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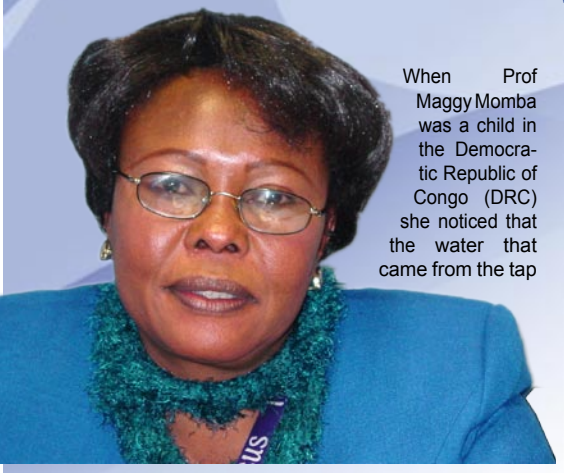
Newsletter of the Water Research Commission

In this Edition

Water – Qualitatively Speaking!



When Prof Maggy Momba was a child in the Democratic Republic of Congo (DRC) she noticed that the water that came from the tap was brown in colour and sometimes contained worms. As a young impressionable child, she was curious as to the cause of such a phenomenon – how treated water could get contaminated. She seemed destined to make a difference! "Water is life, after all. And good water quality is important for South Africa as well as the African continent in general," says Maggy.

In 1991 she was sent by the government to Clark Atlanta University, USA, to study the management of natural resources and the protection of the environment. By then Maggy knew that her destiny in the water sector was somewhat pre-determined. Her almost miraculous appearance and contribution to the South African water sector began when Prof Cloete (University of Pretoria) offered her an opportunity to get involved in the optimization of wastewater treatment. She completed he Bachelors degree at the University of Kisangani (DRC) and both her Masters as well as her Doctoral degrees were completed at the University of Pretoria. In 1995 -1997 she worked as a researcher at the former health programme of the Division of Environment and Forestry Technology, CSIR, whilst also being a PhD student. She joined the University of Fort Hare in 1997 where she developed a research niche titled "The Eastern Cape Water Resources: Use and Protection for Sustainable Development"- a project that received recognition by the NRF. She also established a modern molecular diagnostic laboratory at the University of Fort Hare – a facility that did not exist before! In 2002 Maggy was accorded the status of Associate Professor and in 2006 she was accorded full professor status. Maggy has returned to Pretoria where she holds the post of Research Professor in the Department of Water Care at the Tshwane University of Technology (TUT).

Her efforts hence snowballed, earning her the prestigious Women in Water Award in 2005 in the category "Researcher over 35 years old". Further accolades include: Winner – outstanding Community Supporter Awards organized by the 2nd International Conference on Safe Water (2004); Winner – Vice Chancellor's Senior Researcher medal at the University of Fort Hare (2005) and the NRF rated Scientist (2005), to name but a few.

This energetic lady enjoys research and her current job allows her to "spend more time on water research and to build capacity not only for South Africa, but also for the continent in terms of Doctoral and Masters students. Lack of skills in wastewater management has a negative impact on the health of the people of this continent and, consequently, on the economy. It is important to pay attention to capacity building and the WRC has aligned itself to this need. The WRC has made a huge contribution in this regard." Maggy was instrumental in establishing one of the largest Black postgraduate programme at a historically disadvantaged university: 20 BSc Honours students and 4 Masters students completed their studies under Maggy's supervision. Currently at the University of Fort Hare and TUT Maggy supervises 2 BSc Honours and 4 BTech students; 5 MSc students as well as 4 PhD students.

Maggy's involvement with the WRC commenced in 1999 and she made a vast contribution during her career as a researcher. "The various guideline documents on water quality and waste-water treatment are a great help to the water sector. There are still problems in municipalities and small water treatment plants. The knowledge needs to filter down to these facilities. This will do wonders to improve the water services delivery to especially rural areas. The WRC is doing a great job in reaching this goal."

