APPENDIX A
Summary of 2010 Drilling Program
February 13, 2011
RGC Project No: 183002

Department of Resources
Mining Performance Division

Level 5 Centrepoint Building
Smith Street Mall
DARWIN, NT 0801
AUSTRALIA

Attention: Mike Fawcett
Principal Mining Scientist

RE: Summary Of 2010 Drilling Program, Rum Jungle Mine Site, NT, Australia

This memo summarizes results of the 2010 drilling program conducted at the historic Rum Jungle mine site as part of the Phase 2 Groundwater Investigation for the site (RGC, 2010a). Included in this memo are bore locations and construction details, borehole logs, hydraulic testing results, and preliminary field data collected during or immediately after bore installation. This report and the 2010 drilling program were completed under Task 5 of project Q10-0385.

1 Background & Scope

The historic Rum Jungle mine site is located 105 km by road south of Darwin near the township of Batchelor and in the headwaters of the East Finniss River. Uranium and polymetallic ore deposits at the site were mined in the 1950s and the site was subsequently abandoned in the mid-1960s. Despite significant remediation work in the early 1980s, groundwater and surface water at the historic mine site remain impacted by acid rock drainage (ARD) and possibly radionuclides and hence additional rehabilitation of the site is currently being planned by the NT Department of Resources (DoR).

Prior to 2010, the Rum Jungle mine site featured an existing network of monitoring bores that were installed primarily during rehabilitation efforts in the early 1980s. Most of these
bores are relatively shallow (<5 m depth) and located close to the major waste rock piles (or Overburden Heaps). Numerous gaps in the historic bore network were identified in RGC (2010a) and hence a series of additional monitoring bores was recommended to characterize the extent of groundwater contamination in areas of the site under-represented in the historic bore network.

This report summarizes the locations of the bores installed in 2010 and also provides details regarding their construction and subsequent testing/sampling. The report is organized as follows:

- Program Objectives & Work Program
- Program Results, including borehole logs, hydraulic testing results, & preliminary water quality data
- Conclusions

Note that water quality data (i.e. metals, major ion, & radionuclide concentrations) are not yet available and hence are beyond the scope of this memo. This memo does, however, present field data collected by the Environmental Monitoring Unit (EMU) during sampling and a brief description of their sampling protocols when needed.

## 2 Program Objectives & Work Program

### 2.1 Program Objectives

The objective of the 2010 drilling program was to install a series of monitoring bores proposed in RGC (2010b) and thereby further constrain the extent of groundwater contamination at the Rum Jungle mine site.

### 2.2 Work Program

The 2010 drilling program consisted of the following core tasks & activities:

- Drilling & monitoring bore installation
- Slug testing
- Water quality sampling
- Groundwater level monitoring
- Analysis & Reporting
The drilling and bore installation was conducted by Girraween Drilling Ltd. (Humpty Doo, Australia) with supervision by Paul Ferguson (RGC). DoR personnel assisted with slug testing and also conducted a site-wide groundwater level survey upon completion of the drilling program. Groundwater sampling was conducted by EMU and most analytical work was done by Northern Territory Environmental Labs (NTEL) (i.e. radionuclide testing is being conducted elsewhere).

3 Program Results

3.1 Drilling & Bore Installations

A total of 27 bores were installed at the historic Rum Jungle mine site from November 4 to December 16, 2010. Bore locations are shown in Figure 1 and construction details are provided in Table 1.

The majority of the bores were purpose-drilled although installation of a few bores involved retrofitting an existing borehole or open exploration hole. Specifically, bores PMB9S/D were installed as a ‘nested pair’ in bore RN022108 (as planned), whereas bores PMB23 and PMB24 were installed in separate exploration holes located in the former heap leach area (i.e. 05BE08 and 08BE57, respectively). Note that PMB23 and PMB24 were not part of the original program but were installed after the open exploration holes were located while drilling nearby.

Borehole logs for the ‘PMB’ bores are provided in Appendix A of this memo. A truck-mounted air rotary (direct circulation) drill rig operated by Girraween Drilling Ltd. was used for the entire 2010 drilling program. Each of the bores was installed via an ‘open hole’ that was drilled with a 130 mm diameter bit after installation of a 200 mm surface casing. In addition to surface casing, some of the bores were also cased (from surface to bedrock) with 150 mm steel casing. This casing was employed to maintain an open hole in unconsolidated material while drilling deeper into the underlying bedrock.

Each of the purpose-drilled monitoring bores was completed using 80 mm diameter, flush-threaded PVC pipes. Bores that involved retrofitting an existing bore (PMB9S/D) or exploration hole (PMB23 and PMB2) were completed with 50 mm PVC. All screens were machine slotted with a slot size of 1 mm and capped at the base with a perforated end-cap (to protect the PVC but enable water to drain). Washed, bagged gravel was
emplaced around the full length of the screen interval (plus at least 1 m above the top of the screen) and installations were completed by backfilling with either bentonite pellets or grout. Each of the bores was sealed at surface using bentonite pellets although steel casing (if utilized) was not typically backfilled with bentonite. Each of the bores was finished at surface with a protective steel monument that was cemented in place.

Below is a brief summary of bores installed in certain areas of interest at the mine site with a brief description of any relevant data or observations collected during drilling.

3.1.1  Dyson’s Area

Bores PMB1a and PMB2 were installed along the drainage channel that runs adjacent to Dyson’s Overburden Heap and then terminates in the upper East Finniss River channel. Bore PMB2 is screened in bedrock of the Rum Jungle Complex that underlies Dyson’s Area whereas bore PMB1a is screened in shallow saprolite.

Bore PMB1b was installed in the braided channel that originates from the sub-surface gravel beds that were built into Dyson’s (backfilled) Open Cut. This bore is screened in a shallow veneer of alluvium that sits atop the bedrock of the Rum Jungle Complex in this area (i.e. bedrock was ‘tapped’ during drilling). This bore collapsed once during installation and hence an airlift test was not possible but seepage from alluvium into the open hole was evident after the drill rods were removed. This suggests that the screened material is highly-permeable although no specific yield was determined.

3.1.2  White’s Overburden Heap Area

Bores PMB3 and PMB4 are located at the head of the EFDC (i.e. near the ‘weir structure’) along the main access road to the mine site. Bore PMB4 is screened in bedrock of the Rum Jungle Complex whereas bore PMB4 is screened in shallow saprolite. PMB4 yielded slightly more water than most bores screened in the Rum Jungle Complex (~0.1 L/s) due to the presence of a small (20 cm) fracture at 11.8 m bgs.

3.1.3  Former Copper Heap Leach Area

The five bores installed in the former heap leach area are summarized as follows:

- PMB10 (screened in black shale of the Whites Formation)
- PMB11 (screened in alluvium of the former East Finniss River channel)
Recall that the installation of bores PMB23 and PMB24 involved retrofitting existing exploration holes whereas bores PMB10, PMB11, and PMB22 were purpose-drilled.

Bore PMB10 was installed in pyritic black shale that yielded very little water. This material offered little resistance during drilling (and ultimately caved around the screen during bore installation) and hence was likely disturbed during mining operations or altered during the process of heap leaching. Regardless the low yield of this bore (and only moderate impact by ARD) suggests that it is not of particular significance to future estimates of contaminant loads from this area.

