SA waterbulletin

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WATER RESEARCH
WRC launches new Partnership Research Fund

WATER REUSE
Report on International Experiences

WATER QUALITY
Researchers study protozoan pathogens in rural water supplies

CALL FOR RESEARCH PROPOSALS

WARFSA

Water Research Fund for Southern Africa

The Water Research Fund has been established to support research projects addressing sustainable utilisation of water resources in the Southern Africa region. The purpose of the Fund is to build research capacity among regional institutions and individuals as well as to promote the utilisation of research results in the planning and management of water resources in the sub-region.

Objectives of the Research Fund

- To promote and facilitate the implementation of multi-disciplinary research projects in integrated water resources management in the region.
- To encourage research that leads to better use of precipitation to increase land productivity or availability of water for domestic use.
- To promote the utilisation of research results for decision making aimed at ensuring sustainable development of water resources in the region.

Priority research areas

Research proposals are invited from SADC nationals and residents for research grants that address the following priority research areas.

- Water use, conservation and technologies
- Rainwater harvesting. [Of special interest is the interaction between water harvesting and agricultural productivity, hydrology, ecology and society].
- Social, political and economic issues.
- Policy and legal issues.

Eligibility for grants

The research grants will be available to researchers and/or research teams attached to recognised institutions and will not be accessible to researchers as individuals. Applications should be from SADC nationals and residents. While North-South collaboration will be encouraged, it is important that research projects originate from a SADC country. Maximum allocation per project will be US$ 50 000 for Integrated Water Resource Management (IWRM) projects, and US$ 24 000 for rainwater harvesting projects.

The Fund Management Agency

The Research Fund is managed by the Institute of Water and Sanitation Development (IWSD), Harare, Zimbabwe, with initial funding from Sida.

Applications / Enquiries

Deadlines for applications are 30 July 2000 (for consideration in October) and 20 December 2000 (for consideration in March 2001). Enquiries and requests for application forms and procedure should be directed to:

Institute of Water and Sanitation Development
P.O Box MP422 · Mount Pleasant · Harare · Zimbabwe
Tel.(09263) - 4 - 73-5017/26/35 · Fax.(09263) - 4 - 73-8120 · E-mail: jndamba@iwsd.co.zw

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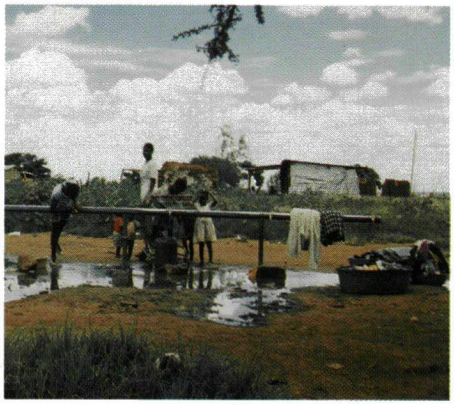

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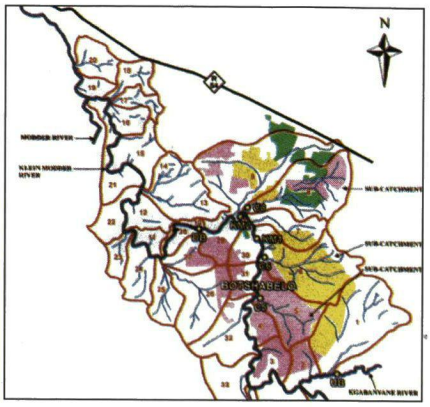

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Cover: Water reuse - Treated effluent from Southern Wastewater Treatment Works is sold to industry for reuse, including the SAPPI pulp and paper plant seen in the background. (Photo: Jan du Plessis)

SA Waterbulletin 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. Editorial offices: Water Research Commission, PO Box 824, Pretoria 0001, Republic of South Africa. Tel (012) 330-0340. Fax (012) 331-2565. WRC Internet address: http://www.wrc.org.za Editor: Jan du Plessis (E-mail: Jan@wrc.org.za). Asst Editor: Helene Joubert (E-mail: Helene@wrc.org.za). Ed Secretary: Rina Human (E-mail: Rina@wrc.org.za). Layout: Ronel Urquhart - 4Images. Colour Separations: 4Images. Printing: Beria Printers.

Government to speed up delivery of RDP services

"Government is considering speeding up the delivery of minimum water and sanitation services to all South Africans by changing the RDP delivery standard of 25 litres of water per person a day within 200 metres of every household to 500 metres in difficult areas." This was announced by the Minister of Water Affairs and Forestry, Mr Ronnie Kasrils, when he recently addressed delegates at the WISA 2000 conference at Sun City. He said that government will not meet its initial deadline of 2007 unless delivery gains momentum. "Despite considerable progress, we have a long way to go before we can meet this undertaking."

From left to right: Dr Ralph Heath, WISA 2000 conference chairman, Mr Ronnie Kasrils, Minister of Water Affairs and Forestry, Mr Pumezo Jonas, incoming president of WISA, and Dr Elsie Meintjies, outgoing president of WISA, at the opening of the conference.

Minister Kasrils said the Department was engaged in two core areas, namely, meeting the minimum requirement set by the RDP and the protection of South Africa's water resources.

"We have committed ourselves to finding ways to ensure that every household has access to the clean, unpolluted water they need for their basic needs.

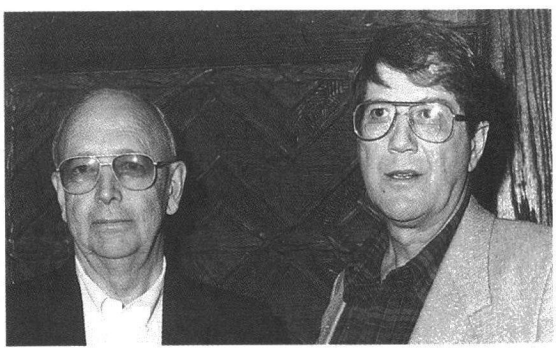
"However, as we have learnt, simply providing toilets and taps is not enough. Once the water supply is installed, we need to make sure it is managed and maintained so that it becomes a sustainable resource for that community."

He said this meant that the Department had to look carefully at the reasons why so many water schemes had failed and what could be done to empower communities at the local level with the necessary expertise and commitment.

Minister Kasrils lauded the city councils of Durban and Hermanus for their innovative approaches to water pricing.

"The Durban metropolitan council has come up with a staggered water tariff that I consider to be an excellent working model - the first six kilolitres of water per month is absolutely free. This amount is considered essential water consumption for an average sized family. Any water consumed over and above that rises in price in a series of steps.

"The staggered tariff not only ensures that those who cannot afford to pay receive a basic minimum, but it also seeks to change the attitudes of those who take water for granted and waste it, because it is too cheap and too freely available.



Mr Danie Bosman (left), who has retired from his position as chief executive officer of WISA with his successor Mr Willie Lötz (right).

"The real problem of water pricing, however, lies in the rural areas that lack the cross subsidisation of the more economically viable urban areas," the Minister said.

Minister Kasrils challenged delegates to play a more critical role in the building of economic sustainability in South Africa and to become involved in initiatives such as the integrated rural development strategy, which is an attempt to provide a common framework for development in underdeveloped rural areas.

"Here again, we seek partnerships with the private sector in the achievement of our goals. We urge you to continue to research and develop low cost equipment that is easy to install and operate and we urge you too to share your considerable knowledge in areas where you implement your projects."

WISA President Elsie Meintjies says:

Conference creates opportunities to solve problems

"Each paper, every poster presentation and all workshops at the WISA 2000 conference are vital pieces to be fitted into the incredibly complex puzzle that makes up the picture of Southern Africa's major and minor water problems," Dr Elsie Meintjies, outgoing president of WISA, said when she welcomed delegates at the opening session of the conference.

