

RED LETTER YEAR

for authorities to prevent mine-water catastrophe



Authorities have less than 400 days to act before acid mine-water rising beneath Johannesburg reaches critical levels. Lani van Vuuren looks at what could arguably be the most important environmental decision in South African history.

One of the richest gold-bearing areas in the world, the Witwatersrand has, through more than a century of mining, brought unspeakable wealth to South Africa. It has also brought economic growth, infrastructure and development, all exemplified in Africa's 'City of Gold'. Now this city is under threat by what has been described as one of the worst

potential environmental catastrophes in the country's history.

One of the largest gold-bearing areas in the world, the Witwatersrand is around 350 km long and 200 km wide. Since gold was discovered here in 1886, it has been mined to depths of more than 3 000 m and has yielded by far the most gold ever mined in South Africa. Geologically, the Witwatersrand is sub-divided into four main geological areas, the Far Western Basin, the Western Basin, the Central Basin and the Eastern Basin.

Much has been said and written about the acid mine drainage menace lurking underground, steadily rising in the catacombs of old mined-out shafts that underlie Gauteng. On the East Rand, the struggling Grootvlei Mine remains

the last man standing, although at the time of writing, pumping and treatment was wholly inadequate from this mine, and millions of litres of polluted mine-water were flowing into the Ramsar-listed Marievale Bird Sanctuary in the Blesbokspruit.

Water is already decanting (flowing from underground) in the area of Krugersdorp/Randfontein on the West Rand while in the Central Basin water has passed the 500 m mark, and is expected to decant by early 2012. The former imperils thousands of years of cultural history lying buried in the Cradle of Humankind, and has rendered much of the water supply in the Krugersdorp Nature Reserve undrinkable and inhabitable. However, it is the latter threat to the people and

economic institutions of South Africa's wealthiest province that has caught the attention of the public, who are now demanding action. "The threat of acid water decanting from old mine workings is a real and present danger. It poses a threat to our economy, environment, health and history," noted Prof Terence McCarthy of the School of Geosciences at the University of Witwatersrand.

Speaking at the launch of the latest in the Gauteng City Region Observatory Provocation Series titled 'The decanting of acid mine drainage in the Gauteng City Region' Prof McCarthy stated that "The solutions are expensive, though not technically daunting, and must be implemented within a matter of months, if we are to prevent acid mine drainage at different points in the Gauteng city region."

AREAS AT RISK

According to Prof McCarthy, the prime risk area where decant points are likely to develop is in a zone about 500 m wide straddling Main Reef Road and the M2 motorway, plus a secondary zone some 2 km to the south. "Deep basements of buildings and other sub-surface infrastructure in the risk zones could experience flooding and the

Gold-mine tailings such as these are a grim reminder of the legacy of gold-mining on the Witwatersrand.



underground facility at Gold Reef City, a national treasure, will be lost."

It is not only where this toxic water is likely to decant that is cause for concern, but when. The water level in the mine void is currently rising at a rate of around 15 m a month (this rate of rise increases exponentially during the rainy season). Estimates suggest that if left to fill the mine void unhindered, acid mine drainage will start decanting in the Central Basin in a year's time.

However, action will need to be taken much earlier. The environmental critical level has been set at between 100 and 150 m below surface. If acid mine-water is allowed to cross this level unspeakable damage to the environment could occur. It should be noted, however, that to ensure the security of the Gold Reef City underground facility, the water level would need to be maintained at a depth of at least 250 m below surface.

CALL TO ACTION

Authorities have been criticised for taking so long to come up with an assertive plan of action. Only in September last year was an Inter-Ministerial Committee (IMC) appointed to address the acid mine drainage issue on the Western and Central basins. A panel of experts from various institutions was

subsequently tasked to investigate the issues at hand, as well as to study possible remedies and costs, and come up with a series of recommendations for Cabinet to make an appropriate decision.

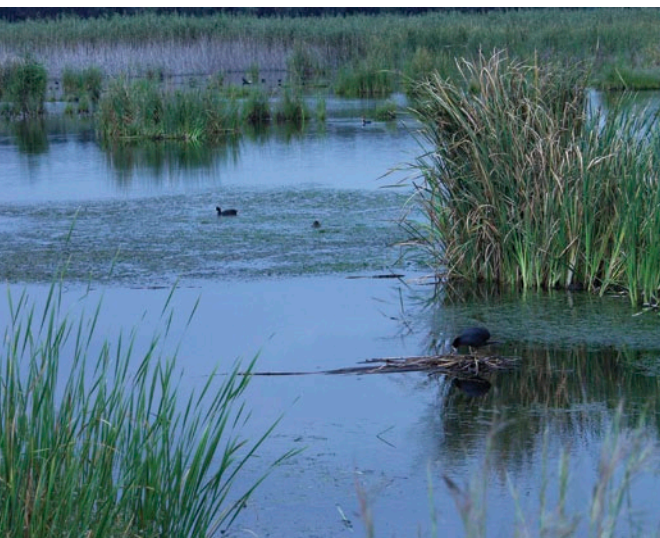
WHAT CAUSES ACID MINE DRAINAGE?

