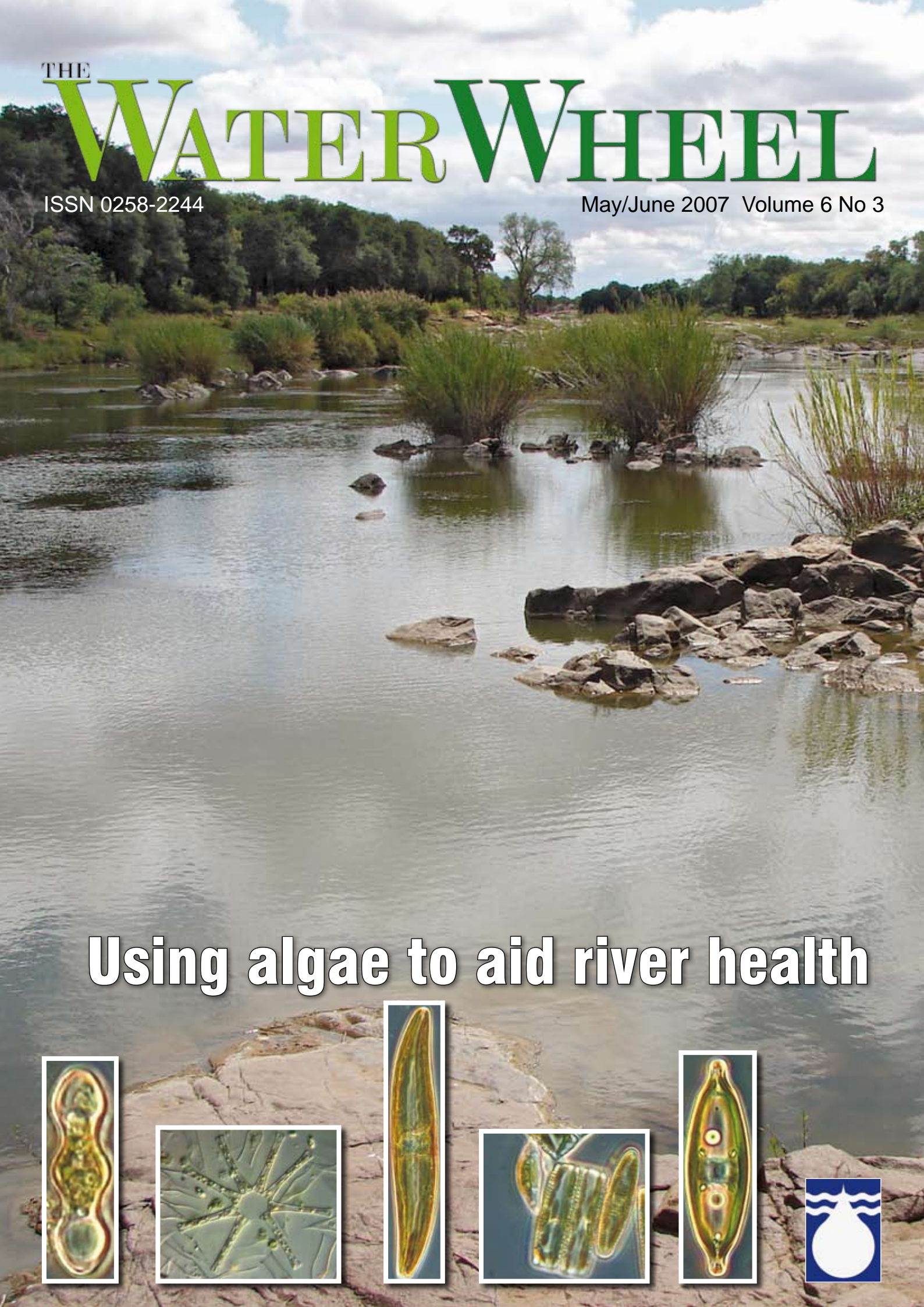


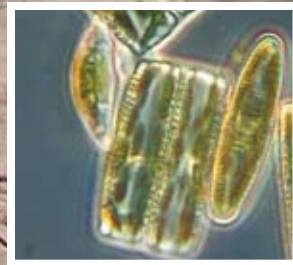
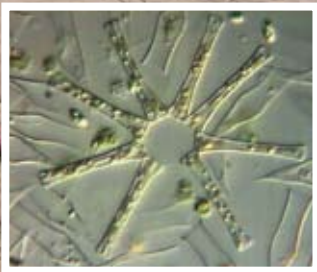
THE WATER WHEEL

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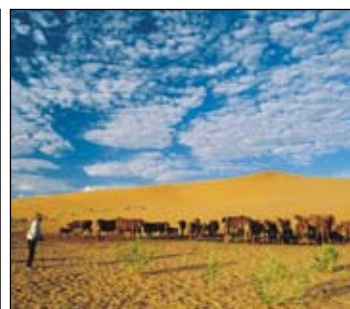
Water Institute of S.A.
www.wisa.org.za



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www.dst.gov.za



Cover: South Africa is leading research into the use of diatoms to monitor water quality. See page 12. (Background photograph by Drinie van Rensburg).

LETTERS	4
UPFRONT	5
WATER QUALITY MONITORING	12
Diatoms – a new dimension to water monitoring	
GROUNDWATER RESEARCH	15
Project sheds light on underground water	
RESEARCH & DEVELOPMENT	18
UP water experts unite under one umbrella	
KNOWLEDGE SHARING	20
Communicating science: Mission impossible?	
GOVERNANCE	24
New book pushes good water governance	
ICHTHYOLOGY	26
Africa's largest fish collection is moving	
WATER KIDZ	28
Water scarcity – making every drop count	
THE LAST WORD	30
Water engineers of the future	

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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Tackle dam problems now

Danny Walmsley correctly and accurately bemoans the lack of limnological specialization in a country hugely dependent on reservoirs for its very existence (Bring Back Reservoir Limnology, *Water Wheel* January/February 2007).

The immediate needs in this country are not to yet again examine what other people have done, but to roll up our sleeves and actually do something about the problems our dams face! To anyone not familiar with the past 20 years, during which reservoir limnology was downgraded to near non-existence in South Africa, the lack of attention to the functioning and health of our dams must

appear stunningly confusing!

While South Africa previously held a globally-recognised leadership position in reservoir and water resources management, now superceded by countries in Latin America and Asia, we currently have virtually no practicing professional limnologists and the Department of Water Affairs & Forestry (DWAF) is totally under-resourced in this capacity – with obvious and negative implications for informed decision-making on issues pertaining to reservoir management.

'Turn-around' rehabilitation plans, such as that prepared for Hartbeespoort Dam in 2004, have yet to be implemented and remain bogged down in ill-informed man-

agement processes and wheel-reinvention tactics! All the while pipelines, costing hundreds of millions of rands, are being built to bypass dams simply to bring drinkable water to towns a few kilometers downstream thereof!

Offers to provide DWAF with university-supported, regionally-specific reservoir training programs, formulated by leading international specialists, were declined due to a lack of funds for

capacity development.

However, amidst the darkness some isolated bright lights are shining! The Hartbeespoort Dam rehabilitation approach is being used as a text for student training; there are various initiatives setting threshold management limits for nutrient loading in key dams; and the foodweb management initiative is now being expanded to nine additional dams.

However, in the absence of an inter-departmental framework to take these forward to implementation, they will continue to remain mired in indecision and inaction!

Bill Harding and Jeff Thornton, professional limnologists and certified lake managers and Brian Allanson, professional limnologist

Sewage problem understated

The article in the Upfront section of *the Water Wheel* of January/February (Sewage Threatens World's Oceans) is completely understated as regards to South Africa.

In Durban, KwaZulu-Natal, raw untreated sewage sludge is trucked in to the southern wastewater treatment works on the Bluff from other overloaded plants in the area and pumped out to sea by the ton.

Cape Town has a nick name of s..ty city, they pump the whole wastewater flow to sea from the Green Point pump station and most of the wastewater treatment works have major odour problems.

The fact is that these municipalities and Port Elizabeth are trying to run their treatment plants with obsolete systems and just not spending enough money on technology that would enable them to keep up.

Len Palmer



Letters must be addressed to The Editor and can be faxed to (012) 331-2565 or E-mailed to laniv@wrc.org.za. Letters are published at the editor's discretion, and may be edited for length. Letters are strictly the opinion of the author(s) only and do not necessarily reflect the considered opinions of the members of *the Water Wheel* or the WRC.

Schools' water target being determined



The Department of Water Affairs & Forestry (DWAF) is working with the Department of Education (DoE) to come up with a strategy to address the lack of access of safe water in schools.

In answer to a question raised in Parliament, DWAF Minister Lindiwe Hendricks said that the departments were currently working together to define minimum standards and criteria by which to base a target on, for example, the minimum number of learners per toilet, the type of structures to be constructed, and so forth. "Already the DoE has done a great deal of work to identify which schools are lacking services, and DWAF is currently working with them to finalise the database so that project plans can be devel-

oped and budget allocated," she reported.

In addition to the existing capital expenditure budget of the DoE, an additional top-up budget of R950-million over the Medium Term Expenditure Framework period (i.e 2007/08 to 2009/10) has been allocated from the fiscus to address the backlog of water, sanitation and electricity in schools and clinics.

"During the 2007/08 financial year our programme to address water and sanitation in schools and clinics will focus primarily (although not exclusively) on clinics so that this backlog is addressed by the end of this year," Hendricks noted. "From 2008/09 onwards we will then focus on addressing the water and sanitation need in schools."

Wastewater conference on the cards

The Water Institute of Southern Africa, together with the Water Research Commission and Amatola Water are hosting a Wastewater Management Conference with the theme "From Challenge to Opportunity" on 12 & 13 June at the Regent Hotel, in East London.

Wastewater management is becoming increasingly challenging in the South African context due to the promulgation of more stringent legislation and the shrinking resource base coupled with the expectation of a rapid increase in service delivery across all communities in the country.

According to the organisers, this conference provides a broad foundation to change the approach to wastewater management in South Africa. The first half of the conference focuses on the drivers, responsibilities and challenges that face wastewater management and practitioners. The second half of the programme focuses on identifying opportunities through the appropriate use of technology and resources.

