

THE

WATER WHEEL

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Gauteng's
Rivers
Smothering
in Concrete



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THE WATER WHEEL is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source.

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LETTERS TO THE EDITOR

Twenty years of sewage

I read and was touched deeply by your editorial in *the Water Wheel* (November/December 2005). I have recently dealt with a client of Glencoe in northern KwaZulu-Natal, who has, for 20 years, been battling to get rectification of sewage streaming into his farm dam and the Wasbank River.

Perhaps someone could cover the story, as he has literally run out of options as far as government departments go. Nobody has been prepared to remediate the pollution and it continues to this day to flow unabated on to his property. He has files of records, minutes of meeting after meeting and resolutions that have singularly failed to bring any remedy.

James Mitchell, Dundee

Small companies also credible

As a supplier of water treatment chemicals to numerous small (and larger) local authorities within KZN, I read your article in the November/December 2005 edition of *the Water Wheel*, 'What's That in Your Water', with interest.

Reputable water treatment chemical suppliers have been acutely aware over the past 11 years of the lack of formal legislation in South Africa with regard to the suitability

of water treatment polymers. This was the motivation for our primary manufacturer, Zetachem, to become the first South African company to achieve international standards for potable water treatment polymers.

We wish to point out that, while there are undoubtedly 'unscrupulous treatment chemical suppliers' in the municipal market throughout South Africa, there are also medium-sized companies, like Rheochem, who provide a very useful technical support service to small municipalities. Our dedication to service, including monitoring of plant results, chemical optimisation, technical advice, free operating training etc. provides much needed support to customers who don't have access to the resources of the larger Water Services Authorities.

Speaking for Rheochem, strict ethics and standards are applied to all aspects of the business, from quality control to general business practices to Black Empowerment. We therefore trust that your article, while quite rightly alerting consumers to suppliers who to quote, "place the entire industry in disrepute", does not create the impression that there is a danger in dealing with any company other than the companies that were favourably mentioned (albeit one of those manufacturers on our behalf).

Jacqui Swart, MD, Rheochem

(The article certainly recognises that not all small companies are 'bad' and that there are, in fact, smaller water treatment chemical firms, such as yourselves, who are providing an extremely valuable and essential service in ensuring that our drinking water remains safe. One can only hope that stricter standards will rid the sector of the existing bad apples, thereby opening up the way for more reputable, credible firms. – Ed.)

Idea not new

I am intrigued as to why WRC gave all the free publicity to Garden Res-Q (*the Water*

Wheel November/December 2005) to an idea that is not original and other organisations have been promoting and selling for far longer periods. For example, Guy Preston and myself have had them installed for years. Guy's efforts have been featured in national magazines such as *You*, *Water Rhapsody* has been on Radio 702 – all before Garden Res-Q came on the scene.

For example *Water Rhapsody* in Cape Town have installed over 1 500 unites, in Canarvon 110 units were installed to solve the problem of greywater disposal (funded by the Department of Water Affairs & Forestry), another 10 went into Kgalagadi and a number of units have been installed around Johannesburg (BRD Engineering/Aquasave).

Winning a design prize for something that has been done before does not reflect well on the Design Institute.

Also there is a litter matter of cost, which is not discussed. The biggest problem on take-up is cost. Aquasave and *Water Rhapsody* have kept their costs down by using off-the-shelf components. It might not look so nice but if it works and sells then the objective is achieved.

Richard Holden, Department of Science & Technology

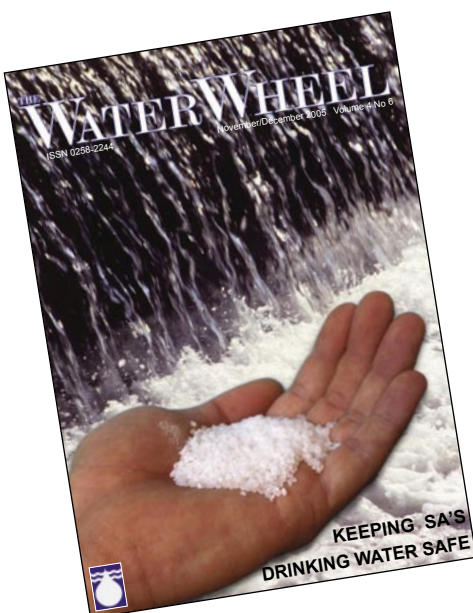
Correction in order

I would like to point out an error in your article 'What's That in Your Water' (*the Water Wheel* November/December 2005).

The fact is that both Süd Chemie and Zetachem have applied for and been granted approval by the National Sanitation Foundation (NSF) (not the FDA as stated in the article). The NSF is the only regulatory body accepted by the World Bank when it supports tenders for chemicals for water treatment and the global list of approved chemicals can be found on their website at www.nsf.org.

ISO 9002 has nothing to do with safety in use and only regulates procedures to ensure that reproducible systems are in use whether they are safe or not.

Peter Leopold, Süd-Chemie Water and Process Technologies



Award for Rivers Programme



In celebration of their CSIR Environmentek Knowledge Management Award, members of the State-of-the-Rivers (SoR) reporting team recently staged a two-day learning and knowledge sharing event for their clients and partner organisations.

During the two days, participants experienced typical biomonitoring surveys while contributing to lively debates. Guided by experts, those partners who are usually only involved in the theoretical aspects of river health got first-hand experience of a typical river health assessment.

A mini-seminar on the second day covered various SoR related topics, including capacity building within provinces; institutional and financial responsibilities; and the inclusion of wetlands, estuaries and groundwater as part of aquatic ecosystem health monitoring.

Participants included representatives from the Departments of Water Affairs & Forestry and Environmental Affairs & Tourism, Water Research Commission, provincial River Health Programme champions, the Western Cape SoR team and the CSIR SoR reporting team.

The SoR reporting team was also a finalist of the 2005 CSIR Annual Award for Best Team Contribution.

Global Review

- The US Army is conducting an experiment that could convert the exhaust pipes of military vehicles into water fountains. The technology, developed for the space programme, involves a complex system built into a vehicle's truck bed which can recover water from engine exhaust fumes, purifying as much as half the liquid volume from a tank of fuel.
- The first phase of the Africa at eliminating the stockpiles of obsolete pesticides on the continent, has been approved Environment Facility and Agriculture Organisation. every country in Africa has pesticides that have accumulated Many of these chemicals and condition, threatening local and regional environments and human health through contamination of soil, water, air and food.
- Each year as the Amazon River floods, it makes a large portion of South America sink several centimetres before rising again once the flood has cleared, according to research published in *Geophysical Research Letters*. It is reportedly the first time anyone has recorded the movement of a landmass in response to river flow. The researchers believe their finding could help calculate the amount of freshwater on Earth.
- Chinese researchers have reportedly genetically modified a species of algae to remove toxic heavy metals such as mercury from water. A rate gene was inserted into the algae to make it produce metallothionein, a protein produced in the livers of people and other mammals that binds easily to heavy metals. The algae is pasted on to a nylon membrane, which is then lowered into polluted water. After absorbing the heavy metals, the algae-covered membranes are taken out of the water and the heavy metals extracted in a laboratory.



Stockpiles Programme, aimed by the World Bank, the Global the United Nations Food and It is reported that virtually stockpiles of obsolete pesticides over the past several decades. their containers are in poor



Water Quality Doyenne Wins Prize

Dr Jo Barnes of the Department of Community Health of the University of Stellenbosch has won the Cape Times/Caltex Environment Award 2005 for a contribution to environmental concerns.

She was given the award in recognition of her research contribution over the past eight years regarding the extent of pollution in the rivers in the Boland due to untreated sewage contamination.

Water Diary

WATER QUALITY FEBRUARY 6-10

An Introduction to Managing Environmental Water Quality Course will be held in Pretoria. Presented by the Unilever Centre for Environmental Water Quality, Rhodes University Institute for Water Research and DWAF, the course will focus on managing environmental water quality using toxicology, biomonitoring and chemicals monitoring. Enquiries: E-mail: course@iwr.ru.ac.za; Web: www.ru.ac.za/institutes/ucewq.html

WATER & SANITATION SUPPLY FEBRUARY 13-16

The 13th African Water Association Congress will take place in Algiers, Algeria. The theme of the congress is 'Water and Sanitation: What Strategies to Meet the Challenges of the Millennium?'. Enquiries: Tel: +21321 79 1763; Fax: +21321 79 0047; E-mail: contact@integralconseil.net; Web: www.uade.org

WATER & ENVIRONMENT FEBRUARY 20-22

EnviroWater, to be held in Stellenbosch, will focus on protection of water resources, production and treatment of drinking water, wastewater treatment, and water business management, among others. Enquiries: Elsbeth Verhoeven-Lutsch, Tel: (021) 887-4113, E-mail: verhoeven@enviroWater.de; Web: www.enviroWater.de

Workshop on Low-Cost Sanitation

The Water Research Commission in association with the Water Information Network with support from the Department of Water Affairs & Forestry is hosting a specialist course on low-cost sanitation.

The two-day course, to be presented by Prof Duncan Mara of Leeds University, in the UK, is aimed at municipal water services managers, technologists, planners and decision makers, and will cover an in-depth technical introduction to sanitation technologies and international experiences, their opportunities and impacts, the linkages with diseases, health and the environment, and an introduction to a strategies approach to sanitation planning and technology choice.

According to the organisers, the course is in answer to the inadequate professional courses offered in South Africa on sanitation technology, planning and choice. "This gap reflects the present status and approaches as to who sanitation is being implemented in the country."

The course will be held at four venues around the country: Pretoria (23-24 January); Cape Town (26-27 January); East London (30 and 31 January); and Durban (2 and 3 February). For more information, e-mail Mmule Majole at win-sa@wrc.org.za or Sandra Fritz at sandraf@wrc.org.za



Company Briefs

- **Johannesburg Water** has teamed up with the Johannesburg Metro Police Department to crack down on people and businesses breaking the City's water bylaws. Metro police officers received two months' training in various laws relating to water services and enforcing specific by-laws. Transgressors can be arrested, and face a minimum jail sentence of five years or a fine of up to R1 500.
- **Grundfos South Africa** has acquired local borehole pump manufacturer Brislan Turbo. While Grundfos develops and manufactures pumps for the water supply market, Brislan specialises in the agricultural and domestic borehole sector. Commenting on the acquisition, Grundfos South Africa GM Mitch Holmes said: "Having been in existence for well over 20 years, Brislan Turbo has a wealth of experience in the borehole pump market. Their firmly established national distribution will further help Grundfos establish itself in regions where it did not normally operate."
- **GTZ** has signed a €2,5-million deal with the Southern African Development Community for the regional harmonisation of water sector-related national policy, legislation and management strategies. The German firm will supply expertise on transboundary water management.
- **The Institution of Municipal Engineering of Southern Africa (IMESA)** will for the first time host its annual conference in Soweto this year. It is reported that the township, one of the largest in the country, has come a long way in the last 15 years in terms of infrastructure and development. The theme for this year's conference will be "Knowledge for Action".
- **Webster Ndodana** has become the first black president of the South African Association of Consulting Engineers (SAACE). He takes up the role at a time when the construction sector is in the midst of major transformation. Hailing from the Eastern Cape Ndodana owns his own consulting engineering practice.

