

THE WATER WHEEL

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over at large
SA dams





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LETTERS TO THE EDITOR

Orange River Floods

I would like to tell you how much I have enjoyed your articles in the January/February 2006 issue of *the Water Wheel*. Your stories are well-presented and brimming with topical matters of interest. Keep up the good work. Keep it simple.

The floods, which the Witwatersrand has recently experienced, will do an enormous amount of good in flushing out the river systems. Loch Vaal on the Barrage Reservoir (53 km of stored water) is so contaminated that from time to time it is declared by Rand Water unsuitable for water contact sports. You are then warned by Rand Water not to put your toe in it!

Fortunately Rand Water no longer draws any of its water from Loch Vaal. It supplies its Vereeniging purification plants direct from Vaal Dam via a canal (on the east bank of the river) built about 20 years ago.

I thought that your reading public might be interested in information regarding Orange River floods, which I put together in 2001. It is historical, but at the same time relevant.

Intensive and widespread rains in the Orange/Vaal catchments seem to recur at intervals of ten to fifteen years, and when abnormal rain patterns in the respective catchments coincide, the phenomenon generates an enormous volume of water.

The Vaal joins the Orange at the small village of Bucklands near Douglas in the Northern Cape. Bucklands is 800 km downstream of the Vaal Barrage at Vereeniging. When flood waters from both systems converge at Bucklands, no man-made barrier would be able to contain the vast volume and the impetus of the river force. At the peak of a high-intensity Orange River flood, the chocolate-coloured tumbling water will carry some 250 000 t of silt downstream every hour.

From Bucklands the silt-laden flood water races through the river valley for 200 km to Prieska, then sweeps north-west a further 200 km to surge in a wall of water over the Boegoeberg River Barrage, and then onward a further 100 km to Upington.

Leaving the green vineyards in its wake the flood pounds through the lower Orange region for 500 km and, having taken the Augrabies Gorge in its stride at 6 000 m³/s, the end of the irrigation line is reached at Vioolsdrif.

And then, on the final leg of its epic journey, the flood water races past the junction of the Orange River and Namibia's deeply incised Fish River Canyon, through the foothills of the desolate and forbidding Richtersveld

Mountains to finally spill into the river estuary at Alexander Bay and then into the Atlantic Ocean.

Some of the flood water would have travelled over a river reach of more than 2 000 km. A register of the occurrence of high-intensity Orange River floods over the past 126 years is maintained by the Upington museum. It makes for interesting reading.

During the high-intensity flood of the Orange River in 1988, some 26 000 million cubic metres of water flowed into the Atlantic over a period of six weeks. This volume is equivalent to eleven years of normal water usage in the Lower Orange. The 1988 flood would have filled the giant Gariep Dam five times over.

During February 1996 a volume of water equivalent to the total capacity of the Vaal Dam (2 600 million cubic metres) passed through the dam in a period of 16 days, and it is estimated that during the full 1996/97 summer season some 4 500 million cubic metres of Vaal water flowed unutilised via the Orange River into the Atlantic Ocean.

Not all floods in the Orange River system originate above the Gariep and Vanderkloof dams. There are rare occurrences of more localised floods. In the major flood of March 1925 a significant proportion of the flood water was generated below Hopetown i.e. below the present Vanderkloof Dam. The flood of March/April 1961 was largely generated downstream of Prieska owing to widespread rains in the Karoo.

AH Charnaud, Howick

(The letter has been edited – Ed.)

Package plants – technology not the problem

The fact that package treatment plants (PTPs) are finally under the microscope (*the Water Wheel*, January/February 2006 edition) makes for interesting reading. Finally, this contentious issue is getting the attention it so rightfully deserves.



The Vaal Dam at more than 100% full.

Sadly, the research itself is already flawed, in that it is based on three different types of "package plants". The definition of a PTP is that it is manufactured off site, it is sealed, and that it requires very little civil work. And that it is simple to operate and maintain. All PTPs require the septic tank for anaerobic predigestion, and not just settling and grit removal, as is in the case of this research programme. If this anaerobic process is not in place, the aerobic (and then nitrification/denitrification) phase becomes less effective. Both rotating bio-contactor, and activated sludge systems do not meet this criteria. And if equipment supplied to Darville was any different to the many already in service, then the results would also be different.

The notoriously high failure rate of PTPs is compounded by the attitude of the authorities. An example where Neil Macleod (Durban Metro) recently lifted the ban on new installations despite many old ones not working, and another in that Lin Gravelet-Blondin (Department of Water Affairs in KwaZulu-Natal) believes that all 64 failed PTPs within Durban Metro alone, "are not a disaster they are made out to be" (*Sunday Tribune* of June 6, 2005). One wonders who the authorities really are.

The high failure rates of these systems cannot be blamed on the technology, as sewage has been treated in the same way long before man arrived. We should rather look to the way we adopt this technology – the method we apply it within our designs – to find the answers. Our own research, done over a period of 6 months on live systems revealed some interesting facts. Air blowers without ventilation, tanks without drain/desludging valves, chlorine contact tanks with drain lines directly to the septic tank, and tilting clarifier launders, are just a few noted design/engineering

flaws. One supplier claimed that sewage had changed in 5 years and that is why his systems had failed (implying, possibly, that his design is 5 years out of date and/or that for 5 years the product has been marketed with a known flaw). Another supplier suggested that commissioning could take up to 2 years, and that the PTP be allowed to discharge for this period. The real reason these systems fail is those that supply equipment either don't know any better, or don't care.

The Umgeni team also suggests that the regulators ease the standards. A year ago, the ammonia limit was dropped from 3 mg/ℓ to 6 mg/ℓ, and not one of the existing failed systems passed the new limit. In fact, should the level be relaxed even further to 25 mg/ℓ, only 7 addition systems would pass this environmental threshold. The fact is that 5 known systems that were shut down, had no bearing on environmental impact, but were health hazards. Relieving these plants (and their suppliers) of their duties to perform would have the same effect as the current value of Matric school leavers.

There can be no doubt; the future of the package plant is guaranteed. When consumers put value to water (and wastewater) then more good products will see the marketplace. And then, there will no longer be any place for ignorance and arrogance.

Steve Nicol, Scarab Technologies, Durban

Lack of maintenance causes pollution

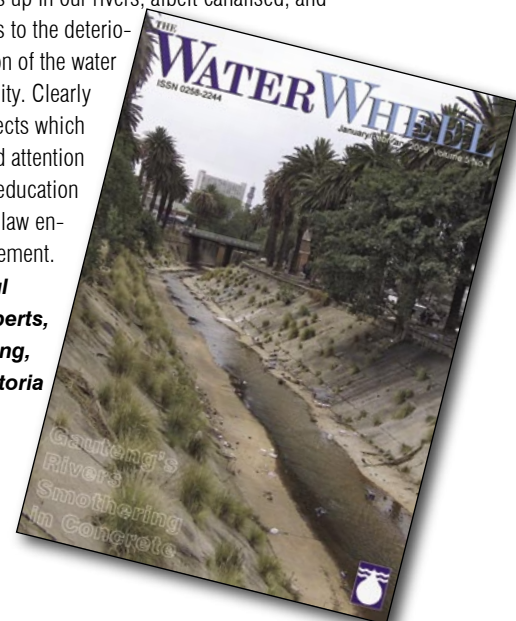
I refer to the cover photograph of the January/February edition of *the Water Wheel*. The photograph shows a portion of the canalised Apies River passing through Pretoria. While such a concrete structure may not be

attractive, it does clearly illustrate the lack of maintenance of our water infrastructure and the pollution of our water.

The Tshwane local authority has clearly not undertaken any maintenance of this canal for a number of years as evidenced by the growth of vegetation between the joints of the concrete slabs. In addition many of the slabs are badly cracked and deterioration has taken place. The canal lining shows a high potential for failure during a major flood. Maintenance of existing water infrastructure is essential and adequate funds should be set aside for this purpose.

The picture also illustrates the amount of solid waste which has been thrown into the canal. The litter on the bank where the people are congregated also indicates the lack of enforcement of anti-littering legislation. Probably a lot of solid waste also enters the canal from the storm water inlets along roads as people (including municipal cleaners) use them for disposal of waste. All of this waste ends up in our rivers, albeit canalised, and adds to the deterioration of the water quality. Clearly aspects which need attention are education and law enforcement.

Paul Roberts, PrEng, Pretoria



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Swiss Reach Out to SA Municipalities

The governments of South Africa and Switzerland have signed a R19-million agreement to support local government capacity building in South Africa through knowledge sharing in the water sector.

It is reported that the agreement, which takes the form of a grant of R9,5-million from the Swiss government and a further R9,5-million from the Department of Water Affairs & Forestry (DWAF) will ensure that municipalities are able to learn and access lessons on successful water services provision systems, procedures and operational models. The funds will be utilised for the implementation of the Masibambane project focused on 'Local Government Capacity Building through Knowledge Sharing'.

According to DWAF, the knowledge sharing project, which is a joint initiative of the department, the South African Local Government Association (SALGA), and the Water Research Commission through the Water Information Network, is significant for a number of reasons. "The resources within the project will enable these partners to jointly establish mechanisms whereby good practice, knowledge and information can be accessed and systematically made available to municipalities to enable them to improve the provision of sustainable water and sanitation services in South Africa and beyond the border," DWAF said in a statement.

In addition, the project will directly contribute to the functioning of the SALGA Municipal Water Services Provider Network where experienced and newly established water services providers from metropolitan municipalities, district and local municipalities can come together to learn lessons and to fast track improvements in service provision.



Virtual Discussion List Sparks Interest in Water

A new mailing list has been created to encourage debate among professionals regarding water engineering issues in South Africa and Africa.

The mailing list, dubbed ZA_WATER_ENG can be used to ask questions, hold discussions or disseminate information that is important to the water engineering community. The list is open to all interested parties, including non-engineers, and is being supported by the Water Engineering Division of the South African Institution of Civil Engineering.

Creator Prof Kobus van Zyl, Chair of the Department of Civil Engineering Science at the University of Johannesburg, explains that e-mail discussion lists are 'virtual communities' of people who share a particular interest and use the list to communicate. The list has a central e-mail address where members send their contributions. These contributions are then automatically distributed to all other list members.

Any member can take part in a discussion or simply follow the discussions to stay abreast of developments in the water engineering field. Only members can send

Diary

EARTH OBSERVATION

MARCH 26-28

The first biennial summit of the South African Observation Network (SAON) will be held at Leriba Lodge, Centurion, Gauteng. The summit will provide a forum for stakeholders to contribute to a core Earth observation science plan for the organisation. Enquiries: Karen Bruyere, E-mail: bruyerek@mweb.co.za

DISASTER MANAGEMENT

MARCH 27-29

The Third International Conference on Early Warning will take place in Bonn, Germany. The conference, themed 'From Concept to Action', will focus on selected practical early warning projects. Enquiries: Fax: +41 22 917 0528 & 0563; E-mail: ewc3@un.org; or www.ewc3.org

RIVER HYDRAULICS

APRIL 3-6

The Institute for Water and Environmental Engineering at the University of Stellenbosch is presenting a four-day short course on River Hydraulics, Floods & Stormwater. Enquiries: Marechia Jacobs, Tel: (021) 808-4352; Fax: (021) 808-4351; E-mail: msjacobs@sun.ac.za

URBAN DRAINAGE

APRIL 3-7

The Seventh International Conference on Urban Drainage Modelling and the Fourth International Conference on Water Sensitive Urban Design will be held conjunctively in Melbourne Australia. The joint conference is organised by the Institute for Sustainable Water Resources, Engineers Australia, the International

Water Association and the Stormwater Industry Association Australia. Enquiries: UDMandWSUD@icms.com.au; www.icms.com.au/UDMandWSUD

CLIMATE CHANGE

APRIL 20-21

The 17th Global Warming International Conference and Expo will be held in Miami, US. E-mail: gw17@globalwarming.net

AGRICULTURE

MAY 7-10

An international workshop on crop and forage production using saline waters in dry areas will be held in Birjand, Iran. The workshop will broadly address the present trends and advances in production of crops and forage using saline waters,

messages or view the searchable archive.

"We live in a fast changing world where the knowledge base is constantly being enlarged and improved. It is thus essential for engineers and other professionals to continuously update and improve their knowledge to stay abreast of new developments in their fields," explains Prof Van Zyl. "In the past, knowledge was gained from magazines, journals, professional bodies and conferences. However, electronic media have created many new and exciting possibilities for people to communicate."

To join, simply send a blank e-mail to ZA_WATER_ENG-SUBSCRIBE-REQUEST@home.ease.lsoft.com

Students from Namibia and South Africa learning more about the Orange-Senqu basin.



SA's Biggest River Aids Capacity Building

A group of students from South Africa and Namibia have successfully completed a two-week training course focusing on the Orange-Senqu river basin, the most developed transboundary basin in southern Africa.

An initiative between the FETWater programme and the Desert Research Foundation of Namibia, the course was aimed at educating the students on the social, economic and environmental aspects related to the management of water resources. The course was funded by UNESCO and the Flemish government.

According to Dana Grobler, network coordinator of the FETWater Resource Directed

Measures network, the experiential training programme created an understanding among the students of the complexities of managing a shared resource such as the Orange-Senqu basin. "Several key sites were visited, including the Lesotho Highlands Water Project, the Tugela-Vaal transfer scheme, the Vaalharts Irrigation Scheme, and water boards such as Rand Water and Bloem Water. At these sites the students gained much information concerning geography, hydrology, infrastructure, management, water users, environmental water requirements, the Reserve and relevant institutions."

Grobler tells *the Water Wheel* that the

participants focused on interpreting their learning and understanding to derive a holistic overview of water use and management in the basin. "The Orange and Senqu rivers were identified as an ideal case study which challenged students to understand the complexities in terms of management and operation of such a system to implement environmental water requirements."

The training initiative is part of a broader programme to build capacity in the water sector in South Africa. A similar training course is planned for the Komati River basin which is shared by South Africa, Swaziland and Mozambique.

with particular emphasis on technological innovations in production of salt resistant plants. E-mail: namstct@vsnl.com or apknam@gmail.com

WEATHER MAY 8-12

The International Conference on the Application of Meteorological Extremes (CAMEX) will take place in Pretoria. Enquiries: Dr Emsie Klopper, Tel: 082 922 8229, Fax: (012) 998 8252; E-mail: emsie@lawwindow.co.za

CLIMATE CHANGE MAY 10-12

A climate change technology conference with the theme 'Engineering Challenges & Solutions in the 21st Century' will be

held in the Ottawa Congress Centre, Canada. The conference is hosted by the Engineering Institute of Canada. Enquiries: Tel: 613-839-1108; Fax: 613-839-1406; E-mail: EICCC2006@ieee.org; Web: www.ccc2006.ca

SOIL CONSERVATION MAY 14-19

The 14th Conference of the International Soil Conservation Organisation will take place in Marrakech, Morocco. This conference will be a common forum for experts in various disciplines related to sustainable management of soil and water, particularly in semi-arid environment. Enquiries: E-mail: isco2006@wanadoo.net.ma; Web: www.swcs.org/en/international/isco/isco_2006.cfm

WATER MANAGEMENT MAY 17-19

EnviroWater 2006, to take place in Delft, in the Netherlands, will focus on 'Concepts for Water Management and Multifunctional Land-Uses in Lowlands'. Enquiries: E-mail: Envirwater2006@wur.nl; Web: www.wau.nl/rpv/isomul/envirwater2006

URBAN WATER MANAGEMENT JUNE 19-23

The Third World Urban Forum, organised by UN-Habitat, will take place in Vancouver, Canada. The overall topic of the event is how to reduce burgeoning poverty in cities, improve the urban poor's access to basic facilities and achieve environment-friendly, sustainable urban growth and development. Web: www.unhabitat.org/2006

Contract to Bring Water to the People

The Greater Tubatse Municipality, in Burgersfort, Limpopo, has launched a R300-million plan to meet critical water backlogs.

