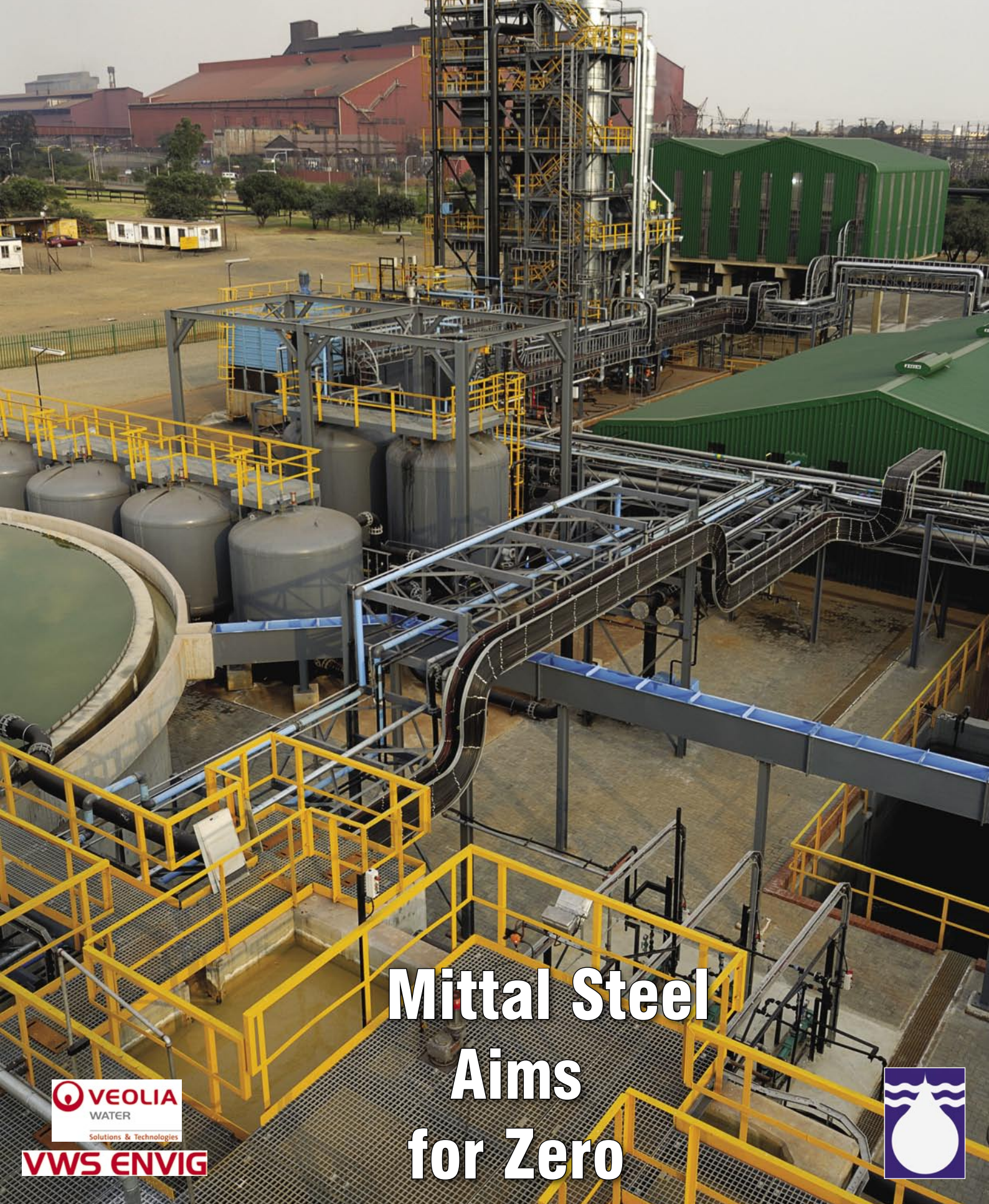


THE

WATER WHEEL

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Mittal Steel Aims for Zero



**Water Institute of Southern Africa
Membrane Technology Division (MTD)**

7th WISA MTD WORKSHOP
Mabalingwe Nature Reserve, Limpopo, 18-20 March 2007
www.mabalingwe.co.za

Call for Papers and Poster Presentations

Please submit abstracts electronically, by e-mail or on disk, as MS Word documents, to Marshall Sheldon (see below). Abstracts should be no longer than 200 words using Times New Roman font, 12 point, and should include:

- Introduction
- Brief description of experimental procedures / project / pilot programme
- Results and discussion
- References

Due dates:

Abstract (200 words)	10 November 2006
Acceptance	8 December 2006
Extended abstract (2 A4 pages)	2 February 2007

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Cover: Mittal Steel South Africa commissioned its R100-million water treatment plant at Vanderbijlpark earlier this year – page 12. Cover sponsored by WWS Envig.

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

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State of national assets 'concerning'

Minister of Water Affairs & Forestry Lindiwe Hendricks has expressed concern over the present state of some of the assets being transferred from the national department to local and district municipalities.

The transfer process is part of the national department's transition from an implementing organisation to a regulator within the water, sanitation and forestry sectors. Speaking to the press after her first 90 days in office, Hendricks said that agreements with regards to the transfer of assets had been signed with most Water Services Authorities, while the transfer of operations personnel was in progress. The entire transfer process is expected to be completed by the end of this year.

Hendricks said her attention had been drawn to the unsatisfactory status of some of these assets. Earlier this year (March/April 2006 issue), *the Water Wheel* reported on concerns regarding the operation and maintenance of the country's water and wastewater infrastructure, including those historically managed by the Department of Water Affairs & Forestry.

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 undertaken.

"This issue has been discussed with executive management, and the budget is certainly available to do the necessary repairs," Hendricks told *the Water Wheel*. "Being the national department, and therefore, being likely to have more skills and expertise available, we need to ensure that these assets are in perfect working condition before being transferred to provincial and/or local authorities."

Apart from the transfer of schemes, Hendricks said she was committed to driving the process of restructuring of the department through the establishment of the National Water Resources Infrastructure Agency, and catchment management agencies. "I hope to leave behind a lean and mean and much smaller department that is clearly focused on its role as sector leader for forestry and water, and its role as regulator and supporter of other institutions in these sectors."

R10-m for science internships

The Department of Science & Technology has set aside R10-million in a joint internship programme designed for science, engineering and technology graduates. Government news agency BuaNews reports that the department has partnered with the National Research Foundation in this initiative to bridge the gap between theory and actual workplace requirements. Graduates are assisted to raise their employability through mentoring and coaching.

The department said it intended to increase the pool of human resources available to science councils, science institutions and the National System of Innovation, while responding to national priorities. It also aimed to provide university graduates with various areas of specialisation.

Finnish-SA science agreement signed

South Africa and Finland have agreed to develop a cooperation framework programme with the overall objective of strengthening the national system of innovation.

The programme will run for 30 months with a total budget of €4-million, reports government news agency BuaNews. The aim is to have a national coordination mechanism, linked to a regional network to enable the delivery of support services for science parks and centres of excellence.

According to the Department of Science and Technology (DST), this will enhance provincial innovation systems as well as pilot innovation systems in rural areas. This will take place through activities like training, workshops and networking among the stakeholders at national and provincial level with targeted interventions. According to the agreement, the DST will be the lead agency with assistance provided by the Embassy of Finland.

It is understood that the programme will also foster collaboration and the exchange of expertise between South Africa and Finland.

Kudos for DWAF engineer

Kelvin Legge, an engineer with the Department of Water Affairs & Forestry, has scooped an international award for his contribution to the expansion of technology.

Legge, who lost part of his sight in 1992 when he was exposed to toxic waste which had contaminated the soil he was working with, was bestowed the award at the General Assembly of the International Geosynthetics Society in Yokohama, Japan. He is reportedly the first South African to receive this award in the field of civil and environmental engineering.

What drew the international community's attention is Legge's design theory in the use of plastic filter materials in earth embankment dams. He also invented a solution to improve the performance of contaminant containment barriers, such as those found at the bottom of landfills and hazardous waste sites.

Study looks at Roman water law

The Water Research Commission has published a new report following a study of Roman water law, with specific reference to water allocations and prior appropriation.

The study was aimed at determining whether Roman law could provide some guidance for water law and water allocations in South Africa.

Author Alewyn Burger reports that the principles of Roman law were developed over a long period in the vast Roman Empire, which covered a number of different countries with widely different climates. Subsequently, the law of all European, and many other countries (including South Africa) grew out of Roman



law. "Before a law has withstood the test of years of practice, one cannot say whether it is a successful law or not. The Roman interdicts

offer practical, tested guidance for resolving conflicts arising in water-stressed situations typical of arid and semi-arid areas."

It is reported that Roman law is the most important and influential collection of secular legal materials the world as ever known. According to Burger, this makes the body of Roman water law worthy of attention and further study for application in South Africa, particularly as the country approaches full-scale implementation of the National Water Act.

- To order the report (WRC Report No TT 297/06, contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za)

Boost for aquaculture through new policy



The Department of Environmental Affairs & Tourism (DEAT) is finalising a policy on aquaculture in an effort to grow this sector in South Africa.

Aquaculture is one of the fastest growing food production systems in the world.

Over the past 15-20 years it has developed into a global industry with over 60 countries engaging in the production of more than 250 species of fish, shellfish, crustaceans and aquatic plants.

Despite this phenomenal growth in global

aquaculture, South Africa's contribution has

remained low, accounting for less than 1% of African aquaculture production. In addition, the sector is dominated by large commercial enterprises. Through the Policy for the Development of a Sustainable Aquaculture Sector in South Africa, the government hopes to accelerate delivery of a bigger and profitable aquaculture sector in an environmentally sound manner.

A workshop engaging various stakeholders, including legislators, researchers, industry, labour, other national departments and provincial and local government, was held in September to share insights that would assist in mapping out the future agenda for aquaculture development in South Africa.