Water by Numbers

- **82%** – The number of Americans that wash their hands after going to the bathroom, according to a recent study. Harris Interactive, who conducted the research, found that more women (90%) wash their hands compared with only 75% of men.
- **R600-million** – The capital set aside by Johannesburg Water in the current financial year to upgrade and refurbish water and sewerage infrastructure.
- **465** – The number of students supported by Water Research Commission funded research in 2004/05. About 60% were from historically disadvantaged backgrounds.
- **US\$30-million** – The grant presented to Malawi by the World Bank to support emergency recovery activities in the country, which is experiencing its worst food crisis owed to drought since 1994. An estimated 4,2 million or 34% of the population will not be able to meet their minimum food requirements from now until the next harvest, according to UNICEF.
- **8,44 t** – The greenhouse gas carbon dioxide generated per person each year in South Africa. The US generates 16 t per person per annum.
- **900 000 t** – The capacity of the new reservoir constructed in Dwarssloep township, near Bushbuckridge in Limpopo.
- **US\$50-billion** – The additional funding for development aid agreed upon by world leaders at the recent World Summit in New York to fight poverty.
- **R1-billion** – The funds to be set aside by Rand Water over the next five years to upgrade its distribution infrastructure. The objective of the renovation programme, which includes an additional R70-billion to investigate the conditions of the utility's 3 800 km pipelines, is to ensure security of water supply amid growth in the economy and population.
- **650 000** – The number of households in the Eastern Cape without basic sanitation facilities, according to Eastern Cape deputy director of environmental health, David Bezani.

Groundwater Not Above the Law

FAO and UNESCO have jointly launched a publication entitled *Groundwater in International Law: Compilation of Treaties and Other Legal Instruments*.

To date, international law has paid much less attention to ground- than to surface water. Slowly, however, a body of rules dealing with this vital resource is emerging that indicates a trend towards more comprehensive international regulation.

The publication brings together binding and non-binding international law instruments that, in varying degrees and from different angles, deal with groundwater. It aims to report developments in international law and to contribute to detecting law in-the-making in this important field.

* To access a free online copy, visit www.unesco.org/water/ihp/publications/groundwater_law.shtml

SA Technology Wins International Award

Dr Brian La Trobe of South Africa's Enviro Options won the first prize in the Environmental category at the international 2005 Tech Museum.

The Tech Museum of Innovation, located in San Jose, California, announced 25 laureates for its awards programme, which celebrates those who leverage new and existing technologies to benefit humanity.

Enviro Options initiated the research and development of a dry sanitation system in the early 1980s. The Enviro Loo has been sold nationally and internationally since 1993, and is patented in some 64 countries, including the US.

The Enviro Loo sanitation technology does not use water and requires no other chemicals. It is driven by radiant heat and wind power. It does not pollute groundwater. The solid human waste is stabilised with the aid of aerobic bacteria. The liquid is either evaporated or diverted out of the system.

Botswana's Largest Dam Nears Construction

Preparations for the construction of the Dikgathong Dam, set to be the largest dam in Botswana, are at an advanced stage. This is against the backdrop of continued water shortages and restrictions gripping parts of the country. The Dikgathong Dam, which will be built at the confluence of the Shashe-Tati-Limpopo rivers, will provide water to the villages of Molepolole, Kanye and Serowe. At 400 million cubic metres, the dam is expected to surpass the combined capacity of the Gaborone, Letsibogo and Shashe dams.

Tenders for the project have already been invited, and construction is due to take four years.

Water on the Web

www.agu.org/journals/g/

Published by the American Geophysical Union, *Geophysical Research Letters* publishes short, concise research letters that present scientific advances that are likely to have immediate influence on the research of other investigators. GRL letters can focus on a specific discipline or apply broadly to the geophysical science community.

www.baselpretoria.org.za

For those wanting to keep abreast of national and international environment and waste management issues, the website of the Basel Convention Regional Centre Pretoria offers

a daily roundup of news regarding pollution, waste management and environment issues.

www.iwmi.org/africawaterupdate

The Africa Water Update provides practical information on sustainable water and land management for food, livelihoods and nature. Here, policymakers, researchers, implementers and other development professionals can find the latest thinking on key water and land management issues in Africa.

www.northernwater.net

NoWNet, a partnership for water in the North, is a network of industrialised countries with

the aim of sharing experiences encountered specifically by countries in the North with countries from the South. The member countries include Japan, the Netherlands, Denmark, Australia, South Korea, Sweden and France.

<http://water.nationalacademies.org>

The US National Academies has launched its Water Information Centre, a portal of more than 100 peer-reviewed reports from the National Academies of water-related issues. The website aims to assist the work of water scientists, engineers, managers, policymakers, and students throughout the world.

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Study Shows not all Answers in Science

Approaching research merely from a 'scientific' point of view without regarding the human element may lead to short-sighted results as a recent study in the wetlands of the Sand River catchment, in Mpumalanga, demonstrates, writes Karen King.

The study was undertaken in a multi-disciplinary manner, thus aside from hydrologists, geologists, soil scientists and wetlands experts, sociologists made up core members of the research team. A part of the study focused on the impoverished, rural, wetland communities' use of the small wetlands in the area, thus a comparison was made between two small wetlands in the catchment termed the 'Craigieburn' wetland and the 'control' wetland.

Although all the scientific evidence collected within this study points toward recommendation of the use of one wetland over the other, in practice the opposite occurs. This non-scientific approach to farming in the area occurs to the extent that the seemingly less desirable wetland is decidedly over-utilised, and the far more pristine of the two is not used at all. Evidence suggests that a very small number of plots were once cultivated in this wetland, but had not been used in the more recent past, and no new plots had been created.

The characteristics of many wetlands that lead to their use in subsistence farming are their typically high fertility, abundance of water, even during the drier seasons, and shallow gradients. Although the soils underlying the wetlands of the Sand River catchments are characteristically sandy, areas of relatively clay-rich soils were identified. The clay-rich soils have a greater cation exchange capacity than those dominated by silt and sand particles, thus are more fertile soils.

An intensive survey of the characteristics of both the abovementioned wetlands was undertaken. Soil samples were collected and analysed by the University of KwaZulu-Natal (UKZN) to determine the textural and nutrient composition of the soils sampled. A topographic survey of the area was also performed by the university, while the percentage vegetative coverage was estimated by the project

team (Prof Graham Jewitt, Prof Fred Ellery, Dr Donovan Kotze of the UKZN, and Dr Sharon Pollard and Tessa Cousins of the Association for Water and Rural Development).


These analyses produced interesting results. A visit to the site highlighted the uncharacteristically lush vegetation, flat gradients, clay-rich soil and a wet environment. Results of soil sample readings show significantly higher clay content in the control wetland than in the Craigieburn wetland.

In turn, results of the topographic survey show that the slope of the control wetland is gentler than that measured in the Craigieburn wetland plots. Further measured and calculated variables of the respective wetlands highlighted the differences between the characteristics of the wetlands. A hydrological modelling exercise that made use of the small-scale HOWWET? model, calculated for and averaged over one year, was also performed.

From these results it becomes evident why one would conclude that the control wetland is far more arable, thus preferable for the members of the local wetland community to

place subsistence plots in. This conclusion is, however, false. While the control wetland remains free of plots, attempts are made to cultivate some of the steepest, driest, most infertile pieces of land available in the Craigieburn wetland.

When questioned, few members of the community appeared eager to offer an explanation for this phenomenon. On further investigation, it was found that it is believed that the 'control' wetland area of the catchment is home to an evil spirit, thus the local community's fear of cultivating the area.

This belief clearly holds enough weight to deter the vast majority of the community from attempting to cultivate this area, and to prevent those who have made such an attempt from persisting with their efforts. 

Don't Forget World Wetlands Day

World Wetlands Day will be celebrated on 2 February. It marks the date of the signing of the Convention on Wetlands on 2 February 1971 in the Iranian city of Ramsar on the shores of the Caspian Sea. World Wetlands Day has been celebrated since 1997. This year, the theme is "Livelihoods at Risk."

TABLE 1
SOIL TEXTURE CLASSIFICATION SUMMARY TABLE

Upper 0 – 10 cm of the soil profile			
	Average % Sand	Average % Silt	Average % Clay
Craigieburn wetland	72.62	8.46	18.92
'control' wetland	48.50	26.04	25.46
Lower 40 – 50 cm of the soil profile			
Craigieburn wetland	78.05	9.22	12.73
'control' wetland	47.97	35.40	16.63

TABLE 2
DIFFERENCES IN INPUT VARIABLES USED WITHIN THE HOWWET? MODEL FOR THE CRAIGIEBURN AND 'CONTROL' WETLANDS

Wetland	Average slope	Organic carbon	Vegetative coverage
Craigieburn	2.1%	0.74%	60%
'Control'	1%	1.04%	90%

Package Plants Under the Microscope

Concerns over the efficacy of small-scale sewage treatment plants have raised much debate around South Africa recently. To increase local knowledge about these systems, the Water Research Commission is funding an investigation into the performance of small-scale package sewage treatment plants under South African conditions.

The project is evaluating different types of sewage treatment package plants for rural and peri-urban community use. While this is admittedly not ground-breaking research, it is practical and should enhance the capacity of local authorities and other service providers in achieving more effective management of package sewage treatment plants.

According to Paul Gaydon and Neil McNab, both from Umgeni Water, who are undertaking the project, these type of package sewage treatment plants seem to be used quite widely in South Africa, but usually only as a last resort, i.e. where soil conditions or available areas dictate against the use of septic tanks and the availability of centralised disposal facilities are absent. The scale of the plants employed varies widely, from single household size to larger institutional units, which typically include housing estates, hotels, schools, mines and shopping complexes.

