additional information

- Drilling Break
- JT 15° UN VR Clay CT
- VO IR up to 30% of total core volume
- JT 5° PR VR Clay VN

### Core details

- TCR = Total Core Recovery (%)
- RQD = Rock Quality Designation (%)
- Graphic log/core recovery

### Water inflow

- 30%, 28%, 26%, 24%, 22%, 20%, 18%, 16%, 14%, 12%, 10%, 8%, 6%, 4%, 2%, 0% (m)
<table>
<thead>
<tr>
<th>Hole No.</th>
<th>BH12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheet No.</td>
<td>4 of 4</td>
</tr>
<tr>
<td>Project No.</td>
<td>GEOTHERD08491AA</td>
</tr>
</tbody>
</table>

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Date started:** 8/6/08  
**Date completed:** 9/6/08  
**Logged by:** SPN  
**Checked by:** NB

<table>
<thead>
<tr>
<th>Position</th>
<th>E: 474109.739, N: 7721268.6 (50 MGA94)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface Elevation</td>
<td>-5.826m (CD)</td>
</tr>
<tr>
<td>Angle from horizontal</td>
<td>90°</td>
</tr>
</tbody>
</table>

**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Hole Diameter:**

### Drilling Information

<table>
<thead>
<tr>
<th>Hole No.</th>
<th>BH12</th>
</tr>
</thead>
<tbody>
<tr>
<td>Angle from horizontal</td>
<td>90°</td>
</tr>
<tr>
<td>Estimated Strength</td>
<td>Is(50)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Is(50)</th>
<th>24.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Is(50)</td>
<td>27.50</td>
</tr>
<tr>
<td>Is(50)</td>
<td>29.00</td>
</tr>
</tbody>
</table>

**Material Description:**

- **GRANITE,** becoming coarse grained 3mm grain size with pink phenocrysts to 10mm, calcite infill in joints

**Weathering:**

- **RS** Extremely Weathered
- **XW** Extremely Weathered
- **HW** Highly Weathered
- **MW** Moderately Weathered
- **SW** Slightly Weathered
- **FR** Fresh Rock

**Material Substance:**

- **WV** Very Weakly cemented
- **Wc** Weakly cemented
- **Mwc** Moderately Weakly cemented
- **Me** Moderately cemented
- **Hc** Well cemented
- **VHc** Very Well cemented

**Weathering & Planarity:**

- **RS** Residual Soil
- **RF** Rough
- **CA** Coated
- **CT** Coating

**Defect Type:**

- **BP** bedding parting
- **PR** planar
- **CS** crushed seam
- **CU** curved
- **FC** fracture, JT parting
- **SS** sheared surface
- **ST** stepped
- **SZ** sheared zone
- **RL** rough
- **VL** very rough
- **SN** stained
- **CN** clean
- **VN** veneer
- **POL** polished
- **DIS** discontinuous

**Detected Defects:**

- **JT 24.00-26.15:** Drilling Break  
- **JT 29.65-29.60:** Joint Replacement  
- **JT 26.95-26.00:** Calcite Replacement  
- **JT 26.75-27.00:** JT 35° PR RF CA FILLED  
- **JT 26.60:** JT 55° PR RF CA FILLED  
- **JT 25.95-26.00:** Calcite Replacement  
- **JT 24.45-26.15:** JT 25 - 45° UN RF CA CT 50% open 1mm 50% closed  
- **JT 24.00-26.15:** Calcite Replacement  

**Graphic Symbols:**

- **ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)**
- **water pressure test result** (lugeons) for depth interval shown

**Other Notations:**

- **COFFEEY_02.GLB  Log  CORED BOREHOLE  DAMPIER_NEARSHORE_BOREHOLE_LOGS.GPJ  <<DrawingFile>>  15/10/2008 14:33**

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**Core Details:**

- **TCR = Total Core Recovery (%)**
- **SCR = Solid Core Recovery (%)**
- **RQD = Rock Quality Designation (%)**
- **Vc = v. weakly cemented**
- **Wc = weakly cemented**
- **Mwc = moderately Weakly cemented**
- **Me = moderately cemented**
- **Hc = well cemented**
- **VHc = very Well cemented**

**Water:**

- **VL:** Very Low
- **L:** Low
- **M:** Medium
- **H:** High
- **VH:** Very High

**Additional Data:**

- **JT 24.00-26.15:** DT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
- **JT 24.45-26.15:** JT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
- **JT 29.65-29.60:** Joint Replacement
- **JT 26.95-26.00:** Calcite Replacement
- **JT 26.75-27.00:** JT 35° PR RF CA FILLED
- **JT 26.60:** JT 55° PR RF CA FILLED
- **JT 25.95-26.00:** Calcite Replacement
- **JT 24.45-26.15:** JT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
- **JT 24.00-26.15:** Calcite Replacement

---

**Engineering Log - Cored Borehole**

**Hole Diameter:**

- **4** of 4

**Approximate Depth:**

- **50.0** m

**Estimated Strength:**

- **Is(50):**
  - 24.50
  - 27.50
  - 29.00

**Material Substance:**

- **WV:**
  - 24.00-26.15
  - 24.45-26.15

**Weathering & Planarity:**

- **RS:**
  - 24.00-26.15

**Detected Defects:**

- **JT 24.00-26.15:**
  - Drilling Break
  - JT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
  - Calcite Replacement

**Graphic Symbols:**

- **ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)**
- **water pressure test result** (lugeons) for depth interval shown

**Core Details:**

- **TCR = Total Core Recovery (%)**
- **SCR = Solid Core Recovery (%)**
- **RQD = Rock Quality Designation (%)**
- **Vc = v. weakly cemented**
- **Wc = weakly cemented**
- **Mwc = moderately Weakly cemented**
- **Me = moderately cemented**
- **Hc = well cemented**
- **VHc = very Well cemented**

**Water:**

- **VL:** Very Low
- **L:** Low
- **M:** Medium
- **H:** High
- **VH:** Very High

**Additional Data:**

- **JT 24.00-26.15:** DT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
- **JT 24.45-26.15:** JT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
- **JT 29.65-29.60:** Joint Replacement
- **JT 26.95-26.00:** Calcite Replacement
- **JT 26.75-26.00:** JT 35° PR RF CA FILLED
- **JT 26.60:** JT 55° PR RF CA FILLED
- **JT 25.95-26.00:** Calcite Replacement
- **JT 24.45-26.15:** JT 25 - 45° UN RF CA CT 50% open 1mm 50% closed
- **JT 24.00-26.15:** Calcite Replacement
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Hole No.:** BH13  
**Date started:** 11/6/08  
**Date completed:** 11/6/08  
**Logged by:** SPN  
**Checked by:** NB

#### Drilling Information

<table>
<thead>
<tr>
<th>Borehole BH13 Terminated at 9.90 m</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.0</td>
</tr>
</tbody>
</table>

- **Material Description:** SILICEOUS CALCARENITE, fine to coarse grained, pale brown, nodular
- **Estimated Strength:** Is(50) = 0.22MPa
- **Additional Data:** 7.40-9.90: Drilling Break x9

#### Core Details

- **TCR = Total Core Recovery (%):** 100%
- **SCR = Solid Core Recovery (%):** 100%
- **RQD = Rock Quality Designation (%):** 100%

#### Core Recovery

- **Graphic Log:** Core recovered
- **Graphic Symbols:** Indicate material

#### Water

- **Test:** 10 Oct., 73 Water Level on Date shown
- **Graph:** Water inflow, Water outflow

#### Cementation

- **Wc = Weakly cemented**
- **Hc = Well cemented**
- **VHc = Very well cemented**

#### Weathering

- **Residual Soil** (RS)
- **Extremely Weathered** (VWc)
- **Highly Weathered** (Wc)
- **Moderately Weathered** (M)
- **Slightly Weathered** (L)
- **Fresh Rock** (FR)
- **Very High** (VH)

#### Coating

- **Planarity:** Planar
- **Roughness:** Very rough
- **Coating:** Stained

#### Defect Type

- **BP:** Bedding parting
- **PR:** Pressure release
- **CS:** Crushed seam
- **CU:** Curved
- **FC:** Fracture, joint, or fissure
- **ST:** Stretched
- **SS:** Sheared surface
- **IR:** Irregular
- **POL:** Polished

#### Additional Information

- **Lugeons (l) for depth:** (continued)
- **Surface Elevation:** -6.016m (CD)
- **Position:** E: 473907.9, N: 7721034.8 (50 MGA94)
- **Rig type:** UDR100
- **Mounting:** Jack up Barge

---

**Notes:**
- **Samples & Field Tests:**
- **Samples:**
- **Field Tests:**
- **Graphic Log:**
- **Core Recovery:**
- **Logging:**
- **Checking:**
- **Casing:**

---

**Geotechnics:**

- **Coffey Geotechnics**
- **COFFEY_GLB Log CORED BOREHOLE DAMPIER_NEARSHORE_BOREHOLE_LOGS.GPJ <<DrawingFile>> 15/10/2008 14:03
## Engineering Log - Cored Borehole

### Client:
DAMPIER PORT AUTHORITY

### Principal:

### Project:
DAMPIER CARGO BERTH EXPANSION PROJECT

### Location:
PORT DAMPIER

### Position:
E: 473579.5434, N: 7721127.1 (50 MGA94)

### Rig type:
UDR100

### Mounting:
Jack up Barge

### Hole Diameter:

### Details:

<table>
<thead>
<tr>
<th>Drilling Information</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>method</td>
<td>diabase</td>
</tr>
<tr>
<td>graphic log/core recovery</td>
<td>core recovered</td>
</tr>
<tr>
<td>water</td>
<td>SPT recovery: 0.45 m</td>
</tr>
<tr>
<td>cementation</td>
<td>Vf: weakly cemented</td>
</tr>
<tr>
<td>weathering</td>
<td>RS: Residual Soil</td>
</tr>
<tr>
<td>strength</td>
<td>EL: extremely low</td>
</tr>
</tbody>
</table>

### Core Details:

- TCR = Total Core Recovery (%)
- SCR = Solid Core Recovery (%)
- RQD = Rock Quality Designation (%)

### Additional Data:

- water pressure test result (lugeons) for depth
- external strength (mm)
- defect spacing (mm)
- other defects

### Rock Descriptions:

**CALCAREOUS CLAY**
- low plasticity, brown; trace of sand; fine to medium grained, calcilutite nodules; very loose
- below 3.93m with some gravel, fine to coarse grained; sub-rounded, calcilutite nodules
- below 3.4m becoming stiff clay

**MIXED CARBONATE AND NON-CARBONATE GRAVEL**
- Clayey, fine to coarse grained, sub-angular to angular, brown; clay, carbonate nodules; with some clay; non-intact poor recovery
- above 2.8m becoming stiff; medium dense to dense

**CONGLOMERATIC CALCIRUDDITE**
- brown orange; mottled pale grey; trace of sand; with some disseminated clay pockets throughout, to coarse grained gravel sized carbonate nodules; very loose
- below 2.9m to 3.0m sand layer with some clay; below 2.8m becoming stiff

---

**Notes:**
- Water inflow
- Water outflow
- Level on Date shown
- Date completed: 30/5/08
- Date started: 31/5/08
- Sheet No: 1 of 2
- Hole No: BH14

---

**Rig type:** UDR100  
**Position:** E: 473579.5434, N: 7721127.1 (50 MGA94)  
**Location:** PORT DAMPIER  
**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Hole Diameter:**
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

<table>
<thead>
<tr>
<th>Material Substance</th>
<th>Drilling Information</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</td>
<td>core-recovered</td>
<td>BOREHOLE BH14 TERMINATED AT 8.10 m</td>
</tr>
<tr>
<td>Weathering &amp; Cementation</td>
<td>defect type</td>
<td>strength</td>
</tr>
<tr>
<td>Defect Type</td>
<td>Planarity</td>
<td>Roughness</td>
</tr>
<tr>
<td>Water Pressure Test Result</td>
<td>Water Pressure Test Result</td>
<td>Water Pressure Test Result</td>
</tr>
<tr>
<td>Water inflow</td>
<td>Water outflow</td>
<td>Water inflow</td>
</tr>
</tbody>
</table>

**Additional Data:**  
- Description: orientation, infilling or coating, shape, roughness, thickness, etc

**Core Details:**  
- TCR = Total Core Recovery (%)  
- SCR = Solid Core Recovery (%)  
- RQD = Rock Quality Designation (%)  
- Is(50) = Water Level on Date shown

**Table Columns:**  
- Depth (m)
- graphic log
- core recovered
- defect type
- defect spacing (mm)
- water inflow
- water outflow
- water pressure test result

**Graphical Log:**
- Core run details
- Field Lab
- Axial, Diametral, Irregular

**Core Run Details:**  
- rig type: UDR100  
- Mounting: Jack up Barge  
- Hole Diameter:

---

**Date:** 30/5/08  
**Logged by:** NB  
**Checked by:** NB

---

**Client:** DAMPIER PORT AUTHORITY  
**Project:** PORT DAMPIER  
**Date started:** 10 Oct., 73

---

**Engineering Log File:**
- COFFEY_02.GLB  Log  CORED BOREHOLE  DAMPIER_NEARSHORE_BOREHOLE_LOGS.GPJ
- DrawingFile: 15/10/2008 14:33
## Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER  
**Project No.:** Geological Log - Cored Borehole

### Drilling Information
- **Method:** Standard Penetration Test (SPT)
- **Casing:** Wireline core (85.0mm)
- **Logging:** Wireline core (63.5mm)
- **Rig Type:** UDR100
- **Mounting:** Jack up Barge

### Material Substance

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>Water</th>
<th>Rock Type, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.00</td>
<td>100%</td>
<td>Fresh Rock</td>
</tr>
<tr>
<td>1.00</td>
<td>90%</td>
<td>Slightly Weathered</td>
</tr>
<tr>
<td>2.00</td>
<td>80%</td>
<td>Moderately Weathered</td>
</tr>
<tr>
<td>3.00</td>
<td>70%</td>
<td>Highly Weathered</td>
</tr>
<tr>
<td>4.00</td>
<td>60%</td>
<td>Extremely Weathered</td>
</tr>
<tr>
<td>5.00</td>
<td>50%</td>
<td>Residual Soil</td>
</tr>
</tbody>
</table>

### Defect Type
- **Coating:** very high
- **Roughness:** high
- **Weathering:** medium
- **Strength:** low

### Core Details
- **TCR:** Total Core Recovery (%)
- **SCR:** Solid Core Recovery (%)
- **RQD:** Rock Quality Designation (%)

### Additional Data
- **Joints:** parings, seams, zones, etc.
- **Orientation:** description, orientation, infilling or coating, shape, roughness, thickness, etc.

---

### Sample Log

- **Sample:** [description of sample]  
- **Date:** 10 Oct., 73 Water  
- **Water Pressure Test:**  
  - **Level on Date shown:**  
  - **Water Outflow:**  
  - **Water Inflow:**

---

### Rock Description
- **Rock Type:**  
- **Grain size:**  
- **Texture:**  
- **Fabric:**

**Material Substance:**
- **SILICEOUS CALCARENITE:**  
- **CARBONATE GRAVEL:**  
- **CALCAREOUS CLAY:**  
- **SILICEOUS CARBONATE SAND:**

---

### Surface Elevation
- **Surface Elevation:** -6.554m (CD)

---

### Hole Details
- **Hole Dia.:**  
- **Angle from horizontal:** 90°

---

### Additional Information
- **Date started:** 13/6/08  
- **Date completed:** 14/6/08  
- **Logged by:** SPN  
- **Checked by:** NB
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

#### BOREHOLE BH15 TERMINATED AT 8.45 m

**Material Description:** SILICEOUS CALCARENITE, fine to coarse grained, pale brown, nodular (authogenic) with some shells and shell fragments (continued) below 8.0m becoming pale brown/red

**Additional Data:**
- **v. weakly cemented**
- **weakly cemented**
- **mod. weakly cemented**
- **moderately cemented**
- **well cemented**
- **v. well cemented**

**Weathering:**
- **RS**
- **XW**
- **HW**
- **MW**
- **SW**
- **FR**

**Cementation:**
- **VWc**
- **Wc**
- **MWc**
- **Mc**
- **Hc**
- **VHc**

**Strength:**
- **EL**
- **VL**
- **L**
- **M**
- **H**
- **VH**

**Coating:**
- **CN**
- **SN**
- **VN**
- **CT**

**Planarity:**
- **PR**
- **CU**
- **POL**

**Surface Elevation:** -6.554m (CD)

**Sample Details:**
- **TCR** = Total Core Recovery (%)  
- **SCR** = Solid Core Recovery (%)  
- **RQD** = Rock Quality Designation (%)

**Additional Notes:**
- **10 Oct., 73 Water Level on Date shown**
- **Lugeons** for depth interval shown

---

**Graphical Symbols:**
- **core recovered**
- **graphic symbols indicate material**
- **no core recovered**

**Material Substance:**
- **material description**
  - ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness, alteration, cementation, etc as applicable)

**Defect Type:**
- **BP** bedding parting  
- **PR** planar  
- **CR** crushed  
- **CU** curved  
- **FC** fracture  
- **JT** joint  
- **ST** stepped  
- **SM** seam  
- **VO** void

**Planarity:**
- **VR** very rough  
- **RF** rough  
- **SN** stained  
- **VN** veneer  
- **CT** coating  

**Surface Elevation:**
- **RL (m)**

**Defect Spacing:**
- **(mm)**

**Core Details:**
- **TCR** = Total Core Recovery (%)  
- **SCR** = Solid Core Recovery (%)  
- **RQD** = Rock Quality Designation (%)

**Water Pressure Test Result:**
- **water inflow**
- **water outflow**

---

**Table:**
<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Graphic Log</th>
<th>Core Details</th>
<th>Water</th>
<th>Cementation</th>
<th>Weathering</th>
<th>Strength</th>
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<tr>
<td>8.0</td>
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</tr>
</tbody>
</table>

---

**Core Preservation:**
- **graphic log / core recovery**  
  - core recovered  
  - graphic symbols indicate material  
  - no core recovered

---

**Hole No.:** BH15  
**Date started:** 13/6/08  
**Date completed:** 14/6/08  
**Logged by:** SPN  
**Checked by:** NB  
**Position:** E 474017.4, N 7721417 (50 MGA94)  
**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Hole Diameter:**
- **graphic symbols**  
  - indicate material

---

**Client:** DAMPIER PORT AUTHORITY  
**Principal:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER
**Rig type:** UDR100

**Location:** PORT DAMPIER

**Position:** E: 473775.3, N: 7721350.7 (50 MGA94)  
Surface Elevation: -7.394m (CD)  
Angle from horizontal: 90°

**Drilling Information**

<table>
<thead>
<tr>
<th>RL (m)</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td><strong>SILICEOUS CARBONATE SAND</strong></td>
</tr>
<tr>
<td>7.5</td>
<td>Fine to medium grained, grey / brown, with some clay; very loose</td>
</tr>
<tr>
<td>9.5</td>
<td>CORE LOSS 1.05m (0.45-1.50)</td>
</tr>
</tbody>
</table>

**SPT Recovery:** 0.45 m

**Graphic Log**

- **Material Substance:** SILICEOUS CARBONATE SAND
- **Description:** Fine to medium grained, grey / brown, with some clay; very loose
- **Core Loss:** 1.05m (0.45-1.50)

---

**GEOHERD08491AA**

*Checked by:* NB
*Logged by:* SPN
*Date Completed:* 14/6/08
*Date Started:* 14/6/08

---

**Routine Geotechnical Log**

**Rock Type, Grain Size, Texture, Fabric, Colour, Structure**

- **Material Substance:** SILICEOUS CARBONATE SAND
- **Description:** Fine to medium grained, grey / brown, with some clay; very loose
- **Core Loss:** 1.05m (0.45-1.50)

**Additional Data**

- **Core Details:** TCR = Total Core Recovery (%), RQD = Rock Quality Designation (%)
- **Water Recovery:** 0.45 m

---

**Core Details**

- **TCR:** 100%
- **RQD:** 95%

---

**Additional Data**

- **Core Loss:** 1.05m (0.45-1.50)
- **SPT Recovery:** 0.45 m

---

**Water Pressure Test Result**

- **Depth Interval:** 0.0 - 7.5 m
- **Water Inflow:** 0.06 m³/min

---

**Planarly**

- **Sample:** BH16
- **Date:** 14/6/08
- **Hole Diameter:** 400mm

---

**Weathering & Strength**

- **Weathering:** Fresh Rock
- **Strength:** v. well cemented

---

**Artificial Structures**

- **COFFDY GEOTECHNICS**

---

**Core Details**

- **TCR:** 100%
- **RQD:** 95%

---

**Additional Data**

- **Core Loss:** 1.05m (0.45-1.50)
- **SPT Recovery:** 0.45 m
### Engineering Log - Cored Borehole

**Client:** DAMPIER PORT AUTHORITY  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

**Position:** E: 473775.3, N: 7721350.7 (50 MGA94)  
**Rig type:** UDR100  
**Mounting:** Jack up Barge  
**Date started:** 14/6/08  
**Date completed:** 14/6/08  
**Logged by:** SPN  
**Checked by:** NB

#### Drilling Information

<table>
<thead>
<tr>
<th>Method</th>
<th>Water</th>
<th>Core Details</th>
<th>Graphic Log/Core Recovery</th>
<th>Material Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>TCR = Total Core Recovery (%) SCR = Solid Core Recovery (%) RQD = Rock Quality Designation (%)</td>
<td>#</td>
<td>ROCK TYPE, Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)</td>
</tr>
<tr>
<td></td>
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</tr>
</tbody>
</table>

#### Additional Data

- **Joint:** terrestrial sandstone, 0.03
- **Thickness:** 0.03
- **Height:** 0.03
- **VWc:** extremely low
- **Wc:** very low
- **MWc:** low
- **Mc:** medium
- **Hc:** high
- **VHc:** very high
- **EL:** extremely low
- **VL:** very low
- **L:** low
- **M:** medium
- **H:** high
- **VH:** very high
- **CN:** very weak
- **SN:** weak
- **VN:** very weak
- **POL:** polished
- **S:** smooth
- **SS:** rough
- **ST:** very rough
- **SL:** slightly rough
- **IR:** irregular
- **POL:** polished
- **DIS:** discontinuous

#### BOREHOLE BH16 TERMINATED AT 8.45 m

- **10 Oct., 73 Water Level on Date shown**
- **15 Oct., 73 Water outflow**
- **10 Oct., 73 Water in inflow**

---

**Graphical Log / Core Recovery**

- **graphic log:**
  - core recovered
  - graphic symbols
  - indicate material
- **no core recovered**

**Water Pressure Test Result**

- **(lugsions) for depth interval shown**
- **water pressure test result**
- **water inflow**
- **water outflow**

**Core Details**

- **TCR = Total Core Recovery (%)**
- **SCR = Solid Core Recovery (%)**
- **RQD = Rock Quality Designation (%)**

**Core Run Details**

- **Hole Diameter:**
- **RL (m):**
- **CT:**
- **DA:**
- **GR:**
- **C:**
- **CL:**
- **RP:**
- **AD:**
- **AS:**
- **DT:**
- **CB:**
- **NMLC:**
- **HQ:**
- **PQ:**
- **R:**
- **SPT:**
- **DR:**
- **RR:**

**Material Substance**

- **ROCK TYPE:**
  - (SP) SILICIOUS CARBONATE SAND, fine grained, off white and yellow; medium dense; medium dense (continued)

**Additional Data**

- **Description:**
  - coating, orientation, infilling or coating, shape, roughness, thickness, etc.