Maggie is passionate and industrious – obvious ingredients for her success thus far. However, she got where she is today on hard work, immense faith in God, her strong Christian background and strong mentors and role models. The first person was Prof Cloete who believed in her and saw her potential. The CEO of the WRC, Dr Kfir, was a hard taskmaster (or the female equivalent thereof) and she inculcated in Maggy a strong work ethic – a quality that has become one of her guiding principles. "Rivka is a strong woman and she has made me a strong woman too. She introduced me to Watertech and I am grateful for her guidance even to this day." Prof Chris Buckley (Pollution Research Group) "was also a driving force who gave me lots of support and guidance". Dr Msibi "introduced me to the WRC and was most helpful and supportive".

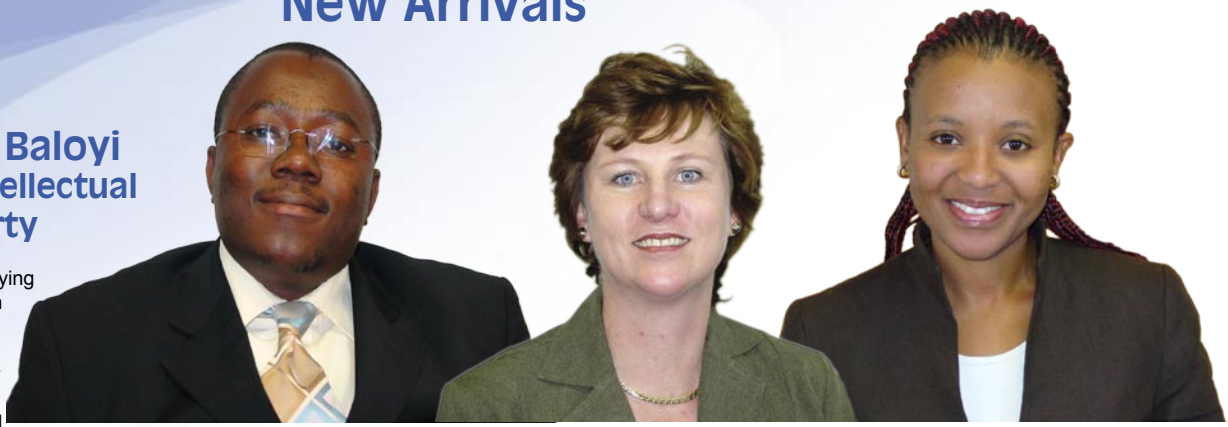
Dr Gerhard Offringa, Research Manager at the WRC and Head of Domain: Water and Health says," I have great admiration and respect for this lady. Not only is she a good researcher and Project Leader, she also does not let even a Councillor – nor difficult technology or circumstances – stand in her way to ensure that a community gets only the best water services and quality. But let her tell you these hair-raising stories herself!"

Maggy, the WRC is proud of your achievements and your proximity to the WRC will ensure greater collaboration in future.

Maggy with some of her students at TUT

Water Research Commission

New Arrivals



Lawrence Baloyi
Manager: Intellectual Property

Lawrence commenced studying towards a B.Sc. degree with the University of Pretoria. Thereafter, he enrolled for an Honours degree in water utilization. However, law, his initial passion, beckoned to him: he was appointed as a Patent candidate attorney at Bowman Gilfillan John and Kernick Attorneys. He enrolled to study towards a law degree with UNISA and discontinued his studies in water utilization. After a stint of almost three years, Lawrence joined Stellenbosch University as an Intellectual Property (IP) legal advisor before joining the WRC in July. In 2001 Lawrence was accorded the accolade of one of the best students in criminal law and in 2005, he was part of a task team from Stellenbosch University who negotiated a few licence agreements with international and local companies. Lawrence plans on commercializing WRC patents and he is working on an IP management system as well as a commercialization strategy.