The team surveyed different types of package sewage treatment technologies, include a submerged bio-contactor, a rotating bio-contactor, and activated sludge plant. These units were tested at Umgeni Water's Darvill Wastewater Treatment Works, using screened and degritted influent from the works.

The investigation has certainly yielded some interesting results. "The inability of some technologies to successfully nitrify despite careful management has been unexpected," say the team members, "it had been anticipated this may have been a design or management issue. Also, the capacity of some systems to function beyond their designed capacity has been unexpectedly good."

Gaydon and McNab point out that the aim of the investigation was not to select the best suitable technology; but rather to explore the efficacy of the technologies employed. However, from the experience gained during the ongoing investigation, it seems that the

scale of the plant has a huge influence on the reliability of treatment as larger plants are easier to operate.

The team members report that some degree of technology selection can become important in specific cases such as where flows are very seasonal. In these instances appropriate selection would make success of treatment more likely. "Correct specification, sufficient capital available for effective wastewater treatment and the fate of the treated effluent are the most important factors in selecting a suitable treatment technology."

"Our experience has shown that larger-scale package plants can meet discharge criteria; smaller ones may not," say Gaydon and McNab. "The question arises as to whether the impact of these smaller plants leads to any environmental degradation. The possibility of relaxed limits for low impact plants is a question to be posed to the regulators."

Fact is that package plants remain the only option for wastewater treatment under many conditions. "Certainly we have identified some technologies as more likely to succeed than others, and perhaps the project has helped confirm the expectation that the most successful technologies require the greatest operator expertise and capital expenditure. Many designs may well benefit from further development," say the team members.

It is hoped that the project will raise the profile of sanitation provision in South Africa, and that it will assist by demonstrating successful solutions to wastewater treatment using package plant technology. It is also hoped that the question of environmental impact will assist the regulators in considering appropriate and sustainable regulatory standards for such units in the future.

The project is scheduled for completion at the end of March. 

How do package plants work?

- Submerged bio-contactor**
 The sewage passes through a set of two septic tanks where settling of solids and anaerobic digestion takes place. It subsequently flows via an equalisation tank to an aeration tank filled with randomly orientated packing. The treated effluent is fed to a constructed wetland, whereafter it is chlorinated using chlorine tablets and irrigated. A pump for irrigation is included in the plant.
- Rotating bio-contactor**
 The sewage passes through a set of two septic tanks where settling of solids and anaerobic digestion takes place. It then flows through the aeration tank where it is treated by the rotating bio-contactors. From there solids are settled out and it is chlorinated using chlorine tablets.
- Activated sludge**
 The unit obtained for the WRC project is a sequencing batch reactor in which extended aeration takes place prior to settling, all in the same tank. Once the aeration cycle has been completed, the aeration is switched off and the tank contents settled before decanting the effluent to two 15 m³ plastic tanks in series. Chlorination takes place between the reactor vessel and the first contact tank using a sodium hypochlorite solution dosed by an adjustable dosing pump. There is also provision for sand filtration of the sand filter using a pressurised upflow filter. The entire system is managed by a programmable logic controller.



GAUTENG: Save Water or Pay the Price

If Gauteng's present spendthrift water ways continue, the province's water resources could be fully utilised by as early as 2016. However, finding ways of using water more efficiently is only one of the challenges South Africa's economic heartland faces as revealed at the Gauteng Water Summit, held in Midrand in October.

Lani Holtzhausen reports.

If Gauteng is the economic engine of South Africa, water is the fuel that keeps that engine running. But this powerhouse faces significant challenges around water and sanitation which, if not addressed adequately, could cause economic growth to grind to a halt.

With the Witwatersrand forming the watershed between the Vaal, Olifants and Crocodile rivers, Gauteng has

little of its own bulk water resources. This has made the province reliant on a series of complex transfer schemes importing water from the Thukela, Usutu, Komati and Orange rivers (the Lesotho Highlands Water Scheme). About 88% of the province's water is imported.

But this intricate web of bulk water infrastructure comes at a price. Water prices in the province have increased

exponentially over the last few years. Customers of Rand Water, the main water supplier in Gauteng, now pay 315.45 cents a kilolitre for purified water, with raw water costs accounting for 53% of the water utility's input costs.

RISING DEMAND

These costs could rise further in future as demand for water in the

province persists, leading to additional bulk infrastructure requirements. Investigations into the feasibility of building more dams in Lesotho are already underway following the signing of an agreement between the governments of the mountain kingdom and South Africa. Early indications are that this augmentation infrastructure could cost as much as R30-billion. End users are sure to bear the brunt of the cost of this infrastructure through further water tariff hikes.

There have been increased calls for the provincial government to look at alternatives to augmentation, such as the increased use of groundwater resources, and the reuse of treated effluent.

“In Gauteng, the availability of water will certainly play a role in the future development of the province,” Minister of Water Affairs & Forestry Buyelwa Sonjica told delegates at the Summit, which explored how the water sector could be aligned to meet Gauteng’s economic growth and development targets. “Water can either be a contributor to growth or a

constraint, and we must make sure that it is not the latter. We must think how to get more jobs per drop and more products per drop.”

“Water can either be a contributor to growth or a constraint, and we must make sure that it is not the latter. We must think how to get more jobs per drop and more products per drop.” – Buyelwa Sonjica, Minister of Water Affairs & Forestry

Contributing about 34% to the country’s gross domestic product, Gauteng is responsible for about 1 355 m³ or 11% of South Africa’s yearly bulk water use. Unlike the rest of the country, irrigation is not the main water user in the province. In fact, it is only responsible for 6% of the annual bulk water consumption. Almost 80% of Gauteng’s bulk water supply goes to the urban sector, with



Unlike the rest of the country, almost 80% of Gauteng’s bulk water supply goes to the urban sector.

mining and industry being the second-largest water users (9%).

SOPHISTICATED SUPPLY

Gauteng boasts sophisticated supply infrastructure, with about 97% of the province’s residents enjoying at least basic access to potable water. The piped networks are extremely dense, and cover most formal and informal

TABLE 1 Basic water services backlog figures from metropolitan municipalities					
	Population	Above RDP	Below RDP	On RDP	Agricultural holdings
Tshwane	2 million	1,7 million	96 000	233 000	0
Johannesburg	3 million	2,5 million	228 000	334 000	0
Ekurhuleni	2,7 million	2,3 million	176 000	97 000	97 500

Source: DWAF Water Services Planning Reference Framework

TABLE 2 Estimated costs to address water services infrastructure backlogs							
Infrastructure service	Tshwane	JHB	Ekurhuleni	West Rand	Sedibeng	Metsweding	Total
Basic water and sanitation	R1,095-bn	R2,34-bn	R2,35-bn	R285-m	R880-m	R620-m	R7,57-bn

Source: DWAF Water Services Planning Reference Framework

TABLE 3 Basic sanitation backlog figures from metropolitan municipalities					
	Population	Above RDP	Below RDP	On RDP	Agricultural holdings
Tshwane	2 million	1,6 million	351 000	43 000	0
Johannesburg	3 million	2,5 million	537 000	26 000	0
Ekurhuleni	2,7 million	2,3 million	181 000	97 000	97 500

Source: DWAF Water Services Planning Reference Framework



Top left: Historic rivers, such as the Apies have been reduced to mere canals.

Top right: Concrete jungle: Gauteng's burgeoning growth is placing increasing pressure on its water resources.

Bottom right: You won't catch many swimming here – Many of Gauteng's rivers are severely polluted.

areas in the province. In turn, at least 93% of the population have access to basic sanitation (there are about 4 660 households that still use the bucket system).

“There is major scope for water conservation and water demand management to improve water use and manage demand in the province.”

However, the provincial government faces severe challenges in this regard due to the continued influx of people from other provinces, and from neighbouring countries. This can be seen in the growth in population from 6,6 million in 1994 to 9,8 million in 2005. About 20% of the population reside the province's 394 informal settlements.

“While Gauteng's process towards the provision of basic services has been impressive (the province has supplied basic water to 2,3 million residents and basic sanitation to 500 000 residents since 1994), the huge population growth continuous to shift the goal posts,” commented Helgard Muller, DWAF Executive Manager: Water Services. The estimated cost to eliminate the present water backlog is in excess of R1-billion, with at least R1,9-million needed to provide remaining communities with basic sanitation.

Of course, as Gauteng develops, people also expect raised levels of infrastructure, and this is something municipalities will have to consider in future planning.

WASTED RESOURCE

Water wastage remains a further concern. According to Cain

Chunda, DWAF Manager: Water Use Efficiency, only 48% of the water supply for the domestic and commercial sector in Gauteng is used efficiently. This inefficiency is due to factors such as physical system losses, water wastages and non-revenue water. “At present, water wastage and losses account for 25% of total water supply, which translates into a loss of R500-million a year,” said Chunda.

Given this current situation on water use inefficiencies and wastages, there is major scope for water conservation and water demand management (WC/WDM) to improve water use and manage demand in the province. According to Chunda, a 10% to 15% saving through WC/WDM can be achieved at minimum costs, which can save more than 150 million m³ a year (this translates to about R300-million per annum).

“We need to put the brakes on premature capital expenditure,” noted Chunda. “Water WC/WDM is no longer an option but an integral part of the solution to our water challenges and ensuring sustainable growth and development in Gauteng. It must be prioritised and accorded the same level of importance that is given to infrastructure augmentation.”

These and other water issues are currently being investigated by DWAF as part of the Vaal Reconciliation Study, which hopes to develop the necessary strategies to meet Gauteng’s growing water requirements.

OPERATION AND MAINTENANCE

One way of reducing waste is ensuring the optimal operation and management of water supply infrastructure. “Good management of operations is critical if we are to avoid not only dry taps, blocked toilets and polluted rivers, but more specifically the outbreak of waterborne diseases such as typhoid and cholera,” said Sonjica. “It is the responsibility of each municipality to ensure proper planning, budgeting and management of such structures.”

The Minister did add that, as part of Project Consolidate, her department had instituted a programme to monitor the performance of water purification plants and sewage treatment works to assist in identifying possible health risks and addressing these.

“The present lack of infrastructure maintenance in Gauteng is causing existing infrastructure to fail, which means that the existing backlog may increase,” noted Muller. Critical refurbishment costs in Gauteng are reportedly nearing R500-million. However, estimated are the present funds for operation and maintenance are only 50% of what is required to keep infrastructure in a good working state.



