Editor's Message

Groundwater management under the new National Water Act in South Africa

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The purpose of the new National Water Act (Act 36 of 1998) of South Africa (SA) is to ensure that the nation's water resources are protected, used, developed, conserved, managed, and controlled in ways that take the following, among other factors, into account:

- meeting the basic human needs of present and future generations;
- promoting equitable access to water;
- redressing the results of past racial and gender discrimination;
- promoting the efficient, sustainable, and beneficial use of water in the public interest;
- facilitating social and economic development;
- providing for growing demand for water use;
- protecting aquatic and associated ecosystems and their biological diversity;
- reducing and preventing pollution and degradation of water resources;
- meeting international obligations; and
- managing floods and droughts.

The water that is required to meet the basic human needs and the needs of the environment is identified as "the Reserve" and must enjoy priority of use by right. The use of water for all other purposes shall be subject to authorization.

Groundwater is the sole or main source of potable water for some urban and many rural communities in SA. Although only 15% of the country's total water consumption is supplied by groundwater sources, very often those communities dependent upon groundwater have no other viable sources of supply. The fact that groundwater can meet drinking-water requirements at the point of need has resulted in hundreds of small villages, schools, clinics, and hospitals in rural areas being dependent upon springs and boreholes that tap shallow groundwater reserves. The picture of ground-

water's role has changed considerably through the present government's priority for the poor and the meeting of basic needs, including the provision of a basic water supply to 12 million people. This demand, spread over approximately 15,000 villages, mainly in the eastern and northern parts of the country, the non-traditional groundwater areas, has no hope of being met cost-effectively from increasingly scarce surface-water resources. Suddenly, groundwater, with its widespread, albeit mostly low-yielding, occurrence, has become a national asset of strategic importance (Braune and Reynders 1998). In January 1999 we celebrated the 3 millionth citizen in SA served with a minimum water supply since the start of the government's Reconstruction and Development Programme. Nonetheless, the task ahead remains daunting, particularly so in the eastern part of the country (Eastern Cape). Here, about 52% of the approximately 5700 communities do not have a water source at all. Where a source exists, groundwater is used in nearly 70% of the cases, either as a sole source or in combination with surface water. Overall, groundwater has the potential to serve over 80% of the communities in the Eastern Cape – a clear change in outlook from a few years ago, when this was viewed the Cinderella of water resources in SA and its planned use was relegated to the dry western parts of the country, where it is virtually the only source of water (Eberhard Braun, Director of Geohydrology, Department of Water Affairs and Forestry, South Africa, personal communication 1999).

Overall, groundwater is still considerably underutilized in SA, whereas surface-water resources are becoming more and more stretched. It is estimated that about 90% of the local groundwater in SA occurs in secondary aquifers consisting primarily of shallow zones of weathering and fracturing. A lack of understanding of the occurrence, movement, and recharge of groundwater, and its private water status, have, however, in general led to this resource not being utilized in a sustainable manner. The consequent failure of boreholes in some instances has unfortunately promoted the view that groundwater is an unre-

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liable source of supply that should be replaced as soon as possible by more reliable surface-water supplies. The growing importance of groundwater is fortunately strongly reflected in the National Water Act. Water resources, including groundwater, are now seen as an indivisible asset, with the National Government as its custodian to ensure that development, apportionment, management, and use of the resources are carried out using criteria of public interest, sustainability, equity, and efficiency of use. Although groundwater is resilient, it is ultimately very vulnerable to poor management. Some obvious and less obvious factors in this regard are its invisible nature; the often long delays before impacts of overexploitation and pollution are detected; and the near impossibility to rehabilitate it once it has become polluted.

During the past 4 years, the Government has spent more than R1 billion (= US\$ 170 million) to supply water to 3 million people in SA, and the plan is to spend more than R13 billion during the next 5 years to supply a further 4.4 million people with water. The per capita use of water for more than 12 million people in SA is less than 25 L per capita per day, which is regarded as the minimum basic requirement. More than 280 cities or towns in SA are wholly or partly dependent on groundwater. Five million cattle, 26 million small stock, and the irrigation of more than 240,000 ha of land (from a total of 1 million ha of irrigated land) are also dependent on groundwater. SA has 18 million people that earn less than R352 (= US\$ 60) per month, which implies that these people find it very difficult to pay for water for domestic use.

The Water Research Commission of SA initiated a comprehensive groundwater research programme with a strong resource-management focus and much greater stakeholder involvement. Four new research projects were started earlier this year to address specific issues related to the National Water Act, such as the estimation of the preliminary and full groundwater reserve for catchment areas.

At present, water projects are focused on the drilling of boreholes to supply people in villages with water. As no information is available on past water-level fluctuations, the only way to estimate the sustainable yield of such a borehole is by the use of pumping-test information. After the completion of the borehole, a 3-day pumping test is performed. The consultant must then recommend an abstraction rate for the borehole, and a suitable pump is selected according to this estimate. In the past, the Theis equation without including boundary conditions was usually used to provide an estimation of the sustainable yield of the borehole. An

increasing number of boreholes in southern Africa have, however, dried up during the past years, in spite of favourable hydrologic conditions. Overestimation of the borehole yield was due to the application of improper extrapolation of drawdown curves, which ignored barrier boundaries and neglected parameter uncertainties arising from the imperfect knowledge of the effective aquifer properties. Moreover, the interpretation of the drawdown curve with respect to the characterization of specific flow regimes, like fracture-matrix flow and double-porosity effects, was difficult to perform. Severe misinterpretations easily occurred.

During 1998, the Institute for Groundwater Studies at the University of the Orange Free State, in conjunction with the Department of Water Affairs in SA and the Institute for Hydromechanics and Water Resources Management in Zurich, developed the Flow Characteristic (FC) method. The FC method enables the clear characterization of flow regimes by the use of derivative and second derivative drawdown information and boundaries are accounted for with semi-analytical formulae. This approach does not require the fitting of the drawdown curve by a model. Parameter uncertainties in late-time effective T and S values and in the distances to the boundaries are included in the analysis by applying Gaussian Error Propagation to the extrapolation of the long-time drawdown curve. A paper on the FC method was presented at the Model CARE99 Conference, held in Zurich in September 1999, and interested readers can extract documentation and a user-friendly EXCEL spreadsheet from the following website: <http://www.uovs.ac.za/igs>. Given the strategic importance of groundwater, the current poor management situation, and the growing water scarcity in SA, it became evident that groundwater management needed a complete overhaul.

An IAH conference with the title "Groundwater: Past Achievements and Future Challenges" will be held in November 2000 in Cape Town. Information about the conference can also be obtained at the above-mentioned website.

Key words South Africa · groundwater management · editorial

Reference

- Braune E, Reynders AJ (1998) Past achievements and future challenges for groundwater in South Africa. GEOCONGRESS 98, July, Pretoria, South Africa