Evaluation of Future Rehabilitation Strategies for the Rum Jungle Mine site

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Northern Territory Department of Mines and Energy

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Format of presentation

• Rum Jungle
• Development of potential rehabilitation scenarios
• Evaluation process
• Preferred rehabilitation strategy
• Future for the project
Rum Jungle
Rum Jungle

• Major environmental impact from Acid and metalliferous drainage (AMD)
  – Seepage from the WRDs and Dysons backfilled pit are the main sources
  – East branch of the Finniss River and groundwater are affected

• Traditional owners excluded from the site
Rum Jungle
Investigating options

- Understand the sources of and transport mechanisms for contaminants from the site
- Thinking about what the traditional owners might want to do with the site
- Investigating leading practice for the management of AMD waste
- Developed objectives for the site
Rehabilitation objectives

- Is safe for people and wildlife;
- Is chemically, radiologically and physically stable;
- Has a significantly reduced contaminant load (associated with AMD travelling beyond the boundaries of the site);
- Supports sustainable land uses by traditional Aboriginal owners of the area with few, if any limitations; and
- Encourages beneficial post-rehabilitation land uses.
Traditional Owners objectives

- “Kungarakan and Warai desire that Rum jungle will be returned to a natural, living environment that also provides for a return to traditional ceremony, culture and subsistence use of natural resources. In modern society, this may include development of commercial operations that are managed according to Kungarakan and Warai traditional principles.”
Investigating options

• Based on all of the things that we had learnt any option would need to:
  – backfill as much waste as possible to the pits
  – consolidation of the remaining waste
  – reinstate some components of the cultural landscape
  – protect culturally important areas
Rehabilitation scenarios

1. Re-cover waste rock dumps in situ
2. Backfill both pits, consolidate remaining waste into Main WRD
3. Backfill both pits, consolidate remaining waste into Dysons WRD
4. Backfill both pits, consolidate waste in former tailings dam area
5. Backfill Main pit, leave Intermediate pit as a lake, re-cover remaining waste in situ
Mine model

• Determined the volumes of voids, WRDs and the volumes of cover material needed
• Simulate the relocation of waste from existing locations to backfill voids or consolidate
• Taken the rehabilitation scenarios from ideas through to concepts
• Allowed for the development of conceptual costings
### Refinement of scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Main WRD</th>
<th>Dyson’s WRD</th>
<th>Intermediate WRD</th>
<th>Backfill (Dyson’s Pit)</th>
<th>Main Pit</th>
<th>Intermediate Pit</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Current covers on WRDs &amp; Dyson’s (backfilled) Open Pit</td>
<td></td>
<td></td>
<td></td>
<td>unfilled</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>WRDs &amp; Dyson’s (backfilled) Open Pit re-covered in situ</td>
<td></td>
<td></td>
<td></td>
<td>unfilled</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>50% to the pits (50% re-covered in situ)</td>
<td>re-located to Main WRD</td>
<td>re-located to Intermediate Pit</td>
<td>re-located to Main Pit</td>
<td>backfilled</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>50% to the pits (50% re-located to Dyson’s Area)</td>
<td>re-covered in situ with waste rock from the Main WRD</td>
<td>re-located to Intermediate Pit</td>
<td>re-located to Main Pit</td>
<td>backfilled</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>50% to the pits (50% re-located to Old Tailings Dam area)</td>
<td>re-located to Old Tailings Dam area</td>
<td>re-located to Intermediate Pit</td>
<td>re-located to Main Pit</td>
<td>backfilled</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>34% to Main Open Pit (66% re-covered in situ)</td>
<td>re-shaped &amp; re-covered in situ</td>
<td></td>
<td>re-located to Main Pit</td>
<td>backfilled</td>
<td>unfilled</td>
</tr>
</tbody>
</table>

**Scenario Overview:**

Scenario 0. Current Conditions

Scenario 1. Re-shape & re-cover the WRDs and Dyson’s (backfilled) Open Pit in situ

Scenario 2. Backfill the pits and consolidate waste rock to the Main WRD

Scenario 3. Backfill the pits and consolidate the residual waste rock from the Main WRD in Dyson’s Area

Scenario 4. Backfill the pits and re-locate the residual waste rock from the Main WRD to the Old Tailings Dam area

Scenario 5. Backfill the Main Open Pit and re-cover the residual waste rock from the Main WRD and Dyson’s WRD in situ
Selecting a preferred scenario

• Need to find a way to evaluate all of the options based on a number of factors including:
  – environmental performance
  – Cultural considerations
  – Technical feasibly
  – Financial cost to implement

• Multiple Accounts Analysis was chosen
Multiple Accounts Analysis

• As it enabled the proposed rehabilitation scenarios to be evaluated based on multiple factors

• A workshop was held with key stakeholders in February 2013 which allowed the accounts, issues, and indicators to be weighted and further refined
Multiple Accounts Analysis

- Environmental, cultural, and technical issues are categorized into ‘accounts’ and account scores are calculated by weighting each issue.

