Key Lessons for Mine Pit Lakes and Mine Closure

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Mine Pit Lakes

- International phenomenon
  - Open-cut mining more common
  - Technological advances; larger pit voids
  - Many Australian examples
    - (WA: 1,800 in 2003)
## Pit Lakes Districts

<table>
<thead>
<tr>
<th>Lake District</th>
<th>Country</th>
<th>Number of lakes in</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Athabascan Oil Sands</td>
<td>Canada</td>
<td>0 current (26 proposed)</td>
<td>Westcott &amp; Watson (2007)</td>
</tr>
<tr>
<td>Borská Nížina</td>
<td>Slovakia</td>
<td>11 current</td>
<td>Otahel'ová and Otahel' 2006</td>
</tr>
<tr>
<td>Central German, Lusatian, Rhenish districts</td>
<td>Germany</td>
<td>370 current; 205 current</td>
<td>Schultze et al. in press</td>
</tr>
<tr>
<td>Collie Lake District</td>
<td>Australia</td>
<td>13 current (more proposed)</td>
<td>Kumar et al. in press</td>
</tr>
<tr>
<td>Iberian</td>
<td>Spain</td>
<td>22 current</td>
<td>Sánchez-Espanã et al. 2008</td>
</tr>
<tr>
<td>Łęknica</td>
<td>Poland</td>
<td>&gt;100</td>
<td>Żurek in press</td>
</tr>
</tbody>
</table>

Potential Closure Risks

Evaporation causing salinisation

Contamination of surface waters

Feral animal watering

Contaminant bioaccumulation

Groundwater losses

Drowning

Potential Closure Risks


Water Quality

Catchment Scale

- Pit lakes should be incorporated back into the landscape\(^1\)
- Both aesthetic and landscape ecosystem function requirements
- As per all land forms in good closure practice

Beneficial End Uses

Aquatic Habitat Loss

- Pressure on water resources increasing
  - Increasing demand
  - Climate change predictions
  - International loss of aquatic habitats
Restoration - Revegetation

- Ecological succession
  - Riparian vegetation; bank stabilisation, vegetation establishment

Van Etten et al. (in review). Setting restoration goals for restoring pit lakes as aquatic ecosystems: a case study from south west Australia. Mining Technology

- Regional examples
  - Reference systems provide restoration guidance
  - Acknowledgement of seration important
Monitoring

- Long term water balance and water quality?
  - Physico-chemical/biological monitoring *essential*
  - Modelling typically required
- Demonstration that closure criteria are met
Lake Kepwari Void (WO5B) Closure

- Began with Collie River South Branch (CRSB) diversion

- Rehabilitation:
  - Overburden dumps/exposed seams covered with waste rock
  - Battered and revegetated with endemic vegetation
  - Rapid-filled by CRSB diversion 2002-2005
  - AMD still developed, water ca. pH <4
  - Diversion engineered to 1:100 year flood event

Lake Breach and Decant

- River breach
  - Storm event August 2011
    - River rose overtopping south bank; 1.7 m height increase
    - Subsequent decant to lower CRSB
  - No significant impacts to downstream river values
  - Significant *improvement* to lake water quality
Collie River Inflow

EC (mS/cm)

pH

Depth (m)
Conclusions

- Pit lakes increasingly common mining legacy
  - Significant mine closure risks
  - Significant legacy opportunities
  
  ... but only when adequately planned ...

- Risks and beneficial end uses managed through:
  - Explicit regard in the closure planning process
  - Life-of-mine closure consideration
Thankyou. Questions?