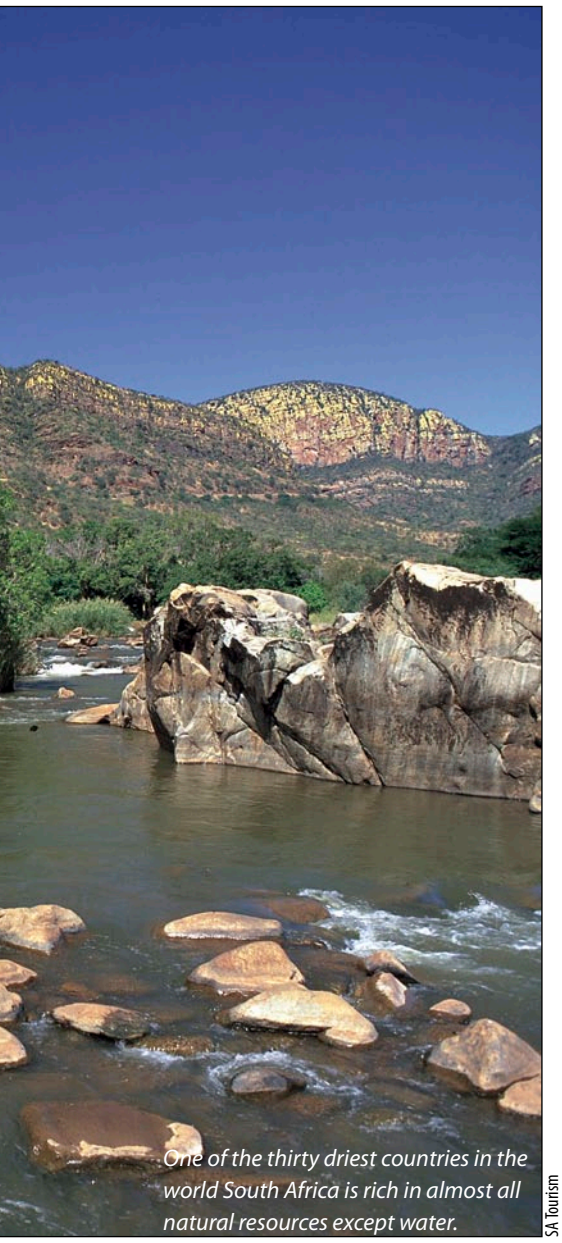
Water Resources: South Africans Must Start Saving EVERY DROP

South Africa's latest national water resources assessment has sounded warning bells over the way we allocate and use water. Lani van Vuuren takes a peek at the Water Resources 2005 study (WR2005) published by the Water Research Commission (WRC) earlier this year.

South Africa has a rainfall that fluctuates widely (both in space and time), comprising only 55% of the global average. Added to this the country's evaporation rates are far higher than the amount of rainfall. On average less than 9% of precipitation eventually reaches river systems.

All of this makes South Africa one of the 30 driest countries in the world. But just how dry is the country and exactly how much water resources do we have? Specialists have been trying to answer this question since the late 1950s through a series of water resources studies. The objective of these studies (five in total) has been to assist decision makers at all levels of government to make informed choices about all policies concerning South Africa's water resources.

"Demand for water and competition between different users is increasing all the time. We need to know exactly how big is the cake available to share between domestic, industrial, agriculture and other users, which is exactly what these studies aim to determine," explains WRC Research Manager Wandile



One of the thirty driest countries in the world South Africa is rich in almost all natural resources except water.

SA Tourism

Nomquphu. "As technologies and methodologies improve so this knowledge improves over time."

The WR2005 study comes 15 years after the previous study was undertaken. Since that time there have been numerous changes in the South African water sector, most notably in national legislation. The National Water Act, promulgated in 1998, places a different emphasis on how water is (and will be governed) and therefore allocated. Priority and legislative protection is placed on basic human needs, ecological as well as international water requirements (in the case of river and groundwater systems shared with other countries).

