

Groundwater

Factors determining the success of groundwater schemes

The Water Research Commission (WRC) has completed an appraisal of the diverse factors influencing long-term success of groundwater schemes for domestic water supplies, focusing on priority areas in South Africa.

Summary

A WRC study has examined the reliability or sustainability of groundwater-based domestic water supplies, and concluded that the issue of operation and maintenance (O&M) is the single biggest factor in ensuring long-term success.

Normally the responsibility of the municipal Water Services Provider, or its appointed Professional Services Provider, O&M is often underfunded or overlooked altogether. Better O&M not only ensures much higher levels of reliability and continuity of water supply, it has been proven to actually save money in the long term.

A study carried out in 2012 by researchers in the United States found that a 3- to 5-fold increase in net value is realised with the implementation of an O&M programme for groundwater supplies in rural areas.

Groundwater: A vital resource

Groundwater is important today in many sectors, ranging from agriculture to domestic water supplies. It will make proportionately greater contributions to South Africa's water supplies in future as surface water reaches the limits of its availability.

Considering its potential, groundwater in South Africa is underutilised and often neglected – it offers a substantial source of unallocated water in the country today, albeit one that is distributed over a large area. Groundwater is a “proximal resource” – although yields from individual

boreholes in South Africa are often modest, groundwater is distributed much more evenly across the country compared with surface water, making it often suitable for small-scale water supplies in rural areas and for smaller municipalities.

The total volume of available, renewable groundwater in South Africa is estimated to be about 7 500 million cubic metres per year, even in a dry year, and we currently use less than half of this. In contrast, the assured yield of our surface water resources is about 12 000 million cubic metres per year – but most of this is already allocated.

As South Africans we often underestimate groundwater – in fact, about two-thirds of South Africans rely on groundwater for their domestic needs. The big metros of Tshwane and Johannesburg use groundwater for part of their water requirements and the city of Mahikeng is 100% reliant on groundwater, sourced from dolomite aquifers to the east.

Other cities such as Port Elizabeth and Cape Town are currently investigating the potential of groundwater. Atlantis, Beaufort West, De Aar, Jamestown, Victoria West and several other towns rely mainly on groundwater. Although most large-volume water users now rely on surface water, the majority of small water supplies, which are critical to livelihoods, health and dignity, depend on groundwater.

Groundwater's huge potential in South Africa, particularly for poor and rural communities, is still being unlocked. The resource also has important functions in improving food security, maintaining ecosystems, and insuring us against drought and climate change. Improved scientific understanding and management is necessary to further unlock groundwater's benefits.

Ecosystems and the Green Economy

A very important function of groundwater is maintaining ecosystems and 'environmental goods and services'. Without groundwater baseflow, many rivers would only flow after heavy rain. Springs, wetlands, pans and many lakes – and the associated plants and animals – are also dependent on groundwater. This is an area that has not received enough attention in the past, particularly in South Africa, although researchers are now catching up and recognising links to the "green economy" and associated opportunities envisaged for the future.

The need for a scientific approach

Groundwater cannot usually be seen in the same way as a dam or river, and many misconceptions about the resource still persist, such as that groundwater flows in "underground rivers", that it is mysterious and unreliable, or that water diviners are needed to locate it.

In fact, groundwater can be understood and managed in much the same way as other natural resources but this does require specific techniques and expertise.

Misconceptions about the physical resource are often amplified by poor choices of technology (e.g. unsuitable pumps) and a lack of appropriate operation and maintenance (O&M) to result in unreliable groundwater schemes. A qualified hydrogeologist should be involved with planning of any groundwater schemes intended for domestic use – even where the resource is easy to find and the quantities needed are small, there are many additional issues such as delineation of protection zones, O&M recommendations based on water quality and other factors, pump duty cycles and other operating rules, the possibility of artificial recharge and so on which need expert assistance.

Since O&M costs often exceed installation costs over the lifetime of a groundwater source, a professional approach to groundwater supply installation in the first place, including appropriate O&M recommendations, will save resources in the long term. The WRC study found that O&M costs for surface water supplies and groundwater supplies in rural South Africa were broadly the same over the life of the assets, although groundwater schemes may have a lower capital cost to O&M cost ratio.

Correctly maintained, groundwater schemes were found to be just as reliable as surface water schemes in the same area.

The discourse of shortage

The WRC study argues that neither absolute shortage of water nor shortage of funds is the cause of domestic water supply backlogs in South Africa, and that adequate and professional operation and maintenance of water supply systems (including groundwater) is in fact the key to sustainable water supplies.

There is a danger that failures to adequately operate and maintain groundwater supplies in South Africa will result in the resource itself being characterised as unreliable or undesirable, and that more expensive options such as desalination or long pipelines to bring surface water will be chosen instead.

Alternatively, domestic water supply failures will be characterised in terms of the "discourse of shortage" – South Africa is a dry country, and therefore it is no surprise that water supplies fail or are inadequate. Both of these outcomes have already happened in parts of South Africa.

There is an urgent need to shift away from a narrow focus on technical hydrogeological factors to a wider appreciation of the varied strands related to O&M that really determine whether domestic water supplies from groundwater are reliable or not. We need to move away from the discourse of shortage, and focus on the local-level institutions and mechanisms for O&M.

The future of groundwater in South Africa

As South Africa puts in place new policies and strategies for growth and jobs, and reinforces its commitment to the poorest in society, there is no doubt that groundwater will continue to grow in importance. According to the National Development Plan (NDP), by 2030 all South Africans should have access to clean running water in their homes.

Many other development outcomes, including health, education, dignity, and gender equality also rely on clean, safe and reliable water supplies – many of them from groundwater. Better use of our groundwater resources, linked to scientific development and adequate operation and maintenance, will help to realise our plans.

Recommendations having policy implications

- All groundwater schemes for domestic supplies must be planned and installed with advice from a qualified hydrogeologist. This input should include advice regarding operation and maintenance.
- A plan for the on-going operation and maintenance of an installed groundwater scheme must be developed, and it must be financially and logistically sustainable. The O&M plan also benefits from professional groundwater advice, since the choice of technology can be matched not only to the existing resource but also to the envisaged O&M regime.
- Costing of groundwater schemes must realistically estimate the costs of O&M, and if necessary set those against the costs of neglecting O&M, leading to premature replacement of assets.
- Mechanisms for the monitoring of asset management (including O&M of water supply systems) at local government level should be supported.

Further reading:

To order the report, *An appraisal of diverse factors influencing long-term success of groundwater schemes for domestic supplies, focusing on priorities areas in South Africa* (Report No. 2158/1/14)

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