Bore PMB11 was screened from 31.5 to 34.5 m bgs in medium to coarse sand that could represent an infilled cavity beneath the former heap leach area. Note that the total depth achieved during drilling was 37 m bgs but drilling deeper was precluded by the inability to advance the drill rods past the 5 to 7 m of alluvial material that was encountered. The hole ultimately caved around the screen to 34.8 m bgs and then the remainder of the installation was completed with bagged gravel. This bore yielded 8 L/s of highly-impacted groundwater and hence represents a significant contaminant load/source should it connect to the Coomalie Dolostone and/or current East Finniss River channel downgradient.

3.1.4 North of the flooded Open Cuts

Nine bores were installed north of the flooded Open Cuts as this area of the site was particularly under-represented in the historic network of monitoring bores. Seven of these bores (bores PMB7 and bores PMB12 to PMB17) were screened in the Coomalie Dolostone (Figure 1). Bore PMB8S and PMB8D are located about 150 m east of the East Finniss River and were screened in laterite and the Geolsec Formation, respectively. Neither of these bores yielded appreciable water during drilling and both appear to be unimpacted by ARD (i.e. EC = 350 to 400 uS/cm).

Bores PMB14, PMB15, and PMB17 are each located along an old roadway that runs from east to west towards the East Finniss River (and the current location of bores...
PMB8S/D). Bore PMB17 yielded approximately 10 L/s during an airlift test and hence has the second-highest reported yield at the mine site. The only bore with a higher yield was bore PMB14 (which yielded close to 50 L/s during an airlift test). Bore PMB14 is located about 250 m east of PMB17 near the intersection of a thrust fault that runs from east-to-west across the site and one of the NE-trending faults that runs through the Coomalie Dolostone. The very high bore yield at this location is therefore not considered typical of the Coomalie Dolostone but instead likely reflects local fault structures (or associated fracture zones) or possibly secondary porosity related to historic acid loading. Note that bore PMB15 is located east of the fault intersection and is characterized by a relatively low yield (which suggests substantial aquifer heterogeneity related to extent and location of fractures in the Coomalie Dolostone).

Bores PMB12 and PMB13 are located adjacent to the main roadway that currently runs through the site. These bores are located about 5 m from one another but are screened at different depths in the Coomalie Dolostone (Table 1). Shallower groundwater from PMB12 appears to be highly-impacted by ARD (EC = 4,449 uS/cm) whereas water quality from deeper in the Coomalie Dolostone appears to reflect background conditions (EC = 369 uS/cm). Bores PMB7 and PMB16 are located southwest of bores PMB12/13 (i.e. closer to the East Finniss River) and are screened relatively shallow in the Coomalie Dolostone. Both of these bores yielded approximately 1 L/s during airlift tests and hence are less productive than other bores screened in the Coomalie Dolostone. This is likely related to the presence of silicified dolostone (i.e. chert) in this area of the site (which was identified in both bores and during drilling of bore RN022543). Groundwater from both bores is slightly acidic and shows elevated EC levels (EC = 2,397 and 4,407 uS/cm respectively) and hence considered highly-impacted by ARD.

### 3.1.5 Old Tailings Area

Bore PMB18 and PMB19 are located near Old Tailings Creek close to the northern boundary of the mine site. Bore PMB19 is screened in a more metamorphosed sub-unit of the Coomalie Dolostone whereas PMB18 is screened in unconsolidated material (possibly alluvium). Bore PMB19 yielded 1 L/s during an airlift test whereas bore PMB18 yielded insufficient water for such a test. EC values for groundwater from both bores were only slightly elevated (i.e. 500 to 600 uS/cm) and hence groundwater in this
area appear to be only modestly impacted by ARD. The source of contaminants to groundwater from these bores is likely surface water from Old Tailings Creek (or a diffuse seepage from tailings in this area) as these bores are not likely located along a groundwater flowpath that originates at the backfilled Open Cuts and/or the copper heap leach area.

3.1.6 Downstream of the mine site

Bore PMB20 and PMB21 are located on private property close to the East Finniss River about 2.5 km downstream of gauge GS8150200. Bore PMB21 is screened in the Rum Jungle Complex (with low yield). The shallow bore PMB20 is screened in unconsolidated material (alluvium) closer to the river but also showed no detectable yield.

Groundwater from bore PMB21 does not appear to be hydraulically connected to the East Finniss River and hence groundwater is unimpacted by ARD whereas shallow groundwater from bore PMB20 is impacted by contaminants from the East Finniss River. Note that additional water quality data is required to affirm that bore PMB21 is unimpacted by ARD (as this bore is intended to be used as a drinking water source by the landowner).

3.2 Hydraulic Testing

A selection of the new and existing bores was slug tested to determine hydraulic conductivity (K) values for the screened material/lithologies. Results of the slug testing are summarized in Table 2. Most of the tests were completed in bores screened in the Rum Jungle Complex but selected tests were also completed in bores screened in the Whites Formation, Geolsec Formation, and Coomalie Dolostone. For each bore, both rising and falling head tests were completed and analyzed and best engineering judgment (BEJ) was used to determine a representative K of the material screened.

3.3 Groundwater level survey

A comprehensive survey of static water levels across the Rum Jungle mine site was completed by DoR personnel on December 13/14 (2010) and then again in mid-January 2011 using an electric water level tape. Results of water level survey are provided in Table 1 (and discussed in more detail in the Phase 2 report).
3.4 Water sampling

Each of the bores installed in 2010 was sampled (and partially developed) by EMU. Bore development, in this instance, refers to purging the bore until pH, EC, and turbidity values have sufficiently stabilized (meaning that samples collected from the bores are highly-representative but that cuttings/sediments could remain at the bottom of the installations). Note that a lack of sufficient development appears to effect bore PMB15 in particular as the water level in this bore never recovered after bore installation was completed.

All samples were filtered and acidified in the EMU Labtruck and subsequently refrigerated before being couriered to NTEL for analysis. Field measurements of pH and EC collected by EMU at the time of sample collection are provided in Table 3. The following areas showed highly-impacted groundwater characterized by acidic pH and/or highly elevated EC readings (> 4,000 uS/cm):

- To the south of Dyson’s (backfilled) Open Cut (at bore PMB1a and PMB1b)
- To the north of Whites overburden heap (at bore PMB3)
- In the former heap leach area (at bores PMB11, PMB22, and PMB23)
- To the northwest (downgradient) of the former heap leach area & Intermediate Open Cut (at bores PMB7, PMB16 and PMB9D)

Of particular concern is the former heap leach area (PMB11 and PMB23) where highly impacted groundwater (i.e. field pH ~3.5-5.0 and EC ~ 7,000 uS/cm) was encountered in highly permeable alluvial sediments. This pool of acidic groundwater may represent a significant (hitherto unknown) source of groundwater contamination and may potentially explain the TDS plume identified during this 2010 drilling program in the Coomalie dolostone to the north of the former heap leach area.

