THE WATER WHEEL

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STORM-WATER: Urban health threat

AQUA-CULTURE: Farming fish for food

University of Pretoria presents

Water Engineering Course
7 - 8 July 2005

Free Surface Flow Modeling

COURSE DETAILS

The course will be presented by Prof. SJ (Fanie) van Vuuren and it focuses on the basic theory and practical applications of free surface flow modeling. The course has been structured over 2 days in which the basic theory of free surface flow; energy, momentum and continuity as well as the use of the public domain widely used free software HEC-RAS will be demonstrated and applied to solve practical problems. The HEC-RAS River Analysis System Software will be demonstrated for one-dimensional hydraulic calculations for steady flow, unsteady flow and dam break analysis. Practical sessions have also been included in which the participants will be familiarised with the use of the software. This course will be preceded by a three day PCSWMM workshop that is arranged by University of Cape Town.

WHO SHOULD ATTEND?

The discussions and demonstrations of the use of the HEC-RAS software in solving practical problems, will assist all persons that are involved in the design of hydraulic structures, free surface flow modeling, flood line calculations and drainage design.

COST OF COURSE

In the table below different options are offered:
- Firstly there is a discount for persons who attend the entire course.
- Secondly there is a discount for organisations that send more than 3 persons to the course.

Delegates must clearly indicate for which day/s they want to enrol -

DAY 1 - Free Surface Flow and Modeling
or
DAY 2 - Free Surface Flow and Structure

Option	Fee Structure	Day 1	Day 2	Total/participant
1	Normal daily fee	R 1250	R 1250	As indicated/day
2	Attending both days of the course	Discount of R 100/day		R 2 300
3	Organisations sending more than 3 participants to the entire course (2 days).	Discount of R 500/ participant		R 2 000

Graduate Centre, University of Pretoria

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South Africa's Rivers Threatened

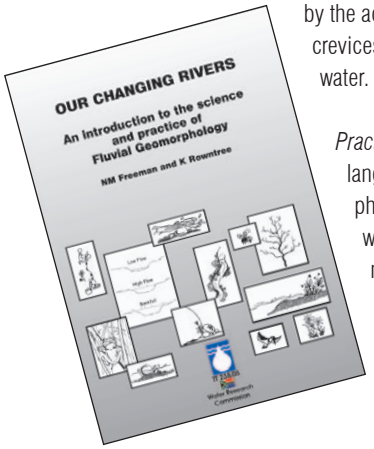
More than 80% of South Africa's rivers are under threat.

This was one of the main findings of the National Spatial Biodiversity Assessment – the first-ever comprehensive spatial evaluation of biodiversity throughout the country. Led by the South African National Biodiversity Institute, the assessment was launched by Environmental Affairs & Forestry Minister Marthinus van Schalkwyk in May.

The assessment showed that a disturbing 44% of the country's rivers are critically endangered, 27% are endangered, 11% are vulnerable and 18% are least threatened. Because South Africa is a water-scarce country, many of its mainstream rivers are heavy utilised, and its river ecosystems are, in general, under more pressure than its terrestrial ecosystems, the assessment found. "Protecting rivers are extremely difficult, as rivers are impacted by activities throughout their entire catchments, so even if a whole river length is included in a protected area, the river is subject to impacts that could originate far away. However, rivers that do flow through protected area show significant recovery (i.e. their health is in much better condition downstream of the protected area than upstream of the protected area)."

Booklet Increases Knowledge of Rivers

A new booklet into the science and practice of fluvial geomorphology has been published by the Water Research Commission.



Fluvial geomorphology is the study of relief features (land shapes and forms) shaped by the action of running water. Mountains, valleys, flood plains, hills, cliffs and crevices are all examples of relief features that have been shaped in some way by water.

The booklet, *Our Changing Rivers: An Introduction to the Science and Practice of Fluvial Geomorphology*, has been written in easy understandable language, with many explanatory sketches. It explains what fluvial geomorphology has to do with understanding rivers; in particular, change caused by water management schemes. Readers will not only come to understand the meaning of usually foreign concepts such as 'hydraulic biotopes', but will learn many interesting facts about water and see how river science relates directly to their lives.

♦ To order this booklet (Report NoTT 238/05), contact Rina Winter or Judas Sindana at the Water Research Commission. Tel: (012) 330-0340, Fax: (012) 331-2565 or E-mail: publications@wrc.org.za.

Job Creation in Sanitation Highlighted

A national seminar to find ways of alleviating poverty through the delivery of sanitation services was held at the St George Hotel in Kempton Park on 28 and 29 April 2005. The conference was a joint initiative by the Department of Water Affairs & Forestry and the Job Creation Trust.

The provision of basic sanitation remains a priority for the South African government as it strives to eliminate the backlog of 18 million people still lacking access to safe sanitation by 2010. At the same time, an estimated 72% of South Africa's total population of poor are resident in rural areas, which are also the biggest target for sanitation delivery. Delegates, which included representatives from government, non-governmental organisations and donors, discussed ways of combining sanitation delivery and job creation to promote economic development in delivery areas.

Several case studies were placed under the spotlight, including the Ethekwini Rural Water & Sanitation Programme, in KwaZulu-Natal, which has already seen the training of 400 contractors in the last three years through the construction of 28 000 toilets in the Ethekwini metropolitan area. In turn, in Alfred Nzo district municipality, in the Eastern Cape, toilet manufacturing yards have been established where rural women are employed to cast concrete toilet pedestals.

Water by numbers

* **9%** – Africa's share of global fresh water resources.
* **1 200** – The estimated number of dams in Africa. More than 60% of these (539) are located in South Africa and Zimbabwe (213).
* **21%** – The percentage of South Africa that receives less than 200 mm rain a year.
* **21 billion m³** – The estimated total volume of water utilised for human activities in South Africa. Of this volume, 52% is used for agriculture and irrigation, 4% for forestry, 4% for industry, 10% for domestic use, and 19% allocated to ensuring a sustainable environment.
* **20 000** – The estimated number of work opportunities created to date by the Working for Water programme.
* **70%** – The percentage of industrial waste dumped untreated in developing countries' water resources.
* **40%** – The percentage of the world's population without basic sanitation.
* **40 000** – The work hours lost every year in Africa to the need to fetch drinking water.
* **1 000** – The estimated tons of water required to produce one ton of grain.
* **25%** – The estimated percentage of people in developing country cities that buy their water from private water vendors.
* **60%** – The percentage of the world's 227 largest rivers that have been severely fragmented by dams, diversions, and canals, leading to the degradation of ecosystems.
* **12%** – The average growth of the global bottled water industry every year. The world bottled water market represents an annual volume of 89 billion litres, and is estimated to be worth US$22-billion. The consumption of bottled water in Africa increases by about 3% a year.
* **6** – The number of fish species in the world that have become extinct since the 1970s.
* **55,2%** – The percentage of South Africa's poor served by Free Basic Water, according to the Department of Water Affairs & Forestry.

Three-year Water Resources Study Underway

A consortium of South African consulting firms has embarked on a three-year assessment of the water resources in the country as well as its neighbouring states, Lesotho and Swaziland. The study includes surface and groundwater resources, as well as water quality assessments. Funding is being provided by the Water Research Commission (WRC).

"The study, to be completed in March 2007, is crucial as it will be used to assist with future planning in southern Africa," reports Brian Middleton, managing director of SRK Consulting, one of the members of the consortium. The other members are Stewart Scott, Knight Píesold, Ninham Shand, Arcus Gibb, PD Naidoo and Umfula Wempilo. "This project, dubbed WR2005, is a broad-based water resources baseline study that puts the whole country on an equal footing," says Middleton.

The objective of the study is to provide information for national water resources planning. In any catchment, the present day condition will be known. A future scenario may then be constructed, Middleton explains. New developments might include town or city

A three-year study into the water resources of South Africa and its neighbouring states Lesotho and Swaziland is currently underway.

expansion, or industrial, mining or other kinds of development in a particular area. From this an assessment can be made on whether or not there would be sufficient water in a development situation.

This is the fourth in a series of assessments being undertaken for the WRC. The first was done through the Hydrological Research Unit (HRU) at the University of the Witwatersrand. The second was undertaken through the HRU in 1980, followed by a third in 1990 done by a consortium of consulting firms.

Interestingly, this is the first time this type of assessment will integrate surface water, groundwater and water quality. In addition, new modelling and spatial data handling tools will be developed in this project to provide a more accurate, reliable and comprehensive countrywide water resources assessment.

As to how the work is to be done, Middleton explains that there are 22 primary drainage regions in southern Africa and 19 catchment management authorities. For more effective management, the drainage regions are further sub-divided into about 2 000 quaternary sub-catchments. "Our task is to compute the naturalised runoff sequence from these divisions and to assess what is derived from rainfall/surface runoff and what is derived from groundwater."

"The project is too big for one consulting firm, and for this reason we have teamed up with others. Our team will comprise hydrologists, water engineers, hydrogeologists, water quality specialists, and development specialists, among others," Middleton points out. An important aspect of this project will be knowledge transfer for the benefit of previously disadvantaged individuals who will be involved in the research effort.

