TR 29/96
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL DRILLING INVESTIGATION

Prepared For:
Westham Dredging Company Pty Ltd
and
Department of Transport and Works

Prepared By:
Acer Vaughan (Darwin) Pty Ltd
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GPO Box 2015
DARWIN NT 0801
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ISSUED: 29 AUG 1996
CONTENTS

1.0 INTRODUCTION 5

2.0 SCOPE OF INVESTIGATION 5
2.1 Objectives 5
2.2 Boreholes 5
2.3 Survey Methods 7
  2.3.1 Position 7
  2.3.2 Level 8
2.4 Laboratory Testing 8
  2.4.1 Unconfined Compressive Strength Tests 8
  2.4.2 Point Load Tests 9
2.5 Seismic Reflection Survey 10

3.0 INVESTIGATION FINDINGS 11
3.1 Walker Shoal 11
3.2 Subsurface Conditions 11
  3.2.1 Seabed Lithology 11
  3.2.2 Conglomerate 11
    3.2.2.1 Lithology 11
    3.2.2.2 Strength and Weathering 12
    3.2.2.3 Defects 12

4.0 CONCLUSION 13

5.0 REFERENCES

TABLES

Table 1. Summary of Drilling Results
Table 2. UCS vs Is (50) - Statistics Samples

FIGURES

Figure 1. Location Plan
Figure 2. Walker Shoal - P Is (50) vs N Is (50)
Figure 3. Walker Shoal - P Is (50) vs N Is (50)
Figure 4. Interpretative Summary of Point Load Strength Distribution in Boreholes
APPENDICES

Appendix A  Borelogs and Photographs
Appendix B  UCS Test Certificates and Photographs
OVERVIEW

This report represents a record of geological conditions encountered in diamond cored boreholes on Walker Shoal, East Arm Port.

It contains detailed borelogs and strength parameters obtained by Point Load tests, Unconfined Compressive Strength testing and geological interpretation.

Materials encountered during the drilling include seabed sediments (15%) and quartz conglomerate of the Burrell Creek Formation (85%).

The strength of the conglomerate is variable, depending on the degree of weathering and initial cementation.

Rock penetrated in the boreholes has been classified in terms of Point Load Strength (Is 50).

A (corrected) correlation Factor between UCS and Is (50) of 15.5 has been used for estimating conglomerate strength.
1.0 INTRODUCTION

In July 1996 Acer Vaughan (AV) was commissioned by the Westham Dredging Company Pty Ltd (WDC) to undertake a Geotechnical Investigation for Walker Shoal within the East Arm Port Area. Walker Shoal is a submarine topographical high which could endanger ship access to the new port structure. The commission was later extended to include additional boreholes for the Department of Transport and Works (DTW). The investigation entailed overwater diamond core drilling of the seabed and subsequent laboratory strength testing. During the investigation close liaison was maintained with the clients. Core samples, preliminary borelogs and test results were made available on completion of boreholes.

2.0 SCOPE OF INVESTIGATION

2.1 Objectives

The objectives of the Geotechnical Investigation were:

1. To evaluate geological conditions at borehole locations selected by the client/s, and from this;

2. Provide information to dredgers for preparation of cost estimates.

2.2 Boreholes

At the request of WDC initially five (5) boreholes were drilled. These are numbered BHs 36, 37, 38, 40 and 41 in this report.

After a further request by DTW three (3) additional boreholes (BHs 39, 42 and 43) were drilled, with BH39 at the outcrop of Walker Shoal and BHs 42 and 43 some 400 to 500m SE of Walker Shoal. From BHs 42 and 43, two transects were run by a diver to inspect and sample surface sediments.

Prior to the current investigation, in 1995, Borehole BH 8 had been drilled at the centre of Walker Shoal (See Acer Vaughan, 1995). Information from this borehole is incorporated in this report.

One (1) borehole (BH 41) was redrilled after the drilling platform tilted. The redrilled borehole was numbered BH 41A.
The total number of drilled boreholes comprising this investigation therefore was ten (10).

The locations of the 10 boreholes are shown in Figure 1 - Location Plan.

On completion of each borehole, the core boxes were transported to the Darwin Laboratory of CSR Readymix and detailed logs completed by Engineering Geologist Dr Bernd Weber. Suitable lengths of core were selected for testing at the above, NATA registered laboratory. Point Load testing was done during core logging. All remaining core is stored at the Department of Mines and Energy, Core Library, Darwin.

Borelogs and core photography are presented in Appendix A.

Due to the tidal range in Darwin Harbour, a jack-up platform was selected for borehole drilling. Drilling was carried out by White Drilling Pty Ltd using a Jacro 250 rotary drilling rig and seawater flush. A total length of 43.55m was drilled and details are contained in Table 1 - Summary of Drilling Results shown below.

**TABLE 1 Summary of Drilling Results**

<table>
<thead>
<tr>
<th>Borehole</th>
<th>Total Drilled (m)</th>
<th>Seabed Sediments (m)</th>
<th>Total Rock (m)</th>
<th>Lithology</th>
<th>Strengths Weathering (m)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>36</td>
<td>5.0</td>
<td>-</td>
<td>5.0 (4.5)x</td>
<td>Conglomerate (brecciated)</td>
<td>3.05</td>
<td>O/D 0.5</td>
</tr>
<tr>
<td>37</td>
<td>6.7</td>
<td>2.00</td>
<td>4.7 (3.2)</td>
<td>Conglomerate</td>
<td>2.00</td>
<td>O/D 1.2</td>
</tr>
<tr>
<td>38</td>
<td>5.65</td>
<td>0.20</td>
<td>5.45 (5.10)</td>
<td>Conglomerate</td>
<td>0.55</td>
<td>O/D 0.35</td>
</tr>
<tr>
<td>39</td>
<td>8.30</td>
<td>0</td>
<td>8.30 (7.20)</td>
<td>Conglomerate</td>
<td>0.30</td>
<td>O/D 1.10</td>
</tr>
<tr>
<td>40</td>
<td>6.00</td>
<td>1.00</td>
<td>5.00 (3.90)</td>
<td>Conglomerate</td>
<td>0.40</td>
<td>O/D 1.10</td>
</tr>
<tr>
<td>41</td>
<td>1.65</td>
<td>0.80</td>
<td>0.85</td>
<td>Conglomerate</td>
<td>0.425</td>
<td>U/D 2.55</td>
</tr>
</tbody>
</table>

(Platform Tilted)
### Table 1: Summary of Drilling Results (Cont.)

<table>
<thead>
<tr>
<th>Borehole</th>
<th>Total Drilled (m)</th>
<th>Seabed Sediments (m)</th>
<th>Total Rock (m)</th>
<th>Lithology</th>
<th>Strengths Weathering (m)</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>41A</td>
<td>5.20</td>
<td>0.20 GC?</td>
<td>5.00 (4.0)</td>
<td>Conglomerate</td>
<td>1 0.10 2 0.65 4 0.10 5 4.05 6 0.20</td>
<td>O/D 1.0</td>
</tr>
<tr>
<td>42</td>
<td>2.40</td>
<td>0.80 GC</td>
<td>1.6 (0.2)</td>
<td>Phyllite</td>
<td>1 0.10 2 0.10</td>
<td>O/D 1.4</td>
</tr>
<tr>
<td>43</td>
<td>2.55</td>
<td>1.20 GC</td>
<td>1.35 (0.0)</td>
<td>-</td>
<td>-</td>
<td>O/D 1.35</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>43.55</strong></td>
<td><strong>6.20</strong></td>
<td><strong>37.35</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Legend:**

- **x**: (4.5) Rock Thickness to Dredge Level
- **xx**: Core grinded
- **O/D**: Overdrilled
- **U/D**: Underdrilled

As in previous investigations in this vicinity carried out by **Acer Vaughan**, the drilling operations were designed to achieve optimum core recovery, and techniques included:

- use of HQ size triple and subsequently double core barrel;
- core runs initially limited to 0.5m;
- judicious application of hydraulic pressure on the drill string;
- use of diamond flat bits;
- continuous supervision by **Acer Vaughan** personnel with substantial experience in overwater drilling operations.

### 2.3 Survey Methods

#### 2.3.1 Position

Borehole positioning was carried out by **Hydrographic Surveys Pty Ltd** and overseen by a qualified Hydrographic Surveyor. Equipment included Trimble real time differential GPS with target software installed in a desk top computer with video screen display of user’s position. The GPS base station was set up in the site offices of **Westham Dredging Company** at a fixed point previously established during construction of the bund walls.
Locations were recorded in ATM co-ordinates and were later converted to Local Grid Co-ordinates.

2.3.2 Level

The level of the seabed relative to Australian Height Datum (AHD) was obtained as follows:

a) The water depth adjacent to the drill stem was measured by tape and the time and date noted.

b) A value of the tidal level above the zero of the tide gauge at Port Darwin was obtained by prediction using the Admiralty Tidal Programme and the determination of the level of the seabed relative to AHD calculated thus:

\[ \text{RL Seabed (AHD)} = \text{Observed Water Depth} @ \text{TO-Tide} @ \text{TO} + 3.962 \text{ metres.} \]

c) The tidal height was checked against the tide pole established adjacent to the site and/or the observed value at the Port Darwin tide gauge upon receipt of data, with further check being made against the post construction sounding data taken adjacent to the bund wall.

d) Accuracy of the data is +/-0.05 metres.

2.4 Laboratory Testing

Laboratory testing included;

- Unconfined Compression Tests; at the NATA registered laboratory of CSR Readymix, Darwin.
- Point Load Tests were carried out by the logging geologist.

2.4.1 Unconfined Compressive Strength Tests

Unconfined Compressive Strength Tests (UCS) were carried out on intact core pieces of sufficient length, according to ISRM suggested method specification. Some deviation became necessary due to the nature of the conglomerate texture. This included capping with sulphur (Calibrated at 60 MPa) and, occasionally, of reduced length/diameter ratio. (UCS tests on BH8 material were not capped and it is well possible that this has resulted in reduced strength values).
Two sub-core specimens were drilled out from BH8 HQ core samples measuring approximately 30mm (D) x 60 mm (L). These were capped and tested.

UCS tests are the primary rock parameter defining the dredgedibility characteristics, supported by the attitude, spacing, persistence and filling of defects.

Photographic records of core prior and after the tests have been kept and are shown together with UCS test certificates in Appendix B.

All test specimens were soaked in water for up to 24 hours before testing.

