

# THE WATER WHEEL

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DEAD CROCS SYMPTOMATIC  
OF A DYING RIVER





**Implementing Environmental  
Water Allocations, 2009**

INTERNATIONAL CONFERENCE ON

## **IMPLEMENTING ENVIRONMENTAL WATER ALLOCATIONS**

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## **IMPLEMENTING ENVIRONMENTAL WATER ALLOCATIONS**

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23 – 26 FEBRUARY 2009

Feather Market Convention Centre, Port Elizabeth, South Africa

Organised by the

**WATER RESEARCH COMMISSION (WRC), South Africa  
and the**

**DEPARTMENT OF WATER AFFAIRS & FORESTRY (DWAf), South Africa**

under the auspices of the

**World Conservation Union (IUCN)  
and the**

**International Association of Hydrological Sciences (IAHS)**

and with the support and co-operation of

**SA National Biodiversity Institute (SANBI)  
Department of Agriculture, South Africa**

**Department of Environmental Affairs & Tourism, South Africa**



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**Cover:** KNP croc deaths spur experts to act. (See page 14). Cover photograph by Drinie van Rensburg.

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## LETTER TO THE EDITOR

### Water hyacinth – solutions exist

The cover article on eutrophication in *the Water Wheel*, Vol 7 No 5 refers.

The choking of rivers, dams and fish ponds by this beautiful looking pest of a plant is costing a fortune to control the growth.

To date it is removed mechanically and I believe it can be recycled into cattle feed, fertilizer and fuel. Something that is non-

toxic was discovered accidentally in the East that choked and stumped its growth.

This information was passed on but obviously fell on deaf ears or no-one believed me because the problem still exists.

I will now pass on this information only if a financial arrangement is negotiated legally.

**Michael D Blosscham**

Letters must be addressed to The Editor and can be faxed to (012) 331-2565 or E-mailed to [laniv@wrc.org.za](mailto:laniv@wrc.org.za).

## Water researcher to lead university scientists

One of the country's leading water researchers Prof Eugene Cloete has been appointed the new dean of the Faculty of Science at Stellenbosch University (SU).

Prof Cloete joins the university from the University of Pretoria (UP) where he was the head of the Department of Microbiology and Plant Pathology as well as chairperson of the School of Biological Sciences. In addition, he was director of UP's Water Institute and of the Edward de Bono Institute of Creativity.

Prof Cloete views the natural sciences as fundamentally important to economic growth, job creation, the eradication of poverty and the general improvement of the quality of life of those living in South Africa and the rest of Africa. "We live in a technically driven world that is built on the basic sciences and high-level expertise. The shortage of human capital in this regard, however, poses great challenges for the country's secondary and tertiary institutions."

Prof Cloete says he is looking forward to the new challenge. "The highly-qualified staff component, which includes many international leaders in their fields of expertise, as well as the high standard of its research outputs, makes the SU Faculty of Science one of the leading faculties in the country."

## Service delivery shortcomings laid bare

Researchers from the Centre of Applied Legal Studies (CALS), the Centre on Housing Rights and Evictions and the Norwegian Centre for Human Rights have released a report identifying key fault lines in water and sanitation policy and implementation.

"South Africa has one of the most progressive legislative and policy frameworks for water services in the world. However, when it comes to implementation at the

local government level, where actual water services provision is located, the reality is quite different," reports CALS researcher Jackie Dugard. The report follows interviews with 15 municipalities across South Africa. In interviews conducted between November 2007 and July 2008, many municipalities cited a fundamental lack of capacity, both financial and technical as a major problem. Having devolved the responsibility of water services delivery to local government in 2000, national government has steadily decreased financial and technical support. This means that municipalities have to do more with less money.

The report, titled *Water Services Fault Lines: an Assessment of South Africa's Water and Sanitation Provision across fifteen Municipalities*, also found wide variance in municipal policies, many of which were inconsistent with national guidelines. Significant problems with the application of free basic water are also highlighted. According to the report, the absence of a national free basic sanitation policy is glaring, and the poor are often heavily under-represented on indigency registers which are used to determine who receives the allocation.



## Mapping South Africa's climate

The *South African Atlas of Climatology and Agrohydrology* is an illustration of the diversity of South Africa's biophysical make-up – its climate, agricultural production and the water-related environment.

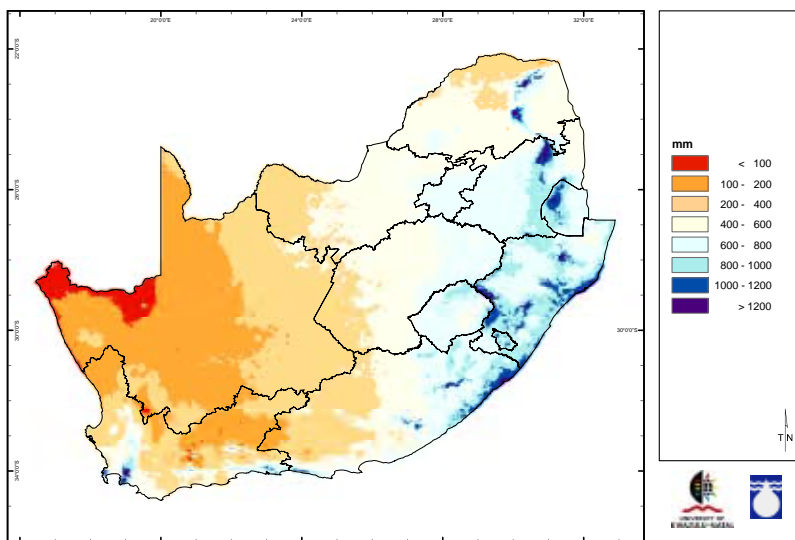
In this project accumulated data, information and knowledge was processed into a set of electronic map coverage for the South African region (including Lesotho and Swaziland).

New soils and baseline land cover information was used in the project while optimum climatic growth areas, yield and the inter-annual variabilities of a range of crops were revised.

The Atlas also presents the diverse nature of South Africa's inhabitants and the socio-economic milieu which, on the one

hand, they have shaped and which, on the other hand, they have responded to either voluntarily or involuntarily through history, politics and the physical environment. This background is given at the geographic scale of provinces, by demographic indicators, educational and socio-economic indicators, and those related to personal conveniences.

The Atlas is being used as a reference by a wide variety of water sector stakeholders, including all spheres of government, non-governmental and aid organisations, parastatals, research and educational institutions, consultants and agricultural producers. To order a copy of the interactive CD (WRC Number: **1489/1/08**) contact Publications at Tel: (012) 330-0340 or E-mail: [orders@wrc.org.za](mailto:orders@wrc.org.za)



## Pipeline to bring clean water to Delmas

The town of Delmas, which has been plagued with outbreaks of waterborne diseases in the last three years, is getting a new bulk water pipeline.

This follows the signing of an agreement between the Department of Water Affairs & Forestry (DWAF); the Mpumalanga Department of Local Government, Rand Water, and the Delmas municipality. All the entities have agreed to collectively fund the R85-million pipeline, which will be constructed to

transport water for 34 km from Bloemendal to the Mpumalanga town.

According to DWAF, the pipeline forms part of a range of initiatives to improve the quality of drinking water served to residents of the town. Other initiatives include the construction of two water treatment plants and the cleaning and testing of 18 boreholes in the area.

The pipeline will take an estimated 24 months to complete.

## WATER BY NUMBERS

**130** – The estimated number of jobs created through Working for Wetlands' and the South African National Biodiversity Institute's project to rehabilitate and preserve the wetlands in Limpopo's Waterberg area.

**60 Mℓ** – The volume of water that gold-mining company ERPM pumped from its South West Vertical Shaft on the East Rand every day to manage the rising water level on the Central Witwatersrand Basin. The company announced in October that it had decided to cease pumping operations for safety reasons.

**2** – The number of planets we will require by 2030 to keep up with humanity's demand for goods and services, according to WWF's *Living Planet Report 2008*.

**20** – The number of townships which are prioritised for improvement by the Gauteng provincial government. They include Atteridgeville, Soshanguve, Mamelodi, Kagiso, Munsieville, Mohlakeng, Boipatong, Sebokeng, Ratanda, Kwatsaduzza, Wattville, Daveyton and Tembisa, among others.

**70%** – The percentage of Africa's urban residents who stay in slum areas. The latest research indicates that more than 1,6 billion Africans will be living in slums by 2020.

**7 000 ℓ** – The water required to refine one barrel of crude oil.

**70** – The number of countries across five continents which celebrated Global Handwashing Day on 15 October. Two hundred million people, mostly children, participated in special events across the globe.

**R1-billion** – The funds made available from national government to KwaZulu-Natal to bring relief to communities that were affected by fire and storm disasters that ravaged the province last year.

**2 900 ℓ** – The volume of water required to produce one cotton t-shirt.

**102** – The number of bird species recorded at the Nylsvley wetland, in Limpopo. During good rainy seasons the floodplain becomes a hive of activity, with up to 80 000 water birds being recorded at any one time.

## WATER ON THE WEB

<http://africacan.worldbank.org>  
The World Bank Africa Region has launched a new blog from its Chief Economist Shanta Devarajan. The blog serves as an online forum for the sharing of ideas about Africa's development. It includes guest commentary from Devarajan's colleagues at the World Bank and features posts in English and French.

[www.irc.nl/content/download/137692/412831/file/facilitation.pdf](http://www.irc.nl/content/download/137692/412831/file/facilitation.pdf)  
The Facilitation Toolkit is a collection of documents from the IRC International Water and Sanitation Centre explaining the concepts of capacity building, learning and facilitation, and provides a range of tools, methods, skill and exercises to put it into practice.

[www.siswebs.org/water/](http://www.siswebs.org/water/)  
WaterSISWEB is a free social bookmarking website for water resources professionals. It is part of the Scientific Information Syndication websites (SIS-WEBS) family of websites. While the main focus is on the US and Canada, there are regional categories for Africa and Asia.

[www.waterefficiencysa.co.za](http://www.waterefficiencysa.co.za)  
The purpose of this website is, among others, to provide current information and news about water efficient devices available in South Africa, act as an information portal and network for all materials relating to water efficiency in the domestic and commercial sector in South Africa, and highlight innovative best practices regarding water demand management.

[www.wetlands.org](http://www.wetlands.org)  
Wetlands International has launched its new improved website. The new Web system provides users with a lot of information about the organisation's work in general, its projects and publications. All this information is presented in a user-friendly way, varying from clickable maps with projects, videos to search selections for all the organisation's work by topic, region or type of activities.

## SADC students learn more about IWRM

Nine students from four southern African countries participated in the Orange Senqu Fish River Basin Integrated Flow Management and Environment Water Requirement training course undertaken under the auspices of FETWater in 2008.

FETWater (Framework for Education and Training in Water) is a programme for effective cooperation in research, education, training and capacity building initiatives to achieve integrated water resources management (IWRM) in South Africa. The latest course was presented with financial assistance from the United Nations Education Scientific and Cultural Organisation (UNESCO).

The main focus of the course was to place environmental water requirements within the context of IWRM, with an emphasis on the use of alternative water resource management measures as a means of meeting the environmental water requirements (EWR) for areas where water resources are limited.

The course covered the Orange

Senqu Fish River basin as a case study for demonstrating integrated flow management and EWR in practice. The students were exposed to various aspects of IWRM and EWR in theory and then shown how that theory was working in practice.

The course started at the watershed of the Fish River tributary at Windhoek, Namibia, to the highly utilised and impacted lower Orange River at Upington, South Africa, to the lesser developed Senqu River and Katse Dam in Lesotho. The courses ended in Pretoria at the offices of the Water Research Commission where final presentations were made.



## UNISA students share their research

UNISA's College of Agriculture and Environmental Sciences hosted a successful postgraduate students' research colloquium in September.

The aim of the colloquium, with the theme 'Expanding the Frontier through Research' was aimed at showcasing the research conducted and planned by the college's masters and doctoral students.

Papers presented spanned several topics, including indigenous knowledge/scientific research, environmental sciences, and food sciences. Masters student Robert Karssing received the Best Paper Award for his paper titled 'Influence of Waterfalls on Patterns of Association between Trout and Natal Ghost Frog *Heleophyrne natalensis* tadpoles in two headwater streams'. Initial findings of his research, conducted in the Drakensberg, indicate that waterfalls play an important part in protecting frog species from predation by exotic predators, such as trout.

Adelaide Agyepong won the Best Poster Award for an agriculture-related poster titled 'Possible Contribution of *Moringa Oleifera* Lam Leaves to Diet Quality in Two Communities in Mokopane, Limpopo'.

The colloquium coincided with the Prof G Humphrey Memorial lecture, which was presented this year by Prof JO Okonkwo from Tshwane University of Technology. He spoke on the impact of global warming on food security, human and environmental health and safety. Prof Okonkwo warned that much more attention needed to be given to adaptation to climate change, as there was increasing evidence that the earth was warming, with all fingers pointing to human activities. He noted that poor communities would suffer most as a result of a changing environment. "Higher temperatures could cause a significant drop in the production of maize, which is a staple food in many African countries."

## Hurting river systems leads to leaner wallets

The incessant degradation of the country's water resources through pollution and over-allocation does not only affect aquatic ecosystems, it is also hurting South Africans' pockets.

This is one of the main messages the organisers of the 2009 International Conference on Implementing Environmental Water Allocations, which will be held from 23 to 26 February at the Feather Market Centre in Port Elizabeth, hope to bring home. The conference, which is expected to be attended by about 500 delegates from all over the world, is being organised by the Water Research Commission (WRC) and the Department of Water Affairs & Forestry. The conference also boasts the support of a host of international organisations, including the World Conservation Union, International Association of Hydrological Sciences and the Chartered Institution of Water and Environmental Management.