DIARY

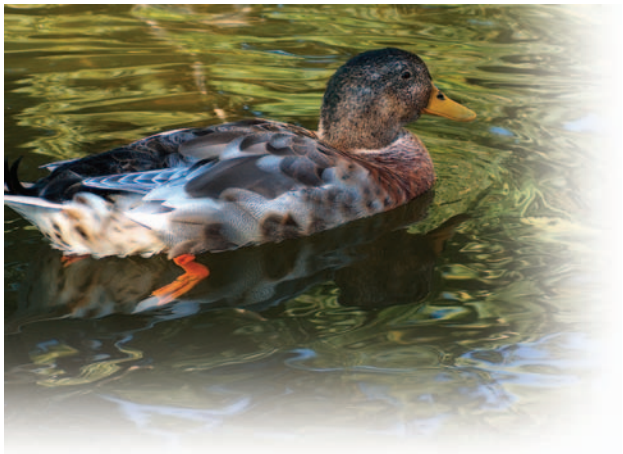
WATER SERVICES: JUNE 8-10

The second Annual Water Services Convention with the focus on Rural Water Supply will take place at Gallagher Estate, Midrand. *Enquiries: Dale Newman; Tel: (011) 803-0009; Fax: (011) 803-5500; E-mail: dale@tci-sa.co.za; Web: www.tci-sa.co.za*

GROUNDWATER POLLUTION: JUNE 20-22

The second Annual Conference on Site Assessment & Remediation for Groundwater and Soil Pollution will take place at Melrose Estate, Johannesburg. *Enquiries: Tel: (011) 669-5000; Fax: (011) 669-5069; E-mail: registration@iqpc.co.za ; Web: www.iqpc.co.za*

Degraded Ecosystems Curb Development



Preserving healthy ecosystems is essential for alleviating global poverty and achieving sustainable development, according to a new report.

The world will not be able to effectively alleviate poverty and hunger if its ecosystems continue to be destroyed. So warns a new global report on the world's ecosystems.

The *Millennium Ecosystem Assessment*, conducted by 1 300 experts from 95 countries, reveals that about 60% of the ecosystem services that support life on Earth – such as fresh water, capture fisheries, air and water regulation, and the regulation of regional climate, natural hazards and pests – are being degraded or used unsustainably. These ecosystems are considered essential in meeting the Millennium Development Goals (MDGs), a series of eight global targets to reduce poverty and disease by 2015.

According to the report: "Many of the regions facing the greatest challenges in achieving the MDGs coincide with those facing significant problems of ecosystem degradation. Rural poor people, a primary target of the MDGs, tend to be most directly reliant on ecosystem services and most vulnerable to changes in those services. More generally, any progress achieved in addressing the MDGs of poverty and hunger eradication, improved health, and environmental sustainability is unlikely to be sustained if most of the ecosystem services on which humanity relies continue to be degraded. In contrast, the sound management of ecosystem services provides cost-effective opportunities for addressing multiple development goals in a synergistic manner."

The report found that over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history. For example, the amount of water impounded behind dams quadrupled since 1960, and three to six times as much water is held in reservoirs as in natural rivers. Water withdrawals from rivers and lakes doubled since 1960; most water use (about 70% worldwide) is for agriculture.

The continual degradation of ecosystems could have significant effects on people's health and wellbeing. Exports warn that changes in ecosystems such as deforestation influence the abundance of human pathogens such as malaria and cholera, as well as the risk of emergence of new disease.

The picture is not entirely bleak. According to the report, the challenge of reversing the degradation of ecosystems while meeting increasing demands can be met under some scenarios involving significant policy and institutions changes. "However, these changes will be large and are not currently underway." The report mentions options that exist to conserve of enhance ecosystem services that reduce negative trade-offs or that will positively impact other services. Protection of natural forests, for example, not only conserves wildlife, but also supplies fresh water and reduces carbon emissions.

The report is the first in a series of seven synthesis and summary reports and four technical volumes that assess the state of global ecosystems and their impact on human well-being.

To access the report, visit www.maweb.org.

Water on the Web

www.groundwater.com.au
This is an interesting site for those interested in the water that appears underground. The Centre for Groundwater Studies is an international cooperative research and education organisation with strong focus on groundwater recharge, discharge, contamination, remediation and management. Research is undertaken under four main themes, namely sustainability of groundwater supply; resource recovery; groundwater and the environment; and groundwater as a geological agent. The site offers information on interesting research topics as well as direct access to the researchers involved.

www.iwha.net
The International Water History Association was established in 2001. Members are historians of water, historians with an interest in water or policy makers with an interest in history. Water history touches on and informs many areas, including economic business and political history, the history of science and medicine, history of technology, development, environmental sciences and geography. The website includes papers from previous water history conferences as well as interesting water history links.

New R8,5-m Lab Opened

The East Rand Water Services Company (ERWAT) has officially opened its new R8,5-million laboratory.

Situated in Kempton Park, next to the company's head office, the new 2 000 m^2 facility was necessitated by continuously growing demand for the company's laboratory services. The new laboratory caters for chemical, microbiological and biological services, with the main focus on chemical and microbiological analysis and related services. Lab manager Alison Chapman tells *The Water Wheel* that the laboratory receives about 4 000 samples a month, with between 40 000 and 50 000 analyses undertaken each month.

Just as the old laboratory, the new laboratory is also SANAS 17025 accredited.

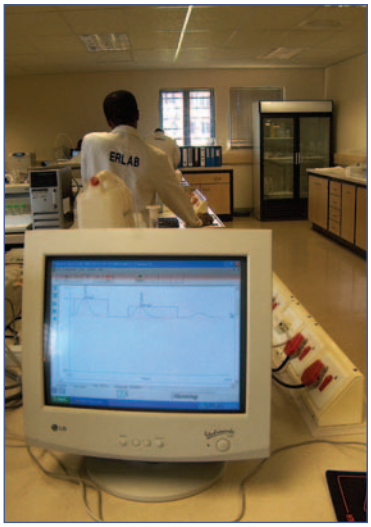
Sean MacCurtain of SANAS explains that this means that the laboratory has all the necessary systems in place to deliver consistently accurate results.

ERWAT Laboratory Services offers an analytical and microbiological analysis as well as industrial effluent monitoring and management programme which include process control, product loss control, pollution risk surveys, stormwater pollution control, borehole sampling and evaluations. These surveys are rendered to local authorities, metropolitan municipalities, industry consultants and the private sectors.

Among the laboratory's services is the development of a password-protected On-line facility where preliminary and verified results can be viewed and downloaded by clients are soon as they become available. The laboratory also actively participates in water forums and research activities, and offers practical training to chemistry, microbiology and chemical engineering students.

Apart from its new state-of-the-art analytical equipment and machinery, the new laboratory also include some practical features, such as wide aisles for the easy manoeuvring of sample-carrying trolleys; a separate sample receiving room; and kitchen and office facilities.

Members of the public (e.g. schools) are welcome to visit the new facility. Please contact Wanda Henning at Tel: (011) 929-7040 or Fax: (011) 929-7740 or e-mail: wandah@erwat.co.za.

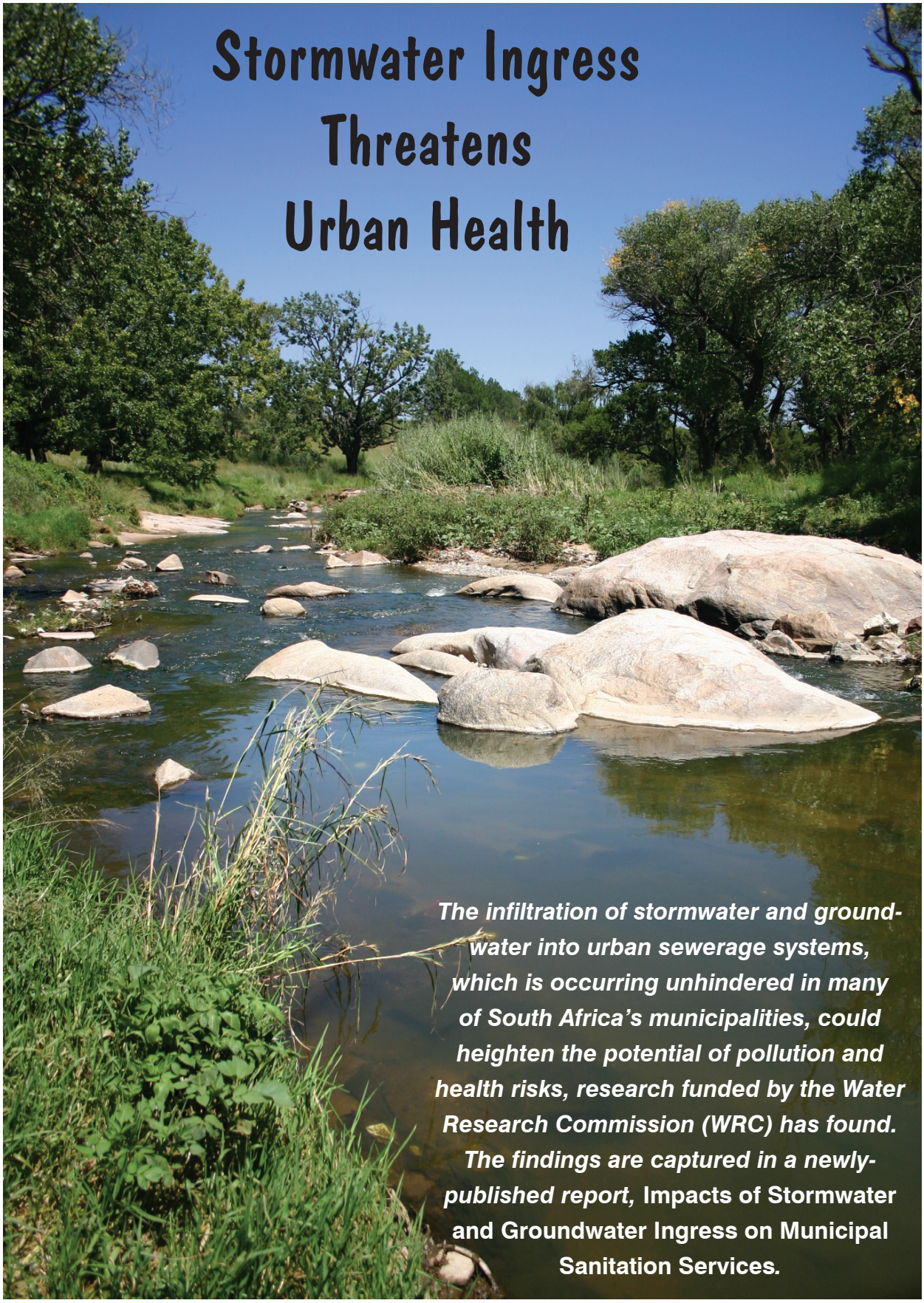


(Left) *The new ERWAT laboratory includes new state-of-the-art equipment to handle large volumes of samples.*

(Right) *The microbiology laboratory can undertake bacteriological identification and analysis of wastewater, drinking water, swimming pool water, dairy and food products, rivers, and boreholes, among others.*

www.livinglakes.org
Living Lakes is an international network and partnership whose mission is to enhance the protection, restoration and rehabilitation of lakes, wetlands and other fresh water bodies of the world and their catchment areas. The Living Lakes partnership promotes voluntary international collaboration among organisations that carry out projects benefiting lakes, wildlife and people.

www.transboundarywaters.orst.edu
The Transboundary Freshwater Dispute Database has been created by the Oregon State University Department of Geosciences, in collaboration with the Northwest Alliance for Computational Science and Engineering. It offers much insight into transboundary water basins, including an atlas of international freshwater agreements; an international freshwater treaties database, an international water event database; and an international river basin register, which lists the world's international river basins, delineated by continent.