<table>
<thead>
<tr>
<th>ACCOUNTS</th>
<th>SUB-ACCOUNTS</th>
<th>INDICATORS</th>
<th>INDICATOR WEIGHTS</th>
<th>ALT 1</th>
<th>ALT 2</th>
<th>ALT 3</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVIRONMENT</td>
<td>Re-establishment of Biological/Vegetative</td>
<td>Density of revegetated areas</td>
<td>3</td>
<td>1</td>
<td>5</td>
<td>9</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td>Potential</td>
<td>Ecosystem diversity/sustainability</td>
<td>5</td>
<td>5</td>
<td>9</td>
<td>1</td>
<td>...</td>
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<tr>
<td></td>
<td></td>
<td>Percent of area with regrowth</td>
<td>3</td>
<td>5</td>
<td>6</td>
<td>9</td>
<td>...</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Compatibility with wildlife habitat</td>
<td>4</td>
<td>1</td>
<td>9</td>
<td>1</td>
<td>...</td>
</tr>
<tr>
<td>SUB-ACCOUNT SCORE</td>
<td></td>
<td></td>
<td></td>
<td>3.13</td>
<td>7.42</td>
<td>4.03</td>
<td></td>
</tr>
<tr>
<td>ACCOUNT SCORE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sealed Factor:

9  BEST
8  very good
7  GOOD
6  good ‘ish
5  INTERMEDIATE
4  poor ‘ish
3  POOR
2  very poor
1  WORST

Alternative A (e.g. 88% revegetated)
Alternative B (e.g. 58% revegetated)
Alternative C (e.g. 45% revegetated)
## Multiple Accounts Analysis

<table>
<thead>
<tr>
<th>Accounts Assessment Criteria</th>
<th>Alternative Rehabilitation Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Weight</strong></td>
<td><strong>Account Score</strong></td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td><strong>Issue Score</strong></td>
</tr>
<tr>
<td>9</td>
<td>6</td>
</tr>
</tbody>
</table>
| 9 | 9 | Removal of contaminated materials from currently affected areas | Environmental impact sensitivity/assessive capacity | Conditions in the east branch of the Finniss River downstream | Locations & heights of the WRDs (female perspective) | Minimizes burden on society (
based on residual footprint area) |
| 9 | 9 | New borrow areas (for cover materials) | Contaminant re-mobilization due to re-locating WRDs | Potential for first flush exceedances | Locations & heights of the WRDs (male perspective) | Minimizes burden on society (based on residual footprint area) |
| 9 | 9 | No Rehabilitation | Re-Cover WRDs & Dyson’s Landform | Backfill the pits (consolidate to Main WRD) | Employment & training opportunities during rehabilitation | Minimizes burden on society (based on residual footprint area) |
| 9 | 9 | #1 Backfill the pits (consolidate to Main WRD) | Backfill the pits (consolidate to Dyson’s Area) | Potential migration of groundwater from heap leach area | Community infrastructure & long-term employment opportunities | Minimizes burden on society (based on residual footprint area) |
| 9 | 9 | #2 Backfill the Main Pit (consolidate to Old Tailings Dam area) | Backfill the Main Pit & re-cover in situ | Contaminant loading to groundwater | Long-term active management (based on residual footprint area) | Minimizes burden on society (based on residual footprint area) |
| 9 | 5 | & | & | & | & | & |
| 9 | 4 | & | & | & | & | & |
| 9 | 3 | & | & | & | & | & |
| 9 | 2 | & | & | & | & | & |
| 9 | 1 | & | & | & | & | & |
| 5 | 5 | & | & | & | & | & |
| 5 | 4 | & | & | & | & | & |
| 5 | 3 | & | & | & | & | & |
| 5 | 2 | & | & | & | & | & |
| 5 | 1 | & | & | & | & | & |
| 5 | 0 | & | & | & | & | & |

### MAA Score:

| Overall Ranking: | 6 | 5 | 3 | 4 | 2 |

### MAA Score:

| Account Score: | 6 | 5 | 3 | 4 | 2 |

### Overall Ranking:

| 6 | 5 | 3 | 4 | 2 |

### Issue Score:

| 9 | 8 | 7 | 6 | 5 | 4 | 3 | 2 | 1 |

### Technical Feasibility of Solution

- Line treatment during backfilling process
- Seepage collection
- Issues & feasibility of cover construction

### Availability of Mitigation Strategies to Adaptive Management

- Flexibility of solution to adaptive management after rehabilitation

### MAA Score:

| 4.3 | 3.9 | 5.4 | 3.3 | 7.3 | 5.7 | 5.5 |

### Overall MAA Score:

| 2.9 | 3.5 | 5.5 | 4.3 | 7.8 | 5.5 | 5.5 |

### Overall MAA Ranking:

| 6 | 5 | 3 | 4 | 2 | 1 | 0 |
Evaluation process

• The importance ascribed to the various issues was based on:
  – Technical knowledge of the site
  – Extensive consultation with stakeholders (particularly the traditional Aboriginal owners)
  – Leading practice rehabilitation principles
Outcome

• Based on the MAA, the preferred rehabilitation strategy chosen was Scenario 4:
  – backfill both pits with waste
  – Maintain a water cover on the pits
  – consolidate the remaining waste in a new facility in the former tailings dam area
Future

• Considerable amount of work still needs to be undertaken to refine the preferred scenario including detailed design

• The Northern Territory and Commonwealth government are now working under a new Project Agreement to make this happen
In summary

• Need to understand the site and the sources of contamination
• Allow objectives to drive your options
• Make sure that your options are practical
• Work with your stakeholders to make the final decision
Overview of the former Rum Jungle mine site

The former Rum Jungle mine site (Section 2968 Hundred of Goyder) is located approximately 150km (by road) south of Darwin, near Batchelor in the Northern Territory. The site was declared a Restricted Use Area in 1985 under the Northern Territory’s Soil Conservation and Land Utilisation Act and is closed to public access.