---

**Core Run Details**

- **Hole Diameter:**
  - **8.0**
  - **9.0**
  - **10.0**
  - **11.0**
  - **12.0**
  - **13.0**
  - **14.0**
  - **15.0**
  - **16.0**
  - **17.0**
  - **18.0**
  - **19.0**
  - **20.0**
  - **21.0**
  - **22.0**
  - **23.0**

---

**Additional Data**

- **Description:**
  - coating, orientation, infilling or coating, shape, roughness, thickness, etc.

---

**Core Run Details**

- **Hole Diameter:**
  - **8.0**
  - **9.0**
  - **10.0**
  - **11.0**
  - **12.0**
  - **13.0**
  - **14.0**
  - **15.0**
  - **16.0**
  - **17.0**
  - **18.0**
  - **19.0**
  - **20.0**
  - **21.0**
  - **22.0**
  - **23.0**
**Engineering Log - Cored Borehole**

**Client:** DAMPIER PORT AUTHORITY  
**Principle:**  
**Project:** DAMPIER CARGO BERTH EXPANSION PROJECT  
**Location:** PORT DAMPIER

**Hole No.** BH17  
**Sheet No.** 2 of 2  
**Project No.** GEOTHERD08491AA

**Date started:** 15/6/07  
**Date completed:** 16/6/08  
**Logged by:** SPN  
**Checked by:** NB

---

### Drilling Information

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Material Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.00</td>
<td>SILICEOUS CALCARENE, fine to coarse grained, pale brown / red, with some medium to coarse grained and cobbles of grey rhyodacite clasts and some shell fragments (continued)</td>
</tr>
</tbody>
</table>

**Borehole BH17 Terminated at 10.00 m**

---

### Additional Data

- **Rock Type:** Grain size, Texture, Fabric, Colour, Structure (mineral composition, hardness alteration, cementation, etc as applicable)
- **Weathering & Cementation:** V. Weakly cemented, Weakly cemented, Moderately cemented, Well cemented, Very well cemented
- **Strength:** EL extremely low, VL very low, L low, M medium, H high, VH very high
- **Material Substance:** Water inflow, Water outflow
- **Core Recovery:** Core recovered, Graphic symbols indicate material, Graphic log / core recovery
- **Material Details:** TCR = Total Core Recovery (%), SCR = Solid Core Recovery (%), RQD = Rock Quality Designation (%)
- **Drilling Method:** Diatube, Auger screwing, Auger drilling, Roller/tricone
- **Core Run Details:** Is(50) = 0.28 MPa, Is(50) = 0.94 MPa

---

### Graphical Log

- **Surface Elevation:** -5.532 m (CD)
- **Angle from horizontal:** 90°
- **Mounting:** Jack up Barge
- **Rig Type:** UDR100
- **Lab Method:** Axial - Diametral - Irregular
- **Background:** Clean, Stained, Veneer, Coating
- **Defect Type:** BP = bedding parting, PR = planar, VS = undulating, S = smooth, V = very rough, SN = stained
- **Coating:** Pastel, Transparent, Yellow, Black
- **Roughness:** PR = planar, TR = rough, ST = stepped, SL = slickensided
- **Planarity:** Planar, Curved, Jointed, Unjointed
- **Coating:** L = long, M = medium, S = short, U = undulating
- **Defect Spacing:** (mms) (mm)
- **Water Pressure Test Result:** Lugeons for depth interval shown

---

### Core Details

- **TCR** = Total Core Recovery (%)
- **SCR** = Solid Core Recovery (%)
- **RQD** = Rock Quality Designation (%)

---

### Core Run Details

- **Boreshole BH17 Terminated at 10.00 m**
Core Photographs
TRAY 1: 0.00m to 2.20m.

TRAY 2: 2.20m to 6.70m.
TRAY 4: 8.50m to 11.20m.

CHANGE TO HQ

TRAY 5: 11.20m to 13.15m.

TRAY 6: 13.15m to 17.25m.
TRAY 1: 0.00m to 1.80m.
TRAY 4: 9.00m to 11.80m.

TRAY 5: 11.80m to 14.00m.

TRAY 6: 14.00m to 19.05m.
TRAY 4: 8.60m to 13.60m.
TRAY 1: 0.00m to 3.00m.

TRAY 2: 3.00m to 6.00m.

TRAY 3: 6.00m to 9.00m.

TRAY 4: 9.00m to 10.00m.
BH07

TRAY 1: 0.00m to 3.00m.

TRAY 2: 3.00m to 6.00m.

TRAY 3: 6.00m to 9.00m.

---

**drawn**

**approved**

**date** 17/6/08

**scale** NOT TO SCALE

**original size** A4

---

**client:** DAMPIER PORT AUTHORITY

**project:** DAMPIER CARGO BERTH EXPANSION

DAMPIER, WA

**title:** CORE PHOTOGRAPHS

**project no:** GEOTHERD08491AA

**fig no:**

**rev:**
TRAY 1: 0.00m to 3.00m.

TRAY 2: 3.00m to 6.00m.

TRAY 3: 6.00m to 9.00m.
BH08

TRAY 7: 17.40m to 20.00m.

TRAY 8: 20.00m to 22.90m.

TRAY 9: 22.90m to 25.50m.
TRAY 10: 22.50m to 30.55m.
BH09

TRAY 1: 0.00m to 3.00m.

TRAY 2: 3.00m to 5.50m.

TRAY 3: 5.50m to 8.50m.
TRAY 4: 8.50m to 11.50m.

TRAY 5: 11.50m to 14.50m.

TRAY 6: 14.50m to 17.50m.
TRAY 7: 17.50m to 20.50m.

TRAY 8: 20.50m to 23.50m.

TRAY 9: 23.50m to 25.50m.
TRAY 10: 25.50m to 30.50m.

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**BH10**

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**drawn**

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**client:**

**DAMPIER PORT AUTHORITY**

**project:**

DAMPIER CARGO BERTH EXPANSION
DAMPIER, WA

**title:**

CORE PHOTOGRAPHS

**project no:**

GEOTHERD08491AA

**fig no:**

new:
BH11

TRAY 1: 0.00m to 3.00m.

TRAY 2: 3.00m to 6.00m.

TRAY 3: 6.00m to 9.00m.

TRAY 4: 9.00m to 10.00m.
Tray 1: 0.00m to 3.00m

Tray 2: 3.00m to 6.00m

Tray 3: 6.00m to 9.00m
TRAY 4: 9.00m to 12.00m.

TRAY 5: 12.00m to 15.00m.

TRAY 6: 15.00m to 18.00m.

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**CLIENT:** DAMPIER PORT AUTHORITY

**PROJECT:** DAMPIER CARGO BERTH EXPANSION

**LOCATION:** DAMPIER, WA

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**ORIGINAL SIZE:** A4

**PROJECT NO:** GEOTHERD8491AA

**FIG NO:**

**REV:**
BH12

TRAY 7: 18.00m to 21.00m.

TRAY 8: 21.00m to 23.94m.

TRAY 9: 23.94m to 26.15m.
TRAY 10: 26.15m to 28.05m.

TRAY 11: 28.05m to 29.00m.
BH14

TRAY 1: 0.00m to 3.00m.

TRAY 2: 3.00m to 6.00m.

TRAY 3: 6.00m to 8.10m.
### TRAY 1: 0.00m to 3.00m.

### TRAY 2: 3.00m to 6.00m.

### TRAY 3: 6.00m to 8.45m.

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**drawn** | **LB**
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**approved** |  
**date** | 17/6/08
**scale** | NOT TO SCALE
**original size** | A4

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**client:** DAMPIER PORT AUTHORITY

**project:** DAMPIER CARGO BERTH EXPANSION
DAMPIER, WA

**title:** CORE PHOTOGRAPHS

**project no:** GEOTHERD08491AA
**fig no:**  
**rev:**
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- Correlation - Uniaxial Compressive Strength vs Indirect Tensile Strength (1 Pg)
- Correlation - Indirect Tensile Strength vs Point Load Strength Index (1 Page)
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### SUMMARIES OF LABORATORY TEST RESULTS
- Summary of Laboratory Test Results (7 Pages)

### LABORATORY TEST CERTIFICATES
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- BH02 Test Certificates (26 Pages)
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- BH04 Test Certificates (24 Pages)
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- Cerchar Abrasivity Laboratory Results (1 Page)
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Correlation - Uniaxial Compressive Strength vs Point Load Strength Index

Point Load (Mpa) vs UCS (Mpa)

Carbonate Rock
Conglomerate
Granite
Rhyodacite
Summary of Laboratory Test Results
## SUMMARY OF SOIL LABORATORY TEST RESULTS

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<th>Sand (%)</th>
<th>Fines (%)</th>
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<td>BH15</td>
<td>6.50 - 6.70</td>
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<td>0.07</td>
<td>0.651</td>
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</tbody>
</table>
BH01

Laboratory Certificates
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.1
Bulk Dry Density (t/m³): 1.420
Moisture Content (%): 32.7

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
11.7

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Shear
Duration of Tests: 1.1 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

(John.Reid)
Date: 5/08/2008
Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8131  
Sample ID: BH01 (0.3 - 0.6)

Test No.:  
Test Type: A  
Platen Separation D:  
Load at Failure P: 4.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 1.1

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 1.2

Load (kN): 4.5

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ3 Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 60.7
Bulk Dry Density (t/m3): 2.650
Moisture Content (%): 0.1

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
192

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Shattered
Duration of Tests 2.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John. Reid) Date: 5/08/2008
ULTRASONIC PULSE VELOCITY

Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY

(meters/sec) 5,523

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8134
Sample ID: BH01 (5.5 - 5.65)

Test No.: 
Test Type: A
Platen Separation
D: 
Load at Failure
P: 29.3

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 12

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 12

Load (kN): 29

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)  HQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3) 2.642
Water Content (%): 0.1
Specimen Height (mm): 31
Specimen Diameter (mm): 61

INDIRECT TENSILE STRENGTH (MPa): 28.2

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 12/08/2008
BH02
Laboratory Certificates
### PARTICLE SIZE DISTRIBUTION

**AS1289.3.6.1**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<tr>
<td>2.36</td>
<td>99</td>
</tr>
<tr>
<td>1.18</td>
<td>88</td>
</tr>
<tr>
<td>0.600</td>
<td>61</td>
</tr>
<tr>
<td>0.425</td>
<td>51</td>
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<tr>
<td>0.300</td>
<td>44</td>
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<tr>
<td>0.150</td>
<td>30</td>
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<tr>
<td>0.075</td>
<td>16</td>
</tr>
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</table>

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8136
Sample ID: BH02 (3.3 - 3.35)

Client Job No: GEOTHERD08491AA
Order No: 
Test No: 
Test Type: A
Platen Separation
D: 
Load at Failure
P: 7.6

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 2.2

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 2.4

Load (kN): 7.6

Note: Sample supplied by client.
1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 11.7
Dry Density (t/m3) 2.433

Note: Sample supplied by client.
Client: Coffey Geotechnics
Test No.:
Test Type: A
Platen Separation
D:
Load at Failure
P: 5.8

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 1.4

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa) 1.6

Load (kN): 5.8

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8138-R304
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 90.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8138-S900_interim
This Certificate replaces the previously issued Certificate No.: 08-WG-8138-S900
**TEST CERTIFICATE**

**Client:** Coffey Geotechnics  
**Project:** Dampier Cargo Berth Expansion Project  
**Location:** Dampier, WA  
**Sample No.:** 08-WG-8139  
**Sample ID:** BH02 (5.4 - 5.5)

---

**INDIRECT TENSILE STRENGTH**

ISRM Doc 8 Pt 2 (Brazil Method)

---

**Core Size (mm):** PQ3

---

**Initial Specimen Details**

- **Height / Diameter Ratio:** 0.5
- **Bulk Dry Density (t/m3):** 2.010
- **Water Content (%):** 10.7
- **Specimen Height (mm):** 44
- **Specimen Diameter (mm):** 83

---

**INDIRECT TENSILE STRENGTH (MPa):** 3.00

---

**Note:** Sample supplied by client.

- Bulk Density Value was determined by the Calliper Method
- Tested on an Hydraulic Compression Machine

---

Approved Signatory: (John Reid)  
Date: 12/08/2008

---

**This document is issued in accordance with NATA’s accreditation requirements**

Accreditation No.: 2418  
Form No.: R305.Cert.07.A  
Cert No.: 08-WG-8139-R305  
Site No.: 2411  
Page: 1
POINT LOAD INDEX

AS4133.4.1

Test No.: 
Test Type: A

Platen Separation
D: 
Load at Failure
P: 5.0

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 1.6

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 1.7

Load (kN): 5

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8140-R304
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type:  A 

Platen Separation 
D: 
Load at Failure 
P:  5.3 

UNCORRECTED POINT LOAD STRENGTH Is (MPa):  0.96 

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) :  1.2 
Load (kN):  5.3 

Note: Sample supplied by client. 
1. Test Types:  D=Diametral  A= Axial  I=Irregular Lump  B= Block 
2. Test Directions:  1= Perpendicular  2=Parallel  (to planes of weakness) 
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.4

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 84.1
Bulk Dry Density (t/m3): 1.956
Moisture Content (%): 13.1

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
0.032

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling failure
Duration of Tests 3.4 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8142-R300

Approved Signatory: (John Reid) Date: 6/08/2008
Point Load Index

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.0

Uncorrected Point Load Strength Is (MPa): 0.00

Corrected Point Load Strength Is (50) (MPa): 0.00

Load (kN): 0

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in “as received” condition.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 63.1

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8142-S900_interim
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8143
Sample ID: BH02 (8.4 - 8.45)

Test No.: 
Test Type: A
Platen Separation
D:
Load at Failure
P: 0.8

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.17

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.19
Load (kN): 0.76

Note: Sample supplied by client.
1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 21.3
Dry Density (t/m3) 2.200

Note: Sample supplied by client.
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 9.8 |

Note: Sample supplied by client.
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

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<th>Sieve Size (mm)</th>
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<td>1.18</td>
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<table>
<thead>
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<th>Particle Diameter (mm)</th>
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An assumed specific gravity of 2.70 has been used in the calculation of this test.

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8145-S303_interim
# TEST CERTIFICATE

## PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

<table>
<thead>
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<th>Test Method</th>
<th>Result</th>
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<td>AS 1289.3.9.2 Liquid Limit</td>
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<td>AS 1289.3.2.1 Plastic Limit</td>
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<td>AS 1289.3.3.1 Plasticity Index</td>
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<tr>
<td>AS 1289.3.4.1 Linear Shrinkage</td>
<td>14.0</td>
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</table>

Oven Dried  
Dry Sieved  
Flat

Note: Sample supplied by client.

Approved Signatory:  
(Russell.Calvert)  
Date: 31/07/2008
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE
- According to WGPL In-House Test Method # 6

CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA) PROJECT : Dampier Cargo Berth Expansion Project
Sample Id : BH02, Depth : (9.5 - 9.9) Test Type : Unconsolidated Undrained, Multi-stage
Specimen Details : Placement
Length/Diameter (ratio) : 1.92
Dry Density (t/m$^3$) : 1.991
Moisture Content (%) : 9.8

Sampling Details : 85mm Ø core sample

MOHR CIRCLES - Composite Plot
The dotted fit line is @ Cohesion of 207 kPa & Ø : 11°

SHEAR STAGE DATA

<table>
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<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>$\varepsilon_t$ (%)</th>
<th>$\sigma_1$ (kPa)</th>
<th>$(\sigma_t)_f$ (kPa)</th>
<th>$(\sigma_1 - \sigma_3)_f$ (kPa)</th>
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<td>555</td>
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<td>637</td>
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</table>

Cohesion, $C$ (kPa) : - Friction Angle, $\Theta$ (degrees) : -

Failure Mode : sheared
Notes : Corrected area used for stress calculations
Sample supplied by client
* Stages 1 & 2 used for calculations.

Authorised Signatory : ___________________________ ( F. Lee ) Date : 26/07/2008
Certificate No.: 08-WG-8145 / S700

600
500
400
300
200
100
0

0 200 400 600 800 1000 1200

08-WG-8145

Total Stress (kPa)

Shear Stress (kPa)

36 Railway Parade Welshpool WA 6106 Phone 1300 781 744 Fax (08) 9458 3700

S700.Cert.06.A
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT :  Coffey Geotechnics (Job # GEOTHERD08491AA)
PROJECT :  Dampier Cargo Berth Expansion Project
Sample Id :  BH02, Depth : (9.5 - 9.9)
Test Type :  Unconsolidated Undrained, Multi-stage

Specimen Details :
- Placement
- Length/Diameter (ratio) : 1.92
- Dry Density (t/m^3) : 1.991
- Moisture Content (%) : 9.8

Sampling Details :
- 85mm Ø core sample

Note: deviator stress = (σ₁ - σ₃)

Authorised Signatory :  ____________________________ ( F. Lee )  Date :  26/07/2008
Certificate No.: 08-WG-8145 / S700
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)

52.1

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8146-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.0

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.00

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.00

Load (kN): 0.02

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

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

Client: Coffey Geotechnics
Client Job No: GEOTHERD08491AA
Test No.
Test Type: A

Location: Dampier, WA
Order No: 5/08/2008
Tested Date: 5/08/2008

Sample No: 08-WG-8148
WG Job Number: 08-01-1408
Sample ID: BH02 (11.5 - 11.55)
Lab: Welshpool

POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 9.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 2.0

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 2.3

Load (kN): 9.4

Note: Sample supplied by client.
1. Test Types: D= Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 24.6

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 8.4

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 8.7

Load (kN): 25

Note: Sample supplied by client.
1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8150  
Sample ID: BH02 (13.45 - 13.8)  
Client Job No: GEOTHERD08491AA  
Order No:  
Tested Date: 5/08/2008  
WG Job Number: 08-01-1408  
Lab: Welshpool

**UNIAXIAL COMpressive STRENGTH OF ROCK**  
AS4133.4.2.1

Sample Type: HQ3 Core  
Length/Diameter Ratio: 2.7

**INITIAL SPECIMEN DETAILS**

Core Diameter (mm): 60.6  
Bulk Dry Density (t/m3): 2.608  
Moisture Content (%): 0.2

**UNIAXIAL COMPRESSION STRENGTH (MPa):**  
137

Moisture Condition: Specimen tested at the moisture condition as received  
Mode of Failure: Axial  
Duration of Tests 4.3 mins

Note: Sample supplied by client.  
Bulk Density value was determined by the Calliper method  
Tested on an hydraulic compression machine

Approved Signatory: (John Reid)  
Date: 11/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 26.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 10.0

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 10

Load (kN): 27

Note: Sample supplied by client.
1. Test Types: D=Diametral    A= Axial     I=Irregular Lump     B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
ULTRASONIC PULSE VELOCITY

Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY

(meters/sec) 5,410

Note: Sample supplied by client.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A1

Platen Separation

D:

Load at Failure

P: 20.5

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 7.7

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 7.8

Load (kN): 20

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
BH03A

Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0</td>
<td>100</td>
</tr>
<tr>
<td>9.5</td>
<td>100</td>
</tr>
<tr>
<td>4.75</td>
<td>99</td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8153-S301_interim
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 18.0 |

Note: Sample supplied by client.
### Particle Size Distribution - With Hydrometer Analysis

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size Passing Particle Diameter Finer (mm)</th>
<th>%</th>
<th>Finer (mm)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0455</td>
<td>33</td>
<td>0.0455</td>
<td>33</td>
</tr>
<tr>
<td>0.0332</td>
<td>30</td>
<td>0.0332</td>
<td>30</td>
</tr>
<tr>
<td>0.0238</td>
<td>28</td>
<td>0.0238</td>
<td>28</td>
</tr>
<tr>
<td>0.0170</td>
<td>26</td>
<td>0.0170</td>
<td>26</td>
</tr>
<tr>
<td>0.0122</td>
<td>25</td>
<td>0.0122</td>
<td>25</td>
</tr>
<tr>
<td>0.0088</td>
<td>24</td>
<td>0.0088</td>
<td>24</td>
</tr>
<tr>
<td>0.0064</td>
<td>23</td>
<td>0.0064</td>
<td>23</td>
</tr>
<tr>
<td>0.0045</td>
<td>21</td>
<td>0.0045</td>
<td>21</td>
</tr>
<tr>
<td>0.0031</td>
<td>20</td>
<td>0.0031</td>
<td>20</td>
</tr>
<tr>
<td>0.0022</td>
<td>18</td>
<td>0.0022</td>
<td>18</td>
</tr>
<tr>
<td>0.0014</td>
<td>16</td>
<td>0.0014</td>
<td>16</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.