2.4.2 Point Load Testing

177 point Load Index tests (Is(50)) were performed on suitable core pieces recovered from the boreholes, comprising 110 “P - tests” (parallel with the core) and 66 “N - tests (normal with the core), one (lump) test on a quartz pebble. The testing was done in accordance with established practise. The testing machine used was a Geotechnical Systems Point Load Tester with a strain gauged load cell located on top of the platen and digital display read out. (The machine was hired from Western Geotechnics Pty Ltd, Perth).

Is(50) values were used to classify the rock strength and individual tests are plotted in the borelogs. The tested rock was essentially of the DW/SW/FR type classification of weathering. All specimens were soaked prior to testing.

N-tests are generally more difficult to perform than P-tests, mainly on account of shape and are very sensitive to testing length (D).

27 paired tests were used to check on core anisotrophy, Figure 2. A correlation factor of $P = 1.08 N$ was obtained. This is not very significant, but indicative that a slight bias is expressed by N-tests.

Failure mode was mainly vertical split across quartz pebbles and matrix, shear and tension or shattering. High strength rock characteristically produced rock noise before failing, in particular in BH39 and 41A. Rock with pre-existing defect was excluded, or rejected when evidence of the presence of defects was obtained after testing.

P-tests were used to correlate Is (50) with Unconfined Compressive Strength tests in accordance with procedures agreed with by the clients. The correlation was done on nominated tests as shown in Table 2.
This yields a correlation factor of 14.4, whilst a computer based correlation on all data yielded a practically equal correlation Factor (14.7), Figure 3. It was concluded that anisotropy could increase the correlation factor by 8% to a value of 15.5.

Worksheets of the Point Load testing are not included in this report but are retained by Acer Vaughan.

Table 2. UCS Vs Is (50) - Statistics Sample

<table>
<thead>
<tr>
<th>Borehole</th>
<th>Depth Range</th>
<th>UCS (Mpa)</th>
<th>Point Load Is 50</th>
<th>Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>1.0-2.4</td>
<td>33.4</td>
<td>5.2, 3.0, 2.6, 2.8, 2.3, 2.2, (3.02)</td>
<td>11.07</td>
</tr>
<tr>
<td>8</td>
<td>5.0-5.0</td>
<td>17.3</td>
<td>2.3, 1.05, 2.95, 2.8, (2.28)</td>
<td>7.6</td>
</tr>
<tr>
<td>8</td>
<td>5.0-5.70</td>
<td>22.0</td>
<td>1.15, 2.7, (1.93)</td>
<td>11.4</td>
</tr>
<tr>
<td>37</td>
<td>3.0-4.0</td>
<td>18.5</td>
<td>1.2, 0.45, 1.25, (0.97)</td>
<td>19</td>
</tr>
<tr>
<td>40</td>
<td>0-3.0</td>
<td>31.2, 59.6, 76.6, (55.8)</td>
<td>1.1, 2.05, 4.5, 0.9, 1.8, 4.0, 1.9, 3.8, 2.2, 1.7, (2.4)</td>
<td>23.3</td>
</tr>
<tr>
<td>40</td>
<td>3.0-6.0</td>
<td>51.8, 67.1, (59.45)</td>
<td>4.5, 3.5, 4.0, 5.0, 4.0, 1.05, 4.0, 4.0, 4.0, 2.9, 5.9, 2.9, 6.0, (3.98)</td>
<td>14.9</td>
</tr>
<tr>
<td>41</td>
<td>0-1.6</td>
<td>23.1, 26.1, (24.6)</td>
<td>2.0, 1.25, 2.7, (1.98)</td>
<td>12.4</td>
</tr>
<tr>
<td>41</td>
<td>2.4-3.3</td>
<td>36.9</td>
<td>1.4, 3.95, 1.8, 1.5, 1.45, (2.02)</td>
<td>18.3</td>
</tr>
<tr>
<td>41</td>
<td>3.7-5.0</td>
<td>69.7, 63.1, 56.1, (63.0)</td>
<td>4.5, 6.0, 5.5, 5.0, 6.0, (5.33)</td>
<td>11.8</td>
</tr>
</tbody>
</table>

2.5 Seismic Reflection Survey

In the Hydrosets 1995 Investigation (TR 02/94) a Seismic Reflection Survey was carried out but not completely covering Walker Shoal. The field track plot results were re-visited but could not be reliably interpreted to predict sea bed conditions due to a lack of coverage of the +12m CD contour.
3.0 INVESTIGATION FINDINGS

3.1 Walker Shoal

Walker Shoal is one of the submarine “inselbergs” dotting the East Arm. It consists of an oval shaped submarine ridge raising to about 15m above the southern flank of the Port access channel. Unlike other “inselbergs” like Catalina Island, Old Man Rock, etc, at 5m CD, Walker Shoal is permanently submerged.

3.2 Subsurface Conditions

3.2.1 Seabed Lithology

In the boreholes the seabed sediments account for about 15% of the penetrated lithology. They range in thickness from zero (BH39) to two (2) metres (BH37). The boreholes show the sediments to consist of relatively consolidated clayey gravel (GC) and gravelly clays (CH/CI). Similar sediment was sampled from two diver transects originating from boreholes 42 and 43 respectively. The recovered gravel showed a maximum size of 100mm consisting of angular quartz, flat shaped silicified phyllite, sandstone shell and coral set in medium coarse sand shell grit matrix. The composition and angularity of the pebbles would indicate a nearby phyllite provenance rather than conglomerate. The diver also reported boulders, or outcrop up to 600mm thick, which were too hard to break up. (We presume this refers to a quartz dyke).

3.2.2 Conglomerate

3.2.2.1 Lithology

Over the investigated area, conglomerate is virtually the only bedrock lithology. A tectonically emplaced phyllite lens was intersected in BH40. It is well possible that other lithologies such as sandstone and phyllite are present as discrete layers, or lenses but have not been intersected by the boreholes.

The conglomerate is generally of massive texture without showing bedding plane partings. However long axes of strained pebbles show a vertical attitude similar to the foliation in phyllite lithology and some joints may be considered as bedding and foliation plan partings. The conglomerate is monomictic in that it consists entirely of well rounded to sub-rounded quartz pebbles. Angular to sub-angular shaped pebbles occur within brecciation zones particularly in BH36 and 37. The rock is densely packed with pebbles accounting for up to 85% of the rock mass. They are set in a quartz-sandy, limonitic or haematitic matrix. Locally the conglomerate is intensely fractured and cut by disjointed...
quartz veins. Petrographic examination of thin sections was undertaken in BH 8 in Acer Vaughan 1995.

3.2.2.2 Strength and Weathering

Throughout the boreholes the conglomerate is found in various stages of weathering, which governs the compressive strength. The weathering ranges from extremely weathered rock disintegrating into "loose" pebbles to slightly weathered resonant core, which is hard to cut by masonry saw and slow to drill. Most of the core rock can be classified as distinctly weathered with converted UCS value ranging from 15 to 45 MPa. Maximum achieved unconfined compression is 76.3 Mpa in BH40 is "distinctly" weathered (DW) rock. (Fresh, very hard and strong massive conglomerate is exposed on Catalina Island).

The two undersized subcore specimens from BH8 yielded UCS of 36.6 and 38.0 Mpa (these have not been included for correlation purposes).

A break-up of strength grade, based on the interpretation of point load indices and visual inspection has been presented in Figure 4 (2, 3, 4). Because of the very limited sample size this should not be seen as being representative of the entire dredging area.

3.2.2.3 Defects

The core rock contains defects and has been broken along pre-existing joints and fractures. These are principally of the Class I (stepped rough) or Class VII (planer rough) type. Maximum spacing of 0.50m was measured in the boreholes. Few contain clay fillings. The majority is clean and tight.
4.0 CONCLUSION

Based on available borehole information, Walker Shoal is lithologically made up of quartz conglomerate. A rock strength classification of drill core has been made based on Point Load strength test data, (using a correlation factor of 15.5 to assess UCS) and visual inspection. The majority of core rock is in the high strength (Is (50) 1 to 3 MPa), with some rock falling into the very high range (Is (50) = 3 MPa plus). Maximum intact core length is 500mm.

Boreholes 42 and 43 are not located on Walker Shoal, and dredging is essentially in seabed sediments overlying extremely weathered phyllite, including cobbles and boulders or resistant rock up to 600mm based on a divers report.

Overall we do not have the expertise using the available strength data to:
- classify the rock into dredgeable units
- quantify these units into compartments
- determine a measure of abrasiveness, or quantitatively assess other properties of rock to match the capacity of the available dredge.

The available core presents only a very small sample of lithology, state of weathering or internal fracturing. Based on experience in the area the weathering patterns are likely to be very irregular extending deeper in some places than in others. Additional drilling is not likely to yield more conclusive information to justify the expense.

5.0 REFERENCES


LEVELS ADDED TO NAVILE 27.B.96 M.LW. CHART DATUM.

NOTE:
1. ALL LEVELS ARE NEGATIVE CHART DATUM.
Figure 2 - Walker Shoal - P Is(50) vs N Is(50)

\[ y = 1.08x \]
\[ R^2 = 0.6643 \]
Mean N = 2.55
Standard Dev. N = 1.75
Mean P = 3.50
Standard Dev. P = 1.87
Figure 3 - Walker Shoal - UCS vs P Is(50)

Unconfined Compressive Strength (MPa)

Point Load Index (I_is(50) MPa)

y = 14.735x
R² = -1.2049
Figure 4 - Interpretive Summary of Point Load Strength Distribution in Boreholes

1. Distribution of Lithology
   - Burrell Creek Formation 65%
   - Seabed Sediment 15%
   - N.C < 0.03 3%
   - 0.03 - 0.10 5%
   - 0.10 - 0.30 16%
   - 0.30 - 1.00 7%
   - 1.00 - 3.00 64%

2. Burrell Creek Formation (without BH8)
   - N.C < 0.03 3%
   - 0.03 - 0.10 5%
   - 0.10 - 0.30 16%
   - 0.30 - 1.00 7%
   - 1.00 - 3.00 64%

3. Burrell Creek Formation (including BH8)
   - N.C 2%
   - 0.03 - 0.10 5%
   - 0.10 - 0.30 13%
   - 0.30 - 1.00 10%
   - 1.00 - 3.00 65%
   - < 0.03 1%
   - 3.00 - 10.00 4%

4. Total (Burrell Creek Formation plus Seabed Sediment)
   - N.C 2%
   - Seabed Sediment 15%
   - 0.03 - 0.10 4%
   - 0.10 - 0.30 11%
   - 0.30 - 1.00 9%
   - 1.00 - 3.00 55%
   - 3.00 - 10.00 3%
   - < 0.03 1%
APPENDIX A

BORELOGS

AND

PHOTOGRAPHS
**CORED BOREHOLE LOG**

**PROJECT:** EAST ARM PORT  
**BOREHOLE No.:** 36  
**BOREHOLE LOCATION:** 7050.0E, 49710.0N  
**JOB No.:** AV1084

**DRILLING RIG:** JACRO  
**HOLE COMMENCED:** 10.07.96  
**ANGLE FROM HORIZONTAL:** 90°  
**HOLE COMPLETED:** 10.07.96  
**BEARING:**  
**SUPERVISED:** D.W.  
**R.L. SEALED:** -12.50m -8.50m  
**CHECKED BY:** B.W.  
**DATUM:** A.H.D. C.D.