Moderately-impacted groundwater was identified in bores installed north of White’s Open Cut (bores PMB14 and PMB15) and near the East Finniss River (bore PMB21) and EFDC (bore PMB6) (see Table 3). Also of interest is the identification of unimpacted groundwater in the deeper portion of the Coomalie Dolostone at bore PMB13 (which is the deepest of any bore at the mine site) and unimpacted groundwater further north in the Geosol formation (at bores PMB8S/D).
A more detailed discussion of the extent of impact will be provided at a later phase of the project when full water quality results (including metals and radionuclide concentrations) are available.

4 Summary

Field data collected during the 2010 drilling program have confirmed the presence of contaminated groundwater in areas of the Rum Jungle mine site that were previously under-represented in the historic bore network. Of particular interest is the identification of highly-contaminated (acidic) groundwater in the former copper heap leach area, and moderately to highly contaminated groundwater in the Coomalie dolostone downgradient, i.e. in the reach between the former copper heap leach area (& backfilled Intermediate Open Cut) and the East Finnis River.

Each of these areas is obviously affected by a TDS plume (and possibly a metals plume) although further analysis is required to determine whether contamination is ongoing or residual in nature. Such an analysis will be provided in subsequent phases of the groundwater investigation when additional water quality data is available.

5 Closure

We trust that the information provided in this letter report meets your requirements.

Please contact the undersigned if you have any questions regarding the content of this report or require further information.

Best Regards,

ROBERTSON GEOCONSULTANTS INC.

Paul Ferguson, Ph.D.       Christoph Wels, Ph.D., M.Sc.
Senior Geochemist          Principal & Senior Hydrogeologist
6 References


TABLES
Table 1. Summary of monitoring bores installed in 2010, Rum Jungle mine site

<table>
<thead>
<tr>
<th>Bore ID</th>
<th>Installation Date</th>
<th>Location/description</th>
<th>Easting (MGA94 Zone 56)</th>
<th>Northing</th>
<th>Total depth (m bgs)</th>
<th>Screened Internal (m bgs)</th>
<th>Stickup (m ags)</th>
<th>Screened lithology</th>
<th>TOC (m AHD 71)</th>
<th>DTW (m AHD 71)</th>
<th>Static water level</th>
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<td>PMB1a</td>
<td>Nov-10</td>
<td>Drainage channel from Dyson’s area</td>
<td>719072</td>
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<td>5.0</td>
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<td>23.4 to 29.4</td>
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<td>Dec-10 Center of former heap leach area</td>
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<td>34.5</td>
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<td>Dec-10 North of former heap leach area</td>
<td>717251</td>
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<td>Dec-10 North of Whites Open Cut</td>
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<td>Dec-10 North of Intermediate Open Cut</td>
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<td>Dec-10 North of Whites Open Cut &amp; former heap leach area</td>
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<td>Dec-10 North of Old Tailings Creek</td>
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<td>Nov-10 East Finniss River channel (about 2 km downstream of site)</td>
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<td>PMB22</td>
<td>Dec-10 Drainage channel north of former heap leach area</td>
<td>717363</td>
<td>8583324</td>
<td>24.6</td>
<td>12.6 to 24.6</td>
<td>0.70</td>
<td>Coomalie Dolomite</td>
<td>67.01</td>
<td>1.90</td>
<td>65.11</td>
<td></td>
</tr>
<tr>
<td>PMB23</td>
<td>Dec-10 West of former heap leach area (formerly 08BE08)</td>
<td>717369</td>
<td>8583209</td>
<td>25.0</td>
<td>15.0 to 25.0</td>
<td>0.50</td>
<td>Coomalie Dolomite</td>
<td>67.25</td>
<td>3.46</td>
<td>63.80</td>
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</tr>
<tr>
<td>PMB24</td>
<td>Dec-10 West of former heap leach area (formerly 08BE07)</td>
<td>717342</td>
<td>8583211</td>
<td>16.0</td>
<td>4.0 to 16.0</td>
<td>0.61</td>
<td>Coomalie Dolomite</td>
<td>65.91</td>
<td>1.72</td>
<td>64.19</td>
<td></td>
</tr>
</tbody>
</table>

1. bgs = below ground surface.
2. Height of top of casing above ground surface (ags).
3. TOC = Top of casing
4. DTW = Depth to water below top of casing (btoc) measured on January 18/19, 2011
5. Top of casing below concrete surround.
Table 2. Summary of hydraulic conductivity values

<table>
<thead>
<tr>
<th>Bore ID</th>
<th>Location</th>
<th>Type/method</th>
<th>K, m/s</th>
<th>Type/method</th>
<th>K, m/s</th>
<th>Average K, m/s</th>
<th>BEJ K, m/s</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Falling Head</td>
<td></td>
<td>Rising Head</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN025165</td>
<td>Rum Jungle Complex</td>
<td>Hvorslev*</td>
<td>1.20E-07</td>
<td>Hvorslev</td>
<td>2.50E-07</td>
<td>1.9E-07</td>
<td>2.00E-07</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bouwer &amp; Rice**</td>
<td>1.00E-07</td>
<td>Bouwer &amp; Rice</td>
<td>1.90E-07</td>
<td>1.5E-07</td>
<td></td>
</tr>
<tr>
<td>RN025170</td>
<td>Rum Jungle Complex</td>
<td>Hvorslev</td>
<td>2.60E-06</td>
<td>Hvorslev</td>
<td>1.30E-06</td>
<td>2.0E-06</td>
<td>2.00E-06</td>
</tr>
<tr>
<td>RN025173</td>
<td>Rum Jungle Complex</td>
<td>Hvorslev</td>
<td>4.30E-06</td>
<td>Hvorslev</td>
<td>3.80E-06</td>
<td>4.1E-06</td>
<td>4.00E-06</td>
</tr>
<tr>
<td>RN025792</td>
<td>Geolsec Formation</td>
<td>Hvorslev</td>
<td>1.10E-05</td>
<td>Hvorslev</td>
<td>1.10E-05</td>
<td>1.1E-05</td>
<td>1.00E-05</td>
</tr>
<tr>
<td>RN022083</td>
<td>Rum Jungle Complex</td>
<td>Hvorslev</td>
<td>9.10E-06</td>
<td>Hvorslev</td>
<td>1.20E-05</td>
<td>1.1E-05</td>
<td>1.00E-05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bouwer &amp; Rice</td>
<td>7.20E-06</td>
<td>Bouwer &amp; Rice</td>
<td>1.20E-05</td>
<td>9.6E-06</td>
<td></td>
</tr>
<tr>
<td>RN022084</td>
<td>Rum Jungle Complex</td>
<td>Hvorslev</td>
<td>3.20E-06</td>
<td>Hvorslev</td>
<td>2.50E-06</td>
<td>2.9E-06</td>
<td>3.00E-06</td>
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<tr>
<td>PMB4</td>
<td>Rum Jungle Complex</td>
<td>Hvorslev</td>
<td>4.00E-07</td>
<td>na</td>
<td>-</td>
<td>-</td>
<td>4.00E-07</td>
</tr>
<tr>
<td>PMB6</td>
<td>Whites Formation</td>
<td>Hvorslev</td>
<td>3.00E-05</td>
<td>Hvorslev</td>
<td>2.30E-05</td>
<td>2.7E-05</td>
<td>2.00E-05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Bouwer &amp; Rice</td>
<td>3.10E-05</td>
<td>Bouwer &amp; Rice</td>
<td>8.70E-05</td>
<td>5.9E-05</td>
<td></td>
</tr>
<tr>
<td>PMB19</td>
<td>Coomalie Dolomite</td>
<td>na</td>
<td>-</td>
<td>Hvorslev</td>
<td>2.30E-05</td>
<td>-</td>
<td>2.00E-05</td>
</tr>
<tr>
<td></td>
<td></td>
<td>na</td>
<td>-</td>
<td>Bouwer &amp; Rice</td>
<td>2.10E-05</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