Research has shown that the demand on South Africa's scarce water resources (including rivers, wetlands, estuaries and groundwater) is increasing. At the same time, there is an overall deterioration of the quality of the country's water resources. Sustainable aquatic ecosystems rely on the availability of water of adequate quantity and quality. While the majority of South African citizens now enjoy access to fresh drinking water from a tap rather than from a river, stream or spring, the pollution of water resources still affects us directly, reports Conference Chair



Dr Stanley Liphadzi. "People often think that the protection of the environment is the sole responsibility of the government or ecologists and conservationists. The truth is that we all have a part to play in safeguarding our water plants and animals."

"We can never separate ourselves from our natural environment," he adds. "When we pollute our rivers or use too much water without considering what aquatic systems need to function properly, we hurt ourselves." Few people realise that the aquatic environment also provides a whole host of goods and services, from food to aesthetic enjoyment. For coastal municipalities, for example, estuaries can provide valuable income through ecotourism.

Dr Liphadzi explains that the more chemicals, metals and other toxins are dumped in our rivers, the more sophisticated (and expensive) treatment systems are required to make the water acceptable for human consumption. "In the end, this pushes up water tariffs, which means we pay more for the same volume of water used."

The conference aims to identify and critique present global trends in the implementation of environmental water allocations in the fields of policy and legislation, integrating ecosystem protection with socio-economic development, defining and involving stakeholders; decision-making for sustainable use; operational management of water allocations; and sharing knowledge and skills. Delegates representing more than 30 countries, including China, Thailand, the USA, Australia and Canada have already registered for the conference.

Concludes Dr Liphadzi: "It is important that the multitude of demands (including ecological, domestic, industrial and agricultural) on our water resources are balanced equitably. We cannot maintain a strong economy and improve social standards in this country without sustaining healthy aquatic ecosystems. There is a need for all sectors to understand and recognise the important link between water in the environment and water in our tap"

To access the conference website, go to [www.wrc.org.za](http://www.wrc.org.za) and click on the conference logo.

### WATER DIARY

#### WATER RESOURCE PROTECTION FEBRUARY 11-13

The Department of Water Affairs & Forestry Directorate: Resource Protection and Waste is finalising the development of a series of Best Practice Guidelines. The Directorate has joined with the WISA Mine Water Division and Chamber of Mines to ensure training for all DWAF staff and mining industry, other government departments, consultants etc on the protection of water resources in the South African mining industry.

Enquiries: *Fhedzisani Ramusiya*; Tel: (012) 336-7506; Fax: (012) 323-0321

#### WASTEWATER TREATMENT FEBRUARY 18-20

Organised by WISA, the Small Wastewater Treatment Conference will be held at the 1-on-1 Conference Centre at Umhlanga Rocks. Enquiries: *Dot Zandberg*; Tel: (011) 805-3537; E-mail: [conference@wisa.org.za](mailto:conference@wisa.org.za)

#### BIODIVERSITY MARCH 9-13

The Biodiversity Planning Forum, hosted by the South African National Biodiversity Institute will provide an opportunity for individuals, agencies and departments involved in spatial biodiversity planning to share and synthesise valuable lessons from projects around South Africa. The core focus of the forum is on systematic biodiversity planning, with a key theme being planning for implementation. Enquiries: *TJ Mashua*; Tel: (012) 843-5228; E-mail: [mashua@sanbi.org](mailto:mashua@sanbi.org); Visit: [www.sanbi.org](http://www.sanbi.org)

## SRK leads challenging Namibian groundwater project

SRK Consulting is leading an ambitious project to quantify Namibia's groundwater resources.

The appointment of the South African consulting firm by the Namibian Ministry of Agriculture, Water & Forestry to manage the NS\$1,5-million project follows SRK's role as the lead consultant during the South African Groundwater Resources Assessment project completed in 2005. "Development is ongoing in Namibia and the information obtained during this project will provide us with better overall data for intelligent future planning," reports Greg Christelis, Deputy Director: Geohydrology for the Namibian government. According to Dr Eric Tordiffe of Namibian firm Karst Geo-Hydro Consultants, who is also involved in the project, the survey is vitally important to Namibia. "We know where most of the aquifers are, but we need to put a figure on our resources to establish how much of this can be utilised, and for this to be sustainable. The main advantage will be for the

*Principal hydrogeologist Peter Rosewarne, who is representing SRK in an ambitious project to quantify Namibia's groundwater resources.*



effective management of our groundwater resources," he says. Dr Tordiffe adds that a survey of this magnitude has never been conducted in Namibia.

Peter Rosewarne, principal hydrogeologist and a partner in SRK is representing the company in the Namibian undertaking. This assessment is a challenging task for the team of mainly Namibian Hydrogeologists and scientists involved, he comments.

## New head for TCTA

TCTA has a new CEO. James Ndlovu has broad experience ranging from development planning, research, land reform as well as banking and development finance. He has worked with a number of institutions, including non-governmental organisations, government and the Development Bank of Southern Africa.

Meanwhile, TCTA's Berg Water Project outside Franschoek in the Western Cape has received two awards for excellence.

First, the project received the Consulting Engineers South Africa Glenrand MIB Award for Engineering Excellence, and later the International Association for Environmental Impact Assessment South Africa Award for Excellence in Environmental Management in Project Execution.

TCTA Acting Head of Capital Investments David Keyser, who was involved in the project from the outset, said the authority strove

to apply international best practice in the engineering and environmental disciplines for the design and construction of the project from the outset. "It is rewarding to achieve recognition from one's peers after the effort to make things happen. The project is also an example that southern Africa has the expertise to successfully implement a quality project of this magnitude, below the initial budget and within a short timeframe," he noted.

All construction work at the project,



## WATER DIARY (CONTINUED)

### WATER

#### MARCH 15-22

The Fifth World Water Forum will be held in Istanbul, Turkey. The theme is 'Bridging Divides for Water'. E-mail: [m.giard@worldwatercouncil.org](mailto:m.giard@worldwatercouncil.org); Visit: [www.worldwatercouncil.org](http://www.worldwatercouncil.org)

### CLIMATE CHANGE

#### MARCH 23-26

An international conference, Greenhouse 2009: Climate Change and Resources, will be held in Perth, Australia. The conference is hosted by CSIRO in conjunction with the Australian Climate Change Science Programme. Visit: [www.greenhouse2009.com](http://www.greenhouse2009.com)

### OXIDATION TECHNOLOGIES

#### MARCH 30-APRIL 1

The 5<sup>th</sup> IWA Specialist Conference on Oxidation Technologies for Water and Wastewater Treatment will be held in Berlin, Germany. E-mail: [aop5@cutec.de](mailto:aop5@cutec.de); Visit: [www.aspd5.com](http://www.aspd5.com)

which started in 2003, has now been completed and the dam is already 100% full. In other news, TCTA's other high-priority project, the R2,7-billion Vaal River Eastern Subsystem Augmentation Project (VRESAP), will only start delivering water from December following unforeseen delays. The project, comprising abstraction works at the Vaal Dam, including a high-lift pump station and a 121 km pipeline, will deliver water to recommissioned and new Eskom power stations and to Sasol in Mpumalanga.

The permanent abstraction works is expected to be completed by May 2010. The company reports that the redesign of the coffer dam, due to the unexpected high water level in the Vaal Dam during early construction period and the worse than expected geotechnical conditions at the abstraction works, was the main reason for the delay in the completion date.



## VWS Envig expands into Namibia

South African company VWS Envig has announced the acquisition of Aqua Services & Engineering (ASE), a Namibian-based supplier of water treatment services and equipment, subject to pre-conditions being met.

The acquisition sees the South African company increasing its presence in sub-Saharan Africa. "ASE fell into the right niche. We didn't have much coverage in Namibia and Angola and with this acquisition, we can grow our footprint in these areas along with many others," says VWS Envig MD Gunter Rencken. "The deal offers both companies many advantages. We both now have extra resources at our disposal. It also provides re-assurance for clients, as well as a solid foundation for further growth over the next decade."

The Namibian firm provides a number of services, including consulting work, project



*The recently commissioned Opuwo nanofiltration plant*

evaluation, turnkey project management and construction, commissioning, lifecycle analysis, as well as operation and maintenance of water treatment facilities. The company recently commissioned a 50 000 l/h nanofiltration plant to treat water for the residents of the remote Namibian town of Opuwo.

## New, tougher body for well-known pump range

Pump manufacturer Denorco has launched its upgraded Super D submersible borehole pumps range.

Designed and manufactured for lifetime borehole applications, the range of 100 mm pumps, which was first launched 30 years ago, is now more robust than ever with addition of tough stainless-steel tops and bottoms to the pump, reports Denorco Product Manager Frik Adendorff. "The proven success of the 100 mm series in raising water from any borehole fitted with a single or three-phase electronic connection has now been updated,

concreting the demand for this workhorse for all borehole applications."

Each component of the series is machined from top-quality materials to afford a long life in the toughest conditions. Stringent mechanical, hydraulic and electrical testing, backing by ongoing research and development, ensures reliable operation. "The unsurpassed efficiency of both pump and motor ensures a smooth, silent, and cost-effective operation," explains Adendorff. "The new pumps will be as competitively priced as the previous models, so our clients are receiving even more value for their money."

### WATER DIARY (CONTINUED)

#### WINERY EFFLUENT APRIL 1-3

An IWA Specialist Conference on Sustainable Viticulture: Winery Waste & Ecological Impacts Management will be held in Trento and Verona, Italy. Enquiries: David Bolzonella; Tel: +39 4580 27965; Fax: +39 4580 27965; E-mail: [winery2009@gmail.com](mailto:winery2009@gmail.com); Visit: [www.aidic.it/winery/winery.htm](http://www.aidic.it/winery/winery.htm)



## Large recycled water treatment plant hatches in Oz

International company Hatch had completed design and delivery of an advanced water treatment plant to provide up to 70 Ml/day of purified recycled water to industrial users in Queensland, Australia.

The firm was a member of the consortium which won the contract to design and construct the Luggage Point Advanced Water Treatment Plant – the largest of three advanced water treatment plants to be constructed as part of the Queensland government's Western Corridor Recycled Water Project. This project is reported to be the largest recycled water scheme in the Southern Hemisphere and aims to reduce demand on the region's fresh water supply while securing water supplies for industrial use and reducing the environmental impact on water resources.

The A\$300-million Luggage Point plant uses state-of-the-art technologies to improve the water quality of secondary treated sewage for reuse as potable water and industrial cooling water. It includes: flow equalisation, pre-treatment (coagulation and clarification for phosphate and turbidity removal), microfiltration, reverse osmosis, advanced oxidation (hydrogen peroxide and UV dosing) and final stabilisation of the water together with residues handling (thickening and dewatering).

The plant started producing water in December within 20 months of design commencement. Following a three-month performance testing period, treated water will be conveyed to nearby power stations and the Wivenhoe Dam, the area's principal freshwater storage reservoir.

## Agenda set for climate and health research

More than 80 researchers and representatives from donor and UN agencies gathered at a meeting of the World Health Organisation (WHO) in Madrid, Spain, to draw up a research agenda to better deal with the impacts of climate change on human health.

The aim is to "speed up, focus and intensify climate change and health research," according to Maria Neira, WHO Director of Public Health and Environment. "We want to provide the best possible scientific evidence base for governments to take protective actions to protect people from climate change," she said at a news conference.

The agenda identifies several priority research areas, including how climate change will interact with key factors affecting health, such as economic development, urbanisation, access to care and exposure to health risks. More research is needed to better characterise the long-term effects of climate change – such as drought, fewer freshwater resources and population displacement – on health. Such effects will have a major impact on mental health and increase the risk of conflict, say the researchers.

Source: [www.scidev.net](http://www.scidev.net)



## Glowing results from new method to detect mercury in fish

Researchers at the University of Pittsburgh, in the US, have developed a simple and quick method for detecting mercury in fish using a fluorescent substance that glows bright green when it comes into contact with oxidised mercury. The intensity of the glow indicates the amount of mercury present.

Developed in the laboratory of Kazunori Koide, a chemistry professor in the School of Arts & Sciences, the new method can be used on site and can detect mercury in ten to thirty minutes in fish. "We have developed a reliable indicator for mercury that a person could easily and safely use at home. It could also be used at the fish market, for example."

The fluorescence results from the reaction of mercury ions with hydrocarbons called alkynes – the alkyne is converted into a ketone and creates a fluorescent molecule. Prof Koide's method differs from similar mercury indicators in that it withstands the oxidation process mercury samples must undergo prior to testing. The method can also be used on dental samples.

For more information, Visit: [www.news.pitt.edu/m/FMPro?-db=ma&-lay=a&-format=d.html&id=3524&-Find](http://www.news.pitt.edu/m/FMPro?-db=ma&-lay=a&-format=d.html&id=3524&-Find)

## Nitrate increasing in US groundwater

A 16-year long nationwide study conducted by the US Geological Survey (USGS) indicates that nitrate concentrations of groundwater is increasing in many parts of the US.

Nitrate is the most common chemical contaminant in the world's groundwater. Decadal-scale changes of nitrate concentrations were evaluated in groundwater samples collected from 495 wells in 24 well networks across the US in predominantly agricultural areas. Each well network was sampled once during 1988-1995 and resampled once during 2000-2004. Findings show statistically significant increases in concentrations of nitrate in seven of the 24 well networks. Median nitrate concentrations of three of those seven well networks increase above the maximum allowed contaminant level of ten parts per million.

The findings of the USGS study were published in a companion supplement to the September-October 2008 issue of the *Journal of Environmental Quality*.

## Freshwater pollution hurting American pockets

Phosphorus and nitrogen pollution is hurting Americans' wallets, research by Kansas State University has shown.

Freshwater pollution impacts individuals on a level as basic as how much they spend on bottled water, according to Walter Dodds, professor of biology. "If your municipal water plant has to spend more money to treat the water coming through your tap, your water bills will increase. According to Prof Dodds, monetary damages put environmental problems in terms that make policymakers and the public take notice.