With more than 270 papers and presentations delivered in three days, she said, "some delegates may go away, feeling overwhelmed by the overall complexity of South Africa's water situation".

However, the conference created many "golden keys" of opportunity for delegates to solve some of the more importunate water problems because "a chance comment or observation may well provide a clue as to why some piece will not properly fit in the ever growing puzzle of water resource development and management".

Dr Meintjies said WISA 2000 provided a forum of quiet reason and studied application. She said the public perception of science was often based on the perception that somehow the processes of science are at fault because "even its experts fail to agree".

"But it is this very process of acid criticism and painstaking vigilance against possible errors that hones our cutting edge of technology. Scientific critique is often confused with political agendas that mostly and usually defend against external criticism, whereas in reality, science itself slowly mutates by its internally built in critical feedback mechanisms.

"Science does indeed change what has gone before, but does not lose sight of what has withstood the test of time," Dr Meintjies said.

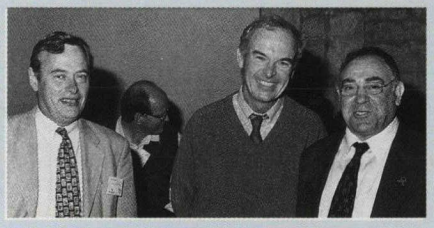
Clem Sunter calls for more "foxy" behaviour

Foxes and hedgehogs was the theme of well-known author Clem Sunter's keynote address at WISA 2000. Speaking about employment, poverty and entrepreneurship in the new South Africa, Sunter illustrated the different approaches to these problems with two metaphors taken from the work of the Oxford philosopher Isaiah Berlin - the fox and the hedgehog.

Hedgehogs symbolise the old order where government and big business controlled everything and created most of the jobs. "A hedgehog is a person who believes that life revolves around one big idea, one ultimate truth," Sunter says.

A fox, on the other hand, is someone who believes that life is about knowing many things. The fox's ambition is to get the majority of little things right and then the big picture will automatically improve. Foxes have the slogan "ready, fire aim" because they are only interested in action and results - the mark of a true entrepreneur.

Sunter believes that during the last forty years society has moved from the Age of Hedgehogs to the Age of Foxes. And this new kind of thinking and behaviour is what South Africa needs if it wants to solve the current problems of poverty and unemployment.



Mr Mike Muller, director general of Department of Water Affairs and Forestry, Mr Clem Sunter, keynote speaker at the WISA 2000 conference, in conversation with Mr Ronie Kasrils, Minister of Water Affairs and Forestry.

To establish a more "foxy" society, Sunter says the following conditions are necessary in South Africa:

- **Credit.** Without capital, foxes can only dream and can never turn their dreams into business realities. Sunter says South Africa should create a Sasdaq for raising venture capital for small businesses, similar to the American Nasdaq. Savings in South Africa should flow to the venture capital market rather than to all the newly built casinos.
- **Protection.** Foxes are very vulnerable to being harassed by the criminal element, the wolves. Small businesses usually operate on cash and cannot afford elaborate security systems. He says most of the crime in South Africa is attributable to small packs of highly professional wolves. Furthermore, Foxy societies are honest societies and cannot tolerate corruption and bribery.
- **Freedom.** Foxes want to try, and if they fail - to try again. They do not want to get bogged down in lots of red tape. Hence, many township businesses operate outside the law. Sunter says one of the main restrictions stopping women from becoming entrepreneurs in South Africa's rural areas is the traditional structures of authority.
- **Low taxes.** Legitimise the tax position of small businesses by declaring them exempt from company tax up to a certain size (e.g the first R100 000 earnings tax free) and then gradually increasing the percentage until the maximum rate. "If you want foxes to come out into the open, do not penalise them with excessive tax rates."
- **Education.** Foxes need encouragement from the educational system as Sunter believes that entrepreneurs are not born, but can be trained. "Anyone can open a small business, should they put their mind to it," he says.

Demonstrating true foxy behaviour at the conference, Sunter signed and sold many copies of his latest best-seller, ***Never mind the Millennium - What about the next 24 hours?*** published by Human and Rousseau.

WISA Awards 2000

Five prestigious Water Institute of Southern Africa (WISA) awards were presented at a the 2000 biennial conference held at Sun City from May 28 to June 1. WISA bestows awards in recognition of achievement in the fields of water science, engineering and technology. These are in different categories and are not automatically awarded each year, as a strict set of judging criteria must satisfy the various panels before an award is bestowed.

GG CILLIE AWARD

About the award
The WISA Anaerobic Processes Division annually awards the GG Cillié Award.

This accolade is intended to honour the contribution of Dr GG Cillié to research on water treatment, by promoting contributions from university students on anaerobic digestion research. The award consists of a floating trophy and book prize.

About the recipient
Retha Lloyd has been announced winner of the GG Cillié Award for the best contribution to anaerobic research in South Africa for 1999. Lloyd will be submitting her M.Sc thesis in Microbiology, University of Stellenbosh, on the subject 'Anaerobic Treatment of High-Strength Gelatin-Manufacturing Effluent'. Her study leaders are Prof Trevor Britz and Dr M van der Merwe-Botha. She is currently employed at Krugersdorp Water Care Works, where she is conducting her research as well.

FOUNDATION FOR WATER RESEARCH AWARD

About the award
The Foundation for Water Research (UK) has for the second year, offered an award for the best paper, presented at the WISA biennial conference by a young presenter (born in 1970 or later), in the field of water science and technology. The award consists of a year's membership of the FWR and a shield containing the author's name.

About the recipient
This year's recipient of the FWR Award is Rajan Moodley, a University of Cape Town post graduate student (Department of Civil Engineering). Moodley's paper presented at the WISA 2000 Conference is titled: External nitrification in BNR activated sludge systems with varying aerobic mass fractions.

UMGENI AWARD

About the award
Umgeni Water sponsors an annual cash award to the principal author of a paper which, in the opinion of the Council of the Water Institute of Southern Africa, makes a noteworthy contribution to water science and engineering. The current value of the award is R1 000 and is accompanied by a certificate and a bronze medal (or certificates and medals in the case of co-authors) bearing the name of the sponsor together with the coat of arms of the institute and the name(s) of the successful author and co-authors.

About the recipient
The Umgeni Award was presented to Dr. Ania Grobicki for her paper "A flow balance approach to scenarios for water reclamation", co-authored with B Cohen, which was published in the Water Research Commission's refereed journal Water SA Vol. 25 No. 4 October 1999. This paper was deemed very relevant to the South African water and wastewater field. Water conservation via the re-use of treated sewage effluent does require more emphasis in South Africa where our scarce water resources must be used to the fullest possible potential. (Also see article on page 14 in this Bulletin.)

WILSON AWARD

About the award
The Wilson Award was initiated to commemorate the late Dr Wilson's dedicated approach to his work and his efforts in developing the Southern African Branch of the Institute of Sewage Purification, which in 1967 changed its name to the Institute of Water Pollution Control. When the latter organisation was disbanded in 1987 and the Water Institute of Southern Africa formed, it was decided to carry on with this tradition.

The award acknowledges the combined competence and initiative of the owner and works manager of a wastewater treatment works, having a total design capacity of up to 25 000kl/day average dry weather flow.

About the recipient
The Wilson Award was presented to the Flip Human Sewage Treatment Works, owned and operated by the Krugersdorp Local Council. In a closely contested event, this treatment works was judged the winner of this award. The Flip Human Works obtained full marks on all assessed criteria. The Works is well managed and exceptionally maintained. Several initiatives are ongoing relating to the improvement of wastewater management and the better utilisation of sludge. The staff are enthusiastic and very knowledgeable about the works process. Hartenbos WTW (Mossel Bay) and JP Marais WTW (ERWAT) were the very worthy runners-up for this award.