* - Confined aquifer, partially penetrating screen
** - Confined aquifer, partially penetrating screen
na - Not suitable for analysis
<table>
<thead>
<tr>
<th>Bore ID</th>
<th>Installation Date</th>
<th>Location/description</th>
<th>Total depth (m bgs)</th>
<th>Screened Interval (m bgs)</th>
<th>Screened lithology</th>
<th>Yield (L/s)</th>
<th>Field pH</th>
<th>Field EC (uS/cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PMB1a</td>
<td>Nov-10</td>
<td>Drainage channel from Dyson's area</td>
<td>3.4</td>
<td>1.4 to 3.4</td>
<td>Saprolite</td>
<td>n.d.</td>
<td>6.2</td>
<td>3232</td>
</tr>
<tr>
<td>PMB1b</td>
<td>Nov-10</td>
<td>Adjacent to braided channel south of Dyson's (backfilled) Open Cut</td>
<td>3.7</td>
<td>2.2 to 3.7</td>
<td>Alluvium</td>
<td>n.d.</td>
<td>3.5</td>
<td>4066</td>
</tr>
<tr>
<td>PMB2</td>
<td>Nov-10</td>
<td>Bedrock beneath drainage channel from Dyson's area</td>
<td>18.7</td>
<td>12.7 to 18.7</td>
<td>Rum Jungle Complex</td>
<td>0.1</td>
<td>6.8</td>
<td>2350</td>
</tr>
<tr>
<td>PMB3</td>
<td>Nov-10</td>
<td>Saprolite at the head of the EFDC (near White's Heap)</td>
<td>2.7</td>
<td>1.2 to 2.7</td>
<td>Saprolite/Alluvium</td>
<td>n.d.</td>
<td>3.8</td>
<td>2079</td>
</tr>
<tr>
<td>PMB4</td>
<td>Nov-10</td>
<td>Bedrock at the head of the EFDC (near White's Heap)</td>
<td>15.0</td>
<td>9.0 to 15.0</td>
<td>Rum Jungle Complex</td>
<td>0.1</td>
<td>6.8</td>
<td>2232</td>
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<tr>
<td>PMB5</td>
<td>Nov-10</td>
<td>West of Intermediate Overburden Heap (at EFDC)</td>
<td>5.0</td>
<td>2.0 to 5.0</td>
<td>Roadfill</td>
<td>n.d.</td>
<td>6.6</td>
<td>1358</td>
</tr>
<tr>
<td>PMB6</td>
<td>Nov-10</td>
<td>West of Intermediate Overburden Heap (at EFDC)</td>
<td>25.5</td>
<td>13.5 to 25.5</td>
<td>Whites Formation</td>
<td>2</td>
<td>7.2</td>
<td>1952</td>
</tr>
<tr>
<td>PMB7</td>
<td>Dec-10</td>
<td>North of Intermediate Open Cut</td>
<td>18.0</td>
<td>9 to 18</td>
<td>Coomalie Dolomite</td>
<td>1.5</td>
<td>6.4</td>
<td>2395</td>
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<tr>
<td>PMB8S</td>
<td>Nov-10</td>
<td>East of the East Finniss River</td>
<td>14.0</td>
<td>5 to 14</td>
<td>Laterite</td>
<td>n.d.</td>
<td>7.2</td>
<td>320</td>
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<tr>
<td>PMB8D</td>
<td>Nov-10</td>
<td>East of the East Finniss River</td>
<td>23.0</td>
<td>20 to 23</td>
<td>Geolsec Formation</td>
<td>0.1</td>
<td>7.5</td>
<td>374</td>
</tr>
<tr>
<td>PMB9S</td>
<td>Dec-10</td>
<td>Near East Finniss River (formerly RN022108)</td>
<td>59.4</td>
<td>47.4 to 59.4</td>
<td>Coomalie Dolomite</td>
<td>n.d.</td>
<td>7.5</td>
<td>703</td>
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<tr>
<td>PMB9D</td>
<td>Dec-10</td>
<td>Near East Finniss River (formerly RN022108)</td>
<td>29.4</td>
<td>23.4 to 29.4</td>
<td>Coomalie Dolomite</td>
<td>n.d.</td>
<td>6.7</td>
<td>4760</td>
</tr>
<tr>
<td>PMB10</td>
<td>Dec-10</td>
<td>Center of former heap leach area</td>
<td>32.0</td>
<td>16 to 32</td>
<td>Whites Formation</td>
<td>n.d.</td>
<td>6.7</td>
<td>969</td>
</tr>
<tr>
<td>PMB11</td>
<td>Dec-10</td>
<td>Center of former heap leach area</td>
<td>34.5</td>
<td>31.5 to 34.5</td>
<td>Alluvium</td>
<td>8</td>
<td>5.0</td>
<td>7540</td>
</tr>
<tr>
<td>PMB12</td>
<td>Dec-10</td>
<td>North of former heap leach area</td>
<td>24.0</td>
<td>12 to 24</td>
<td>Coomalie Dolomite</td>
<td>2</td>
<td>7.2</td>
<td>4449</td>
</tr>
<tr>
<td>PMB13</td>
<td>Dec-10</td>
<td>North of former heap leach area</td>
<td>60.0</td>
<td>48 to 60</td>
<td>Coomalie Dolomite</td>
<td>2</td>
<td>8.1</td>
<td>369</td>
</tr>
<tr>
<td>PMB14</td>
<td>Dec-10</td>
<td>North of White’s Open Cut</td>
<td>17.5</td>
<td>15.5 to 17.5</td>
<td>Coomalie Dolomite</td>
<td>50</td>
<td>6.1</td>
<td>1525</td>
</tr>
<tr>
<td>PMB15</td>
<td>Dec-10</td>
<td>North of White’s Open Cut</td>
<td>25.0</td>
<td>13 to 25</td>
<td>Coomalie Dolomite</td>
<td>1</td>
<td>6.6</td>
<td>1460</td>
</tr>
<tr>
<td>PMB16</td>
<td>Dec-10</td>
<td>North of Intermediate Open Cut</td>
<td>22.5</td>
<td>13.5 to 22.5</td>
<td>Coomalie Dolomite</td>
<td>1</td>
<td>6.8</td>
<td>4407</td>
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<tr>
<td>PMB17</td>
<td>Dec-10</td>
<td>North of White’s Open Cut &amp; former heap leach area</td>
<td>26.0</td>
<td>20 to 26</td>
<td>Coomalie Dolomite</td>
<td>10</td>
<td>6.7</td>
<td>944</td>
</tr>
<tr>
<td>PMB18</td>
<td>Nov-10</td>
<td>Near Old Tailings Creek</td>
<td>6.0</td>
<td>2 to 6</td>
<td>Saprolite/Alluvium</td>
<td>n.d.</td>
<td>7.3</td>
<td>600</td>
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<tr>
<td>PMB19</td>
<td>Nov-10</td>
<td>Near Old Tailings Creek</td>
<td>18.0</td>
<td>12 to 18</td>
<td>Schist</td>
<td>1</td>
<td>7.4</td>
<td>517</td>
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<tr>
<td>PMB20</td>
<td>Nov-10</td>
<td>East Finniss River channel (about 2 km downstream of site)</td>
<td>5.8</td>
<td>1.8 to 5.8</td>
<td>Alluvium</td>
<td>n.d.</td>
<td>5.7</td>
<td>1118</td>
</tr>
<tr>
<td>PMB21</td>
<td>Nov-10</td>
<td>East Finniss River channel (about 2 km downstream of site)</td>
<td>32.2</td>
<td>12.2 to 32.2</td>
<td>Rum Jungle Complex</td>
<td>0.1</td>
<td>6.9</td>
<td>319</td>
</tr>
<tr>
<td>PMB22</td>
<td>Dec-10</td>
<td>Drainage channel north of former heap leach area</td>
<td>24.0</td>
<td>12 to 24</td>
<td>Coomalie Dolomite</td>
<td>n.d.</td>
<td>7.7</td>
<td>2021</td>
</tr>
<tr>
<td>PMB23</td>
<td>Dec-10</td>
<td>West of former heap leach area (formerly 05BE08)</td>
<td>25.0</td>
<td>13 to 25</td>
<td>Coomalie Dolomite</td>
<td>n.d.</td>
<td>3.5</td>
<td>6940</td>
</tr>
<tr>
<td>PMB24</td>
<td>Dec-10</td>
<td>West of former heap leach area (formerly 08BE57)</td>
<td>16.0</td>
<td>4 to 16</td>
<td>Coomalie Dolomite</td>
<td>n.d.</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