Thanks to financial assistance from the Development Bank of Southern Africa, the municipality has signed a contract with bulk water supplier Lepelle Northern Water to help get clean water to the estimated 66% of the 300 000-strong population without access, BuaNews reports.

Greater Tubatse is situated in the arid Sekhukhune district that has four local municipalities. An audit of water infrastructure is being undertaken in the district at present in an effort to determine what more is needed. According to district spokesman Mike Lekala, the exercise will include determining the condition of existing infrastructure such as wastewater treatment plants, as well as the people needed to operate and maintain them.

Vaalharts Due for Overhaul

Northern Cape MEC Dipuo Peters has revealed plans to rehabilitate the Vaalharts Irrigation Scheme.

About R300-million will be spent on overhauling the scheme over the next five years. According to the MEC, almost R70-million will be used for the construction of the sub-surface drainage system to address the existing water logging problem, while R230-million will be spent on upgrading the irrigation systems. "We will also continue to work on the development of the Orange River Emerging Farmer Settlement Programme," Peters said in her State of the Province address.

Vaalharts remains the largest irrigation scheme in South Africa, covering 36 950 ha.

Vaalharts, situated in the northeast corner of the Northern Cape bordering the North West was started as an irrigation scheme during the 1930s. It remains the largest irrigation scheme in South Africa, covering 36 950 ha. Main crops include lucern, cotton, maize, ground-nuts, and of late grapes, citrus and pecan nuts, while fruits such as apricots, watermelon, peaches and olives for the export market are on the increase.

Engineering Students Awarded

Several engineering students have been honoured by the Institute of Professional Engineering Technologists.

Rishaal Ramchunder, a student at the Durban Institute of Technology, was awarded the Top Engineering Graduate award for obtaining the B.Tech. Engineering (Civil) degree with an average of almost 90%. In turn, the Top Engineering Graduate Award for a female student obtaining the highest average marks on completion of the B.Tech. Engineering degree countrywide went to Nonhethetho Moholi from the Vaal University of Technology for her average of 82%.

New DG for Science Department

From 1 April the Department of Science (DST) will have a new Director-General in the form of Dr Philemon Mphati Mjwara.

Dr Mjwara joins the DST from the CSIR where he worked as Group Executive: Research & Development. His experience in academia includes serving as professor in science and technology policy at the

University of Pretoria and as a physics lecturer at the universities of Wits, South Africa and Fort Hare. He has published numerous papers on physics, technology analysis and technology foresight processes.

Dr Mjwara completed his M.Sc. at the University of Fort Hare in 1987, followed by his Ph.D. at Wits in 1995.

in the Amathole District and Buffalo City Municipalities. Both these municipal districts have experienced a steady population growth and rapid urbanisation since 1990. In turn, this has a direct impact on the water board in terms of the operation and present infrastructure as well as the planning and development of infrastructure upgrades and new infrastructure.

According to Sirenya, Amatola Water actively pursues relation-

ships with other stakeholders through forums, liaison meetings, service level agreements, and memorandums of understanding, among others. This includes more informal partnerships with the private sector, which he believes does have a role to play, especially in the field of innovation.

Other lessons learnt include integrated capital and operational expenditure planning; the need for asset management strategies that take cognisance of the lifecycle of the infrastructure; accurate population estimates; and the need to create a balance between the developments in the rural and urban economies.

Partnerships Needed to Overcome Water Hurdles

Partnerships between key roleplayers are critical to successfully managing the impact of rapid population growth and urbanisation, two of the greatest challenges facing water services today.

So says Eastern Cape Water Board Amatola Water CEO Maxwell Sirenya. He was speaking at Pan-African Water 2005, held in Midrand at the end of last year. "These roleplayers include the Department of Water Affairs & Forestry, the water boards, the water services authorities (provincial and local government), the private sector and the public," he told delegates.

Amatola Water is the bulk water supplier



Amatola Water CEO Maxwell Sirenya



The Umgeni River before and after being cleared by Working for Water. More than 80% of the river was invaded by water hyacinth.

Weed-free Water for Canoeists

Clearer, cleaner water met the participants of the 55th annual Hansa Powerade Duzi canoe marathon thanks to the efforts of Working for Water (WfW) to clear the river of aquatic alien plantation.

More than 80 km of the Duzi/Umgeni river systems was invaded by water hyacinth, which potentially threatened the safe passage of the estimated 2 000 paddlers. According to WfW, this aquatic weed is the top invasive alien plant in KwaZulu-Natal.

About R1-million has been spent over the last four to five years to clear the infestation through aerial spraying and mechanical control. However, about 75% of this sum has

been paid to the contractors and workers drawn from communities that call this river system home. At the time of writing, there were three contractors and 30 workers who had benefited from 1 485 person days of work from this project alone.

Water hyacinth is extremely difficult to control, according to contractor Petros Mbongwe. "The weed doubles in biomass every five to ten days. Thus, if left untreated, the infestations would reach 100% in a very short period." For example, if the infestation is one hectare now, in a week it would be two hectares, in two weeks, four hectares, in three weeks, eight hectares, and so forth. Thus a

one hectare patch of hyacinth can reach 32 ha in five weeks.

"Aquatic invasive alien plants are extremely dangerous because they have a negative impact on indigenous plant and animal life. They also create a breeding ground for mosquitoes and bilharzia-carrying snails. If left uncontrolled, they hamper and even prevent recreational sports, such as fishing, swimming and of course even the Duzi," said Abeeda Kadir, the KwaZulu-Natal acting regional programme leader for WfW. WfW is recognised as one of government's most successful Expanded Public Works Programmes.

Canadian Technology Helps Limpopo Poor

For decades, the residents in and around Letsitele, near Tzaneen in Limpopo, treasured their wheelbarrows as their most prized possessions.

It is with these wheelbarrows that they trekked, something for an entire day, to collect precious water resources. Now through a collaboration between Rotary International and Canadian water treatment firm ZENON, about 30 000 residents in the villages of Mariveni, Mafarana, Mulati, Zanghoma, Sedan and Lefara will have access to potable water for the first time.

The Canadian firm has donated a 0,5 Mℓ ultrafiltration system to clean water for the communities using the company's patented membranes. According to ZENON's website,

its membranes are hollow strands of porous polymer fibres that prevent the passage of certain contaminants while permitting water molecules to flow to the inside of each strand.

This selective filtration is possible because the surface of each membrane fibre consists of billion of microscopic pores that block the passage of all particles larger than the size of the pores, creating a physical barrier to contaminants. Water is drawn through the pores with the use of a slight suction, much like that required when sipping liquid through a straw.

Water pipes are also being laid to pipe water to villagers, and the Canadian firm has been training operators from the Greater Tzaneen municipality in the operation and maintenance of its system.

Tzaneen's present water source



Photograph courtesy of ZENON

Regional Support for Science

The African Development Bank will strongly support regional efforts to establish centres of excellence in science and technology, according to bank president Donald Kaberuka. According to Kaberuka, the bank, together with the African Union, New Partnership for Africa's Development, the United Nations Economic Commission for Africa and regional as well as sub-regional organisations, will reinforce measures to reduce the scientific gap that separates Africa from the rest of the world. Efforts will focus on developing infrastructure, strengthening research capacity and promoting innovation and creativity through reinforced public private partnerships.

Meanwhile, individual countries are also increasing efforts to promote science. Malawi has launched a US\$8.3-million science plan to develop policies to support research and development and the transfer of technology from developed countries.

In addition, members of the Southern African Development Community have agreed to coordinate their science policies and work together to develop the region's science and technology infrastructure. In particular, the countries will harmonise some of the rules governing how scientific research is carried out, especially customs regulations on the movement of researchers and scientific equipment.



Kimberly Jennings, a BSc (Hons) student at the Department of Soil, Crop and Climate Sciences at the University of the Free State, was awarded the medal for best oral paper by an author under 30 years old at the combined conference of the Soil and Crop Science Societies, held at the University of KwaZulu-Natal Howard College campus in January. Here she is receiving the award from Garry Patterson, President of the Soil & Science of South Africa and Dr Cornie van Huyssteen, acting Chair of the awards committee.

Search for African Research Assistant

Tufts University, and the University of Georgia, both of the US are searching for a Ph.D. student to act as a research assistant in a water management project being undertaken in Burkina Faso.

The two universities, with the support of the International Research Institute for Climate & Society (IRI) and national collaborators have received a two-year grant to design, implement and test a seasonal streamflow forecasting system integrated with a reservoir operation decision support tool (DST) for the Camoe River Basin, in southwest Burkina Faso.

The prospective research assistant will need to hold an M.Sc. in Water Resources Engineering and have knowledge of hydrology and reservoir optimisation modelling as well as be qualified to enrol in the Ph.D. programme in Civil Engineering at Tufts University. There would also be an opportunity to

participate in the cross-school, interdisciplinary programme in Water: Systems, Science and Society.

The successful candidate needs to speak and write English well. The focus of the work would be the reservoir DST, however, the person will also be trained in the development of seasonal forecasting tools.

For more information, contact Dr Paul Kirshen at Tufts University, Tel: +1 617 627 5589; Fax: +1 617 627 3994; E-mail: paul.kirshen@tufts.edu



Chinese/Australian Collaboration for Water

China and Australia are creating a joint centre for water research, a fund for scientific cooperation and an exchange programme for young scientists.

According to SciDev.Net, the centre for research on water resources will have branches at the Chinese Academy of Sciences in Beijing and the University of Melbourne in Australia. It will focus on issues such as groundwater management and improving irrigation techniques.

It is reported that Australia will provide US\$266 000 over the next three years to

employ a senior research fellow who will help develop the centre's joint research programme. China apparently has yet to commit funds to the project.

Under the agreement, Australia's Commonwealth Scientific and Research Organisation and Chinese laboratories will work together directly and seek joint funding from sources outside the two countries. The initiatives highlight the importance the countries attach to scientific collaboration, commented Australian Minister of Science, Julie Bishop.

African Disaster Reduction Programme Planned



Government ministers from 40 countries have agreed on ways to implement a new continental disaster reduction strategy that will also help to eradicate poverty following the first African Union Ministerial Conference on Disaster Risk Reduction.

Africa is reportedly the only continent whose share of reported disasters in the world total has increased over the past decade. Some 20 million people are recovering from such disasters as the earthquake in East Africa, Karthala Volcano eruption in Comores, drought in southern Africa and Niger, and locust invasions in West Africa.

The Africa Regional Strategy on Disaster Risk Reduction is designed to increase political commitment to and public awareness of disaster risk reduction and enhance continental knowledge of reduction methods, reports the United Nations International Strategy for Disaster Risk Reduction. "The strategy will improve the identification and assessment of risks, improve the governance of disaster risk reduction institutions and integrate reduction methods into emergency responses."

Clinging on to This Straw Might Save Your Life

The world is praising the inventors of the LifeStraw, a US\$3 personal mobile water purification tool, which should become widely available this year.

Developed by international firm Vestergaard Frandsen, the high-tech drinking straw cleanses surface water and makes it safe for human consumption. It is just 250 mm long and 290 mm in diameter and can be hung around the neck, making it suitable for distribution in disaster areas. It requires no electrical power or spare parts.

The product filters up to 700 l of water removing most of the micro-organisms responsible for causing waterborne diseases. This is done through the use of PuroTech Disinfecting Resin – a patented material which reportedly kills bacteria on contact. The LifeStraw does not remove arsenic, iron, fluoride and other heavy metals.

The product reportedly lasts between six and twelve months before it has to be replaced.

- For more information, visit www.lifestraw.com



Risk Management Discussion on the Cards

The Fourth World Water Forum (FWWF), to take place in Mexico City this month, will seek to identify actions at the local level to prevent water-related hazards turning into disasters.

It is reported that 90% of natural disasters are weather related, with 71% of deaths caused by natural disasters being due to extreme hydrometeorological events.

Consequently risk management will form the basis of discussion at 30 sessions of the FWWF. During these sessions, topics such as flood management, social vulnerability, dams and watersheds will be dealt with, among others.

Specifically, the forum will underscore the fact that preventative financing is eight times more cost-effective than the budget allocated for rescue and recovery. Attention will also be drawn to the fact that there are indicators that governments around the world are moving away from investment in the monitoring network on water-related hazards.

Human Waste Can Make Plants Sick

A study, published in the January issues of international journal *PloS Biology*, has showed that faeces from healthy humans contain live viruses, most of which are plant viruses that could sicken and deform plants.

Greywater, sometimes used for irrigation, may also contain these viruses, according to the investigation conducted by the San Diego State University, in the US. However, future studies are required to determine if such water can infect plants.

The researchers say the viruses humans pass probably do not harm us and airborne transmission is unlikely. Instead, the viruses probably hitch a ride through the human body via food, even when the food is cooked or dried.

- To access the journal go to <http://biology.plosjournals.org>

World Snippets

- ◆ A new **climate model** developed by the US National Oceanic Atmospheric Administration shows a dramatic drying of the Sahel region during the next 50 years because of climate change. This refutes other forecasts which expect the region, which stretches from Senegal to Somalia, to become wetter.
- ◆ A **new fund** has been established to assist African ecologists. The British Ecological Society's Capacity Building for Ecology Fund has committed US\$880 000 for the first five years.
- ◆ Last year witnessed the largest financial losses ever as a result of weather-related **natural disaster** linked by many to human action, more than US\$200-billion compared to US\$145-billion in 2004, the previous record, according to statistics presented to the United Nations Climate Change Conference meeting in Montreal, Canada. The year 2005's figures, partly as a result of the highest number of hurricanes ever seen since records began in 1850, are part of a climbing trend being linked to many in the industry with climate change.
- ◆ China's **Three Gorges Dam**, the largest hydroelectric power project in the world, is to be completed by May, three months ahead of schedule. The project, which was launched in 1993 in the middle reaches of the Yangtze River, will have cost US\$22-billion, and required 16 million cubic metres of concrete, the Xinhua news agency reports.

SA/Dutch Partnership Snatches Ghana Contract

Rand Water Services, the newly-established business arm of South Africa's largest water utility is growing its portfolio following its appointment, along with Dutch company Vitens, to manage Ghana's urban water supply.