<table>
<thead>
<tr>
<th>DESCRIPTION OF CORE</th>
<th>VERTICAL</th>
<th>ROCK STRENGTH (in psi)</th>
<th>DEFECT SPACING (in ft)</th>
<th>DESCRIPTION AND ORIENTATION OF ROCK DEFECTS AND COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
<td>10°, Class VIII, lime clay</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0°, fine clay (2x)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0°, Class I, silt clay (2x)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0°, Class I, extremely rough</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Sub-horizontal to horizontal</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>45°, grey clay 5mm</td>
</tr>
<tr>
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<td></td>
<td></td>
<td></td>
<td>45°, grey clay 5mm</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Note: Overconsolidated 0-3m</td>
</tr>
</tbody>
</table>

**WEATHERING (AS 1726-1993)**

- **Strength of core:**
  - CL - Extremely Low
  - OL - Extremely High
  - L - Low
  - M - Medium
  - H - High
  - I - Intermediate
- **Rock quality:**
  - RQD - Rock Quality Index

**WATER**

- Viscosity Index
- Water Level
- Compressibility
- Water Balance
- Partial Discharge

---

**Notes:**
- Overconsolidated 0-3m
- Angles from horizontal: 20°, 30°, 45°, 60°, 90°
- Drill rig: JACRO  
- Borehole location: 7050.0E, 49710.0N  
- Job No.: AV1084
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 1 OF 1
B.H. No.: 36 FROM: 0 m TO 5.00 m
SEABED LEVEL: -12.50 m A.H.D. -8.50 m C.D.
LOCAL CO-ORDINATES: E 7050.0 N 49710.0
# CORED BOREHOLE LOG

**PROJECT:** EAST ARM PORT  
**BOREHOLE No.:** 37  
**BOREHOLE LOCATION:** 7150.0E, 49675.0N  
**JOB No.:** AV1084

## Description of Core

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Type</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Loose gravel, corel</td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td>Gravel, max. 100mm, (GW quartzite), red-brown clay matrix, low plasticity</td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>Clay, red, stiff, fine-grit matrix</td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td>Conglomerate, grey, marbled brown, angular to sub-rounded pebbles of quartzite and quartzite, brecciated, brown limonitic matrix, sheared quartz veins, intensity micro-fractures, mostly healed by limonitic sandy matrix</td>
<td></td>
</tr>
</tbody>
</table>

## Rock Strength

<table>
<thead>
<tr>
<th>Deformation</th>
<th>Strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0.1 - 0.5</td>
</tr>
<tr>
<td>Medium</td>
<td>0.6 - 1.0</td>
</tr>
<tr>
<td>High</td>
<td>1.1 - 3.0</td>
</tr>
<tr>
<td>Very High</td>
<td>&gt; 3.0</td>
</tr>
</tbody>
</table>

## Defects

<table>
<thead>
<tr>
<th>Defect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quartz vein, sheared, 100mm, finally broken to pieces</td>
<td></td>
</tr>
<tr>
<td>35°, Class I</td>
<td></td>
</tr>
<tr>
<td>35°, Class I, 1-2mm clay</td>
<td></td>
</tr>
<tr>
<td>60°, 100mm gauge, clay and quartz</td>
<td></td>
</tr>
<tr>
<td>70°, gauge and clay</td>
<td></td>
</tr>
<tr>
<td>15°, Class VII</td>
<td></td>
</tr>
<tr>
<td>Quartz vein, 45°, 60mm</td>
<td></td>
</tr>
<tr>
<td>15°, Class I, clay mm</td>
<td></td>
</tr>
<tr>
<td>Very broken to pieces, clayey</td>
<td></td>
</tr>
<tr>
<td>45°, pe-st</td>
<td></td>
</tr>
<tr>
<td>25°, 20mm clay</td>
<td></td>
</tr>
<tr>
<td>60°, Class I, &lt;5mm clay</td>
<td></td>
</tr>
<tr>
<td>60°, Class I, &lt;5mm soft clay</td>
<td></td>
</tr>
<tr>
<td>60°, Class I, &lt;5mm clay</td>
<td></td>
</tr>
</tbody>
</table>

## Weathering (Las.1724-1939)

<table>
<thead>
<tr>
<th>Weathering Level</th>
<th>Strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>&gt; 3.0</td>
</tr>
<tr>
<td>Medium</td>
<td>1.1 - 3.0</td>
</tr>
<tr>
<td>Low</td>
<td>0.6 - 1.0</td>
</tr>
<tr>
<td>Very Low</td>
<td>0.1 - 0.5</td>
</tr>
</tbody>
</table>

## Water

- Water Level
- Water Below
- Core Sample Drilling
- Partial Drilling
- Water Level

## Notes

- Overworked 1.5m
- Hole terminated at 4.7m
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 1 OF 2
B.H. No.: 37 FROM: 0 m TO 5.00 m
SEABED LEVEL: -10.80 m A.H.D. -6.80 m C.D.
LOCAL CO-ORDINATES: E 7150.0 N 49675.0

EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 2 OF 2
B.H. No.: 37 FROM: 5.00 m TO 6.70 m
SEABED LEVEL: -10.80 m A.H.D. -6.80 m C.D.
LOCAL CO-ORDINATES: E 7150.0 N 49675.0
## CORED BOREHOLE LOG

**PROJECT:** EAST ARM PORT  
**BOREHOLE No:** 38  
**BOREHOLE LOCATION:** 7118.2E, 49639.5N

### General Information
- **DRILLING RIG:** JACRO
- **DRILLER:** WHITE DRILLING
- **BOREHOLE LOCATION:** 7118.2E, 49639.5N
- **HOLE COMMENCED:** 15.07.96
- **ANGLE FROM HORIZONTAL:** 90°
- **HOLE COMPLETED:** 16.07.96
- **BEARING:** -
- **SUPERVISED:** D.W.
- **R.L. SEALED:** -10.70m
- **DATUM:** A.H.D.

### Rock Description

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description</th>
<th>Water Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Loose pebbles, clayey matrix</td>
<td>-</td>
</tr>
<tr>
<td>0.5</td>
<td>Gravelly sandstone</td>
<td>-</td>
</tr>
<tr>
<td>1.0</td>
<td>Conglomerate, quartz pebbles, rounded to angular, max. size 25mm, limonitic quartz sandy matrix, microfractures</td>
<td>-</td>
</tr>
<tr>
<td>2.0</td>
<td>Loose pebbles, locally brecciated with angular and striated pebbles</td>
<td>-</td>
</tr>
</tbody>
</table>

### Weathering (15.17+9.19)

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Weathered</th>
<th>Unweathered</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gs - Gravel, Sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ds - Weathered</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fs - Fracture</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Rock Quality (RQD %)

<table>
<thead>
<tr>
<th>RQD %</th>
<th>Strength (K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-75</td>
<td>Very Poor (50-75)</td>
</tr>
<tr>
<td>75-90</td>
<td>Medium (75-90)</td>
</tr>
<tr>
<td>90-100</td>
<td>High (90-100)</td>
</tr>
</tbody>
</table>

### Water Location

<table>
<thead>
<tr>
<th>Water Level</th>
<th>Water Inflow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complete Drilling</td>
<td>100 % Water Return</td>
</tr>
<tr>
<td>Partial Drilling</td>
<td>Water Level</td>
</tr>
</tbody>
</table>

### Angle from Horizontal

<table>
<thead>
<tr>
<th>Angle (°)</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>90°</td>
<td>Vertical</td>
</tr>
</tbody>
</table>

### Tests

- **Note:** Hand sample cutting.
# Cored Borehole Log

## Project: East Arm Port

### Borehole No. 39

**Borehole Location:** 7060.1E, 49653.7N

**Drilling Rig:** Saco

**Driller:** White Drilling

**Drill Type & Length:** HD x 1.5m

**Bit Type:** Diamond

**Drilling Fluid:** Water

**Drill commenced:** 30.07.96

**Angle from horizontal:** 90°

**Drill completed:** 31.07.96

**Bearings:**

**Supervised:** D.W.

**R.L. Seabed:** -8.8m / -6.8m

**Checked by:** D.W.

**Datum:** A.H.D.

**C.D.**

## General Notes

**Description of Core:**

Consolidate, quartz pebbles (mammalian), rounded to angular, base size 25mm. Matrix/mammalian matrix, densely packed (65%).

**Weathering (AS 1726-1993):**

- Very broken
- Very weak
- Weak

**Sheared**

## Nature of Core

**Weathering:**

- Strong
- Moderate
- Weak

**Density:**

- Very High
- High
- Medium
- Low
- Very Low

**Texture:**

- Light gravel
- Heavy gravel
- Fine gravel

## Defect Spacing

### Water Level

- 100
- 20
- 5

### General

- 100
- 50
- 10

## Description and Orientation of Rock Defects and Comments

- Drilled in 1m thickness

### Notes

- Hard sample cutting, hard drilling

### Strength (SI Units - MPa)

- E - Elasticity
- V - Young's Modulus
- L - Low
- M - Medium
- H - High

### Rock Mass Index

- Good
- Very Good
- Poor

### Water

- Water level
- Groundwater Table
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 1 OF 2
B.H. No.: 39 FROM: 0 m TO 5.00 m
SEABED LEVEL: -8.8 m A.H.D. -4.8 m C.D.
LOCAL CO-ORDINATES: E 7060.1 N 49653.7

EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 2 OF 2
B.H. No.: 39 FROM: 5.00 m TO 8.30 m
SEABED LEVEL: -8.8 m A.H.D. -4.0 m C.D.
LOCAL CO-ORDINATES: E 7060.1 N 49653.7
**CORED BOREHOLE LOG**

**PROJECT:** EAST ARM PORT

**BOREHOLE LOCATION:** 7023.6E, 49671.4N

**BOREHOLE No.:** 40

**DRILLING RIG:** SACRO

**DRILLER:** WHITE DRILLING

**BARREL TYPE & LENGTH:** HD x 1.5m

**BIT TYPE:** DIAMOND

**DRILLING FLUID:** WATER

**HOLE COMMENCED:** 10.07.96

**HOLE COMPLETED:** 19.07.96

**ANGLE FROM HORIZONTAL:** 90°

**BEARING:** —

**SUPERVISED:** D.W.

**CHECKED BY:** B.W.

**RL. SEALED:** -11.10m -7.10m

**DATUM:** A.H.D. C.D.

### BOREHOLE LOCATION

- **BOREHOLE LOCATION:** 7023.6E, 49671.4N
- **HOLE COMMENCED:** 10.07.96
- **HOLE COMPLETED:** 19.07.96
- **ANGLE FROM HORIZONTAL:** 90°
- **BEARING:** —
- **SUPERVISED:** D.W.
- **CHECKED BY:** B.W.
- **RL. SEALED:** -11.10m -7.10m
- **DATUM:** A.H.D. C.D.