1. bgs = below ground surface.
2. Height of top of casing above ground surface (ags).
3. TOC = Top of casing
4. DTW = Depth to water below top of casing (btoc) measured on July 6, 2003
5. Top of casing below concrete surround.
FIGURES
APPENDIX A

Borehole Logs
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY</th>
<th>SOIL/ROCK DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>SAPROLITE</td>
<td>Light brown to beige colored quartz gravels and sand</td>
</tr>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**WELL**

- **Stickup** = 0.74 m
- **Dry drilled** (no water apparent during drilling).
- **Hole backfilled** to surface with bentonite chips
- **2 m screen installed** from 1.4 to 3.4 m with 80 mm slotted PVC (1 mm perforations)
- **End of Hole** = 3.4 m

**ADDITIONAL COMMENTS**

(Yield, water quality, geofabric, special construction design, etc.)
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY SOIL/ROCK DESCRIPTION</th>
<th>WELL</th>
<th>ADDITIONAL COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>ALLUVIUM</td>
<td>Highly-permeable mixture of sand and gravel (with some cobbles)</td>
<td></td>
<td>Stickup = 1.2 m</td>
</tr>
<tr>
<td>-2</td>
<td>RUM JUNGLE COMPLEX</td>
<td>bedrock tapped to confirm depth</td>
<td></td>
<td>Hole backfilled to surface with bentonite grout (chips)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hole collapsed once during drilling and had to be re-drilled</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Borehole very unstable during drilling due to seepage from the drainage channel</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hole ultimately caved around PVC to about 1 m bgs (remainder of hole sealed with bentonite pellets)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>End of Hole = 2.50 m</td>
</tr>
</tbody>
</table>
**SAPROLITE**

Light brown to beige coloured quartz sands and gravel

**RUM JUNGLE COMPLEX**

- Pinkish to light-brown coloured cuttings (granite); qtz and feldspar present (minor chlorite and biotite as well)
- Rock is very hard and very little water is evident during drilling (appears to be fresh, unfractured granite)
- No appreciable changes in mineralogy with depth and rock appears to be structureless

Partial loss of air pressure at 2.5 m or so as water in the nearby drainage channel begins to churn

Suggests strong hydraulic connection along the bedrock contact

No airflow test was conducted at this location due to lack of water

Bentonite seal (1.4 m)

6 m screen (from 12.7 to 18.7 m) installed with 80 mm slotted PVC (1 mm perforations)

End of Hole = 18.7 m
### Soil/Rock Description

**Lithology**: Saprolite

- Mainly light brown quartz sands and gravels with some alluvium from Fitch Creek channel

**Additional Comments**

- Stickup = 0.66 m
- Bentonite grout (chips) to surface
- Borehole located a few meters from the bank of the diversion channel (near the weir structure)
- Very little water evident during drilling (bore essentially dry upon installation)
- 1.5 m screen installed from 1.2 to 2.7 m with 80 mm slotted PVC (1 mm perforations)
- End of Hole = 2.7 m
SAPROLITE

Light brown quartz gravels and sand (with minor alluvium from Fitch Creek channel)

RUM JUNGLE COMPLEX

fresh, fractured granite
beige to yellowish-brown cuttings; qtz is apparent (fewer mafic minerals than at bore PMB2 in Dyson’s Area)
no chlorite or biotite or reddish-coloured minerals identified
rock hardens slightly at 10 m or so

Bentonite seal (1 m)

20 cm water-bearing fracture from 11.8 to 12.0 m
fracture yields most of the water in the borehole but yield still less than 0.1 L/s
insufficient water for airlift

6 m screen installed from 9.3 to 15.3 m with 80 mm slotted PVC (1 mm perforations)

End of Hole = 15.0 m bgs
**CLIENT NAME:** NT Department of Resources  
**PROJECT NAME:** Rum Jungle  
**PROJECT NUMBER:** 183002  
**METHOD:** DC Rotary  
**LOCATION:** Near EFDC  
**METHOD:** DC Rotary  
**SOIL/ROCK DESCRIPTION**  
**LITHOLOGY**  
**ADDITIONAL COMMENTS**  
(Yield, water quality, geofabric, special construction design, etc.)