There have also been huge improvements in technologies and methodologies – especially considering advances in computing technology. In addition, significant recent findings have been made as a result of improved research on land-use modelling techniques, improved estimates of water use by different water sectors and the development of water-use estimates for water uses such as alien vegetation and other streamflow reduction activities.

RESOURCE SMALLER THAN WE THOUGHT

Estimates of South Africa's national water resources have been declining with each of the studies undertaken since 1952. The latest calculation of naturalised mean annual runoff for the country has been calculated at 49 210 million m^3/year – 4% less than the figure of the 1990 study. "This means that any development based on earlier estimates will over-estimate the size of the development which can be accommodated," explains Project Director Brian Middleton of SRK Consulting. "While the project did not look at water quality in detail it is becoming apparent that water quality is an ever-increasing problem."

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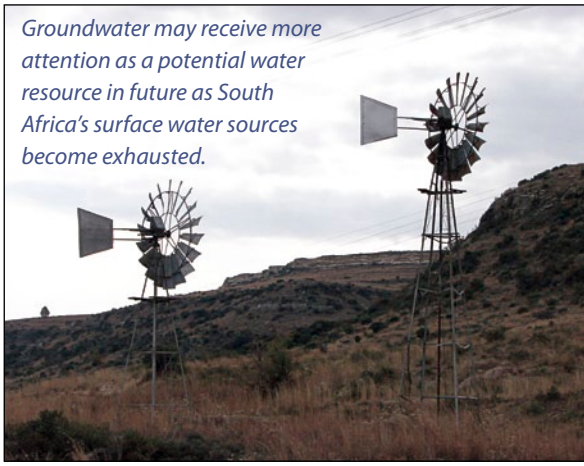
The level of confidence in the results of a complex hydrological or environmental study is an important component of scientific research. According to Nomquphu, the WRC is confident in the results obtained by the study. "With every subsequent study there is more precision and accuracy in the results."

The uncertainty stems from unequal time periods for measurements (e.g. some monitoring points have long uninterrupted measurements while others have short time records), limited precision and accuracy of measurements, to name but a few. The sources of these uncertainties were identified in the previous water resource studies allowing the project team to reduce the degree of error in measurements and observations as well as in methods of data analysis, estimation and modelling in WR2005.

CRUNCHING THE NUMBERS

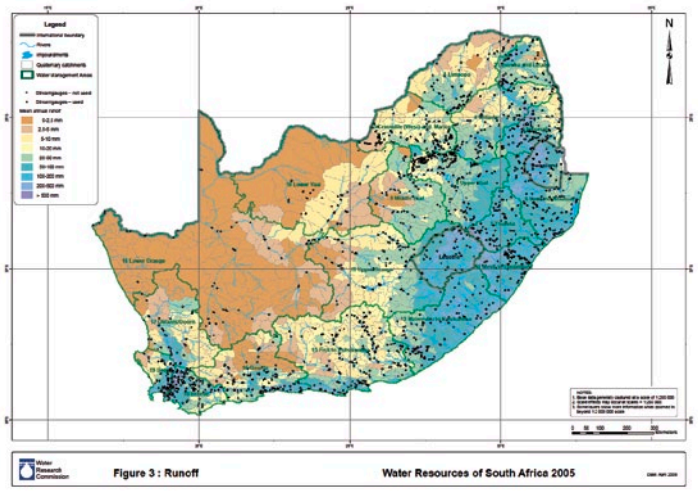
Over 40 people from seven companies worked together over four years to complete the latest water resources study. While previous studies focused almost exclusively on surface water quantities, WR2005, which covered South Africa, Swaziland and Lesotho, includes surface water, groundwater and water quality components. To enable this achievement – a first for South Africa, required a multidisciplinary project team including hydrologists, hydrogeologists, GIS practitioners, civil and water engineers, water quality specialists, computer programmers and scientists, reports Middleton.