The two public-owned water utilities snatched the five-year contract to manage the Ghana Water Company Limited (GWCL) from under the noses of several large international water companies. Under the contract the Ghanaian government remains the owner of all water treatment and reticulation infrastructure.

At present parastatal GWCL manages the water systems in about 80 larger towns and cities in the country serving between six and seven million people. According to Prof Clement Dorm-Adzobu, chair of the Ghana Water Resources Commission, the company has experienced problems in terms of poor service provision, cost recovery and weak capacity of operations and maintenance. This is mainly due to inherent institutional and organisational problems. As in many developing countries, the poor, who mostly rely on private water vendors, pay much more for their water than those connected to a water reticulation system.

"The official coverage figure for urban water supply is 70%, however, it is estimated that only about 40% of those connected enjoy regular supplies, Prof Dorm-Adzobu told delegates at Pan-African Water 2005, held in Midrand at the end of last year.

Now the Ghanaian government has received a grant from the World Bank totalling US\$103-million, as well as US\$5-million from the Nordic Development Fund to improve the situation through the Ghana Urban Water Project. The government is also expected to contribute US\$12-million.

Thabani Myeza, head of business development at Rand Water Services, tells *the Water Wheel* that the management contract spells out all the deliverables by the operator. Key to these is the control of water flows, water pressure, water quality and better management of revenue collection. "Initial focus therefore will be on limiting water losses and improving revenue collection. Thereafter plans will be put in place to ensure that paying customers are receiving reliable service."

The main objective of the management contract is to improve levels of service, reduce non-revenue water, while improving water quality and extending services to under-

served areas. "Our aim is to meet and hopefully beat these service requirements, but also to improve the financial standing of the GWCL while putting sustainable systems and processes in place," reports Myeza.

Rand Water Services and Vitens will be contributing equally to the management contract, each bringing its own expertise. According to Myeza, the expertise of both parties is, for most part, complementary. At operational level the South African firm brings excellent skills in the area of water abstraction, purification and pumping. On the other hand, the Dutch company brings water



reticulation and customer management expertise to the table.

Previous efforts by the Ghanaian government to include private company involvement in restructuring the GWCL have been met by public disdain and regular protests. Yet, the present management contract seems to have been approved. "To date the level of resistance we have seen is minimal, and limited to small sectors of the community. On the whole we believe the project is acceptable to the vast majority of Ghanaian communities,"

notes Myeza. "In fact, most civil groups were present at the signing ceremony and were widely consulted on social issues around this initiative." He points out that, as part of the contract, the project team plans to work closely with the affected communities in ensuring that its plans are communicated properly.

At the time of writing, a small team was being deployed to Ghana to start ground preparations, however, full-scale rollout is only due after final contract negotiations have been concluded.

SA Shows Thailand How it's Done

South Africa is providing Thailand with assistance regarding water demand management.

Local company WRP is part of an international consortium which won the contract to upgrade the water network in Bangkok and introduce water demand management in the Thai capital. The Metropolitan Water Association (MWA) supplies water to 14 million residents in southern Thailand.

The US\$75-million total contract was won against most of the large water companies in the world, including Thames Water, Binnie Black & Veitch and Dorsch Consult. WRP's

role is to provide training to senior management of the MWA as well as specialist ad hoc support to the project team over two years.

"For the South African water industry this is a great compliment as it demonstrates that our experience is both valued and recognised abroad," Ronnie McKenzie, MD of WRP tells the *Water Wheel*.

A number of MWA employees have already completed their training in South Africa. According to McKenzie there was some surprise from the trainees as to the sophistication of South Africa's water systems – many of which are of First World standard.



Top: The Thai delegation who attended a course on water demand management in South Africa.

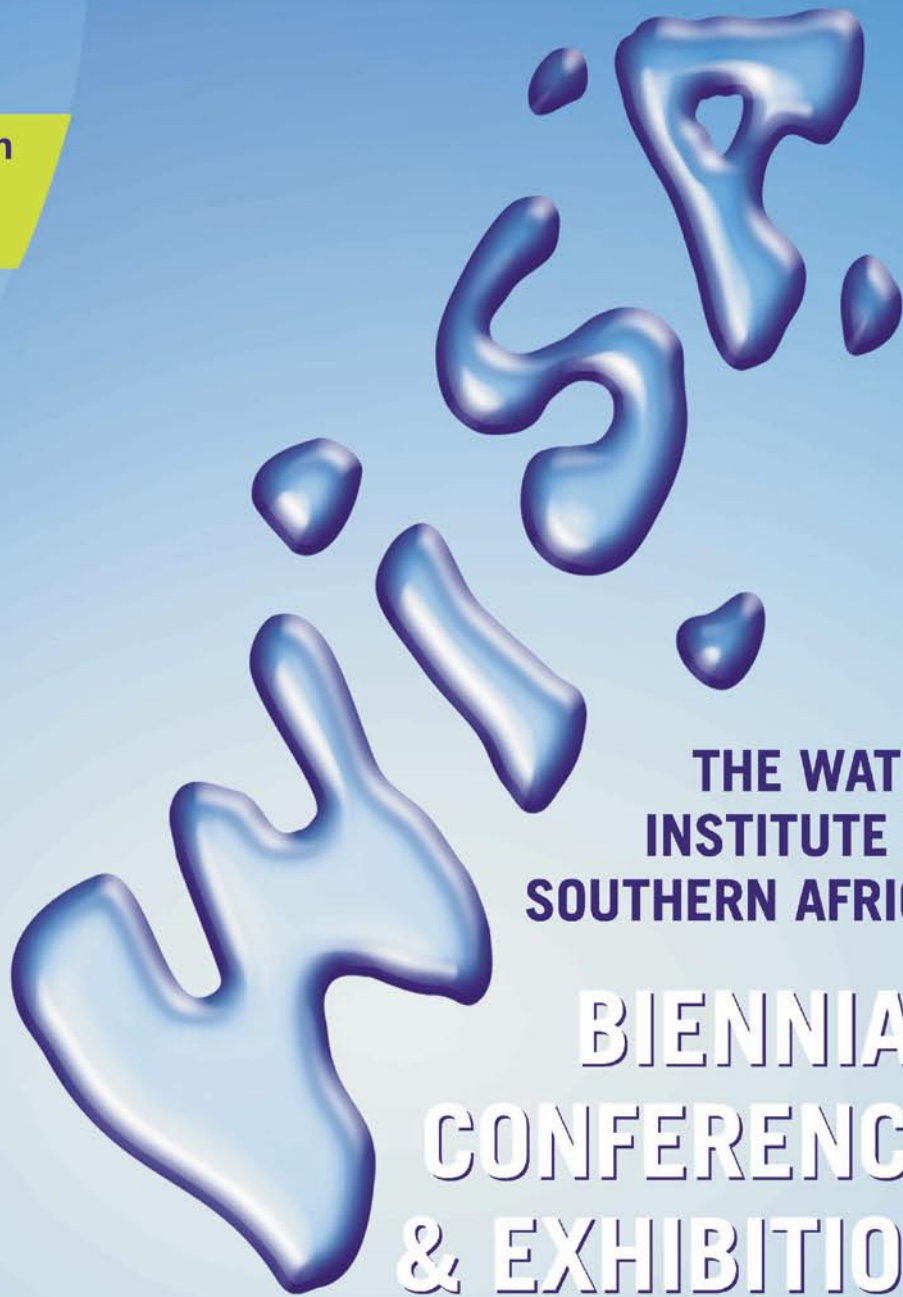


Left: Governor of the Thai Metropolitan Water Association, Santi Somboonvi-boon, receives his training certificate from Ronnie McKenzie, MD of WRP.

Market News

- ◆ **Barloworld Rober Tube** division is marketing a new patented steel pipe which eliminates the need for a socket. Each pipe is reportedly designed with one end flared and internally threaded, while the other end is externally threaded.
- ◆ **Rand-Air**, subsidiary of Atlas Copco, has been selected as the preferred supplier for the Berg River Project Joint Venture, in the Western Cape. The firm's Cape Town depot is reportedly supplying the contractors constructing the dam with 90% of the power and compressed air needed on site.
- ◆ **Denorco** has delivered 37 Tsunami axial flow pumps to the River Nile State in Sudan, in a project that will see the transformation of 50 000 ha of arid desert into arable farmland in the biggest flood irrigation project on the continent. This R40-million pump order received is believed to be the biggest ever pump order from South Africa into Africa.
- ◆ **Biwater** has reportedly instituted arbitration proceedings against the Tanzanian government. This is after the government terminated a ten-year water privatisation contract on the grounds that the UK water company had allegedly failed to make the required investment to improve services in Dar es Salaam.
- ◆ With the introduction of the RMM621 compact DIN rail mounted device, **Endress + Hauser** now offers the possibility of universal pump control, which includes remote transmission of counters and alarm conditions. The modular plug-in card concept allows for flexible adaptation of the unit to the individual requirements from wastewater treatment plants, water plants, breweries and pumping stations.

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World Dams Fail to Make the Grade

Five years on from the launch of the World Commission on Dams (WCD) report dams are continuing to cause excessive social and environmental damage.

So says the World Wildlife Fund (WWF) in a new report, *To Dam or not to Dam? Five years on from the WCD*. The report shows that while dams undoubtedly have a role to play in meeting growing energy and water needs, there is also much at stake as in the past too many projects have resulted in excessive damage to the environment and local societies.

It is reported that already 59% of the world's large river systems are fragmented by dams. The Millennium Ecosystem Assessment found that the amount of water impounded behind dams quadrupled since 1960, and that three to six times as much water is held in reservoirs as in natural rivers.

Yet, dam construction continues at a rapid pace, particularly in the developing world where growth of water and electricity demand is strongest. China, Iran and Turkey lead in the construction of large dams, although industrialised Japan is not far behind. According to the report, close to 400 large dams over 60 m in height are under construction worldwide at present.

"This is not the engineering heyday of the 1950s when dams were seen as the hallmark of development. We know dams can cause

damage and we must put this knowledge to work," says Jamie Pittock, head of WWF's Global Freshwater Programme. "Governments along with the World Bank must insist that the WCD's recommendations are applied to all dam projects now."

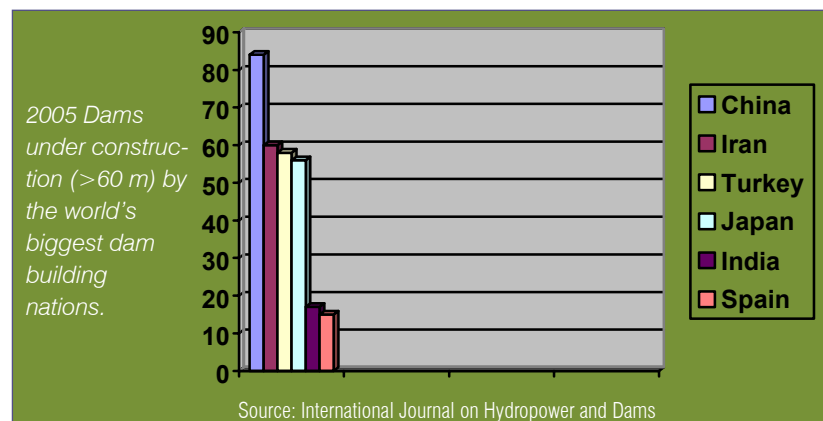
Case studies in the WWF report from, for example, Turkey, Iceland, Spain, Australia, show that there are still numerous examples of individual dam projects that fail to meet one or more of the WCD strategic priorities. In particular, there appears to be a failure to undertake comprehensive needs and options assessments. Furthermore, environmental impact assessments are often inadequate.

The WCD recommendations are aimed at ensuring that dams are economically and environmentally sustainable, by ensuring that

construction plans are given public approval, comprehensive assessments of other options are made and that the economic benefits of any dam are shared with local communities. South Africa is one of the few countries which has embarked on a comprehensive follow-up process to the WCD report. In a three-year process, a multi-stakeholder committee led the South African process to recommendations for changes in policies and procedures.

"Bad dams and bad economics are apparently still alive and kicking five years after the WCD," says report author Ute Collier. "As the energy and water crisis tightens we need to ensure that we choose the solutions with the least environmental damage and the greatest social benefits."

◆ To access the report go to www.panda.org/dams



Water on the Web

www.globalwaterintel.com – *Global Water Intelligence* is a monthly, 32-40 page newsletter delivered electronically and in hard copy format providing analysis and strategic data on the international water market. An interesting site it offers, among others, analysis of current trends, and a project tracker. The downside is one has to be a subscriber to access any information.

www.peopleandplanet.net – Online magazine *People and Planet* provides a global review and Internet gateway into the issues of population, poverty, health, consumption and the environment. It is published by Planet 21, an independent non-profit company and a registered British charity recognised by the United Nations.

www.reservoir.co.za – This website is dedicated to Catchment

Forum activities within the Upper Vaal Management Area. Managed by Rand Water, the site provides a platform for water quality information for all interested and affected parties within the Upper Vaal.

www.wmo.ch/index-en.html – This is the official site of the World Meteorological Organisation, a UN specialised agency focusing on weather, climate and water. Although the site appears a bit busy at times, this is a good place to start if you are interest in what is happening in the atmosphere.

www.wri.org – Based in Washington, the World Resources Institute is an environmental think-tank that goes beyond research to find practical ways to protect the earth and improve people's lives.

Save Traditions, Save Wetlands



South Africa's wetlands can be conserved by preserving the way they are perceived culturally and socially.

So says national training and development coordinator for the Working for Wetlands programme, Mandisa Mangqalaza. She was speaking at the National Wetlands Day celebrations at the Pretoria Botanical Gardens. The theme for this year was 'In the Face of Poverty, Wetlands are a Lifeline.'

Wetlands are among the most productive ecosystems on earth, however, they are decreasing rapidly, plunging the millions of vulnerable people that depend on their life-support systems, into poverty.

"... cultural practices are fast disappearing and, with them, the traditional respect for wetlands"

Mangqalaza said that wetlands were traditionally revered in several local cultures. "By rekindling these traditional values and indigenous knowledge we can begin to conserve our precious wetlands."

Wetlands are essentially the transition or meeting place of land and water. It is said that for many indigenous cultures, wetlands thus represent the transition between the material and spiritual world where one's ancestors have a central place. For this reason, wetlands have historically been heavily guarded. It was believed that the wetland had to be kept in good condition to avoid the wrath of the ancestors.

"Today, research tells us that there are practical reasons why we must protect wetlands; they reduce the effects of floods, and are natural water purifiers, but the end result – the fact that we need to conserve them – remains the same."

Apart from being religious sanctuaries, wetlands are also an essential source of

products for food and medicine. For example, the river pumpkin or *Gunnera perpensa*, has traditionally been used to ease childbirth and promote the

expulsion of after-birth in humans as livestock. Other wetland plants, such as amadumbe (African potato) and waterblommetjies are used in food dishes.