The researchers calculated the money lost from nitrogen and phosphorus pollution, which causes eutrophication of water bodies, by looking at factors such as decreasing lakefront property values, the cost of treating drinking water and the revenue lost when fewer people take part in recreational activities such as fishing or boating. They found that freshwater pollution costs government agencies, drinking water facilities and individual Americans at least US\$4.3-billion. Of that, they calculated that US\$44-million a year is spent just protecting aquatic species from nutrient pollution.

## New global research programme to weather the storms

The International Council for Science (ICSU) has launched a ten-year, international research programme on natural disasters.

The programme is in response to the urgent need to reduce the impacts of natural disasters and is designed to address the gaps in knowledge and methods that are preventing the effective application of science to averting disasters and reducing risk.



Each year hundreds of thousands of people are killed and millions injured, displaced or have their livelihoods destroyed by natural disasters. There has been a dramatic increase in the frequency of disasters from around 30 per year in the 1950s to more than 470 per year since the beginning of this century.

"Integrated Research on Disaster Risk will provide an enhanced capacity around the world to address hazards and make better decisions to reduce their impacts," reported Gordon McBean, Canadian climatologist and Chair of the ICSU Planning Group for Hazards. "In ten years, as a result of this

programme, we would like to see a reduction in loss of life, fewer people adversely impacted, and wiser investments and choices made by governments, the private sector and civil society."

The new programme, which builds on existing research activities, will address the impacts of disasters on all scales, from local to global. It will combine expertise and experience from around the world, and provide an opportunity for the natural and social sciences to work together as never before. The focus is on all hazards related to geophysical, oceanographic, climate and weather trigger events.

## Alien plants smothering Europe

The number of alien plant species in Europe has more than tripled over the last 25 years, scientists have found.

New species that bring about long-term change to ecosystems by, e.g. competing with native species, are regarded as one of the greatest threats to biodiversity. According to research published in the journal *Preslia*, around six new species arrive in Europe each year on average. To date, more than 5 700 plant species have been classified as alien, compared to 1 568 in 1980.

The highest number of alien plant species was reported from Belgium, the UK, and the Czech Republic. The UK, Germany and Belgium have the greatest number of naturalised aliens – new species that have been able to establish stable populations.

Among the most widespread of the new plant species are Canadian fleabane (*Conyza Canadensis*), Jerusalem artichoke (*Helianthus tuberosus*) and black locust or false acacia (*Robinia pseudoacacia*), which all originated in North America. More than three-quarters of all new plant species have been brought to Europe unintentionally.

More information: [www.europe-aliens.org](http://www.europe-aliens.org)

## Indigenous values guide Australian research

The value of rivers and wild food resources to Australia's indigenous people is the focus of new research that will help transform water management in northern Australia, CSIRO reports.

"Indigenous people in the north have a large stake in water resource planning and management based on their distinct cultures, ways of life and substantial land holdings. Yet their interests and values in water are poorly understood by decision makers," says CSIRO researcher Dr Sue Jackson. "Our research will increase understanding of the importance of river systems to indigenous people and help water planners and managers their indigenous people's water needs into consideration."

The TRACK (Tropical Rivers and Coastal Knowledge) funded research will

record indigenous people's social and cultural knowledge relating to water and will survey them to quantify the economic benefit households derive from their use of aquatic plants and animals.

Indigenous people will also be employed in the survey and monitoring components of the research and as advisors on river health. "Our survey will involve asking questions such as how many fish people have caught or bush cucumbers they have collected over the past few weeks and we will compare the cost of purchasing the same amount of food from the community store," explains Dr Jackson. "We will also be looking at what effect different water levels, or flow regimes, have on the patterns of resource used by indigenous people."



Wagiman children with turtles caught on their traditional territory near Pine Creek, Northern Territory.

## New from the WRC

### Report No: KV 212/08

*Technical Report on the State of Yellowfishes in South Africa 2007 (ND Impson; IR Bills and L Wolhuter)*

This status report has been compiled for nine of South Africa's yellowfish species, six true yellowfishes (*Labeobarbus* spp.) and three large *Barbus* species that closely resemble yellowfishes. Yellowfishes are among the most popular indigenous freshwater fishes caught by anglers across the country, and hence support valuable and growing recreational and subsistence fisheries. Three of the nine species are threatened and two are endangered. Threats to these fish are numerous and varied. The most threatened species are all in the Western and Northern Cape. These fishes have experienced huge declines in their distribution ranges and population densities since the 1930s – the main causes being the introduction of alien species, water abstraction from rivers, and water pollution.

### Report No: TT 353/08

*Water Services Barometer Study (Sigodi Marah Martin)*

This is the first comprehensive study to provide a barometer of the general public's knowledge and understanding of the water services messages as communicated, and their involvement in, and preferences for, consultative processes. The study provides a 'reading' of the current state of knowledge and awareness among the South African public regarding five key water services knowledge areas (free basic water, basic water as a constitutional right, responsibilities, water quality, health and hygiene and institutional roles).

### Report No: KV 214/08

*Links Between Water Temperatures, Ecological Responses and Flow Rates: A Framework for Establishing Water Temperature Guidelines for the Ecological Reserve (NA Rivers-Moore; DA Hughes and S Mantel)*

The National Water Act provides legal status to the quantity and quality of water required to maintaining the ecological functioning of

river systems through the declaration of the Ecological Reserve. To date, no methods have been developed for the water temperature component of the Reserve, although the importance of water temperatures in maintaining river systems is fully recognised. Based on temperature time series analyses, this report argues that a suitable water temperature model for use in Ecological Reserve determinations should be dynamic, include flow and air temperature variables, and be modified by a heat exchange coefficient term.

### Report No: TT 354/08

*Environmental Flow Assessment for Rivers: Manual for the Building Block Methodology (Updated Edition) (JM King; RE Tharme and MS de Villiers)*

This report was first published under the same title in 2000. The Building Block Methodology is essentially a prescriptive approach, designed to construct a flow regime for maintaining a river in a predetermined condition. This manual describes its basic nature and main activities, and provides guidelines for its application. It also introduces the links between the methodology and procedures for determination of the Ecological Reserve as embodied in the National Water Act.

### Report No: KV 200/08

*Assessing the Appropriateness of Wetland Mitigation Banking as a Mechanism for Securing Aquatic Biodiversity in the Grassland Biome of South Africa (D Cox and D Kotze)*

The National Spatial Biodiversity Assessment established that 30% of grasslands in South Africa are irreversibly transformed and only 2,8% are formally conserved. This project investigated the concept of mitigation banking for wetlands with the potential to achieve the conservation of aquatic biodiversity within the priority areas of the grassland biome. A background to the development of the mechanism is provided in the main report along with a definition and overview of the concept. This is followed by a more detailed view of the policy, legislation, tools, processes and the respon-

sibilities of different roleplayers involved in establishing and operating mitigation banks.

### Report No: TT 329/08 to TT 332/08

*River Ecoclassification: Manual for Ecotatus Determination (Version 2) Modules A, D, E, and F (CJ Kleynhands; MD Louw; J Moolman; JA Mackenzie and C Thirion)*

These are the first in a series of manuals for ecotatus determination. Module A provides the background to and scientific rationale for the ecological classification and ecological status processes; module D (Volume 1 & 2) provides a step-by-step guideline to use the Fish Response Assessment Index, while Volume E does the same on the use of the Macroinvertebrate Response Assessment Index. Volume F provides guidance on the use of the Riparian Vegetation Response Assessment Index.

### Report No: 1696/1/08

*Nitrate Leaching from Soils Cleared of Alien Vegetation (NZ Jovanovic; A Hon; S Israel; D le Maitre; F Rusinga; L Soltau; G Tredoux; MV Fey; A Rozanov and N van der Merwe)*

Many alien invasive species targeted by the Department of Water Affairs & Forestry's Working for Water programme are nitrogen-fixing legumes. The hypothesis in this study was that clearing invasive alien vegetation might disturb the vegetation-microorganism-soil nitrogen cycling system by producing a large episodic input of fresh litter rich in nitrogen and by eliminating a large nitrogen sink. Among others, the study found that nitrogen levels in soil and groundwater were higher in areas invaded by alien plants compared to fynbos areas; that a quick release of NO<sup>3</sup> into groundwater occurred after clearing land from alien invasive legumes; and that the long-term effect of clearing alien invasive legumes is the reduction of nitrogen concentrations in groundwater. Clearing land of alien invasive legumes may therefore have a beneficial effect on reduced groundwater contamination from nitrate, besides reducing water use in catchments.

To order any of these reports, contact Publications at Tel: (012) 330-0340; Fax (012) 331-2565; E-mail: [orders@wrc.org.za](mailto:orders@wrc.org.za) or visit: [www.wrc.org.za](http://www.wrc.org.za)



**Practical operating guidelines for waste stabilisation ponds will soon be available from the Water Research Commission (WRC).**

Waste stabilisation ponds (also known as oxidation ponds) remain internationally accepted low unit cost wastewater treatment systems suited especially to smaller communities where electricity supply is minimal and there are limited trained personnel available for process control. These wastewater treatment systems are installed in various parts of South Africa where they have historically been effective in limiting environmental pollution and associated health impacts.

Waste stabilisation ponds can treat a variety of wastewater types, including domestic waste (including nightsoil from bucket toilets) and industrial waste (provided no abattoir waste is received). While these systems require low maintenance, they are not completely maintenance free. The last few years has seen many of these systems being neglected and/or overloaded due to upgrades and expansions of sanitation services.

A need was consequently identified to document the occurrence of pond systems throughout South Africa, investigate their present operational status and practices followed, identify in what instances the technology is applicable or whether alternative technologies should be considered, identify how operation and maintenance of these systems can be improved, and assess the potential for reusing treated effluent from pond systems. These aims were addressed in a project undertaken for the WRC by consulting firm Emanti Management, with the Free State and Eastern Cape used as case study areas.

Project leader Unathi Jack explains that the project team interacted with selected municipalities in the Free State and Eastern Cape to identify their pond systems, present operation and maintenance procedures followed and review existing water quality monitoring data (if any). The pond systems were assessed using the following categories: design, maintenance, operation and performance, water quality monitoring, safety, supervision and management. More than 70 pond systems were assessed during 2006 and 2007.



Overall, the systems evaluated scored lowest in the maintenance category, followed by the supervision and management categories. "Even though pond systems are simple to operate and do not require very skilled personnel, they still need to be well maintained in order to operate effectively," explains Jack. "Safety was found to be a particular issue of concern, as some of the systems were not enclosed by fences, allowing free entry by members of the adjacent community." Vandalism at most sites (e.g. stealing of fences) underlined the importance of community awareness and education.

Most of the pond systems were found to be overloaded due to population growth and/or upgrade from bucket toilets to waterborne sewerage systems. The issue of land availability for the extension of ponds (which require large tracts of land) was also noted. In addition, there was a general lack of knowledge of upgrading the pond systems other than building more pond basins.

Pond systems are meant to be closed systems, i.e. they are not meant to discharge effluent into the environment. In cases where there is a discharge of overflow, the final effluent should be monitored and compared to the Department of Water Affairs & Forestry General Authorisation limits for discharge. The study showed, however, that only about 1% of the pond systems where discharge was taking place were conducting monitoring.

The results of the survey were shared with the municipalities concerned. The final effluent quality results were also made available to the systems that were discharging comparing them to the General Authorisation limits. In many cases the local authorities admitted to failing to properly plan for the bucket eradication programme by also upgrading the pond systems. "The good news is that through the survey they became more aware of what was expected of them, and there has since been an improvement in most of the systems in terms of maintenance," Jack tells *the Water Wheel*.

The project is in the stage of being finalised. Four reports will emanate from the research, namely a *status quo* report containing all the information regarding the assessed systems; a management guide to assist managers in terms of understanding when pond systems are appropriate, and the most effective design and operation; a operation and maintenance guide for on-site personnel; and a guide on how to use the pond assessment tool which has been made available on the electronic water quality maintenance system. "Waste stabilisation ponds still have a place in the wastewater treatment sector and we hope that these documents will assist in the improved operation and monitoring of these systems," concludes Jack.



*It is not only the elephant that is threatened with extinction, but also the river carrying its name. South Africa's leading researchers, scientists, conservationists and wildlife pathologists have joined forces under a new programme to save what remains of the Olifants River system.*

*Lani van Vuuren reports.*

The initiative, known as the Consortium for the Restoration of the Olifants Catchment (CROC) at present was established following the perplexing death of hundreds of crocodiles in the Kruger National Park's Olifants gorge.

Led by South Africa National Parks (SANParks) it also includes representatives from national government departments, including the Departments of Water Affairs & Forestry and Environmental Affairs & Tourism, research organisations, universities, independent consultants, and the Water Research Commission.

The programme was initiated after it became increasingly clear that the death of the crocodiles was symptomatic of a serious and growing environmental problem in the Olifants River system. The river has been subjected to prolonged and cumulative ecosystem stress as a result of human activities in the catchment, which is thought to have resulted in the deaths of great numbers of this top predator.

"Next to the Vaal and the Crocodile West rivers, the Olifants is probably South Africa's hardest working river," reports aquatic

ecologist Dr Peter Ashton of the CSIR, who is also part of the programme. "The river has been used and abused for the past five decades, and pollution is getting progressively worse. This can be seen in the character of the water quality, which has worsened markedly over the years."

While clues are increasingly pointing to pollution from industrial, mining and agricultural sources as well as the alteration of the Olifants River system through bulk water infrastructure (such as the raised water level in Massingir Dam), the exact trigger that started the process of crocodile deaths remains elusive. This is one of the first questions the programme hopes to answer through multidisciplinary research. Direct poisoning from, for example, persistent organic pollutants and heavy metals, has already been eliminated as the direct cause of mortality.