This 30-something young man seems to be at home at the WRC already. He enjoyed the "warm welcome" that was extended to him. When he is not being a legal eagle, he relaxes with his wife, Raesetja Mafa and his sixteen-month old son, Nlhamulo. He also indulges in some of his passions: reading and music. Lawrence is an avid musician himself: he plays the piano and has recorded a kwaito album.

Heidi Snyman
Research Manager: Water Use and Waste Management

Heidi commenced working at the CSIR in 1994. Thereafter, she worked at ERWAT as a Research Manager. Whilst employed by ERWAT, she was tasked with establishing a Chair at the University of Pretoria. In 2004 she joined Golder Associates as a waste specialist, executing projects both locally and globally. One of her favorite projects was being part of the team assisting The Coca-Cola Company in Atlanta, Georgia to update their Global Good Environmental Practice Guidelines for wastewater management. Heidi joined the WRC in July.

When she is not mulling over improving wastewater treatment options in South Africa she, among other activities, dives with manta rays, enjoys hiking and traveling, including 4x4 driving and enjoying South Africa's natural diversity.

Dikeledi Mbele
Group Assistant: Research Coordination and Partnerships

Dikeledi joined the WRC as a Group Assistant. This energetic and enthusiastic young lady worked in many job environments: Edcon as sales assistant and trainee manager; the Department of Provincial and Local Government (DPLG). She holds qualifications in both Business Administration as well as Office Management: She holds a diploma in Office Management and has completed part of a BTech degree in Business Administration. She excelled in the Marketing Management component of her BTech degree. This young lady has taken to the WRC like a fish… to water! She sees many opportunities at the WRC and she will also focus on streamlining the processes that exist at the WRC. Dikeledi is the eldest of three children in her family. She enjoys spending time with family and friends when she has the opportunity. She also enjoys studying and plans on furthering her studies next year.

To all of you, the WRC welcomes you. We at the WRC hope that you prosper and grow whilst you are here.

New President for GSSA

Dr Kevin Pietersen, Director: Research Co-ordination and Partnerships, was inducted as President of the Geological Society of South Africa (GSSA) on 22 June 2006. In his speech Dr Pietersen said that he planned on growing the membership of the GSSA and steering the organization to new heights.

Some of his priorities in achieving this goal are:

- Membership growth
- Financial sustainability
- Transformation
- Service to membership
- Building relationships with stakeholders

Movement within the WRC

Dr Kevin Pietersen moved from KSA: Water Resource Management to KSA: Research Coordination and Partnerships. Ms Eiman Karar was promoted to Director of KSA: Water Resource Management. Dr Renias Dube was promoted to the post of Head: Water and the Environment.

The WRC @ the Gelvenor Textile Function

The effluent treatment plant at Gelvenor Textiles held its official commissioning on 19 June 2006 at Hammarsdale, KwaZulu-Natal. This is a role model for co-operation between Government and the Textiles Industry in sustainable development. The project is an example of a win-win relationship between industry and the environment. This process has been made possible with assistance in best practice by the Governments of the Kingdom of Norway, Denmark and the European Union, including local partners such as the Water Research Commission (WRC), the Department of Environmental Affairs and Tourism and the Department of Water Affairs And Forestry.

This project involves collaboration between the University of KwaZulu-Natal's Pollution Research Group (PRG), which has extensive experience and expertise spanning a period of 36 years, and eThweni Municipality. The PRG focuses on promoting cleaner production, reducing water pollution from industry and the cost of water treatment processes. One of the PRG's funders, the WRC has been involved with the PRG since 1990, funding projects to the tune of R17 million. The WRC was represented by Mr Jay Bhagwan, Director: Key Strategic Area: Water Use and Waste Management.

Top left: *A tour of the plant at Gelvenor Textiles*
Top right: *Deputy Mayor, Logie Naidoo, officially opening the plant at Gelvenor Textiles*
Bottom: *Dignitaries at the function at Gelvenor Textiles*

Course opportunity

The International Development Law Organization (IDLO), an intergovernmental organization which aims to contribute to the establishment and progressive development and application of good governance and the rule of law in developing countries and countries in economic transition, will conduct a two-week seminar (in English) on "The Legal Framework of Water Resource Management" in Rome, Italy, from September 11 - 22, 2006.

