Project Background or Rationale
Population growth, rising service levels and economic development means that in many parts of South Africa, demand for water is growing faster than the supply available.

In a first for South Africa, a pioneering public-private partnership (PPP) between eMalahleni Local Municipality and two leading coal mining companies (BHP Billiton and Anglo Coal) has led to the establishment of a major mine water reclamation plant. Acidic, saline, underground water from four nearby coal mines is treated and purified to drinking water standards and supplied to the Municipality.

This type of collaboration between two large mining corporations has few precedents in South Africa, and highlights the growing importance attached to responsible environmental management. This innovative partnership has averted a water supply crisis in eMalahleni. At the same time, a major water contamination problem and environmental hazard has been transformed into a valuable resource which meets the needs of a range of users, safely and reliably.

Capacity and Type of Reuse Application
The eMalahleni Municipality is the main user and now receives 4.2 million gallons (16 megalitres) of safe, treated drinking water each day from the reclamation plant to boost domestic water supplies. Since April 2009, this amount increased to 5.3 million gallons (20 megalitres) per day. The outcome of this solution is based on ten years of research by Anglo Coal into water quality management options identifying a range of possible treatment technologies. No less than 13 different treatment technologies to remove heavy metals and sulphates were evaluated in demonstration projects. In 2004, Anglo Coal short-listed seven technologies for further evaluation, and after extensive investigation, opted for a technology that relied on advanced membrane desalination. The key advantages of this technology were low life-cycle costs, a high rate of water recovery (greater than 99 percent), and waste streams suitable for reprocessing and reuse.

A 31,700 gallons (120 m³/day) pilot plant began in 2005 to test the technology rigorously over a three month trial. Its performance exceeded expectations and Anglo Coal moved swiftly to develop a much larger plant, able to deliver 5.3 million gallons (20 megalitres) a day of potable water, with further capacity to provide safe industrial-grade water for routine mining operations.

Water Quality Standards and Treatment Technology
The treatment process is designed to produce water quality, which meets South African National Standard for Drinking Water Quality (SANS 0241 Class 0 potable water) and uses the High Recovery Precipitating Reverse Osmosis (HiPRO) process from which low salinity product water is generated by the membrane process. This design’s chief characteristic is that it makes use of Reverse Osmosis to concentrate the water and produce supersaturated brine from which the salts can be released in a simple precipitation process. The project’s schematic is shown in Figure 1.

This technology offers the following key advantages:

- Very high recovery
- Simple system configuration
- Easy operation
- Low operating costs
- Low capital costs
- Minimum waste

The plant is designed to treat 6.5 mgd (25 megalitres/day) of acid mine drainage (AMD) with a recovery consistently greater than 99 percent, producing potable water with a guaranteed total dissolved solids (TDS) of under 450 mg/L (SABS...
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Class 0). The treated water is stored in two large concrete reservoirs before being pumped to a municipal reservoir for distribution to users in eMalahleni. Additional water is piped to a number of Anglo Coal sites for domestic use and for mining activities such as dust suppression.

By-products of the treatment process are 26,400 gallons (100 m³) of brine and 100 tons (90,700 kg) of gypsiferous waste each day. Plastic-lined evaporation ponds are used to concentrate the brine further and Anglo Coal is exploring a number of cost-effective options for re-use. Gypsum-based wastes will be used in building construction, and the intention is to establish a market for gypsum-based building products on a large scale.

A second phase, completed in 2010, added a further 2.1 to 2.6 mgd (8-10 megalitres/day) of industrial quality water for use on nearby mines and plans are in place to increase the capacity to 13 mgd (50 megalitres/day).

**Project Funding and Management Practices**

Financing of this option of treating acid mine water was way beyond the means of the municipality, and any proposed alternatives for augmentation had a long lead period before any water was supplied. The fact that the client eMalahleni Municipality realized this constraint and the constraint of managing such an advanced technology, the only lucrative option was this long term arrangement to purchase the water. The mines needed to continue to dewater to sustain its ongoing operation and where in a better position to raise the capital, based on the all-round benefits which were envisaged to accrue. The purchase of the treated water made the project viable for the mining companies, while meeting the municipality's urgent need for additional water supplies. Ingwe Collieries owns South Witbank Colliery, where mining activities ended in 1969. In 2005, BECSA's Ingwe Collieries entered a Joint Venture with Anglo Coal to develop the R296 million eMalahleni Water Reclamation Plant.

**Successes and Lessons Learned**

The water reclamation plant and project offers a number of direct benefits. For the municipality, over and above an additional assured supply of clean water, perhaps the three most important benefits are cost-effectiveness, delivery of safe drinking water that requires no further treatment, and the technical expertise and financial resources of two major mining companies who funded the plants' capital cost of nearly US $43 million. For the mines, there is a small financial loss in subsidizing this treated water of the cost of treatment is US $1.50 per 264 gallons (m³) and sold to the Municipality for USm$1.00 per 264 gallons (m³). However the environmental and social gains are much higher in that they have avoided serious future environmental damage.

**References**

Mr. Peter Gunther, Project Manager, Anglo Coal (personal communication)