For more information, contact Taryn van Rooyen at Tel: (011) 463-5085; Fax: (011) 463-3265; E-mail: conference@soafrica.com

Programme looks beyond toilets and taps

Government's Masibambane programme has entered its third phase.

Since its launch in 2001, the programme has become known for its achievements in institutional support and development, sector collaboration and for seeking to fulfil national strategic objectives in the water sector, the Department of Water Affairs & Forestry said in a statement. "The programme has successfully integrated the three spheres of government around water issues to build the capacity of municipalities to be able to perform their functions of being water services authorities."

In the third phase, the programme will look beyond that provision of basic services to ways in which water can be used to enhance the development of principally rural South Africans. "There are still many opportunities to further improve the integrated management of water at municipal level – water quality monitoring, waste discharge and waste conservation – which in turn offer more potential to put water to more productive use," said DWAF. "In a water-scarce country such as South Africa, which is aiming for 6% annual growth and for the provision of First World services to its people, while at the same time addressing rampant poverty and the HIV/Aids pandemic, Masibambane III is one of the essential mechanisms through which the sustainable use of water for growth and development will be achieved."



Calling all water women



Nominations are now open for the 2007 Women in Water Sanitation & Forestry Awards.

The awards, developed jointly by the Department of Water Affairs & Forestry, the

Water Institute of Southern Africa and the Water Research Commission, recognise the role that women play in water, sanitation and forestry management. It highlights the participation of professional and community-based women as well as the key role that women play in poverty eradication, education and sustainable development.

Nominees are sought for four categories, namely research, community development, education and awareness, and management and policy-making. Successful nominations will be chosen by the adjudication panel for the use of knowledge and skills as well as considerable capacity to ensure that water, sanitation and forestry management in South Africa contribute towards building a country that belongs to all. Entries close 31 May. For more information, contact Liz Maziya at Tel: (011) 466-6336/9; Fax: (011) 466-6337; E-mail: info@zzone.co.za; or visit: www.dwaf.gov.za/events.asp

Regional conference comes to JHB

The Second African regional conference of the International Commission on Irrigation & Drainage will take place at Glenburn Lodge, in Gauteng, from 6 to 9 November.

The theme of this year's conference is 'Contribution of Rainfed and Irrigated Agriculture to Poverty Alleviation through Increased Productivity in Africa'. It is reported

that the conference aims to attract a multi-disciplinary group of professionals involved with water management in Africa, including academics, researchers, extensionists, practitioners, consultants and policy advisors. For more information, contact Monica Chipeta, Tel: (011) 884-1502; E-mail: monica@globalconf.co.za; or Visit: www.sancid.org.za

Aussie water centre comes to SA

The Brisbane-based International Water Centre (IWC) is to establish an office in Johannesburg.

Supported by the Queensland government, the centre is a joint venture of the University of Queensland, Griffith University, Monash University, the University of Western Australia, the Moreton Bay Catchment Partnership and the International River Foundation. The IWC's mission is to provide quality skills, services and products for managing the world's water resources, waterways and catchments.

The centre offers a series of water management courses which South African students will now be able to enrol in. In addition, the IWC will allocate significant resources to water research in South Africa, and its office in Johannesburg, situated within the Monash University campus, said Queensland Premier Peter Beattie. "The management of the world's water resources has become one of the most critical issues of the twenty-first Century."

Beattie also announced that the Queensland government would contribute A\$10 000 towards funding a post-graduate student scholarship exchange through the IWC which has its headquarters at the University of Queensland. The scholarship will allow a PhD student from the University of KwaZulu-Natal to undertake water-related research for up to a year.

Water on the Web

www.envirolearn.org.za

In support of learning and teaching about water and water-related issues, the Water Research Commission and Share-Net have developed a series of lesson plans on water. The lesson plan packs, from grade R to grade 10, are linked to the national curriculum. All the lesson packs are now available on the Share-Net website.

www.sancold.org.za

SANCOLD (South African National Committee on Large Dams) represents South Africa on the International Commission on Large Dams. The website contains

useful information on dam engineering in South Africa and emphasises environmental and social matters pertaining to dams. The site also provides current information on various events related to SANCOLD and its impending reorganisation.

www.unep.org/women_env/

This website includes a database of influential women in the field of environment. Individuals and organisations are invited to add to this list by nominating women who they feel have made a significant and recognised contribution, nationally, regionally and globally, to the field of the environment.

<http://www.unesco-ihe.org>

UNESCO-IHE Institute for Water Education is instrumental to the strengthening of efforts by other universities and research centres in increasing knowledge and skills of professionals working in the water sector. The mandate given by UNESCO to IHE is to strengthen and mobilise the global educational and knowledge base for integrated water resources management. The website offers information on educational programmes and courses offered by the institute, research and development and publications to name but a few.

Dam construction imminent

The construction of the R5-billion De Hoop Dam on the Steelpoort River, in Limpopo, is due to start in the second quarter of this year.

The dam project, which was officially launched by Minister of Water Affairs & Forestry Lindiwe Hendricks in March, forms part of the Olifants River Water Resource Development Project. The dam is set to supply water to the towns, industries and poorly serviced rural communities in the Sekhukhune district, while also supplying water to developing platinum mines in the region.

According to Hendricks, municipalities in the area, supported by national and provincial government, are preparing to invest an additional R3-billion on infrastructure to treat and distribute potable water to domestic users. More than 800 000 people are set to benefit from improved domestic water supply once the dam has been constructed. The first impoundment of water is planned during the 2009/2010 rainy season.

Environmental groups have expressed concern over the potential downstream consequences of the proposed dam. "Detailed

scientific studies have been conducted on the volumes of water required, and at what times, to meet the requirements for the environment in various parts of the Olifants River Catchment – including the Kruger National Park," said Hendricks. "The De Hoop Dam has consequently been planned and designed to fully meet the downstream environmental requirements in the Steelpoort River. The dam will mainly retain flood waters and will, in fact, significantly improve flow conditions downstream during the low flow season as well as during droughts."

Water Diary

PUMPS & VALVES

JUNE 26-28

The Fifth International Pumps, Valves & Pipes Exhibition will take place in Johannesburg. *Enquiries: Exhibitions Africa at Tel: (011) 783-7250; E-mail: marketing@exhibitionsafrica.com; Visit: www.exhibitionsafrica.com*

ENVIRONMENTAL EDUCATION

JULY 2-6

The Fourth World Environmental Education Congress will be held at the Durban International Convention Centre. *Enquiries: Nina Freysen-Pretorius, the Conference Company; Tel: (031) 303-9852; Fax: (031) 303-9529; E-mail: nina@confco.co.za; Visit: www.weec2007.com*

KNOWLEDGE MANAGEMENT

JULY 17

The Second Biennial Knowledge Management Africa Conference will take place in Nairobi, Kenya. *Enquiries: Johanna Chiloane, Tel: (011) 313-3534; E-mail: johannac@dbsa.org*

New software

Utility Programs for Drainage

The Utility Programs for Drainage is a suite of software programs that will assist in the design and analyses of drainage structures. It consists of the following components:

- Economic calculations
- Flood calculations (deterministic, empirical and statistical methods)
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- Surface drainage
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World News Roundup

- The Stockholm International Water Institute has published a new report on transboundary water management in the Nile River Basin. The report, which can be downloaded from www.siwj.org/downloads/Reports/Nile_Basin_Report_07.pdf, focuses on public goods in the context of the Nile River Basin.
- The first geological map of the earth is being assembled in a large international project. Scientists from more than 55 countries are participating in the One-Geology project, which is pooling national geological survey information and presenting it on the Internet for all to see.
- China's Gezhouba Group has been awarded a US\$1,46-billion contract to construct what will be Nigeria's largest hydroelectric plant, with 2,6 MW installed capacity.
- The Japanese government has signed an agreement with the Maputo Municipal Council, under which the Asian country will finance the construction of 11 boreholes in outlying city neighbourhoods. The boreholes, which will be equipped with handpumps, will cost about US\$88 500.
- A Europe-wide weather alarm system, covering 21 countries, has been launched. Meteoalarm provides information on severe weather in 17 languages from a single website, www.meteoalarm.eu.



Virus removing technology developed

US University of Delaware researchers have reportedly developed an inexpensive, non-chlorine based technology that can remove harmful microorganisms, including viruses, from drinking water.

The patented technology incorporates highly reactive iron in the filtering process to deliver a chemical "knock out punch" to a host of pathogens, from *E. coli* to rotavirus. "By using elemental iron in the filtration process, we were able to remove viral agents from drinking water at high efficiencies," noted associated professor Pei Chiu. "Of a quarter of a million particles going in, only a few were going out."

The elemental or 'zero-valent' iron used in the technology is widely available

as a byproduct of iron and steel production. Viruses are either chemically inactivated by or irreversibly adsorbed to the iron, according to the scientists.

Waste membrane conserves water

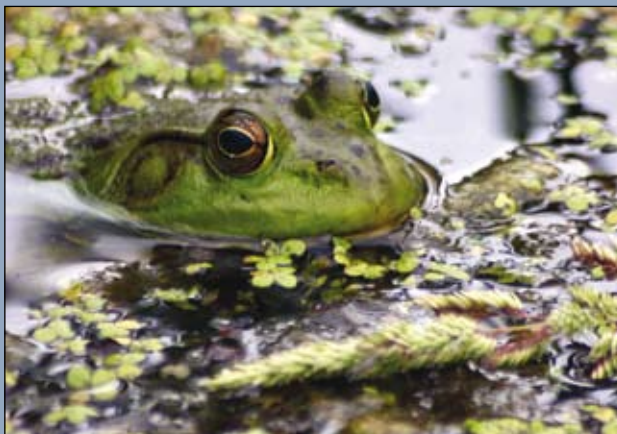
Scientists have developed a sponge-like membrane that enables plant roots to retain more water and regulate soil temperature – which could help agriculture in parched lands.

SciDev.Net reports that the eco-friendly membrane, developed by the Norway-based University of Stavanger, is made from organic waste matter, such as seaweed, fish bones and chicken manure. It helps absorb more of the water around the roots, before it drains away.

The membrane comes in the form of a powder that is dissolved in water and then applied to seedlings. After absorption into the soil, the material forms a membrane around plant roots and helps them retain available water.