This two-week seminar will analyze key elements of the access, management and integrated development of water resources. Topics will include the components of an efficient legal framework for water management, and the necessity of strong and accountable water management institutions at both the national and local levels. The course will draw upon the direct experience of water experts from several jurisdictions and nationalities, in order to provide participants with the practical skills training that is essential for working in this area.

For more information contact:

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The WRC in Parliament

On 13 June the WRC was one of the presenters to the Portfolio Committee on Science and Technology. The WRC outlined the role of the WRC as well as WRC projects that reflected water-related technology. The WRC was represented by the CEO, Dr Kfir and Dr Kevin Pietersen.

The Portfolio Committee on Water Affairs & Forestry held public hearings on water quality on 20-21 June. The WRC delivered a presentation at this forum on 20 June. The Chairperson of the Committee, Ms Connie September, mentioned the WRC presentation in a television broadcast. Her comments alluded to the informative nature of the WRC presentation. The WRC was represented by Dr Gerhard Offringa and Dr Innocent Msibi.

WRC External Review

The WRC was subjected to an external institutional review during July. The WRC initiated this institutional review to provide the WRC with an external, independent assessment of its current operations. The outcomes of the review are intended to be used as an input to its next five-year plan. This review was considered to be timely as approximately six years has elapsed since the last external review of the WRC. Panel members comprised six members: three from South Africa and three international panel members. They were:

John Connolly (Convenor)
Anati Canca
Don Bursill
Thibedi Ramontja
Hector Garduno
Paul Taylor

The review was generally highly favourable and suggested that the WRC was meeting its mission and vision.

Panel members at the WRC

The WRC @ the Open Day at UWC

The WRC held its Open Day at the University of the Western Cape (UWC) on 3 July. The event showcased WRC-funded projects in the Western Cape. Some noteworthy projects included:

- Groundwater
- Endocrine Disrupting Compounds (EDCs)
- Environmental flows
- Membrane technology
- Estuary-related research
- Leak management
- Waste minimization

On 4 July, following a WRC Board meeting, a technical tour to the Berg River dam project in Franschhoek, was conducted. Board members were introduced to the project and were taken on a site visit.

Prof Bian O'Connel (Rector: UWC) addressing guests at the Open Day

Guests at the WRC Open Day

WRC Board members at the Berg River Dam project presentation

What's New

Report No 1317/1/05 (Contractor: University of the Free State)

The relationship between soil water regime and soil profile morphology in the Weatherly catchment, an afforestation area in the Eastern Cape

This research was motivated by the need to improve the understanding of hillslope hydrological processes using the relationship between soil physics, pedology and soil hydrology. This project investigated the relationship between the duration of water saturation and the quantity as well as type of iron oxide minerals present in soil and hence its colour. The well-gauged 160 ha Weatherly catchment was used in this study to characterise and quantify the soil water regime and soil profile morphology. The correlation between soil water regime and profile morphology was determined and translated into a model that is expected to be used in assessing the hydrological characteristics of catchments where water measurements are limited or unavailable. Detailed measurements and descriptions of 28 modal profiles located at different sites in the catchment were used in the research. Digital colour photographs of each of the modal profiles and horizons were used in developing a computer-aided process for quantifying the colours in an objective manner. Bulk density determinations, piezometric water sampling and soil water content measurements using neutron water meters were obtained and assessed against soil profile morphology. It was observed that the soils investigated in the study were mainly those that have developed in the sillicious parent material. The implications of reactions between Fe and other different parent material will need further research. The implications of the climate, especially rainfall and temperature, in these reactions and resultant soil morphology also need further investigation.