The draft policy is undergoing final stages of comment and stakeholder input at present. DEAT will further develop and implement a sector development plan that will be driven by a dedicated aquaculture unit.

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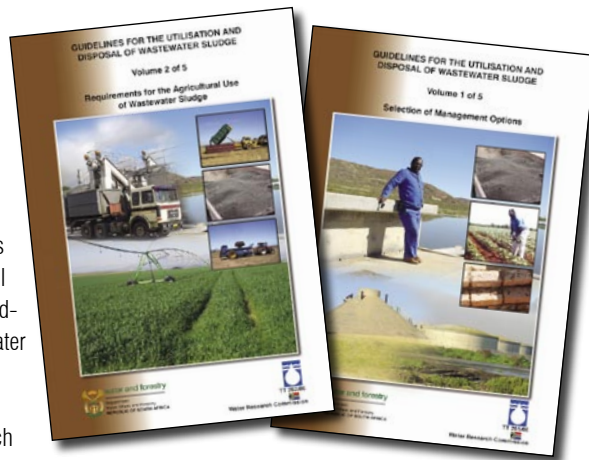
Help for authorities to manage sludge

Sludge produced at a wastewater treatment works can be regarded as the pollution removed from the water in a concentrated form. Correct management and disposal of this sludge is thus crucial to avoid potential contamination of the surrounding environment and fresh water rivers and streams.

The Water Research Commission initiated research to characterise local wastewater sludges and to develop a better understanding of sludge disposal practices that could form the basis for a comprehensive revision of the 1997 Guideline documents pertaining to the use and disposal of sewage sludge.

The result is the publication of two volumes of a planned five-volume series. The *Guidelines for the Utilisation & Disposal of Wastewater Sludge* are aligned with international trends and local knowledge gleaned over the past five years.

The first volume provides guidance on the selection of management options while the second volume outlines requirements for the agricultural use of sludge. The remaining volumes, which are in the planning stages



at present, will deal with requirements for on-site and off-site disposal of sludge, the beneficial use of sludge, thermal sludge management practices and commercial products containing sludge.

It is reported that the Guidelines were developed so that regulatory authorities, managers, practitioners and operators responsible for sludge management could easily understand them.

- To order the first two volumes, *Selection of Management Options* (WRC Report No: TT 261/06), or *Requirements for the Agricultural Use of Wastewater Sludge* (WRC Report No TT 262/06), contact Publications at Tel: (012) 330-0340 or E-mail: orders@wrc.org.za

Water on the Web

www.africanwater.net

This website is dedicated to a two-year project funded by the European community to increase the involvement of African researchers in the water-related components of the European Union Framework Programme 7 (FP7). The website provides African specific information about participation in FP7; newsletters and electronic news bulletins; training courses for water researchers in Africa on how to succeed in FP7; and promotion of partnerships between EU and African water research communities.

www.econologica.com

This website is dedicated to

ecological designs and solutions for low-cost pumping and transport. This includes the yardpump, Flutterwell pump, Cottage pump and Flo¹ pump. It provides a short description of the device, troubleshooting, and explanatory photographs and video-clips.

www.waterintegritynetwork.net

The Water Integrity Network (WIN) stimulates anti-corruption activities in the water sector worldwide. The network promotes solutions-oriented action and coalition-building between civil society, private and public sectors, media and governments, and advocates a range of anti-corruption activities.

Water by Numbers

- **63 602** – The number of remaining buckets that will be eradicated by December, according to Minister of Water Affairs & Forestry Lindiwe Hendricks.
- **8,8%** – The rate of rise in the price of potable water in South Africa, according to international firm NUS Consulting. South Africa had the fourth-lowest water tariffs out of 14 countries surveyed.
- **R15-million** – The fine payable by Italian construction firm Impregilo after it pleaded guilty to charges of attempting to defeat the ends of justice. It is the fourth company to be prosecuted and found guilty by the Lesotho High Court of corruption and paying bribes to secure contracts in the Lesotho Highlands Water Project.
- **129 400** – The estimated number of people relocating to Cape Town between 2001 and 2006, many of them to informal settlements outside the city.
- **581** – The number of students supported by Water Research Commission funded projects during the past financial year. About 69% of these students are from historically disadvantaged backgrounds.
- **80%** – The estimated percentage of sewage from Ghanaian capital Accra that flows untreated into the ocean.
- **US\$4-billion** – Estimated annual sales of the US bottled water industry.
- **US\$90-billion** – Estimated annual global investments in public water supplies.
- **20** – The percentage of the world's freshwater supply that is in Canada, which has banned bulk exports of water.
- **75%** – The percentage of Namibian citizens who have access to potable water.
- **18-million** – The estimated number of people affected by China's worst drought in 50 years.
- **92%** – Present average dam levels in South Africa following recent rains. Levels recorded in each provinces are Eastern Cape 89%, Free State 96%, Gauteng 99%, KwaZulu-Natal 85%, Limpopo 72%, Mpumalanga 93%, North West 74%, Northern Cape 101%, and Western Cape 85%.

Changed Attitude Can Feed More With Less

There is enough land, water and human capacity to end hunger and protect the environment over the next 50 years if “radical action” is taken today.

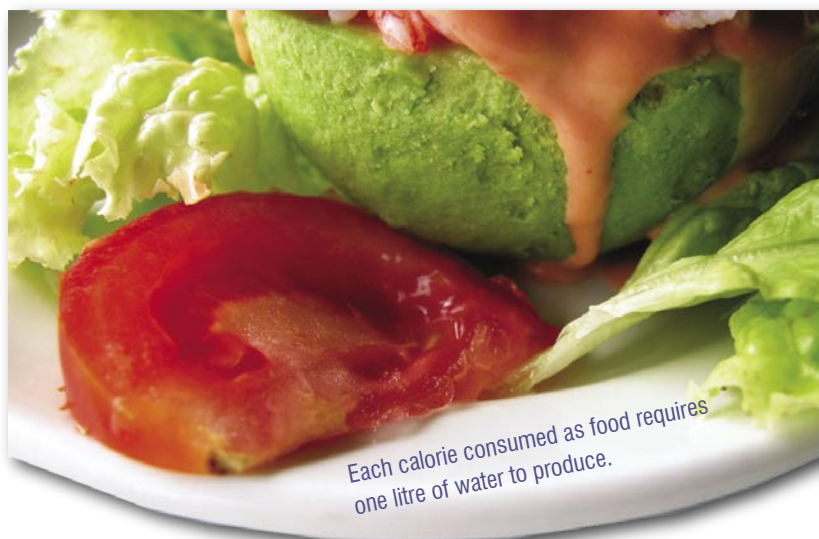
So say the authors of the *Comprehensive Assessment of Water Management in Agriculture*, which was launched in Stockholm during World Water Week. The Assessment, reportedly the first of its kind, critically examined policies and practices of water use and development in the agricultural water sector over the last 50 years. About 700 researchers took part in the project. It was co-sponsored by the Consultative Group on International Agricultural Research (CGIAR), the United Nations Food and Agriculture Organisation, the Ramsar Convention on Wetlands and the Convention on Biological Diversity in a bid to find solutions to the challenge of balancing water-food-environment needs.

Total water withdrawals are estimated at 3 390 km³, with 2 490 km³ (or 74%) for agriculture, mostly irrigation. As a rule of thumb, each calorie consumed as food requires one litre of water to produce.

In sub-Saharan Africa, withdrawals are only a tenth of those in First World countries, with little water developed for agriculture. But, according to the Assessment, the variation is huge. In the Zambezi basin less than 1% of the total water resources are withdrawn for human purposes. In the Limpopo basin, on the other hand, most water is allocated, and the basin is closing.

According to the authors, a quarter of the world's population live in river basins where water is physically scarce – water is overused and people are affected by environmental consequences from falling groundwater levels to dying rivers that no longer reach the sea. Another one billion people live in river basins where water is economically scarce – water is available in rivers and aquifers, but the infrastructure is lacking to make this water available to the people.

The scientists warn that if nothing changes, in 2050 the agriculture sector will need to double the amount of water to grow the food we eat. But with appropriate action, total growth in water use could slow down by 50% and water withdrawals from rivers could stabilise.



Speaking at the launch, David Molden, who led the Assessment said: “To feed the growing population and reduce malnourishment, the world has three choices: to expand irrigation by diverting more water to agriculture and building more dams (at a major cost to the environment); expand the area under rain-fed agriculture at the expense of natural areas; or do more with the water we already use. We must grow more crop per drop, more meat and milk per drop and more fish per drop.”

Africa's savannahs – which have the most of the world's poorest people who typically rely on rain-fed agriculture – are singled out by the Assessment as holding the greatest potential for increasing water productivity, and increasing agricultural yields per unit water used.

The Assessment recommends a radical new agenda for agricultural water management – one that prioritises obtaining the maximum social, environmental and economic value out of every drop of water. Main points outlined in the report include:

- **Think differently about water**

“The prevailing attitude of the last 50 years has been that water is a free, renewable resource and that the main challenge is to capture it and make it available to people without regard to the environmental consequences,” said Molden. “This agenda urgently needs to be replaced by awareness that there is no more ‘new’ water.”

- **Get water to poor people**

Providing access to water for productive purposes to smallholder farmers in marginal or vulnerable areas through affordable small-scale technologies, such as treadle pumps and micro-drip kits, is a proven strategy to fight poverty, the authors point out. This, combined with micro credit and access to markets can provide additional income up to several times the investment cost in a single year.

- **Increase water productivity**

Future improvements in water productivity at the farm level are expected to come primarily from a combination of smart field practices, using techniques from ‘conservation tillage’ and ‘land levelling’ to improved irrigation scheduling, with a potential breakthrough possible in the breeding of drought-resistant crop varieties.

- **Consider a continuum of options for agricultural water management**

The new approach to water for agriculture recognises that the greatest potential for improving yields is in the grey zone between rain-fed and irrigated systems, i.e. supplementing irrigation to rain-fed systems through rainwater harvesting.