Stormwater Ingress Threatens Urban Health

The infiltration of stormwater and groundwater into urban sewerage systems, which is occurring unhindered in many of South Africa's municipalities, could heighten the potential of pollution and health risks, research funded by the Water Research Commission (WRC) has found. The findings are captured in a newly-published report, **Impacts of Stormwater and Groundwater Ingress on Municipal Sanitation Services.**

Infiltration of stormwater and groundwater (known as extraneous flow) into sewerage systems is not a new phenomenon. In fact, it is a problem for municipalities worldwide. Systems are usually designed to handle some of this ingress (a norm of 15% of the dry weather flow allowance for extraneous flows is the generally acceptable standard). However, excessive flows can have detrimental effects on a sewerage system.

Research, undertaken by the Water Systems Research Group of the University of the Witwatersrand and captured in the new WRC report, has found that extraneous flow can reduce the originally designed capacity of a sewage collection system and negatively affect operation of the entire waterborne sanitation system, including the wastewater treatment component. This increases the potential of higher pollution loads leaving the wastewater treatment plant and disposing partially treated sewage into rivers, increasing the risk for waterborne diseases such as cholera.

The East Rand Water Services Company (ERWAT) indicates that the effect of extraneous flow on treatment processes can be rather dramatic as the final effluent produces will not comply with required effluent standards. Their experience shows that where stormwater ingress and groundwater infiltration are a serious problem, seasonally the built-in capacity of the wastewater treatment plant can be exceeded by up to twice for a limited time.

Investigations into municipalities nationwide found that most water services authorities (WSAs) and water services providers (WSPs) were not really aware of the infiltration problems and remedial or rehabilitation techniques. The problem is compounded by a general lack of adequate maintenance. Most municipal sewerage systems in South Africa are 30 to 50 years old, and the ageing process is taking its toll.

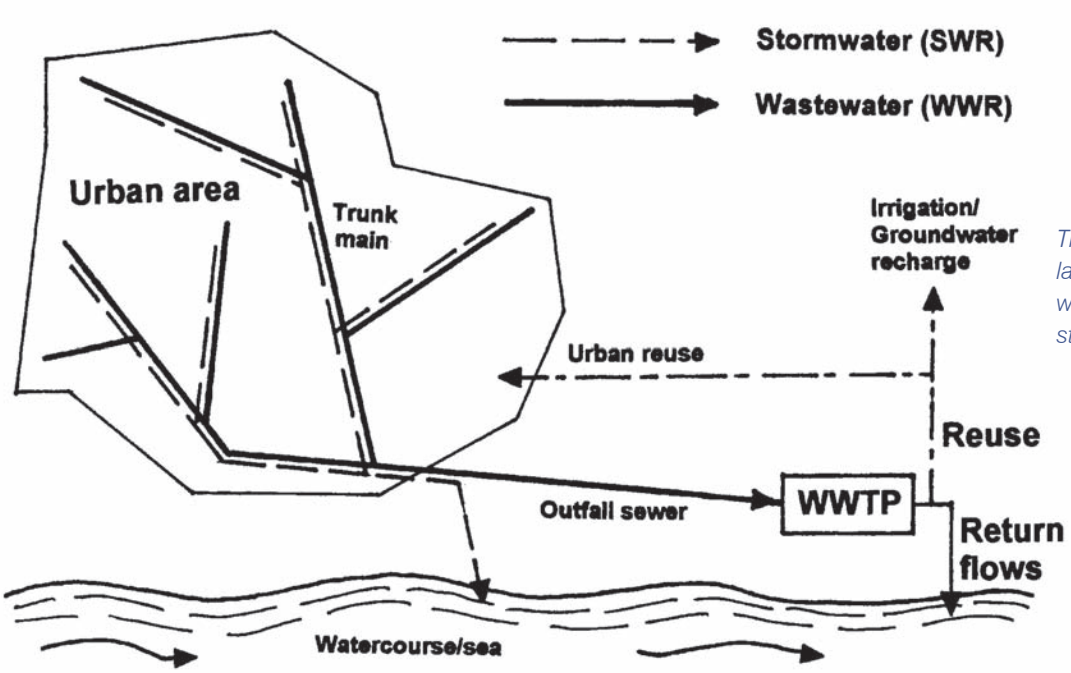
If allowed to continue unabated, stormwater ingress can lead to serious health problems in urban areas.

However, most municipalities are undertaking reactive maintenance only, where problems are dealt with on a corrective basis as they arise. Consequently, municipal wastewater system maintenance budgets are commonly low, and are based on the previous year's financial expenditure on clogging and collapse. An alarming find by the research team is that the typical sewer blockage rate in South African sewerage systems is 3,3 blockages per kilometre of sewer pipe a year. This is about ten times the international average.

COMMON CAUSES

The most common causes of stormwater inflows and groundwater infiltration were found to be inadequate design of certain system components; illegal house down-pipe (gutter) connections to municipal sewers; open gullies serving mainly as sullage disposal (this is typical in most formal and informal townships); unsealed manholes due to theft on manhole covers; faulty pipe joints due to improper construction or deterioration; roots penetrating joints; unwise man-made stormwater

10 STORMWATER INGRESS



The hypothetical layout of a separate wastewater from stormwater system

channelisation (e.g. road crossings and culverts); and unattended overgrown vegetation in natural channels as well as a high groundwater table.

Other factors that can contribute to infiltration to sewers are undulating topography that may lead to easy flooding; re-considered flood lines; swimming pools if additional stormwater or backwash water is linked directly to the sewers; ground movement due to removed mine dumps which destroy the continuity of sewers; and thunderstorms of short duration and higher intensities in various locations.

Disturbingly, investigations found that both stormwater inflow and groundwater infiltration are continuing to increase in South African municipal sewerage systems due to reactive maintenance instead of planned preventative maintenance and planned rehabilitation programmes.

The illegal connection of gutter down pipes to sewer gullies and the paving of yards, especially in sectional title properties, are some of the leading causes of stormwater ingress.

"Stoppages and clogging of sewers in South Africa per unit length of sewer are about ten times higher than the international average."

The WRC report proposes a number of approaches and methods on how to eliminate or mitigate the problems associated with extraneous flow. This includes the proper planning, design, construction, operation and rehabilitation of municipal sewerage systems.

EXCESSIVE EXTRANEOUS FLOWS

The urban area of Boksburg, which falls under the Ekurhuleni Metropolitan Municipality, was assessed as

part of the research project. Next to residential and recreational grounds, it abuts an industrial area, and sewers are built through waterlogged ground. It was found that stormwater inflows amounted to up to 40% of sewer capacity and groundwater infiltration amounted to 15% of capacity.

Stormwater and surface inflows account for dramatic peak flows (up to three times the average dry weather flow). The source of the inflows can be attributed mainly to household stormwater being directed into the system through gullies and, to a lesser extent, due to missing or damaged manholes covers.

Extraneous flow can reduce the originally designed capacity of a sewage collection system.

REDUCING EXPENDITURE

A reduction in these extraneous flows will not only save on sewage treatment costs, but may defer capital expenditure for the upsizing of collection sewerage pipelines and wastewater treatment plants. One water and sanitation services provider which has realised this Johannesburg Water (JW). "By reducing the inflow of stormwater and infiltration of groundwater into the sewer reticulation systems as much as possible, it is not necessary to upgrade the sewer reticulation," explains JW networks manager Andries Lotz. "The result will be no capital expenditure and hence a saving in future operating budgets, which will mean a more acceptable tariff to the customer."

Lotz tells *The Water Wheel* that in the company's service area most stormwater ingress is the result of the illegal connection of domestic stormwater drainage systems to the sewerage system. For example, the connection of gutter down pipes to sewer gullies. The paving of yards is also a factor, especially in sectional title properties. Paving increases the quantity of water to be drained and therefore the height of the flowing water sheet. To get rid of this water, some individuals construct private manholes later which drain into the sewers or directly into the sewerage system.

To prevent this; the company has dispatched a number of meter and gully inspectors to inspect private properties. Where stormwater is illegally allowed to infiltrate the sewerage system, property owners are given notice to rectify this. If after a certain period of time the problem is still not rectified these transgressors can be taken to Johannesburg's municipal court where they can be fined if found guilty of contravening the metropolitan municipality's bylaws.

In addition, JW has a significant operation and maintenance budget to ensure its system functions optimally. A preventative sewer cleaning programme, which includes hydro-jetting vacuum tankers, is in place. "By using our management system, one can prioritise the most problematic areas to be cleaned. At present, 10% to 15% of the city's sewers are cleaned annually," notes Lotz. In addition, air tests are conducted on all new sewer reticulation systems to ensure that the system is water tight to prevent infiltration.