<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY</th>
<th>WELL</th>
<th>ADDITIONAL COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>FILL</td>
<td></td>
<td>Stickup = 0.77 m</td>
<td>Hole backfilled to ground surface with bentonite chips</td>
</tr>
<tr>
<td>1</td>
<td>FILL</td>
<td></td>
<td></td>
<td>Air lost briefly to EFDC at 2.5 m (large air bubbles surfacing)</td>
</tr>
<tr>
<td>2</td>
<td>CLAYEY FILL</td>
<td></td>
<td></td>
<td>3 m screen installed from 1.8 to 4.8 m with 80 mm slotted PVC (1 mm perforations)</td>
</tr>
<tr>
<td>3</td>
<td>CLAYEY FILL</td>
<td></td>
<td></td>
<td>End of Hole = 4.8 m bgs</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**GROUND ELEVATION (m):** 64.7  
**DATE COMPLETED:** 18-Nov-2010  
**PAGE 1 OF 1**
### Soil/Rock Description

- **Fill**
  - Mixture of shaley overburden and roadfill

- **Clayey Fill**
  - Sands and gravels in yellowish-orange clay matrix (same clay as in the nearby EFDC)

- **White’s Formation**
  - Dark grey to black, fine-grained, and competent pyritic black shale
  - Shale appears less carbonaceous than stored drill cores or shale in former heap leach area
  - Small fractures evident throughout but particularly over the last 4 to 5 m of borehole
  - Small flecks of pyrite are evident throughout the cuttings

### Additional Comments

- Stickup = 0.77 m
- 6" steel casing to 11.5 m
- Bentonite seal
- 19.2 m, 40 cm fracture zone
  - Airlift yield = 1 L/s (EC = 1,245 uS/cm)
- 22.0 m
  - Airlift yield = 1.5 L/s (EC = 1,630 uS/cm)
- End of Hole = 25.5 m bgs
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY</th>
<th>WELL</th>
<th>ADDITIONAL COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>SOIL/FILL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td></td>
<td>clayey gravel (chunks of asphalt evident)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
<td>CLAYEY FILL</td>
<td>sandy clay (yellowish orange)</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td>COOMALIE DOLOSTONE (silicified)</td>
<td>pinkish-white, coarsely-crystalline marble and/or inclusions of brownish chert (appears to be brecciated/silicified dolostone)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td>very sharp, angular fragments of marble and chert returned to surface (not just consistently-sized cuttings)</td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
<td>moderate reaction to HCl in powdered form</td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
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<td>8</td>
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<tr>
<td>9</td>
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<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SOIL/FILL**
- clayey gravel (chunks of asphalt evident)

**CLAYEY FILL**
- sandy clay (yellowish orange)

**COOMALIE DOLOSTONE (silicified)**
- pinkish-white, coarsely-crystalline marble and/or inclusions of brownish chert (appears to be brecciated/silicified dolostone)
- very sharp, angular fragments of marble and chert returned to surface (not just consistently-sized cuttings)
- moderate reaction to HCl in powdered form

**WELL**
- Bentonite seal (1 m)
- 80 mm PVC w/ 1 mm slotted screen from 9.0 to 18.0 m
- Water returned from borehole turns yellowish-brown at 12 m (EC = 1750 uS/cm)
- Airlift test conducted at 14 m Yield: 1.5 L/s EC = 1960 uS/cm
- End of Hole = 18.0 m bgs
LATERITE
Reddish-brown sandy clay

Stickup = 0.62 m
borehole dry drilled immediately after installing PMB8D
laterite moist but no water evident
hole backfilled to ground surface with bentonite chips

9 m screen installed from 5.6 to 14.6 m with 80 mm PVC (1 mm perforations)

GEOLSEC FORMATION
Very hard, pure white quartzite
No reaction to acid
Cuttings are consistent in size (no chunks of angular chert)

Bedrock 'tapped' during drilling (later backfilled with sand)

End of Hole: 15 m
**LATERITE**
reddish-brown sandy clay

**GEOLSEC FORMATION**
very hard, unfractured quartzite (pure white in colour)
cuttings are very consistent in size (i.e. no chunks of chert returned to surface)
rock does not react to acid and no calcite evident

3 m screen installed from 20 to 23 m with slotted PVC screen (1 mm perforations)

End of Hole = 23.0 m

Stickup = 0.71 m

6" Steel Casing to 13.7 m

8 m bentonite seal (from 11.6 to 19.6 m)

Very little yield (0.1 L/s or less); water is very clear in appearance

EC < 400 uS/cm (suggests unimpacted groundwater)
**PROJECT NUMBER:** 183002  
**METHOD:** DC Rotary  
**LOCATION:** formerly RN022108

### Soil/Rock Description

- **ALLUVIUM**  
  black sand with broken (compacted) black shale; brown clay and quartz riverine gravel up to 1 cm

- **COOMALIE DOLOSTONE (silicified)**  
  massive grey dolostone and coarsely-crystalline marble (calcite up to 4 mm)

- **COOMALIE DOLOSTONE**  
  white dolostone with fractures filled with fine to medium grained sand partially re-cemented with ferruginous cement

**ADDITIONAL COMMENTS**

- No drilling required at this location (installation involved retrofitting bore RN022108 with 50 mm PVC)
- 40 L/s yield (EC = 3,500 uS/cm)
- End of hole: 29.2 m
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY</th>
<th>SOIL/ROCK DESCRIPTION</th>
<th>WELL</th>
<th>ADDITIONAL COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>ALLUVIUM</td>
<td>riverine gravel (up to 1 cm) with black sand and broken compacted black shale (of White’s Formation)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>COOMALIE DOLOSTONE (silicified)</td>
<td>massive grey dolostone with coarsely-crystalline marble (calcite up to 4 mm)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td></td>
<td>COOMALIE DOLOSTONE</td>
<td>white dolostone with fractures filled with fine to medium grained sand partially re-cemented with ferruginous cement</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24.5</td>
<td></td>
<td></td>
<td>End of Hole: 60.7 m</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Stickup = 0.92 m

no drilling required

installation involved retrofitting bore RN022108 with 50 mm PVC (an ‘open hole’ bore drilled in 1983)

40 L/s from fracture zone (EC = 3,500 uS/cm)

30 L/s (fracture)

Bentonite seal

2 m cavity filled with medium-grained heavily-ferruginized sand (from 55 to 57 m)

60 L/s yield (EC = 4,000 uS/cm; copper plates steel casing)

End of Hole: 60.7 m
SOIL/FILL
Mixture of fill and clay covered in black film (moist)
Fragments of dull grey, almost metallic-looking rock and chunks of dolostone

WHITE'S FORMATION (highly-altered)
altered/disturbed pyritic black shale
extremely soft (hammer doesn't fire during drilling); very few cuttings returned from borehole as material surfaces as a dark greyish-black carbonaceous ooze
ooze does contain bits of shale that are obviously black shale of White's Formation but not the competent pyritic black shale that was encountered at PMB6 (near the Intermediate Overburden Heap)
bits of pyrite (up to 1 cm)

Drilled to 37 m but hole partially collapsed

SOIL/FILL

Stickup = 0.5 m
very little water upon installation (recovered slowly overnight)
metallic 'ooze' surfaces from borehole (and from an exploration hole ~10 m away)
Bentonite seal

16 m screen installed from 16.0 to 32.0 m with 80 mm PVC (1 mm perforations)
Shaley material caved around screen
FILL/SOIL
Mixture of brownish top soil and chunks of dull grey rock returned to surface (with bits of black shale)

WHITE'S FORMATION
(altered)
carbonaceous black shale (no pyrite)