Apparently, the extent to which the membrane can help reduce water loss varies between different plants and soil types. However, in a test performed in Nigeria, the technology reportedly cut irrigation needs by 30% to 50%. The technology is already being promoted in Nigeria, with plans to extend trials to Algeria and western Europe.

Male frogs threatened by pollution



In a study undertaken at Uppsala University, in Sweden, frogs that started life as male tadpoles were changed into females by oestrogen-like pollutants similar to those found in water bodies around the world.

It is reported that two species of frogs were exposed to levels of oestrogen similar to those found in water resources in Europe, the US, and Canada. The results showed that the percentage of females in two control groups was under 50% (not unusual among frogs), however, the sex ratio in three pairs of groups maturing in water dosed with different levels of oestrogen were significantly skewed.

Some of the sex-altered males became fully functioning females, while others had ovaries but no oviducts, making them sterile.

Climate change, pollution, threaten world's top rivers

Rivers on every continent are drying out, threatening severe water shortages, according to a new WWF report.

The report, *World's Top Rivers at Risk*, lists the top ten rivers that are fast dying as a result of climate change, pollution and dams. "Poor planning and inadequate protection of natural areas means we can no longer assume that water will flow for ever," reported WWF Global Freshwater Programme director Jamie Pittock. "Like the climate

change crisis, which now has the attention of business and government, we want leaders to take notice of the emergency facing freshwater now not later."

Five of the ten rivers listed in the reports are in Asia alone. They are the Yangtze, Mekong, Salween, Ganges and Indus. Europe's Danube, the Americas' La Plata and Rio Grande/Rio Bravo, Africa's Nile-Lake Victoria and Australia's Murray-Darling also make the list.



Endangered rivers threaten the livelihoods of people. River basins are the way nature gathers and delivers water for human use. These ecosystems provide electricity generation, transport, recreation and tourism, and valuable but often unaccounted flood and drought regulation, sediment and nutrient retention, and habitat for diverse fauna and flora.

The Nile River-Lake Victoria basin, which falls within ten countries, is threatened by

climate change due to heavy human extraction and high evaporation. Present water withdrawals for irrigation are so high, that despite its size, in dry periods, the river does not reach the sea.

Climate warning models provide diverging pictures of future river flows in the Nile from a 30% increase to a 78% decrease. In addition, saltwater intrusion into coastal freshwater resources is likely to increase as a result of sea-level rise.

The report calls on governments to better protect river flows and water allocations to safeguard habitats and people's livelihoods. "The freshwater crisis is bigger than the ten rivers listed in this report, but it mirrors the extent to which unabated development is jeopardising nature's ability to meet our growing demands," said Pittock.

To download the report, go to <http://assets.panda.org/downloads/worldstop10riversatriskfinalmarch13.pdf>

FAO warns against irresponsible alien introduction

The United Nations Food and Agriculture Organisation (FAO) has issued an expanded database to warn of the unintended dangers that can arise from introducing non-endemic species, especially alien fish farming.

The Nile Perch, introduced to Lake Victoria in the 1950s, for example, has been blamed for causing the extinction of several hundred native species, although it is a major source of income for lakeshore communities.

The database is available on CD-Rom, and focuses specifically on species used in aquaculture. It includes over 5 000 records of introductions of several hundred species produced via aquaculture.

The CD-Rom also includes a virtual library of reports and studies by FAO. For more information go to <http://www.fao.org/fi/default.asp>.

Bank prioritises water and sanitation

The African Development Bank, the lead development finance institution on the continent, has placed water and sanitation at the heart of Africa's sustainable development.

The bank has significantly increased water supply and sanitation financing, reaching over US\$330-million a year between 2003 and 2006. The main area of focus has been the poorest 65% of the population living in rural areas. Other areas of interest include sanitation in peri-urban areas and transboundary water resource management.

It is expected that the 2007 financing will be 50% more than 2006, both in terms of the number of countries supported and the volume of financing. A 70% increase in staffing was allocated in the 2007 budget to reinforce the capability of the department.



Water by numbers

- **R1-billion** – The funds needed to upgrade Cape Town's sewage treatment plants. According to Mayoral Committee member Lionel Roelf, most of the city's wastewater treatment plants are already operating near or beyond capacity.
- **2001** – The last time Lake St Lucia had an open passage to the sea. The latest breaching, which occurred in March, was expected to be good for the estuary ecologically as well as for tourism and community livelihoods.
- **R28-billion** – Total municipal debt in South Africa.
- **5** – The number of people killed when an earthen embankment around a sewage reservoir in Om-Al Nasser village in the northern Gaza Strip collapsed, sending a 'sewage tsunami' to surrounding villages.
- **780 Mℓ** – The volume of water Umgeni Water serves daily to its 400 000 customers.
- **5 000 m³** – The volume of water there would be available for each person if all the freshwater on the planet were divided equally among the global population.
- **8,9 billion** – The projected world population by 2050.
- **152** – The number of State dams in South Africa. The total storage capacity in these dams is 28 538 million m³.
- **1,2 billion** – The estimated number of people that live in areas of physical water scarcity, according to the UN. Another 500 million people are approaching this situation.
- **1 200** – The number of households in the Western Cape that have no access to basic sanitation facilities.
- **4%** – The percentage of its renewable freshwater resources that Africa uses.
- **200-million** – The estimated number of people who could become refugees as a result of droughts or floods brought on by climate change, according to the report by former World Bank economist Sir Nicholas Stern.
- **53,2%** – The present average level of Cape Town's dams, prompting the municipality to call on its citizens to use water sparingly.

Planning for bulk pipeline progresses



Construction of Umgeni Water's Richmond Bulk Pipeline is due to start later this year.

The multimillion Rand project, which was waiting for a final Record of Decision at the time of writing, will see the construction of 30 km of 600 mm-diameter steel pipeline from the France township, next to Thornville, along the R56 to Richmond. The pipeline route will follow the R56 Pietermaritzburg to Richmond Road and for the most part will be about 18 m from the centre line of the road. A new pump station will also be built.

The project is necessitated by the increase of population of Richmond and

surrounding areas in recent years, which is putting strain on the existing water supply infrastructure. It is believed that the new bulk water pipeline and pump station will enable new allocations and reallocation of water to meet present and future water needs of all sectors in the area.

At present, the Richmond municipality provides potable water to residents sourced from boreholes and dams. The new pipeline will source water from Umgeni Water's Midmar Dam and waterworks.

The pipeline is expected to be completed by 2008.

New water pipes for Alex and Sandton

A R22-million project to install a new water pipeline in Alexandra township and its affluent neighbour Sandton has been completed by Johannesburg Water.

The 6,7 km of 650 mm-diameter pipeline is expected to compliment the existing pipelines and will serve as an alternative water supply feed into these areas. The replacement of water infrastructure forms part of the city's attempt to provide Johannesburg with sufficient water and a proper sanitation system. The pipeline stretches from Randjeslaagte reservoir in Highlands North, east of Dunkeld and Illovo reservoir.

Firm expands bottled water foothold

JOSE-listed Lonrho Africa has established a new division Lonrho Springs, following its acquisition of the remaining 50% shares in bottled water company Swissta Holdings. Swissta, which has operations in Mozambique and the Democratic Republic of Congo, reportedly provides Lonrho with "invaluable access" to the African bottled water market, the group said in a note to shareholders. "It is also part of Lonrho's broader strategy to become a pan-African company, focused on investing in growth businesses that will make a difference to Africa by enhancing basic infrastructure to facilitate sustainable growth of the continent as a resources and business hub."

Study reports on cities' 'lost' water

Until water wastage in South Africa's cities and towns can be quantified accurately, it is impossible to develop and prioritise the actions that must be taken to ensure that water is used more effectively and efficiently in the country. To this end, the Water Research Commission (WRC) has completed a water loss study of 62 municipalities around the country.

Municipal water in South Africa has been under investigation for many years, with the Department of Water Affairs & Forestry (DWAf) attempting to establish the levels of wastage from all water supply systems countrywide. This has proven a difficult task due to the absence of reliable data in many municipalities as well as confusion regarding how such wastage should be estimated.

Over the last few years WRC has invested heavily in developing advanced and pragmatic tools and methodologies to quantify and assess water losses. In addition to analysing the performance indicators and determining the components of non-revenue water, during this project a methodology was developed to determine realistic water uses for the various areas based on the number of properties being served. Using the realistic uses combined with the actual bulk system input volumes, it was possible to estimate potential savings that each water services authority could expect should they attempt certain water demand management interventions.

Revealing details of the report during the opening of the National Water Conservation and Water Demand Indaba, held in March, DWAf Minister Lindiwe Hendricks said the losses (real and apparent) for the 62 systems analysed was estimated to be 623 million m³/annum or about 29% of the total water supplied. "This highlights a serious challenge,



and I am told that the situation is equally challenging internationally," she said.

The study highlighted the root causes, nature and extent of estimated water losses in the various water use categories. It found that in low-income areas, the greatest challenge to reducing non-revenue water was unbilled authorised consumption. This was generally due to the underestimation of water use in areas where tariffs were based on a 'deemed consumption' or assumed meter readings.

In medium- to high-income areas the greatest contribution to non-revenue water was real losses (i.e. physical leakage). The study therefore highlighted the importance of

undertaking active leakage control at regular intervals since metering, billing and payment in these areas are generally under control.

The extent of water losses, wastages and inefficient use of water is negatively affecting the ability of municipalities to provide sustainable services; conversely successful receipt of water income by municipalities could dramatically improve their financial position, noted Hendricks. "DWAf is, therefore, looking at how it can support municipalities to implement water conservation measures. To date, R45-million has been allocated to municipalities as part of a flagship project on water conservation and water demand management (WC/WDM) implementation."

It is envisaged that at least eight municipalities selected across various regions will receive this support in the coming year. The success of this pilot project will determine the benefits for DWAf in establishing a WC/WDM fund for municipalities.

Hendricks further noted that her department was in the process of developing a National Water Use Efficiency Information System to assist in monitoring the water use efficiency trends in the country at local, provincial and national scale to be able to identify areas of interventions. "This information system will play a critical role in creating a water saving South Africa, with a dedicated interactive educational tool for water users to learn and share information on efficient water use best practices and initiatives."

