Emalahleni Water Reclamation Project

Supplying Water to the Community

South African Colliery Managers’ Association

12 July 2007

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Assistant Water Plant Manager
Tel: 013 6915452
• Safety

• Statistics 2006/7:

• 7 recordable incidents on site to date:
  • Rod onto forehead – FAC
  • Punctured hand with screwdriver - MTC
  • Slip and fall on plastic lining in brine pond - MTC
  • Hand puncture on scaffolding – MTC
  • Fractured pelvis at batching plant – LTI
  • Amputated finger with board on truck at brine pond – LTI & Reportable
  • Fractured wrist resulting from fall from ladder – LTI
**Safety**

- **Safety System:**
  - Full time Safety Officer on site – Willie van der Nest
  - Visible felt leadership
  - Monthly RLT Manager’s safety audit
  - Safety incentive scheme adopted:
    - Individual bonus
    - Safest team member
    - Safest site contractor
Anglo Coal and BHP Billiton Joint Initiative

Co-operative Water Management between Anglo Coal and Ingwe Collieries in the Olifants River Catchment

An initiative was started by Anglo Coal and Ingwe on 14 May 2002 to jointly develop and implement water management strategies that will contribute to the achievement of the in-stream and dam water quality, quantity and aquatic objectives, set or amended by DWAF for the catchment.

The Emalahleni Water Reclamation Plant is a product of this initiative.
Anglo Coal and BHP Billiton Joint Initiative

LEGEND
- Rivers
- Roads
- Collieries
- Dams

EMALAHLENI
“Place of Coal”
PROJECT

STEVE TSHWETE
PROJECT
Water Impact
Greenside Colliery
Underground Mining
Water Impact
Greenside Colliery
Underground Mining
Water Impact

Kleinkopje Colliery
Open Cast Mining
Water Impact

South Witbank Colliery
Open Cast Mining

Void prior to rehabilitation

Void after partial rehabilitation
Geo-hydrological model of 2 seam floor

South Witbank/Greenside barrier pillar

South Witbank/Landau 2 barrier pillar

Landau 1 and 2 / Greenside barrier pillar

Landau 3/Greenside barrier pillar

Wolwekrans/Kleinkopje barrier pillar

Navigation/Greenside barrier pillar

Greenside/Tweefontein barrier pillar

Kleinkopje/Tweefontein barrier pillar
Model Output - excess water rate

- **Total excess water (m³/d)**
- **Available for desalination (m³/d)**
- **Emalahleni Municipality requirement (m³/d)**

**Predicted potable water shortfall by the Emalahleni Municipality**

- 2007: Desalination plant operational.
- 2005: Water not taken by Municipality is discharged into the stream.
- 2010: Water capacity 10 Mm³
- 2010: Block 2A Dam dry
- 2010: NAV dry
- 2010: 5W closure
- 2010: Water shortfall to be made up from Ingwe Collieries mines.
- 2020: 2A & 3A closure, KK plant closed
- 2020: 2A Opencast full of water
- 2020: GS and NAV closure
- 2020: 3A Opencast full of water
- 2023: Predicted potable water shortfall to be made up from Ingwe Collieries mines.
- 2030: 32 Ml/day predicted decant volume after closure.

- 10 Ml/day for mining purposes
- 20 Ml/day for desalination plant

Years:
- 1990
- 2000
- 2005
- 2010
- 2020
- 2030
- 2040
- 2050
## Water Quantity Design Basis

<table>
<thead>
<tr>
<th></th>
<th>Average Flow Rate (Ml/day)</th>
<th>Maximum Flow Rate (Ml/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kleinkopje</td>
<td>10.5</td>
<td>20</td>
</tr>
<tr>
<td>Landau</td>
<td>2.0</td>
<td>10</td>
</tr>
<tr>
<td>Greenside</td>
<td>6.0</td>
<td>20</td>
</tr>
<tr>
<td>South Witbank</td>
<td>1.5</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>20.0</strong></td>
<td><strong>55</strong></td>
</tr>
</tbody>
</table>

- Minimum treated water flow = 20 Ml/day
- Maximum treated water flow = 24 Ml/day
- Improved to 25 Ml/day (max 29 Ml/day) with demo plant trials
### Water Quality

- 4 Different mine waters are treated with varying water qualities
- Plant design made on 95 percentile of worst water quality which is acidic