SAND & GRAVEL (infilled cavity?)
predominantly chunks of black shale but quartz and a reddish brown rock also evident
whole rocks returned to surface (not just cuttings); rocks appear rounded to sub-rounded and often appear affected by altered by dissolution (similar in appearance to rocks in the East Finniss River channel d/s of gauge GS8150200)
large chunk of rock drilled through around 30 m (smaller cuttings); mistaken for bedrock contact and hence 30 m of steel casing installed (turns out to be a cobble as we move into what appears to be a sand-filled cavity from 30.5 to 37 m)
no resistance to hammer in this cavity and heaps of sand returned to surface; difficult drilling conditions as rods keep getting stuck as sand collapses around them; sand is quite angular but chunks of rounded river rocks returned from the borehole with the sand

Airlift test conducted at 12 m
Yield: 3 to 4 L/s (EC = 5,160 uS/cm)

Bentonite seal
3 m screen installed from 31.5 to 34.5 m with 80 mm slotted PVC (1 mm perforations)
heaps of water (yield estimated at 8 L/s but no airlift possible because sand collapsing around rods)
rods are tinted orangish pink when removed
Drilled to 37 m but hole collapsed to 34.5 m
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY</th>
<th>SOIL/ROCK DESCRIPTION</th>
<th>WELL</th>
<th>ADDITIONAL COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>LATERITE</td>
<td>dark reddish-brown clayey sand</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td>COOMALIE DOLOSTONE</td>
<td>hard, fractured dolostone (with magnesite)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>alternating layers/bands of fine-grained, brick red dolomite and white calcite</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>whole rock reacts to HCl in powdered form (calcite flakes react more vigorously)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- Stickup = 0.44 m
- Bentonite seal
- 12 m screen installed from 12.6 to 24.6 m with 80 mm slotted PVC (1 mm perforations)
- Rock is fractured throughout but bore terminates in a particularly productive fracture zone (from 22 to 24 m).
- Airlift test conducted at 22.8 m (2 L/s, EC = 2300 uS/cm)
LATERITE
reddish-brown clayey sand

COOMALIE DOLOSTONE
bands of fine-grained brick red dolostone and white calcite
rock reacts to HCl in powdered form
calcite becomes much more dominant from 40.0 to 62.5 m
cuttings are mainly white with only minor reddish-coloured dolostone

Stickup = 0.57 m
6" Steel Casing to 11.0 m
airlift test conducted at 15.5 m
(1 to 2 L/s yield, EC = 2,000 uS/cm)
hammer tinted green after test
fracture zone at 18.8 m (2 to 3 L/s), water turns from reddish purple to dirty brown

Bentonite seal
12 m screen installed from 50.5 to 62.5 m with 80 mm slotted PVC (1 mm perforations)
water becomes noticeably clearer near bottom of hole (and less impacted)
End of Hole = 62.5 m
**LITHOLOGY**

**SOIL/ROCK DESCRIPTION**

**Additional Comments**

(Yield, water quality, geofabric, special construction design, etc.)

---

**Laterite**

Reddish brown sandy clay

**Coomalie Dolostone**

Reddish brown, fine-grained dolostone

No flakes of crystalline calcite (same rock as at PMB17)

Rock reacts to HCl in powdered form

Stickup = 0.8 m

6" Steel Casing

Bentonite seal

Two closely-spaced, 20 to 30 cm thick sand-filled fractures from 16.0 to 17.5 m

Together these fractures yielded 40 to 50 L/s during a 30 minute airlift test
LATERITE
reddish brown clayey sand

COOMALIE DOLOSTONE
dark brown, fine-grained dolostone
very little calcite although rock does react to acid in powdered form
same rock as observed at PMB14 and PMB17 (no evidence of silicification)

Stickup = 0.46 m

water level observed at 5 m bgs or so (much shallower than at bore PMB14)

airlift test conducted at depth of 9.5 m (2.5 m into bedrock)
2 to 3 L/s yield (EC = 950 uS/cm)

Bentonite seal

12 m screen installed from 12.4 to 24.4 m with 80 mm slotted PVC (1 mm perforations)

End of Hole = 24.4 m bgs
<table>
<thead>
<tr>
<th>DEPTH (m)</th>
<th>SOIL PROFILE</th>
<th>LITHOLOGY SOIL/ROCK DESCRIPTION</th>
<th>WELL</th>
<th>ADDITIONAL COMMENTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td></td>
<td>LATERITE</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>reddish-brown sandy clay with</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>ferruginous mottles</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>fragments of yellowish clay near</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>bedrock contact</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td>COOMALIE DOLOSTONE (silicified)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>whiteish grey, coarse crystalline</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>marble (appears to be silicified</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>dolomite)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>sharp, angular chunks of chert</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>returned to surface (same as PMB7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>rock reacts to HCl in powdered</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>form (likely due to calcite)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>white crystalline flakes of calcite</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>react more vigorously to acid (similar to PMB12)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22.5</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

**Stickup = 0.64 m**

**Bentonite seal**

- at 15 m: water turns milky white colour (EC spikes to 1,800 uS/cm)
- at 15.1 m: EC = 2,200 uS/cm
- at 15.5 m: EC = 3,000 uS/cm (yield increases briefly; fracture zone)

Airlift test conducted at 17 m: <0.5 L/s yield (EC = 950 uS/cm)

**End of Hole: 22.5 m**
### Soil/Rock Description

**Lateralite**
- reddish brown sandy clay

**Coomalie Dolostone**
- dark brown, fine-grained dolostone
- no flakes of crystalline calcite as observed at PMB12 and PMB13 (just brown dolostone)
- powdered rock reacts vigorously to HCl
- fractured particularly evident from 14.0 to 15.3 and 22.0 to 26.0 m

**Additional Comments**
- Yield, water quality, geofabric, special construction design, etc..

**Driller:** Girraween Drilling Ltd.

**Location:** N of Open Cuts

**Method:** DC Rotary

**Log:**
- Stickup = 0.62 m
- 6" Steel Casing to 15.0 m
- Bentonite seal
- 6 m screen installed from 20 to 26 m with 80 mm slotted PVC (1 mm perforations)
- 23 m
- 6 to 8 L/s (30 min air lift yield)
- EC = 800 uS/cm
- 25.5 m
- 10 L/s (30 min air lift yield)
- EC = 840 uS/cm
- End of Hole = 26 m
FILL/SAPROLITE (with minor alluvium)
mixture of sandy clay and rocky material associated with Old Tailings Creek

Stickup = 0.62 m

Bentonite grout

6 m screen installed from 2 to 8 m with 80 mm PVC (1 mm perforations)

End of Hole = 8 m
FILL/SAPROLITE
mixture of sandy clay and rock material/alluvium from Old Tailings Creek

COOMALIE DOLOSTONE
brownish-beige coloured rock (possibly tremolite schist)
rock does not reach to HCl (even in powdered form)

Stickup = 0.73 m

Bentonite seal

Airlift test conducted from 15 to 18 m (2 to 3 L/s); fracture zone

12 m screen installed from 12.5 to 24.5 m with 80 mm slotted PVC (1 mm perforations)

End of Hole = 24.5 m
**LITHOLOGY**

**SOIL DESCRIPTION**

- **SAPROLITE**
  - light brown/beige-coloured quartz sands and gravels

**WELL**

- **Stickup** = 1.4 m
- Bentonite grout to surface

- 80 mm PVC w/ 1 mm slotted screen from 2.9 to 6.9 m
- Very little water; no yield test possible
- End of Hole = 6.9 m
SOIL/SAPROLITE
brownish quartz gravels and sand