- ◆ Gauteng is South Africa’s smallest province, covering only 17 000 km² yet accounts for about 33% of the country’s gross domestic product.
- ◆ The province has a population of about ten million. It has by far the highest population density and the highest growth rate.
- ◆ Areas such as Alexandra, Soweto, Tembisa, and Mamelodi have densities of over 10 000 people/km².
- ◆ Gauteng is about 94% urbanised, with agriculture accounting for only 1% of total employment.
- ◆ Gauteng generates 80% of the total waste stream in South Africa, and has the highest volume waste per capita.
- ◆ The province has the second highest national access to potable water at 97,5% (partly due to the small rural areas in the province).
- ◆ Gauteng has the highest levels of access to adequate sanitation in South Africa (93%).

RESOURCE POLLUTION

This lack of adequate maintenance adds to Gauteng’s pollution concerns worsened by the large population, mining and industrial developments and the short river sectors. Although discharge standards for wastewater are high, the condition of the available streams and rivers is not healthy and most are in a fair to poor state, especially those close to the central watershed in Johannesburg and Ekurhuleni.

Sulphate and salinity levels are highest along the central mining belt (includes the Blesbokspruit, Klip River, Wonderfonteinpruit and Suikerbosrand rivers); while faecal coliforms in the Pienaars, Hennops, Klip and Suikerbosrand rivers have found to be unacceptably high. At the same time, most of the major dams in Gauteng

have unacceptable levels of eutrophication leading to algal production.

Effluent return flows from the urban areas forms a major part of the total river flow and is mostly used in the provinces downstream of the province, i.e. North West, Limpopo, Mpumalanga and Free State. The province will have to strike a careful balance between looking after its limited water resources and lifting people out of poverty while supporting economic growth and development.

As pointed out in the Gauteng Development Strategy, launched earlier this year: “The growing social and environmental challenges are in increasing burden on Gauteng’s stability and sustainability.” Unless these challenges are addressed they will pose a significant complication for the future prosperity and development of the province. 



Water from the dam is distributed by means of an extensive canal system which was constructed in the 1940s.

Dam Project Could Improve Aquatic Environment

The aquatic environment is proving to be an important stakeholder in the proposed raising of the Clanwilliam Dam, in the Western Cape, which could bring much needed additional water resources to the area.

Lani Holtzhausen reports.

Originally completed in 1935, the Clanwilliam Dam is situated on the Olifants River upstream of Bulshoek Barrage. It is the major dam in the Olifants/Doring Basin, and provides water to a number of towns, the Clanwilliam canal scheme, to irrigation farmers who draw water from the river, and especially to the Olifants River Government Water Scheme around Vredendal.

Water is released from the Clanwilliam Dam to the Bulshoek Barrage, from where it is distributed by means of an extensive canal system to downstream towns and irrigation farmers. While about 85% of the total river flow occurs during winter months, more than 60% of the annual urban demand and 90% of the irrigation demand occurs in summer.

The concrete gravity dam was raised between 1962 and 1964 by adding

13 crest gates and through the use of pre-stressed cables, giving the wall a present height of 43 m. The dam has a current net storage capacity of 122 million cubic metres.

It is reported that water resources in the Olifants River catchment are over-allocated at present, with a deficit of some 55 million cubic metres being experienced every year on average. This places tremendous pressure on farmers' crops from water

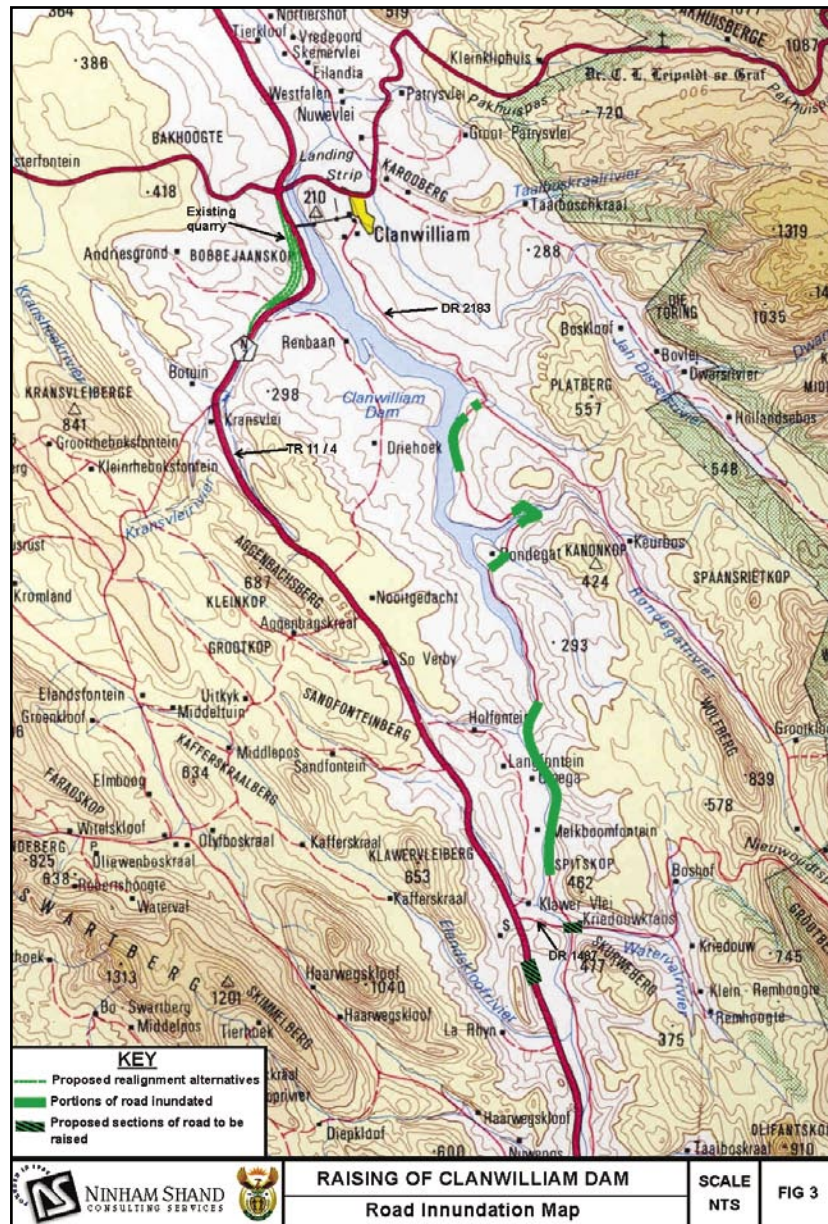
deprivation, while it leaves very little additional water resources for emerging farmers.

Furthermore, no releases for the ecological water requirements are currently made from the Clanwilliam Dam, although considerable releases are made via the river channel to supply Bulshoek Barrage. This means that if the dam were not to be raised current water users may have to forego a portion of their allocation to satisfy the ecological water requirements.

The raising of Clanwilliam Dam is likely to have negative impacts in the Olifants River upstream of the dam, by replacing the natural riverine environment with an artificial lake environment.

The possibility of raising the Clanwilliam Dam wall to relieve some of these pressures was first studied by the Department of Water Affairs & Forestry in 2003. It has since been found that, in order for the dam to comply with present dam safety legislation, the dam wall will have to be strengthened, offering an opportunity to raise the fully supply level at the same time.

Improving the safety of the existing dam as well as the raising thereof would require the replacing of the spillway gates with a fixed concrete spillway and the possible raising of this spillway by between 5 m and 15 m. This would be achieved by adding concrete on the downstream face of the existing overspill. No specific costs are being mentioned at this stage, but such a project is expected to cost hundreds of millions of Rands.



Possible road inundation and realignment during raising of the Clanwilliam Dam in the Western Cape.

In January 2004, the Clanwilliam Dam Raising Association (CDRA), comprising Ninham Shand, ASCH Consulting Engineers and Jakoet & Associates was appointed to undertake a feasibility study for the possible raising of the dam. The environmental impact assessment is nearing completion and several meetings have already been held with interested and affected parties to date.

ENVIRONMENTAL CONSIDERATIONS

According to Erik van der Berg of the CDRA, there are several possible socio-economic and environmental impacts, which are currently being investigated in depth as part of the assessment process. One potential environmental concern is the effect of the project on the ecology of the Olifants River and its tributaries,

Courtesy of Ninham Shand



Plans are afoot to raise the Clanwilliam Dam to bring welcome additional resources to the area. While a final decision is yet to be made, it is speculated that the dam wall is likely to be raised by about 10 m.



Wine grapes are the main crops irrigated in the area.

which contain several endemic fish species, the highest number of endemic fish south of the Zambezi.

The raising of Clanwilliam Dam is likely to have negative impacts in the Olifants River upstream of the dam, by replacing the natural riverine environment with an artificial lake environment, thereby increasing

the habitat for exotic fish, such as smallmouth bass, banded tilapia and brown trout that already pose a threat to endemic fish.

On the positive side, however, the raising of the dam would facilitate meeting the ecological water requirements downstream. At present, the water released from the dam is colder


than the water entering the reservoir, retarding the onset of spawning in the Clanwilliam yellowfish, listed internationally as vulnerable. Van der Berg reports that the installation of a multi-level outlet is being suggested which could reduce some of the existing impacts on the riverine and estuarine environment downstream of the dam wall.