Gold was discovered on the Witwatersrand in 1886. Through the centuries, vertical shafts were sunk to depths of more than 3 000 m below the surface. In the process, the layers of gold-bearing reef rock were extracted (around 1 300 million tons in total), and an extensive cavity was created. This cavity is known as the mine void. Adjacent mines are generally interconnected through their workings.

In the course of mining, water-bearing fractures are intersected, causing water to flow from these openings into the mine workings. Water also penetrates from the surface. While a mine is operational, this water is pumped out to allow mining to continue unhindered.

The mines on the Witwatersrand began to close in the late 1950s due to declining profits. Closure of a mine means that pumping of water from the mine void ceases and water starts accumulating in the deeper underground workings. The gold-bearing rock contains all sorts of metals and minerals, including pyrite or 'fool's gold'. When pyrite is exposed to oxygenated water, it forms sulphuric acid. In the acidic water, other minerals also break down and their metals dissolve into the water.

By the time acid mine drainage reaches the surface it is highly acidic, and usually contains high concentrations of metals, sulphides and salts. This water is not only corrosive but highly toxic.



The Marievale Bird Sanctuary, part of the RAMSAR-listed Blesbokspruit, which is on the receiving end of the acid mine-water flowing from Grootvlei Mine on the Eastern Basin.

The final report was laid before Parliament in December. Two main options have been considered, the 'do nothing' approach and intervention through pumping and treatment. While not acting immediately might not cost anything in the short term, the resultant socio-economic and environmental damage will take decades if not hundreds of years to remediate.

Pumping and treating the water seems the only option. Within this recommendation there are various options and technologies available and, at the time of writing, no details had been publicly available yet, although the IMC made the following statement on 15 December: "[The IMC] advocates for the three priority basins to have implementation plans that include pumping and neutralisation of AMD." A decision will have to be taken before the end of January to enable any intervention decided upon to be carried out in time.

The Department of Water Affairs' Marius Keet remains positive that action will take place in time. Speaking at the WISA Mine Water Reclamation Symposium in Pretoria late last year he defended government's apparent inaction saying it was arguably the most important decision South Africa would ever make, and all options had to be considered before a final commitment was made.

ON THE SHOULDERS OF SOCIETY

Who will carry the cost? Prof McCarthy argues that the cost should be borne by the State as government has for decades been paying pumping subsidies to mines to cover the cost of pumping inflow from defunct, adjacent mines as it is. "Government is invariably the largest single beneficiary of mining ventures through the State share of profits formulae, taxation of company profits and taxation of salaries paid to workers." According to Keet, government will probably be responsible for bearing the costs of intervention on the short term, however, alternative funding options will have to be found over the long term.

Some argue that the remaining mining companies must bear the financial burden. However, it must

be borne in mind that acid mine drainage on the Witwatersrand is the result of mining which has taken place over more than a 100 years, and thus cannot be the sole responsibility of the remaining mines. The unsustainability of the situation where this has occurred is clear when one looks at Grootvlei Mine where financial troubles and resultant labour unrest have caused interruptions in the pumping of acid mine-water. Even on the Western Basin where Rand Uranium is operating a treatment plant to partially treat mine-water decanting on its property, it has been left unable to cope with the volumes of water now pouring unhindered into the Tweelopies Spruit.

Whatever decision is made, it is hoped that swift action will be taken by all parties concerned to ensure the prevention of this potential crisis situation. □

THE FOUR BASINS OF THE WITWATERSRAND AND THEIR ACID MINE-WATER STATUS

- **Far Western Basin:** Most of the mines in this basin are still operational and issues around acid mine drainage are not regarded as urgent at this stage.
- **Western Basin:** Acid mine-water started decanting from the Mogale City/Randfontein area in 2002. Present decant volumes vary from around 25 to 50 Ml/day of which only 15 Ml/day is partially treated. The remainder of the water flows uncontrolled into the Tweelopies Spruit, which feeds into the Crocodile River system. Decanting mine-water is already impacting the environment and people living in the area and is threatening the Cradle of Humankind World Heritage Site.
- **Central Basin:** Arguably, the basin of biggest concern at present. Pumping in this basin was stopped in 2008 due to health and safety concerns. Due to its proximity to the Johannesburg CBD and particularly the presence of abandoned near-surface workings in the city centre, a solution will urgently need to be found. It is estimated that this basin will start decanting at a rate of between 60 and 70 Ml/day in 2012.
- **Eastern Basin:** A single pump station (at Grootvlei Mine) is operating intermittently in this basin at present. The mine pumps out between 50 Ml/day and 70 Ml/day of mine-water while around 108 Ml/day is required to maintain the water balance. Significant financial and administrative issues have resulted in the mine being unable to meet the discharge standards as set out in its water license. Sub-standard effluent is flowing into the Blesbokspruit, a Ramsar-listed wetland.