Approved Signatory: (Russell Calvert)  Date: 31/07/2008
**PLASTICITY INDEX**

<table>
<thead>
<tr>
<th>Standard</th>
<th>Test Method</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1289.3.9.2</td>
<td>Liquid Limit (%)</td>
<td>32</td>
</tr>
<tr>
<td>AS 1289.3.2.1</td>
<td>Plastic Limit (%)</td>
<td>14</td>
</tr>
<tr>
<td>AS 1289.3.3.1</td>
<td>Plasticity Index (%)</td>
<td>18</td>
</tr>
<tr>
<td>AS 1289.3.4.1</td>
<td>Linear Shrinkage (%)</td>
<td>8.0</td>
</tr>
</tbody>
</table>

Oven Dried

Dry Sieved

Flat

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8154
Sample ID: BH03A (6.5 - 6.75)

CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 49.5

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8154-S900_interim

Approved Signatory: (Russell.Calvert) Date: 5/08/2008

This document is issued in accordance with NATA’s accreditation requirements
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.1

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.0
Bulk Dry Density (t/m³): 1.999
Moisture Content (%): 11.4

UNIAXIAL COMRESSIVE STRENGTH (MPa):
3.30

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Crumbling failure
Duration of Tests 8.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8155-R300
CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  
79.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8155-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.0

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.00

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.00

Load (kN): 0

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8156-R304
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details

Height / Diameter Ratio: 0.5

Bulk Dry Density (t/m3): 1.750

Water Content (%): 17.2

Specimen Height (mm): 42

Specimen Diameter (mm): 82

INDIRECT
TENSILE STRENGTH (MPa):

0.610

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 12/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:

Load at Failure
P: 1.5

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.39

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.43

Load (kN): 1.5

Note: Sample supplied by client.
1. Test Types: D=Diametral    A= Axial    I=Irregular Lump    B= Block
2. Test Directions: 1= Perpendicular   2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8159
Sample ID: BH03A (10 - 10.15)

Client Job No: GEOHERD08491AA
Order No:
Tested Date: 6/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY
AS4133.2.1.2 buoyancy method

Porosity (%)  21.9
Dry Density (t/m3)  2.121

Note: Sample supplied by client.

Approved Signatory: (John.Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.1

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 2.024
Moisture Content (%): 9.9

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
1.01

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Crumbling failure - Upper end
Duration of Tests: 6.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8160-R300
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  83.2

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8160-S900_interim
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation 
D: 
Load at Failure 
P: 0.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.10

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 0.11

Load (kN): 0.36

Note: Sample supplied by client.
1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:

Load at Failure
P: 1.0

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.26

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.29

Load (kN): 1

Note: Sample supplied by client.
1. Test Types: D=Diametral    A= Axial    I=Irregular Lump    B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.5

INITIAL SPECIMEN DETAILS

Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 2.252
Moisture Content (%): 6.6

UNIAXIAL COMPRESSIVE STRENGTH (MPa):

0.825

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Crumbling failure
Duration of Tests: 6.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
**POINT LOAD INDEX**

AS4133.4.1

Test No.: [Test No.]

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.3

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.07

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.08

Load (kN): 0.34

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

| Calcium Carbonate Content (%) | 70.8 |

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8164-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 37.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 16

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 15

Load (kN): 37

Note: Sample supplied by client.

1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

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

Site No.: 2411
Cert No.: 08-WG-8165-R304
Page: 1
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8166
Sample ID: BH03A (17 - 17.3)

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 60.9
Bulk Dry Density (t/m³): 2.817
Moisture Content (%): 0.0

UNIAXIAL COMpressive STRENGTH (MPa):
134

Moisture Condition: Specimen tested at the moisture condition as received
Cored by WgeoG
Mode of Failure: Shear axial
Duration of Tests: 4.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John.Reid) Date: 11/08/2008
ULTRASONIC PULSE VELOCITY

Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY
(meters/sec) 5,617

Note: Sample supplied by client.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type:  A

Platen Separation

D:

Load at Failure

P:  33.9

UNCORRECTED POINT LOAD STRENGTH Is (MPa):  14

CORRECTED POINT LOAD STRENGTH Is (50) (MPa):  14

Load (kN):  34

Note: Sample supplied by client.

1. Test Types:  D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions:  1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory:  (John Reid)  Date: 12/08/2008
BH04

Laboratory Certificates
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Note: Sample supplied by client.
MOISTURE CONTENT
AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%)  8.4

Note: Sample supplied by client.
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>100</td>
<td>0.0453</td>
<td>26</td>
</tr>
<tr>
<td>19.0</td>
<td>86</td>
<td>0.0322</td>
<td>25</td>
</tr>
<tr>
<td>9.5</td>
<td>81</td>
<td>0.0229</td>
<td>25</td>
</tr>
<tr>
<td>4.75</td>
<td>77</td>
<td>0.0162</td>
<td>25</td>
</tr>
<tr>
<td>2.36</td>
<td>55</td>
<td>0.0115</td>
<td>25</td>
</tr>
<tr>
<td>1.18</td>
<td>40</td>
<td>0.0084</td>
<td>24</td>
</tr>
<tr>
<td>0.600</td>
<td>32</td>
<td>0.0059</td>
<td>24</td>
</tr>
<tr>
<td>0.425</td>
<td>30</td>
<td>0.0042</td>
<td>24</td>
</tr>
<tr>
<td>0.300</td>
<td>29</td>
<td>0.0020</td>
<td>23</td>
</tr>
<tr>
<td>0.150</td>
<td>28</td>
<td>0.0013</td>
<td>20</td>
</tr>
<tr>
<td>0.075</td>
<td>26</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Note: Sample supplied by client.

This Certificate replaces the previously issued Certificate No.: 08-WG-8170-S303
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 64

AS 1289.3.2.1
Plastic Limit (%) 21

AS 1289.3.3.1
Plasticity Index (%) 43

AS 1289.3.4.1
Linear Shrinkage (%) 13.0

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE
- According to WGPL In-House Test Method # 5

CLIENT : Coffey Geotechnics  (Job # GEOTHERD08491AA)
JOB NO : 08-01-1408
PROJECT : Dampier Cargo Berth Expansion Project
LOCATION : Dampier, WA
Sample Id : BH04, Depth : (5.2 - 5.6)
Lab No. : 08-WG-8170
Test Type : Consolidated Isotropically Undrained, Multi-stage
Date Tested : 12-22/7/08

Specimen Details :
<table>
<thead>
<tr>
<th>Placement</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length/Diameter (ratio) :</td>
<td>1.88</td>
</tr>
<tr>
<td>Dry Density (t/m$^3$) :</td>
<td>2.134</td>
</tr>
<tr>
<td>Moisture Content (%) :</td>
<td>8.4</td>
</tr>
</tbody>
</table>

Sample Description (Visual) :
reddish brown clayey GRAVELS

Saturation Stage Data
Pore Pressure Coefficient, B : 0.98

Sampling Details : 85mm Ø core sample

MOHR CIRCLES - Composite Plot
The dotted fit line is @ Cohesion of 18 kPa & Ø : 34°

Shear Stage Data
(Failure based on peak effective stress ratio )

<table>
<thead>
<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>$\varepsilon$ (degree)</th>
<th>$\sigma^1_1 / \sigma^3_3$</th>
<th>$\sigma^3_3$ (kPa)</th>
<th>$U_o$ (kPa)</th>
<th>$U_f$ (kPa)</th>
<th>$\sigma^1_1$ (kPa)</th>
<th>$\sigma^1_1 - \sigma^3_3$ (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.02</td>
<td>2.73</td>
<td>4.39</td>
<td>425</td>
<td>347</td>
<td>341</td>
<td>368</td>
<td>284</td>
</tr>
<tr>
<td>2</td>
<td>0.02</td>
<td>1.14</td>
<td>4.05</td>
<td>500</td>
<td>348</td>
<td>365</td>
<td>546</td>
<td>411</td>
</tr>
<tr>
<td>3</td>
<td>0.02</td>
<td>5.86</td>
<td>3.75</td>
<td>650</td>
<td>347</td>
<td>303</td>
<td>1301</td>
<td>954</td>
</tr>
</tbody>
</table>

Cohesion, C (kPa) : -
Friction Angle, Ø (degrees) : -

Consolidation Test Data
($\Delta\sigma^3_3$ of 13 kPa used during initial saturation stage)

<table>
<thead>
<tr>
<th>Stage No</th>
<th>$\Delta\sigma^3_3$ (kPa)</th>
<th>$c_v$ (m$^2$/year)</th>
<th>$M_v$ (m$^2$/MN)</th>
<th>$k$ (m/sec)</th>
<th>Drainage Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>3</td>
<td>150</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
</tbody>
</table>

Failure Mode : sheared
Notes : Corrected area used for stress calculations
Sample supplied by client

Authorised Signatory : __________________( F. Lee )
Date : 26/07/2008
Certificate No.: 08-WG-8170 / S700

36 Railway Parade Welshpool WA 6106 Phone 1300 781 744 Fax (08) 9458 3700
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)  
JOB NO: 08-01-1408

PROJECT: Dampier Cargo Berth Expansion Project  
LOCATION: Dampier, WA

Sample Id: BH04, Depth: (5.2 - 5.6)  
Lab No.: 08-WG-8170

Test Type: Consolidated Isotropically Undrained, Multi-stage  
Date Tested: 12-22/7/08

Specimen Details:  
Length/Diameter (ratio): 1.88 -  
Dry Density (t/m³): 2.134 - 2.147  
Moisture Content (%): 8.4 - 9.3

Sample Description (Visual): reddish brown clayey GRAVELS

Saturation Stage Data:  
Pore Pressure Coefficient, B: 0.98

Sampling Details: 85mm Ø core sample

Deviator Stress Vs Axial Strain

Note: deviator stress = (σ₁ - σ₃)

Authorised Signatory: ________________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8170 / S700
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)

PROJECT: Dampier Cargo Berth Expansion Project

Sample Id: BH04, Depth: (5.2 - 5.6)

Test Type: Consolidated Isotropically Undrained, Multi-stage

Specimen Details:
- Length/Diameter (ratio): 1.88
- Dry Density (t/m$^3$): 2.134, 2.147
- Moisture Content (%): 8.4, 9.3

Sample Description (Visual):
reddish brown clayey GRAVELS

Sampling Details:
85mm Ø core sample

Saturation Stage Data:
- Pore Pressure Coefficient, B: 0.98

Induced Pore Water Pressure Vs Axial Strain

Axial Strain (%)

Induced pwp (kPa)

Stage 1 Stage 2 Stage 3

Authorised Signatory: ______________________ (F. Lee)  Date: 26/07/2008

Certificate No.: 08-WG-8170 / S700
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)
PROJECT : Dampier Cargo Berth Expansion Project
Sample Id : BH04, Depth : (5.2 - 5.6)
Test Type : Consolidated Isotropically Undrained, Multi-stage
Specimen Details : Placement Final
Length/Diameter (ratio) : 1.88 -
Dry Density (t/m$^3$) : 2.134 2.147
Moisture Content (%) : 8.4 9.3

Sampling Details : 85mm Ø core sample

Effective Stress Path (Cambridge Method)

Note : $p' = (\sigma_1' + 2\sigma_3')/3$ & $q' = q = (\sigma_1' - \sigma_3')$

Authorised Signatory : ___________________________ ( F. Lee )
Date : 26/07/2008
Certificate No.: 08-WG-8170 / S700
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)  
JOB NO: 08-01-1408  
PROJECT: Dampier Cargo Berth Expansion Project  
LOCATION: Dampier, WA  
Sample Id: BH04, Depth: (5.2 - 5.6)  
Lab No.: 08-WG-8170  
Date Tested: 12-22/7/08  
Sample Description (Visual): reddish brown clayey GRAVELS  
Saturation Stage Data  
Pore Pressure Coefficient, B: 0.98  
Specimen Details: Length/Diameter (ratio): 1.88  
Dry Density (t/m^3): 2.134  
Moisture Content (%): 8.4  
Sampling Details: 85mm Ø core sample  
Effective Stress Path (M.I.T. Method)  
Note: s' = (σ'_1 + σ'_3)/2 & t' = (σ'_1 - σ'_3)/2  
Stress Path Parameter, s' (kPa)  
Authorised Signatory: ___________________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8170 / S700
PH – SOIL OR WATER

AS1289.4.3.1  (Electrometric)

| pH Value | 8.6 |

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8170-S902_interim
DATE: 28 August 2008

TO: Western Geotechnics
    PO Box 219
    BENTLEY WA 6102

ATTENTION: Mr Mark Matthews

YOUR REFERENCE: Dampier Cargo Berth Expansion Proj, Job#08-01-1408

OUR REFERENCE: PE018029

SAMPLES RECEIVED: 18/08/08

SAMPLES/QUANTITY: 1 Solid

The above samples were received intact and analysed according to your instructions. Unless otherwise stated, solid samples are reported on a dry weight basis and liquid samples as received.
LAboratory report

<table>
<thead>
<tr>
<th>Your Reference</th>
<th>Units</th>
<th>08-WG-8170</th>
<th>08-WG-8170</th>
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<td>Our Reference</td>
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<td>PE018029-1</td>
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<td>Type of Sample</td>
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<td>Solid</td>
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<tr>
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<td>Date Analysed</td>
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<td>Chloride, Cl#</td>
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<tr>
<td>Sulphate, SO4#</td>
<td>mg/kg</td>
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This report must not be reproduced except in full.

Page 2 of 4
LABORATORY REPORT

<table>
<thead>
<tr>
<th>TEST PARAMETERS</th>
<th>UNITS</th>
<th>LOR</th>
<th>METHOD</th>
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<tr>
<td>Soil/Solids Analysis</td>
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<tr>
<td>Date Analysed</td>
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<tr>
<td>Chloride, Cl #</td>
<td>mg/kg</td>
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<td>AN002-AN274</td>
</tr>
<tr>
<td>Sulphate, SO4 #</td>
<td>mg/kg</td>
<td>5</td>
<td>AN002-AN275</td>
</tr>
</tbody>
</table>
NOTES:
LOR - Limit of Reporting.

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Unless otherwise stated the results shown in this test report only refer to the sample(s) tested and such sample(s) are only retained for 60 days only. This document cannot be reproduced except in full, without prior approval of the Company.
 POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 1.0

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.22

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 0.25

Load (kN): 1

Note: Sample supplied by client.

1. Test Types: D= Diametral A= Axial I= Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2= Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.6
Bulk Dry Density (t/m3): 2.369
Water Content (%): 3.1
Specimen Height (mm): 47
Specimen Diameter (mm): 84

INDIRECT TENSILE STRENGTH (MPa):
1.10

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8172
Sample ID: BH04 (7 - 7.15)
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.7

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.9
Bulk Dry Density (t/m³): 2.440
Moisture Content (%): 3.0

UNIAXIAL COMpressive STRENGTH (MPa):
7.78

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Shear
Duration of Tests: .5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008

This document is issued in accordance with NATA’s accreditation requirements
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.9

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.16

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.19

Load (kN): 0.86

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)

3.6

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8173-S900_interim
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: HQ3 Core
Length/Diameter Ratio: 2.1

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 75.9
Bulk Dry Density (t/m³): 1.663
Moisture Content (%): 0.4

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
90.6

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Shear
Duration of Tests: 3.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 27.4

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 12

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa) : 12

Load (kN): 27

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
ULTRASONIC PULSE VELOCITY
Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY
(meters/sec)  5,574

Note: Sample supplied by client.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation

D:

Load at Failure

P: 24.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 12

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 11

Load (kN): 25

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John.Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A 

Platen Separation
D: 
Load at Failure
P: 31.8

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 13

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 13

Load (kN): 32

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
BH05

Laboratory Certificates
## PARTICLE SIZE DISTRIBUTION

**AS1289.3.6.1**

### Sieve Size % Passing

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<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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</thead>
<tbody>
<tr>
<td>2.36</td>
<td>85</td>
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<tr>
<td>1.18</td>
<td>75</td>
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<td>0.600</td>
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<td>0.425</td>
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<td>0.150</td>
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<td>0.075</td>
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### Sieve Size % Passing

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<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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</thead>
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<td>9.5</td>
<td>95</td>
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<td>4.75</td>
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Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8177-S301_interim

---

**Approved Signatory:** (Russell Calvert)  
**Date:** 31/07/2008
POINT LOAD INDEX
AS4133.4.1

Test No.:
Test Type: A
Platen Separation
D:
Load at Failure
P: 0.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.19

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.20
Load (kN): 0.66

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8180
Sample ID: BH05 (3.5 - 4.0)

Client Job No: GEOTHERD08491AA
Order No: 08-01-1408
Test No: A
Test Type: Platen Separation
Platen Separation D: Load at Failure P: 0.6

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.27

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.27
Load (kN): 0.64

Note: Sample supplied by client.
1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8180-R304

Approved Signatory: (John.Reid) Date: 13/08/2008

Western Geotechnics Group
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

perth@westerngeo.com.au
ABN: 91105324436
ph: (08) 9458 3700
fx: (08) 9458 3700

This document is issued in accordance with NATA's accreditation requirements
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.509
Water Content (%): 27.5
Specimen Height (mm): 42
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.321

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine
Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8180-R305
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 88.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8180-S900_interim
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm) | PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3): 1.380
Water Content (%): 28.5
Specimen Height (mm): 41
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.424

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John. Reid) Date: 12/08/2008
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8183
Sample ID: BH05 (4.1 - 4.3)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 6/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY
AS4133.2.1.2 buoyancy method

Porosity (%) 50.7
Dry Density (t/m3) 1.359

Note: Sample supplied by client.

Approved Signatory: (John. Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8184
Sample ID: BH05 (5.5 - 5.85)

Sample Type: HQ3 Core
Length/Diameter Ratio: 2.5

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 60.8
Bulk Dry Density (t/m³): 2.725
Moisture Content (%): 0.0

UNIAXIAL COMPRESSION STRENGTH OF ROCK
AS4133.4.2.1

UNIAXIAL COMPRESSION STRENGTH (MPa):
224

Moisture Condition: Specimen tested at the moisture condition as received
Diameter less than 10 x Maximum grain size
Mode of Failure: Axial failure - Semi-Shattered
Duration of Tests 5.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008
POINt LOAD INDEX

AS4133.4.1

Test No.:

Test Type:  A

Platen Separation

D:

Load at Failure

P:  46.8

UNCORRECTED POINT LOAD
STRENGTH Is (MPa):  15

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa):

:  16

Load (kN):

47

Note: Sample supplied by client.

1. Test Types:  D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions:  1=Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory:  (John Reid)  Date: 12/08/2008
UNIAXIAL COMPRRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: HQ3 Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 61.1
Bulk Dry Density (t/m³): 2.730
Moisture Content (%): 0.1

UNIAXIAL COMPRRESSIVE STRENGTH (MPa):
395

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Shattered
Duration of Tests: 17.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid)
Date: 11/08/2008

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

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8186
Sample ID: BH05 (9.53 - 9.83)

Client Job No: GEOTHERD08491AA
Order No: GEOTHERD08491AA
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

ULTRASONIC PULSE VELOCITY
Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY
(meters/sec) 6,205

Note: Sample supplied by client.

Approved Signatory: (John.Reid) Date: 12/08/2008

Site No.: 2411
Cert No.: 08-WG-8186-R603
Form No. R603.Cert.07.A
Page: 1
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:

Load at Failure
P: 32.3

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 12

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 12

Load (kN): 32

Note: Sample supplied by client.
1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
BH06
Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

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<td>1.18</td>
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<td>0.075</td>
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Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8252-S301_interim
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

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Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8253-S301_interim
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

| Moisture Content (%) | 20.6 |

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method)  AS 1289.3.2.1  AS 1289.3.3.1  AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%)  37

AS 1289.3.2.1
Plastic Limit (%)  15

AS 1289.3.3.1
Plasticity Index (%)  22

AS 1289.3.4.1
Linear Shrinkage (%)  10.0

Oven Dried
Dry Sieved
Curling

Note: Sample supplied by client.

Approved Signatory: (John Reid) Date: 26/08/2008

This document is issued in accordance with NATA’s accreditation requirements
CLIENT: Coffey Geotechnics  (Job # GEOTHERD08491AA)  
PROJECT: Dampier Cargo Berth Expansion Project  
Sample Id: BH06, Depth: (6.5 - 6.85)  
Test Type: Unconsolidated Undrained, Multi-stage  
Specimen Details: Placement  
Length/Diameter (ratio): 1.88  
Dry Density (t/m³): 1.779  
Moisture Content (%): 18.6

Sampling Details: 84mm Ø core sample

CLIENT: Coffey Geotechnics  (Job # GEOTHERD08491AA)  
JOB NO: 08-01-1408  
LOCATION: Dampier, WA  
Lab No.: 08-WG-8255  
Date Tested: 12-21/7/08

Sample Description (Visual): dull brown clayey SILTS with gravels

MOHR CIRCLES - Composite Plot

The dotted fit line is @ Cohesion of 16 kPa & Ø : 1°

SHEAR STAGE DATA

<table>
<thead>
<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>εt (°)</th>
<th>σt (kPa)</th>
<th>(σt)tr (kPa)</th>
<th>(σt - σ3)tr (kPa)</th>
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</thead>
<tbody>
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<td>224</td>
<td>44</td>
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<td>3</td>
<td>1.00</td>
<td>3.31</td>
<td>360</td>
<td>407</td>
<td>47</td>
</tr>
</tbody>
</table>

Cohesion, C (kPa) : -  
Friction Angle, Θ (degrees) : -

Failure Mode: sheared
Notes: Corrected area used for stress calculations
Sample supplied by client
Note: sample broken on 1st stage, calculations not provided.