To order the WRC report (Report No TT 300/07), contact Publications at tel: 012 330-0340 or e-mail: orders@wrc.org.za

Diatoms – A New Dimension to Water Monitoring

There is more to the brown, slimy stuff covering rocks and plants in rivers, wetlands and estuaries than meets the eye. Diatoms, the microscopic algae found in almost all aquatic and semi-aquatic habitats, are playing an increasingly important role in the assessment and monitoring of the health of South Africa's water resources. Lani van Vuuren reports.

Diatoms are one of the most common types of phytoplankton. They are delicate unicellular organisms that have a yellow-brown chloroplast (rather than a green chloroplast colour) that enables them to photosynthesise.

Dr Bill Harding of DH Consulting, a phytoplankton ecologist, explains that the cell walls ('skeletons') of diatoms are made of silica, almost like a glass house. The construction of the cell wall, called the frustule, consists of two halves (known as 'valves') that fit into each other like a pill box. These valves are ornamented by a variety of other structures.

Diatoms were discovered shortly after the invention of the microscope. It is

reported that their varied shapes and beautiful ornamentation of their cell walls made the study of the diatoms and related siliceous organisms a favourite pursuit of the microscopical pioneers.

Interestingly, the frustules can persist in the environment long after the organisms have died. This attribute extends into fossil records and supports accurate historical and paleolimnological determinations of what conditions used to be like, making these algae a favourite tool of modern ecological and evolutionary researchers.

DIATOMS AND WATER QUALITY

Within the last two decades diatom indices have gained considerable

popularity throughout the world as a tool to provide an integrated reflection of water quality. Water quality assessment protocols based on the use of diatoms are well developed. For example, diatoms are now a mandatory component of the European Water Directive Monitoring.

Dr Harding explains that diatoms are primary producers located at the bottom of the food chain. Accordingly, their responses at this level (assemblages and type of species present, among others) reflect what is happening at the interface between the water they live in and the chemoautotrophic response. "A change in nutrients, salinity, pH or a number of other factors will allow some members of the diatom community to grow and

reproduce more quickly while others are outcompeted, thus the community composition as a whole changes in response to changes in environmental conditions." Up to 70% of what happens in the water quality can be reflected in diatom assemblages.

It is said that many aquatic systems being studied are not supported by good information on their water chemistries, and require fairly lengthy monitoring programmes to provide the same. One or two diatom samples per year can provide this. Unlike other biotic indices, diatom communities change in response to average water quality conditions rather than 'spikes' such as those brought on by pollution spills. They are also not washed away as easily as invertebrates, for example.

As Dr Harding points out, diatom indices can potentially be used in any river system. "Even ephemeral rivers may be monitored in dry periods as the diatom cells persist, and can be sampled after the river stops flowing."

COSMOPOLITAN SPECIES

Another interesting characteristic of diatoms is that even though there is a high degree of endemism, many species are cosmopolitan or 'multi-national'. This means that in many cases, environmental

conditions allow for the development of the same species in Europe as in Africa as in Australia and so forth. This is important as methodologies and results from these methodologies may be used to compare river systems across provinces, countries, and even continents.

"Unlike larger animals, diatoms cannot be re-located to a new river or propagated as part of captive breeding programmes."

Diatom-based monitoring has proved to be very useful in regions such as Europe to monitor shared rivers and water resources, reports Dr Jonathan Taylor of the School of Environmental Sciences & Development at North West University. This cosmopolitanism does have a down side, however. "Typically, when conditions are changed from those naturally prevailing, cosmopolitan species tolerant to pollution will become dominant in an assemblage. There are relatively few of these universal dominant species, but they occur all over the world, and will outcompete endemic species

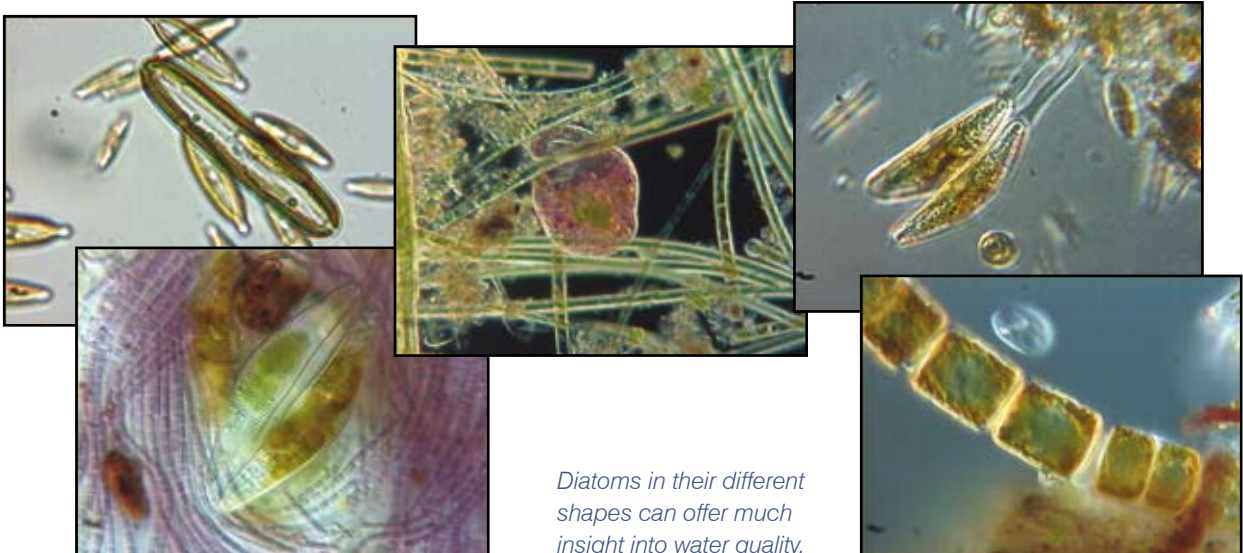
sensitive to pollution should conditions favour them," notes Dr Taylor.

This underlines the importance of conserving the integrity and health of water resources not only for larger aquatic species, such as fish, frogs and insects, but also for the tiny microorganisms that live in them. "Unlike larger animals, diatoms cannot be re-located to a new river or propagated as part of captive breeding programmes," stresses Dr Taylor.

DIATOM MONITORING IN SOUTH AFRICA

South Africa has a long and proud history of diatom research, mainly as a result of the work of pioneer diatom specialists such as the late Dr Bela Cholnoky. In fact, unbeknown to many, South Africa possesses one of the most comprehensive collections of diatoms in the world.

This substantial collection of documents, slides, unprocessed sample materials and various records and observations dates back to the 1950s. At present, it is housed at the offices of CSIR in Durban. This collection is considered of cardinal value, as it contains samples of diatoms from many rivers in South Africa prior to development, i.e. before the construction of weirs and dams.



Diatoms in their different shapes can offer much insight into water quality.



A thick layer of diatom cells attached to boulders.



Diatoms inhabiting sediments.

It is hoped that this collection, which has largely been gathering dust, will be properly curated and actively managed in the near future. "This is a vital national resource of biodiversity which needs to be housed where it can be brought into the electronic age and also continually developed," notes Dr Harding.

Despite this vast collection of knowledge in the country, the use of diatoms in South African water quality studies has been virtually non-existent, until recently. A possible reason for this has been the perceived difficulty in the use of diatoms for biomonitoring. To date, other biotic indices have been favoured for freshwater health monitoring, including fish, riparian vegetation and invertebrates. In addition, the study of diatoms remains a specialist field, and there are only a handful of experts in the country.

Significant advances in supporting methods and tools have been made in the last few years, however. These have rendered diatoms easier to use as a bio-indicator. Through funding from the Water Research Commission (WRC), an illustrated guide to some common diatom species in South Africa has been compiled by DH Environmental Consulting, in collaboration with KZN Aquatic Ecosystems and North West University.

There is also a stand-alone software-based taxonomic key to the diatom species most commonly encountered in South African rivers and streams. This is a hierarchical, interactive tool

that assists the user in learning more about diatoms and diatom taxonomy while seeking identification for an observed species.

In the last few years, indices developed in Europe and elsewhere have been tested in several South African river systems, and have been found useful in reflecting water quality and water quality impacts. In 2005, diatoms were successfully used for the first time as one of the biological indicators for the State of the Rivers Report on the Crocodile West/Marico catchments.

However, as Dr Taylor points out, some of the (possibly) endemic species found in South Africa are not included in international diatom indices. For this reason, diatom indices unique to South Africa are now being developed in a three-year WRC project. In addition, regional assessment using diatom indices are being planned for the Western Cape, KwaZulu-Natal and North West.

COMPARABLE TO THE BEST

According to Dr Harding, South Africa's diatom knowledge compares very well internationally. "We have come a long way within a very short time with a small group of eager and dedicated people." He reports that some of the tools produced are now being used as far afield as India and Peru – an indication of their cosmopolitan application.

Renewed interest in diatoms has awakened a wider recognition of the value of this technique such that it is

now being applied across entire river systems, in urban environments and in wetland assessments. Dr Harding notes, however, that the use of diatoms does not replace any of the other biotic indices, it simply augments them.

The lack of trained diatomologists remains a challenge. "We have some very capable people, our problem is that there are too few of them," says Dr Harding. "It is crucial that we inculcate a level of interest in this field of science such that we can attract young scientists with a career interest in working with diatoms and biomonitoring." The good news is that this year at least another four diatomologists will be trained.

It is believed that diatoms have a great future in South Africa. "As recognition grows I see it becoming a mainstay of aquatic ecosystem monitoring and assessment for rivers, wetlands and estuaries", concludes Dr Harding.