While no direct threat has been found yet, there is also increased concern over the potential effect of pollution on the health of communities residing in the Olifants River catchment, especially those households still using untreated water from the river. This will also be investigated by the programme.

Crocodile carcasses were first spotted in the Kruger National Park in May last year. To date, at least 160 carcasses have been found, although the actual number of deaths is estimated to be at least double this figure, as crocodile carcasses sink quickly or are consumed by other crocodiles and are then missed. Post-mortem results show that the crocodiles died of pansteatitis, a disease which results in the general hardening of the body fat, mostly as a result of inadequate antioxidant levels (e.g. Vitamin E). The hardened fat causes the crocodiles to become stiff which results in reduction in mobility and the inability to swim. This leads to starvation and even drowning of the affected animals.

**“The Olifants River has been subjected to prolonged and cumulative ecosystem stress as a result of human activities in the catchment, which is thought to have resulted in the death of many of this top predator.”**

This is not the first time crocodiles have died in the Olifants River system (crocodile and terrapin mortalities also due to pansteatitis have also been reported in Loskop Dam), although the massive die-off of Kruger crocodiles did catch authorities unaware. “We suspected that the ongoing pollution of the Olifants River system would eventually result in some kind of ecological disaster. The large number of crocodile mortalities, however, caught us by surprise,” notes Danie Pienaar, Head of the Department for Scientific Services at the Kruger National Park. “One of the important outcomes of this programme will



*Surviving crocodiles in the Olifants gorge are tagged with radio transmitters to track movements.*

SANParks



*Lesions of pansteatitis in a Serrated hinged terrapin (Pelusios sinuatus) from Loskop Dam after a fish kill in 2007.*

Jan Myburgh

**CRIES OF HELP FROM A DYING RIVER**



Jamie Coetzee

The Olifants River rises in the Highveld, flowing southwest to northeast through Mpumalanga and Limpopo. Upon leaving South Africa, the river enters Mozambique and joins the Limpopo before discharging into the Indian Ocean about 200 km north of Maputo.

The Olifants River basin is home to nearly 10% of South Africa's population. People have lived in the basin for hundreds of years, but it is the last couple of decades, signalled by the arrival of intensified irrigated agriculture, as well as large-scale mining, power generation and heavy industry that has seen the river turn from a majestic water resource into little more than a sewage ditch in some places.

Most of the pollution of the river occurs in the upper basin. More than 55% of South Africa's electricity is produced here. It is also the epicentre of the country's coal-mining industry. It is here that about 90% of the country's saleable coal is mined. The Highveld is also home to a significant petrochemical and steel industry.

Return effluent, which includes acid mine drainage (AMD) from a number of defunct mines, releases a deadly cocktail of heavy metals, chemicals and other toxins into the river. The Department of Environmental Affairs & Forestry estimates that around 50 Ml/day of AMD discharges into the Olifants River catchment from decanting coal mines.

There are more than 200 dams located in the Olifants River basin, 37 of which are major dams (i.e. have a reservoir capacity in excess of two million m<sup>3</sup>). Most of this water is used to irrigate an area of about 110 000 ha. Runoff from these lands, which contain pesticides and fertilisers also find their way into the river.

The river health assessment, conducted on the Olifants River as part of the national River Health Programme nearly a decade ago, already warned of looming ecological disaster. "In the upper parts of the catchment mining-related disturbances are the main causes of impairment of river health. There is also an extensive invasion by alien vegetation, and to a lesser extent alien fauna. Ecologically insensitive releases of water and sediment from storage dams are another major cause of environmental degradation downstream, which is particularly relevant in the middle and lower parts of the catchment," says the report.

The death of hundreds of crocodiles in the Olifants gorge was not the first ecological disaster to hit the catchment. Regular fish



*The death of hundreds of crocodiles in the Olifants River basin sets of warning lights not because it will lead to the dearth of the species, but for what it means for the human population in the catchment. Carcasses found in the Kruger National Park are burnt to prevent cannibalism and subsequent infection of other crocodiles.*

kills have been occurring in the river for many years.

In 2006, Loskop Dam experienced its largest fish kill to date, with thousands upon thousands of indigenous fish being found clogging the shorelines of the dam, including huge numbers of blue kurper for which Loskop was famous in the past. Crocodile populations at the dam have also been decimated, with at least six of the last remaining dozen or so crocodiles dying of pansteatitis in 2007. This was the first case of the disease ever to be recorded in wild crocodiles. Turtles have been found in the vicinity of Loskop Dam perished from the same disease. Another disturbing fact is that the population structure of the Loskop Dam crocodiles is completely abnormal. There are no mature crocodiles (larger than 2,1 m) in the dam.

Concerted efforts are required to save what is left of this once magnificent river. It is hoped that this can be achieved before it is too late.





be to put in place a rapid response management mechanism should something of this nature ever happen again."

While rangers are still finding sporadic cases of dead crocodiles, the number of mortalities has slowed significantly of late. This could perhaps be attributed to management actions, such as the removal and burning of carcasses to prevent cannibalism. How the mortalities will affect future population numbers remains to be seen. Meanwhile research into crocodile population dynamics, which involves fitting of radio transmitters on surviving crocodiles to track movements, as well as studies of other aquatic species in the river system continue. The quality of the water in the Olifants River is also being monitored closely.

As the Olifants is a transboundary (i.e. shared) river system, active cooperation is being sought with Mozambican authorities. SANParks Honorary Rangers' Rangers Support Services Group have donated two boats worth R150 000 to the Kruger National Park, one to be used for law enforcement, monitoring and research on the South African side, while the other has been lent to the Limpopo National Park in Mozambique to be used for the same purposes downstream in the Olifants River.

Pansteatitis is usually associated with the consumption of rotten and rancid fish. However, no confirmed fish mortalities were observed in the Olifants gorge. Recent investigations by independent fish pathologist Dr David Huchzermeyer indicated that most of the fish caught in the gorge are not healthy and that their internal organs and gills are affected. This is symptomatic of exposure to toxic agents.

It is hoped that the outputs from this programme will not only benefit the communities and wildlife dependent on the Olifants River system, but will lead to the improvement of the management of South Africa's other river systems to prevent such ecological disasters occurring in future and an overall improvement in river health. 



Acid mine drainage spillages from surrounding coal mines contribute significantly to pollution levels in the Olifants River.



A perished crocodile from Arabie Dam on its way to a post mortem.



## VAAL BARRAGE:

*The construction of the Vaal Barrage was the first attempt to tame the waters of the Vaal River.*

Lani van Vuuren

# Storing Water for a Thirsty City

*Completed in 1923, the Vaal Barrage, one of the earliest large dams to be constructed in the country, was one of the most ambitious water projects of its kind in South Africa at the start of the twentieth century.*

*Lani van Vuuren reports.*

Even before the official end of the Anglo Boer War in 1901, British authorities commissioned an investigation into the possible damming of the Vaal River. The gold mines and industries of the Witwatersrand needed water, and local sources (mostly groundwater) were diminishing at a rapid rate.

In its final report the appointed commission of enquiry was critical of the Vaal River, however. This was mainly because the river was still the de jure border between the two Boer republics at war with Britain. After the conclusion of the Anglo Boer War in 1902, the river was the border between two British colonies.

## VAAL RIVER RE-INVESTIGATED

Shortly after South Africa became a Union in 1910, drought set in exposing the unstable foundations upon which the Witwatersrand's rapid expansion and growing prosperity was based. By 1911, the mines were the largest water consumers in the area. At the same time, the number of municipal authorities had increased considerably.

Rand Water instructed its chief engineer, William Ingham, to launch an investigation to find the most suitable water catchments within a radius of 80 km of Johannesburg to expand the board's sources

of supply. As many as 21 different sites and schemes were scrutinised before Lindeque's Drift, on the Vaal River, some 70 km from Johannesburg was settled on as the best solution.

The scheme was approved by the Board of Rand Water on 26 September 1913. As originally conceived the potential yield of water from the Vaal River and the four tributaries flowing into the barrage was estimated at 91 Mℓ/day, 45 Mℓ/day of which could be tapped.

**“The Vaal Barrage was part of a novel and pioneering endeavour of farsighted engineers.”**

Ingham wrote in a report in February 1913: “The Lindeque’s Falls site is situated about 24 miles below Vereeniging, and, by building a dam 30 feet high at the Fall, the water would be backed up the river to Engelbrecht’s Drift above Vereeniging for a distance of 44 miles, and a pumping station could be erected at Vereeniging in the neighbourhood of the collieries.”

The plan was essentially to dam up the Vaal River over a distance of 60 to 70 km. The water would then be extracted at a point well above the site where the major storage source was located. The deep river banks were to be used as a longitudinal storage passage extending from above Vereeniging, at Engelbrecht’s Drift, to the barrage.

**THE SCHEME EXPANDS**

In March 1916, the Board approved a plan to expand the capacity of the scheme further by 23 Mℓ/day. A further £758 000 was earmarked for the project. Interestingly, upon completion in 1923 it transpired that the construction of the barrage only cost £1,5-million, much less than anticipated.

In his paper published in *History*, May 2001, Prof Johann Tempelhoff, Director of School of Basic Sciences in the Vaal Triangle Faculty of North West University writes: “In many respects the Vaal Barrage was part of a novel and pioneering endeavour of farsighted engineers who were cognisant of the leisure and aesthetic value significance of the (Vaal) river. It was one of the most ambitious water projects of its kind in South Africa at the start of the twentieth century.”

The project was based on the latest technological developments in engineering. Before plans were drawn up for the barrage, Ingham and Donald Simpson, a member of the Rand Water Board, visited large dam projects in Egypt and Europe to become acquainted with the latest engineering technology. Leading British engineering firms were contracted to supply the necessary mechanical equipment to be used for the barrage.

**DELAYED CONSTRUCTION**

It was originally anticipated that construction of the Vaal Barrage would start in 1914. However, World War II broke out that year hampering not only the construction of the barrage, but all of Rand Water’s operations. Firstly, this was due to financial reasons. Up until the 1950s South Africa had no domestic capital market, and had to raise all its loans overseas. As a result of the outbreak of war and the diversion of all financial and other resources to the war effort, Rand Water was unable to raise the necessary loan capital to finance the barrage. This would only become available in 1916.

Secondly, the Rand Water Board at that time had a distinctly British character, with practically all of its senior employees being either British or English speaking. As a result the water board lost the services of a substantial number of its employees as they enlisted in the war. In fact, between 1914 and 1918, 75% of head office staff, 57% of the officials of the Chief Engineer’s Department and 33% of the ordinary employees of the Chief Engineer’s Department enlisted in one or other war-related activity (on the understanding that their posts would



*Governor-general of South Africa, Prince Arthur of Connaught, was one of the guests at the inauguration of the Vaal Barrage in 1923.*

Wikipedia

be kept open until they returned). Inevitably, all aspects of the work of Rand Water slowed down.

### INTERMITTENT LABOUR

In the end work on the barrage started in June 1916, and overnight the site took on the appearance of a small village. Between 1916 and 1923 the scheme employed about 300 black workers and 40 to 50 white workers. While many white workers comprised carpenters and other skilled trades, about 25 unskilled whites were employed as gangers in charge of squads of black labourers.

Interestingly, when construction work started the white employees were accommodated at a cooperative mess established by the Rand Water Board. Later the mess was dissolved and most of the men then took up residence with storekeepers and farmers situated close to the site. On the other hand, the black workers were housed in a compound with their own cooking house. Most were former mine workers.

Construction reports of that time indicate that labour shortages were an intermittent feature of the early years of construction of the Vaal Barrage. In November 1916, 50 black workers left the site to plough their lands. This was a common practice among migrant mine workers, and their return was confidently expected in January the following year.

Again in June 1917 an abundant harvest in the African reserves prompted a significant drop in the number of black workers on site. Efforts were now made to attract new recruits from uMzikhulu in Natal and also from Herschel and Klerksdorp district. It is said that management even urged workers on site to write letters to their families asking the men to come work on the project.

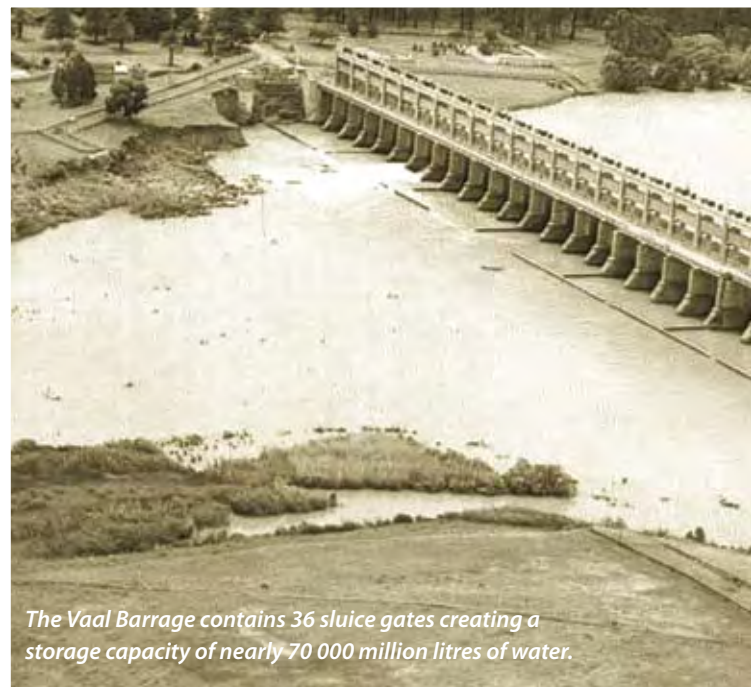
### THE VAAL FLOODS

Further delays in construction were experienced in late 1917 when major floods struck the Vaal. Water levels in January 1918 were recorded as shooting up six to seven metres. Even once the floods had passed their peak, water levels remained high



Rand Water

*The Vaal Barrage at the time of its inauguration in 1923.*



*The Vaal Barrage contains 36 sluice gates creating a storage capacity of nearly 70 000 million litres of water.*

DWAf

and it was recorded in May 1919 that since concreting had begun, it had been possible to work on the river bed for only 193 days due to its flooded state.