- **Managing agriculture for multiple ecosystem services**

The report advocates multiple use of

water. For example, multi-functional rice fields can grow rice, fish, ducks, frogs and edible snails, thus generating livelihoods for small farmers while supporting high biodiversity and better soil erosion control.

- **Reform the State to improve the governance of water**
Governments will need to enable water to be re-allocated from lower to higher-value

uses, including transfers from agriculture to cities and industry; provide incentives for water conservation; set and enforce water quality standards; and establish and implement systems of water (use) rights or entitlements.

- **Deal with trade-offs and difficult choices**
According to the researchers, there is a

lot that can be done to relieve the problems of scarcity, but, in reality, there will be a lot of hard choices about water that need to be made – often creating winners and losers. Usually, the losers are the poor farmers, live-stock herders and fishermen. What are needed are more informed negotiations where all these stakeholders are brought to the table.

Water Diary

WATER & FOOD NOVEMBER 12-17

The International Forum on Water and Food will be held in Vientiane, Lao PDR with the theme, Synthesising Knowledge on Livelihoods, Water, Food and the Environment. *Visit: www.waterandfood.org*

WATER IN MINING NOVEMBER 14-16

Water in Mining 2006, with the theme Multiple Uses of Water, will be held at the Sofitel Hotel, in Brisbane, Australia. *Enquiries: Donna Edwards; Tel: +61 3 9662 3166; E-mail: dedwards@ausimm.com.au or Visit ausimm.com*

EDUCATION & TRAINING NOVEMBER 15-16

The Second Annual ESETA Conference & Exhibition will be held at Kopanong Hotel & Conference Centre, Benoni. The theme is 'Energy and Water: Essential for the South African Economy'. *Enquiries: Taryn, Scatterlings of Africa, Tel: (011) 563-5085; E-mail: Conference@soafrica.com*

SANITATION NOVEMBER 16-18

The World Toilet Expo and Forum will take place in Bangkok. *Web: www.worldtoilet-expo.com/home*

AGRICULTURE NOVEMBER 20-23

The Innovation Africa Symposium will convene a group of internationally recognised experts on innovation systems in Kampala, Uganda, to share their latest

thinking with agricultural researchers and development partners. *Enquiries: Dr Susan Kaaria, Rural Innovation Institute; Tel: +256 41 567 804; Fax: +256 41 567 635; E-mail: s.kaarla@cgiar.org*

INDUSTRIAL EFFLUENT NOVEMBER 22-24

An industrial effluent management conference with the title 'Best Practices of Wastewater Treatment to conform to DWAF Standards' will be held at Southern Sun, Johannesburg International. *Enquiries: Tel: (011) 771-7000; Fax: (011) 880-6789/880-8260; Visit: www.iir-conferences.co.za/effluent*

WATER DEMAND MANAGEMENT NOVEMBER 27-28

The Water Institute of Southern Africa, in conjunction with WRP, is offering a Water Demand Management Master Class at Vulindlela Auditorium, in Midrand on 27 & 28 November and at the The Pavilion Conference Centre, in Cape Town, on 30 November and 1 December. *Enquiries: Taryn at Scatterlings of Africa, Tel: (011) 563-5085; E-mail: conference@soafrica.com*

WATER MANAGEMENT NOVEMBER 27-30

The Pan African Water Congress will take place at the Sandton Convention Centre. *Enquiries: Tshago Ratshidi, Tel: (011) 516-4023; E-mail: tshago.ratshidi@terrapinn.co.za; Visit: www.terrapinn.com/2006/waterza*

URBAN WATER USE DECEMBER 3-6

The International Conference for the Sustainable Development of ecoCities will be held

in Bangalore. *Visit: www.tciconferences.com/ecocity2006/ecocity2006.htm*

RAINWATER HARVESTING DECEMBER 4-8

The Tenth Southern and Eastern Africa Rainwater Network (SearNet) Conference on Rainwater Harvesting and Management in Africa will be held in Mombasa, Kenya. The theme for the conference is 'Rainwater Management for Disaster Mitigation and Sustainable Development.' *Enquiries: SearNet Secretariat at E-mail: searnet@cgjar.org, Visit: www.searnet.org*

SCIENCE COMMUNICATION DECEMBER 4-7

The annual conference of the South African Agency for Science and Technology Advancement will be held in Port Elizabeth. The conference will focus on the need to develop science communication and establish collaborative networks on the African continent. *Enquiries: Taskeen Henry, Tel: (041) 365-5634; E-mail: taskeen@inkanyezi.co.za*

SOIL SCIENCE JANUARY 22-25

The combined conference of the South African Society of Crop Production; the Soil Science Society of South Africa and the South African Society for Horticultural Sciences will be held at the Aventura Resort at Badplaas, Mpumalanga. *Enquiries: Garry Paterson at E-mail: garry@arc.agric.za; or Charmaine Sullivan at E-mail: sullivanc@mweb.co.za; or Visit: www.sascp.org.za/congress/CongressHome.html*

WHO guidelines on use of wastewater

The new guidelines from the World Health Organisation on the use of wastewater, excreta and greywater in agriculture and aquaculture was presented to the public for the first time at the Fifth International Water Association Water Conference, held in China earlier this year.

Wastewater is a resource of ever-growing importance. However, its use for crop and fish production carries important health risks.

The third edition of the guidelines reportedly marks a departure from the presentation of static standards and norms to best practice guidance in risk assessment and management for the use of this increasingly important water resources. The guidelines describe possible risk management interventions for the various phases from the generation of wastewater, excreta and greywater to the consumption of produce from which they were used. There are four volumes, each with a different focus and target audience.

To access the guidelines, go to www.who.int/water_sanitation_health/wastewater/gsuww/en/index.html

'Drought-proof' village for Brisbane

Work on Brisbane, Australia's first 'drought-proof' village is continuing. Construction of the 21-house development, dubbed S3 Manly West, started in April. It will not be connected to the city's water or wastewater network.

Instead, all homes in the village will have rainwater tanks installed, and use recycled water extensively, reportedly using up to 50% less water than a typical residential community. Residents will also enjoy biological, organic water treatment of all rainwater, and wastewater will be recycled and treated to a standard comparable to drinking water – before being reused in toilets, gardens and car washing. The initiative has been welcomed by authorities as the area is suffering from its worst drought on record.



Filtration technique proven to remove algae toxin

A water filtration technique that normally cleans up agricultural chemicals is also effective at removing a toxin secreted by algae found in lakes and rivers, an Ohio State University, in the US, has found.

Engineers here have determined that the technique greatly outperformed other methods by removing at least 95% of a toxin secreted by *Microcystis*, a blue-green algae. Apparently some water filtration plants around the country are already using the technique, which couples activated carbon with membrane filters. The engineers combined the active carbon with three different commercially available membrane filters. Each combination apparently produced good results.

Calling all engineers with a conscience

Engineers play a crucial role in improving living standards throughout the world, and they have the potential to ensure sustainable development in the 21st century.

The Mondialogo Engineering Award invites engineering students in developing and developed countries to form international teams to create project proposals that address the UN Millennium Development Goals – proposals to improve the quality of life in the developing world, particularly poverty eradication and the promotion of sustainable development. Each team should actively engage in international cooperation and intercultural dialogue over a six-month period, from December 2006 to May 2007, to propose practical, high-quality engineering projects for the benefit of local communities in developing countries.

Registration is open to project teams whose members are officially registered as students at universities, technical colleges or similar institutions through to May 2007. Teams must register before 30 November. Ten awards of €20 000 will go to teams with the top project proposals, with an Honourable Mention and €5 000 earmarked for 20 more teams.

For more information and to register, go to www.mondialogo.org

Soybean touted as pollution solution

US scientists are testing soybean hulls as a filtering agent that can adsorb harmful levels of lead, chromium, copper and cadmium from contaminated waters.

Researchers from the US Agricultural Research Service have reportedly created a material from these residues known as a dual-functioning ion exchange resin. These resins, which are commonly used for treating industrial and municipal wastewaters and for recycling heavy metals from solutions, are typically effective in capturing only one kind of particle with either a positive or negative charge. However, the soybean hull resin can apparently capture both.



Fish 'grown' rather than caught



Nearly half the fish consumed as food worldwide are raised on fish farms rather than caught in the world, according to a new report from the United Nations Food and Agriculture Organisation (FAO).

While in 1980 just 9% of the fish consumed by human beings came from aquaculture, today 43% does, the report, *The State of World Aquaculture 2006*, shows. That is 45.4 million tons of farmed fish, worth US\$63-billion, eaten each year.

Globally, consumer demand for fish continues to climb, especially in affluent,

developed nations which in 2004 imported 33 million tons of fish. However, levels of captures of fish in the wild have remained roughly stable since the mid-1980s, hovering around 90 to 93 million tons a year. According to the FAO, there is little chance of any significant increases in catches beyond these levels. The only option for meeting future demand for fish is by farming them, the FAO argues.

To access the report, go to ftp://ftp.fao.org/FI/DOCUMENT/t500_advanced/advanced_t500e.pdf

Atlas notes human destruction of lakes

Increasing concern as to how human activities impact Africa's lakes has led to the launch of *Africa's Lakes: Atlas of Our Changing Environment* by the United Nations Environment Programme (UNEP).

Through a combination of ground photographs, present and historic satellite images, and narrative based on extensive scientific evidence, this publication illustrates how humans have altered their surroundings, and continue to make observable and measurable changes to Africa's lakes and their environment. The atlas underscores the importance of developing, harnessing and sharing technologies that help provide deeper understanding of the dynamics of the changes.

Africa has an estimated 677 lakes (both natural and man-made). These lakes hold about 30 000 km³ of water. Among the lakes featured in the atlas is Lake Songor, a brackish coastal lagoon in Ghana. Home to several threatened species, the lake appears as a solid blue mass some 74 km³ in size in December 1990. But, by December 2000, the water body is a pale shadow of its former self largely as a result of intensive salt production and evaporation at the western end.