Authorised Signatory: ______________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8255 / S700-S719

36 Railway Parade  Welshpool WA  6106  Phone 1300 781 744  Fax (08) 9458 3700

S700-S719.Triaxial.MohrTotal.06.A
CLIENT:  Coffey Geotechnics  (Job # GEOTHERD08491AA)
PROJECT:  Dampier Cargo Berth Expansion Project
Sample Id:  BH06, Depth: 6.5 - 6.85
Test Type:  Unconsolidated Undrained, Multi-stage
Specimen Details:  
- Length/Diameter (ratio): 1.88
- Dry Density (t/m³): 1.779
- Moisture Content (%): 18.6

Sample Description (Visual):
- dull brown clayey SILTS with gravels

Sampling Details:  84mm Ø core sample

Deviator Stress Vs Axial Strain

Note: deviator stress = (σ₁ - σ₃)

Authorised Signatory:  ____________________________ (F. Lee)  
Date:  26/07/2008

Certificate No.: 08-WG-8255 / S700-S719
CALCULATION CARBONATE CONTENT

WA915.1  (% soluble in HCl)

Calcium Carbonate Content (%)  54.8

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8255-S900_interim
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.05

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.06

Load (kN): 0.2

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.682
Water Content (%): 17.8
Specimen Height (mm): 39
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa):
0.125

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: 
(John Reid)
Date: 12/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.19

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.21

Load (kN): 0.74

Note: Sample supplied by client.
1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2= Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8257-R304
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)

75.2

Note: Sample supplied by client.
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 2.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.79

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.85

Load (kN): 2.7

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8258-R304
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.6
Bulk Dry Density (t/m³): 1.944
Water Content (%): 10.5
Specimen Height (mm): 46
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.825

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 13/08/2008
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8258
Sample ID: BH06 (9.25 - 9.45)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 8/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

INFORMATION TENSILE STRENGTH
(ISRM Doc 8 Pt 2 (Brazil Method))

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.6
Bulk Dry Density (t/m³): 1.944
Water Content (%): 10.5
Specimen Height (mm): 46
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH
(MPa):

0.825

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8258-R305

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 79.8

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8258-S900_interim
BH07

Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>97</td>
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<tr>
<td>1.18</td>
<td>95</td>
</tr>
<tr>
<td>0.600</td>
<td>92</td>
</tr>
<tr>
<td>0.425</td>
<td>88</td>
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<tr>
<td>0.300</td>
<td>84</td>
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<tr>
<td>0.150</td>
<td>60</td>
</tr>
<tr>
<td>0.075</td>
<td>26</td>
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<td>19.0</td>
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<tr>
<td>9.5</td>
<td>100</td>
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<tr>
<td>4.75</td>
<td>98</td>
</tr>
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</table>

Note: Sample supplied by client.
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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<tr>
<td>2.36</td>
<td>95</td>
<td>1.18</td>
<td>92</td>
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<tr>
<td>1.18</td>
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<td>87</td>
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<td>0.300</td>
<td>81</td>
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<tr>
<td>0.150</td>
<td>64</td>
<td>0.075</td>
<td>32</td>
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</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8261-S301_interim

Approved Signatory: (Russell Calvert)  Date: 31/07/2008
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 17.5

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

<table>
<thead>
<tr>
<th>Standard</th>
<th>Result</th>
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</thead>
<tbody>
<tr>
<td>AS 1289.3.9.2</td>
<td>Liquid Limit (%) 30</td>
</tr>
<tr>
<td>AS 1289.3.2.1</td>
<td>Plastic Limit (%) 14</td>
</tr>
<tr>
<td>AS 1289.3.3.1</td>
<td>Plasticity Index (%) 16</td>
</tr>
<tr>
<td>AS 1289.3.4.1</td>
<td>Linear Shrinkage (%) 7.5</td>
</tr>
</tbody>
</table>

- Oven Dried
- Dry Sieved
- Flat

Note: Sample supplied by client.
# TRIAXIAL SHEAR TEST REPORT CERTIFICATE

According to WGPL In-House Test Method # 5

**CLIENT:** Coffey Geotechnics (Job # GEOTHERD08491AA)  
**JOB NO:** 08-01-1408  
**PROJECT:** Dampier Cargo Berth Expansion Project  
**LOCATION:** Dampier, WA  
**Sample Id:** BH07, Depth: (5.5 - 5.9)  
**Lab No.:** 08-WG-8262  
**Date Tested:** 17-22/7/08

**Test Type:** Consolidated Isotropically Undrained, Multi-stage  
**Sample Description (Visual):** brown clayey SILTS with gravels

**Sample Details:**  
- **Length/Diameter (ratio):** 1.84 -  
- **Dry Density (t/m$^3$):** 1.829 - 1.917  
- **Moisture Content (%):** 17.5 - 14.2

**Sampling Details:** 84mm Ø core sample

### MOHR CIRCLES - Composite Plot

The dotted fit line is @ Cohesion of 32 kPa & Ø : 28º *

### SHEAR STAGE DATA

<table>
<thead>
<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>$\varepsilon_f$ (%)</th>
<th>$\sigma'_1 / \sigma'_3$</th>
<th>$\sigma'_3$ (kPa)</th>
<th>$U_o$ (kPa)</th>
<th>$U_t$ (kPa)</th>
<th>$\sigma'_1$ (kPa)</th>
<th>$\sigma'_1 - \sigma'_3$ (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.02</td>
<td>3.51</td>
<td>4.55</td>
<td>275</td>
<td>198</td>
<td>252</td>
<td>105</td>
<td>82</td>
</tr>
<tr>
<td>2</td>
<td>0.12</td>
<td>2.86</td>
<td>4.32</td>
<td>350</td>
<td>199</td>
<td>281</td>
<td>298</td>
<td>229</td>
</tr>
<tr>
<td>3</td>
<td>0.12</td>
<td>6.91</td>
<td>3.12</td>
<td>600</td>
<td>199</td>
<td>314</td>
<td>892</td>
<td>606</td>
</tr>
</tbody>
</table>

- **Cohesion, $C$ (kPa):** -  
- **Friction Angle, $\Phi$ (degrees):** -

### CONSOLIDATION TEST DATA

<table>
<thead>
<tr>
<th>Stage No</th>
<th>$\Delta \sigma'_3$ (kPa)</th>
<th>$c_v$ (m$^2$/year)</th>
<th>$M_v$ (m$^2$/MN)</th>
<th>$k$ (m/sec)</th>
<th>Drainage Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>65</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>2</td>
<td>75</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
</tbody>
</table>

- **Failure Mode:** barrelled  
- **Notes:** Corrected area used for stress calculations  
- **Sample supplied by client**  
- **Stages 2 & 3 used for calculations**

**Authorised Signatory:** ____________________ (F. Lee)  
**Date:** 26/07/2008

**Certificate No.: 08-WG-8262 / S700**

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36 Railway Parade Welshpool WA 6106 Phone 1300 781 744 Fax (08) 9458 3700

---

S700.Cert.06.A
## TRIAXIAL SHEAR TEST
### REPORT CERTIFICATE

<table>
<thead>
<tr>
<th>CLIENT</th>
<th>Coffey Geotechnics (Job # GEOTHERD08491AA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JOB NO</td>
<td>08-01-1408</td>
</tr>
<tr>
<td>PROJECT</td>
<td>Dampier Cargo Berth Expansion Project</td>
</tr>
<tr>
<td>LOCATION</td>
<td>Dampier, WA</td>
</tr>
<tr>
<td>Sample Id</td>
<td>BH07, Depth: (5.5 - 5.9)</td>
</tr>
<tr>
<td>Lab No.</td>
<td>08-WG-8262</td>
</tr>
<tr>
<td>Date Tested</td>
<td>17-22/7/08</td>
</tr>
<tr>
<td>Test Type</td>
<td>Consolidated Isotropically Undrained, Multi-stage</td>
</tr>
<tr>
<td>Specimen Details</td>
<td>Placement Final</td>
</tr>
<tr>
<td>Length/Diameter (ratio)</td>
<td>1.84   -</td>
</tr>
<tr>
<td>Dry Density (t/m³)</td>
<td>1.829  1.917</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>17.5   14.2</td>
</tr>
<tr>
<td>Sampling Details</td>
<td>84mm Ø core sample</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Sample Description (Visual):
- brown clayey SILTS with gravels

### Saturation Stage Data
- Pore Pressure Coefficient, B: 0.98

### Deviator Stress Vs Axial Strain

![Deviator Stress Vs Axial Strain](image)

**Note:** deviator stress = \((\sigma_1 - \sigma_3)\)

**Authorised Signatory:** ______________________ ( F. Lee )  
**Date:** 26/07/2008  
**Certificate No.:** 08-WG-8262 / S700
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)
PROJECT : Dampier Cargo Berth Expansion Project
Sample Id : BH07, Depth : (5.5 - 5.9)
Test Type : Consolidated Isotropically Undrained, Multi-stage
Specimen Details :
- Length/Diameter (ratio) : 1.84 -
- Dry Density (t/m$^3$) : 1.829 1.917
- Moisture Content (%) : 17.5 14.2

Sampling Details : 84mm Ø core sample

Saturation Stage Data
- Pore Pressure Coefficient, B : 0.98

Induced Pore Water Pressure Vs Axial Strain

Authorised Signatory : ___________________________ ( F. Lee )
Date : 26/07/2008
Certificate No.: 08-WG-8262 / S700
TRIAxIAL SHEar TEST
REPORT CERTIFICATE

CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)
PROJECT: Dampier Cargo Berth Expansion Project
Sample Id: BH07, Depth: (5.5 - 5.9)
Test Type: Consolidated Isotropically Undrained, Multi-stage
Specimen Details:
- Length/Diameter (ratio): 1.84
- Dry Density (t/m$^3$): 1.829
- Moisture Content (%): 17.5

Sample Description (Visual):
- brown clayey SIlTS with gravels

Sampling Details:
- 84mm Ø core sample

Effective Stress Path (Cambridge Method)

Note: $p' = (\sigma_1' + 2\sigma_3')/3$ & $q' = q = (\sigma_1' - \sigma_3')$

Authorised Signatory: ___________________________ (F. Lee)  Date: ________________
Certificate No.: 08-WG-8262 / S700
CLIENT : Coffey Geotechnics  (Job # GEOTHERD08491AA)  
JOB NO : 08-01-1408  
PROJECT : Dampier Cargo Berth Expansion Project  
LOCATION : Dampier, WA  
Sample Id : BH07, Depth : (5.5 - 5.9)  
Lab No. : 08-WG-8262  
Date Tested : 17-22/7/08  
Test Type : Consolidated Isotropically Undrained, Multi-stage  
Specimen Details :  
<table>
<thead>
<tr>
<th>Placement</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length/Diameter (ratio)</td>
<td>1.84</td>
</tr>
<tr>
<td>Dry Density (t/m³)</td>
<td>1.829</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>17.5</td>
</tr>
</tbody>
</table>

Sample Description (Visual) : brown clayey SILTS with gravels  
Saturation Stage Data  
Pore Pressure Coefficient, B : 0.98  
Sampling Details : 84mm Ø core sample  

Effective Stress Path (M.I.T. Method)

Note : $s' = (\sigma_1' + \sigma_3')/2$ & $t' = (\sigma_1' - \sigma_3')/2$  
Stress Path Parameter , $s'$ (kPa)

Authorised Signatory : ___________________________ ( F. Lee )  
Date : 26/07/2008  
Certificate No.: 08-WG-8262 / S700
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:

Load at Failure
P:

0.3

UNCORRECTED POINT LOAD
STRENGTH Is (MPa):
0.08

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa):
0.08

Load (kN):
0.3

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8263-R304
CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 85.9

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8263-S900_interim
POINt LOAD INDEX

AS4133.4.1

Test No.:  

Test Type: A  

Platen Separation  
D: Load at Failure  
P: 0.7  

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.19  

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.21  

Load (kN): 0.74  

Note: Sample supplied by client.  
1. Test Types:  D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions:  1= Perpendicular  2=Parallel  (to planes of weakness)  
3. Sample tested in *as received* condition.
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm) PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3) 1.775
Water Content (%): 21.2
Specimen Height (mm): 42
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.893

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 12/08/2008
DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 23.8
Dry Density (t/m³) 2.006

Note: Sample supplied by client.
UNIAXIAL COMPRESSION STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.0

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.3
Bulk Dry Density (t/m3): 2.308
Moisture Content (%): 13.8

UNIAXIAL COMPRESSION STRENGTH (MPa):

0.206

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Axial
Duration of Tests: 6.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8265-R300

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  69.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8265-S900_interim
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.9
Bulk Dry Density (t/m³): 1.919
Moisture Content (%): 13.5

UNIAXIAL COMPRESSION STRENGTH (MPa):

UNIAXIAL COMPRESSIVE STRENGTH (MPa): 1.05

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Lower end
Duration of Tests: 1. mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008
POINT LOAD INDEX

AS4133.4.1

Test No.: [Details]
Test Type: A
Platen Separation
D: [Details]
Load at Failure
P: 0.9

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.24

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.27
Load (kN): 0.94

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)  PQ3

Initial Specimen Details

Height / Diameter Ratio:  0.6

Bulk Dry Density (t/m³)  1.721

Water Content (%):  13.7

Specimen Height (mm):  46

Specimen Diameter (mm):  84

INDIRECT
TENSILE STRENGTH  0.695 (MPa):

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John.Reid) Date: 12/08/2008
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.05

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.05

Load (kN): 0.2

Note: Sample supplied by client.

1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8268
Sample ID: BH07 (12.55 - 13.00)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 20.9
Dry Density (t/m3) 2.165

Note: Sample supplied by client.
Test No.:  
Test Type: A  
Platen Separation  
D:  
Load at Failure  
P: 0.2  
UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.06  
CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.06  
Load (kN): 0.2  

Note: Sample supplied by client.  
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)  
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible  
This Certificate replaces the previously issued Certificate No.: 08-WG-8268-R304
**CALCIUM CARBONATE CONTENT**

WA915.1 (% soluble in HCl)

**Calcium Carbonate Content (%)**

84.5

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8268-S900_interim
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8269
Sample ID: BH07 (13.4 - 13.85)

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.3

UNIAXIAL COMPRESSION STRENGTH OF ROCK
AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.3

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 2.025
Moisture Content (%): 11.1

UNIAXIAL COMPRESSION STRENGTH (MPa): 1.10

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Failed on Irregularities
Duration of Tests: 1.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 12/08/2008

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

Accreditation No.: 2418
Cert No.: 08-WG-8269-R300
Form No.R300.Cert.07.A

Site No.: 2411
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:

Load at Failure
P: 1.1

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.26

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.29

Load (kN): 1.1

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)  PQ3

Initial Specimen Details
Height / Diameter Ratio:  0.5
Bulk Dry Density (t/m3)  1.937
Water Content (%):  11.4
Specimen Height (mm):  42
Specimen Diameter (mm):  83

INDIRECT
TENSILE STRENGTH  0.382
(MPa):

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Approved Signatory:  (John Reid)  Date: 12/08/2008
POINTER LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 1.5

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.35

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.40

Load (kN): 1.5

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 1.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.37

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.43

Load (kN): 1.7

Note: Sample supplied by client.
1. Test Types: D= Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.4

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 2.278
Moisture Content (%): 6.5

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
3.81

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Failed on Irregularities
Duration of Tests: 2.6 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8272-R300
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation

D:

Load at Failure

P: 2.6

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 0.71

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 0.78

Load (kN): 2.6

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block

2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)

3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8272-R304
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8272
Sample ID: BH07 (16.55 - 17.0)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 10/07/2008
WG Job Number: 08-01-1408
Lab: Welshpool

CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate

Content (%)  
81.4

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8272-S900_interim

Approved Signatory: (Russell Calvert) Date: 31/07/2008

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418
Cert No.: 08-WG-8272-S900
Form No.: S900.Cert.07.A
DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%)  16.5
Dry Density (t/m3)  2.256

Note: Sample supplied by client.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.5

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m3): 2.213
Moisture Content (%): 7.1

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
0.908

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Failed on Irregularities
Duration of Tests: 1. mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John.Reid) Date: 12/08/2008
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D: 

Load at Failure

P: 0.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.12

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.14

Load (kN): 0.48

Note: Sample supplied by client.

1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:

Load at Failure
P: 1.0

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.21

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.25

Load (kN): 1

Note: Sample supplied by client.
1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John.Reid) Date: 12/08/2008

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

Accreditation No.: 2418 Form No.R304.Cert.07.A

Site No.: 2411 Cert No.: 08-WG-8274-R304 Page: 1
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.09

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.10

Load (kN): 0.4

Note: Sample supplied by client.

1. Test Types: D= Diametral  A= Axial  I= Irregular Lump  B= Block
2. Test Directions: 1 = Perpendicular  2 = Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

(John Reid)  Date: 12/08/2008
Client: Coffey Geotechnics  
Test Type: A  
Platen Separation: D  
Load at Failure: P = 28.6 kN  

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 6.8  

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 7.7  
Load (kN): 29  

Note: Sample supplied by client. 
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)  
3. Sample tested in "as received" condition.
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D: 

Load at Failure
P: 30.7

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 8.3

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 9.1

Load (kN): 31

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2= Parallel  (to planes of weakness)
3. Sample tested in *as received* condition.

Approved Signatory: (John Reid) Date: 12/08/2008
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8278
Sample ID: BH07 (20.9 - 21.0)

Test No.: 
Test Type: A
Platen Separation D:
Load at Failure P: 20.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 5.4

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 5.9

Load (kN): 20

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA's accreditation requirements
DENSITY-POROSITY

AS4133.2.1.2    buoyancy method

Porosity (%)       0.9

Dry Density (t/m3) 2.612

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8279
Sample ID: BH07 (22.4 - 22.90)

Test No.: A
Platen Separation
D:
Load at Failure
P: 24.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 6.7

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 7.3
Load (kN): 24

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
### ULTRASONIC PULSE VELOCITY

**Steinkamp Method - Shear Wave**

#### ULTRASONIC IMPULSE VELOCITY

| (meters/sec) | 5,531 |

Note: Sample supplied by client.
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D: 

Load at Failure

P: 1.2

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 0.46

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 0.47

Load (kN): 1.2

Note: Sample supplied by client.
1. Test Types: D= Diametral  A= Axial  I= Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2= Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
BH08

Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0</td>
<td>100</td>
</tr>
<tr>
<td>9.5</td>
<td>100</td>
</tr>
<tr>
<td>4.75</td>
<td>99</td>
</tr>
<tr>
<td>2.36</td>
<td>99</td>
</tr>
<tr>
<td>1.18</td>
<td>98</td>
</tr>
<tr>
<td>0.600</td>
<td>96</td>
</tr>
<tr>
<td>0.425</td>
<td>93</td>
</tr>
<tr>
<td>0.300</td>
<td>89</td>
</tr>
<tr>
<td>0.150</td>
<td>71</td>
</tr>
<tr>
<td>0.075</td>
<td>41</td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.
### PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>100</td>
<td>0.0430</td>
<td>21</td>
</tr>
<tr>
<td>19.0</td>
<td>74</td>
<td>0.0311</td>
<td>20</td>
</tr>
<tr>
<td>9.5</td>
<td>59</td>
<td>0.0222</td>
<td>19</td>
</tr>
<tr>
<td>4.75</td>
<td>52</td>
<td>0.0159</td>
<td>18</td>
</tr>
<tr>
<td>2.36</td>
<td>46</td>
<td>0.0111</td>
<td>17</td>
</tr>
<tr>
<td>1.18</td>
<td>41</td>
<td>0.0085</td>
<td>17</td>
</tr>
<tr>
<td>0.600</td>
<td>37</td>
<td>0.0058</td>
<td>16</td>
</tr>
<tr>
<td>0.425</td>
<td>36</td>
<td>0.0043</td>
<td>14</td>
</tr>
<tr>
<td>0.300</td>
<td>34</td>
<td>0.0030</td>
<td>13</td>
</tr>
<tr>
<td>0.150</td>
<td>30</td>
<td>0.0022</td>
<td>12</td>
</tr>
<tr>
<td>0.075</td>
<td>25</td>
<td>0.0014</td>
<td>9</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method

Note: Sample supplied by client.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 78.8

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8189-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa):

0.09

CORRECTED POINT LOAD STRENGTH Is (50) (MPa):

0.11

Load (kN):

0.44

Note: Sample supplied by client.

1. Test Types: D=Diametral   A=Axial   I=Irregular Lump   B=Block
2. Test Directions: 1=Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMpressive STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.0

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.3
Bulk Dry Density (t/m³): 1.864
Moisture Content (%): 13.7

UNIAXIAL COMpressive STRENGTH (MPa):
0.033

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Bulging at bottom end
Duration of Tests: 3.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8192-R300

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)  PQ3

Initial Specimen Details
Height / Diameter Ratio:  0.5
Bulk Dry Density (t/m³)  1.864
Water Content (%):  15.7
Specimen Height (mm):  43
Specimen Diameter (mm):  83

INDIRECT TENSILE STRENGTH (MPa):  0.106

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8192-R305

Approved Signatory:  (John Reid)  Date: 13/08/2008
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 

71.6

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8192-S900_interim
<table>
<thead>
<tr>
<th>Client:</th>
<th>Coffey Geotechnics</th>
<th>Client Job No:</th>
<th>GEOTHERD08491AA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project:</td>
<td>Dampier Cargo Berth Expansion Project</td>
<td>Order No:</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>Dampier, WA</td>
<td>Tested Date:</td>
<td>5/08/2008</td>
</tr>
<tr>
<td>Sample No:</td>
<td>08-WG-8193</td>
<td>WG Job Number:</td>
<td>08-01-1408</td>
</tr>
<tr>
<td>Sample ID:</td>
<td>BH08 (9.5 - 9.55)</td>
<td>Lab:</td>
<td>Welshpool</td>
</tr>
</tbody>
</table>

**INDIRECT TENSILE STRENGTH**

ISRM Doc 8 Pt 2 (Brazil Method)

<table>
<thead>
<tr>
<th>Core Size (mm)</th>
<th>PQ3</th>
</tr>
</thead>
</table>

**Initial Specimen Details**

- Height / Diameter Ratio: 0.5
- Bulk Dry Density (t/m³): 1.924
- Water Content (%): 12.5
- Specimen Height (mm): 44
- Specimen Diameter (mm): 84

**INDIRECT TENSILE STRENGTH (MPa):** 0.007

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 12/08/2008
**UNIAXIAL COMPRESSIVE STRENGTH OF ROCK**

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.9

**INITIAL SPECIMEN DETAILS**

Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 1.827
Moisture Content (%): 16.0

**UNIAXIAL COMPRESSION STRENGTH (MPa):**

0.498

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Crumbling failure
Duration of Tests: 2.7 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porosity (%)</td>
<td>28.3</td>
</tr>
<tr>
<td>Dry Density (t/m³)</td>
<td>1.958</td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.