Next to strike was the worldwide epidemic of Spanish influenza in what became known as Black October in 1918. A total of 38% of Rand Water's white and 83% of the board's black employees were temporarily disabled by this debilitating disease. Of the 402 workers at the Vaal Barrage project 98% were incapacitated and nearly 10% died.

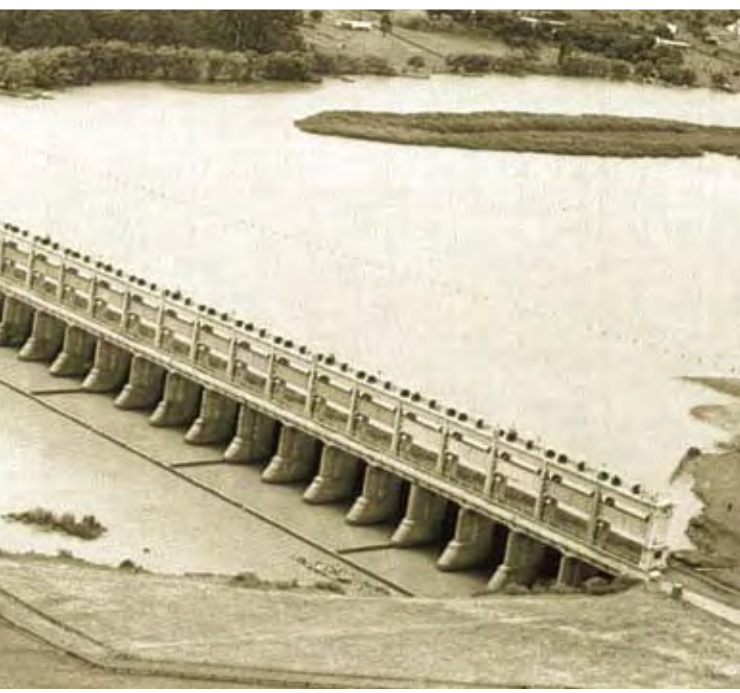
Other health problems experienced included food poisoning, and an outbreak of scarlet fever. Many of the war veterans who joined the project after WWI also suffered from malaria relapses.

### MONUMENT TO ENGINEERING SKILL


The Vaal Barrage was finally completed in 1923. Spanning the Vaal River over a distance of about 400 m, it was as Prof Tempelhoff describes it "a veritable monument of engineering skill." More than 275 000 m<sup>3</sup> had been excavated in rock of which 43 000 m<sup>3</sup> had been cast in concrete.

By making use of the Duff Abrams method of steel-reinforced concrete the structure was strong and capable of withstanding all types of flooding conditions. It was constructed in a blend of art nouveau and classical styles. There were 36 sluice gates creating a storage capacity of nearly 70 000 million litres of water.

In grand style the Vaal Barrage was officially opened on 27 July 1923 by the then governor-general of South Africa,



Prince Arthur of Connaught. A train was chartered to convey guests from Johannesburg to Vereeniging whence they were conveyed to the site by buses and cars.

The water scheme was a proudly South African development. In many respects it brought about a tumultuous change in the environment along the Vaal River between the barrage and Vereeniging in the first quarter of the twentieth century. Prof Tempelhoff writes: "Without this source the development of the Witwatersrand and the economic progress of South Africa would have taken longer to materialise. The growth of the Rand created a demand for industrial support in the form of water, coal and electricity. The Vaal River... played a crucial role in satisfying the need... for the future Vaal Triangle the river would become the silent hard-working witness to rapid industrialisation." 

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### JOHANNESBURG – THE THIRSTY CITY

It is well known that Johannesburg is one of the few large cities in the world not sited close to a significant river. Instead it was the discovery of gold in 1886 on the farm Langlaagte and the promise of great wealth which drew people to the Witwatersrand. In the early days water was drawn from surrounding rivers and streams, as well as from groundwater sources, but droughts and water shortages were common, and the water resources were quickly polluted.

It is reported that during the severe droughts experienced in 1889 and 1895 the rich resorted to bathing in soda water while the poor had to disguise the smell of their unwashed bodies with toilet water and perfumes. Newspapers of that time reported women resorting to a mixture of ammonia and lavender water for washes.

After the appointment of various governmental commissions, the Rand Water Supply Board was constituted by legislation in 2003. Before then, water supply to Johannesburg was undertaken by several private water companies.

One of the most significant early policy decisions was that there would be a fixed rate per thousand gallons, irrespective of the point on the trunk lines from which the supply was drawn. This meant that the Witwatersrand could develop independently of where the source was. Another important decision was that the rate for water was not to yield any profit, but was calculated to cover working costs.

Raging demand and frequent droughts led the Board to cast its eyes away from groundwater sources and on to the murky Vaal River, and it was less than a decade after the formation of Rand Water that investigations which eventually led to the construction of the Vaal Barrage began.



During the drought of 1895, water was sold for two shillings and sixpence per bucket.

# Knowledge: The Cornerstone of SA's Adaptation to CLIMATE CHANGE



*South Africa's food production could be severely hampered should warmer climatic conditions prevail in future.*

www.sxchu

## *The Water Research Commission (WRC) has redefined its research portfolio on climate change in the water field over the next five years.*

**T**he evidence for global climate change, largely as a result of human activities that produce greenhouse gas emissions, is overwhelming. There is rapidly growing consensus among global climate model projections regarding the nature and extent of the change. The main climate change consequences related to water resources are increases in temperature, shifts

in precipitation patterns, an increase in the frequency of flooding and droughts and, in the coastal areas, sea-level rise.

While the temperature signal produced by climate change is relatively clear, the precipitation signal is mostly still dominated by natural climate variability, as opposed to anthropogenic drivers of change. This could very well remain the

case for the next decade or so, especially at the river catchment scale.

With hydrological variability further amplified in response to variable rainfall; the small 'signal' amid the large level of 'noise' will make it difficult to detect hydrological and water resource impacts with any degree of confidence, thus adding to the challenge of planning appropriate water-sector responses to climate change.

## A POTENTIAL THREAT IS RECOGNISED

The WRC first recognised the potential impacts of climate change on the water resources of South Africa as a priority area for research in the mid-1980s. At the time it was impossible even to begin to address the topic in a meaningful way because of the lack of scientific capacity and (especially computational) resources.

Still hydroclimatology was identified as a research field deserving of dedicated support and funding commenced in this area in 1988, initially focusing on mechanisms and teleconnections (especially links with sea surface temperatures that affect South Africa's climate. Over almost 20 years, roughly R30-million (excluding funding for cloud seeding research) was invested in more than 30 research projects in the field of hydroclimatology.

This research included topics such as the compilation of comprehensive precipitation databases for South Africa, stochastic modelling of precipitation processes, cloud and precipitation physics (including rainfall enhancement), global and regional climate modelling, climate variability studies in relation to ocean-atmosphere processes and teleconnections (including El Niño and El Niña phenomena), precipitation prediction, scale interactions and downscaling.

Partners in this research have included various departments at the universities of Cape Town, KwaZulu-Natal and Pretoria, Witwatersrand and Zululand, as well as the South African Weather Service, and the Department of Water Affairs & Forestry (DWA). Besides the knowledge gained, significant contributions have been made to the development of local climate-related research capacity in climate science and its linkages to water resources.

## PROJECTS IN PROGRESS

The first major WRC-funded study focusing explicitly on climate change

**“Besides the knowledge gained, significant contributions have been made to the development of local climate-related research capacity in climate science and its linkages to water resources.”**

and its impacts on South Africa's water resources started in 2002, with a comprehensive report being published in 2005, named *Climate Change and Water Resources in Southern Africa*. This project provided valuable insight into the magnitude of the potential impacts and the consequential adaptation needs in the sector.

Present climate-change related projects being funded by the WRC include research on predicting the secondary impacts on water resources due to primary changes in precipitation and temperature associated with climate change; applications of rainfall forecasts for agriculturally-related decision-making in selected catchments; using enhanced knowledge of climate variability for the benefit of water resource management; and multidisciplinary analysis of hydroclimatic variability at the catchment scale.

New climate change-related projects to be approved by the WRC include identification, quantification and incorporation of risk and uncertainty in water resource management tools; an evaluation of the sensitivity of socio-economic activities to climate change in climatically divergent South African catchments; and integrating water resources and water services management tools.

## REDEFINING THE FOCUS

The rapid growth in awareness and understanding of global-change issues over the past decade has produced the need to periodically refocus climate-change research. Accordingly, it has been decided to redefine the portfolio of climate change-related research that the WRC envisages supporting in the medium term.

The most necessary shift is probably for such research to be integrated into the larger body of national climate change research, thereby embracing a multi-sectoral, multi-level approach towards securing the water sector's contribution to enabling South Africa deal effectively with a multiplicity of existing stresses that climate change impacts will undoubtedly be adding to over coming decades.



*South Africa's poor population is especially vulnerable to the potential effects of climate change.*

The WRC's new proposed climate change research portfolio will provide direction for Commission funding of climate change-related research over the next five to ten years. The recommended portfolio consists of three main thrusts:

- Impacts of climate change: Refinement and communication of climate-change scenarios, projections, information and data.** Internationally and locally, climate change science is continually refining and building on available data, information and knowledge. Because of currently poor communication channels, decision-makers and managers are not able to access up-to-date, suitably interpreted scientific products for immediate use. A high priority, therefore, is for the water sector, in partnership with other sectors, to research the development and support of an appropriate institution to fill this gap.


**Identification and quantification of impacts.** While the need for inter-sectoral collaboration to establish total water-related impacts of climate change across sectors is recognised, immediate research priorities remain water-sector focused. This is because of remaining critical knowledge gaps relating to direct and indirect impacts of climate change on water quality, the Ecological Reserve, river flow extremes and groundwater resources.
- Adaptation to climate change: Enhancing adaptive capacity.** A water-sector specific research priority is for DWAF-led collaborative research that would enable DWAF and catchment management agencies to develop an integrated climate-change adaptation response strategy, thereby mainstreaming adaptation within water resource management, nationally and regionally. This would also inform the next revision of the National Water Resource Strategy.

**Delivering (piloting) adaptation actions.** A high priority for national and local water-resource and water-use planning and management is to pilot the mainstreaming of climate change considerations into water institutional arrangements, including policies, strategies, pricing, governance etc. At catchment or community level, priority is given to either leading or contributing to cross-sectoral case studies that pilot adaptive action aimed at reducing the socio-economic impacts of climate variability and change on already stressed and vulnerable groups.

- Mitigation of climate change:** With relatively few exceptions, the water sector will not be responsible for taking the lead in mitigation-related research and development projects. However, the sector is clearly a stakeholder in other

projects that have water use or water resource implications. In such instances, the forging of inter-sectoral research partnerships with water sector participation is highly appropriate.

This re-defined research portfolio is intended to ensure that, henceforth, water-sector research funds are invested effectively in the interests of making South African society better able to adapt successfully to the impacts of global climate change and more resilient in the face of enhanced climate variability.

To order a copy of the document, *Towards Defining the WRC Research Portfolio on Climate Change for 2008-2013 (WRC Report No: KV 207/08)* or *Climate Change and Water Resources in Southern Africa (WRC Report No: 1430/1/05)* contact Publications on Tel: (012) 330-0340 or E-mail: [orders@wrc.org.za](mailto:orders@wrc.org.za) 

**HOW WILL CLIMATE CHANGE AFFECT WATER RESOURCES IN SOUTH AFRICA?**

While the exact answer is not certain, climate change has the potential to make a significant impact on both the availability and requirements for water in South Africa. Rising temperatures and increasing variability of rainfall could see a general decrease of 5% to 10% of present rainfall, with longer dry spells in the interior and northeastern areas of the country coupled with more frequent and severe flood events. The probable effect is greater evapotranspiration and more stress on arid and marginal zones.

Research indicates more wetting in the eastern half of the country, particularly along the east coast, while drying is expected in the west of the country, especially around the Western Cape, which seems to be facing a shorter rainfall season, and in the far northern region.

Runoff is highly dependent on changes in rainfall, and groundwater recharge even more so. Parts of South



Africa could experience reductions in runoff and/or streamflow of up to 10%, which could be evident in the western parts of the country as soon as 2015. The decrease in runoff would move progressively from west to east, and could be expected to reach the east coast by 2060.

Even if the average rainfall were to remain the same, increased variability in streamflow would result in reduced natural yields and reliability, and an increase in the unit cost of water from dams. Should warmer climatic conditions prevail, the water requirements of plants, and therefore irrigation requirements would also increase. A decrease in water availability will affect water quality, further limiting the extent to which water may be used and developed.

**Source: South Africa Environment Outlook – A Report on the State of the Environment**



# Lifeline for Struggling Water Treatment Plants



Heidi Symon

*The new national Technical Assistance Centre (TAC) promises to be a much-needed lifeline for small and medium-sized water and wastewater treatment plants struggling to comply with national quality regulations. Lani van Vuuren reports.*

Smaller water and wastewater treatment plants are often situated in far-flung peri-urban or rural areas where technical and management capacity is hard to come by. It is no secret that many of these plants struggle with sustainable and efficient operation within national standards, which could have serious human and environmental health implications.

In an effort to relieve this situation the TAC was launched last year as a joint initiative between the Water Research Commission (WRC), Department of Water Affairs & Forestry (DWAF), Water Institute of Southern Africa, Development Bank of Southern Africa (DBSA) and the South African Local Government Association.