Report No 1195/1/06 (Contractor: University of KwaZulu-Natal)

Integrating socio-economic and cultural values as additional components of the criteria for estimating and managing the "reserve" with an emphasis on rural communities

The project sought to improve our understanding of the nature of the relationships between the needs of rural households, the rivers system and sustainable use. Since much is already known about material needs, the research was directed at two issues: improving our understanding of the role of non-material needs, particularly traditional and contemporary belief systems and values, and how the use of river system goods and services is regulated. Since belief systems and values define the norms that in turn direct behaviour, they are strongly connected to regulatory systems. In order to gain insight into how belief and regulatory systems are changing and how these changes might be harnessed in co-management, the research focused on a community that was in transition from rural to urban. The people of Salem make extensive use of the Mlazi River for a variety of uses such as washing, bathing, and watering livestock, but they also use the river frequently for rituals and ceremonies. Respondents in the survey observed that there was no control over access to and use of river resources. At present there is no structure or defined processes for co-management in the area and people have no opportunity to participate. It is also clear that they have neither the self-confidence nor the competencies for effective participation. Suggestions are made for a structure, the characteristics of constituencies that might participate and for agreements that would

define roles and accountability of participants in co-management of natural resources.

Report No 1433/1/06 (Contractor: Pegasus Strategic Management)

Evaluation of the opportunities for cooperative governance between catchment management agencies and local Government

The distinctive nature of the spheres of government refers to the legislative and executive autonomy that they have while interdependent nature relates to the degree in which each sphere of government depends on another for fulfilment of its constitutional mandates. The inter-related nature relates to the manner in which spheres of government foster relations between themselves based on mutual trust and good faith for the greater good of the country as a whole. The implications are that although the spheres of government are distinct and independent, they cannot function without cooperating with one another. In trying to achieve cooperative governance, the South African Government have in the past years developed a number of mechanisms and strategies which, have, in certain instances, been faced by a number of challenges. Based on the findings it can be concluded that CMAs and Local Government Institutions do have numerous areas of cooperation, which are critical for realisation of integrated water resources management. While work overload and capacity are recognised limitations of local government and are also anticipated with the CMAs; it is critical that both institutions recognise the importance of cooperation between themselves which plays a proactive role in engaging and driving cooperative processes. CMAs, as managers of water resources, should be at the forefront of these cooperative processes. The manner and level at which local government is involved within the CMA processes and activities should reflect the various roles that local government play as an institution. The implications are that CMAs need to recognise the importance of Local Government as the driver of local social and economic development therefore the need to create closer ties for integrated planning and development. The current approach to CMA establishment process on local government engagement largely lies at higher political level; therefore excluding certain levels of administration. It is critical that this process engage officials at administrative level, particularly for planning alignment purposes. Two published simplified guides for local government and CMAs respectively, are part of the outcome from this project.

Report No 1295/1/06 (Contractor: CSIR)

Consolidation and transfer of knowledge and experience gained in the development and implementation of water and related policy in South Africa

The overall aim of this project was to reflect on policy developments that took place over the past 10 years (1994 to 2003) in the water field, and to consolidate and package at least some of the learnings in an explicit form for wider sharing or communication as well as retention of such knowledge in the institutional memory. In essence, it was endeavoured to extend the "paper trail" by capturing the insights, anecdotes and stories related to the policy process that would normally have a small chance of being documented. The project focused on two primary activities. Firstly, a number of potential issues papers were selected to capture lessons from various policy development and implementation experiences to date. The idea was to contribute to an explicit as well as peer-reviewed record or archive of lessons, to enable wider sharing of lessons amongst current practitioners as well as to ensure that these lessons are available to future generations of practitioners. Through a series of workshops with various specialists and policy practitioners, three priority areas were identified to guide the selection of issues papers. Secondly, a training course was developed and presented to facilitate knowledge sharing in an interactive setting. It is hoped that the reflective linking of practical experiences with tested theories and the documentation of associated lessons, that were made possible by this project, would be of benefit to the wider policy and water resource management fraternities of the current as well as future generations.

