Mine Closure Water Management: Choosing the Right Alternative within a Changing Environment

Sharon Clark and Ritva Muhlbauer
IMWA 2010 Symposium, Sydney, Nova Scotia

bhpbilliton
resourcing the future

SA Legislative Context

- Extensive changes to environmental legislation governing mining and water have occurred in the last 15 years:
  - SA Constitution (Act 108 of 1996);
  - Mineral and Petroleum Resources Development Act (Act 28 of 2002);
  - National Water Act (Act 36 of 1998);
  - National Environmental Management Act (Act 107 of 1998 amended in 2006);
- Operational mines still have the opportunity to make necessary changes where required to be compliant
- Closed mines have to conform even though financial resources may no longer be available – this requires innovative thinking

Legislation Implications

Constitution states: “*everyone has the right to an environment that is not harmful to their health and wellbeing and to have an environment protected for the benefit of both present and future generations* “

- Constitution provides mining the right to economic activity, but not to externalise its impacts on society or the environment.
- Duty of Care: further requires mining to design, develop and implement measures to prevent, minimise and rectify pollution

Legislation Implications

- Revised legislation places greater impetus on polluters internalizing their externalities – “polluter pays principle”
- Environmental liabilities remain the responsibility of the mining company into perpetuity
- Even when a mine closure certificate has been obtained the environmental and water liability remains – it does not revert to state upon closure
- Now requires adequate provision to be made for water management / treatment into perpetuity
- Closed mine now need to manage legacy issues with very few alternatives at hand and even less funding

Sustainability?

Project Setting

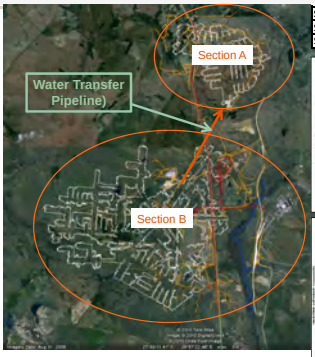
- Defunct colliery in KwaZulu Natal, South Africa consisting of two legally and geographically separate sections
- Mining ceased in Sep 1992 with rehabilitation completed in1996 in compliance with the Minerals Act, Act 50 of 1991

Major items of rehabilitation included:
- 80 Ha discard dump, 15 Ha opencast void, 25 Ha rail siding
- Removal of process plant & associated infrastructure
- Sealing of vertical ventilation shaft & incline shafts
- Closing of cracks and diverting water away from the subsided areas
- Aftercare of rehabilitated areas

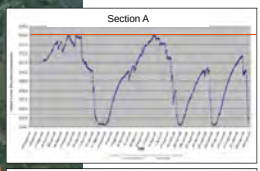
Project Rationale – Water Liability

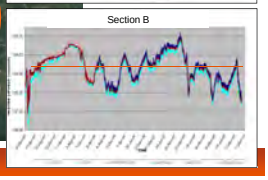
- **In 2004 Section B began to decant, as a contingency measure pipeline built to transfer water to Section A**
- **By 2005 both underground sections were full – built additional emergency control dams**
- **Mine applied for a water use license to release affected water under controlled conditions**
- **Dept of Water Affairs (DWA) issued 5 year directive on condition the mine develop and begin implementing a long-term water management plan**
- **In 2010 this license was extended for an additional 5 yrs**

Water Issue – Current Controls



Section	Surface Area (ha)	Water Make	Avg TDS
Section A	500ha	Ratio 1:4	1000mg/l
Section B	1500ha	Ratio 3:4	4000mg/l





Project Objective

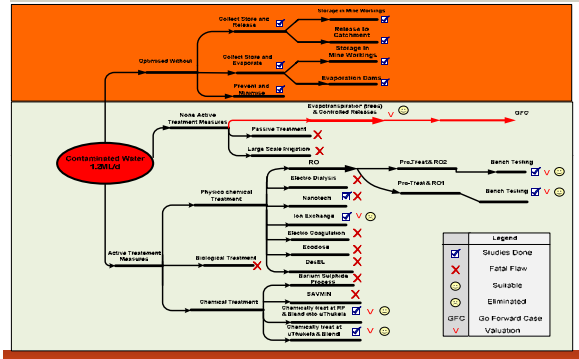
- Project initiated in 2006 – driven by the DWA directive and Company’s Environmental policies to minimize the long term water liability

OBJECTIVE

To develop a long-term sustainable Strategy to manage polluted mine water emanating from Section A & B, as well as Section A individually, that ensures legal compliance at lowest risk and cost

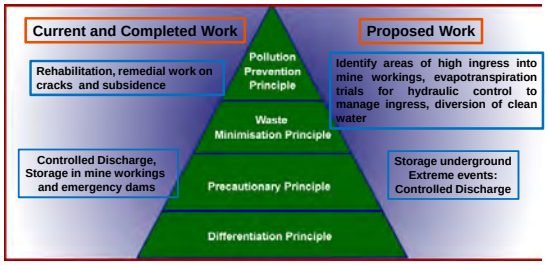
- Selection phase study undertaken in which a problem framing workshop was held to evaluate both passive and active treatment technologies in managing less then 5ML/d of sodium enriched mine water.
- In evaluating the options the project had to consider the following implications:
  - Section A & B combined has 4 times the water volume of Section A alone
  - Section B has 3 times the sulphate concentrations of Section A and exceeds the Instream Water Quality Objectives by 15 times the permissible levels for discharge

Decision Tree – Section A



Way Forward - Proposal

- **Trial evapotranspiration at Section A**
- **Continue to manage Section B via pumping water to Section A – controlled release**



"Prevention is better than cure“

Evapotranspiration – grass vs. trees

	Wet Scenario (Summer)		Dry Scenario (Winter)	
	Trees	Grass	Trees	Grass
Rainfall	1175	1175	384	384
Evaporation	799	572	384	379
Interception	80	50	61	36
Transpiration	572	235	213	180
Soil Evaporation	147	287	163	110
Ingress	361	590	0	0

Reference: Jarmsin, *et al*, 2001

Benefits:
- Control water ingress
- Soil stability

With future potential for:
- Carbon sequestration
- Potential enterprise development

Project requires 150 – 200ha of trees to manage Section A water ingress. This can be easily accommodated on site

Conclusions

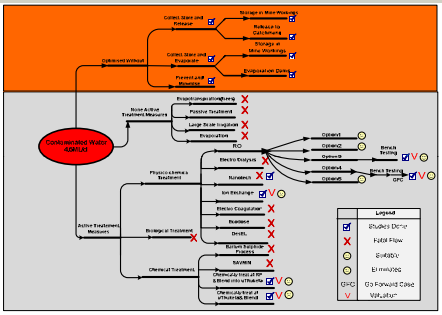
- New SA legislation requires mining to manage its environmental impact better – particularly water
- Water treatment in particular Reverse Osmosis (RO) has been proven to be technologically feasible however currently not self-sustaining:
  - Inadequate financial resources identified for RO on defunct mines
  - Decant volumes not sufficient for RO
- Requires innovative thinking
- Using DWA’s Hierarchy of Controls the project was able to identify a potential long term solution looking at pollution prevention by minimizing water ingress
- Trial to be conducted at Section A and if proved viable may be incorporated into water management strategy for Section B as well

Thank You

Questions??

Back-up Slides

Decision Tree – Section A & B



Bench scale tests for RO treatment were positive, but technically not proven at scale and not sustainable from a cost perspective