Sedges cut from wetlands are used to weave sleeping mats or beer strainers. These traditional mats are also an essential item used by many traditional healers as it is directly linked to water, healing and creation. Sleeping mats are also customary gifts from the bride to the groom's family in traditional Zulu marriage settlements.

Today, these cultural practices are fast disappearing and, with them, the traditional respect for wetlands.

Mangqalaza maintains some of these traditional beliefs need to be reawakened. "When developing wetland management plans the cultural aspects must not be forgotten," she said. "They may be extremely valuable tools for achieving wise and sustainable use of wetlands."

World Wetlands Day

World Wetlands Day is celebrated each year on 2 February. It marks the date of the signing of the Convention on Wetlands on 2 February 1971, in the Iranian city of Ramsar. The day was first celebrated in 1997.

Did you know?

The isiZulu word for 'wetland' is 'ixhaphozi', from the isiZulu, 'xha', the word given to the squelching sound made by cattle as they pull their hooves out of the mud.

Source:
Working for Wetlands

Wetlands at a glance

- ◆ Wetlands ecosystems are estimated to cover more than 1 280 million hectares globally – an area 33% larger than the United States.
- ◆ Wetlands deliver a wide range of ecosystem services that contribute to human well-being.
- ◆ Water supply, water purification, climate regulation, flood regulation, coastal protection, recreational opportunities are all performed by wetlands.
- ◆ The degradation and loss of wetlands is more rapid than other ecosystems on the planet.

Source: *WWF*

Fighting Poverty Through Sanitation

A new government initiative, which combines the provision of sanitation with job creation, has been launched in Limpopo.

The National Sanitation Job Creation Programme is an initiative of the Department of Water & Forestry (DWAF), working in collaboration with the Labour Job Creation Trust, the South African Local Government Association, Umsobomvu Youth Fund, Development Bank of Southern Africa as well as the departments of Public Works (DPW) and Provincial and Local Government.

The programme follows a National Sanitation Job Creation Seminar held in mid-2005, attended by several stakeholders, in which guidelines to accelerate job creation through sanitation provision composed, reports George Tsibani, DWAF Deputy Director: Capacity Building and Training. "The provision of basic sanitation remains a priority for the South African government as it strives to eliminate the backlog of about 16 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 resides in rural areas, which are also the biggest target for sanitation delivery. Through this initiative, which will be executed as part of the Expanded Public Works Programme (EPWP), we hope to alleviate poverty by providing

essential services and creating jobs to needy communities."

Tsibani adds that the aim of this initiative is not to replace present programmes, but to enhance their effectiveness and impact (particularly at local level) by introducing strong coordination and advocacy functions, and by paying more attention to capacity building, job creation and community involvement. Towards the end of last year a pilot initiative was launched by DWAF Minister Buyelwa Sonjica at Mawa Village, outside Tzaneen, in Limpopo. She said: "Our principal task in the medium term points to the need for attacking poverty in delivering sustainable sanitation as funded under the Municipal Infrastructure

"The provision of basic sanitation remains a priority for the South African government"

Grant and the Provincial Infrastructure Grant using EPWP indicators." Further pilot projects are to be negotiated with interested water services authorities. In this regard, DBSA has made significant progress with the support of the North West Legislature using the Sanitation Job Creation Municipal Guideline.

In addition, DWAF, with its strategic partners, will be rolling out this guideline to more than 170 water services agencies and new municipal agencies after March as part of the EPWP programme. At the time of writing, DWAF and DPW were finalising preparations for the rollout of this project.



Minister of Water Affairs & Forestry Buyelwa Sonjica at the National Sanitation Job Creation Programme launch in Limpopo.

Water by Numbers

- **10%** – The percentage of the world's crops being irrigated with sewage, often untreated.
- **15 000** – The number of civil engineering professionals in South Africa at present. According to a new report from the South African Institution of Civil Engineering, the country will need an additional 1 500 to 4 000 civil engineers over the next ten years to cope with the growing pipeline of large projects.
- **R218-million** – The funds approved by Mandela Bay municipality to eradicate the bucket system. At present there are more than 22 000 bucket latrines in use within Mandela Bay, which the authority hopes to eradicate by 2008 in a programme to start in April.
- **30-40 Mℓ** – The volume of raw sewage that was released into the Nsikazi River, a tributary of the Crocodile River, after two ponds collapsed in KaBokweni near White River, in Mpumalanga. The Crocodile River runs through the municipal areas of Mbombela and Nkomazi, the Kruger National Park, and into neighbouring Mozambique.
- **98%** – The percentage of City of Johannesburg residents who have access to a reliable water supply, according to mayor Amos Masondo.
- **600 t** – The volume of water hyacinth removed every day from the Kagera River before it enters Lake Victoria.
- **100 t** – The volume of benzene that spilled into the Songhua River, a tributary of the Amur, which runs along the China-Russian border, after an explosion at a Chinese factory.
- **2007** – The new target date set by the South African government for the elimination of the bucket toilet system.
- **R12,5-million** – The money owed to Johannesburg Water by 99 schools in the city. The utility has threatened to cut off supplies to the schools and take legal action unless there was a firm commitment by the province to pay the outstanding money.
- **50 000** – The number of mathematics and science graduates aimed for by government by 2008.

Granting Fish the Right of Way

Collaborative efforts to determine the correct design of fishways for uniquely South African conditions are bearing fruit. Lani Holtzhausen reports.

Mangrove snapper, silver robber, bluespot mullet, thornfish, spotted grunter, longfin eel, mountain catfish, Lowveld suckermouth. These are but a few on a long list of fish species whose free movement has been impeded by man-made structures such as weirs, dams, levees and embankments. In fact, impassable fabricated barriers to migration have been cited as one of the main reasons, along with pollution and the introduction of alien species, for the threatened status of a number of red data species in southern Africa.

The harmful effect of barriers to migration is particularly severe on

coastal rivers where a number of so-called catadromous species need to migrate from their marine or estuarine spawning grounds into freshwater reaches of rivers for feeding purposes. As these fish migrate upstream as small juveniles even low barriers of less than a metre can be impassable.

INEFFECTIVE STRUCTURES

To mitigate the situation, several fishways have been constructed in South Africa since the 1950s, some at great expense. Recent legislation stipulates that appropriate migration mitigation is required if any proposed in-stream

The natural-bypass fishway at the lower Sabie after heavy rains. It is the only one of its kind in South Africa.

structure obstructs the natural migration of indigenous aquatic species. However, of the 57 odd fishways that have been constructed to date, only 42 are functional to some degree.

The greatest reason for this is that most of these structures were neither designed for South African species nor for local river conditions. Rather, the technology used to construct the fishways was mostly modelled on European and North American structures, designed for large, strong-swimming adult salmonids (trout and salmon). In some cases in the past, fishways were included in a project as an

afterthought to satisfy some legal or social obligation.

Economic considerations also influenced fishway design and, to reduce costs, fishways were often shortened and made impossibly steep. Another mistake has been the incorrect placement of the fishway entrance. As these structures simply did not work, they were in the end a total waste of money.

COLLABORATIVE RESEARCH EFFORT

Only since 2000 has a serious research effort been undertaken to develop fishways in South Africa. Almost all of this research has been funded by the Water Research Commission (WRC). "While necessary, fishways can add huge costs to the construction of a dam or a weir, therefore it needs careful consideration, not only from an environmental point of view, but also from a financial and sustainability point of view," maintains Dr Steve Mitchell, Director: Water-Linked Ecosystems at the WRC. "It is for this reason that we have launched this multi-disciplinary effort to look at providing guidelines to establishing fishways designed to meet the requirements of indigenous species and to suit our environmental conditions." This collaborative effort includes input from hydraulic and design engineers, hydrologists and fish biologists.

Aquatic specialist Dr Anton Bok, who is participating in the research, reports that most countries in Europe, North America, as well as Australia appear to be at least a decade ahead of South Africa in terms of developing fishway designs suitable for their indigenous species and the hydrological conditions in their rivers. "These countries are also many years ahead of us in terms of implementing well-structured fishway monitoring programmes."

Right: Communities living near fishways are often not aware of their real purpose, resulting in fishways being used as bathing and fishing spots.

Below: The Xikundu fishway, 40 km downstream of Nandoni Dam on the Luvuvhu River.

Below bottom: A close-up of the Xikundu fishway.





A close-up of an experimental sloping-baffle pool and weir fishway set up at the Dept. of Ichthyology and Fisheries Science at Rhodes University, Grahamstown.

This fishway implementation work often forms part of ambitious river rehabilitation and recovery programmes, undertaken as part of a broader integrated catchment management programme. Although South Africa simply does not have the financial resources to match these fishway and river rehabilitation programmes, it is thought that the country can certainly benefit from these countries' research findings and experience, and apply appropriate technology developed abroad to local conditions.

WHAT IS A FISHWAY?

A fishway, sometimes known as a fish ladder, is any natural or artificial device that enables fish to overcome structures in rivers that obstruct their natural migrations.

"The current research on fishways funded by the WRC is considered essential to enable a successful fishway implementation programme to be developed in South Africa," maintains Dr Bok. "We have already built far too many expensive, yet unsuccessful fishways in this country simply because overseas designs were

blindly applied to our conditions, which are usually very different."

UNIQUE SOUTH AFRICAN CONSIDERATIONS

Unlike rivers in Europe and North America, many of South Africa's rivers are seasonal and flows naturally fluctuate widely at different times of the year. In addition, initial data from monitoring existing fishways in South Africa show that both juveniles as well as adults of some species migrate, with the small fish commonly migrating during low-flow conditions as well.

Thus fishways in South Africa need to operate effectively over a wide range of river flows, and must cater for a very wide size range of fish with different swimming abilities and behavioural preferences. It must also be remembered that it is not only fish which migrate. There are at least nine species of macrocrustacea (freshwater prawns and crabs) that are known to migrate between the sea or estuary and freshwater reaches.

The three most common types of fishways found in South Africa are the pool-and-weir type, the vertical-slot type, and 'natural' type by-pass channels and fish ramps (although

FRESHWATER FISH IN SOUTH AFRICA

An estimated 220 freshwater fishes occur in South Africa, of which 21 are threatened. It is reported that about 60% of the primary and secondary freshwater fishes in southern Africa are endemic, which means they are found only within this region.

Among the Red Data species are the southern barred minnow; Clanwilliam rock catfish, Eastern Cape rocky, Vaal Orange Large-mouth Yellowfish, Clanwilliam sawfin, white steenbras, Cape Galaxia, Namaqua barb, spotted rock catfish; Clanwilliam sandfish, and spotted killifish.

Most indigenous fish species in this country undertake annual migrations within river systems for a number of reasons, such as to optimise feeding, to promote dispersal, to avoid unfavourable conditions, and to enhance reproductive success. In addition, there are at least 24 marine-spawning and estuarine-spawning fish species that are known to migrate (mainly as post-larvae and juveniles) into freshwater zones of rivers along the south and east coasts of South Africa.

there is only one of the latter to be found in the country). An assessment of all three types of fishways was undertaken to determine the suitability of each design for local conditions, reports Dr Ralph Heath, Executive Director of Pulles Howard & De Lange, who is partaking in the research.

While all types have their advantages and disadvantages, the vertical-slot design is thought to hold the most promise for South Africa. Fine-tuning of vertical-slot type fishway designs for the country is being researched in ongoing WRC sponsored fishway studies. "The fishway designs being used in South Africa at present are

only a few of the possibilities, and further investigations are currently being undertaken in laboratory conditions to determine the optimal fishway designs for South Africa,” reports Dr Heath.

Internationally, there is an increasing preference towards more natural alternatives for fish barrier mitigation. These include nature-like bypass channels, which consist of low-gradient rocky channels that mimic the natural rapids and riffles found in the particular river. In addition to allowing the free passage of a variety of aquatic organisms, they also provide important flowing water habitats and are often integrated into river restoration programmes.

Another unique South African aspect which has to be taken into account is communities’ perception of fishways. For example, during monitoring of the Xikundu fishway, 40 km downstream of Nandoni Dam on the Luvuvhu River, the research team found the local community using the fishway to

A portable experimental fishway being set up on the Kowie River ‘Ebb & Flow’ Weir.



wash clothes; bathe themselves, and even using it as a diving platform. Men with casting nets were also spotted at the fishway.

Locals believed crocodiles are unable to move into the structure and that they are therefore safe if they use the fishway. This despite the fact that crocodiles were observed at the entrance to the fishway on more than one occasion. Neither of the people interviewed knew what the real

purpose of the fishway was. “This points out how important it is to make communities part of the decision-making process,” notes Dr Heath.

Research is still ongoing, with the swimming abilities and behavioural characteristics of a selected number of key indigenous fishes being tested at present. It is anticipated that, once all the research has been completed, the results will be collected in a guideline book on how to design, monitor and maintain fishways for local conditions.

A series of regional workshops will be held later this year to introduce the latest South African fishway designs and protocols to regulators, design engineers, scientists and members of the public. The dates of these workshops will be announced on the WRC website, www.wrc.org.za.

FURTHER READING

- *Guidelines for the Planning, Design, and Operation of Fishways in South Africa* (WRC Report No 1270/2/04)
- *Development of Criteria for the Design of Fishways for South African Rivers and Estuaries* (WRC Report No 1310/1/05)

To order these and other reports contact Publications at
Tel: (012) 330 0340 or
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FISHWAY DESIGNS IN SOUTH AFRICA

Pool and weir

This fishway comprises a sloping, usually rectangular channel, which is divided into a series of pools by the construction of weir walls across the full width of the channel. The weir crests can be notched and also low-level orifices can be incorporated in the weir walls. Variations in channel slope and the dimensions of the pools are obvious design features that influence the internal hydraulics within the fishway.

Vertical-slot fishways

These fishways have the same basic design as pool and weir fishways, except that the weir walls do not extend the full width of the channel. The water flows between each pool through a slot, which normally extends the full depth of each pool. The weir walls may have single or double slots, but in South Africa, where only ten vertical slot fishways have been constructed to date, only the single slot design has been used.