For further reading:

- *The South African Diatom Collection: An Appraisal and Overview of Needs and Opportunities* (WRC Report No TT 242/04)
- *A Methods Manual for the Collection, Preparation and Analysis of Diatom Samples* (WRC Report No TT 281/07)
- *An illustrated Guide to Some Common Diatom Species from South Africa* (WRC Report No TT282/07)

To order any of these reports, contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za





Project Sheds Light on Underground Water

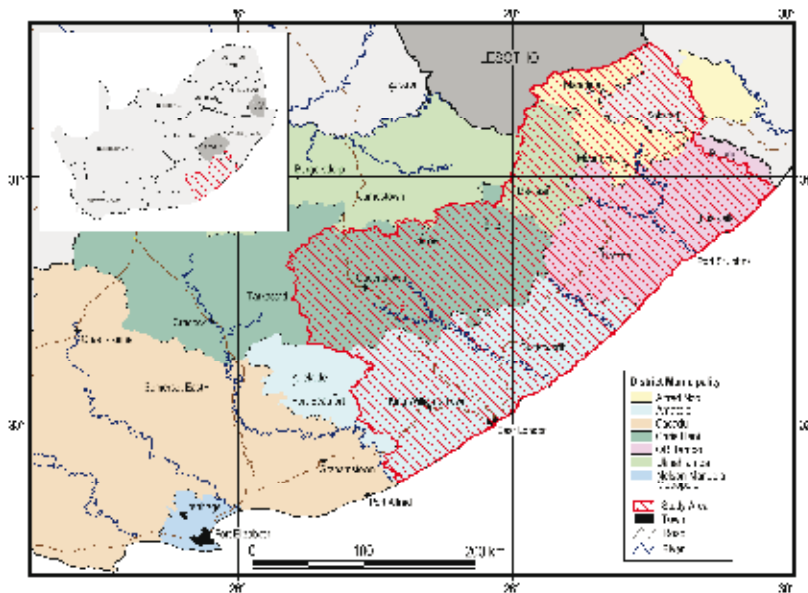
All photographs by Ricky Murray

Despite government's best efforts, lack of access to safe drinking water remains a reality for many South Africans, especially those in far-flung rural areas. Increasing the knowledge about the water resources surrounding these communities could go a long way in alleviating the problem, as one Water Research Commission (WRC) funded project demonstrates. Lani van Vuuren reports.

In the impoverished eastern regions of the Eastern Cape many communities remain without a sustainable potable water supply. Rural settlements are often dispersed and located in inaccessible terrain. It is reported that more than a third of the people in the province are without safe water and/or sanitation.

Most people in the region are dependent on groundwater from boreholes or springs for their domestic water supply. Often these boreholes have not been sited at the best places for groundwater, as the emphasis has rather been on finding sites close to villages that could be equipped with hand- or windpumps.

This can be attributed to the low basic water supply targets of the past (in the former Transkei and Ciskei especially), and to the lack of coordinated groundwater research undertaken in the eastern parts of the Eastern Cape to date. (Interestingly, almost all of the major groundwater research in the region has been



The study area.

funded by the WRC.) The reasons for this can mostly be traced back to the country's discriminatory past.

This means that there is still limited knowledge of the best sources of groundwater (both in terms of water quantity and quality), as well as the sustainability of groundwater resources in the area.

IDENTIFYING RESEARCH NEEDS

Recognising this need, the WRC appointed Groundwater Africa, SRK Consulting, Maluti GSM and the Council for Geoscience to jointly conduct a study aimed at identifying the present groundwater research needs in the eastern regions of the Eastern Cape. The research was focused specifically on the Eastern Karoo Basin, underlying the former Transkei and Ciskei.

Past research was taken into account, and the study considered the most important groundwater research projects completed to date. Officials from the Department of Water Affairs & Forestry (DWA) as well as a number of locally-based groundwater and engineering consultants were consulted.

But what does research have to do with supplying clean water to needy communities? "The goal of providing all the people in this area with at least a basic level of service means that higher yielding boreholes are required," explains project hydrogeologist Dr Ricky Murray. "The study area has substantial groundwater reserves that are largely untapped. The challenge is to not only access this water cost-effectively, but also

sustainably in a way that is not detrimental to the environment or the communities in the long term. One of the first steps in achieving this is attempting to understand the resource and establish how it works so that plans can be developed to access it."

“More than a third of the people in the province are without safe water and/or sanitation.”

It has been demonstrated that very high borehole yields can be obtained if the appropriate approach is used in siting them. "We need to establish all the potential high-yielding areas, and work out where it is best to drill in these areas," noted Dr Murray. "This requires thorough scientific investigation."

It appears that there is still very little knowledge of the vulnerability of aquifers in the area, and of baseline water quality. In addition, the environmental impact of groundwater use is not well understood. Current understanding of the relationship of



Queuing for water in a village near Queenstown.



Artesian borehole at Makhoba near Matatiele.



Gathering water from an unprotected spring near Cofimvaba.



Poorly sited borehole near a school pit latrine.

different aquifers to spring flow and base flow is undocumented and not considered in either surface water or groundwater management or regulatory decisions (As a result, it is impossible to determine the groundwater component of the Reserve with any accuracy at present).

KEY FINDINGS

The final WRC research report puts forward several preliminary points regarding research needs of the Eastern Karoo Basin. Firstly, it seems little research has been done in the eastern part of the basin, where most of the communities are located. Ironically, this is also the area where there is the greatest need for basic water and sanitation services. The coastal strip, in particular, with its large rural population, is poorly understood.

It was found that data on groundwater was not collected systematically in the past, and little is known about higher yielding Karoo boreholes (those yielding greater than 5 l/s). More investigation is also needed on geological structures such as fractured dolerite sills, ring complexes and dykes.

The presence and/or extent of deep-seated groundwater in the Eastern Karoo Basin remain largely unknown. Little is also known about groundwater sustainability (particularly

high-yielding boreholes), about the age and chemical characteristics of (particularly deeper) Karoo groundwater, or the effect of prolonged pumping on the environment, and about possible management options such as artificial recharge.

“We appreciate any research towards improving management of groundwater in the Eastern Cape, in support of our commitment to ensuring sustainable development of water resources.”

The relevant authorities have welcomed the results of the project. “We appreciate any research towards improving management of groundwater in the Eastern Cape, in support of our commitment to ensuring sustainable development of water resources,” said Zolile Keke, Director: Water Resources for DWAF in the Eastern Cape. “Groundwater has the potential to contribute to the growth and development of the region and is uniquely suitable to the circumstances of the demographic, economics and socio-political context.”

Dr Murray believes the necessary technical and scientific backup exists

to be able to conduct the necessary research in the area and answer some of the needs identified in the report. “Large-scale research will be the catalyst for developing local research skills.”

Based on the findings of this project, another WRC funded research project has been launched to investigate flow conceptualisation, recharge and storativity in Karoo aquifers. The emphasis is specifically on aquifers falling within the Eastern Cape (Mzimvubu to Keiskamma water management area) and KwaZulu-Natal (Mvoti to Umzimkulu water management area).

DWAF is providing the drilling support for this project. It is envisaged that this project will be completed in 2009.

“There is a substantial knowledge base in the eastern parts of the Eastern Cape,” noted Dr Murray. “But as in many areas where the need to meet basic needs is so high, little time is given to trying new things, to exploring alternative ways of doing things. An investment in research creates that opportunity.”

- The WRC Report (No TT 286/06) is available. Contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za 

UP Water Experts Unite Under One Umbrella

The University of Pretoria (UP) has created a united front in the form of its new Water Institute to tackle capacity and research problems towards more sustainable use of Africa's water resources. Lani van Vuuren reports.

South Africa, and the continent, faces tremendous water challenges, not the least of which is a lack of skilled people to ensure sustainable access to clean water and safe sanitation to the millions that are still going without. Capacity building through research is a crucial building block not only for the supply of basic services, but also to ensure the sustainable use of water for growth and development.

UP has a well proven record in water research and education across several disciplines, and the tertiary institution has already contributed significantly towards building capacity in the sector. During the past

decade, more than 40 highly qualified internationally recognised researchers and their students completed many successful research projects related to water supply, sanitation and integrated water resource management, providing state-of-the-art technology to the water sector.

STRENGTH IN NUMBERS

However, this research was historically undertaken largely in isolation within several faculties, creating the potential for duplication and gaps. Calls for a more cohesive and concerted level of organisation to give impetus to the university's water focus area led to the formation of the

UP Water Institute (UPWI). "By working together as a team, the university's water experts are able to meet the challenges with which they are faced in a more coordinated fashion than they would have been able to do individually," explains Prof Eugene Cloete, Head of the Department of Microbiology & Plant Pathology, who leads the institute.

The institute was officially opened in March in a ceremony attended by guests from at least ten countries. Prof Cloete says the UPWI has been welcomed by the international water community. "A coordinated research and education effort such as this has been lacking in the water sector, not

only in South Africa, but in Africa, as a whole in recent years.”

Apart from building further on existing relationships with organisations such as the Georgia Institute of Technology in Atlanta, in the US, the UPWI has received calls of interest from the International Water Association and the US National Academy of Science, among others. It also hopes to unite forces with other local institutions to tackle South African specific water challenges (already UP is a founding partner with CSIR of the Southern Education and Research Alliance or SERA, for example). The private sector has not been left out. “Industry is more than a client, it must play a crucial partnership role in finding answers to the country’s water challenges,” says Prof Cloete.

The UPWI’s network of water professionals brings together six faculties, including engineering, natural and agricultural sciences, law, human and health sciences, and veterinary science, covering all facets of the water cycle. The institute conducts research in five main areas, namely water and health, water treatment and supply systems, water agriculture and biodiversity, water flow in the environment, and water-related decision-making, policy and governance. “The institute’s strength lies in its multidisciplinary approach to water sector challenges, and the high degree of expertise among personnel,” reports Prof Cloete.

WATER AND HEALTH

UPWI is conducting several research projects aimed at unravelling the links between water and health. These can be grouped into three main focus areas, namely waterborne bacteria (including bacteria pathogens and cyanobacteria), waterborne viruses, and endocrine disruptors (EDCs). Research projects include the development of low-cost water purification techniques, investigations into the potential effects of EDCs on animal

and human health, and developing improved techniques to recover viruses from environmental samples.

With regards to the latter, an important aspect of virological research at UP has been the application of molecular techniques to verify the reliability of cell culture identification procedures in the South African context. Research undertaken at the university offers the first comprehensive view of the virological quality of drinking water supplies in South Africa.

WATER TREATMENT

Research undertaken through UPWI concerning water treatment and supply systems focuses on the purification of water, the disposal of wastewater and the transport and distribution of water to and from users.