RUM JUNGLE COMPLEX
hard, competent granite (fractured)
quartz and plagioclase feldspar evident (few mafic minerals)
fractured throughout but relatively low permeability overall (<0.2 L/s)

Stickup = 0.81 m
switched to 6" bit at 8 m
Bentonite seal
< 0.1 L/s; no flow test possible
18 m screen installed from 12.1 to 30.1 m with 80 mm slotted PVC (1 mm perforations)
End of Hole = 30.1 m
### Soil and Rock Description

<table>
<thead>
<tr>
<th>Layer</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alluvium</strong></td>
<td>Sand and gravel w/larger (up to 10 cm), sub-rounded river rocks often returned to surface from borehole. River rocks represent a mixture of shale and dolomite (similar to that encountered in the East Finniss River channel).</td>
</tr>
<tr>
<td><strong>Coomalie Dolomite (silicified)</strong></td>
<td>mixture of siliceous dolostone and black shale returned from borehole. Dolostone reacts to acid in powdered form. Dry drilling (very little water returned from borehole).</td>
</tr>
<tr>
<td><strong>White's Formation</strong></td>
<td>Layer of carbonaceous black shale (water turns greyish-black with metallic sheen and resembles the water observed during drilling PMB10).</td>
</tr>
<tr>
<td><strong>Coomalie Dolomite</strong></td>
<td>Primarily whiteish-greyish dolostone with some black shale present. Water returned from borehole has a metallic sheen due to minor black shale; numerous water-bearing fractures are present.</td>
</tr>
</tbody>
</table>

### Additional Comments
- **Stickup = 0.65 m**
- Bentonite grout
- Air lift test conducted at 14 m bgs (< 0.5 L/s)
- End of Hole = 24 m
**SOIL/ROCK DESCRIPTION**

**LITHOLOGY**

<table>
<thead>
<tr>
<th>SOIL PROFILE</th>
<th>LITHOLOGY</th>
<th>WELL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>ALLUVIUM</td>
<td>Stickup = 0.47 m</td>
</tr>
<tr>
<td></td>
<td>Mixture of sands and gravels from nearby river channel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WHITE’S FORMATION (altered) highly-weathered, carbonaceous black shale</td>
<td></td>
</tr>
<tr>
<td></td>
<td>WHITE’S FORMATION weathered black shale (less weathered than above though)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>COOMALIE DOLOSTONE (silicified) whiteish grey dolostone with coarse crystalline marble/quartz from 20 to 24 m rock reacts weakly to acid in powdered form</td>
<td></td>
</tr>
</tbody>
</table>

**ADDITIONAL COMMENTS**

(Yield, water quality, geofabric, special construction design, etc.)

**MOBILE GEOTECHNICAL INVESTIGATION REPORT**

**PROJECT NAME:** Rum Jungle  
**PROJECT NUMBER:** 183002  
**METHOD:** DC Rotary  
**LOCATION:** fmr. heap leach area  
**TOC ELEVATION (m AHD):** 67.25

**LOGGED/SUPERVISED BY:** P. Ferguson  
**REVIEWED BY:** C. Wels  
**DATE COMPLETED:** 15-Dec-2010*
FILL/ALLUVIUM
sands and gravels likely associated with nearby East Finniss River channel (some fill material as well)

WHITE’S FORMATION
black shale with some quartz veining
degree of weathering unclear from exploration hole log (08BE57)

COOMALIE DOLOSTONE (silificed)
dolostone and minor HQB present as well (i.e. silificed dolostone and/or chert)

12 m screen installed from 4 to 16 m with 80 mm slotted PVC (1 mm perforations)

Stickup = 0.68 m

Bentonite seal

End of Hole = 26.0 m
APPENDIX B
Slug Tests
Hvorslev

RN025165 - Falling Head

Hydrological Conductivity

Initial Displacement

LEGEND

Hydraulic Conductivity: 1.2e-007 m/sec
Initial Displacement: 0.59 m
RN025165 - Rising Head

Hvorslev

LEGEND

Hydraulic Conductivity 2.5e-007 m/sec
Initial Displacement 0.64 m
RN025170 - Falling Head
Hvorslev

LEGEND

Hydraulic Conductivity  2.6e-006 m/sec
Initial Displacement    0.54 m
RN025170 - Rising Head
Hvorslev

**LEGEND**

- Hydraulic Conductivity: 1.7e-006 m/sec
- Initial Displacement: 0.60 m
RN025173 - Falling Head
Hvorslev

Hydraulic Conductivity: 4.3e-006 m/sec
Initial Displacement: 0.60 m
RN025173 - Rising Head
Hvorslev

LEGEND

Hydraulic Conductivity 3.8e-006 m/sec
Initial Displacement 0.61 m
RN025792 - Rising Head
Hvorslev

LEGEND

Hydraulic Conductivity  1.1e-005 m/sec
Initial Displacement    0.60 m
Hvorslev

RN022083 - Rising Head

Hydraulic Conductivity

Initial Displacement

LEGEND

Hydraulic Conductivity 1.2e-005 m/sec
Initial Displacement 0.58 m
RN022084 - Falling Head
Hvorslev

Hydraulic Conductivity
3.2e-006 m/sec

Initial Displacement
0.55 m
RN022084 - Rising Head
Hvorslev

LEGEND
Hydraulic Conductivity: 2.5e-006 m/sec
Initial Displacement: 0.62 m
PMB4 - Falling Head

Hvorslev

LEGEND

Hydraulic Conductivity  4.0e-007 m/sec
Initial Displacement  0.64 m
PMB6 - Rising Head

LEGEND
Hydraulic Conductivity
2.3e-005 m/sec
Initial Displacement
0.53 m
PMB19 - Rising Head

Hvorslev

**LEGEND**

Hydraulic Conductivity: $2.3 \times 10^{-5}$ m/sec
Initial Displacement: 0.54 m
RN025165 - Falling Head
Bouwer & Rice

Displacement (m)

Time (sec)

LEGEND

Hydraulic Conductivity 1.0e-007 m/sec
Initial Displacement 0.33 m
Bouwer & Rice

RN025165 - Rising Head

Displacement (m)

Time (sec)

LEGEND

Hydraulic Conductivity  1.9e-007 m/sec
Initial Displacement  0.34 m
RN022083 - Falling Head
Bouwer & Rice

Displacement (m) vs Time (sec)

LEGEND

Hydraulic Conductivity: 7.2e-006 m/sec
Initial Displacement: 0.28 m
Displacement (m) vs. Time (sec) graph for RN022083 - Rising Head experiment.

**Legend:**
- Hydraulic Conductivity: $1.2 \times 10^{-5}$ m/sec
- Initial Displacement: 0.48 m
PMB6 - Falling Head
Bouwer & Rice

LEGEND

Hydraulic Conductivity  3.1e-005 m/sec
Initial Displacement  0.37 m
PMB6 - Rising Head

Hydraulic Conductivity: $8.7 \times 10^{-5}$ m/sec
Initial Displacement: 0.52 m