Speaking at the launch of the atlas in August, UNEP Executive Director, Achim Steiner, said: "Lakes and the natural goods and services they supply to communities are

In brief

- The Ntimbale Dam, in the North Eastern District of Botswana, is nearing completion.
- The government of China is planning to spend US\$125-billion over the next five years to remediate the declining quality of its urban water supplies.
- The 77-year-old Nile Treaty, said to favour Egypt, is set to be replaced as negotiations continue for the establishment of a Nile Basin Commission to replace the controversial 1929 treaty that restricts the use of the river.
- US space agency NASA can reportedly track the effect of climate change on forests. Scientists have found that satellite measurements of tree species and growth in forested areas across the US were often equivalent to those taken directly on the ground.
- The 87-km Katima-Mulilo-Linyanti water pipeline has been officially inaugurated in Namibia.
- Brazil and Botswana have agreed to cooperate in agricultural research over the next five years. According to SciDev.Net, the collaboration will include research to improve livestock and crop production. It will involve work on plant and animal health, food processing, and the sustainable use of soils and other natural resources.
- SUEZ Environment has been named preferred bidder for a concession-type contract to manage the water services for the city of Changshu, located in the delta of the Yangtze River. The 30-year full services contract represents a first-year turnover of €1-billion.

of huge economic significance. I hope that the images in the atlas will sound a warning around the world that, if we are to overcome poverty and meet internationally agreed development targets by 2015, the sustainable management of Africa's lakes must be part of the equation."

MoU to enhance African water

A Memorandum of Understanding (MoU) has been signed between the Stockholm International Water Institute (SIWI) and the CSIR.

The MoU aims to foster knowledge creation that leads to concrete water-driven social, economic and environmental improvements. "This MoU offers exciting potential for concrete action because it combines the strengths of the CSIR in science, technology and research with SIWI's well-respected policy perspectives," commented Dr Pat Manders, Acting Executive Director of CSIR Natural Resources and Environment.

In particular, the two organisations seek to develop cooperative opportunities in water policy, water governance, transboundary water resource management, and water-resource based socio-economic development. The activities are intended to be placed within the general context of Millennium Development Goal attainment as well as more specific objectives outlined by the New Partnership for Africa's Development.

Water purifier wins award

The AG+ Colloidal Purifier water purifying device, designed by Boris Iskra, Jean-Marie Julien and Vadim Drozdov was one of the winners at the 2006 SABS Design Institute Prototype Awards.

The device comprises a three-sectioned cylinder divided into an electrodes compartment, a sealed circuitry and a battery compartment. Containing two silver electrodes the electrode compartment screws into a two-litre plastic cold drink bottle. In turn, the battery compartment contains a 12 V battery and a LED with an activating link.

The electrodes are inserted in the water that needs to be purified and the LED flashes to show that the purification is in process. The LED stops flashing once the process is completed.

According to the designers, all bacteria are killed within 45 minutes. Commenting on the device, the adjudicators said: "Using silver electrodes for water purification is known technology, but the designers applied sound and practical design considerations."

Multimillion Rand upgrade for JW works

Johannesburg Water is upgrading its Northern Works Wastewater Treatment Plant.

The upgrade is aimed at catering for increased flows due to ongoing developments in its catchment area.

The new unit is being designed at present and will ultimately add 150 Mℓ capacity to the Northern Works at an estimated cost of about R450-million.

With regards to the reported spillages into the Jukskei River during June, JW said these were mainly due to a problem developed during some essential upgrading work being undertaken. "The substandard effluent of some 80 litres per second of settled sewage was substantially diluted and neutralised by the treated effluent of about 3 000 litres per second with a quality well within the Department of Water and Forestry license requirements," the company said in a statement. Current *E. coli* levels are said to be within allowances.

More flexibility with ultrasonic upgrade

Endress+Hauser has released its Prosonic S ultrasonic level measurement device.

Prosonic S comprises the FMU90 transmitter and the FDU9x sensor, which may be remotely mounted at a distance of up to 300 m. Two housing variants are available: on the one hand, the robust and weatherproof field housing for on-site assembly, on the other hand the top-hat rail housing for space saving assembly in control cabinets. A separate display for installation in control panels is offered as an option.

The new sensors feature improved properties in relation to blocking distance, material, temperature and measuring range. Hermetically-welded sensors are available for liquid applications and safeguard smooth operation in aggressive media.

For more information, contact Sean Frost at Tel: (011) 262-8000 or E-mail:

info@za.endress.com





New Treatment Plant Cuts Mittal's Discharge to Zero

Weir Techna SA, represented locally by VWS Envig has handed over a fully commissioned water treatment plant to Mittal Steel South Africa in Vanderbijlpark. The R100-million water treatment plant will cut the steel producer's liquid discharge down to zero. VWS Envig was created earlier this year through the merger of Weir and Veolia Water Solutions.

With a focus on delivering complete water treatment solutions that benefit both customer and the environment, this project showcases the company's extensive research capabilities and its ability to draw on vast international resources and expertise. According to VWS Envig General Manager – Design and Build Projects Francois Gouws, the water treatment project was necessary in order for the steel manufacturer to reduce the environmental impact of its operations. It forms part of

Mittal Steel's larger R1-billion environmental plan designed to help the company to meet the highest possible environmental standards.

"In addition to treating water efficiently, the plant needed to be cost effective both in terms of capital and operating costs. The primary objective of the plant is the removal of hardness and suspended solids from the main process water circuit and the removal of salts from the blowdown water from various unit

processes within the steel mill, for example, the cooling towers."

VWS Envig executed the project on a turnkey basis, the scope of which included design, detailed engineering, project management, procurement, construction, commissioning and testing.

"After an extensive study of the plant's requirements, and internal laboratory work, we designed a unique combination of technologies, tailor-made to ensure optimum

efficiency, cost effectiveness and the highest quality of water. The solution combines various technologies, namely clarification, media filtration, reverse osmosis (RO), evaporation and crystallisation.

“The result is a zero liquid discharge plant. The process water is treated at a rate of up to 2 000 m³/h and, once treated, is reused within the plant as general utility water. The waste sludge generated in the process is dewatered and sent to a landfill.” says Gouws.

“In addition to treating water efficiently, the plant needed to be cost effective both in terms of capital and operating costs.”

The blowdown water is treated at a rate of up to 220 m³/h, but with its high concentration of salt, it is not suitable for direct reuse within the plant. The dissolved salts are removed through membrane separation and evaporation and the plant therefore provides a suitable salt sink from the overall water circuit. The final waste from the plant consists of dewatered crystals. This is sent to a landfill for disposal. Stormwater from around the plant is also treated, and a portion is reused.


The process involves pre-treatment of the water, which includes lime and soda ash softening, clarification, sand filtration and granular activated carbon filtration. The RO process consists of a two-stage brackish water RO (BWRO) phase, including cellulose acetate membranes in the first stage and composite polyamide membranes in the second. The evaporation stage includes a double-effect evaporator with thermo-compressor, while the crystallisation stage employs a single-effect forced circulation crystalliser with thermo-compressor.



Mittal Steel South Africa's zero liquid discharge plant.



Process water is treated at a rate of up to 2 000 m³/h and is then reused.

Gouws notes that during commissioning experts from French parent company, Veolia Water Solutions and Technologies, were called in to assist with the blending of the various streams of feed water. “The plant was fully commissioned at the beginning of this year and in addition to limiting its effect on the environment, Mittal is also lowering its water consumption by using the reclaimed water.” 

MORE ABOUT THE VANDERBIJLPARK PLANT

Vanderbijlpark is one of the world's largest inland steel mills, and the largest supplier of flat steel products in sub-Saharan Africa. The plant employs some 5 200 staff.

The plant's steel products are manufactured in an integrated process. Raw materials such as iron ore, coke and dolomite are charged to blast furnaces where they are converted to liquid iron. Then the liquid iron is refined in basic oxygen furnaces and electric arc furnaces to produce liquid steel.

The liquid steel is cast into slabs, which are hot rolled into heavy plate in a plate mill, or into coils in a strip mill. The coils are either sold as hot-rolled strip or processed further into cold-rolled and coated products, such as hot-dip galvanized, electrogalvanized and pre-painted sheet, and tinplate.

Vanderbijlpark has two blast furnaces, three electric arc furnaces and three basic oxygen furnaces.

Source: Mittal Steel South Africa website



Economic Boom Strains Waterberg Resource

Authorities are investigating several options to augment water resources within the Mokolo River Catchment, in Limpopo, in anticipation of a surge in economic development in the area. Lani van Vuuren reports.

The Mokolo River Catchment covers an area of 8 387 km², stretching from the Waterberg Mountains through the upper reaches of the Sand River. It includes a number of small tributaries that join the main Mokolo River up to its confluence with the Limpopo River, including the Tambotie River, Poer-se-Loop, and the Rietspruit River.

According to Beyers Havenga, Department of Water Affairs & Forestry (DWAFF) Chief Engineer:

National Water Resources Planning (North), water availability and water use in the catchment are in balance, with no spare resources existing for future allocations. "In addition, considering the water requirements of the Reserve as stipulated in South Africa's water legislation, there is insufficient water to maintain the present balance," he tells *the Water Wheel*.

Irrigation is the largest present water user here. The area contributes significantly towards agricultural

activity in the province, with produce including tobacco, sorghum, maize and sunflower. An estimated 87% of present water use in the catchment is dedicated to agricultural activities.

Constructed in the 1970s, the Mokolo Dam is one of the main impoundments in the province. It is considered one of the largest dams in the Limpopo water management area, with a full supply capacity of about 146 million m³. A concrete-faced rockfill dam, Mokolo was built mainly

to serve the 4 000 MW Matimba Power station, situated outside Lephalale (formerly Ellisras). Matimba is the world's largest dry cooling power station, and uses about 7,3 million m³/year of water.