PIET VOSLOO AWARD

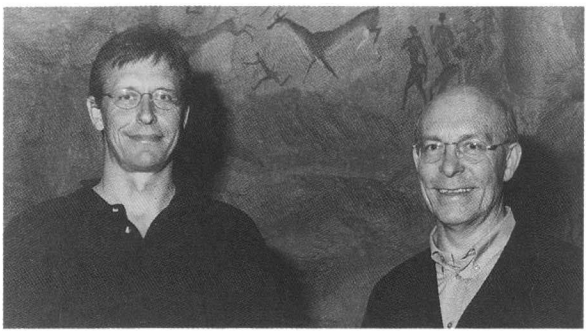
About the award
The award, in the form of a citation certificate is offered for a notable technical achievement in the water field.

The criteria are for a completed project involving innovative technology in the water field to the benefit of the effective management of water resources. The project may be in any area of the water field including:

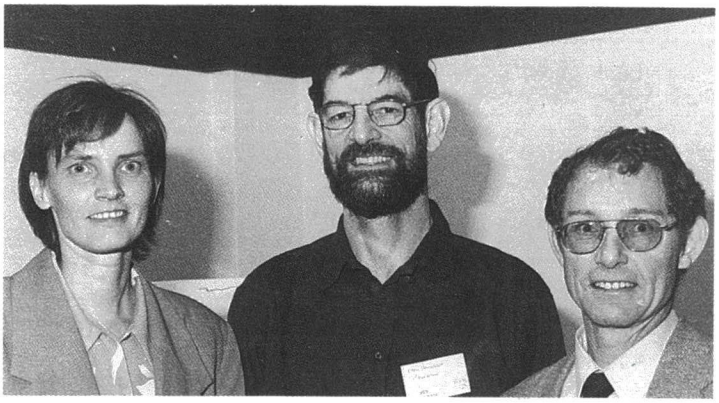
- Water supply, treatment, distribution and conservation;
- Wastewater collection, treatment, disposal and re-use;
- Water pollution control and prevention.

About the recipient
The Piet Vosloo Award was presented to DB Thermal, the company responsible for the project "Saldanha Steel cooling water treatment and reticulation system". This project involves a unique combination of various processes to produce a zero effluent discharge. Effluent treatment and water re-use principles have been utilised to reduce the volume of wastewater requiring treatment which limits the total water usage required for any given process. The system also utilises storm water run-off and the municipal sewage treatment facility's final effluent as a raw water supply to supplement the water taken from the local river and aquifer systems. The Saldanha Bay area is environmentally sensitive and this project is designed for minimal pollution impact.

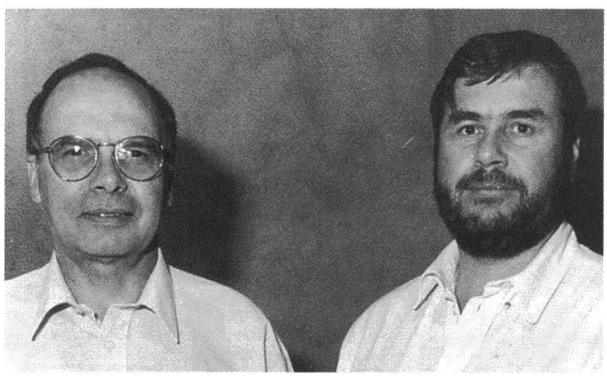
WISA and WRC Workshops well attended...



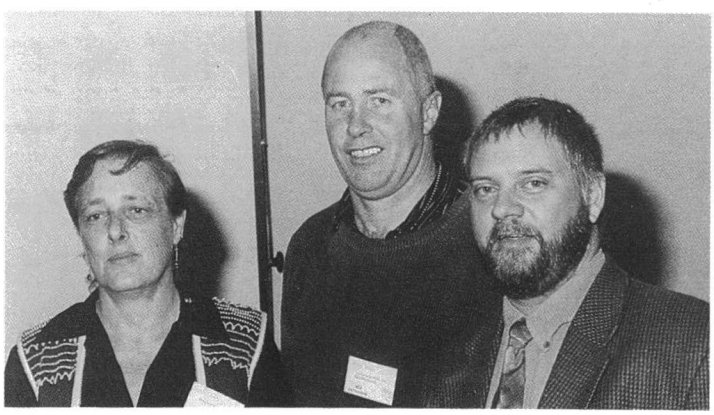
Prof Hendrik Wentzel (left) from the Technical University of Denmark, was a speaker at the workshop on Life Cycle Assessment - A comprehensive tool for environmental management. Prof Wentzel, a leader in this field is seen here with Dr Gerhard Offringa, research manager at the Water Research Commission.



The speakers at the WRC workshop on computational fluid dynamics were Dorothee Kleine from the University of Cape Town, Chris Brouckaert of the University of Natal, and Prof CG de K du Toit from the Potchefstroom University for CHE.



Mr Meiring du Plessis (left) research manager at the Water Research Commission (WRC) chaired a WRC workshop on non-point source pollution. Mr Gavin Quibell (right) from Carl Bro presented a paper at the workshop on managing the root causes of non-point source pollution based on experiences from managing water quality effects of densely populated settlements.



Lesley Steele from Rural Support Services, Phillip Walker of the Association for Water and Rural Development, and Dr Anton Rossouw from the University of Port Elizabeth, took part in the WRC workshop on institutional arrangements for the delivery of water services.

A workshop on Cryptosporidium *with presentations by international speakers was held at the WISA conference: (from left) Dr Zia Bukhari from the USA, Fanus Venter of the University of Pretoria, Dr Jennifer Clancy from the USA, Dr Colin Fricker of the UK, Dr Chrissie de Wet of Rand Water chaired the workshop, Ian Bailey from Umgeni Water and Annatjie Oelofse, research manager at the Water Research Commission.*

Peer Review in Pretoria

The Water Research Commission has since 1996 been engaged with four overseas water research agencies in a peer review system at executive level, Research Centres International Peer Review Organisation (RECIPRO). *The WRC was reviewed for the second time in May this year. This photograph was taken during the review: From left to right: Mareie-Marguerite Bourbigot (Vivendi Water, France), Piet Odendaal (Water Research Commission), Don Bursill (Cooperative Research Centre for Water Quality and Treatment, Australia), James F. Manwaring (American Water Works Association Research Fundation, USA) and Frans L. Schulting (KIWA, Netherlands).*

SAICE Water Engineering Award for Excellence

The South African Institute of Civil Engineers (SAICE) recently presented Award certificates to representatives of the agencies involved in the creation and joint publication of the "Quality of Domestic Water Supplies (Volume 1): Assessment Guide". The publication has attracted attention in other African countries and has received very favourable comments from the USA and Britain as well. Dr Philip Kempster, one of the co-workers on the project and publication has been invited to present a paper in Paris, France, on the process involved in producing the highly commended guide. Pictured above are (from left) Dr Chris Herold, chairman of SAICE, with the representatives: Mr Piet Odendaal, executive director of the Water Research Commission, Mr Leonard Ramagwede , chief director: Development, Department of Water Affairs and Forestry, Dr Eddie Mhlanga, chief director: Maternal, child and women's health and nutrition, Department of Health, and Mr Martin van Veelen, BKS.

WRC Partnership Research Fund

The Water Research Commission has established a special Partnership Research Fund aimed at promoting the building of research capacity with previously disadvantaged institutions and individuals.

The Water Research Commission recognises the important role that water research plays in the development of the skilled manpower that South Africa will need in the water sector, over the short as well as the long term. It also recognises the need to broaden the country's water research base through extending the involvement of previously disadvantaged individuals and designated institutions (historically black universities and technikons, and small, medium and micro-enterprises - SMMEs). The creation of the Partnership Research Fund is one of the strategies being explored towards this end.