This Certificate replaces the previously issued Certificate No.:08-WG-8195-R202
Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8195  
Sample ID: BH08 (10 - 10.2)  

Client Job No: GEOTHERD08491AA  
Order No:  
Tested Date: 5/08/2008  
WG Job Number: 08-01-1408  
Lab: Welshpool  

POINT LOAD INDEX  
AS4133.4.1  

Test No.:  
Test Type: A  
Platen Separation  
D:  
Load at Failure  
P: 0.1  

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.02  

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.02  
Load (kN): 0.06  

Note: Sample supplied by client.  
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)  
3. Sample tested in "as received" condition.  
This Certificate replaces the previously issued Certificate No.:08-WG-8195-304  

Approved Signatory: (John Reid) Date: 26/08/2008
TRIAXIAL SHEAR TEST REPORT CERTIFICATE

- According to WGPL In-House Test Method # 5

CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)
JOB NO.: 08-01-1408
PROJECT: Dampier Cargo Berth Expansion Project
LOCATION: Dampier, WA
LAB NO.: 08-WG-8196

Sample Id: BH08, Depth: (11.4 - 11.8)
Date Tested: 12-22/7/08

Test Type: Consolidated Isotropically Undrained, Multi-stage

Specimen Details:
- Placement: Final
- Sample Description (Visual):
  - mottled reddish brown, bright brown
  - sandy SILTS
- Dry Density (t/m$^3$): 1.702 - 1.736
- Moisture Content (%): 23.7 - 21.5
- Lab No.: 08-WG-8196

Sampling Details:
- 83mm Ø core sample

---

MOHR CIRCLES - Composite Plot

The dotted fit line is @ Cohesion of 173 kPa & Ø: 24º

---

SHEAR STAGE DATA
(Failure based on peak effective stress ratio: stage 1, peak deviator stress: stages 2 & 3)

<table>
<thead>
<tr>
<th>Stage No.</th>
<th>Strain Rate (mm/min)</th>
<th>εf (%)</th>
<th>($\sigma'_1 / \sigma'_3$)f</th>
<th>$\sigma'_3$ (kPa)</th>
<th>$U_o$ (kPa)</th>
<th>$U_r$ (kPa)</th>
<th>($\sigma'_1$)$_f$ (kPa)</th>
<th>($\sigma'_1 - \sigma'_3$)$_f$ (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.07</td>
<td>0.53</td>
<td>7.13</td>
<td>525</td>
<td>400</td>
<td>417</td>
<td>770</td>
<td>662</td>
</tr>
<tr>
<td>2</td>
<td>0.07</td>
<td>0.65</td>
<td>4.94</td>
<td>650</td>
<td>398</td>
<td>444</td>
<td>1017</td>
<td>811</td>
</tr>
<tr>
<td>3</td>
<td>0.07</td>
<td>1.02</td>
<td>3.55</td>
<td>900</td>
<td>397</td>
<td>473</td>
<td>1515</td>
<td>1088</td>
</tr>
</tbody>
</table>

Cohesion, C (kPa): -
Friction Angle, Ø (degrees): -

CONSOLIDATION TEST DATA
($\Delta \sigma'_3$ of 10 kPa used during initial saturation stage)

<table>
<thead>
<tr>
<th>Stage No.</th>
<th>$\Delta \sigma'_3$ (kPa)</th>
<th>c_v (m²/year)</th>
<th>M_v (m²/MN)</th>
<th>k (m/sec)</th>
<th>Drainage Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>115</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>2</td>
<td>125</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
</tbody>
</table>

Failure Mode: barrelled
Notes: Corrected area used for stress calculations
Sample supplied by client

Authorised Signatory: _________________________ (F. Lee) Date: 26/07/2008
Certificate No.: 08-WG-8196 / S700

36 Railway Parade   Welshpool   WA   6106   Phone 1300 781 744   Fax (08) 9458 3700
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)
PROJECT : Dampier Cargo Berth Expansion Project
Sample Id : BH08, Depth : (11.4 - 11.8)
Test Type : Consolidated Isotropically Undrained, Multi-stage

<table>
<thead>
<tr>
<th>Specimen Details</th>
<th>Placement</th>
<th>Final</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length/Diameter (ratio)</td>
<td>1.95</td>
<td>-</td>
</tr>
<tr>
<td>Dry Density (t/m$^3$)</td>
<td>1.702</td>
<td>1.736</td>
</tr>
<tr>
<td>Moisture Content (%)</td>
<td>23.7</td>
<td>21.5</td>
</tr>
</tbody>
</table>

Sample Description (Visual):
- mottled reddish brown, bright brown
- sandy SILTS

Saturation Stage Data:
- Pore Pressure Coefficient, $B$ : 0.96

Sampling Details : 83mm Ø core sample

Note: deviator stress = ($\sigma_1 - \sigma_3$)

Deviator Stress Vs Axial Strain

Authorised Signatory : _________________________ (F. Lee)  
Date : 26/07/2008  
Certificate No.: 08-WG-8196 / S700
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)
JOB NO: 08-01-1408
PROJECT: Dampier Cargo Berth Expansion Project
LOCATION: Dampier, WA
Sample Id: BH08, Depth: (11.4 - 11.8)
Lab No.: 08-WG-8196
Test Type: Consolidated Isotropically Undrained, Multi-stage
Date Tested: 12-22/7/08

Specimen Details:
Length/Diameter (ratio): 1.95
Dry Density (t/m³): 1.702 1.736
Moisture Content (%): 23.7 21.5

Sample Description (Visual):
mottled reddish brown, bright brown
sandy SILTS

Sampling Details: 83mm Ø core sample

Induced Pore Water Pressure Vs Axial Strain

Authorised Signatory: ___________________________ (F. Lee)
Date: 26/07/2008
Certificate No.: 08-WG-8196 / S700
CLIENT : Coffey Geotechnics  (Job # GEOTHERD08491AA)
PROJECT : Dampier Cargo Berth Expansion Project
Sample Id : BH08, Depth : (11.4 - 11.8)
Test Type : Consolidated Isotropically Undrained, Multi-stage
Specimen Details : Placement | Final
| Length/Diameter (ratio) : 1.95 | - |
| Dry Density  (t/m$^3$) : 1.702 | 1.736 |
| Moisture Content (%) : 23.7 | 21.5 |
Sampling Details : 83mm Ø core sample

Sample Description (Visual) :
- mottled reddish brown, bright brown
- sandy SILTS

Saturation Stage Data
- Pore Pressure Coefficient, B : 0.96

Note : $p' = (\sigma_1' + 2\sigma_3')/3$ & $q' = q = (\sigma_1' - \sigma_3')$

Effective Stress Path (Cambridge Method)

Stress Path Parameter , $p'$ (kPa)
Deviator Stress , $q$ (kPa)

Authorised Signatory : ___________________________ ( F. Lee )  Date : 26/07/2008
Certificate No.: 08-WG-8196 / S700
CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)  
PROJECT : Dampier Cargo Berth Expansion Project  
Sample Id : BH08, Depth : (11.4 - 11.8)  
Test Type : Consolidated Isotropically Undrained, Multi-stage  

Specimen Details :  
- Length/Diameter (ratio)  
- Dry Density (t/m$^3$)  
- Moisture Content (%)  

Sample Description (Visual) :  
mottled reddish brown, bright brown  
sandy SILTS  

Saturation Stage Data  
Pore Pressure Coefficient, B : 0.96  

Sampling Details : 83mm Ø core sample  

Effective Stress Path (M.I.T. Method)

Note : $s' = (\sigma_1' + \sigma_3')/2$ & $t' = (\sigma_1' - \sigma_3')/2$  
Stress Path Parameter , $s'$ (kPa)

Authorised Signatory : ___________________________ ( F. Lee )  
Date : 26/07/2008  
Certificate No.: 08-WG-8196 / S700
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 22.9 |

Note: Sample supplied by client.
### PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
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<tr>
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</tr>
<tr>
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</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.

Approved Signatory: (Russell.Calvert) Date: 31/07/2008
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 28

AS 1289.3.2.1
Plastic Limit (%) 20

AS 1289.3.3.1
Plasticity Index (%) 8

AS 1289.3.4.1
Linear Shrinkage (%) 3.0

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D: 

Load at Failure

P: 0.0

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 0.00

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 0.01

Load (kN): 0.02

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
## DENSITY-POROSITY

AS4133.2.1.2  buoyancy method

<table>
<thead>
<tr>
<th>Description</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Porosity (%)</td>
<td>44.6</td>
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<tr>
<td>Dry Density (t/m³)</td>
<td>1.698</td>
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</tbody>
</table>

Note: Sample supplied by client.
**POINT LOAD INDEX**

AS4133.4.1

<table>
<thead>
<tr>
<th>Test No.:</th>
<th>A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test Type:</td>
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</tr>
<tr>
<td>Platen Separation</td>
<td></td>
</tr>
<tr>
<td>D:</td>
<td></td>
</tr>
<tr>
<td>Load at Failure</td>
<td></td>
</tr>
<tr>
<td>P:</td>
<td>0.4</td>
</tr>
</tbody>
</table>

**UNCORRECTED POINT LOAD STRENGTH Is (MPa):**

0.10

**CORRECTED POINT LOAD STRENGTH Is (50) (MPa):**

0.12

Load (kN):

0.44

Note: Sample supplied by client.

1. Test Types:  D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions:  1= Perpendicular  2=Parallel  (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8200-R304
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>100</td>
<td>0.0432</td>
<td>24</td>
</tr>
<tr>
<td>19.0</td>
<td>94</td>
<td>0.0313</td>
<td>22</td>
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<td>9.5</td>
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<td>4.75</td>
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<td>0.0161</td>
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<td>0.300</td>
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<td>0.150</td>
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<tr>
<td>0.075</td>
<td>28</td>
<td>0.0015</td>
<td>7</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.
Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8201
Sample ID: BH08 (14.85 - 15.2)

Sample Type: HQ Core
Length/Diameter Ratio: 2.7

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 1.951
Moisture Content (%): 12.3

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
AS4133.4.2.1

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
0.780

Moisture Condition: Specimen tested at the moisture condition as received
Duration of Tests: .9 mins

Note: Sample supplied by client,
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008
POINT LOAD INDEX

AS4133.4.1

Test No.: 
Test Type: A 
Platen Separation 
D: 
Load at Failure 
P: 0.3 
UNCORRECTED POINT LOAD 
STRENGTH Is (MPa): 0.07 
CORRECTED POINT LOAD 
STRENGTH Is (50) (MPa): 0.08 
Load (kN): 0.28 

Note: Sample supplied by client. 
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block 
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness) 
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: HQ Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.9
Bulk Dry Density (t/m³): 1.911
Moisture Content (%): 13.3

UNIAXIAL COMPRESSION
STRENGTH (MPa): 44.9

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Upper end
Duration of Tests: 0.9 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8202-R300

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Site No.: 2411
Cert No.: 08-WG-8202-R300/1
Form No.R300.Cert.07.A
Client: Coffey Geotechnics  
Test No.:  
Test Type: A  
Platen Separation  
D:  
Load at Failure  
P: 0.4  

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.11  

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.12  
Load (kN): 0.42  

Note: Sample supplied by client.  
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)  
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible  
This Certificate replaces the previously issued Certificate No.: 08-WG-8202-R304
CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  64.4

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8202-S900_interim

Approved Signatory: (Russell Calvert) Date: 31/07/2008
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.11

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.12

Load (kN): 0.42

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
TEST CERTIFICATE

Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8204  
Sample ID: BH08 (17 - 17.10)

Client Job No: GEOTHERD08491AA  
Order No:  
Tested Date: 6/08/2008  
WG Job Number: 08-01-1408  
Lab: Welshpool

DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%)  29.7
Dry Density (t/m3)  1.905

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8205
Sample ID: BH08 (18.5 - 19.2)

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.9

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 2.197
Moisture Content (%): 7.1

UNIAXIAL COMRESSIVE STRENGTH (MPa):
3.34

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Shear
Duration of Tests: 1.4 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John. Reid)
Date: 11/08/2008
**POINT LOAD INDEX**

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 1.6

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.51

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.54

Load (kN): 1.6

Note: Sample supplied by client.

1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8205
Sample ID: BH08 (18.5 - 19.2)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm) PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3) 2.082
Water Content (%): 7.9
Specimen Height (mm): 39
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa):
0.361

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid)
Date: 12/08/2008

This document is issued in accordance with NATA's accreditation requirements
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 1.9

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 2.092
Moisture Content (%): 11.1

UNIAXIAL COMPRESSIVE STRENGTH (MPa): 2.40

Moisture Condition: Specimen exposed by previous sampling in the lab; some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Multiple Axial failures
Duration of Tests: 5.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8206-R300
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 64.6

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8206-S900_interim

Approved Signatory: (Russell.Calvert) Date: 31/07/2008
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D: 

Load at Failure
P: 14.2

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 3.3

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 3.8

Load (kN): 14

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid)  Date: 12/08/2008

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

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8208
Sample ID: BH08 (20.5 - 20.65)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm) PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5

Bulk Dry Density (t/m3) 1.888

Water Content (%): 14.8

Specimen Height (mm): 41

Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.218

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements
POINT LOAD INDEX

AS4133.4.1

Test No.:  

Test Type:  

I

Platen Separation  

D:

Load at Failure  

P:  

2.1

UNCORRECTED POINT LOAD STRENGTH Is (MPa):  

0.52

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) :  

0.58

Load (kN):  

2.1

Note: Sample supplied by client.
1. Test Types:  

D= Diametral  

A= Axial  

I= Irregular Lump  

B= Block

2. Test Directions:  

1= Perpendicular  

2= Parallel (to planes of weakness)

3. Sample tested in "as received" condition.

Approved Signatory:  

(John Reid)  

Date: 12/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 1.2

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.24

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.28

Load (kN): 1.2

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8211
Sample ID: BH08 (22.5 - 22.7)

DENSITY-POROSITY
AS4133.2.1.2   buoyancy method

Porosity (%)  12.4
Dry Density (t/m3)  2.340

Note: Sample supplied by client.

Approved Signatory: (John Reid) Date: 12/08/2008
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8212
Sample ID: BH08 (23.2 - 23.25)

Test No.: Test Type: A
Platen Separation D:
Load at Failure P: 0.8

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.21

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.23
Load (kN): 0.82

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 35.7

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8213-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 24.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 8.9

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 9.1

Load (kN): 25

Note: Sample supplied by client.

1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: HQ3 Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 61.0
Bulk Dry Density (t/m³): 2.619
Moisture Content (%): 0.1

UNIAXIAL
COMPRESSIVE
STRENGTH (MPa):
132

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Shear/shatter
Duration of Tests: 3.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008
ULTRASONIC PULSE VELOCITY

Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY

(meters/sec) 5,591

Note: Sample supplied by client.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation

D:

Load at Failure

P: 17.6

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 6.5

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 6.6

Load (kN): 18

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>99</td>
<td>1.18</td>
<td>98</td>
</tr>
<tr>
<td>0.600</td>
<td>93</td>
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<td>19.0</td>
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</tr>
<tr>
<td>9.5</td>
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</tr>
<tr>
<td>4.75</td>
<td>100</td>
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</tr>
</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8217-S301_interim
### PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>100</td>
<td>0.0429</td>
<td>21</td>
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<td>0.0311</td>
<td>20</td>
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<tr>
<td>9.5</td>
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<td>0.0224</td>
<td>19</td>
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<tr>
<td>4.75</td>
<td>51</td>
<td>0.0160</td>
<td>18</td>
</tr>
<tr>
<td>2.36</td>
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<td>0.0030</td>
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<td>0.150</td>
<td>31</td>
<td>0.0022</td>
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</tr>
<tr>
<td>0.075</td>
<td>25</td>
<td>0.0014</td>
<td>9</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Note: Sample supplied by client.
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

Moisture Content (%) 19.1

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%)  35

AS 1289.3.2.1
Plastic Limit (%)  16

AS 1289.3.3.1
Plasticity Index (%)  19

AS 1289.3.4.1
Linear Shrinkage (%)  10.0

Oven Dried

Dry Sieved

Flat

Note: Sample supplied by client.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 70.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8219-S900_interim
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

SIEVING

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
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<tbody>
<tr>
<td>37.5</td>
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<td>19.0</td>
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HYDROMETER

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<tr>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
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</thead>
<tbody>
<tr>
<td>0.0435</td>
<td>29</td>
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<td>0.0315</td>
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<td>0.0224</td>
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<td>0.0022</td>
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<tr>
<td>0.0014</td>
<td>11</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test. Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.

Approved Signatory: (Russell Calvert)
Date: 31/07/2008
**CALCULATED CARBONATE CONTENT**

WA915.1 (% soluble in HCl)

<table>
<thead>
<tr>
<th>Client:</th>
<th>Coffey Geotechnics</th>
<th>Client Job No:</th>
<th>GEOTHERD08491AA</th>
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</thead>
<tbody>
<tr>
<td>Project:</td>
<td>Dampier Cargo Berth Expansion Project</td>
<td>Order No:</td>
<td></td>
</tr>
<tr>
<td>Location:</td>
<td>Dampier, WA</td>
<td>Tested Date:</td>
<td>10/07/2008</td>
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<tr>
<td>Sample No:</td>
<td>08-WG-8220</td>
<td>WG Job Number:</td>
<td>08-01-1408</td>
</tr>
<tr>
<td>Sample ID:</td>
<td>BH09 (7.95 - 8.3)</td>
<td>Lab:</td>
<td>Welshpool</td>
</tr>
</tbody>
</table>

**Calcium Carbonate Content (%)**

| Calcium Carbonate Content (%) | 67.7 |

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8220-S900_interim
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8221
Sample ID: BH09 (8.5 - 8.7)

Client Job No: GEOTHERD08491AA
Order No: 08-WG-8221
Tested Date: 6/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 22.1
Dry Density (t/m3) 2.121

Note: Sample supplied by client.

Approved Signatory: (John Reid)
Date: 12/08/2008

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

Accreditation No.: 2418
Cert No.: 08-WG-8221-R202
Page: 1
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 26.4 |

Note: Sample supplied by client.
**PLASTICITY INDEX**

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

<table>
<thead>
<tr>
<th>Method</th>
<th>Value</th>
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<tbody>
<tr>
<td>Liquid Limit (%)</td>
<td>46</td>
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<tr>
<td>Plastic Limit (%)</td>
<td>24</td>
</tr>
<tr>
<td>Plasticity Index (%)</td>
<td>22</td>
</tr>
<tr>
<td>Linear Shrinkage (%)</td>
<td>11.0</td>
</tr>
</tbody>
</table>

Unknown

Dry Sieved

Flat

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8224
Sample ID: BH09 (12.6 - 12.95)

Client Job No: GEOTHERD08491AA
Order No:
Test No: A
Test Type: A
Platen Separation
D:  
Load at Failure
P: 0.8

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.22

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.24
Load (kN): 0.8

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8224-R304
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

**Calcium Carbonate Content (%)**

72.3

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8224-S900_interim
**PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS**

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
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</thead>
<tbody>
<tr>
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<tr>
<td>0.075</td>
<td>18</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.

Approved Signatory: (Russell.Calvert)  
Date: 31/07/2008

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

AS4133.2.1.2 buoyancy method

Porosity (%)  30.1
Dry Density (t/m3)  1.883

Note: Sample supplied by client.
Point Load Index
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.4

Uncorrected Point Load Strength Is (MPa): 0.13

Corrected Point Load Strength Is (50) (MPa): 0.14

Load (kN): 0.44

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.769
Water Content (%): 17.3
Specimen Height (mm): 39
Specimen Diameter (mm): 84

INDIRECT
TENSILE STRENGTH
(MPa):

0.215

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: HQ Core
Length/Diameter Ratio: 2.3

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.3
Bulk Dry Density (t/m3): 1.761
Moisture Content (%): 16.7

UNIAXIAL
COMPRESSION
STRENGTH (MPa):

37.4

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Shear
Duration of Tests: .8 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

Sample Type: HQ Core
Length/Diameter Ratio: 2.5

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 2.032
Moisture Content (%): 13.2

UNIAXIAL COMPRESSION STRENGTH (MPa):
1.41

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Crumbling Failure - Upper end
Duration of Tests: 1.7 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.3

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.07

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.08

Load (kN): 0.28

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failures Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.7

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.9
Bulk Dry Density (t/m³): 1.928
Moisture Content (%): 13.5

UNIAXIAL COMPRESSIVE STRENGTH (MPa):

1.03

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Upper end
Duration of Tests: .7 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8232
Sample ID: BH09 (17.2 - 17.5)

Client Job No: GEOTHERD08491AA
Order No: 6/08/2008
Tested Date: 6/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

Approved Signatory: (John Reid) Date: 11/08/2008
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8233
Sample ID: BH09 (17.5 - 17.75)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 6/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%)  28.2
Dry Density (t/m3)  1.971

Note: Sample supplied by client.

Approved Signatory: (John Reid)
Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418
Cert No.: 08-WG-8233-R202
Site No.: 2411
Form No. R202.Cert.07.A
Client: Coffey Geotechnics  
Test No.:  
Client Job No: GEOTHERD08491AA  
Test Type: A  
Order No:  
Platen Separation: D  
Tested Date: 5/08/2008  
Load at Failure: P: 0.3  
WG Job Number: 08-01-1408  
Sample No: 08-WG-8233  
Lab: Welshpool  
Sample ID: BH09 (17.5 - 17.75)  

POINT LOAD INDEX  
AS4133.4.1  

Test No.:  
Test Type: A  
Platen Separation: D  
Load at Failure: P: 0.3  

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.07  

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.08  
Load (kN): 0.28  

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)  
3. Sample tested in "as received" condition.  

Approved Signatory: (John.Reid)  
Date: 12/08/2008
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8234
Sample ID: BH09 (18.9 - 19.2)

**INITIAL SPECIMEN DETAILS**

Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 2.016
Moisture Content (%): 11.8

**UNIAXIAL COMPRESSION STRENGTH OF ROCK**

AS4133.4.2.1

Sample Type: HQ Core
Length/Diameter Ratio: 2.5

UNIAXIAL COMPRESSIVE STRENGTH (MPa):

0.876

Durational Tests 1 mins

Mode of Failure: Shear
Deviation from Standard: Non-uniformity of sides exceeds limits of test method

Specimen tested at the moisture condition as received

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

This Certificate replaces the previously issued Certificate No.: 08-WG-8234-R300

Approved Signatory: (John Reid) Date: 13/08/2008

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

Accreditation No.: 2418
Form No.: R300.Cert.07.A
Site No.: 2411
Cert No.: 08-WG-8234-R300/1
Page: 1
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  

59.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8234-S900_interim
POINT LOAD INDEX

Test No.: 

Test Type: A 

Platen Separation
D: 

Load at Failure
P: 0.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.04

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.05

Load (kN): 0.2

Note: Sample supplied by client.
1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX
AS4133.4.1

Test No.: 
Test Type: A 
Platen Separation 
D: 
Load at Failure 
P: 1.0 

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.29 

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.31 
Load (kN): 1

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block 
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness) 
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics  
Test No.:  
Test Type: A  
Platen Separation  
D:  
Load at Failure  
P: 1.2  
UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.28  
CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.32  
Load (kN): 1.2  

Note: Sample supplied by client.  
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block  
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)  
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8239
Sample ID: BH09 (26.45 - 26.5)

Test No.:
Test Type: A
Platen Separation:
D:
Load at Failure:
P: 24.6

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 12

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 11
Load (kN): 25

Note: Sample supplied by client.
1. Test Types: D=Diametral     A= Axial     I=Irregular Lump     B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ3 Core
Length/Diameter Ratio: 2.8

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 60.6
Bulk Dry Density (t/m³): 2.483
Moisture Content (%): 0.1

UNIAXIAL
COMPRESSIVE
STRENGTH (MPa):
125

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Shattered
Duration of Tests: 4.1 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 11/08/2008

This document is issued in accordance with NATA's accreditation requirements
ULTRASONIC PULSE VELOCITY

Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY

(meters/sec) 5,820

Note: Sample supplied by client.
Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8241  
Sample ID: BH09 (27.85 - 27.9)  

Test Type: A  
Platen Separation D:  
Load at Failure P: 22.6  

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 9.7  

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 9.6  
Load (kN): 23  

Note: Sample supplied by client.  
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block  
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)  
3. Sample tested in "as received" condition.
BH10

Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>96</td>
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<tr>
<td>1.18</td>
<td>93</td>
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<td>0.425</td>
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<td>0.300</td>
<td>78</td>
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<td>0.150</td>
<td>55</td>
</tr>
<tr>
<td>0.075</td>
<td>28</td>
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</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8281-S301_interim
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8282
Sample ID: BH10 (5.3 - 5.75)

Client Job No: GEOTHERD08491AA
Order No: 5/08/2008
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

MOISTURE CONTENT
AS 1289.2.1.1 (Oven Convection)

Moisture Content (%) 22.5

Note: Sample supplied by client.