While inspectors' duties are made difficult by the sheer volume of erven as well as the difficulty of gaining entrance to some of these properties due to the high security, Lotz says the service provider is making progress.

Aquaculture Gets a Second Chance in SA

Aquaculture, also known as fish farming, has been tried many times in South Africa, and failed as many times. Today, with food security a priority, there is a move to start it up again. Can it work this time?
By Robert Berold.

Much is being done to revive aquaculture in South Africa.

A recent study published by the Water Research Commission (WRC) indicates there is much potential if things are done right. Qurban Rouhani and Peter Britz of the Department of Ichthyology and Fisheries Science at Rhodes University, who did the baseline study, believe that aquaculture can provide protein for many poor people, and even make some money for emerging farmers. "But," they say, "We need to know why we are doing it, where, and for whom."

The problem with past attempts, says Britz and Rouhani, was "a complete lack of direction." During the 1980s several fish hatcheries and production units were set up in the former homelands to contribute to food security, but by the 1990s all of these had failed. The reasons, say the researchers, were mostly that there was little or no backup in the form of extension services and financial support. "The history of these

community-based projects was pretty dismal," says Britz. "They were so badly conceived that they were non-starters."

Projects set up as commercial ventures fared slightly better, with some of the warm water species projects still surviving in Limpopo province, as well as the Western Cape, with small farmer trout cage-culture projects. There are less than 100 farmers involved in commercial aquaculture throughout the country, and they tend to earn very little – between R1 000 and R2 000 per annum.

DOING THINGS RIGHT

The WRC and the Department of Agriculture (DoA) have been combining efforts to promote a national policy for aquaculture. This is already a big step, as historically aquaculture work has been undertaken piecemeal by provinces or nature conservation departments. It is said that often the DoA was not even aware of these initiatives.

Part of Rouhani and Britz' brief is to engage provincial support for the national initiative. In the next phase they will work with provincial departments, formulate objectives and get provincial buy-in for a national policy. As Rouhani puts it: "This project is different from efforts in the past since it is putting policy in place. To date there has been no national policy. Without policy there is no plan, there is no comprehensive funding, resulting in things becoming disjointed."

Keith Ramsay, the senior livestock specialist in animal and aqua production services at the DoA believes the new policy will work. "Before, people did not do their homework properly. They where thinking too big, too fast. Instead we are looking at a lower scale, not just for food security, but also for small commercial farmers." They idea, continues Ramsay, is to have one-stop resource centres were one can get fingerlings (small fish) and training, as well as support. "We want to revive the old provincial fish farming centres to provide these services."

At the food security level, much can be done with small farm dams. "Farm dams can be highly productive," explains Rouhani. "They provide opportunities for stock enhancement – taking fish from hatcheries and putting them into dams. This will not be commercially viable, but it could be a State-supported source of protein. There is no operational cost apart from the fingerlings, as the farmers would just put in enough fish the dam can support naturally."

WORKING TOGETHER FOR PROFIT

Commercial production is a different matter altogether. It needs good organisation since the market demands consistent quality and quantity. The success stories show that commercial aquaculture needs both sustained technical support and a link with the private sector. In the Western Cape, commercial buyers are willing to buy as much trout as the farmers can produce, but the quality of the fish is still not good enough. This,

There are an estimated R100-million worth of facilities and hatcheries in the country. Most are dormant and some have fallen into disrepair.

There are less than 100 farmers involved in commercial agriculture throughout the country.

notes Britz, can be rectified with more technical support.

Commercial trout farmers in the Western Cape are getting that kind of support from Stellenbosch University. Danie Brink from the university's Department of Genetics, who is driving much of the work in the province, explains that most of their aquaculture promotion is on irrigation dams on the fruit farms. "We are working with communities and individuals living on or near the farms. Of course, this is only possible with the cooperation of the farmers. They do not subsidise the projects directly, but they can provide essential supervision and transport. If we secure the supervision of a farmer, we know we are already halfway to a successful project."

Currently, there are eight producers under Brink's guidance, and he aims to build this up to 30 producers in all, which will be equivalent to 200 t of trout a year, with a market value of R50-million. For marketing purposes, the producers have formed themselves into a cooperative called the Hands-On Fish Farming Cooperative.

"It is a huge effort," says Brink. "Already we can see that we underestimated the aftercare requirements. Most of the producers have never been in business of any kind before, and we should not have expected them to have the necessary entrepreneurial commitment."

REVIVING EXISTING FACILITIES

Rouhani and Britz' survey found that there are R100-million worth of facilities and hatcheries in the country. Most of them are dormant, and some have fallen into disrepair. "The revival of these facilities needs to occur in parallel with groundwork in the communities," notes Rouhani. "We are looking at some of the provinces sharing facilities. For example, Turfloop has a warm water species facility which could be shared by North West, Limpopo and Mpumalanga. They could be a source of fingerlings such as tilapia, cat fish and carp. In turn, Marble Hall has a training centre that can be shared, and at Lydenburg there is a trout hatchery."

"If provincial and local departments of agriculture are serious, they must dedicate some of their extension staff to aquaculture"

Is there a market for warm water species? "Sure there is," maintains Rouhani. "We have seen men in Limpopo selling fish out of a sack on the side of the road. Within 20 minutes all of the fish were sold. And this despite the price of R10 a kilogram."

The WRC-funded survey, *Contribution of Aquaculture to Rural Livelihoods in South Africa: A Baseline Study*, makes a number of recommendations for food security-focused aquaculture. Among these

are that projects are designed correctly, farmers have access to fingerlings at affordable rates, and farmers are provided with good technical extension support. "You always need someone there to troubleshoot. If provincial and local departments of agriculture are serious, they must dedicate some of their extension staff to aquaculture," says Rouhani. For commercial aquaculture, the research team recommends that variability studies, markets, and species selection should be undertaken more thoroughly.

William Gertenbach, head of animal production for the Western Cape Department of Agriculture at Elsenburg, expresses his concern over the human resources needed for aftercare. "One of the challenges facing the whole aquaculture industry is a shortage of expertise. To overcome this, my division has been bringing in young professionals from previously disadvantaged backgrounds to work with senior scientists. We will be doubling our extension staff to 60 in the near future, and we will make sure that at least some of these extension officers will be dedicated to aquaculture," he says.

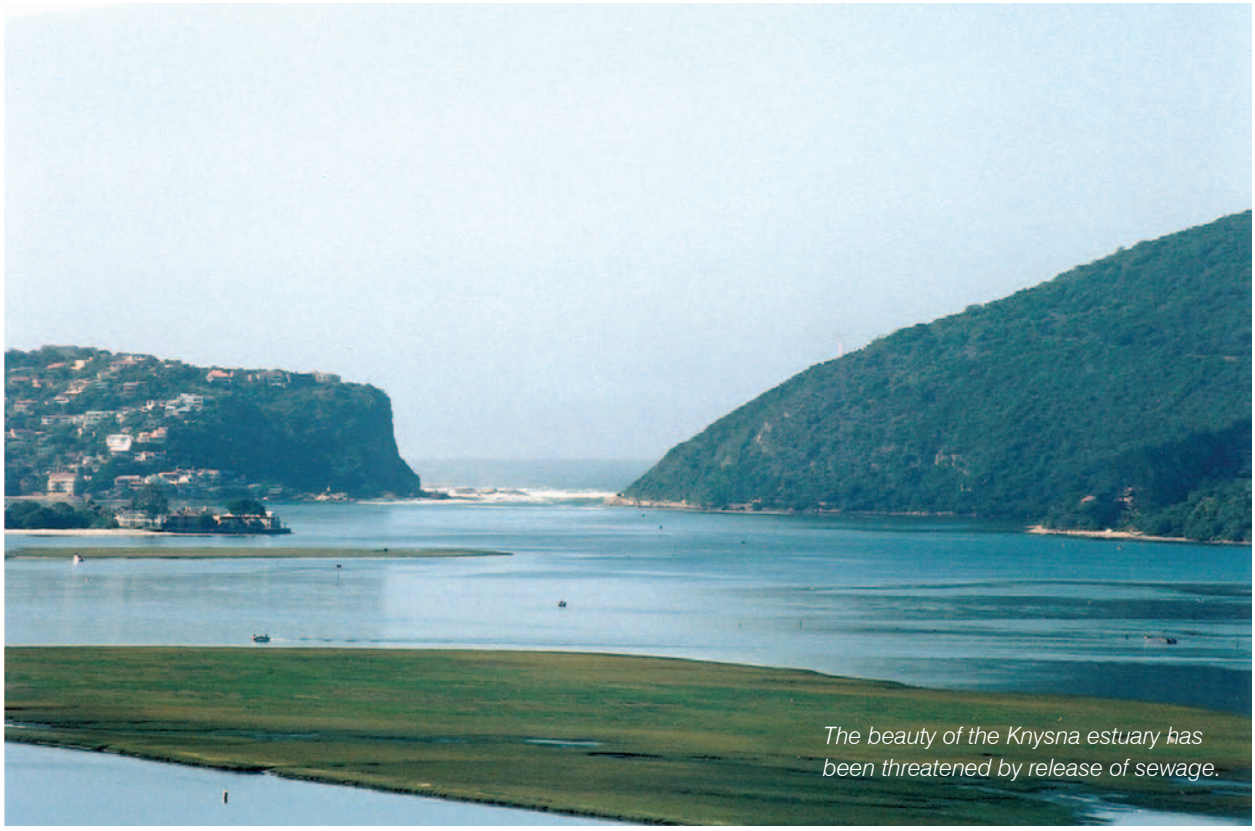
Britz and Rouhani are now on to the second phase, again sponsored by WRC, spending a lot of time on the road, persuading the provincial departments of agriculture to support the national strategy. They want to focus mainly on three provinces, one with good capacity (the Western Cape is the best candidate), one with moderate capacity (Limpopo is the logical one here), and one with poor capacity (probably the Eastern Cape). So far, it looks like aquaculture is well on the way to revival.