With regards to water purification, research activities include seeking ways to control fouling in filters and membranes as well as the development of techniques to reduce high fluoride and nitrate in borehole water. Another aspect of research on water purification is identifying the chemicals responsible for health risks or unpleasant flavours and odours so that appropriate steps can be taken to remove or neutralise them. Improved methods for seawater desalination are also being developed.

In turn, wastewater management research includes investigations into the use of soil filters in reeds to filter wastewater from roadside filling stations and rest stops, as well as the development of an integrated passive system for the treatment of mine wastewater.

WATER, AGRICULTURE AND BIODIVERSITY

Irrigation and agricultural use of groundwater are two important research areas for the UPWI. Human interference with watercourses

through, for example, pollution and the construction of dams and weirs, is a major factor responsible for the threat to biodiversity. Thus another research focus area is aimed at assessing and mitigating this impact.


WATER FLOW AND THE ENVIRONMENT

A number of scientists affiliated with the UPWI are engaged in research on weather forecasting and climate change. A routine weather prediction system focusing on short-term forecasting has already been developed. Research also continues into predicting heavy rainfall from tropical weather systems to improve timely warning of floods.

Other projects include research on the movement of water in rivers and the evolution of river systems over time, as well as research on the characterisation of aquifer structures.

WATER-RELATED DECISION-MAKING, POLICY AND GOVERNANCE

The UPWI hosts a number of research initiatives concerned with water-related decision-making, policy and governance. There are three main focus areas, namely environmental, economic and social linkages; policy and legislation; and capacity building and dispute resolution.

“With the establishment of the UPWI will come a lasting mechanism for the continuous development of technical professionals, facilitated by the provision of valuable services, the generation of new knowledge through research and the creation of human resources needed for government agencies, regional and national water resource centres, industry and academia,” notes Prof Cloete. “This institute has the potential to be a leading research and education organisation, and a real asset to South Africa.” 

Communicating Science: Mission Impossible?



Professional information providers often wonder whether and how their work finds its way to political level decision-making. Nikki Funke and Ernita van Wyk from CSIR Natural Resources & the Environment provide some insights.

Water resource and other environmental and related social issues have become so complex that there is increasing pressure for science to serve society via the decision-making needs of elected officials. But how is this to be achieved, especially when we perceive the scientific and political worlds to be divergent in terminology, values and objectives?

For the most part, scientists do not make much of an effort to communicate their findings to politicians. When scientists do communicate with government, their attempts are

often limited to providing politicians with complicated scientific reports. These are sometimes incomprehensible to non-specialists and may not be user friendly or adequately integrated for decision-making. Thus, while scientists do try to communicate sometimes, they tend to make assumptions about the palatability of their products to a political recipient.

The apparently obvious answer to this problem would be for scientists to package their information more effectively. While this seems to be sound reasoning, attractive, glossy, easy-to-read reports have

unfortunately not always made a significant impact at the political level. So, for example, important initiatives such as the River Health Programme have been presented to political decision-makers with much effort, yet have reportedly not had the desired impact in terms of being internalised into political policy- and decision-making processes.

Given this situation, how can South African scientists make a bigger impact at the political level, over and above appropriate packaging of scientific products? While this is a complex problem with many

elements that need to be analysed in more detail, preliminary research has shown that part of the solution may be a combination of more effective communication techniques and relationship-building between scientists and politicians.

WHO SHOULD COMMUNICATE SCIENCE?

The scientific community needs to understand the political workings of different government departments and how to best communicate its findings if it wants successful science communication to take place. The question is whether *scientists* are the best people to be doing the communicating and liaising with government.

Natural scientists, especially often seem to have trouble with translating the every-day jargon they deal with into terminology that is understandable to non-scientists. Also, many of them have more than enough to do by focusing on their research and simply do not have the time or motivation to try and “sell” their work to politicians as well.

It might therefore be good to employ a number of “integrators” at scientific organisations, in other words, people who understand the mindsets and goals of both natural scientists and politicians and will thus be able to mediate and provide a “messaging service” between the two groups. Such integrators would need to have a good basic grasp of the science they want to communicate and, at the same time, have a thorough understanding of the political process and how to effectively feed into it. The advantages of making use of integrators are that translating scientific language into non-scientific language and communicating and relationship-building would form part of these specialists’ full-time job descriptions – thereby relieving many scientists of a sometimes unwelcome burden.

While integrators could therefore play an important role in bridging the science-politics divide, there is also a case to be made for individual scientists who are interested in communicating their science to politicians or even building professional relationships with the latter. Such a situation also has its advantages because it enables politicians to interact directly with scientists without having to deal with an intermediary first.

Whoever ends up doing the communicating needs to keep in mind a few important points when addressing or interacting with politicians.

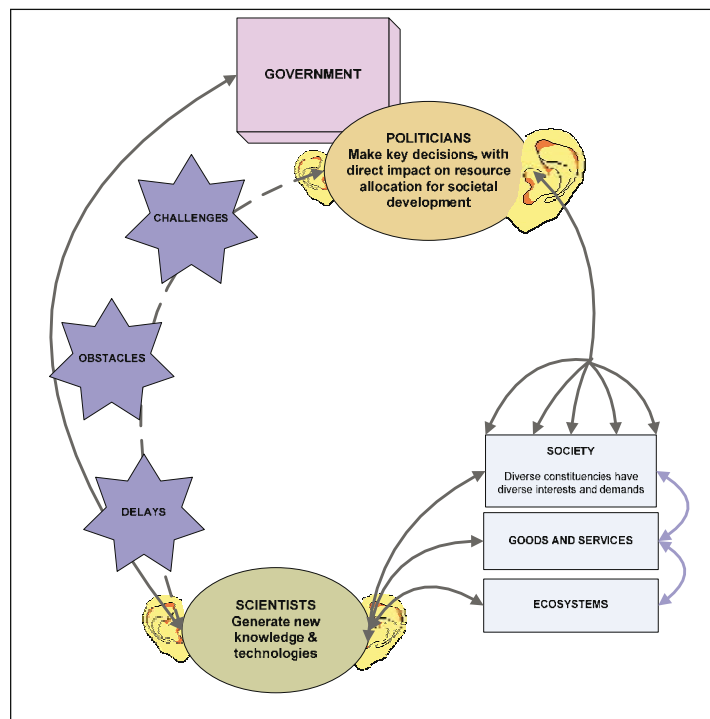
WHAT IS THE MESSAGE?

When communicating to politicians, scientists need to be clear about the nature of the message they want to convey. One tactic is to inspire fear or a notion of high risk in politicians regarding a particular issue to try to bring about a change in their thinking and perhaps even their behaviour. Another tactic is simply to present them with important information.

Government reportedly responds well to two communication tactics: “fear” or “fact”. The first tactic involves scientists informing politicians of the consequences that will ensue if they do not actively try to address a particular problem, for example, climate change. When presenting information in this way, scientists should make use of scenarios to show politicians what might happen if no effort is made to solve the problem at hand.

The second tactic is less threatening, and merely informs politicians of particular research initiatives in a factual yet accessible manner. Here it is important for scientists to grasp their audience’s attention by presenting their research in a way that will ensure their listeners are interested.

Scientists need to be aware of when it is appropriate to use which tactic and need to present their information accordingly. In addition, they also need to take care not to dispute each other’s findings in public if they want to successfully communicate their research to politicians.



The science-decision making communication loop.



Information needs to be packaged correctly for decision-makers to find it useful.

A lack in agreement could create the impression of disunity and could also convey the message that scientists are not sufficiently confident about the work they are producing.

WHERE TO COMMUNICATE THE MESSAGE

Scientists could use several approaches to effectively communicate their research to politicians. This might subsequently increase the chances of their research being understood and internalised by those in power.

Firstly, they could brief politicians on the research they are currently doing by hosting seminars or round-table discussions.

Secondly, scientists could invite politicians to their organisations to look at some of the projects they are working on. A demonstration of how technologies such as water purification systems function is particularly effective as this is a clear and tangible example of how science can help improve the lives of ordinary people. By supporting such technologies politicians would be seen to be endorsing important products that have the potential of changing the lives of many South Africans.

This, of course, would also be of benefit to their political careers. Politicians are reportedly also fond of public 'ribbon-cutting' opportunities,

which make them feel that their status and power are being acknowledged by the scientific community and also serve to make them feel more personally involved in particular projects.

Thirdly, scientists could try to make an impact at high profile events, such as the annual Stockholm World Water Week, by raising some of the key issues they feel need to be researched. Politicians are sensitive to the issues discussed at such events and are likely to take notice of new ideas and priorities, specifically those they deem of high social and political importance.

Fourthly, learning alliances could be formed between scientists and politicians as they may provide an ideal forum for these two groups of people to learn more about each other's worlds and to learn to communicate with each other more effectively. These alliances are an effective way of bringing together people with differing opinions and of getting them to agree on certain commonalities to solve existing problems.

Finally, scientific organisations could host knowledge fairs and invite scientists, members of the public and politicians. Such fairs should be made fun and informative and are an ideal place for scientists to communicate their research in an informal way while simultaneously encouraging visitors to provide them with feedback.

HOW TO BEST GET THE MESSAGE ACROSS

Here are some useful tips for scientists doing oral presentations to politicians:

- ◆ Use minimal text on slides when doing Power Point presentations. This makes it more likely that the audience will listen to you rather than try to take in large amounts of information presented to them on the slides.

- ◆ Be excited and passionate about what you are presenting. This has a contagious effect on the audience, who are likely to become excited about your presentation too.

- ◆ Think of an appealing name for your concept: something that is striking and easy to remember. Also explain the concept's functioning and relevance in short, simple and concise sentences to make politicians feel they are capable of mastering the science you are communicating to them.

- ◆ Learn to link the scientific concepts you are presenting to ideas that are important and relevant to politicians, for example, development, equity and redress. It may help to consult recent political speeches – often posted on departmental websites – to determine which terminology is currently widely used in government circles.

- ◆ Make use of many visuals (maps or graphics). Also, if possible, include photographs of yourself being involved in making science work for society, for example, by participating in a community development project. This shows politicians that you, as a scientist, are committed to changing the lives of ordinary people, something which they see as very important.