Approved Signatory: (Mark Matthews) Date: 11/08/2008

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

Accreditation No.: 2418
Form No.: S200.Cert.07.A
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%)  38

AS 1289.3.2.1
Plastic Limit (%)  19

AS 1289.3.3.1
Plasticity Index (%)  19

AS 1289.3.4.1
Linear Shrinkage (%)  9.5

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE
- According to WGPL In-House Test Method # 6

CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)
JOB NO : 08-01-1408
PROJECT : Dampier Cargo Berth Expansion Project
LOCATION : Dampier, WA
Sample Id : BH10, Depth : (6 - 6.4)
Lab No. : 08-WG-8283
Test Type : Unconsolidated Undrained, Multi-stage
Date Tested : 12-21/7/08

Sample Description (Visual) : mottled orange brown clayey SILTS

Specimen Details : Placement
Length/Diameter (ratio) : 1.91
Dry Density (t/m$^3$) : 1.791
Moisture Content (%) : 18.9

Sampling Details : 84mm Ø core sample

MOHR CIRCLES - Composite Plot
The dotted fit line is @ Cohesion of 69 kPa & Ø : 2°

<table>
<thead>
<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>$\varepsilon_f$ (%)</th>
<th>$\sigma_f$ (kPa)</th>
<th>$(\sigma_f)_f$ (kPa)</th>
<th>$(\sigma_f - \sigma_3)_f$ (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1.00</td>
<td>3.72</td>
<td>75</td>
<td>227</td>
<td>152</td>
</tr>
<tr>
<td>2</td>
<td>1.00</td>
<td>1.74</td>
<td>150</td>
<td>303</td>
<td>153</td>
</tr>
<tr>
<td>3</td>
<td>1.00</td>
<td>1.67</td>
<td>300</td>
<td>470</td>
<td>170</td>
</tr>
</tbody>
</table>

Cohesion, $C$ (kPa) : -
Friction Angle, $\Phi$ (degrees) : -

Failure Mode : sheared
Notes : Corrected area used for stress calculations
Sample supplied by client
Note: sample broken on stage 1 calculations not performed.

Authorised Signatory : ______________________ ( F. Lee )
Date : 26/07/2008
Certificate No.: 08-WG-8283 / S700

36 Railway Parade Welshpool WA 6106 Phone 1300 781 744 Fax (08) 9458 3700
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)

PROJECT: Dampier Cargo Berth Expansion Project

Sample Id: BH10, Depth: (6 - 6.4)

Test Type: Unconsolidated Undrained, Multi-stage

Specimen Details: Placement

- Length/Diameter (ratio): 1.91
- Dry Density (t/m$^3$): 1.791
- Moisture Content (%): 18.9

Sampling Details: 84mm Ø core sample

Deviator Stress Vs Axial Strain

Note: deviator stress = ($\sigma_1 - \sigma_3$)

Authorised Signatory: ____________________________( F. Lee )

Date: 26/07/2008

Certificate No.: 08-WG-8283 / S700
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 18.6

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8283-S900_interim
**UNIAXIAL COMPRESSION TESTING**

**AS4133.4.2.1**

**Failure Diagram not to scale: Indicative Only**

**Sample Type:** HQ Core

**Length/Diameter Ratio:** 2.4

**INITIAL SPECIMEN DETAILS**

**Core Diameter (mm):** 83.1

**Bulk Dry Density (t/m³):** 1.969

**Moisture Content (%):** 15.3

**UNIAXIAL COMPRESSION STRENGTH (MPa):** 0.674

**Moisture Condition:** Specimen tested at the moisture condition as received

**Deviation from Standard:** Less than required minimum of 2.5

**Mode of Failure:** Crumbling Failure - Lower end

**Duration of Tests:** 6.4 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method.
Tested on an hydraulic compression machine.

**Approved Signatory:** (John Reid)  Date: 11/08/2008

---

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

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 1.0

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 0.26

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 0.29

Load (kN): 1

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details

Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.901
Water Content (%): 15.5
Specimen Height (mm): 43
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.663

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
BH11
Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>97</td>
</tr>
<tr>
<td>1.18</td>
<td>91</td>
</tr>
<tr>
<td>0.600</td>
<td>84</td>
</tr>
<tr>
<td>0.425</td>
<td>80</td>
</tr>
<tr>
<td>0.300</td>
<td>75</td>
</tr>
<tr>
<td>0.150</td>
<td>55</td>
</tr>
<tr>
<td>0.075</td>
<td>28</td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418
Form No.: S301.Cert.07.A
Site No.: 2411
Cert No.: 08-WG-8285-S301
Page: 1
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8286
Sample ID: BH11 (5.7 - 5.9)

Test No.: Test Type: A
Platen Separation
D:
Load at Failure
P: 0.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.01

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.02
Load (kN): 0.38

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8286-R304
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  77.7

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8286-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 1.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.38

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.40

Load (kN): 1.2

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
## INDIRECT TENSILE STRENGTH

**ISRM Doc 8 Pt 2 (Brazil Method)**

<table>
<thead>
<tr>
<th>Core Size (mm)</th>
<th>PQ3</th>
</tr>
</thead>
</table>

### Initial Specimen Details
- **Height / Diameter Ratio:** 0.6
- **Bulk Dry Density (t/m3):** 1.788
- **Water Content (%):** 15.7
- **Specimen Height (mm):** 50
- **Specimen Diameter (mm):** 85

### INDIRECT TENSILE STRENGTH (MPa):

| 4.53 |

**Note:** Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

---

**Client:** Coffey Geotechnics  
**Project:** Dampier Cargo Berth Expansion Project  
**Location:** Dampier, WA  
**Sample No:** 08-WG-8287  
**Sample ID:** BH11 (6.5 - 6.7)  
**Client Job No:** GEOTHERD08491AA  
**Order No:**  
**Tested Date:** 7/08/2008  
**WG Job Number:** 08-01-1408  
**Lab:** Welshpool

**Approved Signatory:** (John Reid)  
**Date:** 12/08/2008

---

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

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8289
Sample ID: BH11 (7.8 - 7.9)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX
AS4133.4.1

Test No.: 
Test Type: A

Platen Separation
D:
Load at Failure
P: 0.4

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.12

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 0.13

Load (kN): 0.38

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  l=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John.Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8290
Sample ID: BH11 (8.25 - 8.8)

Client Job No: GEOTHERD08491AA
Order No: 7/08/2008
Sample supplied by client.

DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 20.1
Dry Density (t/m3) 2.179

Note: Sample supplied by client.

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418
Form No. R202.Cert.07.A
Site No.: 2411
Cert No.: 08-WG-8290-R202
Page: 1
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.3

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.2
Bulk Dry Density (t/m3): 1.999
Moisture Content (%): 11.4

UNIAXIAL COMPRESSION STRENGTH (MPa):
2.15

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Failed on Irregularity - Upper end
Duration of Tests: 2. mins

Note: Sample supplied by client. Bulk Density value was determined by the Calliper method. Tested on an hydraulic compression machine. This Certificate replaces the previously issued Certificate No.: 08-WG-8290-R300

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure

P: 4.4

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 1.2

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa) : 1.3

Load (kN): 4.4

Note: Sample supplied by client.

1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8290-R304
**INDIRECT TENSILE STRENGTH**

ISRM Doc 8 Pt 2 (Brazil Method)

<table>
<thead>
<tr>
<th>Core Size (mm)</th>
<th>PQ3</th>
</tr>
</thead>
</table>

**Initial Specimen Details**

<table>
<thead>
<tr>
<th>Height / Diameter Ratio:</th>
<th>0.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Dry Density (t/m³)</td>
<td>2.050</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>10.8</td>
</tr>
<tr>
<td>Specimen Height (mm)</td>
<td>43</td>
</tr>
<tr>
<td>Specimen Diameter (mm)</td>
<td>83</td>
</tr>
</tbody>
</table>

**INDIRECT TENSILE STRENGTH (MPa): 8.41**

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8290-R305

Approved Signatory: (John Reid) Date: 12/08/2008
CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 76.9

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8290-S900_interim
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.8
Bulk Dry Density (t/m³): 1.762
Moisture Content (%): 15.2

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
1.49

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Crumbling failure
Duration of Tests: .5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 5/08/2008

This document is issued in accordance with NATA's accreditation requirements
Accreditation No.: 2418
Site No.: 2411
Cert No.: 08-WG-8291-R300
Form No.R300.Cert.07.A
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.05

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 0.06

Load (kN): 0.24

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

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

Accreditation No.: 2418

Form No.R304.Cert.07.A
BH12

Laboratory Certificates
PARTICLE SIZE DISTRIBUTION

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>80</td>
</tr>
<tr>
<td>1.18</td>
<td>75</td>
</tr>
<tr>
<td>0.600</td>
<td>69</td>
</tr>
<tr>
<td>0.425</td>
<td>67</td>
</tr>
<tr>
<td>0.300</td>
<td>64</td>
</tr>
<tr>
<td>0.150</td>
<td>51</td>
</tr>
<tr>
<td>0.075</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0</td>
<td>100</td>
</tr>
<tr>
<td>9.5</td>
<td>92</td>
</tr>
<tr>
<td>4.75</td>
<td>86</td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.

Approved Signatory: (John Reid) Date: 12/08/2008
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>37.5</td>
<td>100</td>
<td>0.0441</td>
<td>36</td>
</tr>
<tr>
<td>19.0</td>
<td>99</td>
<td>0.0320</td>
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<td>9.5</td>
<td>85</td>
<td>0.0229</td>
<td>31</td>
</tr>
<tr>
<td>4.75</td>
<td>78</td>
<td>0.0164</td>
<td>29</td>
</tr>
<tr>
<td>2.36</td>
<td>75</td>
<td>0.0118</td>
<td>28</td>
</tr>
<tr>
<td>1.18</td>
<td>72</td>
<td>0.0086</td>
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</tr>
<tr>
<td>0.600</td>
<td>69</td>
<td>0.0062</td>
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<tr>
<td>0.425</td>
<td>67</td>
<td>0.0044</td>
<td>23</td>
</tr>
<tr>
<td>0.300</td>
<td>65</td>
<td>0.0031</td>
<td>21</td>
</tr>
<tr>
<td>0.150</td>
<td>59</td>
<td>0.0022</td>
<td>19</td>
</tr>
<tr>
<td>0.075</td>
<td>44</td>
<td>0.0014</td>
<td>15</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.
Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.

Approved Signatory: (Russell.Calvert) Date: 31/07/2008
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 28

AS 1289.3.2.1
Plastic Limit (%) 13

AS 1289.3.3.1
Plasticity Index (%) 15

AS 1289.3.4.1
Linear Shrinkage (%) 3.0

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.

Approved Signatory: (Russell Calvert) Date: 31/07/2008
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 33

AS 1289.3.2.1
Plastic Limit (%) 16

AS 1289.3.3.1
Plasticity Index (%) 17

AS 1289.3.4.1
Linear Shrinkage (%) 8.0

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
UNIAXIAL COMPRESSION STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.7

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 1.898
Moisture Content (%): 15.2

UNIAXIAL
COMPRESSIVE
STRENGTH (MPa):
0.560

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Mode of Failure: Multiple Axial failures
Duration of Tests 1. mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8295-R300

Approved Signatory: (John. Reid) Date: 13/08/2008

This document is issued in accordance with NATA's accreditation requirements
Accreditation No.: 2418
Site No.: 2411
Cert No.: 08-WG-8295-R300/1
Form No.R300.Cert.07.A
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.9

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.24

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.26

Load (kN): 0.86

Note: Sample supplied by client.
1. Test Types: D= Diametral A= Axial I= Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2= Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8295-R304

 Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Site No.: 2411
Cert No.: 08-WG-8295-R304/1
Page: 1
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

<table>
<thead>
<tr>
<th>Core Size (mm)</th>
<th>PQ3</th>
</tr>
</thead>
</table>

Initial Specimen Details

<table>
<thead>
<tr>
<th>Height / Diameter Ratio:</th>
<th>0.4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bulk Dry Density (t/m3)</td>
<td>1.879</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>15.1</td>
</tr>
<tr>
<td>Specimen Height (mm)</td>
<td>38</td>
</tr>
<tr>
<td>Specimen Diameter (mm)</td>
<td>84</td>
</tr>
</tbody>
</table>

INDIRECT TENSILE STRENGTH (MPa): 0.210

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8295-R305
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 96.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8295-S900_interim
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.5

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 2.016
Moisture Content (%): 11.7

UNIAXIAL COMPRRESSIVE STRENGTH (MPa):

Specimen tested at the moisture condition as received
Non-uniformity of sides exceeds limits of test method
Failed on Irregularities - Upper end
1.29

Duration of Tests: 1.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John Reid) Date: 12/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.3

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.08

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.09

Load (kN): 0.34

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8297
Sample ID: BH12 (9.45 - 10.0)

Client Job No: GEOTHERD08491AA
Order No: 08-01-1408
Test No: Test Type: A
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX

AS4133.4.1

Test No:
Test Type: A
Platen Separation
D:
Load at Failure
P: 0.4

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.13

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.13
Load (kN): 0.4

Note: Sample supplied by client.
1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
   This Certificate replaces the previously issued Certificate No.: 08-WG-8297-R304

Approved Signatory: (John Reid) Date: 13/08/2008
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details

Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3): 1.706
Water Content (%): 18.0
Specimen Height (mm): 41
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 1.47

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8297-R305
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  
79.3

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8297-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.12

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.13

Load (kN): 0.46

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

<table>
<thead>
<tr>
<th>Standard</th>
<th>Test Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1289.3.9.2</td>
<td>Liquid Limit (%) 52</td>
</tr>
<tr>
<td>AS 1289.3.2.1</td>
<td>Plastic Limit (%) 26</td>
</tr>
<tr>
<td>AS 1289.3.3.1</td>
<td>Plasticity Index (%) 26</td>
</tr>
<tr>
<td>AS 1289.3.4.1</td>
<td>Linear Shrinkage (%) 11.0</td>
</tr>
</tbody>
</table>

Oven Dried

Dry Sieved

Flat

Note: Sample supplied by client.
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 24.4 |

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%)  33

AS 1289.3.2.1
Plastic Limit (%)  16

AS 1289.3.3.1
Plasticity Index (%)  17

AS 1289.3.4.1
Linear Shrinkage (%)  5.0

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE
- According to WGPL In-House Test Method # 5

CLIENT : Coffey Geotechnics   (Job # GEOTHERD08491AA)  
JOB NO : 08-01-1408

PROJECT : Dampier Cargo Berth Expansion Project
LOCATION : Dampier, WA

Sample Id : BH12, Depth : (12 - 12.45)  
Lab No. : 08-WG-8300

Test Type : Consolidated Isotropically Undrained, Multi-stage
Date Tested : 17-22/7/08

Specimen Details :
Length/Diameter (ratio) : 1.91
Dry Density (t/m$^3$) : 1.597
Moisture Content (%) : 24.4

Sample Description (Visual) :
mottled light greenish grey, bright
reddish brown clayey SILTS

Saturation Stage Data
Pore Pressure Coefficient, $B$ : 0.96

Sampling Details :
84mm Ø core sample

MOHR CIRCLES - Composite Plot
The dotted fit line is @ Cohesion of 35 kPa & $\phi$ : 30°

SHEAR STAGE DATA  (Failure based on peak effective stress ratio : stage 1 , peak deviator stress : stages 2 & 3 )

<table>
<thead>
<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>$\varepsilon_f$ (%)</th>
<th>$(\sigma_1' / \sigma_3')_f$ (ratio)</th>
<th>$\sigma_3$ (kPa)</th>
<th>$U_o$ (kPa)</th>
<th>$U_f$ (kPa)</th>
<th>$(\sigma_1')_f$ (kPa)</th>
<th>$(\sigma_1' - \sigma_3')_f$ (kPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.07</td>
<td>0.89</td>
<td>4.96</td>
<td>475</td>
<td>349</td>
<td>419</td>
<td>278</td>
<td>222</td>
</tr>
<tr>
<td>2</td>
<td>0.07</td>
<td>1.54</td>
<td>4.11</td>
<td>600</td>
<td>348</td>
<td>476</td>
<td>510</td>
<td>386</td>
</tr>
<tr>
<td>3</td>
<td>0.07</td>
<td>1.28</td>
<td>3.47</td>
<td>850</td>
<td>348</td>
<td>618</td>
<td>806</td>
<td>574</td>
</tr>
</tbody>
</table>

Cohesion, $C$ (kPa) : -
Friction Angle, $\phi$ (degrees) : -

CONSOLIDATION TEST DATA  ($\Delta\sigma_3'$ of 11 kPa used during initial saturation stage)

<table>
<thead>
<tr>
<th>Stage No</th>
<th>$\Delta\sigma_3'$ (kPa)</th>
<th>$c_v$ (m$^2$/year)</th>
<th>$M_v$ (m$^2$/MN)</th>
<th>$k$ (m/sec)</th>
<th>Drainage Condition</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>115</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>2</td>
<td>125</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
<tr>
<td>3</td>
<td>250</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>One End &amp; Radial</td>
</tr>
</tbody>
</table>

Failure Mode : sheared
Notes : Corrected area used for stress calculations
Sample supplied by client

Authorised Signatory : ___________________( F. Lee )  
Date : 26/07/2008
Certificate No.: 08-WG-8300 / S700

36 Railway Parade  Welshpool  WA  6106  Phone 1300 781 744  Fax (08) 9458 3700
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)  
JOB NO: 08-01-1408  
PROJECT: Dampier Cargo Berth Expansion Project  
LOCATION: Dampier, WA  
Sample Id: BH12, Depth: (12 - 12.45)  
Lab No.: 08-WG-8300  
Date Tested: 17-22/7/08  
Test Type: Consolidated Isotropically Undrained, Multi-stage  
Specimen Details:  
- Placement:  
  - Final:  
- Length/Diameter (ratio): 1.91  
- Dry Density (t/m$^3$): 1.597  
  - 1.622  
- Moisture Content (%): 24.4  
  - 26.0  
Sample Description (Visual):  
- mottled light greenish grey, bright  
- reddish brown clayey SILTS  
Saturation Stage Data:  
Pore Pressure Coefficient, $B$: 0.96  
Sampling Details: 84mm Ø core sample  

Deviator Stress Vs Axial Strain

Note: deviator stress = $(\sigma_1 - \sigma_3)$

Authorised Signatory: __________________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8300 / S700
CLIENT: Coffey Geotechnics  (Job # GEOTHERD08491AA)
PROJECT: Dampier Cargo Berth Expansion Project
Sample Id : BH12, Depth : (12 - 12.45)
Test Type : Consolidated Isotropically Undrained, Multi-stage
Specimen Details:
- Length/Diameter (ratio) : 1.91 -
- Dry Density (t/m³) : 1.597 1.622
- Moisture Content (%) : 24.4 26.0

Sample Description (Visual):
- mottled light greenish grey, bright reddish brown clayey SILTS

Saturation Stage Data
- Pore Pressure Coefficient, B : 0.96

Sampling Details: 84mm Ø core sample

Induced Pore Water Pressure Vs Axial Strain

Axial Strain (%)
Induced pwp (kPa)

Stage 1 Stage 2 Stage 3

Authorised Signatory: ___________________________  (F. Lee)  Date: 26/07/2008
Certificate No.: 08-WG-8300 / S700
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)  
PROJECT: Dampier Cargo Berth Expansion Project  
Sample Id: BH12, Depth: (12 - 12.45)  
Test Type: Consolidated Isotropically Undrained, Multi-stage  

Specimen Details:  
<table>
<thead>
<tr>
<th>Placement</th>
<th>Final</th>
</tr>
</thead>
</table>
| Length/Diameter (ratio): 1.91 | -  
| Dry Density (t/m$^3$): 1.597 | 1.622  
| Moisture Content (%): 24.4 | 26.0  

Sample Description (Visual): mottled light greenish grey, bright reddish brown clayey SILTS  

Saturation Stage Data:  
Pore Pressure Coefficient, $B$: 0.96

Sampling Details: 84mm Ø core sample  

Effective Stress Path (Cambridge Method)

Note: $p' = (\sigma_1' + 2\sigma_3')/3$ & $q' = q = (\sigma_1' - \sigma_3')$

Authorised Signatory: ___________________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8300 / S700
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE

CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)  
PROJECT : Dampier Cargo Berth Expansion Project  
Sample Id : BH12, Depth : (12 - 12.45)  
Test Type : Consolidated Isotropically Undrained, Multi-stage  
Specimen Details : 

<table>
<thead>
<tr>
<th>Placement</th>
<th>Final</th>
<th>Sample Description (Visual) :</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length/Diameter (ratio) :</td>
<td>1.91</td>
<td>mottled light greenish grey, bright</td>
</tr>
<tr>
<td>Dry Density (t/m$^3$) :</td>
<td>1.597</td>
<td>reddish brown clayey SILTS</td>
</tr>
<tr>
<td>Moisture Content (%) :</td>
<td>24.4</td>
<td>26.0</td>
</tr>
</tbody>
</table>

Sampling Details : 84mm Ø core sample

Effective Stress Path (M.I.T. Method)

Note : $s' = (\sigma'_1 + \sigma'_3)/2$  &  $t = t' = (\sigma'_1 - \sigma'_3)/2$  
Stress Path Parameter , $s'$ (kPa)

Authorised Signatory : ___________________________ ( F. Lee )  
Date : ________________  
Certificate No.: 08-WG-8300 / S700

08-WG-8300
S700.Cert.06.A
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.1

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.02

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.02

Load (kN): 0.08

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8302
Sample ID: BH12 (14.5 - 15.00)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY
AS4133.2.1.2  buoyancy method

Porosity (%)  22.4
Dry Density (t/m3)  2.112

Note: Sample supplied by client.