PROPOSALS

Research proposals should reach the Water Research Commission (WRC) by 31 July 2000. Proposals should follow the guidelines provided by the WRC in a document titled General Guidelines for Compiling Research Proposals (2000). (See WRC website for the complete document). Further conditions are the following:

- Proposals must involve partnerships including at least one designated institution and/or SMME;
- At least 50 per cent of resources must be allocated to the designated partner(s);
- The project coordinator must be designated by the designated partner(s) and will be responsible for compiling reports.

Successful submissions will be funded through multi-party agreements with the Water Research Commission.

Researchers are encouraged to approach WRC research managers on strategic research plans in specific fields of water research and to discuss potential research proposals with them prior to submission of the proposals.

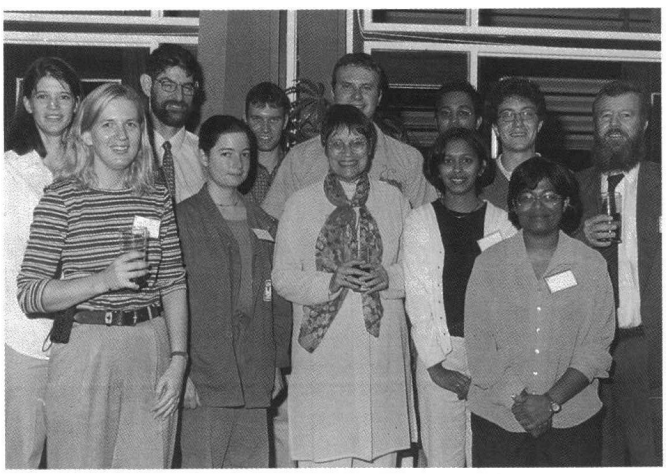
ENQUIRIES

Water Research Commission
PO Box 824, Pretoria 0001 • Tel: (012) 330-0340 • Fax: (012) 331-2565 • Website: http://www.wrc.org.za

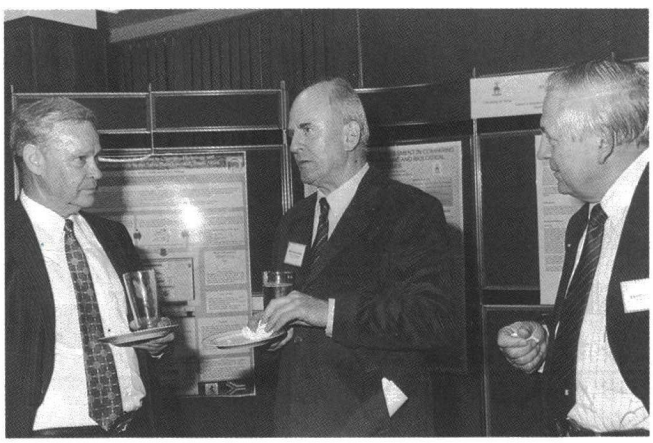
Spotlight on WRC research at university

The Water Research Commission board met in May of this year in Durban at the University of Natal. This was also an opportunity to inform the commissioners of the WRC research projects undertaken at the University of Natal. Two half day sessions were allocated as information sessions. During these sessions the WRC research project leaders at the University gave presentations on their respective WRC research projects. The research is being done in a number of Schools and groups within the university *inter alia* the Pollution Research Group (PRG), School of Chemical Engineering, the School of Bioresources Engineering and Environmental Hydrology, the School of Civil Engineering, Surveying and Construction, the School of Applied Environmental Sciences, the School of Agricultural Science and AgriBusiness, the School of Economics and Management, the Farmer Support Group, the Institute for Natural Resources (INR) and the Computing Centre for Water Research (CCWR).

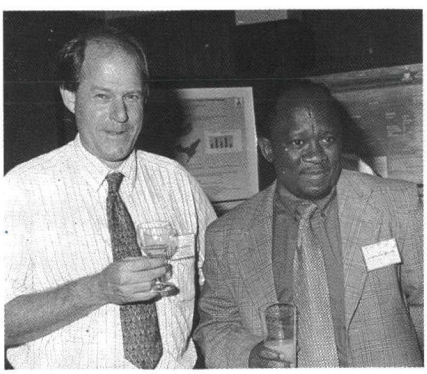
Prof Preston-Whyte, deputy vice-chancellor: research and development of the University, applauded the longstanding collaboration of the WRC and the University with regard to research, and said that she expected this successful collaboration to continue in the future for capacity building and the benefit of both the University and the WRC. She expressed great appreciation for the WRC's contributions towards research excellence at the University through the support and funding of research projects.



Prof EM Preston-Whyte, deputy vice-chancellor: research and development (centre, front), with Prof Chris Buckley (far right)and the research staff and students of the Pollution Research Group in the School of Chemical Engineering.



Prof Geoff Pegram (centre) of the School of Civil Engineering, Survey and Construction in conversation with Mr Piet Odendaal (left), executive director of the WRC, and Mr David van der Merwe (right), deputy executive director, WRC.



Dr Raymond Auerbach of the Farmers Support Group chatting to Mr Mishack Molope, a WRC board member.

Dr Simon Lorentz and Prof Roland Schulze from the School of Bioresources Engineering and Environmental Hydrology.

Prof Kingston Nyamaphene (right), chairman of the WRC board, in a discussion with Dr George Green (left), deputy executive director, WRC, and Prof Chris Buckley.

Waste Minimisation Clubs - Pilot Studies in KwaZulu Natal

Susan Barclay and Chris Buckley
Pollution Research Group, School of Chemical Engineering, University of Natal, Durban 4041

A three-year project funded by the Water Research Commission was initiated at the beginning of 1998, firstly to determine the feasibility of establishing waste minimisation clubs in South Africa to promote sustainable business and environment, and secondly to establish the necessary criteria to replicate these clubs in other regions. In order to achieve this, two pilot clubs were formed in the KwaZulu Natal region; one in the metal finishing sector (Durban and Pinetown), and the other, a cross-sectional club in the Hammarsdale area.

The project is co-funded by the European Union Directorate General XVIII for Energy (Thermie) which allowed for the involvement of two European consultants, namely Enviros March (United Kingdom) and Cowi (Denmark). Enviros March's focus is on energy savings and technical training, while Cowi's involvement is through the South African organisation, Kagiso-Cowi, and focuses on general environmental awareness training for management and shop-floor employees.

WASTE MINIMISATION CLUBS?

Waste Minimisation Clubs are a group of industries working together to reduce their environmental impact, and improve the efficiency of their businesses. It is a concept that was first developed in the Netherlands (PRISMA) and the United Kingdom (Aire and Calder; Project Catalyst) in the early 1990's. There are now over 80 clubs in the United Kingdom, with similar programmes in place in New Zealand and India. It can apply to cross-sectional as well as sector specific industries. These clubs meet on a regular basis to exchange information and experiences related to waste minimisation, and in this way, encourage each other to make improvements in their operation.

METAL FINISHING WASTE MINIMISATION CLUB

The Metal Finishing Waste Minimisation Club (Durban) was formed in June 1998. It consists of 29 companies, which includes 23 electroplaters, 3 powder coaters and 3 galvanisers. More than half of the companies have less than 50 employees. The majority (60 per cent) can be classified as jobbing shops, while the remaining 40 per cent are manufacturers where metal finishing forms part of their production process. Of these member companies, 15 are actively implementing waste minimisation programmes in their factories, resulting in varying degrees of financial savings, and a reduced environmental impact. The remaining 14 members, while not visibly making changes on site, are at least more aware of the pollution caused by their processes and have access to information on methods to reduce their waste.