The dam also serves the adjacent Kumba Resources' Grootegeluk, South Africa's biggest coal mine, which uses an estimated 9,9 million m³/year of water. Lephalale and surrounding areas as well as downstream farmers are also supplied with water from the dam.

“The Waterberg District is set for huge economic growth in the nearby future, with water demand expected to grow from 25,5 million m³ in 2005 to 63,3 million m³ by 2025.”

At the time the dam was built, its yield was given as 39 million m³/year. However, subsequent to the dam's construction, there was rapid and extensive irrigation development upstream, supplied from farm dams and from run-of-river. Consequently, the yield of the dam has dropped to an estimated 27 million m³/year.

ECONOMIC UPSURGE

The Waterberg District is set for huge economic growth in the nearby future, with water demand expected to grow from 25,5 million m³ in 2005 to 63,3 million m³ by 2025, encouraged mainly by mining and electricity developments.

In July, Eskom announced it would proceed with the construction of a 2 250 MW base load power station near Lephalale at a cost of R26-billion as part of its R97-billion expansion programme. The first phase (2 100 MW) of the new so-called Matimba B



Grootegeluk Coal Mine is one of the largest water users in the area.

Power Station will use 4 to 6 million m³/year of water, according to the Environmental Scoping Report. The first tenders for the boilers and turbines were issued in September. It is believed these will be awarded early next year.

In addition, new mining developments are set to further fuel the demand for water as the region contains more than 40% of the country's remaining coal resources. According to Kumba Resources, the Waterberg coalfields have resources of about 163 billion tons and reserves of 3,54 billion tons. The mining

company plans to increase production at its Grootegeluk mine to serve the new power station.

At the same time, AngloCoal is continuing investigations into the commercial application of coal bed methane in the Waterberg area, but it is believed that the region might have coal bed methane gas deposits of 28 billion m³. By August, the first five-post pilot wells had been drilled.

Petrochemical giant Sasol also has extensive coal resources in the Waterberg coalfields. This surge

Estimated future water requirements in million cubic metres

	Allocation	Sub-allocation	Actual 2005	Requirement 2015	Requirement 2025
Grootegeluk Mine	10.9	6.4	1.8	5.6	7.0
Lephalale LM		4.5	3.8	7.5	11.0
Eskom	7.3	6.2	3.6	6.2	6.2
Marapong		1.1	0.5	1.0	1.8
Mogol IB	10.4	16.0	16.0	10.0	10.0
Eskom Future				12.0	12.0
Eskom Future					12.0
Eskom Future				2.5	2.5
Eskom Future					0.8
Total	28.6	34.2	25.7	44.8	63.3

Source: DWAF



Matimba Power Station will soon be joined by the addition of Matimba B.

in developments is set to attract a growing population to Lephalale, stimulating growth in domestic water consumption.

FINDING MORE WATER

DWAF commissioned three simultaneous investigations into the Mokolo River Catchment in 2005. The first, which has already been completed, was a verification and validation study aimed at verifying the water use of each water user and then verifying the information. Satellite images and aerial photographs were applied to determine actual water use, while a rapid assessment model was applied to look at water registration.

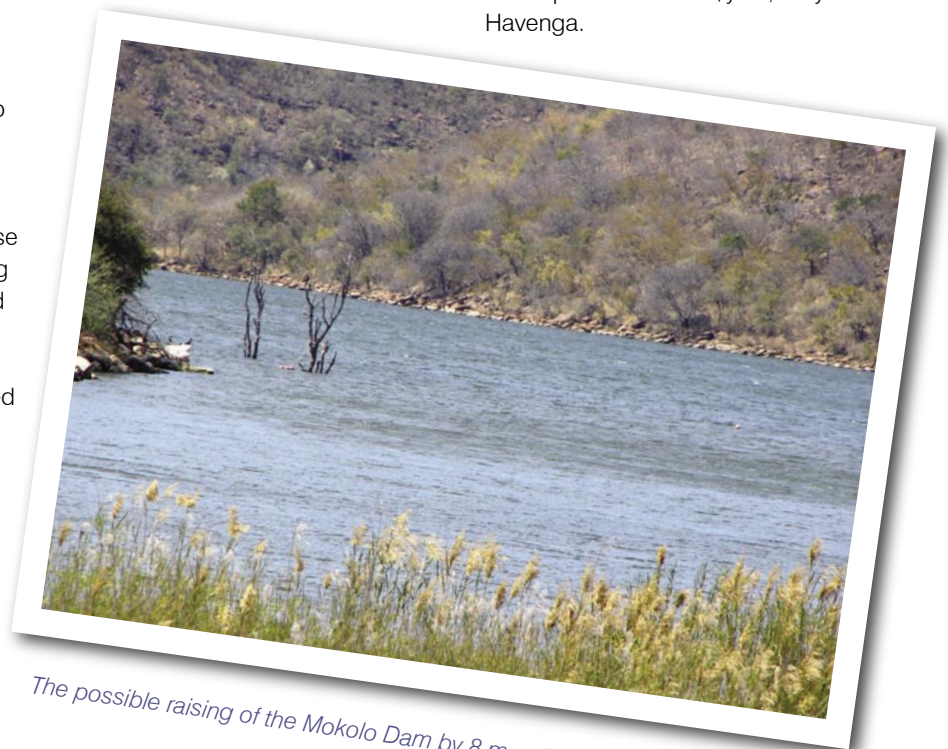
"This will assist us with the issuing of licenses and the evaluation of new license applications," reports Havenga. Focus group meetings were held for different categories of water users (for example, irrigation farmers, and local municipalities). Public meetings were also held to promote access to information and transparency.

The second study, which is to be completed by mid-2007, is aimed at providing DWAF with an updated understanding of how much water (yield) is available in the catchment at present. This hydrology study

is being based on the analysis of historic rainfall patterns, streamflow, ground and surface water resources. The study is also analysing the performance of the Mokolo Dam under different water abstraction scenarios.

Thirdly, a water conservation/water demand management (WC/WDM) study has recently been completed. While it is recognised that some sectors in the catchment are already practising WC/WDM, additional efforts are required to realise additional water conservation and efficient use of water, explains Havenga.

This study assessed the potential to implement further WC/WDM initiatives in the area, such as the removal of alien vegetation. According to Havenga, some interesting observations were made in this regard. For example, irrigation water is released from Mokolo Dam to be abstracted by riparian irrigators as requested. Huge losses in this system estimated up to 60% have been encountered. "By reducing these losses we can save up to 6 million m³/year," says Havenga.



The possible raising of the Mokolo Dam by 8 m or 15 m is being investigated.

FEASIBILITY STUDIES

Further to the catchment studies, pre-feasibility and feasibility assessments have begun to determine the best solution to meet future water needs. The first possible water augmentation source entails the transfer of water from the Crocodile (West) and Marico Catchment to the Mokolo River Catchment.

The transfer will entail the construction of an 84 km pipeline. A total of 45 million m³/year has already been provisionally reserved within the Crocodile West/Marico water management area for this, and investigations around possible pipe sizes, tariffs and so forth are continuing.

Another option is the possible raising of Mokolo Dam. Havenga reports that the design and construction of the dam is such that it is possible to raise the wall to provide additional storage capacity. Two options are being considered. If the dam wall is raised by eight metres the dam will yield an additional ten million m³/year. If the dam wall is



Agriculture is the largest water user in the Mokolo River catchment.

raised by 15 m the dam will yield an additional 21 million m³/year.

Since the Mokolo River is a tributary of the Limpopo River, which is an internationally shared watercourse, the possible raising of the Mokolo Dam wall will first have to be

approved by South Africa's co-basin states, Botswana, Mozambique and Zimbabwe in accordance with international basin sharing agreements. Since these agreements tend to be long and time consuming, such an option might not prove viable considering present time constraints.

Another solution being investigated is the development of borehole fields. Groundwater development has been extremely limited in the area to date due to reported low permeability, storage and transmissivity. There are no artesian boreholes or large-scale abstraction of groundwater reported in the area at present. A larger area of investigation might have to be scrutinised to find suitable discharge rates.

Havenga notes that the costs associated with the construction of new infrastructure and long-term sustainability will be the overriding factors determining which option is pursued. A final decision is expected by end-2007 to enable construction to be completed in time to coincide with the coming-on-stream of the new electricity and mining developments.



Water losses up to 60% of irrigation water has been reported.



Construction is not the only sector in South Africa experiencing a boom leading up to the 2010 Soccer World Cup. The country's fledgling bottled water industry is set to grow by an average 22,5% per annum over the next few years in anticipation of this global event. Lani van Vuuren reports.

If anyone had been told twelve years ago that the South African bottled water sector would be a highly successful industry, they would probably have laughed in disbelief. After all, South Africa is one of few countries where tap water in most places is still good enough to drink. Indeed, a little over a decade ago, the bottled water industry was virtually non-existent. Boy, have things changed.

Walk into any retail outlet, service station convenience store or restaurant, and you can probably take your pick from an aisle filled with different brands, from mineral to spring, still or sparkling, flavoured or unflavoured, local or imported, plastic or glass. These range in sizes from 250 ml to

the household supersized five-litre container.

Spurred on by the global trend towards healthier living, the sector is worth about R1,5-billion today, according to the South African Natural Bottled Water Association (SANBWA) technical manager Charlotte Metcalfe. This translates into a nominal bottle value of R6,90/litre. There are about 100 bottlers country-wide, ranging from small hand-bottled operations (who are in the majority) to large bottlers, such as Nestlé and Valpré, which produce between 15 000 and 20 000 litres of water an hour using automated systems.

SANBWA, whose members represent about 80% of the total South African

bottled water sector, reports that the two biggest markets for natural bottled water at present are Gauteng, where the South African health and lifestyle industry has its biggest footprint, and Cape Town, where tourists have a direct, semi-seasonal impact on sales of natural water.