Approved Signatory: (John Reid)  Date: 12/08/2008

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

Accreditation No.: 2418  Form No.R202.Cert.07.A  Site No.: 2411
Cert No.: 08-WG-8302-R202  Page: 1
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:

Load at Failure
P: 0.9

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.21

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.24

Load (kN): 0.88

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8302-R304

Approved Signatory: (John Reid) Date: 13/08/2008
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm) PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.6
Bulk Dry Density (t/m³) 1.921
Water Content (%): 11.1
Specimen Height (mm): 47
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 14.2

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8302-R305
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate

Content (%) 61.4

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8302-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type:  
A

Platen Separation  

D: 

Load at Failure

P:  
3.1

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 
0.97

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 
1.0

Load (kN):  
3.1

Note: Sample supplied by client.

1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D: Load at Failure
P: 6.1

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 1.4

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 1.5

Load (kN): 6.1

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8304
Sample ID: BH12 (16.45 - 16.70)

Core Size (mm) PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3) 2.153
Water Content (%): 7.8
Specimen Height (mm): 45
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

MPa: 1.68

INDIRECT TENSILE STRENGTH

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

(John.Reid) Date: 12/08/2008

Approved Signatory:

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418  Form No.R305.Cert.07.A

Site No.: 2411  Cert No.: 08-WG-8304-R305

Page: 1
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D: 
Load at Failure
P: 1.8

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.37

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.43

Load (kN): 1.8

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8306
Sample ID: BH12 (18.5 - 19.00)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY

AS4133.2.1.2 buoyancy method

Porosity (%) 15.1
Dry Density (t/m3) 2.306

Note: Sample supplied by client.

Approved Signatory: (John Reid) Date: 12/08/2008
### Point Load Index

**AS4133.4.1**

#### Test Details
- **Test No.:**
- **Test Type:** A
- **Platen Separation:**
  - **D:**
  - **Load at Failure:**
    - **P:** 0.7

#### Uncorrected Point Load Strength
- **Is (MPa):** 0.15

#### Corrected Point Load Strength
- **Is (50) (MPa):** 0.17
- **Load (kN):** 0.66

**Note:** Sample supplied by client.

1. **Test Types:** D=Diametral, A=Axial, I=Irregular Lump, B=Block
2. **Test Directions:** 1=Perpendicular, 2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8306-R304
INDIRECT TENSILE STRENGTH

ISRM Doc 8  Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3): 2.189
Water Content (%): 6.5
Specimen Height (mm): 43
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 1.25

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8306-R305

Approved Signatory: (John.Reid) Date: 13/08/2008
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 47.9

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8306-S900_interim
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8307
Sample ID: BH12 (19.4 - 19.5)

Client Job No: GEOTHER08491AA
Order No: 
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX
AS4133.4.1

Test No: 
Test Type: A

Platen Separation
D: 
Load at Failure
P: 0.0

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.00

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.00

Load (kN): 0

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

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

Site No.: 2411
Cert No.: 08-WG-8307-R304
Form No.R304.Cert.07.A
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.2

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m³): 2.198
Moisture Content (%): 8.0

UNIAXIAL
COMPRESSIVE
STRENGTH (MPa):

4.04

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Failed on Irregularities
Duration of Tests: 4.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John.Reid) Date: 12/08/2008
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.11

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.12

Load (kN): 0.46

Note: Sample supplied by client.

1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.5

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 0.12

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 0.14

Load (kN): 0.54

Note: Sample supplied by client.

1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in *as received* condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 1.9

INITIAL SPECIMEN DETAILS

Core Diameter (mm): 82.9
Bulk Dry Density (t/m³): 2.190
Moisture Content (%): 6.2

UNIAXIAL COMpressive STRENGTH (MPa):

3.54

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Lower end
Duration of Tests: 3.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8311-R300
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 4.6

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 1.2

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 1.3

Load (kN): 4.6

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8311-R304
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 66.5

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8311-S900_interim
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation D:

Load at Failure P: 6.3

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 1.5

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 1.7

Load (kN): 6.3

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8313
Sample ID: BH12 (24.5 - 24.55)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8313
Sample ID: BH12 (24.5 - 24.55)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX

AS4133.4.1

Test No.: 
Test Type: A
Platen Separation

D:
Load at Failure

P: 0.3

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.07

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.08

Load (kN): 0.3

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type:     A

Platen Separation
D:   
Load at Failure
P:     0.9

UNCORRECTED POINT LOAD
STRENGTH Is (MPa):       0.23

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa)    0.26

Load (kN):     0.94

Note: Sample supplied by client.
1. Test Types:  D=Diametral   A= Axial   I=Irregular Lump   B= Block
2. Test Directions:  1= Perpendicular   2=Parallel   (to planes of weakness)
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.4

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m3): 2.569
Moisture Content (%): 0.8

UNIAXIAL COMCOMPRESSIVE STRNGTH (MPa):

30.3

Moisture Condition: Specimen tested at the moisture condition as received
Deviation from Standard: Less than required minimum of 2.5 Diameter less than 10 x Maximum grain size
Mode of Failure: Failure through irregularity
Duration of Tests: 7.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Approved Signatory: (John.Reid) Date: 12/08/2008
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:

Load at Failure
P: 8.5

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 1.9

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 2.2

Load (kN): 8.5

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
ULTRASONIC PULSE VELOCITY

Steinkamp Method - Shear Wave

ULTRASONIC IMPULSE VELOCITY

(meters/sec) 5,167

Note: Sample supplied by client.
BH13

Laboratory Certificates
**PARTICLE SIZE DISTRIBUTION**

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>96</td>
<td>1.18</td>
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<td>1.18</td>
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<tr>
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Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8316-S301_interim
### PARTICLE SIZE DISTRIBUTION

**AS1289.3.6.1**

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<th>Sieve Size (mm)</th>
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<td>0.425</td>
<td>73</td>
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<tr>
<td>0.150</td>
<td>58</td>
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<tr>
<td>0.075</td>
<td>36</td>
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<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
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</thead>
<tbody>
<tr>
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<td>9.5</td>
<td>97</td>
</tr>
<tr>
<td>4.75</td>
<td>93</td>
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Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8317-S301_interim
### PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Finer Particle Diameter (mm)</th>
<th>Finer %</th>
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<tbody>
<tr>
<td>37.5</td>
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<td>19.0</td>
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<td>25</td>
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<tr>
<td>9.5</td>
<td>81</td>
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<td>4.75</td>
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</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%)  26

AS 1289.3.2.1
Plastic Limit (%)  14

AS 1289.3.3.1
Plasticity Index (%)  12

AS 1289.3.4.1
Linear Shrinkage (%)  6.5

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.

Approved Signatory: (Russell.Calvert) Date: 31/07/2008

This document is issued in accordance with NATA's accreditation requirements
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)  
74.2

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8318-S900_interim
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8319
Sample ID: BH13 (5 - 5.45)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

1

Moisture Content (%) 18.2

Note: Sample supplied by client.

Approved Signatory: (Mark Matthews) Date: 11/08/2008

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

Site No.: 2411
Cert No.: 08-WG-8319-S200
Form No. S200.Cert.07.A
Page: 1
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 30

AS 1289.3.2.1
Plastic Limit (%) 13

AS 1289.3.3.1
Plasticity Index (%) 17

AS 1289.3.4.1
Linear Shrinkage (%) 8.5

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)  
PROJECT: Dampier Cargo Berth Expansion Project  
Sample Id: BH13, Depth: (6.6 - 7)  
Test Type: Unconsolidated Undrained, Multi-stage  

Specimen Details:  
- Placement: Length/Diameter (ratio): 1.85, reddish brown sandy clayey SILTS  
- Dry Density (t/m³): 1.900  
- Moisture Content (%): 15.5  

Sampling Details: 84mm Ø core sample  

SHEAR STAGE DATA  

<table>
<thead>
<tr>
<th>Stage No</th>
<th>Strain Rate (mm/min)</th>
<th>εᵣ (%)</th>
<th>σᵢ (kPa)</th>
<th>(σᵢ)ᵣ (kPa)</th>
<th>(σᵢ - σ₃)ᵣ (kPa)</th>
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</thead>
<tbody>
<tr>
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<td>6.57</td>
<td>75</td>
<td>321</td>
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<td>2</td>
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<td>302</td>
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<tr>
<td>3</td>
<td>1.00</td>
<td>2.85</td>
<td>300</td>
<td>683</td>
<td>383</td>
</tr>
</tbody>
</table>

Cohesion, C (kPa): -  
Friction Angle, Ø (degrees): -  

Failure Mode: sheared  
Notes: Corrected area used for stress calculations  
Sample supplied by client  

Authorized Signatory: _____________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8320 / S700
CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)  
PROJECT: Dampier Cargo Berth Expansion Project  
Sample Id: BH13, Depth: (6.6 - 7)  
Test Type: Unconsolidated Undrained, Multi-stage  
Specimen Details:  
- Placement:  
- Length/Diameter (ratio): 1.85  
- Dry Density (t/m^3): 1.900  
- Moisture Content (%): 15.5  
Sampling Details: 84mm Ø core sample

Note: deviator stress = (σ₁ - σ₃)

Deviator Stress Vs Axial Strain

Authorised Signatory: ____________________________ (F. Lee)  
Date: 26/07/2008  
Certificate No.: 08-WG-8320 / S700
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
AS4133.4.2.1

Initial Specimen Details

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.5

UNIAXIAL COMPRESSIVE STRENGTH (MPa):

Initial Sample Details

Core Diameter (mm):
Bulk Dry Density (t/m3):
Moisture Content (%):

0.337

UNIAXIAL COMPRESSIVE STRENGTH (MPa):

Moisture Condition:
Specimen exposed by previous sampling in the lab:
some moisture loss is possible
Diameter less than 10 x Maximum grain size

Mode of Failure:
Crumbling Failure at lower end

Duration of Tests: 6.3 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8321-R300

Approved Signatory:
(John Reid) Date: 13/08/2008

This document is issued in accordance with NATA's accreditation requirements
POINT LOAD INDEX
AS4133.4.1

Test No.:

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.8

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.18

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.21

Load (kN): 0.8

Note: Sample supplied by client.

1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8321-R304
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3): 1.974
Water Content (%): 12.3
Specimen Height (mm): 44
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.245

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8321-R305
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate

82.9

Content (%)

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8321-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation

D:

Load at Failure

P: 0.9

UNCORRECTED POINT LOAD

STRENGTH Is (MPa): 0.19

CORRECTED POINT LOAD

STRENGTH Is (50) (MPa): 0.22

Load (kN): 0.88

Note: Sample supplied by client.

1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

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

Accreditation No.: 2418

Form No.R304.Cert.07.A

Cert No.: 08-WG-8323-R304

Site No.: 2411
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8324
Sample ID: BH13 (9 - 9.5)

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.4
Bulk Dry Density (t/m³): 2.181
Moisture Content (%): 8.6

UNIAXIAL COMPRESSIVE STRENGTH (MPa):

1.41

Moisture Condition: Specimen tested at the moisture condition as received
Mode of Failure: Multiple Axial failures
Duration of Tests: 8.1 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

Date: 11/08/2008

Approved Signatory: (John Reid)
POINT LOAD INDEX
AS4133.4.1

Test No.: 

Test Type: 

A

D: 

Load at Failure

P: 

7.3

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 

2.0

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 

2.2

Load (kN): 

7.3

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel  (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.6
Bulk Dry Density (t/m3): 2.295
Water Content (%): 7.0
Specimen Height (mm): 47
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa):
2.57

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
MOISTURE CONTENT
AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 28.0 |

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 35

AS 1289.3.2.1
Plastic Limit (%) 16

AS 1289.3.3.1
Plasticity Index (%) 19

AS 1289.3.4.1
Linear Shrinkage (%) 9.5

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
</tr>
</thead>
<tbody>
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<td>19.0</td>
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<td>2.36</td>
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<td>0.0014</td>
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</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Note: Sample supplied by client.

Approved Signatory: (Russell.Calvert) Date: 31/07/2008

This document is issued in accordance with NATA's accreditation requirements
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 36.7

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8243-S900_interim
## PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

**AS1289.3.6.2**

### SIEVING

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<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
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<tr>
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### HYDROMETER

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<thead>
<tr>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
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<tbody>
<tr>
<td>0.0445</td>
<td>29</td>
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<tr>
<td>0.0324</td>
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<td>0.0015</td>
<td>12</td>
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</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

**Calcium Carbonate Content (%)**

| Calcium Carbonate Content (%) | 62.5 |

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8244-S900_interim
### PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

#### AS1289.3.6.2

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<th>Passing %</th>
<th>Finer (mm)</th>
<th>Finer %</th>
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<td>0.0031</td>
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</tr>
<tr>
<td>0.150</td>
<td>55</td>
<td>0.0022</td>
<td>19</td>
</tr>
<tr>
<td>0.075</td>
<td>42</td>
<td>0.0014</td>
<td>16</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Note: Sample supplied by client.

This Certificate replaces the previously issued Certificate No.:08-WG-8246-S303.
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A 

Platen Separation D: 

Load at Failure P: 0.0 

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.00 

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.01 

Load (kN): 0.02 

Note: Sample supplied by client. 

1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block 
2. Test Directions: 1= Perpendicular   2=Parallel   (to planes of weakness) 
3. Sample tested in "as received" condition.
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK
AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: PQ3 Core
Length/Diameter Ratio: 2.2

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.0
Bulk Dry Density (t/m3): 1.891
Moisture Content (%): 15.0

UNIAXIAL COMpressive STRENGTH (MPa):
0.392

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Mode of Failure: Crumbling failure
Duration of Tests: 5.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8248-R300
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 62.3

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8248-S900_interim

Approved Signatory: (Russell.Calvert) Date: 31/07/2008
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8249
Sample ID: BH14 (6.35 - 6.4)

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.1

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.01

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 0.01

Load (kN): 0.06

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John.Reid) Date: 12/08/2008
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)  PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.672
Water Content (%): 13.5
Specimen Height (mm): 41
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH
(MPa): 0.172

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid)  Date: 12/08/2008
BH15

Laboratory Certificates
**PARTICLE SIZE DISTRIBUTION**

AS1289.3.6.1

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.0</td>
<td>100</td>
<td>0.300</td>
<td>65</td>
</tr>
<tr>
<td>9.5</td>
<td>97</td>
<td>0.150</td>
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<tr>
<td>4.75</td>
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<td>0.075</td>
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<td>2.36</td>
<td>88</td>
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<td>1.18</td>
<td>80</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.600</td>
<td>73</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0.425</td>
<td>70</td>
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<td></td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8325-S301_interim
### PARTICLE SIZE DISTRIBUTION

**AS1289.3.6.1**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>75</td>
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<td>0.150</td>
<td>48</td>
<td>0.075</td>
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</table>

Note: Sample supplied by client.

---

Approved Signatory: (John Reid)  
Date: 26/08/2008
PLASTICITY INDEX

<table>
<thead>
<tr>
<th>Standard</th>
<th>Value</th>
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<td>Liquid Limit (%)</td>
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<td>AS 1289.3.2.1</td>
<td>14</td>
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<tr>
<td>Plastic Limit (%)</td>
<td></td>
</tr>
<tr>
<td>AS 1289.3.3.1</td>
<td>15</td>
</tr>
<tr>
<td>Plasticity Index (%)</td>
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</tr>
<tr>
<td>AS 1289.3.4.1</td>
<td>7.0</td>
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<tr>
<td>Linear Shrinkage (%)</td>
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</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8327-S324_interim
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8328
Sample ID: BH15 (6.5 - 6.7)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 6/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

DENSITY-POROSITY
AS4133.2.1.2 buoyancy method

Porosity (%) 33.5
Dry Density (t/m3) 1.805

Note: Sample supplied by client.
UNIAXIAL COMpressive STRENGTH OF ROCK

AS4133.4.2.1

Failure Diagram not to scale: Indicative Only

Sample Type: HQ Core
Length/Diameter Ratio: 2.6

INITIAL SPECIMEN DETAILS

Core Diameter (mm): 83.1  
Bulk Dry Density (t/m3): 1.969  
Moisture Content (%): 12.6

UNIAXIAL COMpressive STRENGTH (MPa):

0.619

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Upper end
Duration of Tests: 1.2 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine

This Certificate replaces the previously issued Certificate No.: 08-WG-8328-R300
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8328
Sample ID: BH15 (6.5 - 6.7)

Client Job No: GEOTHERD08491AA
Order No:
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX
AS4133.4.1

Test No:
Test Type: A
Platen Separation
D:
Load at Failure
P: 0.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.06

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.07
Load (kN): 0.22

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8328-R304

Approved Signatory: (John Reid) Date: 13/08/2008

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

Accreditation No.: 2418
Cert No.: 08-WG-8328-R304/1
Form No.R304.Cert.07.A
Site No.: 2411
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8328
Sample ID: BH15 (6.5 - 6.7)

INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm) PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3) 1.748
Water Content (%): 19.1
Specimen Height (mm): 42
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.651

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8328-R305

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Site No.: 2411
Cert No.: 08-WG-8328-R305/1
Page: 1
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8328
Sample ID: BH15 (6.5 - 6.7)

Client Job No: GEOTHERD08491AA
Order No: 08-01-1408
Tested Date: 10/07/2008
WG Job Number: 08-WG-8328-S900
Lab: Welshpool

CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate

Content (%)  79.3

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8328-S900_interim

Approved Signatory: (Russell.Calvert) Date: 31/07/2008

This document is issued in accordance with NATA’s accreditation requirements
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8330
Sample ID: BH15 (7.2 - 7.35)

Test No.: Test Type: A
Platen Separation
D:
Load at Failure
P: 0.0

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.00

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.01
Load (kN): 0.02

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418
Form No.R304.Cert.07.A
Cert No.: 08-WG-8330-R304
Page: 1
**POINT LOAD INDEX**

AS4133.4.1

Test No.:  

Test Type:  A  

Platen Separation  

D:  

Load at Failure  

P:  6.3  

**UNCORRECTED POINT LOAD STRENGTH Is (MPa):**  1.6  

**CORRECTED POINT LOAD STRENGTH Is (50) (MPa):**  1.8  

Load (kN):  6.3

---

Note: Sample supplied by client.  

1. Test Types: D=Diametral   A= Axial   I=Irregular Lump   B= Block  
2. Test Directions: 1= Perpendicular   2=Parallel (to planes of weakness)  
3. Sample tested in "as received" condition.

---

Approved Signatory: (John Reid)  
Date: 12/08/2008
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)  PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³)  1.908
Water Content (%): 14.1
Specimen Height (mm): 43
Specimen Diameter (mm): 83

INDIRECT
TENSILE STRENGTH
(MPa):
0.171

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid)  Date: 12/08/2008
BH16

Laboratory Certificates
### PARTICLE SIZE DISTRIBUTION

**AS1289.3.6.1**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>93</td>
</tr>
<tr>
<td>1.18</td>
<td>88</td>
</tr>
<tr>
<td>0.600</td>
<td>80</td>
</tr>
<tr>
<td>0.425</td>
<td>75</td>
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<td>0.300</td>
<td>70</td>
</tr>
<tr>
<td>0.150</td>
<td>57</td>
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<tr>
<td>0.075</td>
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</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8333-S301_interim

---

**Client**: Coffey Geotechnics  
**Project**: Dampier Cargo Berth Expansion Project  
**Location**: Dampier, WA  
**Sample No**: 08-WG-8333  
**Sample ID**: BH16 (2.7 - 3)  
**Tested Date**: 8/07/2008  
**Lab**: Welshpool

---

**Approved Signatory**: (Russell.Calvert)  
**Date**: 31/07/2008
PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

AS1289.3.6.2

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Particle Diameter (mm)</th>
<th>Finer %</th>
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</thead>
<tbody>
<tr>
<td>37.5</td>
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</tr>
<tr>
<td>19.0</td>
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</tr>
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<td>64</td>
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<td>16</td>
</tr>
<tr>
<td>4.75</td>
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<tr>
<td>2.36</td>
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<td>1.18</td>
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<td>29</td>
<td>0.0021</td>
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</tr>
<tr>
<td>0.075</td>
<td>21</td>
<td>0.0014</td>
<td>6</td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.
Deviation from standard method: Insufficient sample according to requirements of the test method

Note: Sample supplied by client.
### PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

<table>
<thead>
<tr>
<th>Test Method</th>
<th>Result (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>AS 1289.3.9.2</td>
<td>26</td>
</tr>
<tr>
<td>AS 1289.3.2.1</td>
<td>13</td>
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<td>AS 1289.3.3.1</td>
<td>13</td>
</tr>
<tr>
<td>AS 1289.3.4.1</td>
<td>5.5</td>
</tr>
</tbody>
</table>

Oven Dried  
Dry Sieved  
Flat

Note: Sample supplied by client.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 69.7

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8334-S900_interim
PLASTICITY INDEX

AS 1289.3.9.2 (Single Point Cone Method), AS 1289.3.2.1, AS 1289.3.3.1, AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%) 56

AS 1289.3.2.1
Plastic Limit (%) 24

AS 1289.3.3.1
Plasticity Index (%) 32

AS 1289.3.4.1
Linear Shrinkage (%) 13.5

Oven Dried
Dry Sieved
Flat

Note: Sample supplied by client.
TRIAXIAL SHEAR TEST
REPORT CERTIFICATE
- According to WGPL In-House Test Method # 6

CLIENT: Coffey Geotechnics (Job # GEOTHERD08491AA)
JOB NO: 08-01-1408
PROJECT: Dampier Cargo Berth Expansion Project
LOCATION: Dampier, WA
Sample Id: BH16, Depth: (5.25 - 5.60)
Lab No.: 08-WG-8335
Test Type: Unconsolidated Undrained, Multi-stage
Date Tested: 12-21/7/08

Specimen Details: Placement
Length/Diameter (ratio): 1.94
Dry Density (t/m^3): 1.593
Moisture Content (%): 26.6

Sample Description (Visual):
Mottled dull orange, dark brown

CLAYY SILTS

Sampling Details: 83mm Ø tube sample

MOHR CIRCLES - Composite Plot

The dotted fit line is @ Cohesion of 90 kPa & Ø: 11º

SHEAR STAGE DATA

<table>
<thead>
<tr>
<th>Stage</th>
<th>Strain Rate</th>
<th>ε</th>
<th>σI</th>
<th>(σf)T</th>
<th>(σI - σf)T</th>
</tr>
</thead>
<tbody>
<tr>
<td>No</td>
<td>(mm/min)</td>
<td>(%)</td>
<td>(kPa)</td>
<td>(kPa)</td>
<td>(kPa)</td>
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<td>2</td>
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<td>297</td>
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<td>3</td>
<td>1.00</td>
<td>3.57</td>
<td>360</td>
<td>741</td>
<td>381</td>
</tr>
</tbody>
</table>

Cohesion, C (kPa): -
Friction Angle, Ø (degrees): -

Failure Mode: sheared
Notes: Corrected area used for stress calculations
Sample supplied by client

Authorised Signatory: __________________________ ( F. Lee )
Date: 26/07/2008
Certificate No.: 08-WG-8335 / S700

36 Railway Parade  Welshpool  WA  6106  Phone 1300 781 744  Fax (08) 9458 3700
CLIENT : Coffey Geotechnics (Job # GEOTHERD08491AA)  
JOB NO : 08-01-1408  
PROJECT : Dampier Cargo Berth Expansion Project  
LOCATION : Dampier, WA  
Sample Id : BH16, Depth : (5.25 - 5.60)  
Lab No. : 08-WG-8335  
Test Type : Unconsolidated Undrained, Multi-stage  
Date Tested : 12-21/7/08  
Specimen Details : Placement  
Length/Diameter (ratio) : 1.94  
Dry Density (t/m$^3$) : 1.593  
Moisture Content (%) : 26.6  
Sample Description (Visual) : mottled dull orange, dark brown  
clayey SILTS  
Sampling Details : 83mm Ø tube sample  

Deviator Stress Vs Axial Strain  

Note : deviator stress = ($\sigma_1 - \sigma_3$)  

Authorised Signatory : ____________________________ ( F. Lee )  
Date : 26/07/2008  
Certificate No.: 08-WG-8335 / S700
### PARTICLE SIZE DISTRIBUTION - WITH HYDROMETER ANALYSIS

**AS1289.3.6.2**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>Passing %</th>
<th>Finer (mm)</th>
<th>Finer %</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0444</td>
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<td></td>
</tr>
</tbody>
</table>

An assumed specific gravity of 2.70 has been used in the calculation of this test.