### DESCRIPTION OF CORE

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>ROCK STRENGTH (in 50)</th>
<th>Volume</th>
<th>DEFECT SPACING (mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### DEFECTS & COMMENTS

- **PEBBLES:** loose possibly set in clastic matrix, quartz, coarse, convoluted, angular, strong
- **CONGLOMERATE, monolithic:** quartz pebbles up to 6mm, rounded to sub-angular/angular, sandy matrix sheared, brecciated in places, densely packed, 80% clasts
- **80° quartz dyke, Steep**
- **Phyllite sheared, contorted, steep**
- **Abundant haematitic matrix**
- **Fault zone?**
- **Fault zone orientation**

### ROCK QUALITY DESIGNATION (RQD)

<table>
<thead>
<tr>
<th>RQD</th>
<th>Rock Quality Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>50-75</td>
<td>Very Poor</td>
<td>20-50 Poor</td>
</tr>
<tr>
<td>50-75</td>
<td>Fair</td>
<td>15-100 Good</td>
</tr>
<tr>
<td>0-5</td>
<td>Very Good</td>
<td></td>
</tr>
<tr>
<td>5-20</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>20-50</td>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>50-75</td>
<td>Excellent High</td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>Excellent High</td>
<td></td>
</tr>
</tbody>
</table>

### WEATHERING (AS 1726-1993)

1. **RESISTANT SCALES**
   - **RQD**
   - **VH**
   - **Vh**
   - **L**
   - **H**
   - **V**
   - **P**

2. **WEATHERED SCALES**
   - **W**
   - **Vw**
   - **Vw**
   - **L**
   - **H**
   - **V**

### ROCK MEANS DESIGNATION (RMSD)

<table>
<thead>
<tr>
<th>RMSD</th>
<th>Rock Means Designation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-75</td>
<td>Very Poor</td>
<td>20-50 Poor</td>
</tr>
<tr>
<td>50-75</td>
<td>Fair</td>
<td>15-100 Good</td>
</tr>
<tr>
<td>0-5</td>
<td>Very Good</td>
<td></td>
</tr>
<tr>
<td>5-20</td>
<td>Good</td>
<td></td>
</tr>
<tr>
<td>20-50</td>
<td>Excellent</td>
<td></td>
</tr>
<tr>
<td>50-75</td>
<td>Excellent High</td>
<td></td>
</tr>
<tr>
<td>&gt;50</td>
<td>Excellent High</td>
<td></td>
</tr>
</tbody>
</table>

### MATERIALS

- **Water Inflow**
- **Water Inundation**
- **Complete Drying**
- **Partial Drying**
- **Water Loss**
- **Salt Content**
- **Dissolved Salts**
- **Weathering Index**
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.O. CORE DRILLING: BOX 1 OF 2
B.H. No.: 40 FROM: 0 m TO 5.00 m
SEABED LEVEL: 11.10 m A.H.D. 7.10 m C.D.
LOCAL CO-ORDINATES: E 7023.6 N 49671.4

EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.O. CORE DRILLING: BOX 2 OF 2
B.H. No.: 40 FROM: 5.00 m TO 6.00 m
SEABED LEVEL: 11.10 m A.H.D. 7.10 m C.D.
LOCAL CO-ORDINATES: E 7023.6 N 49671.4
**CORED BOREHOLE LOG**

**PROJECT:** EAST ARM PORT

**BOREHOLE No. 41**

**BOREHOLE LOCATION:** 7108.6E, 49575.0N

<table>
<thead>
<tr>
<th>DESCRIPTION OF CORE:</th>
<th>VERT.</th>
<th>ROCK STRENGTH (KSI)</th>
<th>DEPTH (ft)</th>
<th>DEPTH SPACING (mm)</th>
<th>DESCRIPTION AND ORIENTATION OF ROCK DEFECTS AND COMMENTS</th>
<th>PARTICULAR</th>
<th>GENERAL</th>
<th>WATER</th>
<th>DURABILITY NO</th>
<th>R.D.</th>
<th>TESTS</th>
<th>METHOD</th>
<th>LABS</th>
</tr>
</thead>
</table>
| Core shell fragments, sandstone 
  Carbonate matrix broken away by 
  cycling fluids. | GC    |                     | 0.0        |                    |                                          |          |         |       |                |     |       |        |      |
| CONCRETATE, fine and pebby near 
  Bed, becoming larger sized with 
  depth up to 3m quartz, well 
  rounded to sub-angular. | DW    |                     | 1.0        |                    | Laminated surface (case hardened) | 75 [K], Class VII |     |          |       |                |     |       |        |      |
|                        |       |                     |            |                    | 85° [C], Class I | | | | | | | |

**WEATHERING (LS 1756-1993):**

- RS - Rockable Soft
- RV - Very Weathered
- W - Weathered
- V - Very Weak
- H - Hard
- M - Medium
- F - Fresh

**ROCK DUAL DENSITY (G/M3):**

- 3.75 Very Poor
- 5.50 Poor
- 7.75 Fair
- 9.50 Good

**STRENGTH (KSI) = MPa:**

- K - Extremely Low
- L - Low
- M - Medium
- H - High
- V - Very High
- VH - Extremely High

**WATER:**

- Water Below
- Water Level
- Complete Drilling 100% Water Return
- Partial Drilling Water Loss

**TESTS:**

- I - Tensiometer (MPa)
- S - Pressure Cell (MPa)
- L - Swell Test (MPa)
- R - Rock Unit Index
- G - GSI (Mueller Index)
- E - SPP (Shear Permeability)
- T - Tube Sample
- D - Displacement Sample
- F - Plugs in rocks
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 1 OF 1
B.H. No.: 41 FROM: 0 m TO 1.65 m
SEABED LEVEL: -11.8 m A.H.D. -7.8 m C.D.
LOCAL CO-ORDINATES: E 7108.6 N 49575.0
1.65 HOLE ABANDONED: JAMMED
**CORED BOREHOLE LOG**

**PROJECT:** EAST ARM PORT

**BOREHOLE LOCATION:** 7104.0E, 49571.5N

**BOREHOLE No. 41(A)**

**DRILLING RIG:** JACRO
**DRILLER:** WHITE DRILLING

**HOLE COMMENCED:** 23.07.96
**HOLE COMPLETED:** 24.07.96

**ANGLE FROM HORIZONTAL:** 90°
**BEARING:**

**DRILLING TYPE:** WHITE DRILLING
**SUPERVISED:** D.W.
**B.W.

**R.L. SEABED:** -11.80m -7.80m
**DATUM:** A.H.D.

**DESCRIPTION OF CORE:**

- Pebbles, loose
- Conglomerate, monomictic, quartz
  pebbles up to 50mm, rounded to sub-angular, some
  faceted, sandy matrix, density packed (80% pebbles),
  loose pebbles where XW.

**WEATHERING (AS.1/2/98):**

- Very fresh
- Extensive weathering
- Severe weathering

**STRENGTH (x 100) = MOD:**

- Weak
- Very weak
- Weak

**TESTS:**

- Hardness
- X-ray

**RIGS & BARS:**

- 0.35
- 0.01

**HOLE TERMINATED AT 5.2m**

- Very hard drilling
- Very hard core cutting

**DESCRIPTION AND ORIENTATION OF ROCK DEFEATS AND COMMENTS:**

- Very broken
- 90° Class I, hematite

**WATER:**

- Water Table
- Water Level
- Camera Drilling 100 % Water Return

**UNIT:**

- Water Flow
- Water Level

**METHOD:**

- Water Flow

---

**JOB No. AV1084**
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION
H.Q. CORE DRILLING: BOX 1 OF 2
B.H. No: 41A FROM: 0 m TO 5.00 m
SEABED LEVEL -11.8 m A.H.D. -7.8 m C.D.
LOCAL CO-ORDINATES: E 7104.0 N 49571.5

H.Q. CORE DRILLING: BOX 2
B.H. No: 41A FROM: 0 m TO 5.20 m
SEABED LEVEL -11.8 m A.H.D. -7.8 m C.D.
LOCAL CO-ORDINATES: E 7104.0 N 49571.5

B.H. 41A
5.00 - 5.20
BOX 2 of 2
(NO BOX)
B.H. TERMINATED
@ 5.20 m
**CORED BOREHOLE LOG**

**PROJECT:** EAST ARM PORT

**BOREHOLE LOCATION:** 7449.0E, 49167.1N

**BOREHOLE No. 42**

**DRILLING RIG:** JACRO

**DRILLER:** WHITE

**HOLE COMMENCED:** 8.05.96

**HOLE COMPLETED:** 8.05.96

**ANALYZE FROM HORIZONTAL:** 90°

**BEARING:**

**SUPERVISED:** D.W.

**R.L. SEABED:** -14.98m

**DATING:** A.H.D. C.O.

**LOCATION:** 7449.0E, 49167.1N

**DRILLING RIG:** JACRO

**DRILLER:** WHITE

**HOLE COMMENCED:** 8.05.96

**HOLE COMPLETED:** 8.05.96

**ANALYZE FROM HORIZONTAL:** 90°

**BEARING:**

**SUPERVISED:** D.W.

**R.L. SEABED:** -14.98m

**DATING:** A.H.D. C.O.

**LOCATION:** 7449.0E, 49167.1N

**BOREHOLE NO.** 42

**PAGE 1 OF 1**

**DESCRIPTION OF CORE:**

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>ROCK STRENGTH (%)</th>
<th>DESCRIPTION AND ORIENTATION OF ROCK DEFECTS AND COMMENTS</th>
<th>WATER</th>
<th>R.D.</th>
<th>TESTS</th>
</tr>
</thead>
</table>