The reported total savings achieved by the club members to date (May 2000) is in excess of R1.9 million per year **(Table 1)**. These are due to savings in water, energy, chemical and metal use; and effluent treatment costs. This has resulted in savings of over 64 000 kl per year in water. One company has saved 3 520 kg of solvent per year (R 252 000 per year) and 9 900 kg oil per year (R 8 340 per year) by changing chemical suppliers. The mass of metals discharged to drain has decreased, for example, by 275 kg chrome salts per year in one jobbing shop, and approximately 48 000 kg

Table 1: Summary of Reported Savings for the Metal Finishing Club

Item	Approximate Savings (R / year)	Approximate Savings (Quantity / year)
Water	162 000	64 800 kl
Energy (Total)	287 000	not quanitified as yet
Chemicals (Total)	1 278 000	112 000 kg
Effluent	178 000	97 000 kl
Waste disposal	30 900	not quantified as yet
TOTAL	**1 934 000**	

Table 2: Summary of Reported Savings for the Hammarsdale Waste Minimisation Club.

Item	Approximate Savings Achieved		Approximate Potential Savings	
	R / year	Quantity/ year	R / year	Quantity/ year
Water	1 560 000	600 000 kl	1 354 000	520 000 kl
Energy	443 000	not quantified	1 142 000	not quantified
Chemicals			113 000	8 500 kg
Raw materials	1 000 000	84 000 kg	12 000 000	not quantified
Consumables	208 000	not quantified	64 000	not quantified
*Other	1 200 000	unable to quantify		
TOTAL	**4 411 000**		**14 673 000**	

**Other covers those areas where combined savings in water, chemicals and energy have been made and cannot be quantified individually*

total metals per year in a manufacturing operation. Quantification of the savings in terms of volume, mass or energy is currently being assessed for all companies. The figures given in the third column of Table 1 are only for a few of the club members and do not necessarily relate to the total monetary savings. The total chemical savings include those for metals (R 169 000 per year), treatment chemicals, oil and solvent. Energy savings include those made in electricity and liquid petroleum gas (LPG).

The majority of these savings were achieved through no- or low-cost measures, such as fixing leaks, closing off unnecessary taps, controlling chemical addition, monitoring water use and flows, optimising use of heated equipment, improving process operations, reusing of rinse water and other baths, and training staff. Those companies that have made the most savings have attributed these to an increased awareness of the process requirements, improved monitoring of all utilities and a greater management presence on the shop floor.

HAMMARSDALE WASTE MINIMISATION CLUB

The Hammarsdale Waste Minimisation Club was established in November 1998. It consists of 6 textile companies, a chemical manufacturer and a chicken abattoir. These companies are medium to large manufacturing organisations, many of which are subsidiaries of larger international groups. As such, environmental issues are of importance to management, with two member companies holding ISO 14000 certification.

The combined total reported savings of the Hammarsdale Club are in excess of R 4 million per year, with a further R 14 million per year in savings identified. Details of some member companies savings are still awaited. These savings have been achieved through reducing water and energy use and monitoring raw material use and wastage. Again, most savings have been achieved through low cost measures such as optimising dyeing procedures, reuse of washing water, increasing condensate return to the boilerhouse, improved maintenance of all piping (water and steam), replacing disposable consumables with recyclable alternatives and increased monitoring of all utility use. Capital intensive options, such as the installation of new equipment, have also been implemented (or are in the process of being implemented), with payback periods of the order of 1 to 2 years.

These savings have resulted in a decrease in the region of 600 000 kl water per year. Solid waste volumes are also reduced through prevention of waste during processing of fabric and packaging. A summary of the results are given in **Table 2**. As with the Metal Finishing Club, quantification of the savings in terms of mass, volumes and energy is currently underway. The figures reported in this table do not necessarily relate to the complete financial savings.

BARRIERS

There are three main barriers to a company implementing a waste minimisation programme, namely;

- ❒ a lack of time,
- ❒ a lack of resources in terms of personnel and background information, and
- ❒ a lack of finance to implement more capital intensive options.

These are issues that can only be overcome internally by the companies themselves. Once the benefits of waste minimisation are realised, time, resources and money can be freed for further implementation.

It was clear that in order for waste minimisation to become a priority in an industrial organisation, both the carrot and the stick approach needs to be used. The stick, in terms of effluent requirements and charges, and the carrot, the financial and environmental benefits. Especially in South Africa, where resources are so inexpensive, it is felt that there needs to be a stronger motivating factor to implement changes than only the financial benefits to the companies.

SUCCESSFUL CONCEPT

The club concept has been successful in promoting waste minimisation. The companies have benefitted from the information supplied at the meetings in the form of literature, lectures and training sessions, and from the social interaction with other companies. A Metal Finishing Association has now been formed in the KwaZulu Natal region and will promote waste minimisation as one of its core activities. The Hammarsdale Industrial Conservancy has adopted waste minimisation as a key activity to promote environmental improvement in the area.

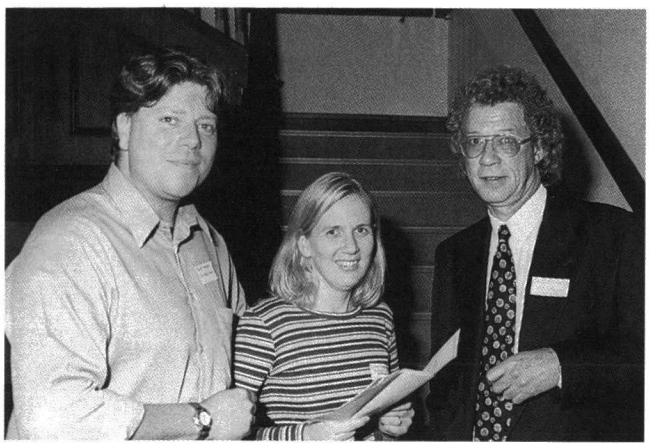
It is hoped that the success of this project and these pilot clubs will motivate similar initiatives in other regions of the country. More details are available in the club newsletter Common Goal (February 2000 edition).

For further information please contact Sue Barclay at tel. (031) 260-1490 or e-mail: barclay@nu.ac.za

Waste Minimisation Clubs:

Information Sharing Evening

An evening of informal technology transfer took place on 23 May 2000 at the Westville Hotel in Durban. The function was sponsored by the Water Research Commission (WRC) and brought together the club members from both the Metal Finishing and Hammarsdale Waste Minimisation Clubs, the Project Team (Pollution Research Group and Enviros March), members of the Steering Committee and government organisations. Presentations were given by Greg Steenveld of the WRC and Chris Buckley of the Pollution Research Group. Nicky Naiker from Buckman Laboratories spoke on behalf of the Hammarsdale Club, and John Danks of Saayman Danks Electroplating spoke on behalf of the Metal Finishing Club. The evening was a great success, with over 55 delegates attending. It allowed for the exchange of experiences between the club members and for other interested parties to talk to those involved in the project on a one-to-one basis.



Waste Minimisation Club project team members present were David Mercer, from Enviros March, UK, and project leader Susan Barclay of the Pollution Research Group, with Greg Steenveld, research manager at the Water Research Commission.

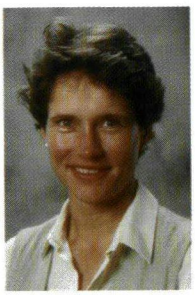
The speakers at the information sharing evening were Greg Steenveld (WRC), John Danks (Saayman Danks Electroplating), Prof. Chris Buckley (Pollution Research Group) and Nicky Naicker (Buckman Laboratories).

Some of the representatives attending the information evening were (from left to right): Mary Mkize (Durban Solid Waste), Johnny Moodley (Federal Mogul / AE Valves), John Zulu (Behr Engine Cooling), Leeny Woompath (Electroplating and Engineering Works), Michelle Presend (Environmental Monitoring Group), Bas Kothuis (University of Cape Town) and Reinholdt Loots (Department of Water Affairs and Forestry).

Evan Kyriakides (Baytown Electroplaters), Rose Treadway (Pinetown Electroplaters) and Steve Coady (Metal Protection Services) at the information evening for the Waste Mimnimisation Clubs.