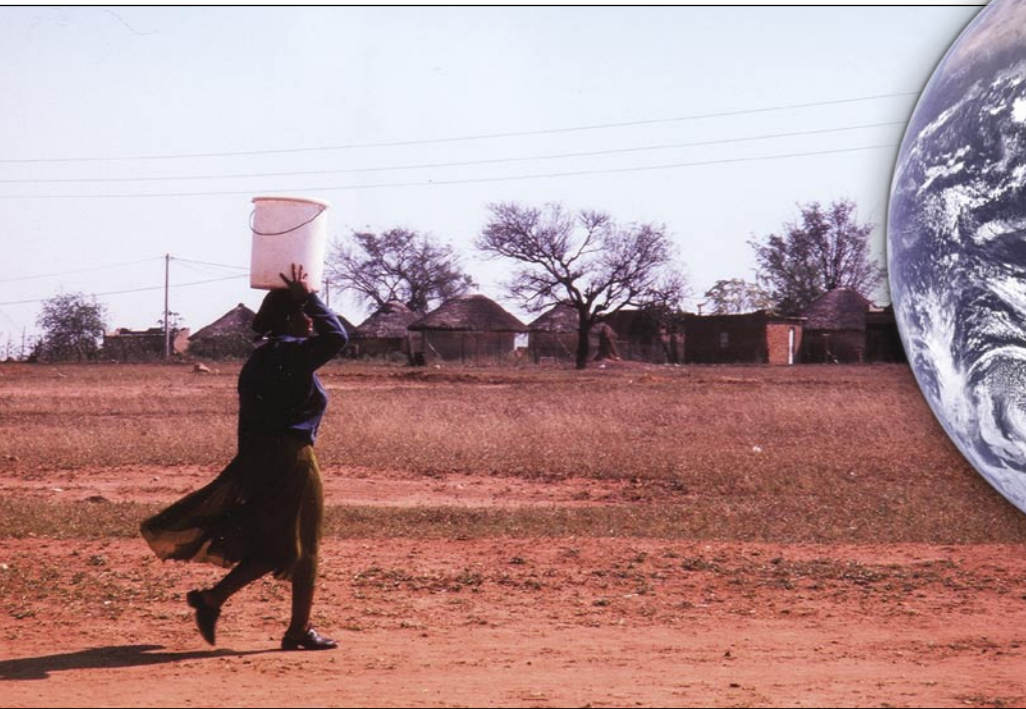
SOCIO-ECONOMIC IMPACTS

The raising of the Clanwilliam Dam could see the flooding of up to 150 hectares of land as well as some 20 farmhouses. In addition, between 1 600 m and 3 200 of the N7 national road that links Cape Town with the Northern Cape and Namibia as well as several secondary roads could be inundated.

An unanticipated problem is the potential greater-than-anticipated flooding of sections of secondary road DR2183, which is used by commercial farmers in the area to take their product to market. Alternative access to the affected farms via Clanwilliam is undesirable due to the increased haulage costs associated with the greater distance. "This is a bigger challenge than we anticipated, and will certainly require some attention," Van der Berg tells *the Water Wheel*.

To investigate the social implications of the project, including loss of land and infrastructure, impacts on livelihoods, and the potential benefits of additional water in the area, a social impact assessment is also being undertaken at present.

Despite these potential impacts, the overall reaction to the project has been surprisingly positive, notes Van der Berg. Further public meetings are planned in February to launch the environmental impact assessment report. If all goes according to plan, construction could start as early as 2007. 



CLIMATE CHANGE:

The Last Straw for Communities at Risk?

Much has been said about the potential effects human induced climate change will have on Southern Africa, its biodiversity, its water resources, the economy of the region and the health of its people. However, this phenomenon is only one stressor in the lives of the area's most vulnerable communities, and should not be viewed in isolation, experts warn.

Lani Holtzhausen reports.

Most scientists agree that climate change is happening, and will continue to happen in the foreseeable future even if the global gas emissions responsible for this phenomenon are curtailed significantly in the short to medium term. According to South Africa's National Climate Change Response Strategy, approved by Cabinet in September 2004, there is now more confidence than ever before that global climate change is a threat to sustainable development, especially in developing countries. It could

undermine global poverty alleviation efforts, and have severe implications for food security, clean water, energy supply, environmental health and human settlements.

Research funded by the Water Research Commission (WRC) has confirmed this, with credible regional projections made available using the latest general circulation models, as well as regional climate models and empirical downscaling techniques. "This is the closest we have ever come in South Africa in projecting

exactly what will happen to the region as a result of climate change," reports Prof Bruce Hewitson of the Climate Systems Analysis Group at the University of Cape Town. The other universities who participated in this collaboration were the universities of KwaZulu-Natal (KZN), Pretoria and Witwatersrand (Wits).

HIGHER TEMPERATURES, LOWER RAINFALL

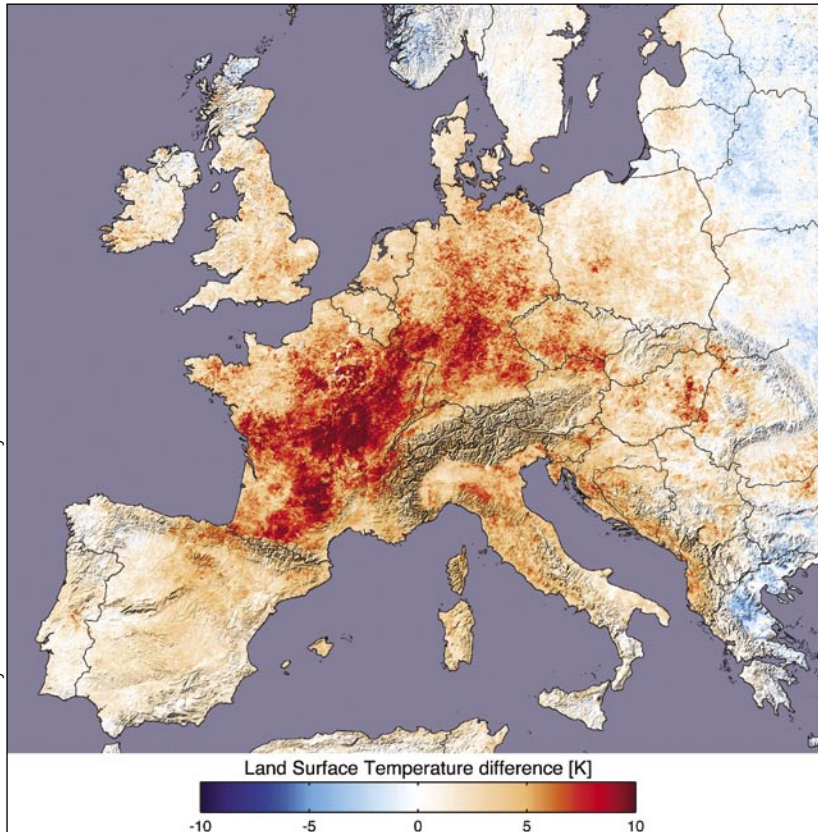
The country as a whole is projected to become warmer, with the highest

increases in the interior. Increases in temperature is already being experienced, with 2005 expected to become the warmest year on record,

beating 1998 as the warmest year yet recorded. Higher temperatures mean more evaporation, which is projected to increase by 10% to 20%.

“Increases in temperature is already being experienced, with 2005 expected to become the warmest year on record, beating 1998 as the warmest year yet recorded.”

This is not great news for a country such as South Africa which already has a high-risk hydroclimatic environment, with low rainfall to runoff conversion and a high inter-annual variability of climate. According to Prof Roland Schulze of KZN University this implies increased evaporation and water losses from dams and increased irrigation demand as soils will dry out more often. “The impact of climate change on the water sector might be felt on the water sector sooner than we think. We could see a significant reduction in runoff in



Courtesy of NASA Earth Observatory

Left: Europe experienced a historic heatwave in 2003. Here the daytime land surface temperatures of 2003 compared to the previous three years are shown.

COULD SA FARMERS SUE FOR CLIMATE CHANGE DAMAGE?

In the not too distant future, a group of local farmers lose their maize crops due to a severe drought. They go on to sue a number of international fossil fuel companies for damages caused by human-induced global warming.

Improbable? Perhaps not, maintains Myles Allen of the Department of Physics at Oxford University. Speaking via telephone link at the National Climate Change Conference in October last year, he said that civil liability could be another vehicle for redistributing the costs of climate change and reducing emissions. “There is increasingly strong evidence for the human influence on global and regional temperature changes,” he told delegates, citing

the example of the 2003 European heat wave which led to more than US\$10-billion of uninsured damages and between 22 000 and 35 000 heat-related deaths.

According to Allen, the contribution of past greenhouse gas emissions to some present climate risks, including recurring droughts in southern Africa, may already exceed 50% – the threshold for civil tort actions. By 2030 more than 50% of anthropogenic greenhouse gas loading will be due to post 1990 emissions.

“Plaintiffs must show that, more probably than not, their individual injuries were caused by the risk factor in question, as opposed to any other cause. So we must ask how human

influence on climate has affected the risk of an extreme weather event.” But who will be the defendants? Allen explained that about 80% of the present greenhouse gas emissions emanated from the products sold by no more than 20 identifiable companies.

Over the coming decade, both the cost and inevitability of climate change will become clearer, fueling demands for compensation for floods and droughts, heat wave damages and deaths, threats to water supplies, coastal erosion and hurricanes, he maintained. “The risk, even if remote, of a successful class-action damages suit would have far more impact than any conceivable follow-up to the Kyoto Protocol.”

certain areas in the west of the country by as early as 2015," he says.

At the same time the eastern half of South Africa, especially the escarpment and eastward is likely to become wetter, with more rainy days and increases in rainfall intensity, which have implications for, for example, soil erosion and flooding. On the positive side, this might result in greater groundwater recharge. The interior regions to the west of the eastern escarpment show more ambiguous changes in rainfall, with some parts likely to experience slight increases and other slight decreases.

Worrying, however, is that most winter months in the Western Cape show a drying trend. This is consistent with the suggestions that the region will experience weaker frontal systems, whose core will be further south than at present. There are also suggestions across the country of increased inter-annual variability. This means we are likely to see more floods and droughts, with prolonged dry spells being followed by intense storms.

All aspects of the water sector will be affected, including water supply, the incidence of waterborne diseases, and even the Ecological Reserve. South Africa might even have to renegotiate its international water agreements with its neighbours with whom it shares 70% of its water resources.

VULNERABLE COMMUNITIES

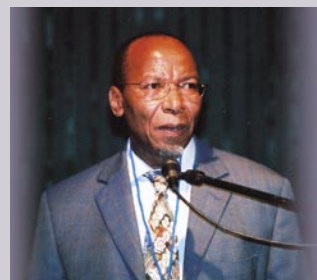
But climate change is not only about changes in the earth system, it is also about the impact of these changes on vulnerable communities. According to Prof Coleen Vogel, Professor: BMW Chair in Sustainability at Wits, research into climate change has been largely one dimensional to date. "For many, the focus thus far has been on the projected impacts of climate change, for example, on the environment, human health, and

WHAT THEY SAY ABOUT CLIMATE CHANGE

"From improved disaster management and emergency response planning to the decisions we make about the materials to build our houses, climate change will require adaptation in almost all spheres of life."
– Minister of Environmental Affairs & Tourism, Marthinus van Schalkwyk



"We run the risk that our grandchildren and great grandchildren may not be able to enjoy the visual splendour of the fynbos of the Western Cape or the daisies of Namaqualand."
– Minister of Minerals & Energy, Lindiwe Hendricks



"A much neglected aspect of climate change understanding is the role that the continuing and pervasive poverty that afflicts more than a third of the people on this planet has on climate change, and the impacts that climate change will in turn have on the most marginalised in the global context."
– Minister of Science & Technology Mosibudi Mangena

"Climate change is a serious risk to poverty reduction and threatens to undo decades of development effects."
– Minister of Agriculture, Thoko Didiza

"We have learned to live with the fact that our water resources are scarce and highly variable in space and time. Now we will have to learn to adapt to a climate that is already changing and will continue to change – possible for 100 years – irrespective of how successful we are in reducing emissions of greenhouse gases into the atmosphere."
– Minister of Water Affairs & Forestry, Buyelwa Sonjica



water resources. We need a multi-faceted approach to climate change, focusing particularly on the human dimension of this phenomenon."