EXPLODING GROWTH

Market researcher Shawn Henning of BMI Foodpack reports that the South African bottled water market grew by an estimated 33% during 2005, following on a consistent annual growth trend in excess of 20% since 2001. "The growth rate surpasses that of other beverages, clearly indicating a more health conscious market preferring bottled water to other beverage

alternatives, such as carbonated soft drinks. In fact, the industry has been doubling in volume every three years." The price could also have something to do with the growth, an average R6,74 per litre compared to the R6,96 of carbonated soft drinks.

Around 32% of the volume consumed is flavoured water, which is steadily increasing its share in the market, even in 'non-traditional' bottled water segments, such as townships and rural areas. Bottled water producer aQuellé, traditionally known for its flavoured water, reports sales across the entire cultural and income spectrum. The company, based in KwaZulu-Natal, has been steadily increasing production to keep up with demand, even launching a still water range (including five-litre packaging) in the last year.

"In the past, our greatest challenge was getting national retailers to stock

"There are about 100 bottlers countrywide, ranging from small hand-bottled operations (who are in the majority) to large bottlers, such as Nestlé and Valpré, which produce between 15 000 and 20 000 litres of water an hour using automated systems."

our product, as they did not believe there was a market for it," notes Arno Stegen of aQuellé. "Now it is keeping the product at the top of the consumer's mind." Marketing certainly plays a big role in consumption, with the introduction of new brands and packaging initiatives among other

promotional activities contributing significantly to sales growth during the past year. At present, the main target market remains those with disposable income, especially the younger generation, aged 20 to 30 and 30 to 45.

Other factors were the favourable beverage consumption weather experienced in 2005, and increased disposable income of consumers. Then, of course, there is the convenience factor. "When you are hurtling down the highway it is difficult to find a tap when you are thirsty," notes SANBWA chair John Weaver.

Only a handful of bottlers distribute nationally, with all the other plants supplying regionally. This is related to the low price of bottled water versus the cost of transportation.

It is uncertain exactly how many people are employed in the



The South African bottled water market grew by an estimated 33% during 2005.



Bottled water is no longer merely a healthier 'on the go' alternative. Larger containers for household use are increasingly being sold.



Flavoured bottled water is gaining in popularity, even in non-traditional markets such as townships.

bottled water industry, but the figure is estimated at 2 500. Small bottlers, operating by hand, provide income to unskilled people for whom there are very few other means of earning a living. They also tend to be regional businesses, generating much-needed income in local economies outside of the main commercial centres.

ON TO THE WORLD CUP

The sector is showing no signs of slowing, in fact, consumption is expected to reach 569,6 million litres by 2010, compared to 198 million litres in 2005 (about 550 m³/day). One of the reasons behind this is the Soccer World Cup, which is expected to bring around 300 000

foreigners to the country, many of them bottled water drinkers. "All indications are that bottled water is definitely a good market to be in," says Henning.

For bottled water producers, it is not all about pure profit, however. The tremendous growth in the sector means continuous capital outlay ensuring they can keep up with growing demand. Paul Collingridge, managing member of Ceres Spring Water, speaks for many when he says most producers are riding the wave with caution. "You don't want to spend too much increasing the capacity of your plant, only to find there is no or little growth in the medium to long term. We are all wondering how long this tremendous growth will last. Profit margins are generally small and so trends are monitored carefully."

The growth in the local bottled market closely follows international trends, with the global bottled water industry reported to be the most dynamic market of all the food and beverage industries. According to an article published by international organisation Earth Policy Institute, global consumption of bottled water has doubled in the last five years, representing a share of 11,8% of the world beverage market at present. In 2004, the global consumption of bottled water reached 154 billion litres. More than half of the bottled water drunk in the world is purified water, the remaining 40% or so being spring or mineral water.

Of course, the South Africa market remains tiny compared to international figures, and represents only 0,8% of present total local beverage consumption (including beverages such as tea, coffee, milk, beer and wine). "South Africa's annual turnover is the size of a single medium to large bottling plant in Europe," Weaver tells *the Water Wheel*. Annual per capita consumption is an

Definitions of bottled water under new regulations

	Natural water	Water defined by origin	Prepared water
Source	Natural or drilled sources from under-ground water-bearing strata	Any specific environmental source without passing through a community water system	Any acceptable water supply
Treatment allowed	Mineral content and essential constituents not modified: <ul style="list-style-type: none"> • Filtration of unstable constituents. • Removal or addition of CO₂ • Not transported in bulk from source to another facility for treatment, packaging or any other process 	Chemical, radiological and microbiological safety not compromised: <ul style="list-style-type: none"> • Elimination of dissolved gases and unstable constituents • Addition of CO₂ • Antimicrobial treatments 	Modification of physiochemical characteristics of original water allowed: <ul style="list-style-type: none"> • Antimicrobial treatment • Reverse osmosis • Deionisation • Chlorination etc.

Source: SANBWA

average 4,2 ℓ per person per year in South Africa (compared to the bottled-water guzzling Italians who drink an average 147 ℓ).

SETTING THE STANDARD

There have been many debates regarding the quality of bottled water versus the quality of tap water. Unlike tap water, bottled water is defined as a food and is therefore regulated by the Department of Health rather than the Department of Water Affairs & Forestry. Interestingly, a random survey of the microbial quality of bottled water undertaken by the University of Pretoria a few years ago indicated that, generally, bottled water in South Africa complied with present drinking water legislation.


SANBWA has done much to promote high quality standards in the sector. Members must adhere to a set of stringent quality control checks at all stages of their operations. These are subject to bi-annual audits, carried out by external reviewers.

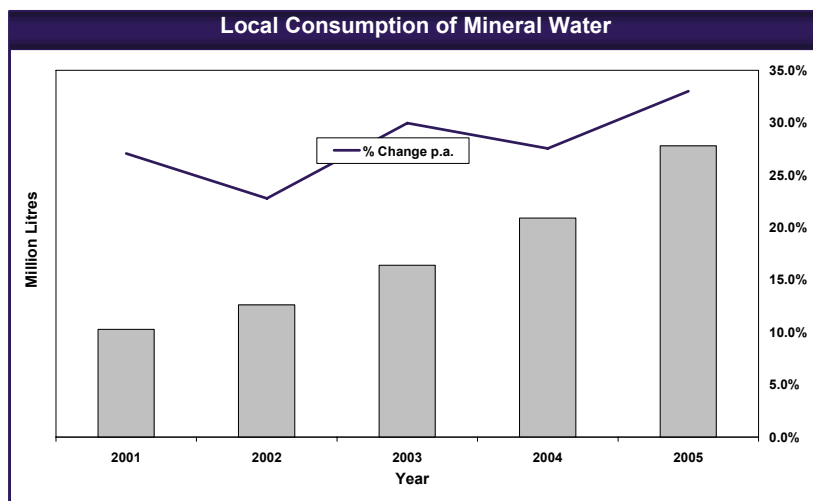
As yet, there is no formal government procedure to monitor and check the quality of bottled water, however, in July, new regulations for bottled water were introduced by the Department of Health. These include quality standards. SANBWA has indicated a willingness to work closely with the department to monitor the industry, even offering to train inspectors to know what to look for.



As yet, there is no formal government procedure to monitor and check the quality of bottled water.

Weaver feels there is no chance that bottled water can threaten the reticulated water-supply industry, even though recent water-quality scares, such as the typhoid outbreak in Delmas, and the maggot reports in Cape Town, have resulted in brief spikes of sales of bottled water. "Bottled water and tap water fulfil the needs of two entirely different market segments, the former being more of a social 'aspiration' beverage. They should actually be regarded as complementary to each other."

With urbanisation speeding up the pace of people's lives, increasing the quest for convenience, and health consciousness turning more people into aspiring gym bunnies there is no doubt that bottled water is here to stay. So what's your flavour? 



Ongoing growth experienced in the bottled water market over the past few years. (Source: BMI Foodpack)



Wild Vegetables Tamed to Decrease Hunger

There is a new drive towards enhancing the status of indigenous crops in South Africa in the hope to improve nutrition among local households while conserving home-grown knowledge. Lani van Vuuren reports.

Historically, South African communities have supplemented their diets with an array of indigenous vegetables, mostly collected (by women) where they grew wild in the veldt. Indigenous crop species such as *Amaranthus*, black jack, gallant soldier, and spiderplant (*Cleome gynandra*), collectively known as morogo or imifino, are believed to be excellent sources of micronutrients (including vitamin A, folate, vitamin C, iron, and protein). Other indigenous crops include legumes such as cowpea and bambara groundnut.

In addition, these traditional African crops can be grown more easily in rural subsistence farming as compared to adopted crops, such as spinach and cabbage, since natural selection has adapted them well to local growing conditions. It is believed that these crops usually require lower inputs of water, chemical fertilizers and pesticides.

Yet, indigenous crops have received limited research attention to date. At this stage, little is known about the role of these vegetables in the overall

food acquisition system of vulnerable people in different parts of the country, especially in terms of their contribution to the intake of important micronutrients.

Knowledge on the water and agronomic requirements of these crops, their different uses, their nutritional value and the bio-availability of the nutrients they contain is also scanty. The Water Research Commission (WRC) is now funding a research project to grow South African knowledge on these indigenous crops,

especially regarding their water use. The research is being conducted by the University of Pretoria, together with the Tshwane University of Technology, the Agricultural Research Council (ARC) and the Medical Research Council (MRC).

CONQUERING FOOD INSECURITY

South Africa is a net exporter of food, yet a considerable section of its population experiences food insecurity and malnutrition. This malnutrition occurs particularly in the form of 'hidden hunger' or micronutrient deficiency. "An estimated 25% of children in South Africa show stunted growth, 10% are underweight, 33% suffer from vitamin A deficiency and 21% from anaemia," reports Dr Mieke Faber of the MRC Nutritional Intervention Research Unit.