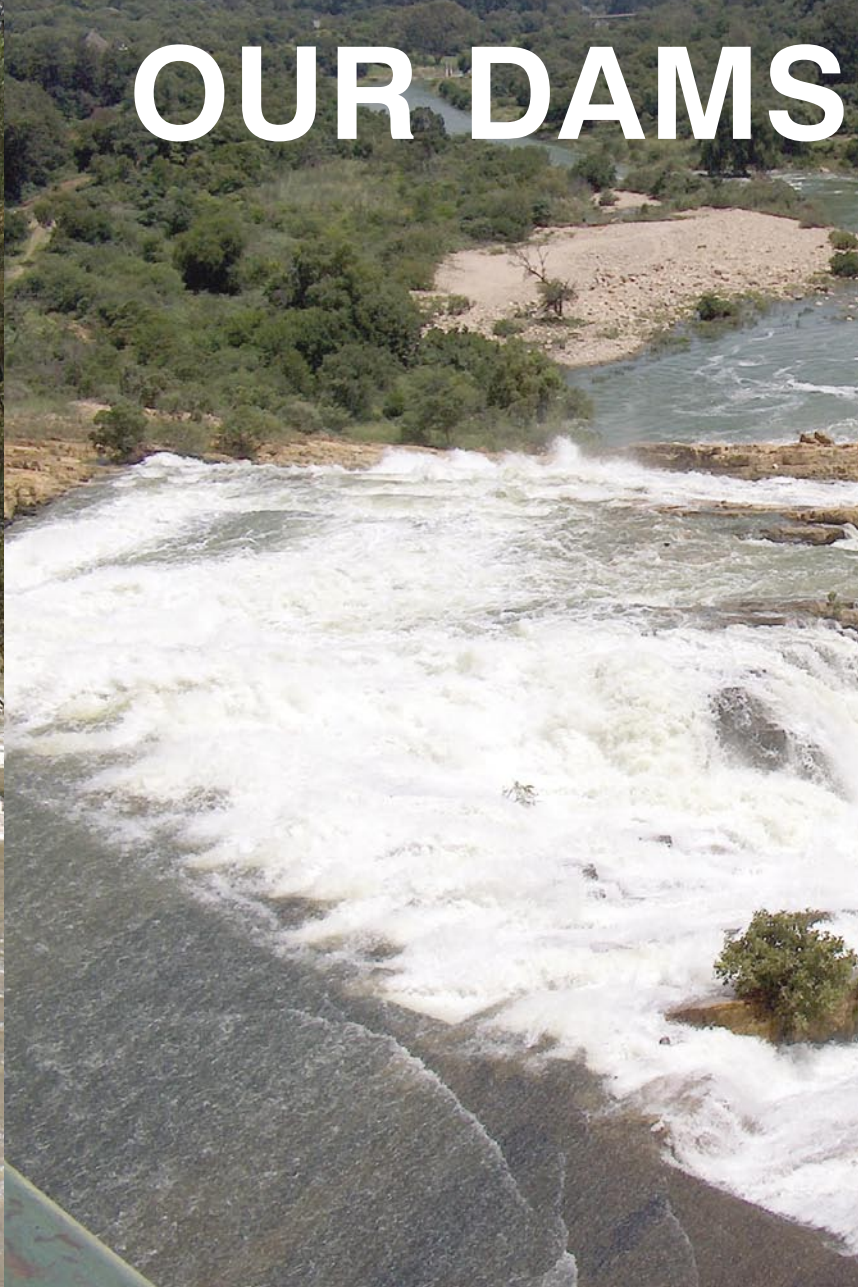
Pool and slot type vertical slot fishways

A number of pool and slot vertical slot fishways have recently been constructed by the Department of Water Affairs & Forestry at gauging weirs in the Kruger National Park, for example, the Riverside weir and Ten Bosch weir on the Crocodile River. These are combinations of the vertical slot and pool and weir design.

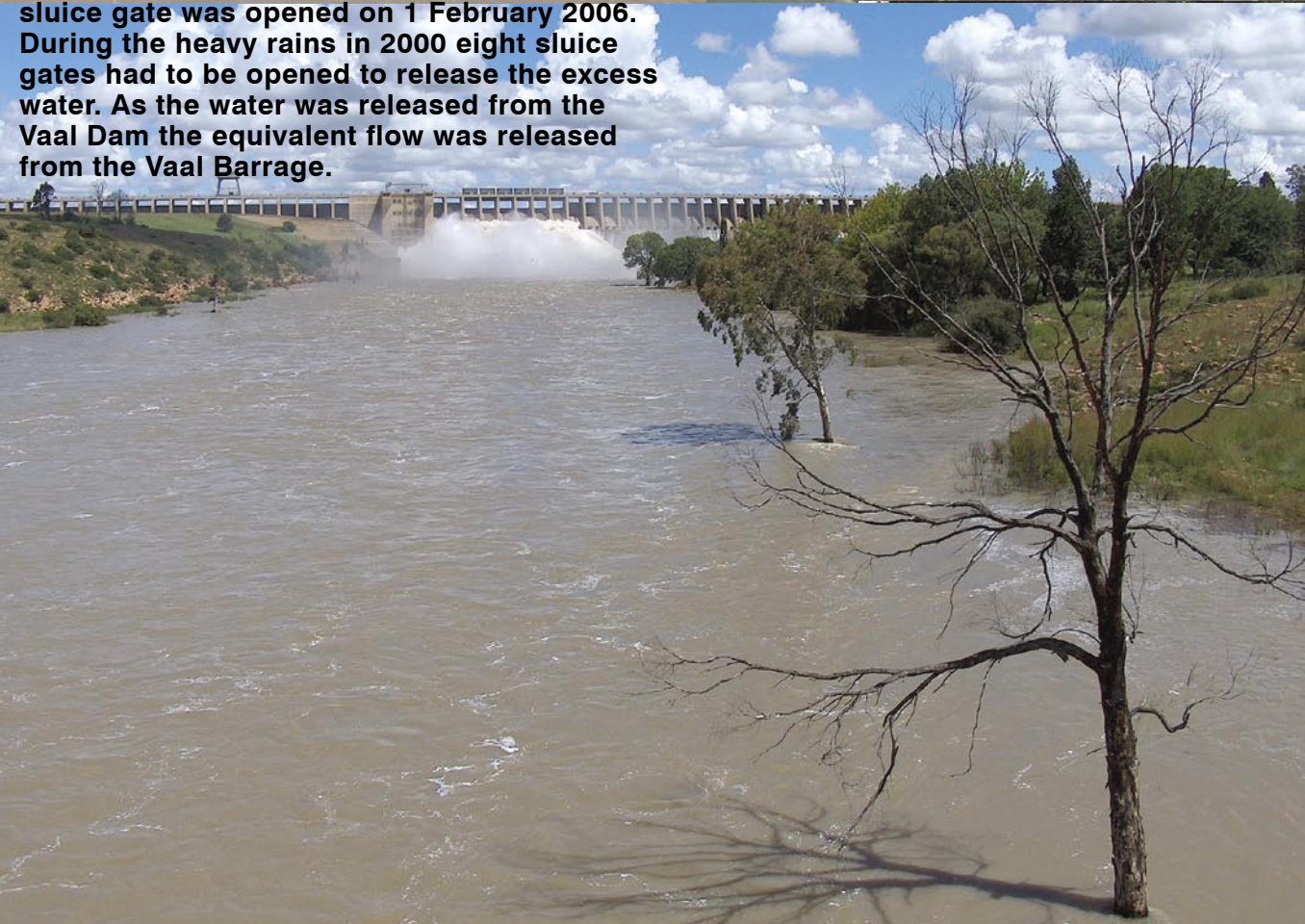
Natural by-pass channels

Low-gradient rocky channels that mimic the natural rapids and riffles found in the particular river.

OUR DAMS



In February six of the Vaal Dam's sluices were opened to release water into the Vaal River. The last time water was released from a full Vaal Dam was in March 2002. The inflow peaked at 1 200 m³/s on 31 January, and gradually abated to the 300 m³/s once the dam level reached the 95% mark. The first sluice gate was opened on 1 February 2006. During the heavy rains in 2000 eight sluice gates had to be opened to release the excess water. As the water was released from the Vaal Dam the equivalent flow was released from the Vaal Barrage.



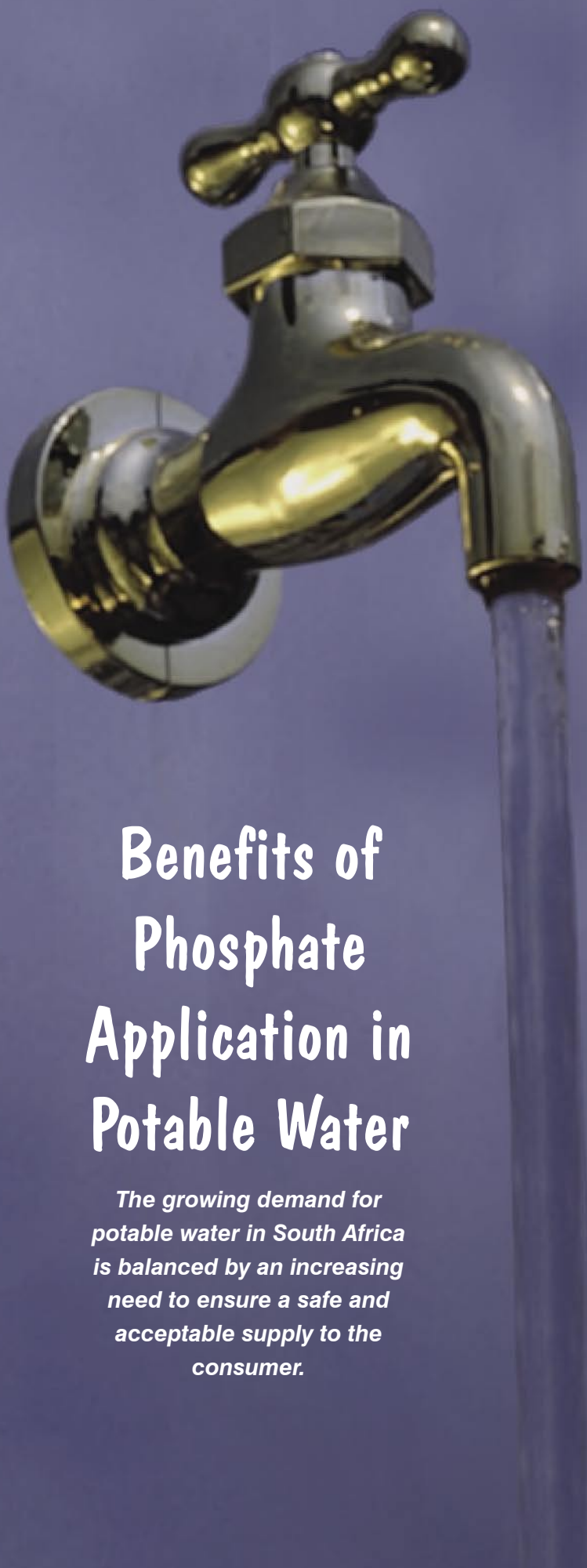
ARE FULL!



Tourists flocked to see the opening of some of the sluice gates at the Hartbeespoort Dam. Water sloshed generously into the Crocodile River downstream, which until recently been but a mere trickle.



Usually sedate rivers and streams in Gauteng were turned into deadly torrents after heavy rains, causing traffic delays and claiming several lives due to flash floods.



Benefits of Phosphate Application in Potable Water

The growing demand for potable water in South Africa is balanced by an increasing need to ensure a safe and acceptable supply to the consumer.

Water utilities have the responsibility to supply safe and acceptable potable water to the consumers. This task is complicated by the accumulation of deposits on pipes in the distribution network which result in; increased disinfectant demand in the system; higher operation cost to maintain a safe water supply; and high investment costs for the replacement of corroded pipes in the network. There is also risk of an increased water loss due to failure of corroded pipes; customer complaints due to the formation of brown water; increased requirements for flushing to control the brown water; and increased energy costs to the producers and consumer.

The increased disinfectant demand is due to reactions of the disinfectant with organic and inorganic constituents, bacteria and corrosion products in the distribution network. This increased disinfectant demand results in higher operation costs in order to maintain a safe disinfectant residual in the distribution system.

Corrosion of steel pipe surfaces, due to microbial action and water chemistry, leads to the formation of brown water due to an accumulation of corrosion products in the bulk water. Scaling of pipes in the water distribution network increases energy required to pump water through the pipes and heat the water at domestic users. Effective control of deposits in water distribution systems is essential to maintain cost-effective supply of safe and acceptable potable water.

Internationally, water utilities rely on the addition of phosphates to control the impact of deposits in distribution networks. Dosing of phosphates will:

- ◆ Prevent scale formation on pipe surfaces and reduce incrustations;
- ◆ Inhibit corrosion in steel pipes by forming a protective layer;
- ◆ Eliminate the formation of brown water;
- ◆ Reduce the solubility of lead and copper in the water network; and
- ◆ Reduce the discolouration of water due to high iron and manganese levels.

Alkali phosphates, when added to water, prevent scale formation by forming insoluble complexes with the calcium and blocking the growth of calcium carbonate and sulphate crystals. The corrosion of iron and steel is reduced by the formation of a protective calcium and iron layer on the surface of the pipe.

Phosphates in combination with hydroxides or silicates can be used to increase the saturation index of water, reducing corrosion and forming a protective layer on the surface of pipes in the network. Brown water is caused by the presence of corrosion products and soluble iron in the water.

The addition of phosphates favours the formation of goethite over lepidocrocite and forms soluble, clear complexes to eliminate brown water. These complexes ensure that the iron and manganese levels are with the target guideline ranges as set in the South African drinking-water standards.

Experience at large water utilities in Europe and the United States have proved that the application of the phosphates increased disinfectant residuals, improved microbiological quality and reduced customer complaints due to brown water. In the case of a German waterworks iron and manganese deposits and bacteriological problems were the reason for cleaning 700 km of unprotected cast iron pipes. Extensive chlorination was necessary to eliminate bacteria, which were growing in the distribution system.

“Effective control of deposits in water distribution systems is essential to maintain cost-effective supply of safe and acceptable potable water.”

The chlorine modified the humic acid content of the water in such a way, that after the chlorine was used up, bacteria could grow better than before chlorination. This fact caused a critical ‘cycle process’ in which bacteria favour chlorination and chlorination favours the growth of bacteria. The combination of corrosion, poor water quality, and bacteriological problems made it necessary to add phosphate to the water to improve water quality and reduce consumer complaints.

After the addition of phosphate disinfectant residuals were maintained in the system with an associated

The accumulation of deposits on pipes in the distribution network can be a huge headache for municipalities.



improvement in the microbiological quality of the water. Iron levels and customer complaints were reduced by the addition of phosphates to the system.

The reduction in corrosion and scaling in domestic water systems, brought about by phosphate addition have the following advantages for domestic users:

- ◆ Increased pipe life of steel pipes;
- ◆ Reduced water loss due to corroded pipes and
- ◆ Reduced energy usage to heat water.

The permitted dosage of phosphates in drinking water is limited to 6,7 mg/l PO_4 or 5,0 mg/l calculated as P_2O_5 . The limit of 5.0 mg/l P_2O_5 is technical since higher concentrations are not necessary to obtain the required effect. Dosing at these levels reduces or stops the corrosion of steel and cast iron pipes, reduces scale formation and the occurrence of brown water due to iron and manganese in the water.

All CLAROFOS products are approved as additives for drinking water under the German regulation DIN 2000. This regulation states that additives should contain no toxicologically dangerous inorganic compounds, especially heavy metals. The purity of the CLAROFOS products ensures that consumers are

not exposed to health risks as a result of their application.

- Contact Dr Craig Bosch at Chemfit Fine Chemicals Pty (Ltd), Tel: 011 918 1900; E-mail: Craig@chemfit.co.za for more details on the application of the CLAROFOS products.