It is believed that the impacts on both rural and urban communities, particularly in the absence of effective risk-reduction strategies, are expected to be significant in a changing climate

scenario and require an effective response. In communities where access to clean water is already a problem, a slight decrease in rainfall has an amplified effect, for example. So climate change will become another stress that cities have to deal with, along with growing informal settlements, pollution, poverty, and health issues, to name but a few.



Drier conditions exacerbated by climate change could see the Cape West Coast and Namaqualand's floral splendour become a rare occurrence.

"The most pressing challenge is to strengthen the social, economic and environmental resilience of the poorest and most vulnerable against climate change and variability," notes Prof Vogel.

COMMUNITIES IN PERIL

The WRC research emphasised this with two case studies undertaken on the vulnerability of communities to climate change in the Thukela catchment in KZN. The one case study was undertaken in the small-scale community of irrigation farmers at Müden while the other was done in a large-scale commercial sugarcane farming community in the area.

KZN has a long history of past climatic stress events, and it is possible that the area may experience future climate stresses. In addition, several farming and other livelihoods in the area are resource dependent, with many requiring water for small or

larger-scale agricultural activities. The area is also characterised by high levels of poverty and other stresses, including HIV/AIDS, malaria and cholera.

"The impact of climate change on the water sector might be felt on the water sector sooner than we think. We could see a significant reduction in runoff in certain areas in the west of the country by as early as 2015."

The case studies showed that how a community deals with the risks of climate change is dependent on the context in which that community finds itself at the time, including the manner in which the community gains

access to resources, how well they are linked to development activities and, more critically, how those activities are institutionalised.


In Müden, which is already prone to droughts and flooding, research showed rather than climate change being the key and overarching 'driving' or 'stress' factor, there were several multiple stressors that enhanced vulnerability and constrained adaptive capacity of the small-scale farmers to climate change. These include lack of institutional organisation, lack of access to information and broader governance issues related with relevant authorities.

The commercial farmers, on the other hand, were almost just as vulnerable, with macro-economic and related factors, including the low price of sugar, the strong local currency, legislation, land distribution, high input costs and labour issues, enhancing their exposure to climate variability.

It is essential that all of these stressors are taken into account when assessing the vulnerability of farmers and when implementing plans for assistance and development, particularly if such events increase in frequency and magnitude, the research team concluded.

“The most pressing challenge is to strengthen the social, economic and environmental resilience of the poorest and most vulnerable against climate change and variability.”

The South African government has indicated its commitment to assisting the country adapt and prepare for climate change. However, it is clear from this research that one size will not fit all when designing future institutional and local response interventions to enhance adaptation to climate variability in the short term and climate change in the longer term.

It is certain that while the picture is slowly becoming clearer, we are a long way off from knowing all there is to know from this phenomenon that is climate change. We can do little to control the timing and intensity of the expected hazardous events in the short term. All we can hope for is to increase our capacity to cope with the projected extreme climatic events, and increasing climatic variability. 



Much still needs to be done to protect vulnerable communities against the onslaught of climate change.



Weather extremities brought about by climate change, such as increased flooding, is only one of the stresses vulnerable communities in urban areas have to deal with.

NEWSFLASH – NEW BOOK ON CLIMATE CHANGE IN AFRICA

A new publication on climate change in Africa is due to be published this year.

Funded by the organisation, System for Analysis Research and Training (START), the book will be an updated, reviewed, scientific synthesis of

global change research in sub-Saharan Africa over the last few years, according to Editor Luanne Otter of the Climatology Research Group at the University of the Witwatersrand. Featuring authors from Africa, the book will be presented in five parts, namely past and present climates; human elements; major ele-

ments of water, carbon and nitrogen; transport and transformations; global change impacts; the vulnerability of Africa to global change and the adaptations required to adjust to these changes. For more information, visit <http://crg.bpb.wits.ac.za> or E-mail: Luanne@crg.bpb.wits.ac.za



Water The Tie That Binds Eastern Cape Community

In a rural corner in the Eastern Cape, amidst mountains and sprawling citrus farms, one community is proving that water can be the tie that binds.

Lani Holtzhausen reports.

At first glance the Kat River Valley might seem just another sleepy farming community. Situated northeast of Grahamstown in the old Ciskei in the foothills of the Winterberg and the Amatole Mountains, the Kat River Catchment is about 80 km in length, and covers an area of about 1 715 km².

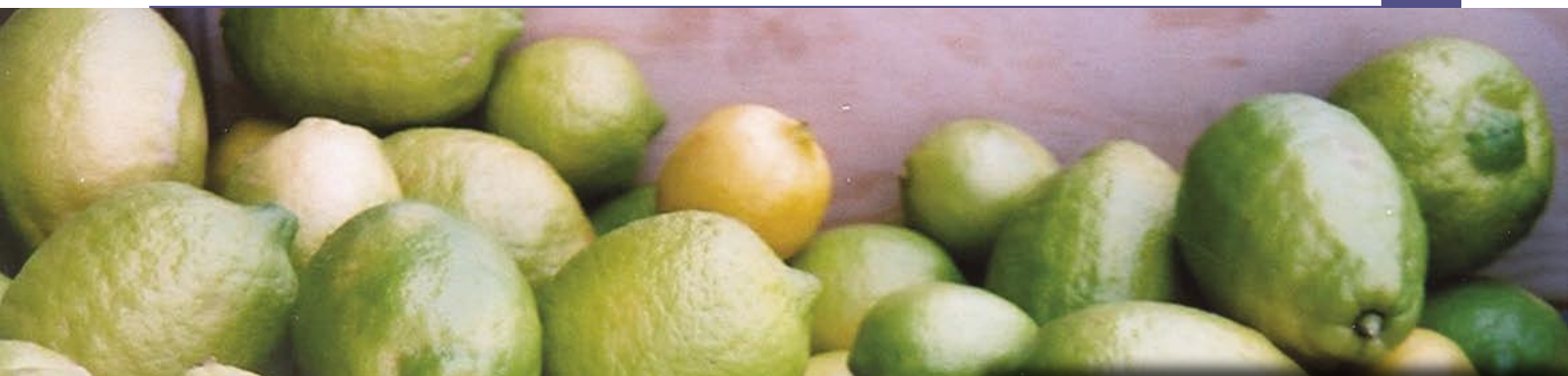
Agriculture is the main activity here. The majority of commercially irrigated farmland is used for citrus production for export, which occurs on the flat river terraces throughout the catchment. Also practiced are

stock and game farming in the lower reaches to the upper reaches, and small-scale community farming. There are several small towns in the catchment, the largest being Fort Beaufort.

The Kat Dam is the main primary bulk water infrastructure, and is situated in the north of the catchment at the town of Seymour. Outside of the towns, few of the villages have access to potable water and where communal or yard taps have been provided water supply is erratic at best.

COMPLEX HISTORY

The area has had a complex history from the start. Since the days of early settlement the land of the Kat River Valley has been severely contested, first between the Khoi-Khoi and the Xhosa, and later between the Xhosa and the white settlers. Throughout the decades, the valley has seen farmers and families of all race and creed come into the area full of hope and hard working dreams only to have politics and government changes destroy them.



Citrus remains the biggest export of the Kat River Valley

The creation of the homelands during the apartheid era resulted in the inclusion of large portions of the Kat River area into the Ciskei. Although earmarked for agricultural purposes, much of the land was never allocated, and the rest was claimed by government officials.

“People here have an understanding of government’s policy of decentralisation. They grasp that they must be responsible for the management of their own water resource, and they realise how important it is to have a say in what is being done with their water.”

Those who were selected to take over land were rarely given title deeds, and very little support was provided. Land tenure is still an issue today,

and it is reported that many of these farms have been abandoned.

FINDING COMMON GROUND

Today, the people of the Kat River Valley are rewriting history, working together around that on which all their lives depend – the Kat River. This process was started almost ten years ago when the Department of Geography at the University of Rhodes aimed to raise environmental awareness and build capacity among the community to manage the water resource at the local scale of two villages, Fairbairn and Hertzog.

By the end of 1998, events had progressed to the point where the desire had been expressed by the villagers to become part of the broader water management structure of the whole catchment. The ensuing project, funded by the Water Research Commission (WRC), focused on facilitating the effective participation of these and other

village communities in the Kat River in both the transformation of the Kat River Irrigation Board into the Kat River Water User Association (WUA) and the development of a catchment forum in which broader issues relating to catchment management could be tackled in a more formal structure.

According to Prof Kate Rowntree of the Rhodes Department of Geography, the Kat River WUA was one of the first to be established in the country, and aims to make government, agricultural business, small town and local rural community stakeholders jointly responsible for the availability and quality of the water of the Kat River, and the environmental health of the catchment area. It has also provided a framework for the establishment of future WUAs in the country.

Communities are also acquiring a large volume of knowledge concerning water law and policy. “People here have an understanding of government’s policy of

decentralisation. They grasp that they must be responsible for the management of their own water resource, and they realise how important it is to have a say in what is being done with their water," Rowntree tells *the Water Wheel*.

Water quality is of special concern to the commercial citrus farmers who need to adhere to strict international standards in order to export their products, as well as to the communities who remain dependent on the river for daily use. In the past there have been incidents of pollution related to the sewage overflows from the town wastewater treatment plants in the area.

Another issue is that of water allocation. With groundwater being unreliable and mostly unusable due to high levels of salinity, all along the

catchment use the water from the river, and measures have to be put in place to ensure enough water for those downstream.

The Catchment Management Forum is made up of representatives of 20 villages in the catchment. Rowntree reports that although not mandated by the Department of Water Affairs & Forestry, the village-inspired catchment forum has provided an invaluable platform for empowering participating communities to a point where they are able to take the lead in improving their environment. "The Kat River Catchment Forum has been in place for five years, during which time the members have endeavoured to actively identify needs in their catchment and implement integrated water resource management principles and practices to bring about change."