**WEATHERING (AS 1726-1993):**

- **WEATHERING 15.1726-1993:**
  - **WEATHERING 15.1726-1993:**
  - **WEATHERING 15.1726-1993:**
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  - **WEATHERING 15.1726-1993:**
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  - **WEATHERING 15.1726-1993:**

**MATERIALS:**

- **MATERIALS:**
  - **MATERIALS:**
  - **MATERIALS:**
  - **MATERIALS:**
  - **MATERIALS:**
  - **MATERIALS:**
  - **MATERIALS:**
  - **MATERIALS:**

**DESCRIPTION:**

- **DESCRIPTION:**
  - **DESCRIPTION:**
  - **DESCRIPTION:**
  - **DESCRIPTION:**
  - **DESCRIPTION:**
  - **DESCRIPTION:**
  - **DESCRIPTION:**
  - **DESCRIPTION:**

**WATER:**

- **WATER:**
  - **WATER:**
  - **WATER:**
  - **WATER:**
  - **WATER:**
  - **WATER:**
  - **WATER:**
  - **WATER:**

**TESTS:**

- **TESTS:**
  - **TESTS:**
  - **TESTS:**
  - **TESTS:**
  - **TESTS:**
  - **TESTS:**
  - **TESTS:**
  - **TESTS:**
<table>
<thead>
<tr>
<th>Layer</th>
<th>Depth</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.0m</td>
<td>Sand</td>
</tr>
<tr>
<td>2</td>
<td>0.8m</td>
<td>Clay</td>
</tr>
<tr>
<td>3</td>
<td>2.4m</td>
<td>Sand</td>
</tr>
</tbody>
</table>

**EAST ARM PORT**
**WALKER SHOAL**
**GEOTECHNICAL INVESTIGATION**

**H.Q. CORE DRILLING:** BOX 1 OF 1

**B.H. No.:** 42
**FROM:** 0.0 m TO 2.4 m

**SEABED LEVEL:** -14.98 m A.H.D., -10.98 m C.D.

**LOCAL CO-ORDINATES:** E 7449.0 N 49167.1
**Cored Borehole Log**

**Project:** East Arm Port  
**Borehole No.:** 43  
**Job No.:** AV1084

**Borehole Location:** 7093.5E, 49041.7N

**Drilling Rig:** Jacru  
**Driller:** White Drilling  
**Supervised by:** D.W.

**Hole Commenced:** 9.08.96  
**Hole Completed:** 9.08.96  
**Angle from Horizontal:** 97°

**Barrel Type & Length:** HQ (15m)  
**Bit Type:** Diamond

**Drilling Fluid:** Water  
**Datum:** A.H.D. R.L. seabed -14.80m -10.80m

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Description of Core</th>
<th>Defect Spacing (mm)</th>
<th>Description and Orientation of Rock Defects and Comments</th>
<th>Water</th>
<th>Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>Gravel, loose, angular</td>
<td>15</td>
<td>Fissure 45° Clastic fill, very broken plane partings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3</td>
<td>Gravel, angular sub-rounded quartz, max. size 80mm, clay at bottom</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.0</td>
<td>Phyllite, green-gray, yellow clay, foliated, foliated</td>
<td>50</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.5</td>
<td>Hole terminated at 2.55m</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Weathering (AS 1776-1993):**

<table>
<thead>
<tr>
<th>Rock Type</th>
<th>Key</th>
<th>Degree of Weathering</th>
</tr>
</thead>
<tbody>
<tr>
<td>HS - Hardened</td>
<td></td>
<td>Extreme Weathered</td>
</tr>
<tr>
<td>D - Diffracted</td>
<td></td>
<td>Highly Weathered</td>
</tr>
<tr>
<td>W - Washed</td>
<td></td>
<td>Weathered</td>
</tr>
</tbody>
</table>

**Rock Quality Design (RQD):**

<table>
<thead>
<tr>
<th>Degree</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 - 15</td>
<td>Poor</td>
</tr>
<tr>
<td>16 - 25</td>
<td>Fair</td>
</tr>
<tr>
<td>26 - 75</td>
<td>Good</td>
</tr>
<tr>
<td>76 - 100</td>
<td>Excellent</td>
</tr>
</tbody>
</table>

**Strength (as (MPa)):**

<table>
<thead>
<tr>
<th>Strength</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.05</td>
<td>Very Low</td>
</tr>
<tr>
<td>0.15</td>
<td>Low</td>
</tr>
<tr>
<td>0.25</td>
<td>Medium</td>
</tr>
<tr>
<td>0.35</td>
<td>High</td>
</tr>
<tr>
<td>0.5</td>
<td>Very High</td>
</tr>
<tr>
<td>&gt; 0.75</td>
<td>Extreme High</td>
</tr>
</tbody>
</table>

**Water Tests:**

<table>
<thead>
<tr>
<th>Test</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Filterable Material (MM)</td>
</tr>
<tr>
<td>PT</td>
<td>Permeability Test (MPa)</td>
</tr>
<tr>
<td>UCS</td>
<td>Unconfined Compressive Strength (MPa)</td>
</tr>
<tr>
<td>L</td>
<td>Load Test (GPa)</td>
</tr>
<tr>
<td>P</td>
<td>Point Load Index</td>
</tr>
<tr>
<td>N</td>
<td>N-value (N/mm2)</td>
</tr>
<tr>
<td>C</td>
<td>Compressive Test</td>
</tr>
</tbody>
</table>
EAST ARM PORT
WALKER SHOAL
GEOTECHNICAL INVESTIGATION

H.Q. CORE DRILLING: BOX 1 OF 1
B.H. No.: 43 FROM 0.0 m TO 255 m
SEABED LEVEL: -14.80 m A.H.D. -10.80 m C.D.
LOCAL CO-ORDINATES: E 7093.5 N 49041.7
## CORED BOREREHOLE LOG

### PROJECT: EAST ARM PORT

#### BOREHOLE No. 8(H)

#### BOREHOLE LOCATION:

- **DRILLING RIG**: Jacro
- **DRILLED**: White Drilling
- **BARREL TYPE & LENGTH**: HD x 15m
- **BIT TYPE**: Diamond
- **DRILLING FLUID**: Water
- **HOLE COMMENCED**: 7.04.96
- **HOLE COMPLETED**: 7.04.96
- **SUPERVISED**: D.W.
- **CHECKED BY**: B.W.

#### Description of Core:

<table>
<thead>
<tr>
<th>Depth (m)</th>
<th>Rock Strength (MPa)</th>
<th>Defect Spacing (mm)</th>
<th>Description and Orientation of Rock Defects and Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td>0.0</td>
<td></td>
<td>Joints very rough with some clay, mostly sub-horizontal, very hard drilling (60°)</td>
</tr>
<tr>
<td>1.0</td>
<td>0.0</td>
<td></td>
<td>Intersecting joints 90°/10°</td>
</tr>
<tr>
<td>2.0</td>
<td>0.0</td>
<td></td>
<td>30°, 40°</td>
</tr>
<tr>
<td>3.0</td>
<td>0.0</td>
<td></td>
<td>Very broken along intersecting joints</td>
</tr>
<tr>
<td>4.0</td>
<td>0.0</td>
<td></td>
<td>Very broken intersecting joints and fractures</td>
</tr>
<tr>
<td>5.0</td>
<td>0.0</td>
<td></td>
<td>Very broken</td>
</tr>
<tr>
<td>6.0</td>
<td>0.0</td>
<td></td>
<td>35°, sub-horizontal cracks, Fe-st 12°</td>
</tr>
<tr>
<td>7.0</td>
<td>0.0</td>
<td></td>
<td>Sub-horizontal sample (60mm x 30mm)</td>
</tr>
</tbody>
</table>

#### Weathering (AS:1724-1999)

- **S1**: Very Poor 30-50 Poor
- **S2**: Poor 15-30 Poor
- **S3**: Medium 5-15 Medium
- **S4**: Good 0-5 Good

#### Water Table

- **Water Level**: Below Water Level
- **Condenser Drilling**: 30% Water Return
- **Percussion Drilling**: Water Level

#### Notes

- **DATE**: 11.05.96
- **B.D.A.:** 7.50m
- **R.I.:** 8.00m
- **R.L.**: -8.00m
- **A.H.D.**: 7.50m
- **STRENGTH**: VH
- **DURATION**: 8.00m
- **DRAUGHT**: -8.00m
- **D.W.**
- **C.D.**

#### Core Sample

- **Description**: Subcored sample 60mm x 30mm
EAST ARM PORT
GEOTECHNICAL INVESTIGATION OF ALTERNATIVE DEVELOPMENT STAGE IA
INCLUDING LONG TERM ALTERNATIVE MASTER PLAN

H.Q. CORE DRILLING: BOX 1 OF 2
B.H. No.: 8(H) FROM: 0.00 M TO 5.00 M
SEABED LEVEL: -8.00 M A.H.D. -4.00 CD
LOCAL CO-ORDINATES: 7064.68 E 49669.01 N

EAST ARM PORT
GEOTECHNICAL INVESTIGATION OF ALTERNATIVE DEVELOPMENT STAGE IA
INCLUDING LONG TERM ALTERNATIVE MASTER PLAN

H.Q. CORE DRILLING: BOX 2 OF 2
B.H. No.: 8(H) FROM: 5.00 M TO 5.70 M
SEABED LEVEL: -8.00 M A.H.D. -4.00 CD
LOCAL CO-ORDINATES: 7064.68 E 49669.01 N
APPENDIX B

UCS TEST CERTIFICATES

AND

PHOTOGRAPHS
### UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**
3 Snell St, Winnellie NT 0810

**Telephone** (089) 817944  
**Facsimile** (089) 817625

---

**CLIENT:** ACER VAUGHAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT  
**SAMPLE LOCATION:** BOREHOLE #37 3.30 TO 3.42 m

---

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1490</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>26</td>
</tr>
<tr>
<td>Sample Diameter (mm)</td>
<td>60.9</td>
</tr>
<tr>
<td>Sample Height (mm)</td>
<td>119</td>
</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>18.5</td>
</tr>
<tr>
<td>Test Duration (min)</td>
<td>6</td>
</tr>
<tr>
<td>Applied Stress Rate (MPa/min)</td>
<td>3</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

### Core Structure Before Testing
Refer Photo

### Core Fractures After Testing
Refer Photo

---

**Remarks:** Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part I

---

**Authorised Signatory:**

E.P. HILL
Note:  Pre-existing Fractures.