Centre facilitator and project leader Chris Swartz explains that a call centre and website are being established to provide pro-active and reactive assistance in the form of rapid and effective information, action plans and solutions to treatment plant owners, managers and personnel experiencing problems with their water and wastewater treatment plants. Information on technical, social, training and capacity building issues will be provided.

The TAC will be coordinated and managed by special coordinators, and


all communication to and from subscribers (individual and institutional) making use of the centre's services (whether by telephone, fax or e-mail) will be undertaken through the centre hub operated by the project leader. Enquiries regarding requirements for treatment plant optimisation or addressing specific problems will be logged and addressed by the centre personnel. Where additional consultation or site visits are required, the site will be visited by one of the centre's regional water professionals or contracted roving technicians.

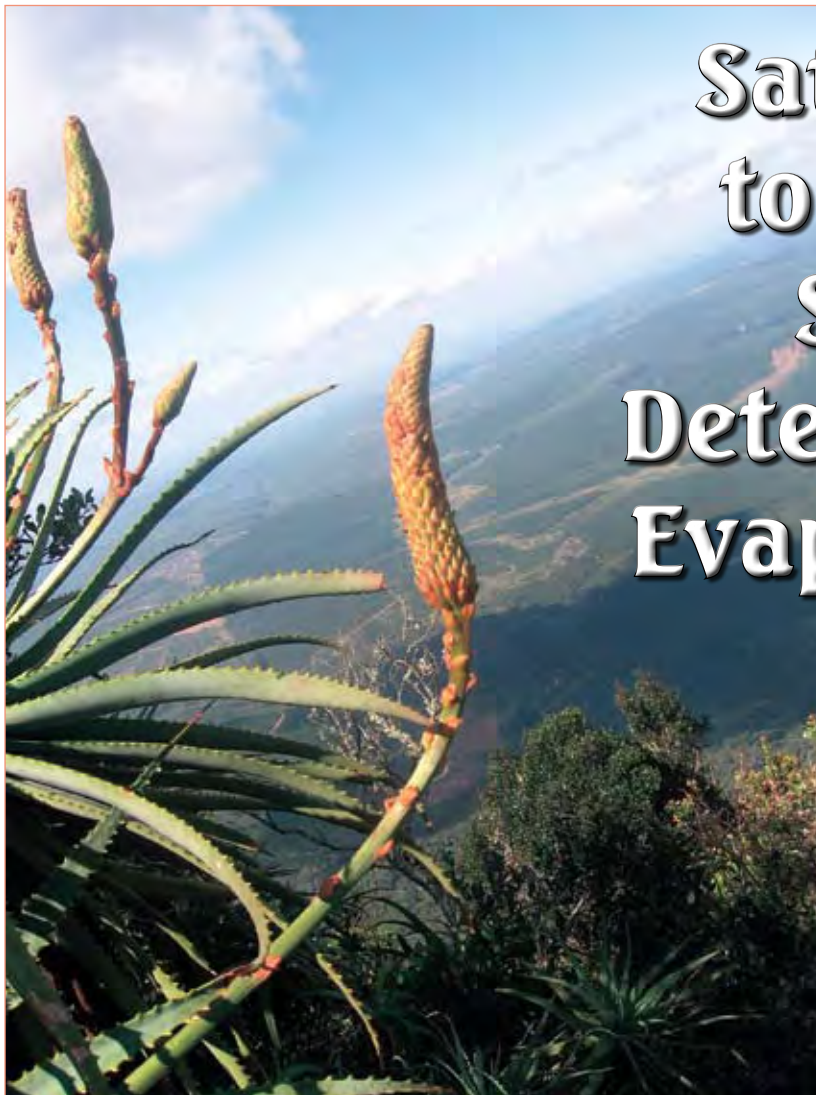
It is important to note that the TAC will not be a regulatory enforcement agent, but will rather ensure effective flow to and from DWAF on regulatory matters, reports Swartz. The centre will also be accountable to a steering committee and DWAF in performing its functions. Specifically, the centre aims to identify the requirements of the owners of small water and wastewater treatment systems, and to advise and assist in the monitoring, evaluation, optimisation and upgrading of these systems.

The concept is being tested in two provinces, namely the Eastern Cape and Western Cape. Funding is being provided by the WRC, DWAF and the DBSA. During the 12-month piloting of the TAC, water and wastewater treatment

plants experiencing serious challenges with compliance and performance will be identified and then assisted on a priority basis. This will be undertaken pro-actively through discussions with authorities, consultants and knowledge of the project team or re-actively by enquiries from municipalities through the call centre, website or during introductory workshops that will be held in the two provinces.

"Providing assistance to these water and wastewater treatment plants will include, but not be limited to, visits to the plants by treatment specialists to perform assessments of the plants' condition, performance and compliance. These specialists will then draw up a list of upgrading needs, and facilitate the required upgrading and improvement actions," says Swartz. "Importantly, it will also include assessment of the present technical and management skills availability at the treatment plants and the relevant municipality's water care section, as well as identification of training needs. Facilitation of training and skills development as may be required will also be performed."

It is hoped that through these efforts non-compliance and operational difficulties at these small plants will soon be the exception rather than the norm. 



www.scschu

# Satellites to Assist SA in Determining Evaporation

*The use of remote sensing to determine evaporation in South Africa has received a welcome boost following the signing of a Memorandum of Agreement (MoA) between CSIR and international scientific advisory firm WaterWatch.*

*Lani van Vuuren reports.*

Evaporation is a significant water loss from a catchment. Types of vegetation and land use (e.g. forestry or agriculture) greatly affect evaporation, and therefore the amount of water leaving a catchment. Understanding the temporal and spatial distribution of evaporative depletion is essential for managing water catchments as this is the basis for evaluating how water is consumed and understanding potential tradeoffs related to the allocation of water for anthropogenic uses and the environment. Yet, evaporation remains one of the most difficult processes to determine accurately because of the natural heterogeneity and complexity of hydrological processes in catchments.

Traditional methods to determine evaporation in South Africa have included energy balance, water balance and micrometeorological techniques, lysimetry, porometry, stem steady state and heat pulse velocity, cut stem technique, as well as semi-empirical and empirical methods. These techniques are mostly at point scale or small spatial scale, however, better large-scale techniques are required to measure evaporation over, for example, an entire catchment. Remote sensing offers a possible solution to this challenge. It is described as an indirect evapotranspiration technique in that it involves using a set of equations in a strict hierarchical sequence to convert the spectral radiances measured by satellites or

aeroplanes into estimates of actual evapotranspiration (evapotranspiration is the sum of evaporation and plant transpiration from the earth's surface to atmosphere). It does not require prior knowledge on soil, crop or management conditions.

WaterWatch, which is headquartered in the Netherlands, uses its own developed SEBAL (the Surface Energy Balance Algorithm for Land) model to determine evapotranspiration. The model determines both actual and potential evapotranspiration on a pixel-by-pixel basis by solving the energy balance at the earth's surface using spatially distributed, visible, near-infrared and thermal infrared data as

supplied by certain satellites. The SEBAL model has already been used successfully by WaterWatch to help determine the water use efficiency of the wine and table grape industry in the Western Cape.

“The advent of the possibility to indirectly measure fundamental evapotranspiration processes from satellites has radically changed our abilities in the area of water resources management,” says WaterWatch Director Prof Wim Bastiaanssen. “Spatial coverage is available at the variety of scales needed: field, project and basin. Temporal coverage is vastly superior at minimal cost to provide similar detail when compared to the field measurement of data.”

While used widely overseas, the use of remote sensing technology to estimate evaporation has been extremely limited in South Africa to date, explains Dr Caren Jarman, researcher in the ecophysiology group of CSIR Natural Resources and the Environment (NRE). “There is currently no known group in this country that estimates evaporation operationally in South Africa,” she tells the Water Wheel. This also means that at present hardly any capacity exists in the country to undertake evapotranspiration estimation using remote sensing.

Therefore the MoA signed between CSIR and WaterWatch to facilitate more work between the two parties and in the use of the SEBAL model in South Africa is seen to be of great benefit to the country. “Local researchers will be trained in the use of SEBAL, which will build much needed capacity in the field of remote sensing.” It is especially the skills of agrometeorology, micro-meteorology and hydrology which are required.

In the long term, it is hoped that this agreement will open up the way for the establishment of a national remote sensing centre where evapotranspiration will be estimated operationally (in near

*Signing the Memorandum of Agreement on behalf of CSIR and WaterWatch is Dr Pat Manders, Director of CSIR NRE and Prof Wim Bastiaanssen, Director of WaterWatch while CSIR researcher Dr Caren Jarman looks on.*



Lani van Vuuren

**THE WESTERN CAPE GRAPE PROJECT**

**T**he economically important grape sector of the Western Cape puts significant pressure on the scarce water resources of this province.

The challenge is for the grape industry to remain economically viable while simultaneously saving water.

WaterWatch was contracted by the Western Cape Department of Agriculture (DoA) to undertake a study in six grape-growing areas (the Hex River Valley, Worcester, Paarl, Franschhoek, Stellenbosch and Somerset West). The aim of the study was to understand the

spatial and temporal variation of water use efficiency in table and wine grape vineyards in the Cape winelands using remote sensing technology.




SA Tourism

Water consumption, biomass production, yield and water use efficiency were estimated for the grape growing

seasons (September to April) between 2004 and 2007. This information was used by the DoA to inform growers on how productively they are managing their water resources.

real time) for different water resources management applications, such as catchment water balance modelling, calculating the efficiency of water use, and determining the needs of the Environmental Reserve, among others. However,

such a centre will require significant infrastructure (including fast computers, and access to data, eg weather data) and CSIR hopes to involve other partners, such as government departments, in the process. 

# SHAP(E)ING UP Service Delivery

*Government policy dictates that thorough consultation must take place with communities regarding all new services, including water and sanitation. A new tool developed by Sigodi Marah Martin (SMM) through research funded by the Water Research Commission (WRC) aims to assist municipalities to better serve their people. Compiled by Lani van Vuuren.*

Nearly 10% of South African households still reside in informal settlements where they live mostly in shacks made of corrugated iron, cardboard and other rudimentary materials. These areas are overcrowded and prone to fires and flooding, with limited access to basic services. The integration of informal areas into South Africa's urban fabric has been high on government's list of priorities in the last few years. Since 1994 around 2,6 million low-cost houses have been constructed.

Last year, the Department of Housing announced its intention to fast-track delivery of housing with the objective of accommodating all those seeking homes within formally planned settlements by 2014. The department is targeting a delivery rate of 500 000 units a year (the present housing delivery rate is about 260 000 units a year). To achieve this, the housing budget is projected to grow from R9-billion in 2007 to R10,6-billion in 2008/09 and R15,3-billion by 2010/11, at an average annual rate of 19,4%.

## INFORMED CHOICES

Housing costs are made up of a number of variables. These include the land, servicing of the land (which will vary depending on the size of the erf and the standard and type of servicing provided), the number of rooms, and the standard of fittings, finishing and services. In addition, there are the costs of the overheads (such as selling and administration costs).

Selecting a house that meets the spatial needs of a household, which is also affordable, is impossible for everyone in the low-income strata. "It is paradoxical that in spite of this fact such a high percentage – if not all – expenditure on housing solutions for the poor is made without consultation with the users," notes Richard Martin, Head of the Research Division at SMM. "This is despite the fact that government advocates the Batho Pele or 'people first' principle, which stipulates that citizens should be consulted and given a choice when it comes to service delivery."

**"The SHAPE model presents the costs in such a way that any variable may be considered in real time, so that beneficiaries may make informed decisions."**

This is especially true when it comes to the selection of sanitation services. "Every sanitation choice affects a consumer's disposable income, and people should be able to make an informed choice," explains Martin. "For example, waterborne sanitation does not only have cost implications for the local authority which has to install, operate and maintain the system, but also for the user who has to purchase fittings and toilet paper. These details are not always shared with communities."

In fact, many municipalities are seemingly not rolling out services with consultation of communities at all, but are instead implementing choices made by decision-makers, rather than by the receiving households themselves. When inappropriate solutions are implemented in terms of what people want it can lead to misuse, neglect or even vandalism of infrastructure. If the infrastructure is too expensive, bills will not be paid which may give rise to the discontinuation of services. Finding the right solution is therefore fundamental in the quest for sustainability.

## COMMUNICATION TOOL

To improve the situation, the WRC tasked SMM to develop a computer modelling tool to help determine the effective demand for services, with a specific focus on sanitation, among peri-urban residents. The result is the SHAPE (Sanitation and Housing Applied Priorities Enquiry) model.

"Crude measures of cost are often used by decision-makers and developers to estimate, for example, a square metre cost for housing, and a fixed sum for a serviced erf. The apparent precision of these estimates hides the crude basis on which the calculations are made, and prevents anything more than a token involvement in decisions on the housing package," explains Pieter Pansegrouw of SMM's Research Division. "The SHAPE model presents the costs in such a way that any variable may be considered in

real time, so that beneficiaries may make informed decisions.”

The model establishes the demands for housing and all other infrastructural services (water, sanitation, electricity etc) simultaneously. This is an enormous advantage to government and other authorities responsible for delivery services to the residents of informal settlements.

## HOW THE MODEL WORKS

The basic objective is to allow the user to specify their preferences for, for example, sanitation, within the context of a global cost for the housing solution. The model recognises that, particularly for the poor, there are trade-offs between stand size and servicing, house size, and standard of finishes and fittings. It also takes the housing subsidy into account. “The value of this model is that, for the first time, as far as we are aware, a comparatively accurate estimate of the actual cost of all components allows such a trade-off to be made,” notes Pansegrouw.

