Institutional conundrum sinking groundwater supply in North West town

North West capital, Mahikeng, is one of several towns in South Africa dependent on groundwater resources. However, a complex array of organisational, operational and financial issues has been bedevilling water supply of late, leading to rising doubt about the sustainability of groundwater resources in meeting residents' future demand. Lani van Vuuren reports.

Courtesy Jude Cobbing

Cries of "the borehole has dried up" or "there is no more groundwater" or even "underground water is unreliable" are not unheard of in many South African communities dependent on groundwater resources. More often than not failure of groundwater supply schemes is blamed on the resource rather than on the infrastructure used to abstract the groundwater.

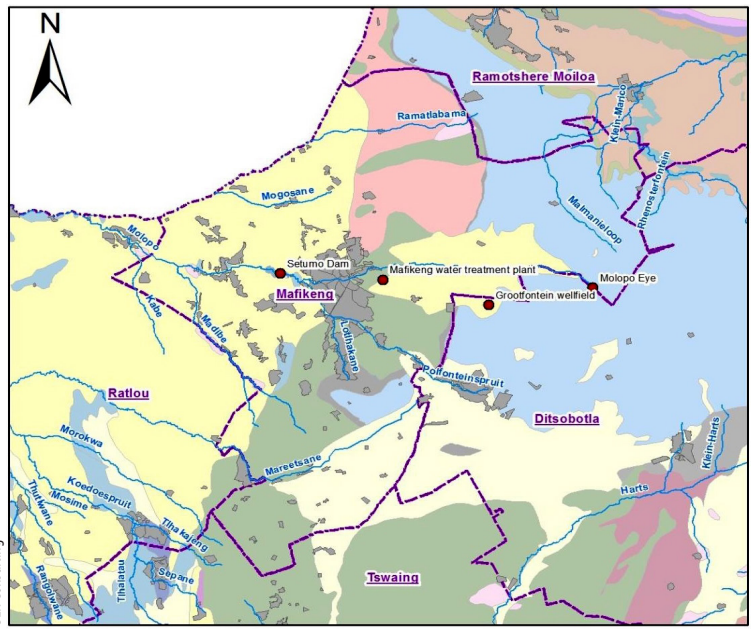
This is partly because groundwater is out of sight – it seems 'mysterious' to most people in comparison with surface water. However, studies show that failure of groundwater supply schemes is almost always either due to failure of infrastructure or unsuitable pumping regimes, rather than a physical lack of water.

Groundwater offers many benefits, for example, it is usually cheaper to develop than surface water resources; it can usually be used with no or minimal treatment, it can be developed incrementally and usually in close proximity to where it is required. However, there still seems to be a reluctance to invest in groundwater supplies, and in the system and organisational requirements needed to keep them operating.

With around 98% of South Africa's surface water already allocated groundwater is bound to play a more meaningful role in local water supply in years to come. At present, only about half of the country's groundwater resources (around 7 500 million m^3/a) are being used. If groundwater is to be used increasingly to provide safe water to South Africans, however, the challenges surrounding its management will have to be overcome.

"The estimated 5-10% of South Africans who do not yet have access to safe water supplies live mostly in rural areas of South Africa, most notably in KwaZulu-Natal and the Eastern Cape. In these rural areas groundwater is often a good option for water supply," reports Jude Cobbing, senior hydrogeologist at SLR Consulting. He is part of a team currently undertaking a research project funded by the Water Research Commission (WRC), which aims to (among others) enhance understanding of the barriers to better use of groundwater for local water supply in South Africa. The other project members include Karabo Lenkoe (of SLR Consulting),

Molopo eye is Mafikeng's main water resource.



SLR Consulting

Map showing water sources of Mafikeng and surrounds.

Kathy Eales (Counterpoint Development) and Jim Gibson (Maluti GSM).

The project, which will run until next year, also hopes to develop useful products for local municipalities on the groundwater availability of their area for resource development and management purposes.

GROUNDWATER IN MAHIKENG

Speaking at the 13th Biennial Groundwater Division Conference, held in Durban earlier this year, Cobbing presented results from the project team's research in Mahikeng where they investigated existing groundwater supplies as well as perceptions about groundwater among various stakeholder groups. It is a case study that illustrates the often complex and interdependent factors that govern sustainable groundwater supplies for municipal purposes in South Africa.

The town, which has a population of around 300 000 (when including the surrounding peri-urban area) is almost solely dependent on groundwater. The main sources of water to the town are the Molopo Eye spring, which yields about 20 Mℓ/day of water, and the Grootfontein Wellfield, which yield about 8 Mℓ/day.

Mahikeng also has a small surface water resource in the form of the Setumo Dam, located on the emphermal Molopo River. However, for much of the year the water flowing into the dam is return flows from two wastewater treatment works, and the quality of the dam water is poor, which makes treatment expensive.