"Many people are not aware of the nutritional value of indigenous crops, and many regard them as inferior."

She was speaking at a recent symposium on indigenous crops, organised as part of the WRC project. The symposium was aimed at bringing together experts in the field of nutrition and agriculture, with specific focus on the contribution of indigenous and traditional crops to human nutrition and livelihoods.

Dr Faber said deficiencies of micronutrients such as vitamin A, iron, zinc and iodine can cause learning disabilities, mental retardation, poor health, low work capacity, blindness, a reduced immune response and even premature death.

One of the main causes of these deficiencies is the lack of variety in the diet – maize and bread remains the most commonly consumed foods in South Africa. Consumption of food

and vegetables remains low, mostly due to a lack of access (in particular, the lack of availability in rural areas and relative high retail cost). Another is that people are simply not growing their own food anymore. Less than 10% of households in the country engage in crop production.

According to Dr Faber, advancing the cultivation of traditional vegetables could be an important step towards a workable strategy to assist rural households to cope with food insecurity. "Traditional vegetables require minimum production input, grow quickly, and can be harvested within a short period of time. Research undertaken in villages in the Valley of a Thousand Hills, in KwaZulu-Natal showed that traditional vegetables were often available at times when others, such as spinach, were not."

WANING POPULARITY

So why aren't these vegetables being grown in large quantities already? Preliminary results of a survey being undertaken by the Department of Agriculture (DoA) countrywide indicated that indigenous crops are seen by many as 'poor people's food', and there is a perception that one may be looked down upon for eating them. "Many people are not aware of the nutritional value of these plants, and many regard them as inferior," reports Thabo Ramashala, Senior Manager: Plant Production at the DoA.

Adoption of Western culture seems to have much to do with this negative perception, leading to young people being less willing to eat traditional vegetables and learn about it, and thus a declining knowledge about these plants. At present, there are no formal interventions to seek to encourage people to use traditional vegetables as sources of essential micronutrients, with health educators rather encouraging the consumption of 'exotic' vegetables, such



Marketing of 'exotic' vegetables has decreased the popularity of indigenous crops.

as orange-fleshed sweet potato to enhance the intake of micronutrients such as vitamin A.

RAISING THE STATUS OF INDIGENOUS CROPS

The DoA is currently finalising its policy on indigenous crops. With government initiatives encouraging farmers to grow more of these vegetables all indications are that this nutritional heritage could be reinstated in many parts of South Africa.





Cowpeas, a popular crop in many parts of Africa, originated from KwaZulu-Natal.

Apart from the WRC project, there are other initiatives to learn more about these crops. Researchers from the ARC-Roodeplaat Vegetables

“Unlike conventional vegetables, there is no documented information about the stage of plant development to define harvest maturity for wild leafy vegetables.”

and Ornamental Plant Institute have studied the effect of drought stress on some indigenous crops, including amaranthus and cowpea. Breeding programmes have been initiated to develop genotypes with improved drought tolerance, improved yield and photoperiod insensitivity.

The North West University's Microbiology Group, School of Environmental Sciences and Development has initiated a Morogo Research Programme (MRP) which has as its long-term goal the advancement of

FURTHER READING

- *Home Gardens to Address Vitamin A Deficiency in South Africa: A Food-based Approach*. Available through ARC, contact Estia Joubert, Tel: (012) 841-9611; Fax: (012) 808-1127; E-mail: ejoubert@arc.agric.za
- *Screening of Cowpea, Bambara Groundnut and Amaranthus Germplasm for Drought Tolerance and Testing of the Selected Plant Material in Participation with Targeted Communities*, WRC Report No 944/1/04. Contact Publications at Tel: (012) 330-0340; E-mail: orders@wrc.org.za

these indigenous leafy vegetables in subsistence farming and the safe storage thereof in resource-limited rural communities.

According to the MRP's Dr Retha van der Walt, the programme investigates health-related aspects as well as low-cost technologies to improve crop yield in subsistence farming. Like commercial crops, certain health risks are also associated with fungal infestation and mycotoxin contamination of traditional morogo. The programme has already

Nutrient composition per 100 g of edible portion of African leafy vegetable plant compared to cabbage

	Amaranthus	Spider plant	Cowpea	Jews mallow	Pumpkin leaves	Cabbage
Iron (mg)	8.9	6.0	3.9	6.3	15.9	0.7
Protein (g)	4.6	4.8	4.1	5.2	4.2	1.7
Moisture (%)	84	86.6	87.6	81	87.3	91.4
Calories	42	34				26
Carbohydrates (g)	8.2	5.2	6.8	10.3	5.0	6.0
Ascorbic acids/ Vitamin C (mg)	64	13				54
Calcium (mg)	410	288	221.1	548.5	382.9	47
Phosphorus (mg)	103	111	80.1	136.4	119.2	40
B-Carotene/ Vitamin A (mg)	5 716		2 249.35	3 662.99	1 694.55	100
Thiamine	0.05		0.05	0.07	0.12	0.04
Riboflavin	0.42					0.1
Folic acid (mg/100 g)	122		107	90		


Source: ARC



About one third of South Africa's children suffer from vitamin A deficiency which agricultural scientists and nutritionists believe can be alleviated by raising the status of indigenous crops.

identified 26 different botanical species as traditional morogo in its study areas located mainly in Limpopo and North West.

Research is also underway at various institutions to develop production practices for some of these crops. "Unlike conventional vegetables, there is no documented information about the stage of plant development to define harvest maturity for wild leafy vegetables," Dr Albert Modi of the University of KwaZulu-Natal Department of Crop Science at the School of Agricultural Sciences & Agribusiness points out. "It is likely that for some of these vegetables there is a preferred stage of plant development when flavour and palatability are favourable for human consumption."

While they have been around for hundreds of years, we are only now starting to understand these crops. It is hoped that these various programmes will go a long way towards safeguarding South Africa's heritage while wiping out hunger and malnutrition. 

AMARANTHUS

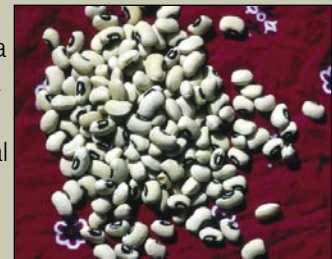
Also known as Thepe in Tswana, Imbuya in Xhosa and Utyutu in Zulu, amaranthus is a common weed. It is a very nutritious leafy vegetable which can be harvested from wild-growing or cultivated plants. The plant is adaptable and grows easily under various weather and soil conditions. Various types occur, however, the green types are less bitter than the reddish ones. There is a belief in some parts of the country that eating the reddish-coloured leaf amaranthus would make one insane.

BAMBARA GROUNDNUT

Also known as Izidlubo, Jugo, Njugo, Dopboontjies or Round Beans, these legumes are widespread in Africa. Bambara groundnut is confined to Limpopo, Swaziland and KwaZulu-Natal where it is a popular crop due to its resistance to drought and the ability to produce a reasonable crop when grown in poor soils. The immature seeds are boiled and eaten as an early harvested source of food while the fully matured seeds are cooked or made into flour. Occasionally, the young whole pods are washed and boiled or used in soups.

COWPEAS

Cowpeas (also known as Dinawe in Ndebele, Imbumba in Zulu and Monawa in Pedi) originated in South Africa. It is a protein-rich crop which leaves nitrogen in the soil, and therefore has a beneficial effect on the follow-up crop. Cowpeas can be planted as an intercrop or in rotation and can tolerate drought.



PIGEON PEAS

Also known as the Cajan Pea, Congo Pea, Red Gram or Duif-ertjie (Afrikaans), pigeon peas are an indigenous seed crop consumed by humans and animals. It has good potential to provide a valuable source of nutrition in areas with very hot, dry climates. It is an important protein food.



SPIDERPLANT (CLEOME GYNANDRA)

The leaves of the spiderplant are said to be more nutritious than most exotic leafy vegetables. Throughout Africa, the tender leaves or young shoots, and even the flowers on occasion, are eaten boiled as a potherb, tasty relish, stew or side dish. Fresh leaves are used as ingredients in other mashed foods, while dried leaves are ground and incorporated in weaning foods. Eating the vegetable is believed to reduce dizzy spells in pregnant women and easing childbirth. It is also traditionally eaten by boys after circumcision to restore blood supply as it contains high levels of iron.

Source: DoA and ARC



Courtesy of SA Tourism

Tools Give Resource Managers More Muscle

A new set of tools, aimed at enhancing the practical application of the resource-directed management of water quality, has been launched by the Department of Water Affairs & Forestry (DWAf). Lani van Vuuren reports.

Following promulgation of South Africa's groundbreaking water legislation in the late 1990s, water quality management in the country entered a new era, moving from a historic end-of-pipe to a more holistic integrated water resource management approach. The purpose of the National Water Act of 1998 is to ensure that the country's water resources are protected, used, developed, conserved, managed and controlled in an equitable, efficient and sustainable manner.

This necessitates a change in the approach of water quality management to an integrated source, resource and remediation focused management approach. Among others, the Act makes provision for the 'Reserve' – a particular water quality and quantity to be set aside to protect the ecological functions of an aquatic ecosystem before water uses such as the abstraction of water from, or the discharge of water containing waste to a water resource can be authorised.

Yet, practically implementing South Africa's internationally recognised legislation has proved challenging, with limited guidance to water resource managers as to exactly how to go about balancing the use of water to achieve social and economic development while safeguarding the resource for future generations. "Few to no guiding policies were available on the various facets of the resource side of water quality management," explains Pieter Viljoen, DWAf Deputy Director: Water Resource Planning Systems: Water Quality Planning. "To date, determination of the requirements at the resource end and the incorporation of these into source-directed water quality management decision making has generally been performed ad hoc, with little uniformity."