Report No 1248/1/06 (Contractor: University of KwaZulu-Natal)

The evaluation of the anaerobic baffled reactor for sanitation in dense peri-urban settlements

This project was undertaken to determine the appropriateness of an anaerobic baffled reactor (ABR) for the treatment of domestic wastewater in low-income communities. A pilot ABR was built and operated at two municipal waste water treatment plants (WWTPs) and operation in terms of chemical and microbial performance was characterised under a number of different operating conditions. A study was performed in which water use patterns and wastewater characteristics in a low-income community were measured. These data were incorporated in a model to predict the performance of the ABR in a low-income community. Based on experiences with pilot ABR, a series of design, operating and maintenance guidelines were developed for future installations. The pilot ABR operated fairly smoothly, showing good biological activity in all of the operating periods. The ABR was found to be a robust treatment system, with biological and hydraulic advantages over septic tank systems, and with considerably reduced installation, operation and maintenance costs compared to aerobic or centralised systems. It also provides an option for communities with dry sanitation that aspire to waterborne sanitation. The ABR meets several critical requirements: it does not require energy for operation; requires low maintenance; is compact and could be mass-produced. Several ABRs could service small sub-groups within an area and eventually connect to a sewer system for further treatment at a WWTP.

Report No 1372/1/06 (Contractor: University of Cape Town)

Prevention of calcium sulphate crystallization in water desalination plants using slurry precipitation and recycle reverse osmosis (SPARRO)

The Slurry Precipitation and Recycle Reverse Osmosis (SPARRO) process was developed in the early 1980's with the primary objective of desalinating water with a high calcium sulphate concentration. The aims of this project were to expand the fundamental understanding of the operation of the SPARRO system; to develop specifications to control the crystallisation on the membrane; to develop design specifications for membrane selection and to define the critical operating parameters for the SPARRO system, in order to render the system a viable treatment option for this type of water. Laboratory studies were executed to modify crystal structure and longer-term runs on a membrane system were done to confirm laboratory studies and establish membrane fouling and damage under different crystallisation conditions. An extensive understanding of the crystallisation aspects of the process and gypsum crystal behaviour has been developed. Design specifications relating to the crystallisation parameters of the system have been determined, based on the critical operating parameters for the SPARRO system. The Project Team has succeeded in establishing and modifying the conditions required to produce optimum crystallisation and platelet crystal forms in order to minimise both fouling and membrane damage. Models that relate seed volume and supersaturation or sulphate: calcium ratio to gypsum morphology in pure solutions, have been developed and preliminary relationships also established for some real mine waters. These results present a quantum improvement in the knowledge required to operate membrane treatment successfully on scaling mine waters and the technology developed will play a significant role in the early use of membranes in the treatment of this very problematic effluent type.

Report No 1373/1/06 (Contractor: Durban Institute of Technology)

Evaluation of locally manufactured membranes for oil/water separation of industrial effluent

The aim of this project was to determine the potential application of a locally developed membrane for the separation of oil from industrial wastewater. The second key aim was to develop expertise in the operations and management of a membrane system for oil/water separation. The project was initiated by conducting test cell investigations on various oil/water effluents. A single module capillary ultra-filtration membrane pilot plant was designed and commissioned. It was found that the membrane was effective in oil-water separation. During short-term tests, fouling was found to be quite low and not to be a big problem. However, the project team was unable to conduct extended trials to determine long-term membrane life, due to various constraints experienced during

the project execution. This project will have a positive future impact on oil removal from water, since much higher efficiencies of oil removal were achieved than currently used processes, but at a reasonable, and controllable, fouling rate.