- ◆ Build trust between yourself and your audience. Find that which you have in common to illustrate your ideas. Also, while you might be the "expert" on the topic, try not to talk down to you audience (i.e. lecture style). Rather engage in a conversation where they might feel confident enough to ask questions, even the silly ones.

The points mentioned above are practical tips that scientists can employ when communicating their research to politicians. It is probably advisable, however, that they be employed within the context of a science organisation's official

communication strategy, rather than on an *ad hoc* basis, if they are to effectively contribute to scientists' efforts to influence politicians. In many cases, it has proven worthwhile for scientists to do more than merely communicate their findings, but try and impact on decision-making processes by building lasting relationships with politicians.

BEYOND COMMUNICATION

A number of tips can be given to scientists on how to build on their interpersonal relationships with politicians:

- ◆ Identify some interests you might have in common with government officials, and use these to get to know them better on a professional level.
- ◆ Build a web of relationships. This will ensure that when people and positions shift, contacts will not



Ribbon-cutting events and workshops can be a good way of sharing information.

necessarily be lost, but instead influence will be gained regardless of where people move to.

- ◆ Choose carefully which politician/s you want to build a professional relationship/s with. What is important here is that this person should be someone with both *will* and *means* to help

you achieve maximum impact.

Communicating science effectively to politicians and making sure it is integrated into both policy and political decision-making is of the utmost importance if scientific research is to make a tangible difference to the lives of ordinary South Africans. 

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Minister Lindiwe Hendricks at the launch of the new book on water governance.

New Book Pushes Good Water Governance

*A new handbook on good water governance has officially been launched by Minister of Water Affairs & Forestry Lindiwe Hendricks. The book, **Governance as a Triologue: Government-Society-Science in Transition**, was compiled by researchers from CSIR and published by Springer-Verlag and IWM.*

explained Hendricks. "The over-riding goals of our policy became integrated water resource management and the establishment of equity in resource distribution, and efficiency and sustainability in water use."

Following a dramatic change in their political environment, South Africans now have a constitutional right to water. "South Africans are fortunate in that the central concepts of social equity and the right to a healthy environment are entrenched in the country's constitution," noted Dr Anthony Turton co-author and water resource governance systems research leader.

IMPLEMENTING LEGISLATION

He added, however, that the country still had a long way to go. "Despite the highly desirable attributes of landmark pieces of legislation, including the National Water Act and the Environmental Management Act, both of which are based on principles of sustainable development – authorities are still struggling to implement the requirements of these acts."

Investigation into possible reasons for non-implementation of legislation and government tools revealed a gap in the understanding of governance as a

Launched on World Water Day (22 March), the book shares how trends leading to a worsening global water crisis can be reversed through good water governance – one of the main contributors to water delivery failures. Using case studies from South Africa, North America, and global institutions, it shows how legal, social, institutional and political viewpoints are reflected in how we govern.

According to Hendricks, the consequence of good water governance, or lack thereof, can clearly be seen throughout South Africa's history. "The historical allocation of water resources in South Africa led to huge

inequality between people of different racial groups. The 1996 census, for example, found that 97% of white-headed households had water piped to their houses, compared to 26,7% of black households. Thus the necessity for South Africa to overhaul its governance structures and water allocations was clear."

Part of the inequality in allocations was related to the way in which the apartheid State allocated water rights; the spatial development of cities; and the institutional arrangements governing water allocation and distribution. Consequently, one of the drivers of the country's transformation was the need to transform institutions,

concept. According to this research, governance has still not been fully explored and defined.

In an attempt to rectify this situation, CSIR organised an international symposium on ecosystem governance in 2005 with the aim of engaging specialists from various disciplines in exchanging ideas on unpacking the 'black box' of governance. There, delegates shared knowledge and exchanged ideas on specific elements of the proposed governance trialogue model, which comprises processes relating to science, government and society.

CSIR researcher Hanlie Hattingh explained that water governance requires effective interfaces between three processes, namely an interface between society and science, between government and society, and between government and science. "These interfaces have to be appropriately balanced and available in the right format, at the right time, to ensure good governance."

Turton and Hattingh were joined by CSIR researchers Dr Marius Claassen, Gillian Maree, Dr Dirk Roux, and Wilma Strydom in editing the book. Prof Asit Biswas, the current Stockholm Water Prize Laureate, who is also Editor-in-Chief of the International Journal of Water Resource Development, along with the Editor-in-Chief of Water Policy, Dr Jerome

Delli Priscoli, are credited for having had a profound influence on the book.

It is reported that the symposium assisted in



Good governance is essential to sustainable water supply.

“South Africans are fortunate in that the central concepts of social equity and the right to a healthy environment are entrenched in the country’s constitution.”

developing a deeper understanding of the variables, enabling a better understanding of what was needed to promote good governance. The discussions formed the basis of the *Governance* book.


NEW DEFINITION OF GOVERNANCE

The book is divided into three sections, each detailed in certain aspects of governance. The first section provides an overview of governance and, importantly, how governance is linked to social and ecological sustainability. In turn, the second section interrogates the applicability and validity of the Trialogue model to real-world ecosystem problems. Cross-cutting issues of science communication, knowledge management, learning and issues of power are dealt with in the final part of the book.

The book concludes with a new definition of water governance, namely

that water governance is the process of informed decision-making that enables trade-offs between competing users of a given resource so as to balance protection with beneficial use in such a way as to mitigate conflict, enhance equity, ensure sustainability and hold officials accountable.

“This definition recognises the importance of how decisions are made and who makes these decisions so that we are able to use our natural resources to address the pressing needs of our society, while at the same time balancing these demands with the need to protect our resources as the heritage of future generations,” reported Hendricks. “A major challenge is doing this in an equitable and sustainable manner for continued growth and transformation in South Africa and internationally.”

In providing a way forward to good water governance, the book suggests a number of approaches. These include comparative analyses of different countries, institutional contexts and institutional reactions that provide valuable insights into related problems that exist in diverse societies. “We need, therefore, to look closely at institutional interactions, at organisational cultures and at the transformation into knowledge,” noted Turton. “We need to study in more detail the move from government to governance.” 



Africa's Largest Fish Collection is Moving

The largest collection of fish specimens on the continent, comprising 880 000 specimens, is moving to its new multimillion Rand facility, in Grahamstown.



South African Institute for Aquatic Biodiversity Managing Director Prof Paul Skelton in front of the new National Fish Collection facility.

All photographs courtesy of SAIAB

The National Fish Collection, developed and managed by the South African Institute for Aquatic Biodiversity (SAIAB), houses the largest collection of southern African fish anywhere in the world. It is the largest fish collection in Africa and the second largest in the Southern Hemisphere.

The collection serves mainly as a reference for scientists to study the identification and conservation of the region's fish biodiversity. Specimens are loaned to researchers based at SAIAB as well as the broader South African and international research communities. Selected specimens are used extensively for education, providing a fascinating insight into how scientists develop our understanding of the region's diverse fish fauna.

The collection spans over 140 years of collecting, with records revealing the oldest specimen dating back to the 1860s. There are specimens from about 170 countries. With ongoing research, exploration and new genetic techniques, more species are being added all the time. Some of the specimens were received as gifts or exchanges from other research organisations and museums.

In addition to alcohol-preserved wet specimens, the National Fish Collection contains cleared and stained fish cartilage and bones, a dry skeletal collection, frozen tissue for genetic research, microscopic slides, X-ray plates, photographic slides, paintings and scientific drawings and illustrations.

Some treasures found in the collection include the first six-gill stingray known to science. The collection also boasts one of the largest collections of coelacanth specimens in the world. Unique to the collection is an albino great white shark, caught by a local fisherman at Boknes, on the Eastern Cape coast.

This continuous growth of the collection was one of the main reasons for the construction of a new, state-of-the-art, two-story facility next to the SAIAB building. The size of the collection had simply outgrown the former storage area.

Another concern was the occupational health and safety of SAIAB staff and visitors – the preservatives in which the specimens are stored are volatile and flammable. The new facility boasts double-thick walls, with metal-slatted windows which can open quickly in the case of a sudden build-up of fumes, while the ventilation system kicks in with a heavy blast to clear the air. The entire collection will be held on four kilometres of mobile shelving.

“This new facility will play a critical role in safeguarding this national asset,” said SAIAB managing director Prof Paul Skelton. “The investment is a clear statement by the institute’s parent organisation, the National Research Foundation and the South African government that our natural heritage matters and will be looked after.”

“The National Fish Collection is a uniquely valuable and irreplaceable research and reference tool It is also an invaluable record of the past, and represents both a national and international asset.”

The collection is now being moved from its current resting place in the basement of the institute to the new facility, which was officially opened by Department of Science & Technology (DST) Deputy Minister Derek Hanekom earlier this year.

Over 78 800 individual lots are being checked, rearranged according to bottle size and catalogue number,




Prof Paul Skelton and Deputy Minister of Science & Technology Derek Hanekom raise their glasses to the new facility.

and their label data reviewed. Each bottle is then packed in preparation for the move, which is expected to take several months.

The launch of the SAIAB Information Portal coincided with the opening of the fish collection facility. The information portal is a way of communicating SAIAB’s biodiversity- and scientific information directly and simply from its database.

In addition to online images of, and specimen information about, southern African fishes (as well as fishes from elsewhere), the portal offers online GIS maps of southern African freshwater fish distributions, as well as the opportunity to learn about fish classification and identification through the use of online taxonomic keys.

“The National Fish Collection is a uniquely valuable and irreplaceable research and reference tool,” said DST in a statement. “It is also an invaluable record of the past, and represents both a national and international asset.” 

Right: Jerraleigh Kruger lifts a specimen from one of the large storage tanks.



Every year, International Water Day is celebrated on 22 March. This year, the theme was 'Coping with Water Scarcity'.

When we think of water scarcity, we usually think of drought, especially in a country such as South Africa, which remains one of the 30 driest countries in the world. But the lack of rain is only one reason why people might not have enough water.

WHAT IS THE DIFFERENCE BETWEEN WATER SCARCITY AND DROUGHT?

While arid and drought-stricken areas suffer the most, people everywhere can be affected by water scarcity, even those living in areas with plenty of rainfall or freshwater. Water scarcity occurs when the ways in which we use and distribute water cannot fully meet the demand from households, farms, industry and the environment.