Failure:  Multiple Shear Along Pre-Existing Fractures.
UCS 18.5 MPa.
## UNIAXIAL COMPRESSION STRENGTH TEST REPORT

### CLIENT: ACER VAUGHN
CAVENAUGH ST.
DARWIN NT

### PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38 0.28 TO 0.39 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1478</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>14</td>
</tr>
<tr>
<td>Sample Diameter (mm)</td>
<td>60.7</td>
</tr>
<tr>
<td>Sample Height (mm)</td>
<td>116</td>
</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>18.8</td>
</tr>
<tr>
<td>Test Duration (min)</td>
<td>9</td>
</tr>
<tr>
<td>Applied Stress Rate (MPa/min)</td>
<td>2</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

### Core Structure Before Testing
Refer Photo

### Core Fractures After Testing
Refer Photo

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signature:**

E.P. HILL
RM 1478
BH 38
0.28-0.39
BEFORE UCS

Note: Edge Defects.

RM 1478
BH 38
0.28-0.39
BEFORE UCS

Failure: Multiple Shear.
UCS 18.8 MPa.
# UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Testing Laboratory  
3 Snell St. Winnellie NT 0810

Telephone: (089) 817944  
Facsimile: (089) 817625

CLIENT: ACER VAUGHAN  
CAVENAUGH ST.  
DARWIN NT

PROJECT: EAST ARM PORT PROJECT  
SAMPLE LOCATION: BOREHOLE #38  1.06 TO 1.14 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Sample Date</th>
<th>Test Date</th>
<th>Specimen Number</th>
<th>Sample Diameter (mm)</th>
<th>Sample Height (mm)</th>
<th>Compressive Strength (MPa)</th>
<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
<th>Mode of Failure</th>
<th>Testing Machine Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1487</td>
<td>N/S</td>
<td>02/08/96</td>
<td>23</td>
<td>60.5</td>
<td>83</td>
<td>36.9</td>
<td>8</td>
<td>5</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing

Refer Photo

Core Fractures After Testing

Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signatory:  
E.P. HILL
Note: Sound Specimen.

Failure: Multiple Shear.
UCS 36.9 MPa.
UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

REPORT NO: RM1479
REPORT DATE: 07/08/96

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38 2.18 TO 2.29 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1479</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>15</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>(mm) 60.8</td>
</tr>
<tr>
<td>Sample Height</td>
<td>(mm) 108</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>(MPa) 29.4</td>
</tr>
<tr>
<td>Test Duration</td>
<td>(min) 7</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>(MPa/min) 4</td>
</tr>
<tr>
<td>Water Content</td>
<td>(%) -</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>(%) Saturated</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signature:

E.P. HILL
Note: Pre-existing Cracks.

Failure: Multiple Shear Along Existing Cracks. UCS 29.4 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

Testing Laboratory:
3 Snell St. Winnellie NT 0810

Telephone  (089) 817944
Facsimile  (089) 817625

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38  2.40 TO 2.50 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1480</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>16</td>
</tr>
<tr>
<td>Sample Diameter (mm)</td>
<td>60.7</td>
</tr>
<tr>
<td>Sample Height (mm)</td>
<td>96</td>
</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>52.2</td>
</tr>
<tr>
<td>Test Duration (min)</td>
<td>9</td>
</tr>
<tr>
<td>Applied Stress Rate (MPa/min)</td>
<td>6</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorized Signatory:

E.P. HILL
Note: Existing Cracks.

Failure: Shear 45°, Foliation 85° Existing Cracks Did Not Fail. UCS 52.2 MPa.
## UNIAXIAL COMPRESSION TEST REPORT

### CLIENT: ACER VAUGNAN
**CAVENAUGH ST.**
**DARWIN NT**

### PROJECT: EAST ARM PORT PROJECT
**SAMPLE LOCATION: BOREHOLE #38 2.55 TO 2.67 m**

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1481</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>17</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>60.8  (mm)</td>
</tr>
<tr>
<td>Sample Height</td>
<td>124 (mm)</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>61.3 (MPa)</td>
</tr>
<tr>
<td>Test Duration</td>
<td>10 (min)</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>6 (MPa/min)</td>
</tr>
<tr>
<td>Water Content</td>
<td>- (%)</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>Saturated (%)</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

### Core Structure Before Testing
Refer Photo

### Core Fractures After Testing
Refer Photo

**Remarks:** Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

**Authorised Signatory:**

E.P. HILL
Note: Microfractures.

Failure: Multiple Shear (80°). Local Shear. UCS 61.3 MPa.
<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Sample Date</th>
<th>Test Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1482</td>
<td>N/S</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>(mm)</td>
<td>18</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>(mm)</td>
<td>60.7</td>
</tr>
<tr>
<td>Sample Height</td>
<td>(mm)</td>
<td>110</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>(MPa)</td>
<td>58.0</td>
</tr>
<tr>
<td>Test Duration</td>
<td>(min)</td>
<td>11</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>(MPa/min)</td>
<td>5</td>
</tr>
<tr>
<td>Water Content</td>
<td>(%)</td>
<td>-</td>
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<tr>
<td>Degree of saturation</td>
<td>(%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td></td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td></td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Core Structure Before Testing**
Refer Photo

**Core Fractures After Testing**
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signatory:

E.P. Hill
RM 1482
BH 38
2-80-2-91
BEFORE
UCS

Note: Sound Core.

Failure: Internal Cracking.
UCS 58.0 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38 3.17 TO 3.27 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1483</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>19</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>60.2 mm</td>
</tr>
<tr>
<td>Sample Height</td>
<td>98 mm</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>59.7 MPa</td>
</tr>
<tr>
<td>Test Duration</td>
<td>10 min</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>6 MPa/min</td>
</tr>
<tr>
<td>Water Content</td>
<td>(%)</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>(Saturated)</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signatory:
E.P. HILL
Note: Intact Core.

Failure: Multiple Shear.
UCS 59.7 MPa.
UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Wannellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38 3.40 TO 3.50 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1484</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
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<tr>
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<tr>
<td>Specimen Number</td>
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<td>Sample Diameter</td>
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<tr>
<td>Sample Height</td>
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<td>Compressive Strength</td>
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<tr>
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<td>Applied Stress Rate</td>
<td>5 (MPa/min)</td>
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<tr>
<td>Water Content</td>
<td>- (MPa/min)</td>
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<tr>
<td>Degree of saturation</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing

Refer Photo

Core Fractures After Testing

Refer Photo

Remarks: Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

Authorised Signatory:

[Signature]

E.P. HILL
Note: Fractured Core.

Failure: Multiple Shear.
UCS 63.1 MPa.
## UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**  
3 Snell St, Winnellie NT 0810

**Telephone** (089) 817944  
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGHAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT

**SAMPLE LOCATION:** BOREHOLE #38 3.77 TO 3.89 m

### Sample Test Results

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1485</th>
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</tr>
<tr>
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<td>Sample Diameter (mm)</td>
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<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

### Core Structures

- **Core Structure Before Testing:** Refer Photo
- **Core Fractures After Testing:** Refer Photo

### Remarks

Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

**Authorised Signatory:**  
E.P. HILL
Note: Cracks In Intact Core.

Failure: Multiple Shear Along Existing Cracks. UCS 40.4 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38 4.50 TO 4.50 m

<table>
<thead>
<tr>
<th>Sample Number</th>
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<tbody>
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<td>Sample Date</td>
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</tr>
<tr>
<td>Specimen Number</td>
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<tr>
<td>Sample Diameter (mm)</td>
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<td>Sample Height (mm)</td>
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<td>48.6</td>
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<tr>
<td>Test Duration (min)</td>
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</tr>
<tr>
<td>Applied Stress Rate (MPa/min)</td>
<td>5</td>
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<tr>
<td>Water Content (%)</td>
<td>-</td>
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<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

[Core Structure Before Testing: Refer Photo]
[Core Fractures After Testing: Refer Photo]

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorized Signatory: E.P. HILL
Note: Healed Fractures.

Failure: Shear Not Affected By Existing Cracks.
UCS 48.6 MPa.
## UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

### Testing Laboratory
3 Snell St. Winnellie NT 0810

**Telephone:** (089) 817944  
**Facsimile:** (089) 817625

### Client:
**ACER VAUGHAN**  
**Cavenough St.**  
**Darwin NT**

### Project:
**East Arm Port Project**

### Sample Location:
**Borehole #38 5.42 to 5.53 m**

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Sample Date</th>
<th>Test Date</th>
<th>Specimen Number</th>
<th>Sample Diameter (mm)</th>
<th>Sample Height (mm)</th>
<th>Compressive Strength (MPa)</th>
<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
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<th>Testing Machine Used</th>
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<td>4</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
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</tbody>
</table>

### Core Structure Before Testing
Refer Photo

### Core Fractures After Testing
Refer Photo

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signature:**

E.P. HILL
Note: Existing Fractures.

Failure: 60° Shear Along Existing Fractures.
UCS 38.3 MPa.
UNIAXIAL COMPRRESSIVE STRENGTH TEST REPORT

Testing Laboratory
3 Stnell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #38 5.30 TO 5.42 m

<table>
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<tbody>
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<tr>
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<td>02/08/96</td>
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<td>Specimen Number</td>
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<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
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</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signatory:

E.P. HILL
Note: 85° Fracture (through-going).

Failure: 80° Shear. Not Along The Existing Fractures. UCS 56.9 MPa.(!)
## UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**
3 Stell St. Winnellie NT 0810

**Telephone** (089) 817944  
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGHAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT
**SAMPLE LOCATION:** BOREHOLE #39 1.26 TO 1.38 m

<table>
<thead>
<tr>
<th>Sample Number</th>
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<th>Specimen Number</th>
<th>Sample Diameter (mm)</th>
<th>Sample Height (mm)</th>
<th>Compressive Strength (MPa)</th>
<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
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<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
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</table>

**Core Structure Before Testing**
*Refer Photo*

**Core Fractures After Testing**
*Refer Photo*

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signatory:**

E.P. HILL
Note: Existing Fractures.

Failure: Existing Fracture - Multiple Shear.
UCS 43.6 MPa.
UNIAXIAL COMPRESSION
STRENGTH TEST REPORT

Testing Laboratory
3 Snell St, Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #39 2.08 TO 2.18 m

<table>
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<td>Sample Diameter</td>
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<td>Sample Height</td>
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<td>(MPa) 27.7</td>
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<td>Test Duration</td>
<td>(min) 10</td>
</tr>
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<td>Applied Stress Rate</td>
<td>(MPa/min) 3</td>
</tr>
<tr>
<td>Water Content</td>
<td>(%) -</td>
</tr>
<tr>
<td>Degree of saturation</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
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</table>

Core Structure Before Testing

Refer Photo

Core Fractures After Testing

Refer Photo

Remarks: Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

Authorised Signatory:

E.P. HILL
Note: Edge Breaking During Cutting.