Report No 1361/1/06 (Contractor: University of Cape Town)

A customized bioreactor for beneficiation and bioremediation of effluents containing high value organic chemicals

The main aim of the project was to design, construct and demonstrate a biocatalytic bioreactor for the bioremediation of organic-containing wastewaters, such as olive wastewater, with concomitant recovery of high-value products. Using laboratory and bench scale studies, a reactor was developed and studies performed on bench-scale reactors. In order to obtain the high value product, hydroxytyrosol, from local olive production brines, a novel supported-solvent membrane extractor was developed. Membrane-supported solvent extraction was successfully demonstrated at laboratory scale and was found to be effective for the extraction of hydroxytyrosol from olive wastewaters. This process was then followed by wastewater remediation in a draught-tube reactor. It was found that more than twice the extent of wastewater biodegradation could be achieved than was possible in normal stirred flasks. The project teams succeeded in developing a technology to facilitate the extraction of hydroxytyrosol from table olive wastewaters, and then to bioremediate the residual extracted wastewater. Approximately 1 g of hydroxytyrosol could be obtained per litre of olive brine, leading to very high potential income values for the olive processing plants. This will stimulate the treatment of this difficult type of effluent and ensure that much lower pollution loads enter the environment.

Report No 1364/1/06 (Contractor: University of Stellenbosch)

Treatment of apple and wine processing wastewaters using combined UASB technology and ozonation scenarios

The main aim of this research programme was to investigate the efficiency of utilising combinations of ozone and up-flow, anaerobic sludge blanket (UASB) reactor technologies to treat winery and apple juice processing wastewaters. This was done on both laboratory and pilot-scale equipment. The use of pre- and post-ozonation steps together with anaerobic digestion, in the form of a UASB reactor, is a technically feasible option to treat fruit juice processing and winery wastewaters. On-site wastewater treatment could produce effluents much lower in COD and therefore reduce the cost of fines payable to municipal wastewater treatment plants. Capital costs and running costs will vary according to the volumes of wastewaters produced, organic load of the wastewaters and specific composition of the organic load. In general, capital costs would amount to *ca*. R1.00 per m^3 for 10 years. Thereafter, the cost would revert to a running cost of only R0.21 per m^3. This study has provided the fruit juice processing and winery industries with proof that anaerobic digestion and ozonation can be combined into effective and feasible wastewater treatment processes. When the new, low-cost, local ozonators are employed in conjunction with UASB, this combined process could soon be an economically viable alternative for the treatment of these and similar, problematic organic wastewater types.

Report No 1515 (Contractor: CSIR)

A compilation of all the international freshwater agreements entered into by South Africa with other states

In order to ensure sustainability, South Africa needs to collaborate with its neighbours about the sharing of the Incomati, Orange, Limpopo and Maputo rivers. South Africa has ratified the United Nations Convention on the Law of the Non-Navigational Uses of International Watercourses (United Nations, 1997), which calls for the exchange of data and information, the protection and preservation of shared water bodies, the creation of joint management mechanisms, and the early settlement of disputes (UNEP, 2002). The overall goal of this research project was to contribute to the good governance of South Africa's shared watercourses, by making available copies of the agreements the country is party to and analysing selected treaties. This study revealed the intricacy of international agreements – both in terms of the domestic ratification process that must be followed, and on an international level with other states. Two key recommendations are made. The first is to distribute the database widely to a broad range of stakeholders, and ensure that it is maintained regularly to include the latest agreements. The second recommendation is that a similar project should be conducted for the entire SADC region – to provide a centralised register of all the international freshwater agreements to which SADC states are party.

Report No 1310/1/05 (Contractor: Pulles, Howard & De Lange Inc.)

Development of criteria for the design of fishways for South African rivers and estuaries

Impassable barriers are amongst the causes identified for certain fish species becoming threatened or endangered. This is the second of three projects addressing very specific questions on the need for fishways, their design and location. The report covers the situation assessment of fishways. Regarding design, the vertical slot fishway appears to be the most suitable for rivers which are subject to large variations in flow. There is an inventory of the known fishways in the country. Forty two of the 57 are functional to some degree. Part of this report outlines a detailed assessment of design criteria based on the needs of the non-salmonid fish which are indigenous in the country. Monitoring results are described for two fishways. A website has been created (http://www.fishways.co.za/) to ensure that up-to-date information is accessible during this development phase of the work on fishways.

Reports can be ordered at
orders@wrc.org.za