To improve the situation, DWAf launched a project aimed at providing enabling policy, with supporting management instruments in 2003. Led by CSIR's Natural Resources and the Environment Unit, the Resource

Directed Management of Water Quality Series specifically addressed the water quality aspects within the integrated water quality management model. The newly-launched management instruments comprise guideline documents and, where applicable, computer-based programs to support streamlined and uniform implementation of the methods and instruments, to facilitate the management of water quality from a water resources perspective.

It is the first time that policy and management tools such as these have been produced by DWAf, according to Director: Water Resource Planning Systems Chris Moseki. "Our present legislation underscores the fact that our natural resources belong not to us but to our children and their children, and we need to ensure sustainable use. These documents go a long way to facilitate the integration of the source and resource-directed management approaches in a uniform and structured manner. Furthermore,

we expect these tools to be dynamic, improving further with time.”

The series comprises a number of volumes, the first being a resource-directed management of water quality policy document. This policy relates specifically to management of the use and protection of the water quality component of inland water resources, including surface water-courses, groundwater, estuaries and wetlands. It also addresses how this water quality management should influence the management of anthropogenic activities that modify the water quality in water resources.

In turn, the strategy document provides the implementation plan for the policy. It addresses who should do what by when, explicitly linking the policy to management approaches and management instruments to facilitate its practical and pragmatic implementation. There is also a document focusing on institutional arrangements for resource-directed management for water quality.

A suite of management instruments to assist regional DWAF offices makes up the remainder of the series. This includes guidelines on catchment visioning for resource-directed management of water quality; guidelines for determining resource water quality objectives; the allocatable resource and resource stress.

The latter is influenced by the socio-economic need to utilise the



The project team responsible for compiling the set of tools.

capacity of water resources to assimilate waste, on the one hand and, on the other hand, by the need to protect the said water resource to ensure a healthy functioning aquatic ecosystem that is fit for use by the recognised water user sectors. The determination of resource water quality objectives provides the basis for conducting water quality allocations, benchmarking during water quality foresights, and the determination of water quality stress.


As part of the guideline, a resource water quality objective model was prepared. This is a computer-based application, which provides users with an approach to consistency when setting resource water quality objectives for water resources. By selecting the water resource and user requirements, the model generates water quality objectives based on a database of provided and entered water

quality parameters. Also included in this regard is a guideline for converting resource water quality objectives into end-of-pipe discharge standards.

Another software program developed as part of the project is the Assessment of Consideration for Water Use Applications or ACWUA. ACWUA has been developed to allow multiple criteria decision analysis, using indicators to inform decisions on licence applications.

The program guides the responsible authority by supporting decision-makers despite incomplete, imprecise and/or variable information. The decisions are based on multiple criteria such as socio-economic factors, race and gender considerations and alignment with catchment strategies.

Lastly, guidelines for monitoring and auditing resource-directed management of water quality are also provided.

Following the completion of the technical phase of the project, DWAF, through consultants Nemai Consulting, has embarked on a regional programme of training and capacity building. “These tools are a solid foundation on which to build. We hope these documents will offer practical tools to make integrated water resource management a reality in South Africa,” concludes Viljoen. 

Signing the final project deliverables are Hanlie Hattingh of the CSIR Natural Resources and the Environment Unit; DWAF Deputy Director: Water Resource Planning Systems Pieter Viljoen; and Water Quality Planning; and Chris Moseki DWAF Director: Water Resource Planning Systems.





– The Creeping Disaster

When we think of drought, most of us immediately think of 'no rainfall'. But drought is much more complicated than that.

Basically, drought occurs when there is less rainfall than expected over an extended period of time, usually several months or longer. How bad a drought is usually depends on how little precipitation falls, how long the drought lasts, and the size of the area that is affected.

Unlike other natural disasters, such as hurricanes, earthquakes, fires

and floods, droughts do not appear suddenly and, while they might not appear as frightening, droughts can have far-reaching effects. Drought doesn't have a clear beginning or end. It starts slowly, and for that reason it is often called a 'creeping phenomenon'.

The damage caused by drought is not always seen right away. Farmers, who need adequate water to grow crops and raise livestock, usually feel the effects of drought first. In poor, rural areas, people are dependent on rain to grow their own food, so a

drought can mean hunger and starvation.

There are four main types of drought:

- ◆ **Meteorological drought** is brought about when there is a prolonged period with less than average precipitation (i.e. rain). Less than 75% of normal rainfall is regarded as a severe meteorological drought, however, a shortfall of 80% of normal rainfall can cause crop and water shortages.
- ◆ **Agricultural drought** is brought about when there is insufficient moisture for crop or range production. This can arise even in times of average precipitation, owing to soil conditions or agricultural techniques.
- ◆ **Physiological drought** is a condition afflicting plants that have been exposed to too much salt, preventing them from absorbing water from the soil.
- ◆ **Hydrological drought** is when water reserves available in sources such as rivers and dams fall below average.

Drought produces a complex web of impacts that spans many sectors

WATER WORDS

Climate: Day-to-day weather over a long period of time. Climatology is the study of climate.

Drought: It is a deficiency of rainfall over a period of time, resulting in a water shortage for some activity, group, or environment sector.

Drought index: A numerical scale that scientists use to describe the severity of a drought.

El Niño: A weather phenomenon that occurs in the eastern and central equatorial Pacific Ocean. During an El Niño, the affected area's winds weaken and sea temperatures become warmer.

Weather: The condition of the Earth's atmosphere over a brief period of time, like day or a week.

Drought often exacerbates environmental problems such as soil erosion.



HELPFUL WEBSITES

- ◆ <http://en.wikipedia.org/wiki/Drought>
- ◆ www.weathersa.co.za
- ◆ <http://www.drought.unl.edu/kids/index.htm>
- ◆ www.sciencenewsforkids.org

of the economy and reaches well beyond the area experiencing physical drought. This complexity exists because water is so integral to our ability to produce goods and provide services.

The potential economic impacts of drought includes farmers losing money because of destroyed crops; water companies having to spend money on new or additional water supplies; increased irrigation costs and increased importation of food (more expensive). There are also environmental impacts, such as the loss of fish and wildlife habitat; loss of wetlands; increased groundwater depletion; more wildfires; lower water levels in dams; lack of food and drinking water for wild animals; and soil erosion. Drought also has social impacts, such as health problems related to low water flows; loss of human life; reduced incomes; water user conflicts and mental and physical stress on people.

Unfortunately, being among the thirty driest countries in the world, drought is a normal, recurrent feature in South Africa. In the past, droughts have resulted in significant economic, environmental and social impacts.


Climate variability of South Africa is determined by prevailing patterns of sea surface temperature, atmospheric winds, regional climate fluctuations in the Indian and Atlantic Oceans and by the the El Niño phenomenon, a warming of sea-surface temperatures which influences atmospheric

circulation, and consequently rainfall and temperature.

During periods of low rainfall, people of the government, farmers, business people and the general public often require additional information regarding rainfall for decision making and planning. With this in mind, the South African Weather Service has created a drought monitoring desk where information regarding observed rainfall and long-range forecasts are presented in one place for easy access. It also provides an opportunity for people to compare this year's rainfall figures with figures from previously dry periods.

Assessing the severity of a drought period and the magnitude of the

impact base purely on the definition of 'percentage of normal rainfall' is extremely difficult, and so other drought indices are also monitored. High temperatures, high wind, low soil moisture and low relative humidity, for example, can aggravate the severity of drought conditions.

To mitigate against the effects of drought, several dams have been built in South Africa to store water for times of need. The country also has several water transfer schemes that transports water over long distances from one area to another, for example, the Lesotho Highland Water Project, which stores water in Lesotho before transferring it to Gauteng. 

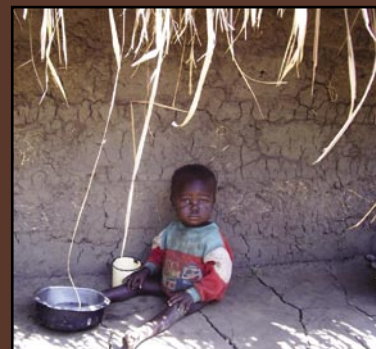
SOUTHERN AFRICA'S WORST DROUGHT

Southern Africa (including South Africa) experienced one of the worst meteorological droughts of the century in 1991-92. From central Zambia through central Malawi and Mozambique southward, there were seasonal deficits of as much as 80% of normal rainfall. Abnormally high temperatures exacerbated the extreme dryness.

An estimated 30 to 40 million of the region's 100 million inhabitants

were directly affected. The drought halved the region's grain harvest and required ten million tons of grain to be imported, the bulk within a 12-month period. Many people faced possible malnutrition and starvation.

The level of the Kariba Dam, which supplies power to Zambia and Zimbabwe, fell below the level required to generate hydroelectric power. The drought also resulted in increased unemployment, heavy government expenditure burden, and reduced industrial production due to curtailed power supply.

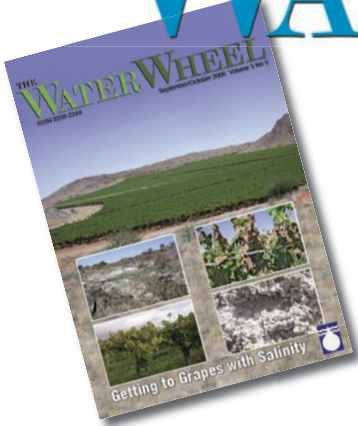


Experts Fight for Freshwater in Kruger

International freshwater experts from countries such as Australia and the US gathered at the Kruger National Park in October for a specialist symposium on designing and managing protected areas to conserve freshwater ecosystems and biodiversity. Discussions were held around the challenges and possibilities around protecting freshwater. Delegates were also treated to an excursion to the Sabie River, the Kruger National Park's last remaining real perennial river to partake in river monitoring. The possibilities of establishing a world database of the last remaining free flowing rivers were also discussed. For a full report on the symposium, see the January/February 2007 edition of the Water Wheel.



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