The SHAPE model is based on the concept of all-inclusive prices that may be used in a component form to obtain an aggregate price. Thus, a price can be obtained for a single room, for two rooms etc. For electricity, for example, there is a connection cost and a wiring cost for each room. In addition, there is the monthly charge. The costs are presented in monthly form – which is the way that people think about housing expenditure – and are totally inclusive. This means that, not only are the construction costs included, but also the monthly service charges and rates.

As far as sanitation is concerned the model allows comparison between the cost-in-use of several different sanitation solutions (including full waterborne, shallow sewer, single and double ventilated improved pit, and urine diversion systems). The user is not required to evaluate the relative capital and running costs – the model incorporates monthly



*Members of a community are taken through service delivery options using the SHAPE model*

amortisation of capital costs as well as water consumption etc, thus allowing all costs to be presented as a single monthly expense.

## HOUSEHOLD SURVEY

To test the model households were surveyed in several informal settlements throughout South Africa. The demand for housing and other services was established according to what households could afford or what they were willing to pay for the services.


Affordability was found to be the main driver, with people selecting certain technologies not because they necessarily wanted them, but because that was what they could afford. For example, all the households initially said they wanted full waterborne sanitation, however, once they understood the costs involved, about a quarter of respondents chose either single or double VIPs. About three-quarters of people surveyed requested water in their homes.

One of the most interesting results of the survey was that 95% of the participants argued that they would be satisfied with small houses (i.e. one and two rooms) as long as they could receive higher levels of water and sanitation services. With smaller families than in the past, many

participants argued that they may build an extra room or two themselves in future. “People realise that the upgrading of services such as water and sanitation is far more complex and expensive than expanding their homes, which they can do themselves,” says Pansegrouw.

Another interesting find is that participants regarded electricity as an extremely important service – even more important than waterborne sanitation. More than 80% of participants indicated that they required electricity, however, few opted for a geyser.

Importantly, the application of the model during the research led to far greater realism among the inhabitants of dense settlements as far as services are concerned. More appropriate and realistic choices were made by the inhabitants which they actually could afford – not only as far as sanitation was concerned, but also with regard to housing and all the other infrastructural services. Many people also said they felt empowered by the exercise as they felt they were taking their own decisions.

The model will be made available to practitioners and it is hoped that this research study will have a positive influence on the establishment of sustainable service delivery that is acceptable to all. 

# Dedicated Membrane Research Programme Builds Viable Local Sector

*Thanks to research funded by the WRC, South Africa is closer to harnessing the sea as a drinking water resource on a large scale than ever before.*

www.sxch.hu

***The Water Research Commission's (WRC's) sustained support of new innovations in membrane technology over the last three decades has resulted in the creation of a viable and innovative local sector. Compiled by Lani van Vuuren.***

Worldwide, the demand for the use of membranes continues to increase. Membranes are used in a wide range of applications, including the purification of water for domestic and industrial use, for treatment of effluent water and concentrated waste streams. Membranes are further used in the food and beverage industries as well as non-water related sector, for example, to extract medicinal enzymes from fungi under specific conditions.

In South Africa, while it has taken some time, membranes are now increasingly being accepted as a viable option in the treatment of water and industrial efflu-

ent, and over 15 local and international companies are marketing membrane-based technologies here. The local membrane market is dominated by the reverse osmosis (RO) type membrane due to its uses in seawater desalination and wastewater treatment projects.

The WRC has long recognised the potential of membrane systems, and has funded research into membrane technologies as far back as the 1970s. However, it was not until 1993 that a dedicated membrane programme was launched. Since then, the Commission has funded nearly 70 projects to the tune of about R1-million a year.

While the WRC is not the only institution in South Africa providing funds for membrane research, it certainly has been the most important. It is the largest funding institution for this type of research in the country. Membrane research has focused on new product development, improved product and regeneration, guidelines, knowledge expansion and the extraction of valuable components.

Recent research by consulting company Frost & Sullivan shows that this support has been justified. This is evident from the fact that WRC-funded research has led to the establishment of a viable

**“WRC-funded research has led to the establishment of a viable South African membrane industry and a growing range of applications of membrane technology.”**

South African membrane industry and a growing range of applications of membrane technology. From humble beginnings research and development on membranes is today actively pursued not only at a number of tertiary educational institutions, but also by private companies and water and power utilities.

Frost & Sullivan has found that membrane research funded by the WRC has had a number of benefits to South Africans. Research projects have not only resulted in the establishment of a number of membrane-based plants to treat water for rural communities, but has also contributed to job

creation and skills development, increased membrane use, export opportunities, increased revenue opportunities, improved use of technology, and best practices implementation.

**IMPROVED QUALITY OF LIFE**

Most of the projects financed by the WRC have focused on improved water quality and have made a significant contribution to various communities and industrial water users. For example, the development of a mobile testing RO unit by local company Ikusasa. The unit can be taken to a water source where the elements in the water is identified by analysing the waste stream collected through RO.

The unit is designed to assist municipalities and industrial users to determine what pre-treatment, membrane type and post-treatment is needed to ensure that clean water is supplied to the community. The unit has been stationed at Agulhas, where it has delivered clean additional drinking water



*Research funded by the WRC led to the establishment of the first South African plant for drinking water purposes using membrane technology to be commissioned in 1990. The plant, situated at Bitterfontein, in the South Namaqualand, makes use of tubular reverse osmosis membranes.*

to holiday visitors during the peak December period.

The first application of membrane technology to treat water for drinking purposes was at Bitterfontein, on the West Coast, in 1990. The system, which

**Products developed through WRC-funded research**

Type of Technology	Description
Ultrafiltration membranes	Used for producing ultrapure water. Able to remove bacteria from water. Ideal for rural water applications for small communities.
Reverse osmosis developments	Used to desalinate water source. Increase available water resources.
Woven fibre microfiltration	The tubular system consists of two layers of a woven polymer material, stitched together to form rows of parallel filter tubes, called a 'curtain'. Liquid is fed from the inside and clear water permeates from the membrane (clarification process). Can be used for sludge dewatering. A simplified, immersed, flat-sheet system has been developed for potable and industrial water treatment.
Electroconducting membranes	Membrane systems that use positive and negatively charged membranes to remove particles from the stream. Some of the systems are able to produce sodium hypochlorite or ozone as byproducts.
Supported liquid membranes	Shows the potential to extract metals such as nickel from liquid streams.
Membrane bioreactors	Most of the studies are using the outer-skinless UF membrane as reactor (fungi is used in bioremediation of wastewater). Flat-sheet woven microfilter units have lately showed great promise as inexpensive, robust, immersed MBRs.
Membrane fouling studies	Research on membrane fouling centres around three aspects: electromagnetic defouling, enzymatic and chemical defouling, and surface modification.
Affinity separation	A process that involves extracting 'wanted' elements from the stream through chemical reaction (it is being developed as a detector for endocrine disrupting compounds).
Nanostructured membranes	Nanotechnology can aid tailoring of membrane thickness, pore size distribution, permeability, and surface chemistry. Membrane design via templating chemistry allows entirely new and more effective membrane architecture to be engineered and developed. A new, nano-membrane has already been developed which claims to provide RO quality water at much lower pressures.

Source: Frost & Sullivan

### TYPES OF MEMBRANE RESEARCH FUNDED BY THE WRC

#### New product development

The WRC has funded 30 research projects aimed at producing new products or improving existing ones. The new products stemming from this research have resulted in the formation of a number of companies and the creation of numerous jobs.

#### Improved product operation and regeneration

The WRC has funded 11 projects specifically in the field of defouling techniques and best practices since 1993. As a result of this research, membranes are becoming increasingly attractive and their efficiency has improved.

#### Membrane research for the extraction of other components

Various projects have been completed for the use of membranes to extract valuable elements from wastewater streams, including metals, enzymes and anti-oxidants.

#### Knowledge expansion

The WRC has funded 20 studies that have resulted in a better understanding of membrane products and their operation since 1993.

#### Guidelines

To address the potential for membrane application and advance the use of membranes in the country, the WRC, in conjunction with research institutions, embarked on the creation of various guidelines for the correct selection, installation and operation of membranes to increase performance. These guidelines are based on both laboratory testing and field application observations, and are aimed at membrane operators.

Source: Frost & Sullivan

*The mobile membrane testing unit at Struisbaai, in the Western Cape. The unit makes use of polysulphone capillary ultrafiltration membranes with an immersed woven fibre microfiltration pretreatment.*



Yvonne Gounden

sources its water from three boreholes, serves a population of 5 000. The original RO membranes used in the system were developed by the University of Stellenbosch through funding supplied by the WRC. Since then various communities around the country have benefited from small-scale desalination plants using membranes.

Funding from the WRC has also resulted in the development of products suitable for rural applications, such as the capillary membrane treatment system. This system requires limited operator knowledge and local people can easily be trained to be responsible to operate these systems.

Since membranes are ideally suited for small-scale, rural applications it is expected that this technology will increasingly be applied to provide communities with access to potable water. Therefore a number of guidelines have also been developed to facilitate increased use and improved performance of rural water membrane systems.


### NEW AND IMPROVED PRODUCTS

Apart from development of locally-produced membranes, the focus of recent research has also been on improving products through, for example, various techniques for defouling. (Fouling of membranes remains one of the greatest hurdles in the wider application of the technology). Over the years innovative techniques have been developed, such

as the ultrasonic device of the Institute for Polymer Science at the University of Stellenbosch, which is able to perform non-intrusive membrane fouling measurement. This method is based on the use of ultrasonic waves and fouling can be detected on the membrane surface, in the membrane module, within ten seconds of initiation thereof.

The WRC has recognised the importance of its efforts, and will continue supporting membrane-related research in future. In addition to the present focus areas, another area expected to receive more attention is the management of intellectual property stemming from this research and development. The WRC has in the past been involved in patenting various ingenious products that were developed through its funding.

Through the Commission's funding of meritorious membrane technologies, local innovations were protected, allowing the free development and commercialisation of these technologies. Although the WRC's brief does not allow it to perform commercialisation *per se*, it assisted in a number of cases to patent worthy inventions which the developers themselves would not have had the means to do.

The WRC has been identified as a key stakeholder in the South African membrane research and development environment and without its dedicated efforts many of the positive benefits of the research conducted would not have materialised. 



# Free Basic Water and Economic Development: CAN THEY CO-EXIST?

*DD Tewari discusses water rights issues and their underlying ethical basis, especially with respect to the justifiability of human rights to water use in South Africa and how this has stimulated economic development.*

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Rights are an integral part of human existence, and can be defined as a claim or refer to a legal title. The incorporation of rights into social choice and political morality has been a familiar theme in the Western world. Government institutions have adopted different viewpoints or ethical theories to address the social need and demands of the people they serve.

Water, a natural resource, has been subjected to laws of demand and supply. As urbanisation and industrialisation has progressed, water has become scarce and more stringent laws to regulate water supplies have been enacted by countries in general. In South Africa, water rights have changed dramatically during the past three hundred years. In the democratic South Africa the structure of water rights has been redesigned with the adoption of a new progressive constitution, which safeguards the individual's human right to basic water.

## ETHICAL BASIS OF HUMAN RIGHTS TO WATER AND TRADE-OFF WITH OTHER WATER RIGHTS

Rights have become a new instrument to engender development in the world. The United Nations (UN) and many governments of the world have proclaimed the rights of individuals to ensure ethical standards are upheld. In the context of water, the UN Committee on Economic, Social and Cultural Rights has elevated the issue of individual rights to water in General Comment No 5 – a non-legally binding document – to which nation states have responded differently.

The divergence of opinion in ascertaining human or individual rights to water use should be seen in the light of the various economic and social roles that water performs in society. Being a scarce resource, water commands a market and hence

a price, which means it is exchanged between a buyer and a seller – a contractual right. When water as a resource is owned by individuals who are granted rights by the State to abstract water from a water source it is known as property right. Finding the balance among these three forms of rights – human, property and contractual – forms the backbone of a new era of water management that we are contending today.

## WATER AND THE TYPES OF RIGHTS

A property right is granted by the government to an individual as a legal claim to access to water. There has been a trend to formalise property rights structure in some countries, such as Brazil, Chile, and South Africa. The programme has been initiated by the World Bank. The main objective of this formalisation scheme is to provide security and certainty of legal title of rights-holders

so that they can defend themselves in court if challenged, trade their right or use them as collateral for raising finance.

The contract between the seller and buyer of water is another legal right. Water services are generally supplied in exchange for payment, and are necessary for financing water facilities. The World Panel on Financing Water Infrastructure Report of 2003 discusses the ways and means of financing water facilities and the focus is on creating an enabling environment which will make water affordable to all. In the South African context, the National Water Act of 1998 promotes equitable access to water and ensures that water institutions have appropriate community, racial and gender representation.

The human right to water emanates from Articles 1 and 2 of the International Covenant on Economic and Social Rights (ICESCR) which refer to the right to an adequate standard of living and highest attainable standard of health for all people. Consistent to this, the General Comment No 15 (GC 15) infers that water of acceptable quality for personal and domestic use be assured to individuals as a basic human right. This General Comment calls for a progressive realisation of the human right to water in the world while acknowledging constraints of available resources. The South African Constitution has created a justiciable human right to water and is one of only eight countries (as of 2004) who have made constitutional provisions to protect access to water.

### ENGENDERING ECONOMIC DEVELOPMENT THROUGH THE RIGHTS-BASED APPROACH

The privatisation of water has been the hallmark of the new water policy regime. The new paradigm of water demand management which came into being in the 1990s has called for the management of water through efficient pricing. The direct translation of this has been the rapid privatisation initiative of water across the world.

The World Bank and International Monetary Fund (IMF) have driven the initiative of privatising water utilities around the world, especially in Africa. For example, a review of IMF loan documents to 40 countries in 2000 revealed that some 12 countries in Africa were granted loans on conditions that they privatise their water utilities.