Courtesy Jude Cobbing

Water from Mahikeng's groundwater sources are chlorinated at the Mahikeng Water Treatment Plant. While the plant also has a sand filtration facility, this is rarely required due to the general good quality of the groundwater.

Water from the groundwater sources is piped to the Mahikeng Water Treatment Plant where the flows are combined and the water is chlorinated. Sand filters have been constructed at the water treatment plant, but since the natural groundwater quality hardly warrants filtration, these are rarely used. From the treatment plant the water is reticulated into the town.

The surrounding peri-urban area makes use of boreholes, which are equipped with various electric, diesel and wind pumps. Groundwater quality from these boreholes are variable, with high nitrates a particular concern in some areas. High levels of salinity, high hardness and microbiological problems have also been reported. Water quality problems have partly been blamed on inadequate sanitation.

OVERABSTRACTION OF GROUNDWATER

The WRC project has found that apparent overabstraction of groundwater, mainly for irrigation, has resulted in falling water levels – especially from the Grootfontein wellfield. Of the nine existing pumping wells, five have reportedly already been lost due to falling water levels.

"There is perceived competition between irrigation farmers and water services providers for a finite resource," Cobbing reports. In the cases where over-abstraction is taking place, it is uncertain whether this is due to farmers exceeding licensed amounts or the actual licensed amounts being inappropriately high.

"Greater pressure on the groundwater resource in dolomite compartments implies a need for better monitoring, better enforcement of rules and agreements, and greater involvement of local organisations (particularly water user associations) in the management of the resource," notes Cobbing. In Mahikeng's case, all of these institutions appear to be weak, and there is a definite need for better regulation and enforcement.

OPERATIONS AND MAINTENANCE

Since December parts of Mahikeng have experienced regular water shortages, with some residents believing that the groundwater resources have become unreliable. This has resulted in increasing calls to augment the town's supply, most notably via a bulk water pipeline to the Vaal River, although this seems rather uneconomic at this stage.

"While most residents seem to be content with groundwater supplies as long as the water keeps flowing, there does seem to be a preference at municipal management level for surface water, which is perceived to be of superior quality," says Cobbing. "During our interview process more than one respondent spoke about wanting a bulk water pipeline from the Vaal River. In one case, the approval of the second phase of the Lesotho Highlands Water Project has given the impression that relatively abundant water will soon be available from the Vaal River system."

Research shows that the additional requirements of Mahikeng could be met by groundwater and by implementing water conservation and water demand management. So if the resource itself is not the problem, then what is?

The WRC project team uncovered a complicated management system at Mahikeng where various institutions are responsible for the groundwater resource. For example, while the Department of Water Affairs (DWA) is responsible for the operation of the Grootfontein boreholes, the monitoring of the resource and the pipelines from Grootfontein and Molopo Eye to the Mafikeng Water Treatment Plant, once the groundwater reaches the treatment plant it becomes the responsibility of the Botshelo Water Board.

In turn, reticulation of drinking water, removal of wastewater, billing of residents, maintenance of local water infrastructure and other functions are the responsibility of the relevant local municipality. While the wastewater treatment plants servicing Mahikeng are owned by the Ngaka Modiri Molema District Municipality (the water service authority of the area), they are operated by Mahikeng Local Municipality.

A dispute between Botshelo Water and the district municipality regarding alleged non-payment as well as on-going disputes between DWA, the water board and the district municipality are said to have contributed to water-supply interruptions to Mahikeng as there is little coordination and cooperation on technical water matters. This has resulted in sub-optimal operations and maintenance (O&M) of water supplies. (Ironically, this lack of O&M is currently protecting the aquifers to some extent as it is reducing actual abstractions)

"Most respondents highlighted the strong requirement for adequate O&M of boreholes to achieve reliable supplies, and agreed that O&M failures were the primary cause of groundwater source failure to Mahikeng and surrounds," notes Cobbing. The O&M issue is far from simple, however, and raises issues of responsibility, funding, authority, complexity and organisational function and interaction.

If O&M problems can be overcome, leading to boreholes yielding more water reliably, then stress on the source will increase and source monitoring (as well as associated management measures) will become more important. Poor O&M does not only affect water quantity, but can affect water quality as well – for example, through leaking diesel tanks or cracked sanitary seals.

It is often cheaper to maintain or rehabilitate a borehole than to replace it, once its performance has deteriorated significantly. Ironically, however, even when rehabilitation is more economical, as is often the case, money for rehabilitation is often more difficult to obtain than money for new projects.

Courtesy Jude Cobbing

The Molopo eye still provides good-quality water to the residents of Mahikeng.

This case study supports the contention that rolling out better and more reliable groundwater supplies is not primarily a technical or hydrogeological issue at all, but that many other factors are involved. It is highly unlikely that Mahikeng will be able to augment or replace its existing groundwater resources with alternative sources, such as surface water. All responsible parties will have to come to the table to make the town's groundwater supplies work. ❑

Courtesy Jude Cobbing

The Grootfontein wellfield, which supplies the town with about 20 Mℓ/day of water.