A trout processing facility.

To obtain a copy of the report, *Contribution of Aquaculture to Rural Livelihoods in South Africa: A Baseline Study*, Report No TT 235/04, contact the Water Research Commission's Rina Winter or Judas Sindana at:
Tel: (012) 330-0340, Fax: (012) 331-2565 or E-mail: publications@wrc.org.za

New Guide to Managing Valuable Resource

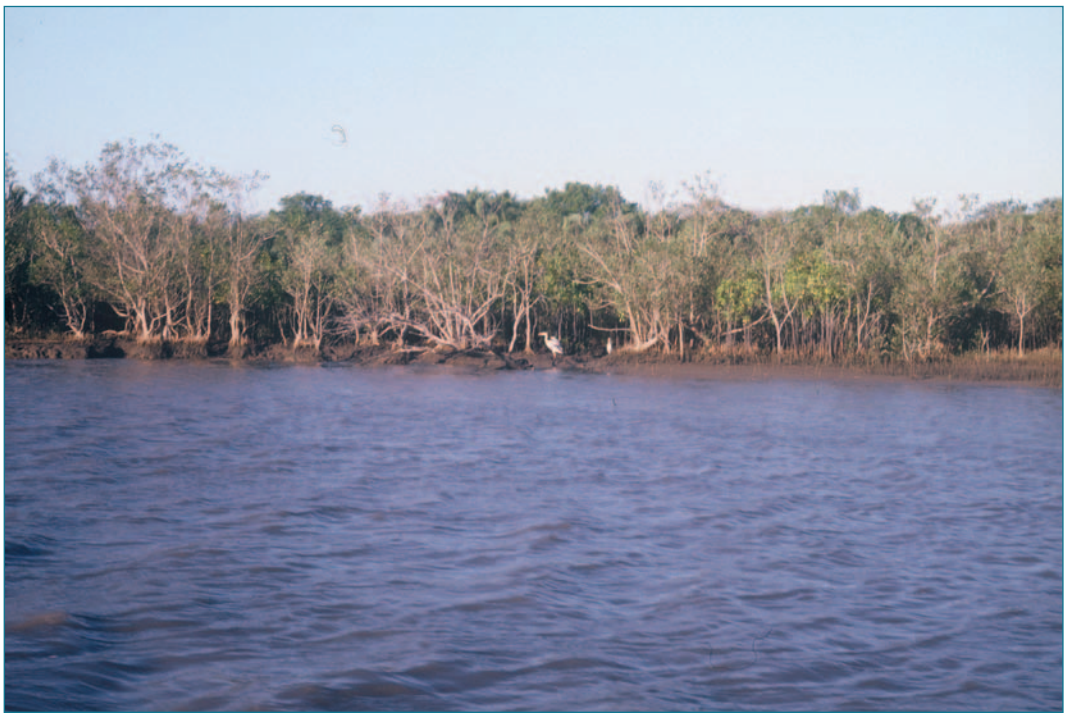
Estuaries have been recognised as one of the most valuable habitats on earth. Yet they are continually undermined by human activities that decrease their economic worth and threaten their existence. A new guideline published by the Water Research Commission (WRC) hopes to increase awareness among decision-makers about the socio-economic importance of South Africa's estuaries and to help them make informed decisions as to the sustainable development of these ecosystems.



The beauty of the Knysna estuary has been threatened by release of sewage.

There are more than 250 estuaries in South Africa, many of which are considered unique in terms of their physical characteristics and biodiversity. These estuaries perform several important ecological and economic functions, not the least of which is their aesthetic and recreational value. Among others they provide important nursery areas for many marine species thus making a significant contribution to inshore fisheries. They are also crucial conduits for the transportation of sediments and nutrients into the marine zone, where they contribute to marine ecosystem productivity. In addition, estuaries help to protect and control storm and flood damage.

However, despite existing laws that govern activities in and around estuaries, the overall protection of these valuable assets remains low. In fact, a recently published assessment of South Africa's national biodiversity shows that only 28% of the country's estuaries are considered to still be in an excellent condition (i.e. near pristine). A further 31% are in good condition, 25% in fair condition, with 15% of the country's estuaries being in a poor condition, which means



St Lucia is one of South Africa's most well known estuaries.

they suffer from major ecological degradation.

..... only 28% of the country's estuaries are considered to still be in an excellent condition.

This assessment, led by the South African National Biodiversity Institute, reports that the country's estuaries face a number of pressures, among others, habitat alteration (due to, for example, the construction of marinas and jetties), changes in mouth dynamics; overexploitation of estuarine resources; sedimentation and other problems in estuaries due to, for instance, abstraction of water from the catchment or poor bad catchment or mouth management; recreational disturbance and pollution (for example, the release of sewage into the Knysna estuary).

According to Dr Steve Mitchell, Director: Water-linked Ecosystems, at the WRC, the organisation started funding research into the conservation and sustainable use of estuaries because of these threatening activities. "These fragile, and often unique, ecosystems have huge potential to contribute to economic development, but are often inadvertently degraded because decision-makers and other stakeholders neither understand how these systems function nor have the know how to manage them appropriately."

A few years ago, an estuaries management programme, led by the Institute of Natural Resources in Pietermaritzburg, was set up in the Eastern Cape with funding from the WRC. Several projects have since been undertaken, the latest outcome of which is *Managing Estuaries in South Africa: A Step by Step Guide*.

Its objective is to assist decision-makers, consultants and stakeholders to manage estuaries in such a way that they contribute to socio-economic development without being irreparably damaged. Written in an easily understandable format, the guide explains the management process and gives advice on areas that can support this process. It also provides a series of tools or guidelines that can be used to assist in the management process for specific issues, including the sustainable use of living resources; biodiversity protection; rehabilitation and enterprise development. It also touches on estuary management at national and

WHAT IS AN ESTUARY?

An estuary is the meeting place of a river or lake system and the sea. Here, freshwater and seawater mix, water flow is influenced by the tides, wave action is reduced, and sediment and nutrients are deposited during normal conditions and eroded during floods. Unlike estuaries elsewhere, most South African estuaries are prone to closure by sand bars which block off the mouth for varying lengths of time.

One of the evaporator pans of a saltworks sited alongside the Swartkops estuary in the Eastern Cape, with high-density housing development coming right to the edge of the industrial development.

TYPES OF ESTUARIES

- **Permanently open estuaries**
  These include the Breede, Swartkops and Mlalazi estuaries. These are usually quite large systems with a perennial river and/or strong tidal exchange with the sea. Under low river flow conditions tidal exchange is sufficient to keep the mouth open.
- **Temporarily closed/open estuaries**
  These include the Groen, Van Stadens and Mhlanga estuaries. About 70% of South African estuaries fall into this category. These estuaries are often closed for many months of the year and sometimes for more than a year at a time. They usually have small catchments and limited penetration by tidal waters when they are open.
- **River mouths**
  These include the Orange, Mzimvubu and Thukela estuaries. All rivers flowing into the sea have a river mouth. However, estuaries under this category are usually permanently open to the sea. The river, rather than the sea, dominates the physical processes within these estuaries.
- **Estuarine lakes**
  These are, for example, Swartvlei, St Lucia and Kosi. These estuaries occur where a coastal lake is connected to the sea by a channel of varying length and width. The mouth of an estuarine lake can be either permanently open or temporarily open.
- **Estuarine bays**
  These include Durban Bay, Knysna and Richards Bay. These estuaries have wide mouths with strong tidal exchange resulting in a continuously open mouth, and the regular replacement of marine water in the lower and middle reaches. Even under high river flow conditions, seawater salinity persist in the bottom waters of the lower reaches as the less dense freshwater flows over the more dense seawater.

Source: Institute of Natural Resources

provincial levels; while introducing the reader to the laws regulating estuary use.

Much attention is given to cooperative management, i.e. getting a group of people with an interest in a specific estuary or group of estuaries together to plan and act in order to achieve certain goals related to those estuaries. The guide also strives to maintain a balance between estuary users.

"It is important to realise that our objective is not to dissuade authorities from developing estuaries, but rather to assist them to do so in a responsible, informed way," notes Dr Mitchell.

"Managers also have to realise when enough is enough. Many mistakes have been made in the past often as a result of the political and economic pressures placed on municipalities.

It has to be understood that limits to development on an estuary need to be set, for instance, how many jetties is one jetty too many. This guide aims to arm authorities with the relevant knowledge to make the right decisions whether to allow development of estuaries or not in a way that will stand when they are challenged."

"Estuaries are lovely places and we want to keep them that way," says Dr Mitchell. "This guideline provides the basis through which this can be done."

- To obtain a copy of *Managing Estuaries in South Africa: A Step by Step Guide* (Report No TT 243/04) contact Rina Winter or Judas Sindana at the Water Research Commission. Tel: (012) 330-0340, Fax: (012) 331-2565 or E-mail: publications@wrc.org.za.

- Other publications available from the WRC on estuaries are: *Towards the Conservation and Sustainable Use of Eastern Cape Estuaries* (Report No TT 237/04) and *Eastern Cape Estuaries Management Research Programme* (Report No 1246/1/04)

- Another useful publication on managing estuaries, *Managing Estuaries in South Africa: An Introduction*, is available from the Institute of Natural Resources, Tel: (033) 346-0796 or E-mail: inr@ukzn.ac.za or visit: www.inr.unp.ac.za.

- The South African National Spatial Biodiversity Assessment 2004 report can be accessed by visiting www.botany.uwc.ac.za/pssa/articles/features/no57.htm

The proliferation of jetties along the Swartkops estuary, in the Eastern Cape, as well as the ingress of marine sediment, which is reducing the volume of the estuary.