Generally, these loan conditions stipulate that water consumers pay for the full cost of water delivery; that is, the cost of operating, maintaining and expanding the water utility and perhaps a reasonable rate of return on investment. The major winners from the privatisation exercise are the businesses, and this has resulted in high prices and disconnections at times. The brunt of privatisation is thus borne by the poor segment of society.

This has engendered conflicts between water users regarding human rights and other non-human rights (contractual and property rights) related aspects as discussed above. In the South African context, prepaid water meters have been used as a tool to collect payment from residents. Thus, when residents cannot pay, their water supplies are shut down. This causes people to look for alternative sources of water, which can be hazardous to human health.

The South African constitution, however, ensures the legal priority to the human right to water above other water uses. Some legal cases exemplify the current legality of water rights in South Africa. The case of Bon Vista Mansions vs. Southern Metropolitan Local Council is a notable one in this regard. The residents of the Bon Vista Mansions block of flats experienced the disconnection of their water supplies by the local council due to the non-payment of water charges. The court ruled in favour of the residents and the water supply was thus restored. This is a clear case where the human right to water use held the legal priority to overpower the claims of contractual right to water use.

In another case of Manqele vs. Durban Transitional Metropolitan Council, the court ruled that it had no clear guidelines regarding the prescribed minimum standard of water supply services necessary for the reliable supply of a sufficient quantity and quality of water to households, including informal households, to support life and personal hygiene, as per the South African Water Services Act. Since Manqele was already being given six kilolitres per month as free basic water and she was consuming more than the basic minimum, the court ruled that her right to water was incomplete and therefore not enforceable. This led to the debate on the free basic water limit – a controversial issue on its own.

In July 2006, five residents of Phiri in Soweto challenged the 6 000 ℓ per household limit imposed by Johannesburg Water in the Johannesburg High Court. Water Programme Director at the US Pacific Institute, Dr Peter Gleick, who acted as an expert witness, was of the opinion that the amount of free basic water should be raised to 50 ℓ/day/person. According to the Coalition Against Water Privatisation, the size of the average household in Phiri is 16, most of whom were unemployed. The current free basic water provided at the rate of 20 ℓ/day lasted no more than 12 days in a month whereafter residents were required to purchase water coupons which they could not afford. The court declared the prepaid meters unconstitutional. The case had reverberating effects – in Cape Town the limit of free basic water was subsequently increased to 10 kℓ/household/month.

### SOUTH AFRICA'S FREE BASIC WATER POLICY

The free basic water policy of South Africa has been criticised as being economically inefficient. However, one has to see the emergence of this policy in the broader social context. In 1994, when the country's first democratically-elected government came into power, some ten million people out of 36 million were without access to safe water. The responsibility to provide access rests squarely on the shoulders of local and provincial authorities, with the Department of Water Affairs & Forestry acting as policymaker and regulator.

Three basic reasons are cited for instituting a free basic water policy:

- ◆ Water is a merit good with positive externality leading to enhanced welfare;
- ◆ Water accessibility leads to improved public health, which has multiplier impacts on the economy; and
- ◆ It enables the local municipalities to meet their constitutionally prescribed development obligations.

Under the Reconstruction and Development Plan it was postulated that the National Water and Sanitation Programme be launched to provide a safe and clean water supply of 20 ℓ/day to 30 ℓ/day *per capita* to all households within 200 m. In the medium term, it is to be revised to 50 ℓ/day to 60 ℓ/day. This was later materialised into a legal requirement in terms of the Water Services Act. The Act

**Table 1: Population Served under Free Basic Water Policy by 30 June, 2008**

Province	Population millions	Served <sup>2</sup> millions	Percent	Poor population <sup>1</sup> Millions	Served <sup>2</sup> millions	Percent
Western Cape	5.25	5.00	95.3	0.79	0.77	97.7
Eastern Cape	6.46	4.62	71.4	3.58	2.076	58.0
Northern Cape	1.02	0.94	92.1	0.37	0.35	92.2
Free State	2.79	2.60	92.9	1.59	1.51	99.3
KwaZulu-Natal	10.58	8.56	80.9	5.86	4.09	69.7
North West	3.44	2.81	81.7	1.64	1.12	68.9
Guateng	10.81	9.54	88.2	3.81	2.83	74.4
Mpumalanga	3.68	3.33	90.5	2.09	1.26	60.2
Limpopo	5.36	4.31	80.5	3.24	2.65	81.7
Total	49.43	41.74	84.4	22.94	16.68	72.7

1. Total number of people in poor household and a poor household has a income of less than R800 per month.

2. The population that receives a basic water supply at no charge/ for free.

Source: DWAF

prescribed the 'basic water supply' of 25 l/person/day within 200 m of the household.

Durban Municipality pioneered the free basic water concept and acted it out in 2000. Following the Durban experience, the African National Congress' (ANC's) manifesto for local government elections included the promise of free basic water. It was finally decided to provide 6 000 l to each household per month and detailed guidelines were prepared by the Department of Water Affairs & Forestry.

The economics of the human right to water cannot be ignored in the long run if we look at the supply and demand situation of water in the country. The major use of water is agriculture, accounting for more than 60% of the total usage. Industry and manufacturing combined with mining and energy consume over 15% of the total national water use. The remainder goes to domestic supply and sanitation.

It is estimated that demand already exceeds supply in 80% of catchments in South Africa and the shortfall is being made up through the transfer of water, however, it is believed that the future scope for further transfer schemes is limited. The consumption of water by households is increasing rapidly as general incomes increase. It is estimated that water consumption is growing three times faster than population growth.

South Africa has thus followed a pragmatic approach to the development as required in the case of dual economy models: one, the policy of market-led allocation of water for the developed sector of the economy which can afford to pay; and two, the

policy of free basic water to the underdeveloped sector which lacks the purchasing power. Currently it is being funded by stepwise linear water rates – thus high-volume consumers are cross-subsidising those who cannot afford to pay for their water.

### ACHIEVEMENTS OF THE FREE BASIC WATER POLICY

It is also important to stress that water privatisation, as propagated by the World Bank and IMF, is not necessarily a harbinger of efficiency and competition. In some cases, privatisation has done more harm than good. Since water is both an economic and social good, privatisation alone cannot be the sole instrument to bring developmental change. The South African government has thus resorted to a mix of a rights-based approach to water allocation for the poor and a market-based allocation for the rich citizens of the country. Such a rights-based approach to development can be justified when widespread poverty persists.

Bearing above in mind, the policy of providing free basic water to all households will be at a cost to taxpayers. The implementation status of the policy up to June 2008 is summarised in Table 1. As per this estimate, some 41,7 million people out of 49,4 million (84,4% of the total population) are served with free basic water. This is an impressive achievement for the country. It is estimated that implementing the policy is costing local authorities as much as R5,84/capita/month. The estimate is not a generalisation for all situations and is rather an indication of projected cost conditions.

Supplying free basic water especially to rural areas has led to the development


of institutions to capacitate people to perform the required tasks in the long run. These institutional mechanisms include local government, private sector and community-based operations. This has brought a lot of government investment in the development of local governments. Thus, one can see the trickle-down effects of the free basic water policy.

### CONCLUSIONS AND POLICY RECOMMENDATIONS

South Africa, like other developing countries, has a dual economy. Since water is a very scarce resource in South Africa policymakers have used water as an instrument for engendering development by following two sets of policies: a market-led allocation for the one sector of the economy and a rights-based allocation for the other sector of the economy. South Africa has thus opted to follow a very pragmatic approach to development by combining the free basic water policy for some people and a market-driven water supply to those who possess purchasing power. However, this is not a costless operation and requires a sustainable strategy for financing water subsidies provided by the State to the underdeveloped sector.

The human right to water is guaranteed in the South African constitution and recent judgements from the country's courts confirm this assertion. Currently, some 84,4% of the population is receiving free basic water. The free basic water policy has been popularised by the ANC and municipalities are trying to implement it within their capacity.

Currently it is being funded by stepwise linear water rates and thus water volume consumers are cross-subsidising poorer users. This has created dissatisfaction in some quarters. However, one should be reminded that water privatisation has not worked particularly well in the water sector, especially in Africa. In the long run, the success of the South African approach will depend on how effectively the free basic water policy is financed.

*DD Tewari is a Professor of Economics with the School of Economics and Finance, and Deputy Dean at the Faculty of Management Studies at the University of KwaZulu-Natal.* 



## CT School Sets New Record in Water Competition

The team from Cape Town's Brackenfell High School set a new record at the 2008 South African Institution of Civil Engineering (SAICE)-DFC Water 'Centenary Schools Water Competition' held at the Sci-Bono Discovery Centre in Newtown, towards the end of last year.

The competition, which was designed by students from the University of Johannesburg and launched in 2003 as part of the centenary celebrations of SAICE and Rand Water, boasted a new main sponsor this year, namely valve firm DFC Water. Teams are tasked to design a model water distribution network to distribute three litres of water equally between three points on a grid using two different diameter pipes and connection pieces. They are then judged on how well they execute the task – working on a penalty points system. Teams are allowed three tries within an hour.

The Brackenfell team nabbed first place with only 30 penalty points, the best result since the start of the competition. The team from Lofentse Girls High School in Soweto won second place with 260 points followed by the Cape Academy of Maths, Science and Technology with 280 penalty points. The prize-money for the winning teams, their schools and teachers amounted to R23 000.

Regional competitions were held throughout the year. Winners of the regional competitions came to Johannesburg from as far afield as Bloemfontein, Cape Town, Richards Bay and Uppington to battle the local winners for top honours. For many learners this was the first time outside their home towns. The competition exposes learners to the practical application of processes that influences their daily lives, which is how water gets to their homes. They are made aware of the intricacies involved in the design of water distribution networks and the actual water delivery to households.

As part of the competition the water cycle is explained to the learners. Issues such as why we have to pay for water, explaining the building of dams, distribution of water through water boards to municipalities and then to users, as well as the conservation of our water resources are discussed.

"The competition creates awareness regarding the issues surrounding water in South Africa. It spreads the message that water is a precious commodity, which should be conserved, recycled and re-used," said SAICE in a statement. "Existing infrastructure should be properly maintained while new infrastructure should be created to provide potable water to those without access to water services."

According to SAICE, this competition strengthens government's initiatives aimed at encouraging learners to take mathematics and science at school and follow a career as a science



SAICE

*Brian Holford, MD of DFC Water, official sponsor, with the winning team from Brackenfell High School.*

or civil engineering professional, a skill that is currently sorely lacking in South Africa.

For many learners it is an experience they will never forget as demonstrated by this SMS received by Makume Mamooka, a Grade 12 learner from Lofentse Girls High School: "I just really want to thank you. The experience I had is priceless and I feel very honoured to have been part of the competition." Makume shared her intention of following a career in electrical engineering. Another student from a previously disadvantaged background is currently studying civil engineering at the University of Cape Town as a direct result of taking part in the competition the previous year.

For more information on the competition contact Marie Ashpole from SAICE at Tel: (011) 805-5947; Fax: (011) 805-5971; or E-mail: mashpole@saice.org.za

## WHY IS CIVIL ENGINEERING IMPORTANT?

Civil Engineering is the practice of developing, improving and maintaining the built and natural environment so that people can live and work efficiently. Civil engineers design, plan and supervise the construction of structures such as water supply systems (including dams, pipelines and treatment plants), transportation systems (roads, railways, bridges, airports and harbours) and buildings (sport stadia, office blocks, shopping centres and convention centres). The field requires people who are mathematically inclined, can make decisions, delegate, control assignments, think logically and work systematically. If you are interested in becoming a civil engineer it is very important that you take mathematics and science at school.



SAICE

*Above: The Lofentse Girls High School team from Soweto came second in the competition. Left to right is Makume Mamooka, Erccah Maja and Siphesihle Ngwendu.*



SAICE

*Right: Luyanda Maome from SABC 1 interviewing the CBC Bloemfontein team.*



*All the finalists of the Centenary Schools Water Competition with their educators. Finalists were flown in from across the country to take part in the competition.*

SAICE

# Focus on Pollution at Excellence Awards

The 2008 Excellence in Water Research Awards, held at CSIR in October, had water pollution as a central theme. The Awards, presented by the Water Institute of Southern Africa, the Water Research Commission and CSIR in honour of the late Dr Gerrie Stander, affords three young researchers the opportunity to present their work

with an established water researcher. Michael van der Laan presented his work on modelling agricultural non-point source nitrogen and phosphorus pollution, while Marcelle Marchand's presentation focused on fish health as an indicator of water pollution. Dr Mapitsi Thantsha's research looked at electrochemically activated water for treatment

of biofilms. Acid mine drainage treatment expert Prof Jannie Maree, formerly of CSIR and now with Tshwane University of Technology, presented the Memorial Lecture on water and byproducts from mine water. Prof Maree's career has come full circle, having been one of the young researchers at the first Awards 20 years ago.



Lani van Vuuren

WISA Vice-President Dr Kevin Pietersen welcomes attendees to the Awards function.



Lani van Vuuren

The Excellence in Research Awards winners are Dr Mapitsi Thantsha, Marcelle Marchand, Michael van der Laan and Prof Jannie Maree.



Lani van Vuuren

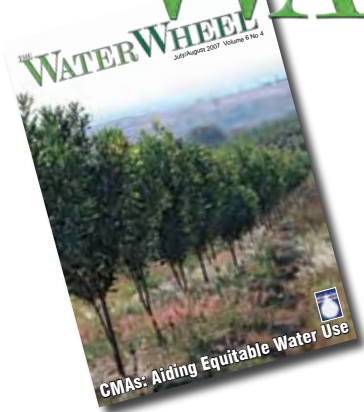
Bunjy Mokoena, Tshepo Matshika, Athalia Sebayana, Thato Mjona and Tracy Gram were some of the attendees at the Awards function.



Lani van Vuuren

WRC CEO Dr Rivka Kfir hands over a certificate to Prof Jannie Maree.

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