Global water use is increasing at more than twice the rate of population

growth and more people than ever are learning first hand about coping with water scarcity. While three-quarters of the Earth is covered by water, only a small fraction of it is available as freshwater. In addition, this water is spread unevenly, in other words, some areas

might have more freshwater while others have less.

WHAT CAUSES WATER SCARCITY?

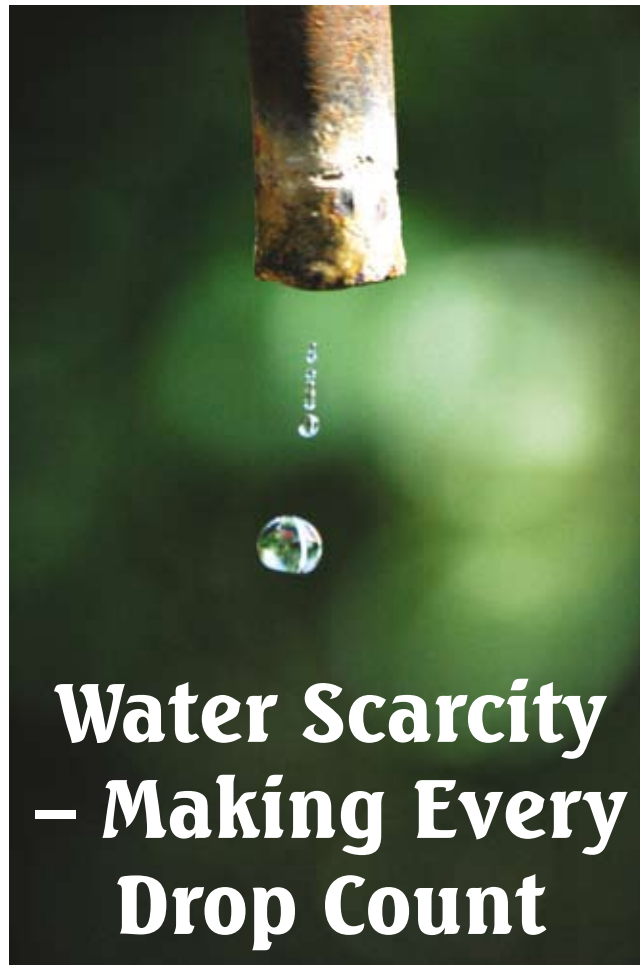
Anything that causes water shortages, contaminates freshwater supplies, damages the facilities that carry water to people, or keeps significant numbers of people from receiving clean water can lead to water scarcity. Major factors include drought, a lack of water near people's homes, high water tariffs, and the overuse of lakes, waterways and aquifers. Other causes range from flooding to poorly-placed dams.

Even climate change is said to increase water scarcity in some areas. Many experts point to the rising level of the Earth's seas, the rapid melting of glaciers, the frequency and ferocity of hurricanes, floods and drought as

consequences of climate change. All of these can threaten the amount or safety of a community's water supply, as they destroy crops, contaminate freshwater bodies and damage water facilities.

In South Africa, a number of factors, ranging from poverty and a subsequent lack of access to potable water to increased demand for water from industry and mining, are stressing the water system. This poses a challenge to public health, agriculture (food production), and the environment. This is in addition to the country's physical water scarcity (i.e. South Africa generally receives less than 500 mm of rain a year compared to the world average of 860 mm a year).

Through various programmes, the government, mainly through the



Water Scarcity – Making Every Drop Count



Courtesy SA Tourism

South Africa, with its erratic rainfall, is prone to water scarcity.



The exponential growth of cities around the world can lead to water scarcity.

Department of Water Affairs & Forestry, has made much progress in bringing clean water to even the country's poorest citizens. These initiatives include the Masimbambane and Water Reallocation programmes, which aims to make water available to communities for domestic (such as drinking) and productive (such as farming) purposes. The country remains on track to meet the United Nations Millennium Development Goals of halving the proportion of people without access to safe water by 2015.

At the same time, stricter regulations have been instituted for issuing permits to use water. Other issues being addressed include increasing urbanisation, industry and the continued need for irrigation.

WEBSITES

- www.worldwaterday07.org
- www.unwater.org
- www.unesco.org/water/wwap/wwdr2/

SHOULD PEOPLE MOVE TO URBAN AREAS TO GET BETTER ACCESS TO WATER?

Living in a town or city is no guarantee of access to water. Many people, especially the poor who come from rural areas, end up living in informal townships where they often have to share communal standpipes. Those who don't have access to piped water often have to purchase water from private vendors at a high price. Water supplies are also threatened by urban pollution such as sewage spills, storm-water runoff and wastewater from industries.

WHY SHOULD PEOPLE GET INVOLVED IN THIS ISSUE?

Water scarcity already affects every continent and more than 40% of the people on our planet. The situation is being made more acute by population growth, urbanisation and the increases in domestic and industrial water use by people who live in more developed areas. Water is intricately linked to every aspect of our lives. We need to improve the use of the world's water and to protect the environment.

WHAT CAN I DO?

Actively support government, non-governmental organisations, private foundations and companies which make it a priority to conserve, recycle and protect water resources, and deliver affordable water to people at every level of the community. Do your part to use water more efficiently, reduce pollution and protect the environment. Support funding initiatives that help to make these objectives possible. Everyone needs water and everyone needs to take responsibility.

HELP FOR TEACHERS

In support for learning and teaching about water and water-related issues, the Water Research Commission and Share-Net (a project of the Wildlife and Environment Society of South Africa) have developed a series of lesson plans on water.

These lesson plan packs, from Grade R to Grade 10, are linked to the national curriculum. Each pack contains five lessons, with each lesson focusing on a different learning area – these can either be used as they are, or adapted to suit the local context. Each lesson is concluded with a rubric of criteria to assess the learners. Learning Outcomes and Assessment Standards covered during each lesson are given in the summary at the beginning of the pack.

The lesson packs can be downloaded from www.environmentalrolelearn.org.za or www.wrc.org.za. Alternatively, contact Share-Net at Tel: (033) 330-3931; Fax: (033) 330-4576; E-mail: sharenet@future.net.co.za

Water Engineers of the Future

High school learners from around the country again assembled at the Sci-Bono Discovery Centre in Newtown, Gauteng, to participate in the finals of the Schools Water Competition, sponsored jointly by Rand Water and the South African Institution of Civil Engineering (SAICE).

The teams were tasked to design a model water distribution network to distribute three litres of water equally

between three points on a grid using two different pipe diameters. They were then judged on how well they execute the task. The learners were allowed three tries in one hour. A total of R15 000 worth of prize-money was up for grabs.

According to SAICE, the competition exposes learners to the practical application of processes that influence 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 delivery of clean water to households.

As part of the competition the water cycle was explained to the learners. Several other issues such as the need to pay for water, the requirement for dams, the distribution of water through water boards to municipalities and then to users, as well as the conservation of water were also discussed.



Above: Learners from Isolesizwe High School, in Matubatuba, KwaZulu-Natal, grabbed first place with 70 penalty points, the best result since the competition was launched in 2003.



Above: The learners from Wittedrift Hoërskool outside Plettenberg Bay, in the Western Cape, were third with 130 penalty points.

Left: The team from Lofentse Girls High School in Soweto were in second place with 120 penalty points.



REGIONAL MASTER DEGREE PROGRAMME IN INTEGRATED WATER RESOURCES MANAGEMENT 2008

Applications are herewith invited for admission to the regional Master Programme in Integrated Water Resources Management to be hosted by the six universities in the region.

Structure of the Programme

The programme comprises a compulsory core (consisting of 6 modules), followed by a specialisation (consisting of three modules) and 2 electives. A preparation module is also available to strengthen English skills especially for applicants from non-English speaking countries.

Preparation Module	Specialisations (3 modules)					
English for Water Managers						
Core Modules (6 modules)						
University of Zimbabwe University of Dar es Salaam Principles of IWRM Principles of Hydrology Socio-Economics and Environmental Resources Aquatic Ecology and Environmental Management Policies, Laws and Institutions Project	University of Zimbabwe <i>Water Resource Management</i>	University of Malawi <i>Water and Environment</i>	University of Dar es Salaam <i>Hydrology</i>	Polytechnic of Namibia <i>Water for People</i>	University of Western Cape <i>Water for Society</i>	University of Botswana <i>Water and Land</i>
	Water Resource Analysis and Planning	Environmental Impact Assessment	Hydrogeology	Water Supply and Sanitation	Water and Security	Agricultural Water Management
	Catchment Management	Water Quality Management	Remote Sensing and GIS	Utility Management	Environmental Education	Wetlands, Ecology and Management
	GIS and Database Management	Environmental Water Requirements	River Engineering	Waste Water Management	Water and Development	Catchment Management
Electives (2 modules)						
Depending on Availability						
Dissertation Research Project						

Entry requirements

Participants are required to have at least a good first degree at Bachelor level (BA or BSc). The candidate should be able to show an orientation of his/her field of study into water related issues. Professional experience in relevant fields is an added advantage.

Start of Programme

Programme starts in February 2008 at the two core host institutions.

Financial Assistance

WaterNet offers a limited number of scholarships on a competitive basis for SADC nationals including Uganda and Kenya.

How to Apply

Complete the application form in full. Applicants should also provide all documents requested on the form. Incomplete applications will not be considered.

Submit the application in electronic form to waternet@waternetonline.org or in hardcopy to WaterNet, PO Box MP 600 Mount Pleasant, Harare, Zimbabwe. Applications should reach WaterNet on or before 31 August 2007.

Only the successful applicants will be contacted. If you have not been contacted by end of December 2007, please consider your application unsuccessful.

For any further information, please contact WaterNet Secretariat

T: +263-4-333248 or 336725

F: +263-4-336740

E: waternet@waternetonline.org

I: www.waternetonline.org



Water Research Commission

Invests in the creation, dissemination and application of knowledge in five Key Strategic Areas (KSAs)

KSA 5 Water-Centred Knowledge

KSA 1 Water Resource Management



KSA 2 Water-Linked Ecosystems

KSA 3 Water Use and Waste Management

KSA 4 Water Utilisation in Agriculture

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