Failure: Multiple Shear - Shattering.
UCS 27.7 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #39 3.40 TO 3.53 m

<table>
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<th>Sample Height (mm)</th>
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<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
<th>Mode of Failure</th>
<th>Testing Machine Used</th>
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<td>Test Date</td>
<td>Specimen Number</td>
<td>Sample Diameter (mm)</td>
<td>Sample Height (mm)</td>
<td>Compressive Strength (MPa)</td>
<td>Test Duration (min)</td>
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<td>5</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

Authorised Signatory:

E.P. HILL
Note: Microfracturing.

Failure: Multiple Shear.
UCS 45.4 MPa.
# UNIAXIAL COMPRRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**  
3 Snell St, Winnellie NT 0810

**Telephone** (089) 817944  
**Facsimile** (089) 817625

**CLIENT**: ACER VAUGHAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT**: EAST ARM PORT PROJECT  
**SAMPLE LOCATION**: BOREHOLE #39 3.80 TO 3.93 m

**REPORT NO**: RM1504  
**PAGE 1 OF 1**  
**REPORT DATE**: 07/08/96

<table>
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<th>Specimen Number</th>
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<th>Sample Height (mm)</th>
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<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
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<td>6</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Core Structure Before Testing**  
Refer Photo

**Core Fractures After Testing**  
Refer Photo

**Remarks**: Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

**Authorised Signatory**:  
E.P. HILL
Note: Microfracturing.

Failure: Multiple Shear - Shattering. 
UCS 60.7 MPa.
### UNIAXIAL COMpressive STRENGTH TEST REPORT

**Testing Laboratory**
3 Snell St, Winnellie NT 0810

**Telephone** (089) 817944
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT
**SAMPLE LOCATION:** BOREHOLE #39 4.38 TO 4.49 m

**REPORT NO:** RM1503
**REPORT DATE:** 07/08/96

<table>
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<th>Test Date</th>
<th>Specimen Number</th>
<th>Sample Diameter (mm)</th>
<th>Sample Height (mm)</th>
<th>Compressive Strength (MPa)</th>
<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
<th>Mode of Failure</th>
<th>Testing Machine Used</th>
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<tbody>
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<td>5</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Core Structure Before Testing**

Refer Photo

**Core Fractures After Testing**

Refer Photo

**Authorised Signature:**
E.P. HILL
RM 1503
BH 39
4.38 - 4.49
BEFORE
UCS

Note : Microfracturing.

Failure : Multiple Shear.
UCS 49.4 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #39 4.84 TO 4.96 m

<table>
<thead>
<tr>
<th>Sample Number</th>
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<tr>
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<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
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</tr>
<tr>
<td>Sample Diameter (mm)</td>
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<tr>
<td>Sample Height (mm)</td>
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</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>62.5</td>
</tr>
<tr>
<td>Test Duration (min)</td>
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<tr>
<td>Applied Stress Rate (MPa/min)</td>
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<tr>
<td>Water Content (%)</td>
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</tr>
<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
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</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

E.P. HILL

Authorised Signatory:
Note: Soundness Of Core.

Failure: Local Shear.
UCS 62.5 MPa.
UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone  (089) 817944
Facsimile (089) 817623

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #39  5.16 TO 5.27 m

<table>
<thead>
<tr>
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<tbody>
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<td>Specimen Number</td>
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<tr>
<td>Sample Diameter</td>
<td>62.9</td>
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<tr>
<td>Sample Height</td>
<td>122</td>
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<tr>
<td>Compressive Strength</td>
<td>31.8</td>
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<tr>
<td>Test Duration</td>
<td>10</td>
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<tr>
<td>Applied Stress Rate</td>
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<td>Water Content</td>
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<tr>
<td>Degree of saturation</td>
<td>Saturated</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

Authorised Signatory:

E.P. HILL
Note: Existing Fractures.

Failure: Multiple Tension Cracks.
UCS 31.8 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

Testing Laboratory
3 Snell St, Wannellie NT 0810

TElephone (089) 817944
Faximile (089) 817625

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #39 5.37 TO 5.49 m

<table>
<thead>
<tr>
<th>Sample Number</th>
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</tr>
<tr>
<td>Specimen Number</td>
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<tr>
<td>Sample Diameter</td>
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<td>39.3</td>
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<td>Test Duration</td>
<td>7</td>
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<tr>
<td>Applied Stress Rate</td>
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<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
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</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorized Signatory:

E.P. HILL
Note: Existing Cracks.

Failure: 75° Shear.
UCS 39.3 MPa.
# UNIAXIAL COMpressive Strength Test Report

**Testing Laboratory**
3 Steel St, Winnellie NT 0810

**Telephone** (089) 817544
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT  
**SAMPLE LOCATION:** BOREHOLE #39 7.19 TO 7.30 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1501</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>29</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>63.1 (mm)</td>
</tr>
<tr>
<td>Sample Height</td>
<td>112 (mm)</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>42.3 (MPa)</td>
</tr>
<tr>
<td>Test Duration</td>
<td>7 (min)</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>6 (MPa/min)</td>
</tr>
<tr>
<td>Water Content</td>
<td>- percentage</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Core Structure Before Testing**
Refer Photo

**Core Fractures After Testing**
Refer Photo

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signatory:**

E.P. HILL
Note: Pre-Existing Cracks.

Failure: Multiple Shear.
UCS 42.3 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #40 1.60 TO 1.71 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1466</th>
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<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>2</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>(mm) 62.9</td>
</tr>
<tr>
<td>Sample Height</td>
<td>(mm) 103</td>
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<tr>
<td>Compressive Strength</td>
<td>(MPa) 31.2</td>
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<tr>
<td>Test Duration</td>
<td>(min) 5</td>
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<tr>
<td>Applied Stress Rate</td>
<td>MPa/min) 6</td>
</tr>
<tr>
<td>Water Content</td>
<td>(%) -</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>(%) Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signatory: E.P.HILL

CSR Readymix Pty. Ltd.
A.C.N. 003 747 822
A unit of CSR Limited
Northern Territory Administration
5/17 Lindsay Street
Darwin NT 0800
PO Box 39351
Winnellie NT 0821
Telephone (089) 41 2906
Facsimile (089) 41 2942

REPORT NO: RM1466
PAGE 1 OF 1

REPORT DATE: 07/08/96
Note: Shear Zone.

Failure: Along Shear Zone.
UCS 31.2 MPa.
### UNIAXIAL COMpressive STRENGTH TEST REPORT

**Testing Laboratory**
3 Snell St. Winnellie NT 0810

**Telephone** (089) 817944
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT
**SAMPLE LOCATION:** BOREHOLE #40 2.67 TO 2.80 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1467</th>
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</thead>
<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
</tbody>
</table>

| Specimen Number | 3 |
| Sample Diameter (mm) | 63.0 |
| Sample Height (mm)  | 132 |
| Compressive Strength (MPa) | 59.6 |
| Test Duration (min) | 14 |
| Applied Stress Rate (MPa/min) | 4 |
| Water Content (%) | - |
| Degree of saturation (%) | Saturated |
| Mode of Failure | Shear |
| Testing Machine Used | Avery Denison 7122 |

**Core Structure Before Testing**

Refer Photo

**Core Fractures After Testing**

Refer Photo

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signatory:**

E.P. HILL
Note: Foliation (85°).

Failure: Hairline Fractures (Internal).
UCS 59.6 MPa.
# UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**
3 Snell St, Winnellie NT 0810

**Telephone** (089) 817944
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT
**SAMPLE LOCATION:** BOREHOLE #40 2.85 TO 2.95 m

## Sample Information

<table>
<thead>
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<th>Sample Number</th>
<th>RM1468</th>
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<tbody>
<tr>
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<tr>
<td>Test Date</td>
<td>02/08/96</td>
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<tr>
<td>Specimen Number</td>
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<tr>
<td>Sample Diameter</td>
<td>(mm) 63.0</td>
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<tr>
<td>Sample Height</td>
<td>(mm) 101</td>
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<td>Compressive Strength</td>
<td>(MPa) 76.6</td>
</tr>
<tr>
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<td>(min) 15</td>
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<td>Applied Stress Rate</td>
<td>(MPa/min) 5</td>
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<td>(%) -</td>
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<tr>
<td>Degree of saturation</td>
<td>(%) Saturated</td>
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<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

## Core Structure Before Testing

Refer Photo

## Core Fractures After Testing

Refer Photo

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signatory:**

E.P. HILL
Note: Existing Cracks.

Failure: Tensions Along Existing Cracks.
UCS 76.6 MPa (Max).
UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #40 3.13 TO 3.25 m

<table>
<thead>
<tr>
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<th>RM1469</th>
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<tbody>
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<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
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<tr>
<td>Sample Diameter</td>
<td>(mm) 62.8</td>
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<tr>
<td>Sample Height</td>
<td>(mm) 113</td>
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<tr>
<td>Compressive Strength</td>
<td>(MPa) 51.8</td>
</tr>
<tr>
<td>Test Duration</td>
<td>(min) 11</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>MPa/min 5</td>
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<tr>
<td>Water Content</td>
<td>(%) -</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>(%) Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorised Signatory:
E.P. HILL
Note:  Shear Zone With Phyllite.

Failure:  Multiple Shear Along Existing Shear Zone.
UCS 51.8 MPa.
### UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**
3 Snell St. Winnellie NT 0810

**Telephone** (089) 817944
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT  
SAMPLE LOCATION: BOREHOLE #40 3.25 TO 3.38 m  

**REPORT NO:** RM1470  
**REPORT DATE:** 07/08/96

<table>
<thead>
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<th>Sample Number</th>
<th>Sample Date</th>
<th>Test Date</th>
<th>Specimen Number</th>
<th>Sample Diameter (mm)</th>
<th>Sample Height (mm)</th>
<th>Compressive Strength (MPa)</th>
<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
<th>Mode of Failure</th>
<th>Testing Machine Used</th>
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</thead>
<tbody>
<tr>
<td>RM1470</td>
<td>N/S</td>
<td>02/08/96</td>
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<td>65.2</td>
<td>129</td>
<td>67.1</td>
<td>11</td>
<td>6</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Core Structure Before Testing**  
Refer Photo

**Core Fractures After Testing**  
Refer Photo

**Remarks:** Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part I

**Authorised Signatory:**

E.P. HILL
Note: Existing Shear.