MORE ABOUT CHEMFIT

The Chemfit Group is a leading southern African supplier of specialised chemical products and services. Since inception, the group has established a sound infrastructure and draws on a wealth of experience and knowledge. Leading international chemical manufacturers, having recognised the capabilities of Chemfit, have entrusted the management, distribution and application development of their products to the group. Chemfit Fine Chemicals is an accredited supplier of a range of speciality chemical additives essential for the preservation, maintenance and enhancement of life. The supply of products is complemented by the provision of technical support and advice to industry.

The company serves the water, feed, food, ceramics and detergents industries.



Licence to Limit – Groundwater Use Authorisation Under Scrutiny

An investigation by a Water Research Commission (WRC) appointed team into groundwater licensing in South Africa has found that present procedures for granting approval for groundwater use are unnecessarily restricting development of this resource. In some instances, it might even be causing individuals to flout the law rather than to face the onerous water license registration process.

Following the promulgation of the National Water Act (NWA) in 1998, groundwater, long considered the ‘poor cousin’ of surface water, has been accorded a new importance in South Africa. With vast untapped underground sources of fresh water being discovered, groundwater has been touted as the answer to many urban

and rural areas’ present and future water needs.

To protect the resource from potential pollution and over-exploitation, several legislative measures have been implemented. Both the Department of Water Affairs & Forestry (DWA) and the Department of Environmental Affairs & Tourism (DEAT)

have different procedures with respect to assessing groundwater use applications. At present, authorisation to use groundwater is legislated under the NWA, Environmental Conservation Act, and the National Environmental Management Act.

While it is acknowledged that these are very powerful tools for managing

groundwater use, the practicality of some aspects of the legislation is in question. If a groundwater user or prospective user has to apply for a licence, he is currently required to apply to both DWAF and the provincial environmental department. In addition, the groundwater Reserve (the minimum water needed for the ecological environment to survive) needs to be set first before DWAF can consider a license. In many cases, this has not happened yet.

In 2004, the WRC launched a project to investigate the groundwater licensing process, and to develop a decision support tool for exploring, developing and usage of groundwater supplies. Team leader Roger Parsons of Parsons & Associates, explains that there are three types of groundwater use authorisations.

SCHEDULE 1

Schedule 1 uses are defined as relatively small quantities of water, mainly for domestic and stock watering purposes, but also for emergency situations and certain recreational purposes. The project team investigation found that the lack of clear guidance on what exactly constitutes Schedule 1 use was a major limitation in the authorisation of water entitlements. "The National Water Act does not specify generally applicable numerical limits to any of the Schedule 1 uses," Parsons tells *the Water Wheel*. "However, the extent of the use must be reasonable to the users' needs and not be excessive in relation to the capacity of the resource and the needs of other users."

GENERAL AUTHORIZATION & LICENSING

General Authorisation allows for conditional water use without a licence. The country's aquifers have been divided into different zones which allow for differing quantities of

water that may be abstracted. Water use that exceeds the limits posed by Schedule 1 and General Authorisations requires licensing. "Comparison of the volumes of water needed for reasonable domestic use and that allowed under General Authorisation indicates the present limits are too low," says Parsons.

"For example, if one assumes an average water use of 200 l/p/day, then a household of four requires 292 m³/a for reasonable domestic purposes (i.e. as allowed under Schedule 1 use). To meet this demand, a person living in a Zone E area (which allows for the abstraction of 400 m³/ha/a) would need to own

GROUNDWATER TO MOVE INTO THE SPOTLIGHT

Despite groundwater's strategic role in supplying water services to African communities, often as the sole source, it remains poorly understood and managed.

This was revealed at a recent international workshop on groundwater protection in Africa, held in Cape Town. The workshop was attended by numerous concerned



scientists and stakeholders, including representatives from the African Ministers' Council on Water (AMCOW), United Nations Environment Programme, World Bank, International Association of Hydrogeologists and the United Nations Economic Commission for Africa.

"There is a general sense that groundwater needs to be higher on the African and international political agenda. This should reflect in policy development, regional and international cooperation in this regard," reports Eberhard Braun, manager: information programmes at the Department of Water Affairs & Forestry.

Groundwater resources are increasingly under threat, despite their importance. The results of a recent cooperative assessment in 11 African cities have shown that pollution of the vital underlying groundwater resources has reached critical levels. Poor understanding and mismanagement has become the norm rather than the exception. There are examples across the continent of vital water supply sources and even whole aquifers being abandoned due to pollution as well as communities being served with polluted water through pipelines leading to the outbreak of waterborne diseases.

To mitigate these challenges several thrusts were discussed at the workshop. The first awareness thrust must result in widespread awareness of key stakeholders at all levels about groundwater, its developmental role, its hydrological and ecosystem function, its vulnerability to human impacts and approaches to sustainable use. The second capacity thrust must result in appropriate capacity, including policy and legislation, appropriate institutions and human resources to plan and implement sustainable groundwater use at all levels. The last knowledge thrust must result in the knowledge base, including monitoring networks, resource assessment, best practice for management, information systems and fundamental sciences, to enable the optimal use of groundwater within an integrated water resources management network.

Delegates recommended that the AMCOW and New Partnership for Africa's Development (NEPAD) initiatives be used to coordinate activities to reach these objectives. A representative team from the workshop are to present their findings at the Fourth World Water Forum in Mexico this month.



It is estimated that windpumps in the Graaff-Reinet area abstract 821 m³/a. This is more than double the volume of groundwater abstraction allowed under General Authorisation. This suggests that all windpumps erected after 1998 will be subject to the granting of a licence.

0,73 ha if the domestic water supply were to be within that volume generally authorised. However, in a Zone B area (which allows for the abstraction of 45 m³/ha/a), a person would have to own 6,5 ha of property. This illustrates an imbalance between that which constitutes Schedule 1 use and that allowed under General Authorisations.”

“Almost 95% of boreholes drilled in the country will require licensing.”

No groundwater abstraction is permissible without a license in 17% of the catchments. This group includes some of the most productive aquifers in the country (for example, Cape Flats Aquifer, Atlantis Aquifer, and Saldanha Aquifer). Reasons for including these aquifers in Zone A are not apparent; and cannot be justified on hydrogeological criteria.

By converting the General Authorisation to a yield, and comparing the thresholds to the yield of the bore-

holes stored in the National Groundwater Database, it is apparent that almost 95% of boreholes drilled in the country will require licensing. “This is clearly contrary to the hierarchical authorisation provided for in present water legislation,” notes Parsons.

It is understood that 100 000 boreholes are drilled in South Africa each year. Assuming that the processing of each license application takes a minimum of five days to complete and further assuming 20 000 boreholes will have to be licensed each year, 500 experienced geohydrological officials will be required to process groundwater licenses only. Other officials experienced in groundwater will also be required to provide input into the environmental authorisation.

“DWAF simply does not have the resources to address all the applications – should they be submitted,” says Parsons. The problem is compounded by the fact that in some instances, officials making decisions are inexperienced and/or not qualified in a particular issue. Mentoring of junior staff by senior staff is required as well as a sound geohydrological education of officials dealing with these matters.

The limitations of the legislation can be seen in areas such as the Western Cape where very few licences have been issued. Given that drillers in the province have had full order books for the last two years, something is amiss.

The greatest challenge in improving the process is determining at what level groundwater use licenses should be required. This needs to be based on known cases of groundwater use impacting on the environment and levels of water stress or conflict within the catchment.

BACK TO BASICS

All is not lost, however. “The NWA has provided a very good structure

GROUNDWATER LICENSING AT A GLANCE:


Authorisation to use groundwater is legislated under the National Water Act, the Environmental Conservation Act, and the National Environmental Management Act.

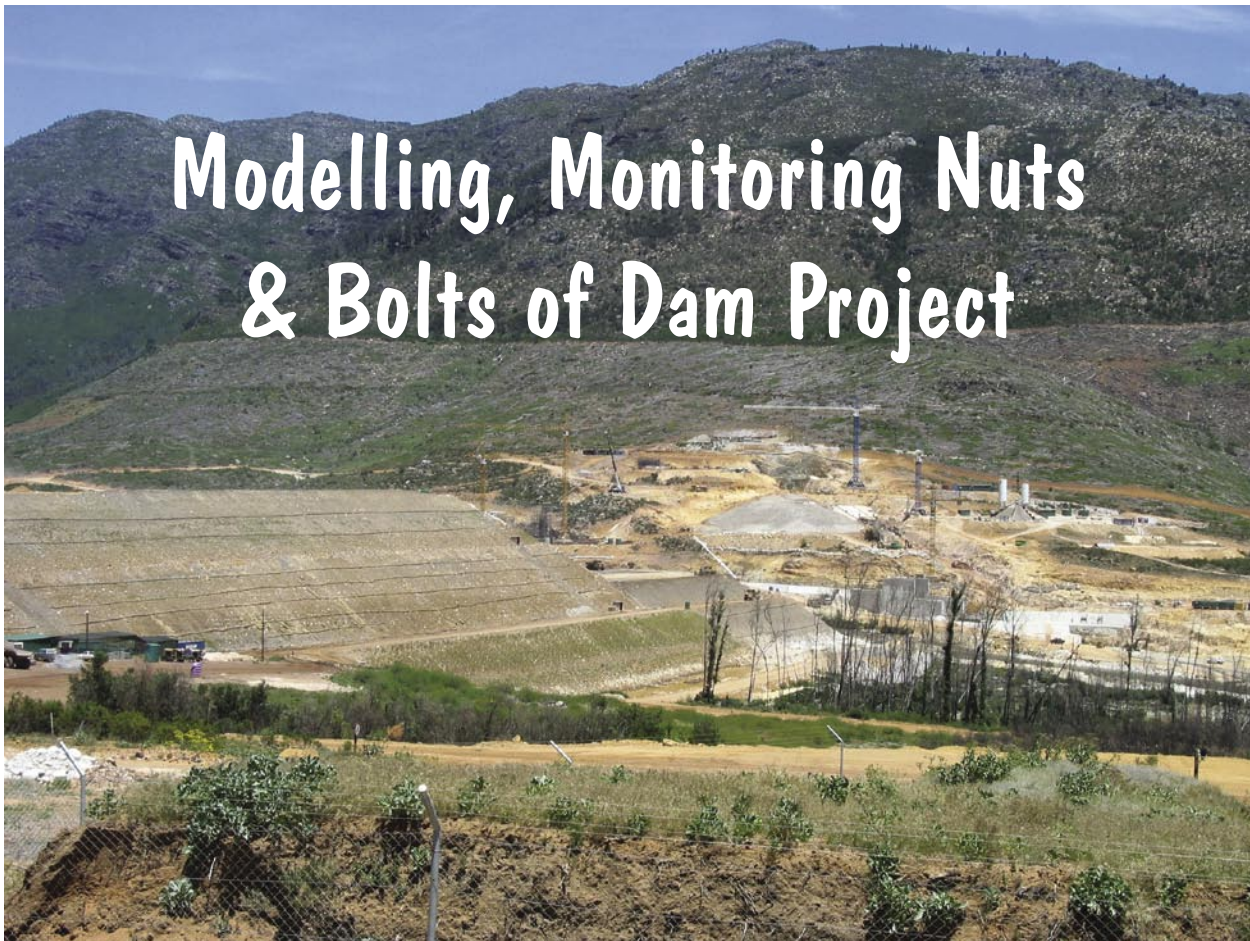
There are basically three types of water use authorisation:

- ◆ **Schedule 1** uses: relatively small quantities of water, mainly for domestic and stock watering purposes, but also for emergency situations and certain recreational purposes.
- ◆ **General Authorisations:** by which limited water use is conditionally allowed without a license. Current General Authorisations are described in Government Notice 1191 of 8 October, 1999.
- ◆ **Water use licenses:** which are used to control water that exceeds the limits imposed by Schedule 1 and General Authorisations. Water use licenses give existing or prospective water users formal authorisation to use water for productive or beneficial purposes.

for allowing groundwater use under General Authorisation and requiring site-specific licensing at higher levels of use. We are not doing well at setting the boundaries at which licenses are required nor providing an efficient mechanism for applying for, and considering or evaluating licenses,” says Parsons.

It is recommended that only one department handle license applications. There also needs to be far better and efficient liaising between departments.

It is hoped that the documentation resulting from the WRC project will assist in this process. At the time of writing, the team was completing a temporary guide to be submitted by this month. 



By the end of 2005 the dam wall – constructed of river boulders with the upstream face covered in concrete – was 45 m high. Ultimately the crest of the wall will be 60 m high and 900 m long.

Construction of the Berg River Dam, near Franschoek in the Western Cape, is in full swing, and all indications are that it will be completed during 2007 as planned.

Sue Matthews reports.

The dam will have a gross storage capacity of some 130 million cubic metres, and will operate in conjunction with Theewaterskloof Dam in the Breede River catchment. The two dams are linked by the Riviersonderend inter-basin transfer tunnel, bored through the imposing Franschoek mountains.

The streams and runoff flowing into the Berg River Dam would only provide enough water to sustain a yield of approximately 56 million cubic metres per year. However, this will be supplemented by an abstraction works 9 km downstream of the dam

– below the confluence of the Dwars River and a number of other tributaries – which in winter will divert water from the Berg River and pump it back to the dam or Theewaterskloof, from where it can be gravity-fed to Cape Town. The Supplement Scheme will increase the yield by 25 million cubic metres, bringing the total contribution of the Berg Water Project to 81 million cubic metres.

This should be enough extra water to meet Cape Town's needs until 2013, by which time other projects will have to be implemented to satisfy the growing demand.

In November, a three-year baseline monitoring programme designed to describe the present state of the river, including its estuary, floodplains and groundwater, came to an end. The comprehensive programme encompassed ecological, physical, chemical, hydrological and hydraulic characteristics, as well as social aspects such as recreational use and dam safety. Determining the system's present state and its natural variability will provide a baseline against which changes resulting from the Berg Water Project can be measured.

The Freshwater Consulting Group's Geordie Ratcliffe, who acts as

- ◆ The Berg Water Project is being undertaken by public entity TCTA on behalf of DWAF.
- ◆ A syndicated loan of R1.6 billion was secured by TCTA from the European Investment Bank (R800 million), the Development Bank of Southern Africa (R500 million) and ABSA Bank (R300 million) to fund the project. Water users in the City of Cape Town will repay this loan by 2027 through a Berg Water Charge added to the tariff imposed by DWAF on water supplied from the Western Cape Water System.
- ◆ In order to ensure that the local community benefits from the Berg Water Project, TCTA introduced the "Franschhoek First Policy". The FFP sets out targets and guidelines aimed at maximising employment, procurement and training opportunities for the area's inhabitants. A social monitoring programme has also been initiated to monitor the impacts of the project, both positive and negative.

technical coordinator of the specialists involved in the baseline monitoring programme, explains that data are currently being analysed and a series of reports written, with the final report due in July. "TCTA is obliged to continue monitoring in terms of its environmental management plan, but the form that this monitoring will take is uncertain," she says. "There is also no point in monitoring if it is not aimed at corrections, so there needs to be a very clear commitment to monitoring as a tool for adaptive management."