For the researchers at Rhodes University who continue to provide scientific and technical support there have also been some valuable lessons. This includes the importance of professionalism when dealing with community participation issues. In this regard, professionalism refers to standards and personal commitment of facilitators involved in stakeholder participation projects.

"The Kat River Catchment has people who want to make a difference to the environment in which they live; people that are hungry for the opportunity and training that would enable them to make their dreams and hopes go that much further."

REWRITING HISTORY

One of the needs identified in the Kat River Valley was to rehabilitated severely degraded land in the area, causing soil erosion and silting up of the river. Heavy overgrazing by sheep and cattle have thinned large areas of the valley bushveld in the southern section of the catchment, and selected regions of the foothills of the Katberg and Elandsberg mountains in the north. Almost all of the grasslands in the catchment are degraded, and some regions are completely bare of vegetation.

Between 2002 to 2004 some 19 villages took part in land rehabilitation projects in the catchment with resources from the Land Care Programme. Apart from safeguarding the river and large tracts of land, the project provided much needed employment.



About 200 people are employed at the Riverside citrus packing shed outside Fort Beaufort.





Minister Buyelwa Sonjica (centre) recently met with representatives of the Kat River Catchment Management Forum and the Water User Association.

The latest initiative, a partnership between the Kat River WUA and Rhodes, is aimed at developing a catchment management plan for the Kat River Valley. The WRC is providing funding for the project. It is envisaged that the project will require major community input, and will hopefully result in enormous benefits for the people in the area.

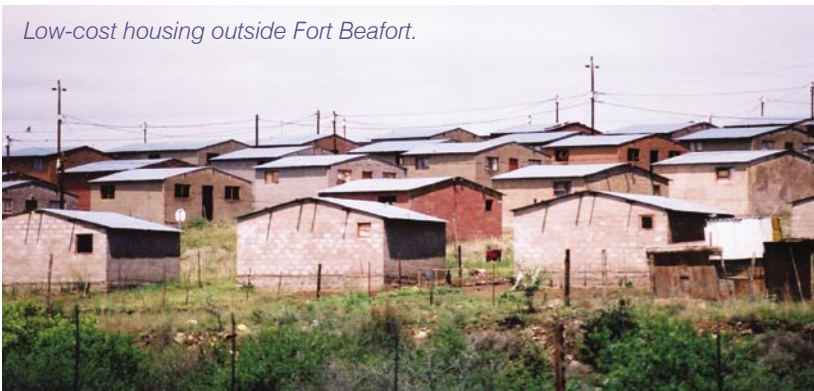
CATALYST FOR CHANGE

Perhaps the biggest breakthrough of the Catchment Management Forum was overcoming centuries of mistrust and misunderstanding and getting the range of social and economic groups around one table to discuss the management guidelines for the Kat River Catchment.

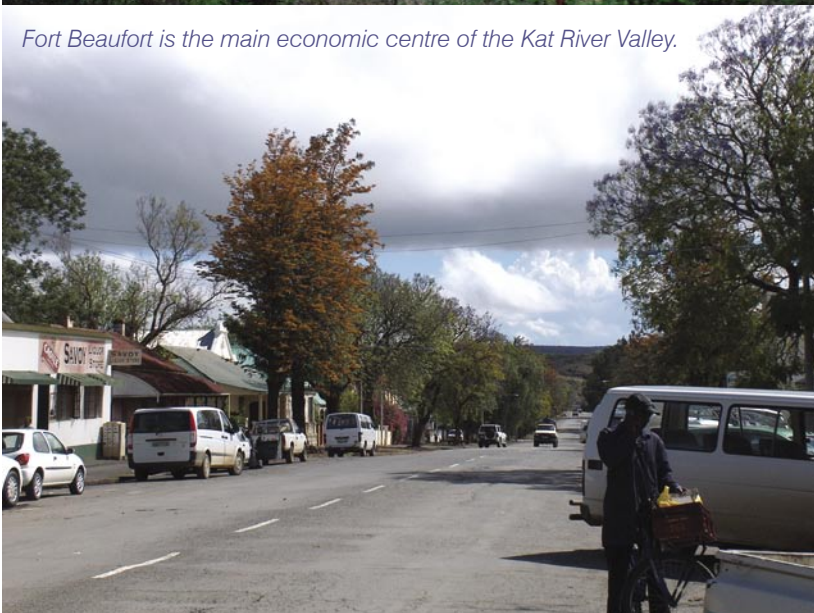
“The Kat River Catchment has people who want to make a difference to the environment in which they live; people that are hungry for the opportunity and training that would enable them to make their dreams and hopes go that much further,” says student Sharon Birkholz of Rhodes University. “The most amazing thing about this process is seeing a commercial farmer, a subsistence farmer and a rural villager sitting together finding common ground in how to best manage their water resources.”

On a recent visit to the Kat River Valley, Minister for Water Affairs & Forestry Buyelwa Sonjica met with representatives of the WUA and the forum. She praised the process, calling it an example of integrated water management in the country. “The Kat River Valley again proves that water need not be a catalyst for conflict, that it can be a catalyst for peace and co-operation. We need to celebrate our differences and together come up with solutions that will bring development and prosperity for all through the one thing that binds us – water.” 

Low-cost housing outside Fort Beaufort.



Fort Beaufort is the main economic centre of the Kat River Valley.



UNIQUE DUNE SYSTEM

Shows Sustainable Use is Possible



Courtesy of Steve Newbould, Clockwork Media

In the middle of the Kalahari a seemingly ordinary set of white dunes are demonstrating the importance and benefits of good water management. Lani Holtzhausen reports.

Proclaimed in 1994 the Witsand Nature Reserve is situated 70 km from Postmasburg, just west of the Langberg Mountain Range, in the Northern Cape. An area of flowing white dunes, nine kilometers long and four kilometers wide, Witsand derived its name after the white sand of the dunes, which is in total contrast against the surrounding red Kalahari sands ('Witsand' literally means 'white sand').

It is reported that the white dunes have been created through continual leaching, which has washed the red iron oxide coating from the quartzite grains. Receiving only about 290 mm of rainfall a year, mostly in the form of thunderstorms, Witsand is extremely arid, and every drop of water is precious. Sustaining this unique ecosystem is the Witsand aquifer, which since earliest times has been the only reliable source of permanent water in this parched region.

According to Hesma Cockrell of the Department of Water Affairs & Forestry (DWAf), the natural status of the dunes, fauna and flora has shown dramatic improvement since the proclamation of the nature reserve more than a decade ago. She believes that Witsand is a wonderful example of the benefits of good groundwater management. "The fact that water use and management of the groundwater resource was implemented from the start and has been maintained continuously has obviously contributed to the sustainability of the resource today."

PRIMARY AQUIFER

Covering an area of about 1 400 ha, the Witsand primary aquifer is situated in the white sand dunes between quartzite

outcrops of the Matsap formation. The average groundwater level in the dunes system is 2 m below surface, dropping to 90 m below surface in the surrounding red Kalahari sands.

The aquifer not only serves as the lifeline of the nature reserve, but also to the adjacent seven game and livestock farms which depend on its supply of fresh groundwater. Approximately 120 000 m³/y of water is abstracted from the resource through pumping at several locations.



This is much less than the estimated annual recharge volume (970 000 m³). All the water is for Schedule 1 water use only, i.e. for game and stock watering as well as domestic use. Water use for any commercial activities is prohibited. Cockrell tells *the Water Wheel* that the quality of the water is very fresh and correlates well with that of rainwater.

CONTINUOUS MONITORING

Water use in the present three well-fields is monitored extensively, and there is a close working relationship between the Witsand Nature Reserve, DWAF and the farming community. The interest and commitment of the individuals involved, and the fact that this is recognised as a unique ecosystem that must be preserved, are cited as the main reasons for the proficient management of this resource.

Abstraction/water use monitoring takes place monthly. Every production borehole is equipped with a flow meter and the monthly readings are recorded in a logbook. The data loggers have been placed in such a way that they provide data on the effect of pumping as well as natural trends in the water levels.

Water level monitoring is undertaken quarterly. During this monitoring process the data from the data loggers are also downloaded and the instruments checked for errors that might occur (such as flat batteries etc). In turn, water quality samples are taken bi-annually.

SUSTAINABLE USE

Cockrell believes that these observations are enough to ensure the sustainable use of the resource at its current status; however, in her opinion water quality monitoring could be improved. "Biological monitoring samples should also be taken bi-annually at



Courtesy of SA Tourism

Underneath the white sand of the Witsand Nature Reserve lies the lifeblood of the area, the Witsand aquifer.

the source and from the taps in the nature reserve camping area."

Close monitoring of water use in the nature reserve is especially important as tourism numbers are constantly increasing throughout the year, and can lead to problems during the summer holiday season when the camp is fully booked and daily temperatures are high, leading to increased evaporation (temperatures can rise up to 48°C during January and February).

There are also other management challenges. "Keeping communication lines open between the stakeholders has proven to be most difficult," says Cockrell. "Due to the remoteness of the area, the far distances people stay from each other, as well as the unreliable power and telecommunications services, people can be cut off from civilisation for days – sometimes weeks – at a time."




The pangolin is one of the rare creatures to be found in the Witsand Nature Reserve, making the preservation of this area, and the protection of its water resources, all the more important.

The management of the infrastructure is also challenging due to the long kilometres of pipeline that need to be monitored every two weeks to reduce losses as a result of leaking. In addition, power failures cause pumps to be unable to operate.

Cockrell advises that, if future developments of the aquifer are considered, the Northern part of the groundwater resource is targeted, since the largest volume of abstraction at present is from the two wellfields in the southern part of the resource.

What are the main lessons to be learnt from the way in which the Witsand aquifer is managed? "The most important aspect of managing any water resource is acquiring the commitment of all the stakeholders involved. The people dependent on the resource need to take ownership of the management and conservation of the resource," explains Cockrell. "You can have the best monitoring systems in place; however, if it is not managed and maintained, it would all have been in vain."

It is hoped that sufficient management of the Witsand aquifer will continue well into the future so as to ensure the preservation of this unique ecosystem for future generations. 

NURSERIES OF THE ENVIRONMENT

Estuaries, the places where rivers meet the sea, are among the most productive yet threatened habitats in South Africa.

Estuaries and the lands surrounding them are places of transition from land to sea, and from freshwater to saltwater. Although influenced by the tides, estuaries are protected from the full force of ocean waves, winds and storms by the reefs, barrier islands, or fingers of land, mud or sand that surround them.