Making the most of a precious resource

The goal of water reuse is to create greater sustainability within total water resource management. However, there is still a sense that the advantages offered by this important resource is not yet fully accepted by planners, professionals in the water field and the public. Dr Ania Grobicki from Abbott Grobicki (Pty) Ltd in Cape Town, earlier this year attended an international conference on water reuse in San Antonio, Texas, with sponsorship from the Water Research Commission. She presented a paper on the Southern African experience in the recycling of water and also filed this report.



Dr Ania Grobicki

The fact that the conference was situated in Texas and hosted by the city of San Antonio is particularly relevant to the whole topic of water reuse. During the 1990s the state of Texas embarked on a process of updating the Texas Water Plan. The drive towards increasing water reuse was given acute urgency by a drought in 1996 which saw 340 communities across Texas implementing water restrictions. There were severe crop losses and widespread wildfires. Hence Texas has recently changed, for its whole approach towards water supply and drought management, placing a heavy emphasis on water conservation and reuse, as well as innovative technologies such as rainwater harvesting and aquifer storage and recovery.

In the United States as a whole, four states dominate reuse activity: Florida with1 855 million litres per day, California with 1 211 million litres per day, Arizona with 795 million litres per day and Texas with 832 million litres per day. This accounts for 87 per cent of all reuse in the USA, which totals approximately 1.4 billion gallons (5.3 billion litres) per day.

ISSUES AFFECTING REUSE PROJECTS IN THE USA

Despite the growing trend towards water reuse throughout the USA, to some extent water reuse is not yet fully accepted by the public, and hence is not in the mainstream of water resource management.

The emphasis in current research into water reuse is therefore on risk assessment and risk management issues, on public perceptions of water reuse and the need for education programmes.

The most important priority to be identified was the need for microbial risk assessment methodologies, in order to establish water reuse criteria. It is also important to develop a credible risk assessment model which can be used for various water reuse applications.

INTERNATIONAL EXPERIENCES

International presenters gave papers over the course of the three-day conference discussing various aspects of water reuse in a wide range of countries, including Mexico, South Africa, Turkey, Jordan, Australia, Saudi Arabia, Spain, Belgium and Japan. In addition, the presenters from the less affluent countries (Mexico, South Africa, Turkey and Jordan) were brought together in a stimulating international panel discussion.

JAPAN

Japan represents the top end of the scale, where since World War II, the Japanese Government has invested heavily in the construction of drainage and sewerage systems, as well as wastewater treatment facilities for water pollution control, environmental protection, and promotion of amenities in the urban environment. Japan's water reuse is decisively directed toward non-potable urban applications, such as toilet flushing, environmental water, in-stream flow augmentation, and industrial reuse, says Professor Asano of the University of California at Davis.

Some 163 publicly owned wastewater treatment plants (POTWs) in Japan provide water reclamation and reuse in 192 use areas, and the amount of reclaimed water reached 135 million m^3/year in

The conference was jointly sponsored by the American Water Works Association and the Water Environment Federation, with support from the Water Reuse Association of California, the National Water Research Institute, the US Bureau of Reclamation, and the US EPA (Environmental Protection Agency).

1998. Of this, some 42 per cent is utilised for in-stream flow requirements of urban rivers, and other urban water amenities. Reclaimed water has been actively promoted by municipalities as a safe, dependable, and aesthetically pleasing water resource. Wastewater reclamation and reuse in Japan are commonly classified in two categories: (1) closed-loop water recycling systems which involve non-potable direct water reuse; and (2) open-loop water recycling systems which involve discharge to streams and rivers, and abstraction downstream.

In the closed-loop systems, there are three main categories, of which the first two are not included in the statistics for water reclamation from POTWs:

❒ **Individual Building Water Recycling System:**
Individual wastewater reclamation and reuse take place, mainly, for toilet flushing in the same site such as in a large office building or an apartment complex with an on-site wastewater treatment plant. In some areas of Tokyo, this system is mandated for newly constructed buildings of certain floor space because local water supply, trunk sewer mains, and sewage treatment capacities are often limited and cannot accommodate increased domestic water demands and wastewater flows.

❒ **Block-Wide Water Recycling System:**
Several buildings were connected together to a block-wide wastewater treatment facility and their reclaimed water is distributed back to the buildings via block-wide urban distribution pipelines for mainly toilet flushing. Many on-site wastewater treatment plants in the above water recycling systems in Japan consist of the membrane separation activated sludge process (membrane bioreactor, MBR), because of the benefits of stable operation and small footprint required for the on-site installation, which is followed by disinfection. The water recycling systems discussed above are constructed in a relatively small scale such as in a single building or several buildings forming a block-wide water recycling system without the benefit of public sewerage systems. They are normally financed by private funds with the low-interest loans guaranteed by government agencies.

❒ **Large Area Water Recycling System:**
The large area water recycling system is generally assisted by government subsidies up to 50 per cent of the capital cost, and implemented via public sewerage system and POTW. Normally, tertiary or advanced wastewater treatment processes are employed for further treatment prior to water reuse. The reclaimed water is distributed through a network of pipelines to large water reuse areas. Main use of reclaimed water is for toilet flushing, but there are some uses for irrigation and cleansing. This type of large scale water reuse schemes has been increasing in Japan with many showcase installations.

The total number of installations of the individual and block-wide water recycling systems was 1,475 and the annual volume of reclaimed water use was approximately 71 million m^3 in 1998. Adding this figure to the volume reclaimed from POTWs, the sum total of water reuse in Japan is approximately 206 million m^3. It must be noted, however, that water reuse in Japan is decisively orientated toward urban applications. In contrast, the majority of wastewater reuse in most other countries is for irrigation; for example, 68 per cent of total water reuse in California is for agricultural and landscape irrigation.

Water reuse in Japan is not cheap. Although the yardstick price for reclaimed water of about 80 per cent of the drinking water price is generally applicable in Japan, the reported production cost for the reclaimed water in Fukuoka City is U.S. \$2.01/m^3 compared to that of drinking water of \$1.88/m^3. The consumer price of reclaimed water averaged \$2.99/m^3 compared to the drinking water price of \$3.73/m^3. Even with a smaller margin for the reclaimed water, Fukuoka City has been able to produce a slight profit for the wastewater reclamation and reuse systems.

Contrary to the large-area water recycling system for toilet flushing, water reuse for environmental purposes is relatively simple and less expensive. Large volumes of reclaimed water can be delivered to the aquatic environment via a single transmission pipeline. In this case, water reclamation and reuse are viewed conveniently as a water resource located right at the doorstep of the urban areas. Water reuse for environmental purposes can be generally characterized as follows:

❒ reclaimed water is treated by tertiary treatment consisting of chemical coagulation, granular-medium filtration, and often ozonation

❒ reclaimed water is normally transported a short distance from POTWs to a point of discharge

❒ unlike the toilet flushing water distribution system, no complex pipeline networks are necessary

❒ maintenance work is normally conducted by the POTW's personnel, keeping O&M costs low.

The reclaimed water quality criteria for environmental water in Japan include a total coliform count that is undetectable. The authors however recommend that less stringent limits should be set of <1000 total coliforms/100 ml for landscape irrigation, and <50 for recreational use.

MEXICO
At the other end of the scale, in Mexico, untreated wastewater is utilized for agricultural irrigation of 90 000 hectares located to the north of Mexico City, in the Mezquital Valley. This problematic water reuse application was discussed by Blanca Jimenez Cisneros of the Mexican Engineering Institute. Due to the fact that the water is untreated, the National Institute of Public Health documented that gastrointestinal illnesses in the area are 13 times higher than areas that use "first-use" water. However, the farmers insist that their irrigation water must be water "with substance", i.e. the BOD, nitrate and phosphate levels are

valued for their fertilising properties. Indeed, a term has now been coined for irrigation with nutrient-containing water: "fertigation". In the experimental work conducted over a 6 month period, the faecal coliform count in the influent wastewater ranged from $6.7x10^8$ to $5.2x10^9$/100 mℓ. In order to protect public health, it is now proposed in this particular reuse project in Mexico that physico-chemical treatment is used for the initial stage of wastewater treatment (called Advanced Primary Treatment or APT), followed by a disinfection step. Research showed that this treatment combination removed 98.8 per cent of helminth eggs, and 91 per cent of faecal coliforms.