Determining How Much is Just Enough

Water laws are becoming increasingly stricter, with especially large water users, such as farmers, having to find new ways of accounting for every drop they use.

Report by A Jansen van Vuuren, E Pretorius and N Benadé.

Sprinkler irrigation.

South Africa is a water-scarce country, which means it water resources are limited. The country does not have that frequent rainfalls to ensure adequate crop growth. The region for agriculture also plays a role. Once planted, it all depends on the rain to fall and water the crops. The only other option left is to use the water resources in terms of reservoir dams, rivers and other methods to irrigate the land manually. This immediately opens up the field to invent new and develop existing methods of crop irrigation.

WHERE DOES THE WATER COME FROM?

All major water resources are captured in reservoir dams. From these dams water can be let into large concrete-lined canals to irrigation districts. The main canals will run along the length of the irrigation district. Smaller feeder canals can then tap of from the main canals and take water deeper into the district and various farms. Community canals will again take to the specific farms and plots where water is diverted through sluices to the storage dams. Once stored, the required irrigation method can be applied.

HOW MUCH WATER IS NEEDED?

Various studies are devoted to determine the volume of water required by any irrigator in respect to the crops to be irrigated, land type, climatical condition, and so forth. From a hydrological engineering point of view, only the required amount of water is necessary. From this, a cumulative volume of water can be released from the source to be distributed into the canal network. The volume to water needs to be adequate as all the requirements of the users must be met. The question may be raised that the water can be let into the canals at a constant basis and users take water as needed, but then one realises again that it is South Africa and we do not have that amount of water to our availability. For this reason also government has enforced legislation to conserve the little amount of water we have.

In our attempt to distribute the water as intended we therefore should release only the required amount of water while allowing for water losses along the canal network. Two methods of determining this volume of water exists.

In the first method, the manual method, users will apply for water by the

means of water application forms. All the forms will then be processed and a single daily volume of water can be determined. This volume, which will take all losses into account, can then be released on a weekly basis. In the second method a database of the entire canal network as well as all the users can be built up into a computer program. Allowing still for losses, the computer program can calculate the same release volume of water. The second method can be seen as the automated computerised method.

The computer originated release volume can only be correct if the database it draws its information from is correct and up to date. From there all the benefits of computer technology can be applied and utilised to successfully manage and distribute the available water.

RESEARCH OBJECTIVES AND AIMS

Extensive cycles of data verification therefore should take place to authenticate the existing database. This in fact was the purpose of the intended research study. The computer program as applied to the Vaalharts Irrigation Scheme (VHIS) is the Water Administrations System (WAS). WAS is designed to be a management tool for irrigation schemes and water management offices that want to manage their water accounts and water supply to users through canal networks, pipelines and rivers. WAS is developed and maintained by N Benadé and was funded by the Water Research Commission (WRC) and the Department of Water Affairs and Forestry (DWAF).

The WAS program has four modules, namely: the administration module, water request module, water accounts module and the water release module. All of these are already implemented except for the release module, which is implemented only partially. To have it fully implemented all the data should be verified, updated and it should be ensured that the program can calculate the correct volume of water to be released. Initial tests showed that WAS under-calculates values in the range of 40 – 45%. The aim of this study would be to fully implement the release module by verifying all data and calculation procedure through achieving the following objectives:

- Conducting meetings and consultations with the members of the irrigations scheme and local community. Especially the water control officers can relay valuable information like sluice numbers, canal geometry and canal capacity.
- From engineering design drawings more technical data can be obtained in terms of slope, geometry and section lengths.
- In the early nineties (1991 – 1993), both the main canals were enlarged by converting the shape to a combined trapezoidal canal. The main purpose would be for improved canal utilisation. The combined section can yield a bigger discharge than the original normal canal or a totally new canal, and in times of low flow evaporation is reduced due to the smaller area exposed to the sun. Currently the program understands that a normal trapezoidal canal section is in use, while in reality a combined canal section is used. The normal water release is still calculated regarding this situation but, mathematical calculations can be done to investigate the difference in discharge between these two sections. Current calculations could have the effect that either too much or too little water is calculated for the canal. Applying some mathematical calculations proved that too much water is constantly calculated and the WAS calculation procedure can now be corrected.
- The most painstaking method of all is to manually collect all other data in the field. Here data like canal geometry, section lengths, sluice verification, etc. was done. This proved to be valuable for further verification methods.

Once all data was collected verified and updated, a cycle of calculation comparisons could be carried out. If the calculation process can be proven correct on a single feeder canal, then the same principle can be applied to the rest of the canal network. In an initial calibration test conducted the release volumes of only requested water (no water losses were added) was compared. In Table 1 the values indicated in orange shows that no differences were encountered. With the basic calculation process assured, the calibration of data, needed to calculate the full release volume (including water losses), could be carried out.

The only actual aspect that differentiate between the calculation procedure of WAS and the VHIS is the way that losses are calculated and the fact that WAS offers more features for irrigation scheme management. The final step therefore is to calibrate the WAS database in order that the losses will be calculated correctly.

Typical flood irrigation.

TABLE 1
CALCULATION COMPARISON RESULTS

	Period 14		Period 30		Period 46	
	Description	Volume	Description	Volume	Description	Volume
VHIS	Without losses	138600	Without losses	241200	Without losses	279000
	With losses (excel)	223692	With losses (excel)	359412	With losses (excel)	418803
WAS	Without losses	138600	Without losses	241200	Without losses	279000
	With losses (WAS)	232968	With losses (WAS)	355899	With losses (WAS)	397506
	% diff- without losses	0.0	% diff- without losses	0.0	% diff- without losses	0.0
	% diff- with losses	4.1	% diff- with losses	-1.0	% diff- with losses	-5.1

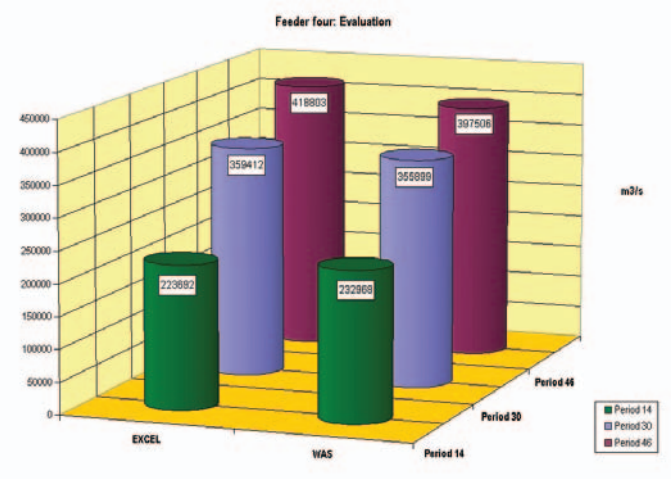


Figure 1

After this database was calibrated and some final adjustments were made to canal geometry, the full release volume were calculated and compared. As indicated in Table 1, the values in green, show that very small differences were encountered. Figure 1 shows the differences of the two calculation procedures after the final calibration.

RECOMMENDATIONS

Valid input data delivers valid output data. In order to conclude the study successfully, one needs to realise that for a study like this the more accurate the database is, the more accurate and valid the results will be. The calculation comparison can only be correct if the data has been verified by means of given method. Through proving this database valid it can be said that the release module can be implemented as required by the irrigation scheme.

It is recommended that all the satisfactory results delivered by the comparison process, should now also be implemented on all the other feeder canals. Completing this exercise will update all data accordingly and render it viable to be used in the calculation of actual release volumes for the canal network. Once the release module is fully implemented, all module of the WAS program can be used on the VHIS.

WAS is already implemented on a number of other irrigation schemes in South Africa with very satisfactory results. Some schemes use WAS only for the accounts, while others use it for the administrational benefits. The intention is to fully implement WAS at the VHIS, making it the water management tool of the scheme. The VHIS also lends itself to future developments of WAS and water management. This will also be in line with new proposed community projects where agriculture in South Africa needs to be improved. Adequate water supply is a much needed commodity for any upcoming farmer. Ongoing calibration of the canal data and calculation procedure as well as an open line of communication with the community should therefore take place until the users and developer are satisfied.

Water losses due to defects in the canal should be minimised. WAS accommodates seepage, but the increase of defects could again result in inaccurate calculations. It could also be recommended for implementing or incorporating a global positioning system phase using geographic information systems which could help considerably locating sections on the canal, read and use canal network data and pin-point certain sections on the canal. A water scheduling program could help to assist farmers and ensure the sustainability of the water resource and better planning and management of their water quota respectively.

Water Minister Declares WAR

Minister of Water Affairs & Forestry, Buyelwa Sonjica, has heralded the second decade of South Africa's democracy by declaring WAR that is Water Allocation Reform. While the Department of Water Affairs & Forestry (DWAF) dedicated the last ten years to removing backlogs with regards to access to safe water and sanitation, the second decade will be dedicated to ensuring fair access of water resources to all.

"Despite the major changes we have made over the past ten years of democracy, our natural resources are still largely in the hands of a relatively wealthy white (male) minority. This is a picture that has to change", said Buyelwa at a workshop on water allocation reform in Pretoria in April. To initiate this process, the Department of Water Affairs & Forestry (DWAF) has launched the Draft Water Allocation Reform Framework. The framework suggests methods that could be used to take proactive steps to meet the water needs of historically disadvantaged individuals, women and the poor; ensure participation by these groups; and establish partnerships to build capacity to use water productively.

The measures needed to address the challenge are already in place. Existing water use has been registered across the country, and work has started to quantify available water in trial catchments and to determine the ecological Reserve, the amount of water required to safeguard the environment. The next step, the verification of water use claims, has already been initiated in the uMhlathuze, Inkomati and Olifants catchments.