Deviation from standard method: Insufficient sample according to requirements of the test method.

Note: Sample supplied by client.
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (\%) 72.0

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8336-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.: 

Test Type: A

Platen Separation
D:
Load at Failure
P: 0.2

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.05

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.06
Load (kN): 0.22

Note: Sample supplied by client.

1. Test Types: D=Diametral  A=Axial   I=Irregular Lump  B=Block
   2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
   3. Sample tested in "as received" condition.
MOISTURE CONTENT

AS 1289.2.1.1 (Oven Convection)

| Moisture Content (%) | 16.9 |

Note: Sample supplied by client.
PLASTICITY INDEX

AS 1289.3.9.2  (Single Point Cone Method),  AS 1289.3.2.1,  AS 1289.3.3.1,  AS 1289.3.4.1

AS 1289.3.9.2
Liquid Limit (%)  27

AS 1289.3.2.1
Plastic Limit (%)  12

AS 1289.3.3.1
Plasticity Index (%)  15

AS 1289.3.4.1
Linear Shrinkage (%)  7.0

Oven Dried

Dry Sieved

Flat

Note: Sample supplied by client.
BH17

Laboratory Certificates
### PARTICLE SIZE DISTRIBUTION

**AS1289.3.6.1**

<table>
<thead>
<tr>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
<th>Sieve Size (mm)</th>
<th>% Passing</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.36</td>
<td>91</td>
<td>1.18</td>
<td>71</td>
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<tr>
<td>1.18</td>
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<td>44</td>
<td>0.075</td>
<td>32</td>
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</tbody>
</table>

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8340-S301_interim

---

Approved Signatory: (Russell.Calvert) Date: 31/07/2008

This document is issued in accordance with NATA's accreditation requirements
UNIAXIAL COMPRESSIVE STRENGTH OF ROCK

AS4133.4.2.1

Sample Type: HQ Core
Length/Diameter Ratio: 2.2

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1
Bulk Dry Density (t/m3): 1.769
Moisture Content (%): 18.9

UNIAXIAL COMpressive STRENGTH (MPa):
0.081

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Barreling
Duration of Tests: 5.1 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8341-R300

Approved Signatory: (John.Reid) Date: 13/08/2008

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

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8341
Sample ID: BH17 (2.15 - 2.5)

POINT LOAD INDEX
AS4133.4.1

Test No: A

Platen Separation
D: Load at Failure
P: 2.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.76

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.82

Load (kN): 2.7

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible

This Certificate replaces the previously issued Certificate No.: 08-WG-8341-R304

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements

Accreditation No.: 2418
Form No: R304.Cert.07.A
Cert No: 08-WG-8341-R304/1

Western Geotechnics Group
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

perth@westerngeo.com.au
ABN: 91 105324436
ph: (08) 9458 3700
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 84.7

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8341-S900_interim
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8342
Sample ID: BH17 (2.9 - 2.95)

Test No.: 
Test Type: A
Platen Separation
D: 
Load at Failure
P: 1.7

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.46

CORRECTED POINT LOAD STRENGTH Is (50) (MPa) : 0.51

Load (kN): 1.7

Note: Sample supplied by client.
1. Test Types: D=Diametral A= Axial I=Irregular Lump B= Block
2. Test Directions: 1= Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

This document is issued in accordance with NATA's accreditation requirements
Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8343  
Sample ID: BH17 (4 - 4.5)

UNIAXIAL COMPRESSIVE STRENGTH OF ROCK  
AS4133.4.2.1

Failure Diagram not to scale: Indicative Only
Sample Type: HQ Core  
Length/Diameter Ratio: 2.7

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 83.1  
Bulk Dry Density (t/m3): 1.721  
Moisture Content (%): 20.0

UNIAXIAL COMPRESSIVE STRENGTH (MPa):
UNIAXIAL STRENGTH (MPa): 3.15

Moisture Condition: Specimen exposed by previous sampling in the lab: some moisture loss is possible
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Crumbling Failure - Axial
Duration of Tests 8.4 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
This Certificate replaces the previously issued Certificate No.: 08-WG-8343-R300

Approved Signatory: (John Reid)  
Date: 13/08/2008

This document is issued in accordance with NATA’s accreditation requirements
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8343
Sample ID: BH17 (4 - 4.5)

Client Job No: GEOTHERD08491AA
Order No: 
Tested Date: 5/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX
AS4133.4.1

Test No: 
Test Type: A

Platen Separation
D:
Load at Failure
P: 4.3

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 1.4

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 1.4

Load (kN): 4.3

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8343-R304

Approved Signatory: (John Reid) Date: 13/08/2008

This document is issued in accordance with NATA's accreditation requirements
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm)          PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.652
Water Content (%):      21.2
Specimen Height (mm):   41
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH
(MPa): 1.60

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 13/08/2008
INDIRECT TENSILE STRENGTH
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m³): 1.652
Water Content (%): 21.2
Specimen Height (mm): 41
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 1.60

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method
Tested on an Hydraulic Compression Machine
Specimen exposed by previous sampling in the Lab: some moisture loss is possible
This Certificate replaces the previously issued Certificate No.: 08-WG-8343-R305.
CALCIUM CARBONATE CONTENT
WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%) 94.8

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8343-S900_interim
Test Certificate

Client: Coffey Geotechnics
Client Job No: GEOTHERD08491AA

Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA

Sample No: 08-WG-8345
Sample ID: BH17 (5.6 - 5.8)

Test No.
Test Type: A

Platen Separation
D: 1.2

Load at Failure
P: 1.2

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.31

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.34

Load (kN): 1.2

Note: Sample supplied by client.
1. Test Types: D=Diametral A=Axial I=Irregular Lump B=Block
2. Test Directions: 1=Perpendicular 2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.

Approved Signatory: (John Reid) Date: 12/08/2008

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

Accreditation No.: 2418
Site No.: 2411
Form No.R304.Cert.07.A

Western Geotechnics Group
PO Box 219 Bentley WA 6982
36 Railway Parade
Welshpool WA 6106

perth@westerngeo.com.au
ABN: 91105324436
ph: (08) 9458 3700
fx: (08) 9458 3700
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details

Height / Diameter Ratio: 0.5

Bulk Dry Density (t/m3): 2.050

Water Content (%): 11.5

Specimen Height (mm): 39

Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 1.62

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine
TEST CERTIFICATE

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8346
Sample ID: BH17 (6.7 - 6.9)

Client Job No: GEOTHERD08491AA
Order No:
Test Date: 7/08/2008
WG Job Number: 08-01-1408
Lab: Welshpool

POINT LOAD INDEX
AS4133.4.1

Test No:
Test Type: A
Platen Separation
D:
Load at Failure
P: 2.6

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.62

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.70
Load (kN): 2.6

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
Client: Coffey Geotechnics  
Project: Dampier Cargo Berth Expansion Project  
Location: Dampier, WA  
Sample No: 08-WG-8346  
Sample ID: BH17 (6.7 - 6.9)  

INDIRECT TENSILE STRENGTH  
ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details
Height / Diameter Ratio: 0.5
Bulk Dry Density (t/m3): 1.781
Water Content (%): 16.7
Specimen Height (mm): 43
Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.845

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid)  
Date: 12/08/2008

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

Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8347
Sample ID: BH17 (7.5 - 7.65)

Client Job No: GEOTHERD08491AA
Order No:
Test Type: A
Platen Separation
D:
Load at Failure
P: 1.1

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.32

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.34

Load (kN): 1.1

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
INDIRECT TENSILE STRENGTH

ISRM Doc 8 Pt 2 (Brazil Method)

Core Size (mm): PQ3

Initial Specimen Details

Height / Diameter Ratio: 0.5

Bulk Dry Density (t/m3): 1.867

Water Content (%): 14.7

Specimen Height (mm): 40

Specimen Diameter (mm): 83

INDIRECT TENSILE STRENGTH (MPa): 0.349

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

Approved Signatory: (John Reid) Date: 12/08/2008
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Client</strong></td>
<td>Coffey Geotechnics</td>
</tr>
<tr>
<td><strong>Project</strong></td>
<td>Dampier Cargo Berth Expansion Project</td>
</tr>
<tr>
<td><strong>Location</strong></td>
<td>Dampier, WA</td>
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<tr>
<td><strong>Sample No</strong></td>
<td>08-WG-8348</td>
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<tr>
<td><strong>Sample ID</strong></td>
<td>BH17 (8.3 - 8.8)</td>
</tr>
<tr>
<td><strong>Client Job No</strong></td>
<td>GEOTHERD08491AA</td>
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<tr>
<td><strong>Order No</strong></td>
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<tr>
<td><strong>Tested Date</strong></td>
<td>6/08/2008</td>
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<tr>
<td><strong>Location</strong></td>
<td></td>
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<tr>
<td><strong>Lab</strong></td>
<td>Welshpool</td>
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**DENSITY-POROSITY**

AS4133.2.1.2  buoyancy method

<table>
<thead>
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<th>Parameter</th>
<th>Value</th>
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<tbody>
<tr>
<td>Porosity (%)</td>
<td>34.2</td>
</tr>
<tr>
<td>Dry Density (t/m3)</td>
<td>1.788</td>
</tr>
</tbody>
</table>

Note: Sample supplied by client.
Client: Coffey Geotechnics
Project: Dampier Cargo Berth Expansion Project
Location: Dampier, WA
Sample No: 08-WG-8348
Sample ID: BH17 (8.3 - 8.8)

INITIAL SPECIMEN DETAILS
Core Diameter (mm): 82.9
Bulk Dry Density (t/m3): 1.722
Moisture Content (%): 17.9

UNIAXIAL COMpressive STRENGTH (MPa):
2.63

Deviation from Standard: Less than required minimum of 2.5
Deviation from Standard: Non-uniformity of sides exceeds limits of test method
Mode of Failure: Multiple Axial failures
Duration of Tests: 2.5 mins

Note: Sample supplied by client.
Bulk Density value was determined by the Calliper method
Tested on an hydraulic compression machine
POINT LOAD INDEX

AS4133.4.1

Test No.: [Blank]

Test Type: A

Platen Separation
D: [Blank]
Load at Failure
P: 2.9

UNCORRECTED POINT LOAD
STRENGTH Is (MPa): 0.88

CORRECTED POINT LOAD
STRENGTH Is (50) (MPa): 0.94

Load (kN): 2.9

Note: Sample supplied by client.
1. Test Types: D=Diametral  A=Axial  I=Irregular Lump  B=Block
2. Test Directions: 1=Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
## INDIRECT TENSILE STRENGTH

**ISRM Doc 8 Pt 2 (Brazil Method)**

<table>
<thead>
<tr>
<th>Core Size (mm)</th>
<th>PQ3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Initial Specimen Details</strong></td>
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<tr>
<td>Height / Diameter Ratio:</td>
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<tr>
<td>Bulk Dry Density (t/m³):</td>
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</tr>
<tr>
<td>Water Content (%):</td>
<td>20.3</td>
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<tr>
<td>Specimen Height (mm):</td>
<td>38</td>
</tr>
<tr>
<td>Specimen Diameter (mm):</td>
<td>83</td>
</tr>
</tbody>
</table>

**INDIRECT TENSILE STRENGTH (MPa):** 1.15

Note: Sample supplied by client.

Bulk Density Value was determined by the Calliper Method

Tested on an Hydraulic Compression Machine

---

Approved Signatory: (John Reid)  
Date: 12/08/2008

---

**Client:** Coffey Geotechnics  
**Project:** Dampier Cargo Berth Expansion Project  
**Location:** Dampier, WA

**Sample No:** 08-WG-8348  
**Sample ID:** BH17 (8.3 - 8.8)

**Client Job No:** GEOTHERD08491AA  
**Order No:**  
**Tested Date:** 5/08/2008

**WG Job Number:** 08-01-1408  
**Lab:** Welshpool

---

**Site No.:** 2411  
**Cert No.:** 08-WG-8348-R305  
**Page:** 1

---

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

---

**Western Geotechnics Group**  
PO Box 219 Bentley WA 6982  
36 Railway Parade  
Welshpool WA 6106

**perth@westerngeo.com.au**  
**ABN:** 91105324436  
**ph:** 1300 781744  
**fx:** (08) 9458 3700
CALCIUM CARBONATE CONTENT

WA915.1 (% soluble in HCl)

Calcium Carbonate Content (%)

77.3

Note: Sample supplied by client.

This report replaces INTERIM REPORT NUMBER: 08-WG-8348-S900_interim
POINT LOAD INDEX

AS4133.4.1

Test No.:

Test Type: A

Platen Separation

D:

Load at Failure

P: 1.0

UNCORRECTED POINT LOAD STRENGTH Is (MPa): 0.26

CORRECTED POINT LOAD STRENGTH Is (50) (MPa): 0.28

Load (kN): 1

Note: Sample supplied by client.
1. Test Types: D=Diametral  A= Axial  I=Irregular Lump  B= Block
2. Test Directions: 1= Perpendicular  2=Parallel (to planes of weakness)
3. Sample tested in "as received" condition.
Cerchar Abrasivity
Laboratory Certificates
## Dampier CERCHAR tests

**DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING**  
**UNIVERSITY OF MELBOURNE**  
**PARKVILLE VICTORIA 3010 AUSTRALIA**

**PROJECT:** Dampier Cargo Berth Expansion Project

<table>
<thead>
<tr>
<th>Borehole ID</th>
<th>Sample Depth : From</th>
<th>To</th>
<th>CERCHAR Abrasivity</th>
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</thead>
<tbody>
<tr>
<td>BH06</td>
<td>9.45</td>
<td>10.00</td>
<td>1.12</td>
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<tr>
<td>BH11</td>
<td>7.20</td>
<td>7.80</td>
<td>0.385</td>
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<tr>
<td>BH13</td>
<td>8.50</td>
<td>9.00</td>
<td>1.225</td>
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<td>BH15</td>
<td>7.35</td>
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<td>0.77</td>
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<td>BH05</td>
<td>3.00</td>
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<td>BH08</td>
<td>7.40</td>
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<td>BH09</td>
<td>9.50</td>
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<tr>
<td>BH17</td>
<td>5.00</td>
<td>5.60</td>
<td>2.135</td>
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</table>

30 July 2008
Petrography

Laboratory Report
Toby Whitnall
Coffey Geotechnics
23 Hasler Road,
Herdsman
Western Australia 6017
our Reference 22339

Your reference 120herd 2613

Preparation of three thin sections and petrographic descriptions of three drillcores

Roger Townend
SAMPLE BH 02 14.15-14.25

DRILL CORE coarse grain pink and white non foliated leucogranite

THIN SECTION

<table>
<thead>
<tr>
<th>Component</th>
<th>Composition</th>
</tr>
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<tbody>
<tr>
<td>PLAGIOCLASE/SERICITE</td>
<td>30-40%</td>
</tr>
<tr>
<td>POTASH FELDSPAR</td>
<td>30-40%</td>
</tr>
<tr>
<td>QUARTZ</td>
<td>20-30%</td>
</tr>
<tr>
<td>ALTERED MICA (SERICITE/CHLORITE/TITANIUM OXIDES)</td>
<td>&lt;5%</td>
</tr>
</tbody>
</table>

CLASSIFIED AS A SLIGHTLY ALTERED LEUCOGRANITE

The granite is essentially composed of two feldspar's and quartz. The texture is phanerocrystalline without preferred fabric. Grainsizes for feldspars average around 5 mm. The potash feldspar has a strong pink colour microscopically.

The leucogranite is also characterized by a corona texture, where a narrow rim of finely polycrystalline potash feldspar is attached to the two feldspar's. The quartz is slightly finer grained than the feldspars, in some polycrystalline areas showing irregular contacts. Otherwise the contact between feldspar and quartz are relatively smooth.

ALTERATION

The plagioclase feldspar which has variable polysynthetic non distorted twin development is always spotted by fine sericite. The potash feldspar is fresher but may be slightly altered. There are sub millimetre irregular patches of fine sercite/chlorite spotted with secondary titanium oxides. These represent former ferromagnesians silicates probably biotite.

SUMMARY

Although slightly altered, the leucogranite is regarded as a stable rock in situ, or is suitable for most aggregate purposes.

Roger Townend and Associates
SAMPLE BH 03 A  17.35-17.45

DRILL CORE       very weakly porphyritic grey granophyre

THIN SECTION

<table>
<thead>
<tr>
<th>Component</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLAGIOCLASE/SERICITE</td>
<td>30-40%</td>
</tr>
<tr>
<td>POTASH FELDSPAR</td>
<td>30-40%</td>
</tr>
<tr>
<td>QUARTZ</td>
<td>20-30%</td>
</tr>
<tr>
<td>OXIDE ORES</td>
<td>5%</td>
</tr>
<tr>
<td>CHLORITE</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>SERICITE</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>VEINS</td>
<td></td>
</tr>
<tr>
<td>EPIDOTE/SERICITE/CARBONATE</td>
<td></td>
</tr>
</tbody>
</table>

CLASSIFIED AS A PART ALTERED GRANITE GRANOPHYRE

The core contains very rare plagioclase phenocrysts, not present in the thin section. The texture is a uniform complex intergrowth of quartz and two feldspar's. This is a combination of subhedral sub millimetre part sericitised plagioclase feldspars, separated by granophyric intergrowths of quartz and potash feldspar. There are occasional pockets of non granophyric quartz.

ALTERATION

The former ferromagnesians silicates probably exceeding 5% are represented by palimpsests of linear arrangements of secondary fine oxides that are typically titanium with associated sericite and chlorite, possibly former amphibole based on the fresher material in drillcore BH 05.

The slide is crossed by a narrow but continuous vein of epidote, sericite and a little carbonate.

SUMMARY

Although altered, the granophyre is regarded as a stable rock in situ or is suitable for most aggregate purposes.
SAMPLE BH 05  9.43-9.53

DRILL CORE       porphyritic grey granophyre

THIN SECTION

<table>
<thead>
<tr>
<th>PHENOCRYSTS</th>
<th>5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLAGIOCLASE/SERICITE</td>
<td>50%</td>
</tr>
<tr>
<td>QUARTZ</td>
<td>50%</td>
</tr>
<tr>
<td>GROUNDMASS</td>
<td>95%</td>
</tr>
<tr>
<td>PLAGIOCLASE/SERICITE</td>
<td>30-40%</td>
</tr>
<tr>
<td>POTASH FELDSPAR</td>
<td>30-40%</td>
</tr>
<tr>
<td>QUARTZ</td>
<td>20-30%</td>
</tr>
<tr>
<td>OXIDE ORES</td>
<td>5%</td>
</tr>
<tr>
<td>CALCIUM AMPHIBOLE</td>
<td>&lt;5%</td>
</tr>
<tr>
<td>SAUSSURITE/CHLORITE/</td>
<td>&lt;5%</td>
</tr>
</tbody>
</table>

CLASSIFIED AS A PART ALTERED PORPHYRITIC GRANITE GRANOPHYRE

The drill core contains of occasional plagioclase and quartz phenocrysts of average 5 mm dimensions. The feldspar is quite sericitised. Both show anhedralism.

The dominant groundmass consists of some submillimetre altered plagioclases laths, but a dominant complex granophytic intergrowth of quartz and two feldspars particularly potash. There are occasional half millimetre non granophytic quartzes.

ALTERATION

The ferromagnesian content probably was dominated by a calcium amphibole, which is partly preserved as fines associated with chlorite/saussurite and extensive fine probable titanium rich oxides. These bodies may reach millimetre long dimensions.

SUMMARY

Although altered, the granophyre is regarded as a stable rock in situ or is suitable for most aggregate purposes.
**Potash feldspar**

**Altered mica**

**BH 02 14.15-25 LEUCOGRAINITE**

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**Quartz**

**BH 02 14.15-14.25 leucogranite showing feldspar rim to slightly altered plag.**

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**Client:** DAMPIER PORT AUTHORITY

**Project:** DAMPIER CARGO BERTH EXPANSION

**Location:** DAMPIER, WA

**Title:** PETROGRAPHIC PHOTOGRAPHS

**Project No:** GEOTHERD08401AA
BH 03 A 17.35 granophyre with quartz epidote vein

BH05 9.43 altered granophyre
BH 03A 17.35 granite granophyre