TURKEY

Another paper discussed a case study of people's behavior towards water use and reuse in the city of Ankara, Turkey, where the majority religion is Islam (The authors were A. Azhar and A. Ajwad of the Department of Environmental Engineering, Middle East Technical University, Ankara). In the developing world too, water reuse projects may not get appreciable acceptance by the public. The authors contend that a technological success at one place may become a total failure at another place. A project can be of benefit only if the people for whom it is conducted co-operate with its implementation and then its maintenance.

This social survey of the inhabitants of Ankara, Turkey, showed that almost all were receiving water from the municipality, but the majority didn't trust the quality of water. The results clearly indicated that a higher literacy rate was not related directly to the stance on environmental issues. So in planning for the public education and outreach programs about environmental projects, the level of literacy should not be the deciding factor.

However, a clear majority (58 per cent) said that water should be conserved for the future generations. People also showed their willingness to use reclaimed wastewater for non-potable purposes (only 33 per cent opposed this practice). A slightly greater proportion (40 per cent) would refuse to drink potable quality reclaimed water. Among women particularly, 35 per cent said that the cost of water would not influence their choice, i.e. if reclaimed water were cheaper, they would still refuse to use it. As far as religion was concerned, a small majority (54 per cent) said they would follow the religion's standing on this issue. People were found to be not well-informed about Islam's position and they simply followed the trend that "dirty water is not allowed to be used". However, actually, this is not the case. A large minority (46 per cent) concluded correctly that if reclaimed water was technically safe and clean, religion would not oppose its use. When asked whether in their opinion Turkey may need to reuse the water in the future, 17 per cent of the people strictly said NO. The percentage of people who forecast the need to reuse water was 51 per cent of the surveyed sample. This clearly indicates Turkish people's great concern about this diminishing resource. The authors express the hope that with a little better communication and management, any water reuse project in Ankara can become a success.

JORDAN

In Jordan, water scarcity is an issue which is high on the agenda, according to Professor Qaisi of the University of Jordan. Jordan's water demand is far exceeding its fresh water resources, and there are no additional known water resources to be extracted by the year 2005. Jordan's water resources average around 200 m^3/capita/year, in comparison with worldwide fresh water resources averages of 7 500 m^3/capita/year. The water stress level is taken to be 500 m^3/capita/year. Hence all conventional and unconventional sources of water supply are under serious investigation in Jordan, and the paper assessed the feasibility of installing on-site gray water recycling systems (GWRS) in buildings. Toilet flushing represents the majority of water consumption in the home, consuming more than 40 per cent of the total domestic water supply. Reusable gray water from laundry, bathroom and kitchen represents the balance. It was calculated that in Jordan, the implementation of these gray water recycling systems could save up to 131 million m^3/year of potable quality mains water. This technology is seen as representing an intermediate step between the full water-borne sewerage system and the composting toilet.

SOUTH AFRICA

The South African experience was summed up by Ania Grobicki in describing the long history of water reuse in this part of the world, with the first potable reuse being implemented in Namibia in the mid 1960s. Direct non-potable reuse is also well-established, in the paper industry, cooling of municipal power stations, and golf course irrigation. However, the overall level of water reuse is low, estimated to be under 30 million m^3 in 1998, or less than three per cent of the total volume of sewage effluent discharged. The divergent case studies of Cape Town and Durban were described. Water reclamation in Cape Town is being driven by policy formulation at metropolitan level, leading to the setting of a target of zero effluent discharge to sea in the summer months, from all secondary wastewater treatment plants. However, no time frames have yet been set for meeting this target. In Durban, reclamation has been finance-driven, with a public-private partnership enabling the construction of the Durban Water Recycling tertiary treatment plant at the Southern Sewage Works. This plant will sell treated effluent to a network of industrial customers located nearby. Inland, direct reuse has been hampered by the policy of "planned indirect reuse" which was enshrined in the 1956 Water Act. The Water Services Act of 1997 and the National Water Act of 1998 have changed the playing field for water reuse efforts, with the definition of Catchment Management Areas. However, there is as yet no specific national policy framework for water reuse, so it is being implemented only where local opportunities arise. The tools and options for water reuse should be introduced to local authorities hand-in-hand with the water demand management measures, which are currently being emphasised.

PANEL DISCUSSION

The international panel discussion picked up on the links between integrat-

ed catchment management and water reuse. Catchment management bodies should ultimately have the decision over water allocations, whether the water be raw water or treated sewage effluent. However, a distinction should be made between consumptive water reuse (as in irrigation) and non-consumptive reuse, as in industrial cooling applications. Also, water quality and the level of wastewater treatment available has a role to play, in determining the possible reuse applications.

People's perceptions, which differ enormously from place to place, also are important determinants of how reuse is carried out in practice. However, public participation in the decision-making process, and positive lobbying and education programs are essential in dispelling myths and fears around reuse. There is no reason why social and religious attitudes towards reuse should be negative, given the right approach to public education and stakeholder buy-in, and careful consideration of public health and environmental factors. Indeed, as people's awareness of the scarcity and preciousness of freshwater resources is heightened, there is likely to be increasing evidence of local initiatives and advocacy of water reuse. For this reason, there is a strong trend internationally towards closing the price gap between reclaimed water and potable water. From the user's point of view, the reclaimed water is just as good as potable quality water in the particular application where it is being used, while the cost of supply may be as high as that of potable water as demonstrated by the example of Fukuoka City in Japan.

Where socio-economic factors play a strong role in water reuse, as in Mexico, the situation is rather different. Here traditional water reuse practices are based upon a low-income peasant economy. Improved treatment technologies are required to protect public health, yet at present the users would be unable to pay for such improvements. In developing countries therefore, reuse projects in agricultural irrigation may require cross-subsidisation from the urban water supply system.

In terms of water management, the international trend appears to be towards shortening the reuse loops in water management systems. This can be seen in the increasing implementation of gray water reuse systems in densely populated urban areas, and by the interest in decentralised wastewater treatment plants. Where reticulation and distribution add greatly to the cost of the water, as in reclaimed water, it makes sense to locate the treatment plant as close as possible to the point or points of reuse.

SUMMARY

In summary, the useful points raised at the Water Reuse 2000 conference which are meaningful for water reuse strategy in South Africa are as follows:

❒ Regarding pricing, consideration should be given to charging for reclaimed water not at a fraction of the cost of potable water, but at the same level. This approach may be dependent on who the customer is, and the level of treatment required, i.e. it may be an appropriate strategy for industrial water, but not so for water for agricultural irrigation.

❒ Concerns regarding public health aspects of reuse projects are legitimate, but are best addressed within the framework of risk assessment and risk management strategies. Furthermore, religious concerns (e.g. from the Muslim community) can be dealt with by investigating more closely the sacred texts, and looking at how Muslim countries implement reuse projects. On both grounds, there is no reason why an open and participative public process, properly carried out, should not lead to the approval of reuse projects.