Failure: Existing Shear, Local Shear.
UCS 67.1 MPa.
## UNIAXIAL COMpressive STRENGTH TEST REPORT

**Testing Laboratory**  
3 Snell St. Winnellie NT 0810  

**Telephone** (089) 817944  
**Facsimile** (089) 817625

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT  
**SAMPLE LOCATION:** BOREHOLE #41A 1.19 TO 1.30 m

### Sample Details

<table>
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<th>Sample Number</th>
<th>RM1471</th>
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<tr>
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<td>Test Date</td>
<td>02/08/96</td>
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<tr>
<td>Specimen Number</td>
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<tr>
<td>Sample Diameter</td>
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<tr>
<td>Sample Height</td>
<td>114</td>
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<tr>
<td>Compressive Strength</td>
<td>74.1</td>
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<td>Test Duration</td>
<td>7</td>
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<tr>
<td>Applied Stress Rate</td>
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</tr>
<tr>
<td>Water Content</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

### Core Structure Before Testing

Refer Photo

### Core Fractures After Testing

Refer Photo

### Remarks

Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1
Note: Existing Cracks.

Failure: Multiple Shear.
UCS 74.1 MPa.
### UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory:**
3 Snell St. Winnellie NT 0810

**Telephone:** (089) 817944  
**Facsimile:** (089) 817625

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT  
**SAMPLE LOCATION:** BOREHOLE #41A  1.47 TO 1.57 m  
**REPORT NO:** RM1472  
**REPORT DATE:** 07/08/96

---

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1472</th>
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<tbody>
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<td>Test Date</td>
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<tr>
<td>Specimen Number</td>
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<tr>
<td>Sample Diameter</td>
<td>62.6 (mm)</td>
</tr>
<tr>
<td>Sample Height</td>
<td>105 (mm)</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>26.1 (MPa)</td>
</tr>
<tr>
<td>Test Duration</td>
<td>7 (min)</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>4 (MPa/min)</td>
</tr>
<tr>
<td>Water Content</td>
<td>- (%)</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>Saturated (%)</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

---

**Core Structure Before Testing**  
Refer Photo

**Core Fractures After Testing**  
Refer Photo

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signatory:**  
E.P. HILL
Note: Edge Defects, Micro Fissuring.

Failure: Multiple Shear 60°.
UCS 26.1 MPa.
UNIAXIAL COMpressive StRENGTH TEST REPORT

Client: ACER VAUGNAN
Cavenaugh St.
Darwin NT

Project: EAST ARM PORT PROJECT
Sample Location: BOREHOLE #41A 2.07 TO 2.20 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1473</th>
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</thead>
<tbody>
<tr>
<td>Sample Date</td>
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<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>9</td>
</tr>
<tr>
<td>Sample Diameter (mm)</td>
<td>63.3</td>
</tr>
<tr>
<td>Sample Height (mm)</td>
<td>126</td>
</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>61.7</td>
</tr>
<tr>
<td>Test Duration (min)</td>
<td>10</td>
</tr>
<tr>
<td>Applied Stress Rate (MPa/min)</td>
<td>6</td>
</tr>
<tr>
<td>Water Content (%)</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorized Signatory:

E.P. Hill
Note: Existing Cracks.

Failure: Shear Along Existing Crack.
UCS 61.7 MPa.
UNIAXIAL COMPR. STRENGTH TEST REPORT

Testing Laboratory
3 Snell St. Winnellie NT 0810

Telephone (089) 817944
Facsimile (089) 817625

CLIENT: ACER VAUGNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #41A 2.82 TO 2.94 m

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>Sample Date</th>
<th>Test Date</th>
<th>Specimen Number</th>
<th>Sample Diameter (mm)</th>
<th>Sample Height (mm)</th>
<th>Compressive Strength (MPa)</th>
<th>Test Duration (min)</th>
<th>Applied Stress Rate (MPa/min)</th>
<th>Water Content (%)</th>
<th>Degree of saturation (%)</th>
<th>Mode of Failure</th>
<th>Testing Machine Used</th>
</tr>
</thead>
<tbody>
<tr>
<td>RM1474</td>
<td>N/S</td>
<td>02/08/96</td>
<td>10</td>
<td>63.4</td>
<td>124</td>
<td>36.9</td>
<td>9</td>
<td>4</td>
<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part I

Authorised Signatory:

E.P. HILL
Note: Existing Cracks.

Failure: Multiple Shear.
UCS 36.9 MPa.
### UNIAXIAL COMpressive STRENGTH TEST REPORT

Testing Laboratory  
3 Snell St. Winnellie NT 0810  

Telephone (089) 817944  
Facsimile (089) 817625  

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT  

**PROJECT:** EAST ARM PORT PROJECT  
**SAMPLE LOCATION:** BOREHOLE #41A 4.04 TO 4.17 m  

<table>
<thead>
<tr>
<th>Sample Number</th>
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<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>11</td>
</tr>
<tr>
<td>Sample Diameter</td>
<td>63.4 mm</td>
</tr>
<tr>
<td>Sample Height</td>
<td>127 mm</td>
</tr>
<tr>
<td>Compressive Strength</td>
<td>69.7 MPa</td>
</tr>
<tr>
<td>Test Duration</td>
<td>15 min</td>
</tr>
<tr>
<td>Applied Stress Rate</td>
<td>5 MPa/min</td>
</tr>
<tr>
<td>Water Content</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation</td>
<td>Saturated</td>
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<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Core Structure Before Testing**  
Refer Photo  

**Core Fractures After Testing**  
Refer Photo  

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorised Signatory:**  
E.P. HILL
Note : Soundness Of Core.

Failure : 65° Shear, Pebble Popout.
UCS 69.7 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

CLIENT: ACER VAUGHAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #41A 4.30 TO 4.43 m

<table>
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<tr>
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<th>RM1476</th>
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<tbody>
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<td>N/S</td>
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<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>12</td>
</tr>
<tr>
<td>Sample Diameter (mm)</td>
<td>63.4</td>
</tr>
<tr>
<td>Sample Height (mm)</td>
<td>124</td>
</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>63.1</td>
</tr>
<tr>
<td>Test Duration (min)</td>
<td>12</td>
</tr>
<tr>
<td>Applied Stress Rate (MPa/min)</td>
<td>5</td>
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<tr>
<td>Water Content (%)</td>
<td>-</td>
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<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing

Refer Photo

Core Fractures After Testing

Refer Photo

Remarks: Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

Authorised Signatory: E.P. HILL
Note: Existing Cracks.

Failure: Multiple Tension.
UCS 63.1 MPa.
UNIAXIAL COMpressive STRENGTH TEST REPORT

CLIENT: ACER VAUGHNAN
CAVENAUGH ST.
DARWIN NT

PROJECT: EAST ARM PORT PROJECT
SAMPLE LOCATION: BOREHOLE #41A 4.48 TO 4.60 m

<table>
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<th>RM1477</th>
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<tbody>
<tr>
<td>Sample Date</td>
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<tr>
<td>Test Date</td>
<td>02/08/96</td>
</tr>
<tr>
<td>Specimen Number</td>
<td>13</td>
</tr>
<tr>
<td>Sample Diameter (mm)</td>
<td>63.4</td>
</tr>
<tr>
<td>Sample Height (mm)</td>
<td>122</td>
</tr>
<tr>
<td>Compressive Strength (MPa)</td>
<td>56.1</td>
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<tr>
<td>Test Duration (min)</td>
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<tr>
<td>Applied Stress Rate (MPa/min)</td>
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</tr>
<tr>
<td>Water Content (%)</td>
<td>-</td>
</tr>
<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

Core Structure Before Testing
Refer Photo

Core Fractures After Testing
Refer Photo

Remarks: Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

Authorized Signatory:

E.P. HILL
Note: Microfracturing.

Failure: Multiple Shear.
UCS 56.1 MPa.
# UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT  
SAMPLE LOCATION: N/S  
BH 8 0.75 - 0.85

<table>
<thead>
<tr>
<th>Sample Number</th>
<th>RM1553</th>
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<tbody>
<tr>
<td>Sample Date</td>
<td>N/S</td>
</tr>
<tr>
<td>Test Date</td>
<td>19/08/96</td>
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<tr>
<td>Specimen Number</td>
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<td>Sample Diameter (mm)</td>
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<td>Sample Height (mm)</td>
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<td>Water Content (%)</td>
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<tr>
<td>Degree of saturation (%)</td>
<td>Saturated</td>
</tr>
<tr>
<td>Mode of Failure</td>
<td>Shear</td>
</tr>
<tr>
<td>Testing Machine Used</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Remarks:** Tested in accordance with ISRM "Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials" Part 1

**Authorised Signatory:**

[Signature]

**CSR Readymix (Australia) Pty Ltd A.C.N. 003 747 822**
## UNIAXIAL COMPRESSIVE STRENGTH TEST REPORT

**Testing Laboratory**  
3 Snell St, Winnellie NT 0810  
Telephone: (089) 817944  
Facsimile: (089) 817625

**CLIENT:** ACER VAUGNAN  
CAVENAUGH ST.  
DARWIN NT

**PROJECT:** EAST ARM PORT PROJECT

**SAMPLE LOCATION:** N/S BHE 2.0 - 2.15

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<th>Sample Height</th>
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<td>-</td>
<td>Saturated</td>
<td>Shear</td>
<td>Avery Denison 7122</td>
</tr>
</tbody>
</table>

**Remarks:** Tested in accordance with ISRM “Suggested Methods for Determining the Uniaxial Compressive Strength and Deformability of Rock Materials” Part 1

**Authorized Signatory:**

E.P. HILL

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**Notes:**  
Darwin Concrete: Snell Street, Darwin, Box 39351, Winnellie, Northern Territory 0820, Phone (08) 8981 7944 Fax (08) 8941 0165  
Darwin Quarry: Thorngate Road, Palmerston, Box 39351, Winnellie, Northern Territory 0830, Phone (08) 8984 3411 Fax (08) 8984 3742  
Alice Springs: 37 Priest Street, Alice Springs, Box 1370, Alice Springs, Northern Territory 0871, Phone (08) 8952 1633 Fax (08) 8952 5990  
Katherine: Stuart Highway, Katherine, Box 1945, Katherine, Northern Territory 0850, Phone (08) 8972 2344 Fax (08) 8971 0609  
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