<table>
<thead>
<tr>
<th>Constituent</th>
<th>Units</th>
<th>Feed Water Quality</th>
<th>Targeted Treated Water Quality</th>
<th>SABS Class 1 standard</th>
<th>Mass rate to be removed (tons/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td></td>
<td>2.7</td>
<td>7.0 – 8.0</td>
<td>5.0 – 9.5</td>
<td>NA</td>
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<tr>
<td>Total Dissolved Salts</td>
<td>mg/l</td>
<td>4800</td>
<td>&lt; 450</td>
<td>&lt; 1000</td>
<td>90</td>
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<tr>
<td>Sulphate</td>
<td>mg/l</td>
<td>3090</td>
<td>&lt; 200</td>
<td>&lt; 450</td>
<td>57.8</td>
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<tr>
<td>Calcium</td>
<td>mg/l</td>
<td>660</td>
<td>&lt; 80</td>
<td>80 – 150</td>
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<tr>
<td>Magnesium</td>
<td>mg/l</td>
<td>230</td>
<td>&lt; 30</td>
<td>30 – 70</td>
<td>4.0</td>
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<tr>
<td>Iron</td>
<td>mg/l</td>
<td>210</td>
<td>&lt; 0.010</td>
<td>&lt; 0.010</td>
<td>4.2</td>
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</table>

- The waters to be treated are **not** polluting the Olifants River but are affecting mining production and need to be treated before they could decant into the Olifants River
- A detailed monitoring program has been compiled which dovetails with the current mine water monitoring system
Technology Selection

• Full enquiry issued to 4 short listed technology suppliers, namely:
  – Keyplan
  – Veolia
  – IST Technik
  – Bateman Africa

• Provide for capital cost, operational and maintenance costs and capital replacement costs

• Provide for the cost to operate the plant for a minimum of 3 years

• Technology had to be able to treat water from very acidic, high sulphate waters to very good potable water quality

• Only water recoveries (yield) > 95 % was acceptable

• Technical and financial adjudication completed over 20 year life (capital, O&M, replacement)
## Technical Adjudication Results

<table>
<thead>
<tr>
<th>Technical Adjudication Criteria</th>
<th>Weighting</th>
<th>IST Technik</th>
<th>Veolia Water</th>
<th>Bateman Africa</th>
<th>Keyplan</th>
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<tr>
<td>Project team resources</td>
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<td>Key factors and pertinent issues</td>
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<td>Operability issues</td>
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<td>Reliable achievement of project targets</td>
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<td>Clients standards and preferred suppliers</td>
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<td>J J J</td>
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<td>Safety, health and environment</td>
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<td>J J J</td>
<td>J J</td>
<td>J J J</td>
</tr>
</tbody>
</table>

Adjudication Team: Anglo; BHP Billiton; Golder; Venn & Milford
Enquiry Adjudication Outcome

- Keyplan awarded the contract
- Keyplan constructed demo plant as per tender submission in Sept 05 for design verification
- Operated successfully for 3 months
- Sludge dewatering trials done
- Comprehensive analyses done

<table>
<thead>
<tr>
<th></th>
<th>Feed</th>
<th>Treated</th>
<th>Design</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH</td>
<td>2.9</td>
<td>8.0</td>
<td>6 – 9</td>
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<tr>
<td>TDS</td>
<td>4500</td>
<td>50</td>
<td>&lt; 450</td>
</tr>
<tr>
<td>Sulphate</td>
<td>3500</td>
<td>30</td>
<td>&lt; 200</td>
</tr>
</tbody>
</table>

Heavy metal gypsum

Pure gypsum
Plant Location

- All the land is owned by the mines
- Water plant may be ring fenced out of mine for establishment of long term water company
- Servitudes are established for the pipelines and electrical supply
Regulatory / Contractual

- **Regulatory**:
  - EIA approved – 2 November 2005
  - Water Use Licences – issued February 2007
  - EMPR Addenda – approved March 2007

- **Contractual**:
  - Joint Initiative Agreement - signed Nov 2006
  - Keyplan O&M Contract – signed 7 June 2007
  - Municipality Water Supply Agreement
    - MOU signed in April 2005
    - Final council resolution taken on 25\textsuperscript{th} January 2006
    - Official signing on 31 May 2007
  - BECSA South Witbank Water Supply Agreement - expected end July 2007