Updated data on rainfall, evaporation, streamflow, water use, land use, return flow, releases, and new impoundments, among others, were used to create the latest picture of the state of South Africa's water resources. Various models were used, including the rainfall-runoff model WRSM2000, which was used to perform calibration and

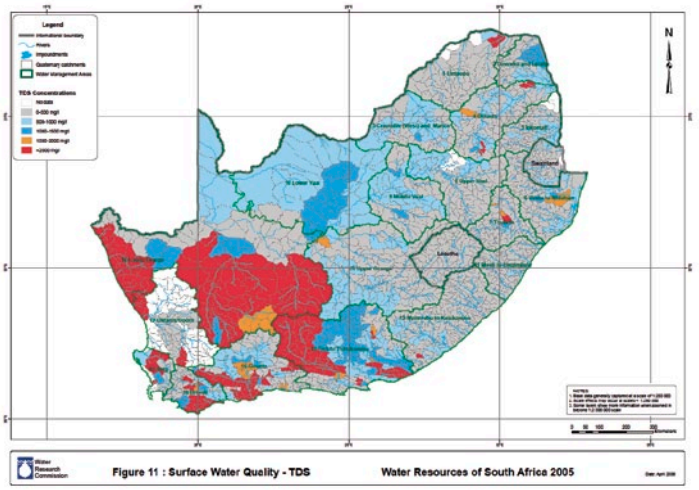


Groundwater may receive more attention as a potential water resource in future as South Africa's surface water sources become exhausted.

Lani van Vuuren



Map 1: Mean Annual Runoff across South Africa



Map 2: Surface water quality across South Africa

Table: Comparison of Naturalised MAR between WR90 and WR2005 studies

Water Management Area	Mean Annual Runoff (MAR) (million m³/a)		
	WR90	WR2005	% change
Limpopo	986.30	931.12	-6
Luvuvhu and Letaba	1 235.20	1 304.02	6
Crocodile West and Marico	748.00	703.49	-6
Olifants	1 990.10	1 919.73	-4
Inkomati	3 361.20	3 088.60	-8
Usutu to Mhlatuze (inc. Swaziland)	6 721.10	6 421.10	-4
Thukela	3 993.90	3 881.72	-3
Upper Vaal	2 580.80	2 452.89	-5
Middle Vaal	1 121.20	912.72	-24
Lower Vaal	235.60	200.85	-15
Mvoti to Umzimkulu	4 928.90	4 922.42	0
Mzimvubu to Keiskama	7 218.90	7 012.20	-3
Upper Orange (incl. Lesotho)	6 945.20	6 756.20	-3
Lower Orange	403.60	274.40	-32
Fish to Tsitsikama	2 152.00	2 183.92	1
Gouritz	1 632.60	1 539.70	-6
Olifants/Doring	1 063.20	1 073.50	1
Breede	2 473.60	2 482.50	0
Berg	1 329.90	1 149.10	-14
Total	**51 121.30**	**49 210.32**	**-4**

Source: WR2005

naturalisation runs as well as the Department of Water Affairs' rainfall database WRIMS to update and patch rainfall data.

"We also used updated GIS tools to produce the maps and information," reports Allan Bailey of SSI Consulting and part of the project team. We had new computer programs written, for example, the water quality analysis tool. We also introduced a user-friendly menu system for accessing computer models, the database, GIS maps, spreadsheets etc."

HOLISTIC VIEW

An important aspect of WR2005 is the inclusion of groundwater data. At present, over 70% of South Africa's water needs are drawn from surface water resources (mostly through dams). With only about 20% of available groundwater resources being used at present, mostly by rural towns and villages, groundwater is considered a huge potential resource.

"Groundwater may well prove to be a strategic resource in the country's efforts to extend basic access to water to all communities."

"The major benefit of including groundwater in the study is that users take cognisance of both surface and groundwater in a holistic way," explains Middleton. "Both are part of the same resource, and components of the hydrological cycle, but previously have been studied separately, usually by different technical disciplines. Integration of both components is vital for the water resource planning for the country."