This information will allow catchment management agencies, which are currently being established, to undertake the detailed work of considering water requirements and proposing the sharing of available water to meet them. One controversial aspect of this process is that, to balance the many demands for water for production, it might be necessary to re-allocate water between users, where some water may be taken from existing users to give to those who have none.

However, Sonjica assured that this would not be done without careful consideration and that there would be no "water grabbing". "While it is important for the economic development of the country that water resources become available to a wider range of users, we need to make water available in a way that will sustain and grow the First Economy while allowing the Second Economy users to develop. This is a complex process. We will not serve the public interest if water is wasted or used unproductively."

DWAF Director: Water Allocation Planning Ashwin Seetal provided further insight into the process. He explained that there are several underlying considerations. "Firstly, the way we allocate water can have serious political, social, economic and ecological consequences. Thus, the pace in which this allocation process occurs is extremely important." If, for example, re-allocation of water is done too quickly, or haphazardly, the country may suffer economic or environmental damage as emerging users struggle to establish productive and beneficial uses of water. Conversely, if water re-allocations take place too slowly, social and political pressures will force a quicker pace for water reform, which could destabilise the process.

Secondly, where water re-allocation of water needs to take place, it must consider the impact on stability, and optimise the beneficial use of water in the interest of the public. This means that the water allocation process will not focus solely on issues of equity. Rather, while addressing issues of equity, it will also support water uses that generate employment and growth. Beneficial use also means promoting a range of uses of water across a variety of sectors to support a diverse, robust and stable economy.

Importantly, any development must be undertaken in an ecological sustainable way. Also, since South Africa shares about 70% of its water resources with other countries, international agreements and obligations towards its neighbours will also have to be taken into account during the water allocation reform process.

To see the *Draft Position Paper on Water Allocation Reform*, visit: www.dwaf.gov.za

Historically disadvantaged people, especially women, will now gain access to water resources under the Department of Water Affairs & Forestry new water allocation reform initiative.

SA Expertise Recognised in Thailand

Software developed through the Water Research Commission (WRC) to assist water utilities to manage their water losses is finding international appeal as water resources become more stressed in many areas.

Pretoria-based company WRP has been working with the WRC in the area of water loss management for almost a decade. Several software packages, which are available through the WRC website, have been developed. It was with this background that Ronnie Mckenzie and Willem Wegelin from WRP were approached to present a one-week training course in the field of water demand management (WDM) at the University of Bangkok earlier this year.

Mckenzie reports that the training session was so well received that Thailand's largest water utility, the Metropolitan Water Association, now wishes to send 50 area managers to South Africa for similar training. Moreover, Mckenzie was asked to provide key input in the recent International Water Association (IWA) training workshops held in Sydney and the Gold Coast in Australia. He is also working with the United Nations to offer training in WDM in four cities in India through the UN-Habitat Water for African Cities project.

In recognition of the efforts of WRP and the WRC, the Australian water authorities have included considerable material and examples from South Africa in their *Managing Leakage* manuals which were officially released at the IWA workshop in Sydney. These manuals supersede the original *Managing Leakage* manuals first published by the UK water sector in 1994.

Since the reports were first published, considerable advancements have been made in various aspects of leakage management, and in particular in the understanding of the influences of pressure on leakage. Many new techniques and associated software products have been developed by various WDM specialists in various parts of the world to assist with the understanding of leakage and wastage in water distribution systems.

The latest set of ten manuals incorporates not only the basic theory of leakage management, but also details of the practical application of the various techniques and methodologies. The techniques and procedures presented in the manuals are applicable not only to Australian conditions, but also to virtually every water supply system worldwide.

The manuals are produced in full colour with pictures covering most aspects of water loss management in a simple and practical manner. The manuals differ from other textbook publications in that they are written in plain English and explain each topic through the use of actual case studies and practical applications. "They represent the present best practice in water loss management and are an essential tool to every water utility worldwide as well as any water loss specialists who are currently supporting the water supply industry," reports Mckenzie. The ten manuals are now available in South Africa through WRP.

The ten water loss management manuals now available in South Africa.

SA's Top Water Women Honoured

South Africa's top water women for 2005. Standing is Thelmah Mavimbela and Prof Maggy Momba; sitting is Portia Mphephu, Minister of Water Affairs & Forestry Buyelwa Sonjica, Lungile Mthembu and Sethe Mothibi-Thinane.

On 18 March five women were honoured for their contribution to the South African water sector during the fourth annual Women in Water Awards. The awards, which have become one of the highlights on the National Water Week calendar, were hosted by the Department of Water Affairs & Forestry and sponsored by Eskom.

Speaking at the ceremony Minister of Water Affairs & Forestry Buyelwa Sonjica lamented the fact that, despite the progress that has been made during the last ten years, the percentage of professional women in the water field remains small. "Gender representivity is still inadequate. Women make up about 52% of the adult population in South Africa. Yet, they only hold 15% of all executive managerial posts. The water sector faces a particular challenge as it is viewed as mainly a technical field, traditionally dominated by men," she said. "We need to balance this reality through a progressive and active approach in transforming certain sections of the water sector, particularly in the engineering and scientific fields, with special emphasis on opportunities for women from historically disadvantaged communities. We need to strengthen the participation of women in the management and policy fields, and we need to create meaningful opportunities for women, particularly the young ones, in the research arena."

THE WINNERS OF THE WOMEN IN WATER AWARDS WERE:

Prof Maggy Momba in the Research Category (35 years and older)

Prof Momba has contributed significantly to scientific knowledge in terms of research and publications in areas of health-related water microbiology, water use and waste water management.

Following the completion of her Masters degree in 1995 and her PhD

Prof Maggy Momba (right) receives her award for the research category (35 years and older) from Water Affairs & Forestry Minister Buyelwa Sonjica.

degree in 1997, she joined the University of Fort Hare. Despite a heavy teaching load, she established a research programme on Water Quality Management in the Eastern Cape. This has led to the establishment of one of the largest black post-graduate programmes at Fort Hare University, including a molecular biology laboratory.

Among others, Prof Momba has investigated why the water supply in South Africa's rural areas may influence the quality of container-stored water and consequently cause infection and disease in the communities. She has also conducted a comparative study which led to improved knowledge on the impact of pipe materials on densities of fixed bacteria, and helped drinking water producers in South Africa to choose pipe materials that reduce the possibility if biofilm development.

In 2002 and 2003, researchers from the universities of Fort Hare and KwaZulu-Natal and Umgeni Water investigated, under her leadership, the cause of inadequate disinfection at the Alice Water Treatment Plant. Her latest study is aimed at improving the efficiency of disinfection in small water treatment plants. This is currently being conducted by a research team from the universities of Fort Hare and Venda, Umgeni Water and CSIR under her leadership.

According to Prof Momba, a crucial aspect of her work is bringing scientific understanding and knowledge down to the lowest level. For this reason, her department has initiated a training programme for the operators of rural water treatment plants, to start in June. "It is becoming increasingly important that, as we improve the technology of these water treatment works, the operators are trained accordingly. No level of sophistication will bring sufficient quality water to rural communities if the operators do not know how to manage these plants properly."

Lungile Mthembu in the Research Category (under 35 years)

Mthembu started working for Umgeni Water in 1996 as an in-service trainee. Since then she has been working in the scientific services division as a microbiologist. Through the years she has contributed a great deal to the training and development of technikon graduates as well as clients of Umgeni Water. She has been involved in a number of scientific research projects relating to water, and has worked extensively in microbiological method development, evaluation and validation.

Her passion for quality in water microbiology landed her an opportunity to prove herself when she successfully implemented the SANAS 17025 standard for two methods now employed in the microbiology laboratory of Umgeni Water. She has been instrumental in encouraging staff to place greater emphasis on quality and customer care.

"Science and research has a crucial role to play in improving the health of especially the vulnerable members of the community, for example, those suffering from HIV/AIDS."

In 2004, Mthembu took up the position of security, safety, health, environment and quality coordinator at Umgeni Water. She continues to ensure that Umgeni Water provides quality water that conforms to regulatory standards as well as customer expectations while maintaining the interest of public health.

Coming from a background where she herself had to fetch unsafe water from a river for her household to drink, community water and health issues remains close to Mthembu's heart. "It has been an amazing journey of discovery in how micro-organisms in water affect the health of the community, for example, by causing diseases such as cholera and diarrhoea. Science and research has

a crucial role to play in improving the health of especially the vulnerable members of the community, for example, those suffering from HIV/AIDS."

As recipient of the award for research under 35 years, Mthembu also received R10 000 from the Water Research Commission.

Portia Mphephu in the Community Development Category

At only 20 years old, Mphephu is the youngest ever recipient of a Women in Water award. She participated in the stormwater project that ensured the 1,5 km channelling of the Duduza Spruit through Tswelapele Extensions 1 and 6. This was undertaken to link the lined water course through Winnie Mandela Park. The Ekurhuleni Municipality had to develop some of the areas in Tembisa because homes and belongings were being washed away during floods in the rainy season.

As a technical student, Mphephu made sure that she was involved in every decision that was taken to help this community. She was appointed occupational health and safety representative and made sure that everyone involved in the project complied with the safety regulations by ensuring that protective clothing was worn; children did not come close to construction areas; and chevron tape was used to mark dangerous places in open areas.

She also played a leadership role in the quality assurance of the project; including ensuring construction was being done in accordance to the drawings and specifications. In addition, she took on administration functions, ensuring that community participants were paid the correct wages every fortnight.

Lungile Mthembu (right) receives her award for the research category (under 35 years old) from Minister of Water Affairs & Forestry Buyelwa Sonjica. She also received a cash prize of R10 000 from the Water Research Commission.

Thelmah Mavimbela in the Education and Communication Category

Mavimbela is a Grade 5 educator at Mhwayi Primary School in a water-scarce area in Mpumalanga. During breaks and cleaning periods, learners had to walk long distances looking for water. Often they could find none.