- **Service Level**:
  - Anglo Operations – target completion end August 2007
Emalahleni Water Supply Agreement Signing Ceremony
31 May 2007
Keyplan O&M Contract Signing Commemoration
7 June 2007
Social & Economic Benefits

- Current stored water volume exceeds 130 million m$^3$ and is both a threat and opportunity.
- Makes mining reserves accessible for mining of the 3 Anglo Coal mines - mining operations would have otherwise ceased if water was not removed.
- Provides long term solution to mine water problems catering for post closure requirements
  - BECSA South Witbank working towards closure.
- Potable water to be produced benefit eMalahleni Local Municipality (ELM)
  - Currently over-abstracting Witbank Dam at peak 106 Ml/day
  - Permitted abstraction from DWAF is 87 Ml/day, with safe yield calculated at 75 Ml/day
  - Only alternative for augmentation of water was from VRESAP
  - EWRP will provide cheaper water and better service
  - Catalyst for economic growth in the area which was stunted due to water shortage.
- Model for regional water management scheme.
- 700 temporary jobs created during construction (63% local labour used).
- 25 permanent jobs created for operations.
- Operations contracted out to South African technology supplier – Keyplan (Pty) Ltd.
Economic Model

- Anglo Coal has funded the entire capital amount of R 296 million for the construction of the water treatment plant and ancillary infrastructure.

- BECSA pay a service fee to have a right to treat their portion of water (~ 15%).

- Operating Cost:
  - Mines pay operating cost to treat the water to an acceptable river discharge quality.
  - Municipality pays operating costs for further treatment to potable quality @ R 3.67/m$^3$ plus CPIX.
  - Municipal revenue apportioned back to participating mines.

- Operating Costs include:
  - Abstraction
  - Storage
  - Treatment
  - Distribution
  - Waste disposal (solid trucked to coal dump & liquid brine evaporated in hazardous lagoon)
  - Management (contractor operated & maintained, with mine supervision)

- Financial model of the project is determined over a 20 year life.

- The 3 Anglo Coal mines collectively still have over 20 years life BUT funds are provided in a pollution control fund to treat polluted water after closure.
Consultation Process

- Memorandum of Understanding (MoU) signed with Emalahleni Local Municipality in April 2005

- Full Environmental Impact Assessment (EIA) and public participation process completed – facilitated through Golder Associates Africa

- Positive Record of Decision (RoD) issued in November 2005 by Mpumalanga Department of Land Affairs and Agriculture (MDALA)

- Public participation process:
  - Two open days held in 2005
  - Interested and Affected Parties (I&AP’s) register compiled with almost 300 individuals and organizations represented
  - Press releases were issued over the course of the project
  - Recent public participation process done on behalf of Municipality regarding acceptance of mine proposal

- Water Supply Agreement signing ceremony held on 31st May 2007 to celebrate the signing of the agreement between the municipality and Anglo Coal – attended by Anglo Coal South Africa CEO, BHP Billiton Energy Coal COO, Executive Mayor Emalahleni Local Municipality and Premier of Mpumalanga
Waste Projects

- Significant enhancements have been made to the water treatment process to improve water recoveries to > 99% by maximising the solid waste production and minimising the liquid brine production.

- Anglo Coal is presently funding all the R&D projects.

- The waste conversion of solid waste gypsum into either:
  - Sulphur, magnesium carbonate and limestone
  - Gypsum building and mining products
  - These projects are well advanced and results expected early in 2008.

- On the liquid brine investigations are looking towards:
  - Algal growth for production of spirulina, beta-carotene or bio-diesel
  - Project proposals are almost ready for funding application.

Heavy metal gypsum  Pure gypsum
Green Awards 2007

• **Mail & Guardian Greening the Future Awards:**
  – Won in two categories –
    • Water Care
    • Companies with Innovative Environmental Strategies that Improve Business Performance

• **Nedbank Capital Green Mining Awards 2007:**
  – Short-listed in category of Sustainability
Project Progress

• 98 % complete

• Expenditure = R 254 million (Budget R 296 million)

• Construction:
  • 7 Main contractors
  • 22 Sub-contractors
  • 450 people at peak
  • Estimate ~ 700 people over duration

• Commissioning:
  • Commissioning of stage 1 (pre-treatment) : March 2007
  • Commissioning of stage 1 (membranes) : Mid July 2007
  • Commissioning of stage 2 & 3 : August 2007
  • Full production : September 2007
Architects Impression of Final Plant
February 2006
From this ……………

To this……………..?????