While the study suggests that there is about 10 000 million m³ of groundwater in South Africa, Nomquphu calls for a cautionary approach. "Groundwater may well prove to be a strategic resource

in the country's efforts to extend basic access to water to all communities, however much research needs to still go into quantifying this resource."

IDENTIFYING DATA GAPS

The study was not without its challenges. The basic data was not always easily accessible, and in some cases information was not available. The integration of groundwater into the rainfall-runoff model also proved problematic, as this was the first time that this integration had been attempted.

Most concerning, however, has been the reduction in the number of data sources, e.g. there are now less usable rainfall stations than there were in the 1990s when the previous study was conducted. "This is a huge concern because spatially representative, long-term consistent records of data are essential for achieving a high level of understanding about water resources," notes Nomquphu. It has been recommended that a national task team be formed to tackle the issue.

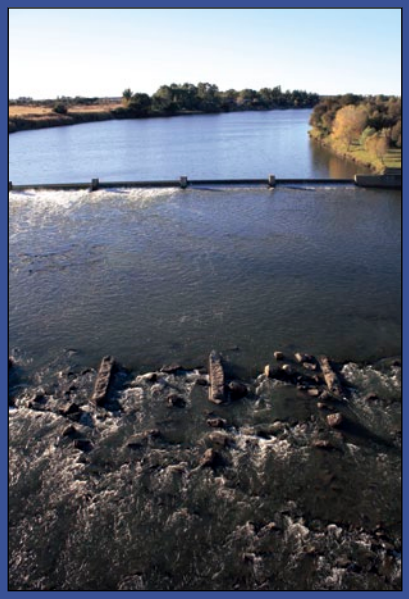
NATIONAL PICTURE

WR2005 brings together, in a library of documents, information about the whole country at the same time at a similar level of detail. "This is of major benefit to planners who are able to get a total picture of the resources," says Middleton.

"Going into the future our biggest strategic challenge is ensuring adequate quantity and quality of water to meet human and ecological needs in the face of competing demands and variable water supply," reports Nomquphu. It is hoped that WR2005 will go a long way to achieving just that.

To obtain the ***Water Resources of South Africa, 2005 Study*** and/or associated products contact Publications at Tel: (012) 330-0340; Fax: (012) 331-2565 or E-mail: orders@wrc.org.za

WATER USERS MUST SAVE OR PAY THE PRICE



South Africa's water users need to seriously reconsider the way in which they use water if the country is to stave off imminent shortages.

This is according to Johan van Rooyen, Director: National Water Resource Planning at the Department of Water Affairs (DWA).

Speaking at the International Mine Water Conference held in Pretoria earlier this year, Van Rooyen said all water users would face strict water restrictions and hiked water tariffs if they did not implement water use efficiency measures as a matter of urgency. "It is not only the department's responsibility to look after South Africa's water resources. Water is going to become very expensive in this country and we will all have to use it very wisely."

Historically, the focus has been on developing bulk water infrastructure, such as large dams and inter-basin transfer schemes. However, with almost all readily available water already put to use, the focus has now shifted to careful management and optimisation of existing use.

Water conservation and water demand management is one measure being increasingly considered by the DWA. According to Van Rooyen, water demand would have to be reduced immediately by up to 30% in South Africa's most water-scarce catchments.

The re-use of water has been identified as another major potential source of water. "Return flows to the Vaal River from the upstream Gauteng metropolitan areas, for example, are increasing to the extent that, with downstream use quite stable, these flows will soon exceed uptake, and thus be in surplus." A portion of these return flows have already been identified as the best resource for the new power stations and a possible coal-to-liquid fuel plant on the Waterberg coalfield near Lephalale in Limpopo.

Groundwater resources are increasing in importance, not only as a potential source of water for rural villages, but also larger cities such as Cape Town and Port Elizabeth. In coastal areas, such as Cape Town and Durban studies were already underway into the possibility of desalination.

"South Africa's golden era of dam building is over. The reliance on ever further exploitation of surface water will have to be replaced with a respect and acceptance of all resources," said Van Rooyen.

Lani van Vuuren

Irrigation is the largest water user in South Africa.