As part of the baseline monitoring programme, a conceptual model of ecosystem functioning is being developed. Given that the dam will significantly alter the flow regime of the Berg River, the model pays particular attention to the links between the flow regime and other ecosystem components. Some of its uses will be to improve prediction of future changes, and determine the effectiveness of the environmental flows released from the dam to meet the instream flow requirements (IFR).

"Basically what we are required to do in IFR assessments is use the best available knowledge to make predictions," says Ratcliffe. "But monitoring is vital in telling us how well we did it, and if the flow releases are shown to be insufficient to maintain the ecosystem in a particular class, they need to be adjusted. That's going to be the acid test – if we get the amounts wrong, will DWAF be prepared to put their money where their mouth is and make the necessary changes?"

One aspect that is already causing concern is the system of artificial flood releases that has been proposed. The dam will have a dampening effect on floods, which are important for scouring the system of sediment build-up and river obstructions, such as fallen trees. Dr Gerrit Basson of the University of Stellenbosch's Department of Civil Engineering, estimates that as a result of the dam the Berg River will narrow by on average 15% down to Hermon, 70 km downstream. Below that the dam's influence will not be as severe, because a number of tributaries join the river, increasing its flow.

Dr Basson was contracted to develop operational procedures for flood releases from the dam, and used a hydrodynamic modelling to simulate the effect of the artificial floods. In November, at a Berg Water Project open day hosted by the South African National Committee on Large Dams (SANCOLD), he explained that the IFR assessments undertaken during the 1990s had proposed a small flood release of 15 m³/s in April, a medium-sized one of 70-100 m³/s in June, and a larger release of 100-220 m³/s between July and September. However, the operating rules used in his hydrodynamic model stipulate that:

- ◆ The 70-100 m³/s artificial flood will be released only if a natural flood



In November the Berg River was closed off by the dam, and diverted temporarily through the outlet conduit shown here.



Dr Gerrit Basson explains the functioning of the Supplement Scheme.

event of 70 m³/s or more occurs in June or July, its magnitude depending on the size of the incoming flood but with a maximum of 100 m³/s;

- The 100-220 m³/s artificial flood will be released with the first naturally occurring flood of more than 160 m³/s in July or August, its magnitude depending on the size of the incoming flood but with a maximum of 220 m³/s. Should none of these requirements be met, no flood will be released.

This kind of talk is alarming to river ecologists. “We do not have much direct evidence of what type of floods cause movement of bed particles, and to what extent this regulates algal biomass and its invertebrate consumers, which would have a cascading effect all the way up the food chain,” says Ratcliffe. “So when Gerrit produced this modelled output, the immediate response of most specialists was that it seems to reduce the environmental flow allocation to levels inadequate to sustain the river.”

“We will therefore recommend in our final report that we use the

hydrodynamic model to evaluate various alternatives for flood releases, based on the new knowledge we’ve gained as a result of the baseline monitoring programme. We will also suggest extending the model into the estuarine floodplain to show when it will be inundated, which is very important for migratory

birds. When the estuarine reserve was undertaken in the early 1990s, it was in the early days of IFR assessments, and there was a whole lot they did not know.”

Another long-standing issue of concern is whether the Berg Water Project will increase salinity in the lower reaches of the river, with negative consequences for the ecosystem and water users alike. Soils derived from the underlying Malmesbury Shales have a naturally high salt content, so irrigation and poor land management practices result in an increase in inorganic salt concentrations in the river.

Wageed Kamish of Ninham Shand is conducting a modelling study on salinity in the Misverstand Dam for DWAF, and one of the key questions is the effect of the Berg Water Project. “The hypothesis is that if you take away water it won’t dilute the salts,” he explains. “Without the dilution effect of winter floods, one would assume there’d be some deterioration in water quality.”


Wageed is also project-managing a



A scale model shows how the Berg River Dam will be prevented from overflowing. Excess water will spill over a 40 m spillway and flow down a deep concrete chute to a ‘ski jump.’ After being thrown 30 m up into the air, the water will land in a plunge pool 80 m away.

hydrodynamic study for TCTA on the Berg River Dam. “The top section of river – down to the supplement scheme – is considered to be sensitive, so the model aims to ensure that dam releases have temperatures close to that of the natural inflow. If water is released from the bottom of the dam it will be cold throughout the year, while water from the surface will be too warm.

“This particular study focuses on temperature, but the model could be used in future for other aspects. For example, the dam might develop algal problems later on, and then we’d have to figure out how best to manage the system. The advantage of modelling is that various scenarios can be tested before implementation.”

Clearly, monitoring and modelling not only form an integral part of the pre-operational investigations for the Berg Water Project, but also have the potential to play a key role in its future implementation. They are the nuts and bolts in the environmental management toolbox, complementing one another to build a stronger information base. 



ALL FALL DOWN

— Existing Assets Abandoned in Race to Meet Targets

The South African government has received international acclaim for its efforts to reduce the enormous water and sanitation backlog inherited after 1994. But all of these efforts will mean nothing in the long term if existing infrastructure is not properly operated and maintained.

It is well known that some municipalities do not prioritise operation and maintenance, especially of 'unglamorous' infrastructure such as sewage treatment works, but, until recently the extent of the problem was not very well known. Last year, the Department of Water Affairs & Forestry (DWAF) launched an investigation into the asset management situation in order to provide guidance to Water Services Agencies (WSAs). An initial study by CSIR into the status of water services infrastructure asset management among these authorities while, pointing out that there are municipalities (especially large metros) that do all they can to keep infrastructure working, the general picture is not a pretty one.

Research shows that insufficient attention is being paid by the majority

of South Africa WSAs to the ongoing commitments that they have incurred to manage their infrastructure. In addition, many authorities have, due to years of neglect, built up a backlog of need in respect of maintenance and also refurbishment, renewal and replacement.

This has serious consequences for the health of communities served as well as the surrounding environment. An example of this is a self-assessment survey undertaken last year of local and metropolitan municipalities. Only 37% were compliant with drinking water quality regulations. A total of 61% perceived their water quality to be good; while 58% stated that they do regular monitoring and 49% stated that they comply to the national drinking water standards.

In addition to water treatment and reticulation services, WSAs are usually responsible for maintaining the waterborne sanitation piped network, and frequently also the pumping facilities. DWAF conducted a nationwide sanitation sustainability audit in 2004/2005 to ascertain the functionality of sanitation projects completed during 1994 to 2003. Most of these projects implemented basic sanitation facilities (e.g. VIP toilets).

The survey revealed that up to 28% of households sanitation facilities have failed or are in the process of failing; only 53% of municipalities have adequate operations and maintenance capacity; 78% of municipalities have no operations and maintenance plan for VIPs; and 66% of households indicated that they did not have a

sanitation health and hygiene education programme.

NON-COMPLIANT SYSTEMS

With regards to wastewater treatment works, especially those that have much mechanical plant, the most common immediate cause of effluent not meeting DWAF standards is, as it is with water treatment works, a breakdown of plant and/or length of time that it takes to have plant repaired, both of which are largely attributable to inadequate budgets or operator error or both.

A survey by CSIR of a number of sewage treatment facilities in Gauteng showed that many of these are producing effluent that is not meeting DWAF standards, in fact, some of the works are producing effluent that is little distinguishable from the raw sewage that flows into the works. A similar survey of Free State systems revealed that almost half of outgoing effluent is not compliant to bacteriological and chemical oxygen demand standards, requiring urgent intervention.

To make matters worse thousands of schemes, previously operated



A national audit has found that up to 28% of household sanitation systems (mostly basic sanitation) have failed or are in the process of failing.

and maintained by national government, are now being handed over to WSAs. In 2003, 1 544 departmental schemes valued at R9,95-billion were surveyed as they were being prepared for transfer to local government. While the vast majority of the schemes were working, some rehabilitation was needed, 40% because of normal ageing, 19% due to vandalism, and 18% because normal maintenance had not been done.

CHASING THE TARGET

South Africa has set ambitious targets for itself in terms of providing access to safe water and sanitation to all. Unfortunately, this means that municipal priority is delivering new infrastructure rather than operating and maintaining existing infrastructure so as to ensure sustained services delivery.

A financial modelling exercise undertaken during 2005 on behalf of the Department of Provincial and Local Government and Development Bank of Southern Africa showed that new infrastructure rollout targets of the majority of municipalities will lead to these municipalities acquiring new infrastructure at such a pace of the next few

Routine maintenance of sewers is essential to reduce sewage spills.



STELLENBOSCH'S DIRTY SECRET

Stellenbosch, the second oldest town in South Africa, renowned for its world famous wineries and prestige university, has got a dirty little secret. The Plankenbrug River, tributary of the Eerste River, the town's main water resource, has become so polluted over the years that it is now little more than an open sewage ditch.

Dr Jo Barnes of the Department of Community Health, at the Faculty of Health Sciences at the University of Stellenbosch has studied the increasing faecal contamination of the river and its effects on the health of the surrounding community for nearly a decade. She raised her concerns at the EnviroWater conference held in Stellenbosch, in February.

In January, she raised the alarm when a rat-tailed maggot was identified in one of her water samples, taken regularly since 1998. These maggots, the larvae of the drone fly, are usually found only in poorly kept sludge and manure ponds. The presence of these maggots in the river, according to Dr Barnes, is a biological indication of the severe pollution of the river. If ingested the organism could cause diarrhoea.

On 23 January, water samples from the Plankenbrug River indicated 16 million faecal coliform organisms per 100 ml, of which 9,2 million organisms were *E. coli*. "Municipal officials have called me a tragedy queen, but this is a serious disaster happening right before our eyes," she told delegates.

Several bacteria and viruses have been found in the river, causing everything from skin rashes and eye irritations, to diarrhoea, kidney infection, scarlet fever, Hepatitis A, and pneumonia. More recently, it has been discovered that some of these disease-causing organisms found in the river are resistant to widely used antibiotics and to

chlorine. Those organisms found to be resistant to chlorine were found to have a double resistance to antibiotics.

The Plankenbrug River runs past the dense settlement of Kayamandi, situated on the outskirts of Stellenbosch. With one toilet for an average ten families ill disposal of human waste is a serious problem. People either use the river directly as a toilet or faecal matter from buckets and other containers find its way into the river through the stormwater system.

While Kayamandi has largely been blamed for the pollution it is not the only culprit, said Dr Barnes. "The systemic failures of the wastewater treatment works and sewerage systems of many towns in the area also contribute to the high faecal coliform counts in the river. The river also passes through the Stellenbosch industrial area and, at times industrial effluent has been found in the river."

Investigation has found that allowing sewage to overflow into the river system when there is a problem at the sewage treatment works is not a new phenomenon and has, in fact, been practiced historically in municipalities. The challenge is changing this entrenched mindset and realising the danger to community health this

causes.

It is the poor among the Stellenbosch community that bear the burden of this pollution. A study commissioned by the Department of Water Affairs & Forestry in 2001 showed that during one year, 1 000 people in Stellenbosch will experience 582 mild cases of diarrhoea, 52 moderate cases and 13 severe cases (these severe cases are mostly children under five years old). Almost all of these cases are people in Kayamandi living in informal housing. In 67% of the cases, the patients are female.

Of the total costs as a result of disease (hospital and treatment costs, lost working days etc), 7% is financed by local government, which is running the clinics. The provincial government running the hospital finances contributes 32%, while the community finances the remaining 61% either as lost income due to illness or due to expenses related to self treatment.

"Water pollution such as this arising from inadequate sanitation in dense settlements is escalating and causing serious water quality problems," noted Dr Barnes. With our serious water situation, we cannot afford to write off rivers like this."



years that they will be increasingly unable to afford the costs associated with the operations and maintenance of that infrastructure.

Never mind that many of them are unable to afford the operations and maintenance costs of the infrastructure they already have. Government's campaign to address imbalances would, ironically, seem to be contributing to widening the range.

An additional contributor to this is the acquisition of infrastructure at levels of services that are higher than 'basic' despite the limited ability of consumers to pay for the service, or for potential for cross-subsidisation within the municipality.

SHOW US THE MONEY

Financial issues often lie behind infrastructure operational and management problems. Firstly, a municipality might not have sufficient financial resources to allocate to infrastructure

management, even if all councillors are fully supportive of infrastructure asset management. Secondly, there is often insufficient understanding by local authority politicians of the importance of maintenance.

This insufficient understanding is crucially manifested in the under-provision of maintenance budgets. This is sometimes exacerbated during

A serene picture, but spillages from overloaded wastewater treatment works are a serious threat to Cape Town's rivers.



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Hatfield Award

... to operators of wastewater treatment plants for outstanding performance and professionalism.

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... to the best mine water management related paper presented by a bona fide registered student at the biennial WISA 2006 conference.

Piet Vosloo Award

... for a completed project involving innovative technology in the water field representing a notable technical advancement.

Potable Water Award

... to the owner and operations manager of a water purification plant with a design capacity of less than 25MI/day for competence and initiative in plant operation.

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... to a company, organisation, group or individual whom has made a major contribution in the field of Industrial Water technology.

Nominations should be accompanied by a brief description of the project.

Umgeni Award

... to author(s) of a paper which makes a noteworthy contribution to water science or engineering.

Wilson Award

... to the owner and works manager of a wastewater treatment works of less than 25MI/day average DWF for competence and initiative in works operation.

FOR MORE INFO or NOMINATIONS:
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the course of the year by reallocation of some of the maintenance budget to other purposes.

It has been found that local and district municipalities spend 60% more of their budgets on capital projects than the metros do and 11% less on operations. In other words, local and district municipalities budget more than the metros do for acquiring infrastructure than they budget on operating and maintaining it.

The loss of key technical staff ... is inhibiting infrastructure management and, in many cases, can be identified as the main reason for breakdown of service.

The budgets of rural-based municipalities are of particular concern. Typical impoverished municipalities, whereas basic levels of water services have been provided, subsequent lack of maintenance coupled with no control over the high levels of informal connections means that the majority of these schemes are no longer capable of providing a consistent daily basic water supply.

GONE IS THE CAPACITY

The loss of 'intellectual assets' is a very major threat to effective infrastructure management and hence to compliance. The loss of key technical staff, and their non-replacement by others less qualified, is inhibiting infrastructure management and, in many cases, can be identified as the main reason for breakdown of service. It is interesting to note, for example, that there is currently no enforceable regulation that the technical services manager of the WSA be a qualified engineer or engineering technologist.

A study published late last year by the South African Institution of



South Africa has an increasing proportion of deteriorating infrastructure together with poor and often unacceptable quality services, an investigation into the status of water services infrastructure has found.



For wastewater treatment works that have much mechanical plant, the most common immediate cause of effluent not meeting national standards is a breakdown of plant and/or length of time that it takes to have plant repaired satisfactorily and for it to resume working correctly.

Civil Engineering has shown that the number of and expertise of the municipal staff whose responsibility it is to operate and maintain municipal infrastructure has not kept up pace with the increase in the stock of infrastructure. Indeed, in many areas it has diminished even in absolute terms, never mind in proportion to the increase in the stock of infrastructure.