Due to regional differences in geology, biology, hydrology and land use, each estuary is unique, though all have fundamental properties in common. South Africa has more than 250 estuaries.

There are several different types of estuaries:

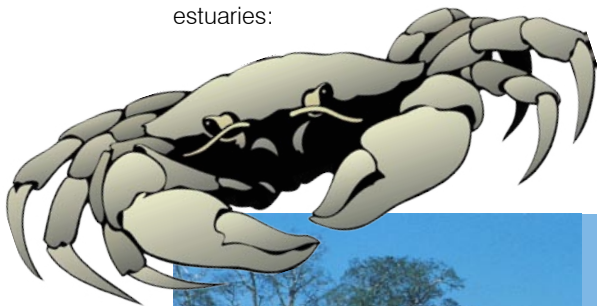
- **Permanently open estuaries:** Usually quite large systems with a perennial river and/or strong tidal exchange with the sea. For example, the Breede and Swartkops estuaries.
- **Temporarily closed/open estuaries:** These estuaries are often closed for many months of the year and sometimes for more than a year at a time. For example, the Van Stadens and Mhlanga estuaries.
- **River mouths:** All rivers flowing into the sea have a river mouth. However, estuaries under this category are usually permanently open to the sea. For example, the Orange and Thukela estuaries.
- **Estuarine lakes:** These estuaries occur where a coastal lake is connected to the sea by a channel of varying length and width.

For example, St Lucia and Kosi estuaries.

- **Estuarine bays:** These estuaries have wide mouths with strong tidal exchange resulting in a continuously open mouth, and the regular replacement of sea water in the lower and middle reaches. For example, Durban Bay and Knysna.



The Durban harbour is an example of an estuarine bay.



EXAMPLE OF AN ESTUARY: ST LUCIA

The Greater St Lucia Wetland Park on the KwaZulu-Natal coast is a United Nations World Heritage Site. Like many tidal estuaries, Greater St Lucia has diverse wildlife reflecting the concentration of diverse ecosystems. Among the animals to be found there are the white-backed and pink-backed pelican, flamingos, fish eagles, and some 530 other bird species. Two sea turtle species use the beaches for laying eggs. It is also home to the largest population of hippopotamus in South African parks.

The estuary is the largest in Africa and boasts, among other attractions, the world's largest forested sand dunes. It is the only park on the continent where you can find hippopotamus, crocodiles and sharks all in the same area.

Swamps along the border of the lake, and 'sponge' areas are fed by water seeping through the dunes. These provide critical refuge to freshwater life when the lake salinity (salt content) is particularly high.

For centuries, people have come to the St. Lucia Estuary for the food, materials, and beauty that it and the surrounding wetlands offer. To this day, thousands of Zulu people harvest ncema grass (*Juncus kraussii*) each spring, which they use to make sleeping and sitting mats.

DID YOU KNOW?

Estuaries are among the most productive natural systems on earth due to the mixing of nutrients from land and sea.

WHY ARE ESTUARIES IMPORTANT?

Estuaries are focal points for community and business activities along the coast as they provide us with a range of opportunities and benefits. They are an important location for cultural and recreational activities for coastal residents and visiting tourists.

Not only do estuaries enhance the quality of life for households, but they also provide numerous opportunities for jobs and income generation. Many businesses rely on estuaries to perform functions which have economic value, such as providing a nursery for marine fish and crustaceans (like certain types of crabs and prawns), for transport or for a place to provide facilities for tourists which, in turn, helps to support business and jobs in the coastal region (think of places like Durban, Knysna and Kosi)

Estuaries are often called the nurseries of the sea. More than 100 species of fishes, prawns and crabs in South African off-shore waters use estuaries as nurseries and/or feeding grounds.



More than 100 species of fishes, crabs and prawns in South Africa use estuaries as nurseries and/or feeding grounds.

The lifecycle of most of these species involves egg production at sea, often close inshore and near an estuary mouth. Eggs and larvae develop at sea, but the larvae and juveniles migrate to estuaries in great numbers. In fish, this migration takes place mainly during late winter, spring and early summer when millions of juveniles swim into estuaries.

Estuaries also have the ability to control or reduce flooding, while improving the quality of water.

WHAT THREATENS ESTUARIES?

Because estuaries are so beautiful and useful to us, many people live around them and make use of them. Unfortunately, as more people flock to the shore, we are upsetting the natural balance of estuaries and threatening their health.

We endanger our estuaries by polluting the water and building on the lands surrounding them. These activities can contribute to unsafe drinking water, beach closings, declines in fisheries, loss of habitat, fish kills and a host of other human health and natural resource problems.

Development can damage or even destroy estuaries. In the past, many people thought estuaries were wasted land and many estuaries were filled in and built on. Today, we are much more aware of the important role estuaries play in the environment and many people are working to save these areas.



Many estuaries are used for recreational purposes.

INTERESTING FACT

The largest reptile in the world is found in estuaries. It is called the estuarine or salt-water crocodile, and can be found throughout the tropical regions of Asia and the Pacific. The Bhitarkanika Wildlife Sanctuary in Orissa State, India, houses four protected estuarine crocodiles measuring more than 6 m in length, the largest being over 7 m long.

There are several unauthenticated reports of specimens up to 10 m in length.



IWMI Africa Appoints New Director



It is reported that Dr Bahri is very involved in policy and legislative issues regarding water and sewage sludge reuse, and is a member of several international scientific committees. She has worked as a consultant to international organisations such as the World Bank, The United Nations

Scientific Committee of the Programme Solidarité-Eau at the Ministry of Foreign Affairs in the same country. In 2000, she was elected to the International Water Academy, and in 2003 she became a member of the Academy of Sciences for the Developing World.

She has received awards from the Guinness Foundation, the International Foundation for Science, and the Kuwait Foundation for the Advancement of Sciences. Previously a member of IWMI's Board of Governors, she recently completed a six-month fellowship at the University of California at Davis as a Fulbright Scholar.

The International Water Management Institute (IWMI) has appointed a new Director for its regional Africa office.

Headquartered in Sri Lanka, IWMI is a non-scientific research organisation specialising in water use in agriculture and integrated management of water and land resources. New Director for Africa Dr Akiça Bahri has been working for the National Research Institute for Agricultural Engineering, Water and Forestry in her home country Tunisia where she was in charge of research management in the field of agricultural water use. Her particular field of interest is agricultural use of marginal water (brackish and wastewater) as well as sewage sludge, and their impacts on the environment.

She holds degrees in agricultural engineering from the National Polytechnical Institute of Toulouse, France, and a PhD from the Department of Water Resources Engineering, Lund University, in Sweden.

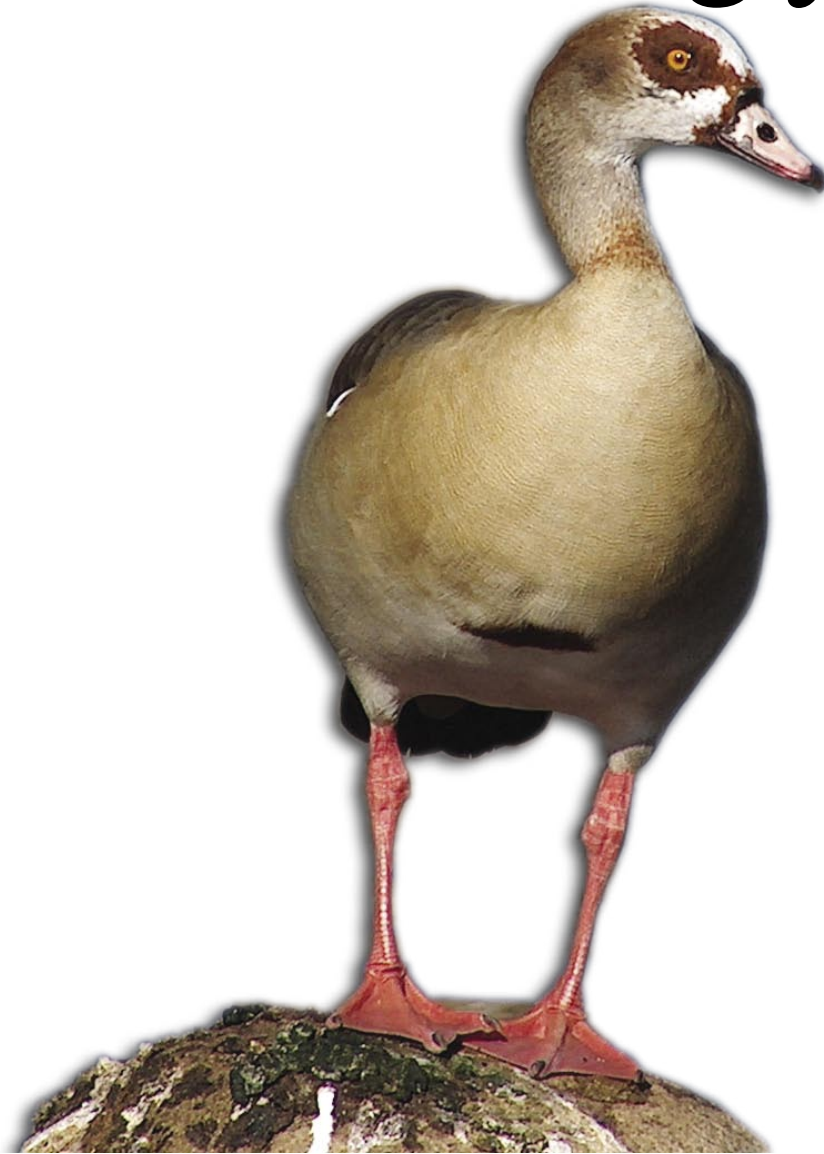
Environment Programme, and the International Programme for Technology and Research in Irrigation and Drainage. She was also a lecturer in the advanced international training programme, Water Resources Development in Arid and Semi-Arid Regions, at Lund University.

Dr Bahri has been a member of the Cemagref Specialised Commission of the Department of Equipments for Water and the Environment, in France, and a member of the

Dr Bahri is based at IWMI's sub-regional office in Accra, Ghana. Her appointment is reportedly part of a re-organisation and re-focusing of the institute's management team and thematic structure that is set to improve IWMI's effectiveness. Doug Merrey, the Institute's first Director for Africa, continues as a scientist working on institutions and policies. He is working with Dr Bahri to make the transition smooth and effective. He remains based in the southern Africa sub-regional office in Pretoria.

For more on this and other careers in water, see *Water @Work* available from the Water Research Commission. To obtain a copy phone Publications at
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