Mavimbela solved the problem by procuring two rainwater-harvesting tanks donated by Eco-link. She also approached the Mbombela Municipality for a 10 000 ℓ Jojo tank, which is used for storing clean water. A water truck replenishes the tank once a week.

Mavimbela also used money won in other competitions to purchase two plastic tanks. These six tanks are used to promote rainwater harvesting and water conservation. She also instituted a policy that each pupil brings 2 ℓ of grey water to school on Mondays and Fridays. This is used for cleaning and watering the flowers, trees and vegetables. Through her efforts she has not made a difference in the lives of her pupils, but has also contributed to community upliftment.

Sethe Mothibi-Thinane in the Management and Policy Category

As group corporate development manager for global forest products, Mothibi-Thinane is one of the few black women to enter the world of water management in the forestry environment. She has been appointed a member of the Rand Water Board, and has been nominated to serve on the Inkomati Governing Board, focusing on all water catchments in Mpumalanga. Her focus is mainly on sustainability and access to water by the villages in the rural areas.

She is also involved with CSIR in developing the strategy to assist the private and public sector to work together in finding solutions that have an impact on water and sanitation.

WATER Kidz

Dams in South Africa

In South Africa we depend mostly on rivers, dams and underground water for our water supply. The country does not get a lot of rain, less than 500 mm a year. In fact, South Africa is one of the 30 driest countries in the world. To make sure that we have enough water to drink, to grow food and for industries, the government builds dams to store water.

A typical dam is a wall of solid material (like concrete, earth and rocks) built across a river to block the flow of the river. In times of excess flow water is stored behind the dam wall in what is known as a reservoir.

These dams make sure that communities don't run out of water in times of drought. About half of South Africa's annual rainfall is stored in dams. Dams can also prevent flooding when there is an overabundance of water. We have more than 500 government dams in South Africa, with a total capacity of 37 000 million square metres (m^3) – that's the same as about 15 million Olympic-sized swimming pools!

There are different types of dams:
Arch dam: The curved shape of these dams holds back the water in the reservoir.
Buttress dam: These dams can be flat or curved, but they always have a series of supports of buttresses on the downstream side to brace the dam.
Embankment dam: Massive dams made of earth and rock. They rely on their weight to resist the force of the water.
Gravity dam: Massive dams that resist the thrust of the water entirely by their own weight. Usually made of concrete.

THE BIGGEST DAM IN SOUTH AFRICA

The Gariep Dam, in the Free State, is the biggest dam ever built in South Africa. Constructed in 1972, it stores water from the Orange River in a 100 km-long dam with a surface area of 374 km^2.

The dam can store about 5 500 million cubic metres (m^3) of water. The dam is a combined gravity and arch dam, built entirely of concrete. The dam wall is 88 m high and contains about 1,73 million m^3 of concrete. Gariep Dam is a double curvature structure, which means it is shaped like an egg shell.

The dam forms part of the Orange River Project, one of the largest African irrigation projects, which was started in 1966. Its purpose is to provide water for the irrigation of 22 400 hectares of land for agricultural use and, at the same time, to provide drinking water for the cities of Bloemfontein and Port Elizabeth.

DAMS AND THE ENVIRONMENT

Dams are not always a good thing. If they are not planned properly they can have devastating effects on rivers and freshwater ecosystems. It is very important that dam sites are chosen that will have the least impact on the environment. Dams can change the hydrology of the river and disturb the seasonal fluctuations. Dams also change daily flows by releasing water as a reaction to demands for irrigation, energy and so on. Furthermore, the transport of sediment along the river can be disrupted. This affects the morphology of the riverbed, downstream flood plains and even coastal deltas, and in turn impacts on the ecosystems in these areas.

Migratory fish species are said to be particularly vulnerable to dams, which block access to their spawning or feeding sites. These days, new dams include fish ladder structures built in the river to allow fish to get safely through the dam to the other side of the river.

For these reasons, the South African government requires that an environmental impact assessment be undertaken before any dam project, and the an environmental management plan is drawn up to ensure the least damage to the environment and surrounding communities.

DAM FACTS AND FIGURES

- According to the World Commission on Dams there are an estimated 48 000 dams worldwide over 15 m high. About half of these are in China.
- There are about 1 500 dams under construction worldwide at present.
- It takes about four years to build one dam.
- The highest dam in the world is the Rogun Dam in Tajikistan which is 335 m high.
- The Three Gorges Dam, which is being built in China, will be the largest concrete dam in the world. When it is completed in 2009, the dam will stretch almost two kilometres across the Yangtze River and soar 183 m above the valley floor. The reservoir will be 563 km long.

Source: World Wildlife Fund

WATER WORDS

Ecosystem: An interconnected and symbiotic grouping of animals, plants, fungi and micro-organisms.
Flood plain: Area bordering a river which is flooded when the river rises over its normal banks.
Hydrology: Science that deals with the transportation and distribution of water in the atmosphere, on and beneath the earth's surface.
Sediment: Material deposited by water.

Managing Rivers for Life

Dr Joan Jaganyi currently works as a research fellow in water resources management at the Centre for Environment and Development, School of Environmental Sciences, University of Natal, Pietermaritzburg.

She has an impressive string of degrees and qualifications. Dr Jaganyi has a BSc (Hons) in Zoology and Biochemistry from the University of Nairobi, Kenya, and in 1990 obtained an MSc in Applied Entomology from the University of London's Imperial College of Science, Medicine and Technology. In 1998 she completed a PhD in Entomology in the field of Conservation Biology at the University of Natal. In 1999, Dr Jaganyi attended further training in conservation planning at the University of Illinois, Chicago, in the US.

Dr Jaganyi's career in water research began when she started working at the Institute of Natural Resources (INR) in 2000 on a National Research Foundation (NRF) funded project. The project aimed to inform researchers, water managers and stakeholders about the water quality and quantity requirements to sustain the natural environments of rivers that flow through the Kruger National Park. Through this project, Dr Jaganyi was able to see more clearly the importance of the link between the pure biological sciences and the social sciences. Finding solutions to minimise these impacts therefore implies an understanding and appreciation of the interface between humans and nature.

Dr Jaganyi's current research in integrated water research management aims at developing socio-economic tools to enhance implementation of the National Water Protection Policy. In simple terms she has to consider the best way to use water for basic needs, agriculture and industry, while balancing the conservation of water. She is looking specifically at tools for integrating socio-economic values in reserve determination (the Reserve is the volume of water to be left in the river for the environment), with emphasis on environmental flows to support basic livelihoods. The key research question is: How can prediction of a changing river be converted into prediction of social impact? In other words, water resource management is not only about managing water, but about managing people as well, who use the river systems as water resources.

Working as an entomologist, Dr Jaganyi sat behind a microscope. With water resource management, she is now working with people, and realises that biology is important in the normal functioning of a river. The use and conservation of water in a river needs to be carefully balanced. Dr Jaganyi has applied her knowledge of biology to real-life issues. Through her study of entomology, she has come to understand how the little animals and insects in water respond to environmental disasters. The reserve water is a necessary volume of water for the continued biodiversity of animal and plant life in the river ecosystem. If these little creatures, and the related plant life, die, then the entire ecosystem and the community that depends on the water suffer.

To promote the management of the natural resources of the floodplain wetland ecosystem, Dr Jaganyi is developing a multidisciplinary research programme around integrated modelling of the floodplain wetland ecosystem, to simulate the evolution of the ecosystem in relation to different scenarios and their impact on traditional farming systems. She enjoys the field work, and has benefited from moving away from pure academic work. She is helping communities put water user associations in place, and makes them aware of the need for small plants to grow along the rivers, rather than planting their crops too close to the river.

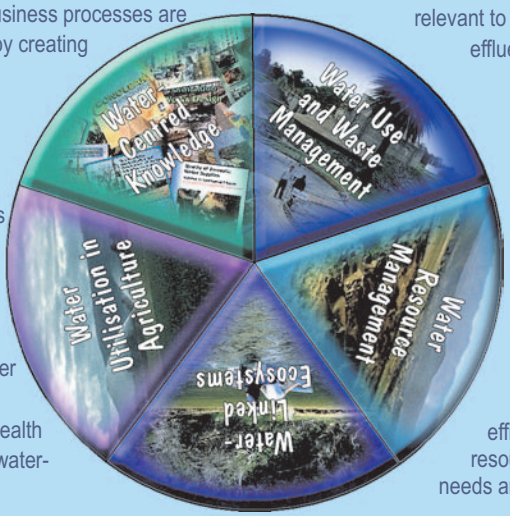
For more on this and other careers in water, see *Water@Work* available from the Water Research Commission. To obtain a copy phone Tel: (012) 330-0340 or Fax: (012) 331-2565 or E-mail: orders@wrc.org.za

Water Research Commission

Invests in the creation, dissemination and application of knowledge through five Key Strategic Areas

The KSA focuses on knowledge management, including the development and protection of knowledge resources. The WRC functions as a knowledge organisation and hence its fundamental business processes are knowledge-based, thereby creating value for the WRC and Its stakeholders.

This KSA aims to proactively and effectively lead and support the advancement of technology, science, management and policies relevant to water supply, waste and effluent management, for the domestic, industrial and mining water sectors.



The strategic focus in this KSA is on increasing the efficient use of water for production of food, fibre, fuelwood and timber; ensuring sustainable water resource use; reducing poverty and increasing wealth of people dependent on water-based agriculture.

This KSA supports the implementation of the policy by developing tools and technologies for water resource assessment, guidelines and decision-support systems to support decision-makers in achieving equitable and efficient allocation of water resources among competing needs among competing needs.

Research undertaken within this KSA addresses the conservation of aquatic ecosystems in order to provide the knowledge for their sustainable functioning in terms of the national commitment to international conventions and the ongoing provision of goods and services which ecosystems deliver.

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