Identifying the problem is always the first step in rectifying it. DWAF has now started a process of identifying the key factors that drive the existing state of water services infrastructure and the state of its management. Thereafter, a plan of action will be prepared for the water services sector. It is hoped that this plan will lead to much needed improvement in many of South Africa's municipalities.

Bring Aboard the Champions

Creative and innovative approaches, as well as commitment from management officials and political leadership are needed to improve coordination between the different spheres of government.

So write Department of Water Affairs & Forestry (DWAF) Director-General *Jabu Sindane* and Deputy Director: Capacity Building and Training *George Tsibani* in a discussion paper.

The paper examines government's inter-governmental relations and its implications or challenges to the department's leadership role under Project Consolidate, the State's hands-on local government support and engagement programme, launched last year.

South Africa's political landscape has changed significantly since 1994, with the introduction of the three spheres of government (national, provincial and local). The new Constitution makes provision for an integrated, inter-sectoral, and cooperative approach to governance. These provisions commit all three spheres of government to be transparent in policy making and inclusive in its approach.

Effective coordination within and between the spheres of government is clearly vital to the country's reconstruction and development efforts. Perhaps understandably, given the recent transition to democracy and the continual political transformation, inter-governmental relations in South Africa are in a state of flux. At times, it is even dysfunctional.

In that respect, write the authors, it is evident that certain aspects of Project Consolidate and the Inter-Governmental Relations institutional framework will require immediate attention to promote more effective cooperation governance between the three spheres of government. However, while the South African Constitution makes provision for national legislation to regulate inter-governmental relations, codification of inter-governmental relations in and of itself will not necessarily lead to dramatic improvements in performance, they argue. "This is because poor inter-governmental coordination and integration is frequently a problem of capacity and efficiency rather than a problem of procedure."

At the same time, this inter-relationship between different spheres of

government are always dynamic and evolve over time to accommodate changing social, economic and political relations. This means policy to support inter-governmental relations will need to be flexible for promoting greater cooperation. Mutual respect is likely to be of more significance than the legal technicalities provided for by the Constitution (Act 106 of 1996) and the Inter-governmental Relations Act of 2005.

According to Sindane and Tsibani, there is still considerable uncertainty over the precise responsibilities of the different spheres of government and the administrative echelon. In turn, this affects the capacity of government to deliver the necessary water and sanitation services.

"Perhaps understandably, given the recent transition to democracy and the continual political transformation, inter-governmental relations in South Africa are in a state of flux. At times, it is even dysfunctional."

Creative and innovative approaches to change are required to generate effective solutions to the problems arising from inter-governmental relations and Project Consolidate. Planning efforts must move towards an approach whereby decisions taken are likely to achieve objectives, yet simultaneously leave open as many options as possible in the event of unanticipated future proceedings occurring under Project Consolidate. It is imperative for DWAF leadership to respond proactively to changes by making necessary adjustments to its internal functioning in the provinces.

Such proactive initiatives need to address four fundamental issues:

- ◆ The choice in the inter-governmental relations and Project Consolidate in which DWAF functions and the department's role in anticipating and recognising Project Consolidate and inter-governmental relation demand to new DWAF function and *modus operandi*;
- ◆ The relevance of existing DWAF work practices and procedures in terms of the position of new water and forestry business in pursuant with cooperative government principles whereby the political leadership role of MECs seems to be critical for ensuring provincial buy-in;
- ◆ The appropriateness of the existing institutional designs and structures at national and provincial levels to proactively respond to inter-governmental relations and Project Consolidate demands; and
- ◆ The capacity and capability of the leadership and administrative structures to meet the changing demands under the new service delivery paradigm in which the innovative and proactive role of MECs seems to be critical to support DWAF's water sector leadership role as a national department.

"It is assumed that this proactive approach to inter-governmental relations and Project Consolidate may transform DWAF into a legitimate agency for executing the new water sector leadership role with political buy-in from the provincial politicians," write the authors.

Thus said, it appears that the main challenges facing DWAF in achieving the required cooperative governance as set out in the Constitution and Inter-governmental Relations Act are the need to exercise imagination and ingenuity in unravelling the respective water and community forestry priorities, and designing, discovering and exercising options for accelerated services delivery as per national targets. "This needs to be done with full awareness of the



Responsible, innovative and accountable transformational leadership is required to improve services at local level.

complexity of political development under inter-governmental relations and Project Consolidate with due regard to the developmental agent role in the water and community forestry portfolios and implications hereto."


Responsible, innovative and accountable transformational leadership is therefore required to tackle the tasks ahead. People who are creative thinkers and who enjoy challenges. "Such innovative strategists must be able to reinvigorate the department so that it is fully equipped to cope with numerous challenges under inter-governmental relations and Project Consolidate," the authors maintain.

Sindane and Tsbani recommend that the MEC for Local Government and Housing (including Traditional Affairs in provinces such as KwaZulu-Natal and the Eastern Cape) be a champion for water and community forestry services at provincial level. This means the MEC will be politically accountable for water and community forestry services delivery at provincial level. As such, provincial water and community forestry services structures must be coordinated and

consolidated under the leadership of the MEC for Local Government.

It is further recommended that water and community forestry services structures must submit a quarterly progress report to the MEC for Local Government. The linkages between present water and community forestry services structure and the provincial liaison committees are to be formalised by ensuring political agreements and protocols with MECs and Premiers.

Transformational leadership within DWAF and in the provinces will result in better water services and community forestry performance at provincial and local levels. DWAF as water sector leader is expected to ensure the enhancement of existing collaborative structures to ensure self-efficacy of various stakeholders towards developmental monitoring, reporting, evaluation and regulations.

This will reduce some of South Africa's developmental challenges on political leadership and DWAF senior managers to deliver sustainable basic water services, the authors conclude. 

EXPLORING WATER CULTURE

Amanzi. Metsi. Water. Whatever you call it, water is the symbol of life and healing. On 22 March we celebrate World Water Day, and internationally the theme is 'Water and Culture'. This offers us the chance to look at what important role water plays in our societies.

As South Africans we are blessed to have people of many cultures and religions living together. In each of these cultures and religions, water, in its many forms, including rivers, lakes, rain and snow, plays a part in how people live and what they believe.

For the San, water is the ancient symbol of life. In ancient San culture, people acquired good or bad rain-bringing abilities at birth. This ability was reactivated when the person died.

In Limpopo, in the Lobedu Mountains, surrounded by the sacred

Modjadji cycads, lives the legendary Queen Modjadji or Rain Queen. Her history can be traced back 400 years to Zimbabwe. Legendary leaders, from King Shaka of the Zulus to former president Nelson Mandela, have paid homage to this leader of the Balobedu, who is said to have power over drought and rain.

In other parts of the country there are lakes and rivers that are legend to be home to water nymphs, mythical serpents and spirits, and people often make pilgrimages to offer sacrifices to appease the gods. Lake Fundudzi, in former Venda, is one such a sacred lake. Believed to be the resting place of the god of fertility, symbolised by a serpent, the lake is so revered that strangers are not allowed to touch the water. Offerings of sorghum beer are made to the lake often.

Some 22 000 thousand years ago, a meteorite hit the earth at a place 40 km north of Pretoria. The result was the Tswaing crater, or 'place of salt'. A giant serpent known to the locals as Kokwana, 'the old woman', is said to inhabit the waters of this lake.

NEW WATER GAME ON THE NET

UNICEF'S Voices of Youth programme has launched *Water Alert!*, a new interactive game that young people can play online, or through a CD version. This educational tool on water, environment and sanitation is intended to engage young people in an adventure of strategy and survival that explores real-life situations.

The object of the game is to ensure that the people in a drought-challenged village, who are facing the threat of a flood, have water that is safe to drink and a clean and healthy school environment. To play the game, your computer needs to have the Flash program installed.

To access the game, go to www.unicef.org/voy/explore/wes/explore_1818.html

Every year, hundreds of faithful worshippers flock to Ngome, a village in KwaZulu-Natal where the waters of seven streams meet to form the Isikhwebezi River. The waters of this

WATER ON THE WEB

Don't forget to check out the Water Research Commission's Education link on the web, www.wrc.org.za, where you will find lots of information on water to help you with school projects.



No matter
our
culture,
water is
the tie
that binds
us all.

river is said to have healing powers, and the area itself is known to be a haven for medicinal plants used by sangomas or traditional healers.

Water is also central to many religions practiced in South Africa. Almost all Christian churches or sects have an initiation ritual involving the use of water. Baptism has its origins in the symbolism of the Israelites being led by Moses out of slavery in Egypt through the Red Sea and from the baptism of Jesus by John the Baptist in Jordan.

Islam ascribes the most sacred qualities of water as a life-giving, sustaining and purifying source. It is the origin of all life on earth, the substance from which Allah created man. Water is important for cleansing and purifying, and Muslims must be ritually pure before approaching Allah in prayer.

Water is imbued with powers of spiritual purification for Hindus, for whom morning cleansing with water is a traditional every day obligation. All temples have historically been located near a water source, and followers must bathe before entering

The San believed some people were born with rain-making abilities



WATER IN A WORD

Did you know that there are over 6 000 different languages in the world? This means that there are more than 6 000 ways to say **WATER**? Can you find these words in the block by searching horizontally (sideways) and vertically (down)?

M	A	K	L	W	B	M	A	X	S
U	G	N	E	R	O	A	M	R	H
L	U	P	A	A	N	I	A	I	O
Q	A	U	U	O	F	M	N	M	U
S	M	J	B	G	W	D	Z	E	E
W	A	I	I	M	A	D	I	E	I
B	T	C	J	V	X	L	E	T	C
S	I	R	O	E	L	F	X	S	E
P	S	W	A	S	S	E	R	E	K
M	E	T	S	I	Z	V	T	A	N

- | | | | |
|-----------------------|-------------------------|------------------------|-------------------------|
| Nero (Greek) | Metsi (Setswana) | Meetse (Sepedi) | Amanzi (Zulu) |
| Maim (Hebrew) | Madi (Venda) | Mati (Tsonga) | Mul (Korean) |
| Agua (Spanish) | Vesi (Finnish) | Uji (Albanian) | L'eau (France) |
| Vtan (Iceland) | Wasser (German) | Wai (Maori) | Shouei (Chinese) |
| Paani (Hindi) | Biyo (Somali) | | |

WATER PROVERBS

Cultures all over the world have proverbs where water is the central theme. Can you think of water proverbs in your culture? Here are some to get you started:

- ◆ Any water in the desert will do. (Saudi Arabia)
- ◆ Heaven is dark and yet out of it streams clear water. (Afghanistan)
- ◆ Words are mere bubbles of water; deeds are drops of gold. (Tibet)
- ◆ You cannot separate water by beating it with a fork. (India)
- ◆ We do not know the worth of water until the well runs dry. (France)
- ◆ The heart of a wise man lies quiet like limpid water. (Cameroon)
- ◆ The horse that arrives early gets good drinking water. (Zulu)
- ◆ Dirty water cannot be washed. (Togo)

the temple. Many pilgrimage sites are found on river banks.

In Judaism, ritual washing is intended to restore or maintain a state of ritual purity and its origins can be found in the Torah. These ablutions can be

washing the hands, the hands and the feet, or total immersion which must done in 'living water', i.e. the sea, a river, a spring or in a mikveh.

So let us make water the tie that binds us all. 



The sacred Lake Fundudzi is said to be home to a fertility god.

All photographs courtesy of SA Tourism

Cooperating Towards MDG Success

Radical thinking is required if the world is to meet the United Nations Millennium Development Goals (MDGs) to halve those without access to water and sanitation by 2015. So says Prof Duncan Mara of Leeds University in the UK, who recently came to South Africa to present a specialist course on low-cost sanitation.

Prof Mara's research interests lie in public health and environmental engineering, specifically low-cost sanitation solution to developing countries, and the cost-effective treatment of wastewater for reuse. Apart from being a lecturer at Leeds University, he has served as an advisor to the United Nations Human Settlements Programme and the World Health Organisation, and published numerous books and papers on the subject.

"To meet the water and sanitation MDGs some 300 000 people have to be provided with improved water supplies and 440 000 with improved sanitation every day until 2015," he tells *the Water Wheel*. "This means we will have to redouble our present efforts. While most governments have the political will to meet these goals, the money and the know-how often remains lacking."

Prof Mara suggests a change in the way basic water and sanitation services are supplied. Rather than providing services to individual households in urban and peri-urban areas, the focus should be on providing services to groups of households. The group or co-operative collectively decides on the level and type of service they can afford (i.e. standpipe, yard-tap or multiple taps, ventilated improved pit latrines (VIPs), pour-flush sanitation or shallow sewers).

The infrastructure is supplied by the relevant water and sanitation services authority and the cooperative as a unit is then billed monthly. There are no connection fees because the co-op's have paid for all the in-block pipe work and so forth. The services authority can also lend the co-op money to do this, and recover the loan through the water bill over an amount of time. This needn't be undertaken only in poorer neighbourhoods, but can also be a solution for richer households, says Prof Mara.


While in countries such as Brazil simplified sewerage is now regarded as an acceptable sanitation technology, the national design codes in many countries do not permit the use pipes with diameters smaller than 100 mm. Prof Mara believes that such codes need to be altered to take into account present practice in simplified sewerage, otherwise local design engineers will be forced to continue to develop extremely conservative and hence expensive solutions for the poor.



To meet the water and sanitation MDGs some 300 000 people have to be provided with improved water supplies and 440 000 with improved sanitation every day until 2015.

According to Prof Mara, cost is really the most important criterion for sanitation technology selection for poor households. He is a strong advocate for the use of shallow sewerage systems, also called simplified sewerage. The technology, which is reportedly significantly cheaper than conventional waterborne systems, involves relaxation of the design parameters of conventional sewerage, allowing for shallower pipe-laying depths, smaller diameter pipes and flatter gradients.

Of course, providing the physical infrastructure is not enough. Hygiene education is as important and should be undertaken continuously to provide people with information to enable them to improve their health by using improved water supplies and sanitation facilities correctly. "Coca Cola did not become such a worldwide phenomenon by advertising only once," notes Prof Mara. "In the same way good hygiene

practices should be advertised constantly." Also important to note is that hygiene education should not be coercive, but rather motivational, i.e. not telling people what to do, but rather explaining to them what to do, why they need to do it and how to do it to improve their health and well-being. "It is only with consistent effort that we decrease the number of people that die each year as a result of poor access to safe sanitation," Prof Mara concludes. 

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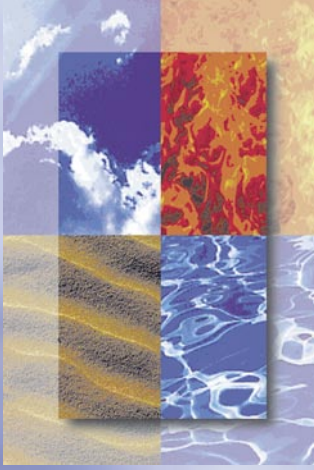
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