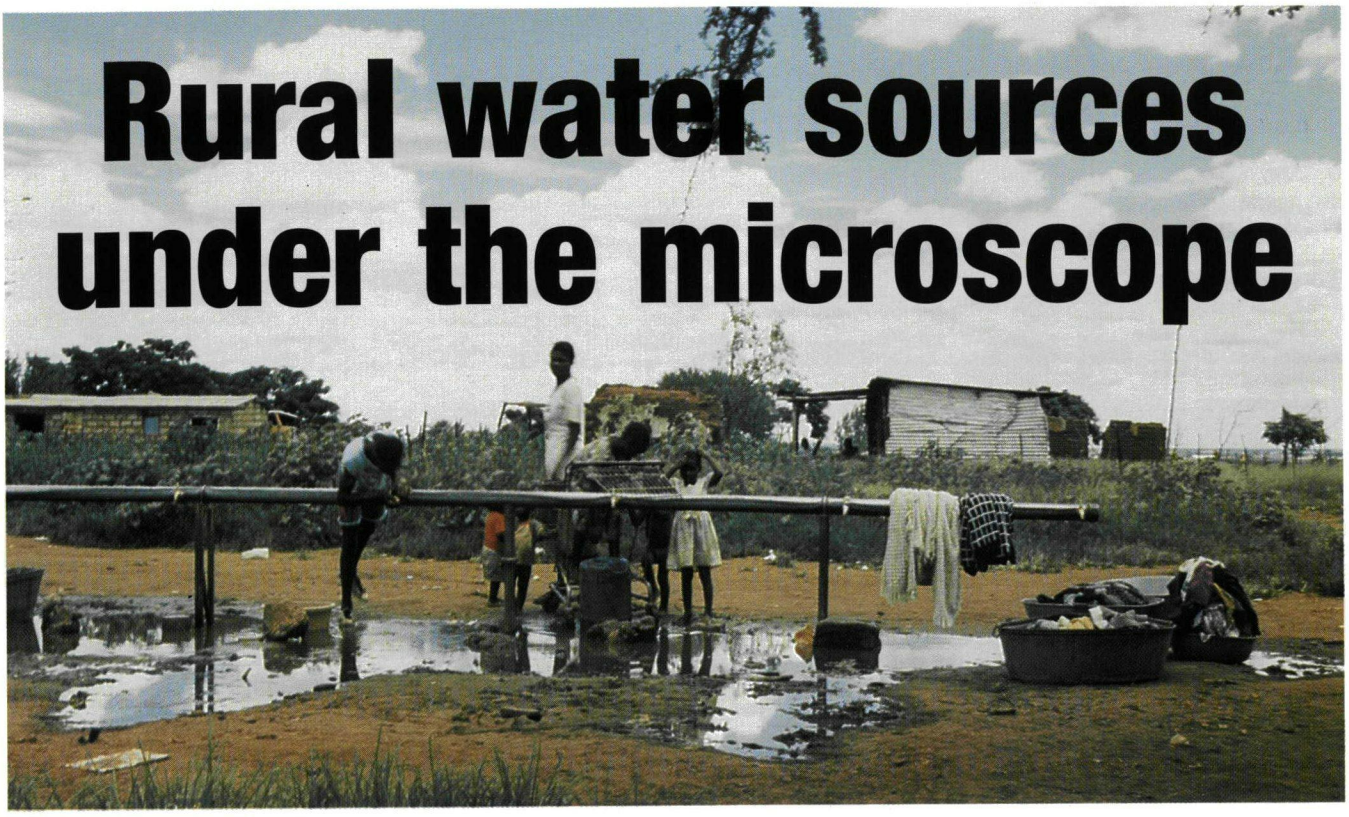
❒ It is important to keep the regulatory system flexible enough where reuse projects are concerned, that new treatment technologies can be easily introduced. Hence water quality objectives are preferable to strict performance and design criteria.

❒ Catchment or watershed management should take on board the beneficial reuse not only of stormwater in urban areas, but also of treated sewage effluent. Urban water management needs to be carried out in the context of the catchment as a whole, in order to avoid or resolve possible conflicts about the allocation of treated effluent between the river system and proposed reuse applications.

Finally, the goal of water reuse should be to create greater sustainability within water resource management. Sustainability, in this context, can be viewed as holistic water management which maximises the usage of water within the human water cycle, prior to releasing it back into the natural water cycle (i.e. groundwater, evaporation, evapotranspiration, and release to surface water and marine environments). Exploiting water that is kept within the human water cycle is less damaging in environmental terms; indeed the major parameter that needs to be kept in mind is the public health risk. On the other hand, exploiting water from the natural water cycle is by definition an environmentally damaging activity, since aquatic ecosystems are modified or destroyed. In this view, it can be seen that aquifer storage and recharge, coupled with the utilisation of groundwater, is a more sustainable way of managing water needs than utilising river systems and dams.

The goal of sustainability is looking also towards maximising the non-consumptive uses of reclaimed water, since clearly consumptive uses immediately lose the water to the natural water cycle. In this way, water as a medium may be recycled many times within the human water loop, in densely populated and developed urban areas. This would enormously reduce urban and developmental pressures on freshwater resources, through the recycle effect. Even so, with freshwater being viewed only as a "top-up" to compensate for the losses from the human water cycle, it is possible that lack of freshwater will eventually act as a brake on development. In the 22nd century, the world may well see water reuse becoming the primary supply source and freshwater supply being viewed as secondary.

Rural water sources under the microscope



Community water supply: these communal taps at Temba, Hammanskraal, were used for drinking water, washing and watering of cattle.

A new threat to the safety of water supplies, namely protozoal pathogens, has emerged over the last two decades. The protozoan parasites *Giardia* and C*ryptosporidium* have become recognized causes of diarrhoea in man and can cause acute or sporadic gastroenteritis in otherwise healthy individuals. The incidence of giardiasis and cryptosporidiosis has in recent years reached epidemic proportions worldwide, implicating these two parasites as the main causes of waterborne parasitic diseases. South Africa is not exempt from these waterborne parasites, as previous studies have indicated the presence of both *Giardia* cysts and *Cryptosporidium* oocysts in South African source waters. Researchers M du Preez and M Gericke of the Division of Water, Environment and Forest Technology, CSIR, have presented their findings on the occurrence and survival of protozoan parasites in source water used by unserved rural communities, in a report to the Water Research Commission.

According to the report certain unique characteristics of protozoan cysts and oocysts contribute to the fact that they are recognised as the main causes of waterborne parasitic diseases.

- The thick walled cysts and oocysts possess a unique structure and composition, which render them resistant to disinfectants such as chlorine.
- The size of the cysts and oocysts make them difficult to detect or remove physically.
- There is no simple test which can be used routinely to evaluate the occurrence of protozoan parasites in water, and
- the bacterial indicators traditionally used as indicators of the quality of water, have been found inadequate to assess the possible presence of protozoan parasites.

Furthermore, even though the numbers of cysts and oocysts in environmental waters are generally low, the minimum infectious dose is very small. Detection of cysts and oocysts under a light microscope is problematic because of their small size, low concentrations in environmental waters and the difficulty of identifying them amongst other debri.

No data were available at the initiation of this research project on the occurrence of protozoan parasites in water sources used by informal communities in the rural areas in South Africa. These communities often use surface water and groundwater, either directly or after limited treatment (chlorination only), for drinking purposes. In these informal communities the lack of, or limited, sanitation infrastructure results in increased levels of pollution of drinking water sources. Furthermore, pollution caused by increased amounts of domestic sewage coincides with increased levels of parasites, which in turn may lead to a higher incidence of disease.

AIMS

The aims of the study were:

- ❒ to investigate the occurrence of protozoan parasites in South African surface water used by informal communities for drinking purposes
- ❒ to investigate the survival of protozoan parasites in surface water (using seeded chamber studies), and
- ❒ to use the data obtained to devise appropriate guidelines for the treatment of water by informal developing communities

METHODOLOGY

Twelve sampling sites in two areas, namely Groblersdal/Marble Hall (Northern Province) and Hammanskraal/Moretele (Northwest Province), were selected for sampling. Samples consisted of borehole, river, treated tap, unprotected spring, canal and chlorinated river water. Information regarding the human activities and presence of animals in the vicinity of the sampling sites was also recorded.

The researchers distinguished three types of sampling points from which water samples were collected in this study. The three different types of sampling points were defined as:

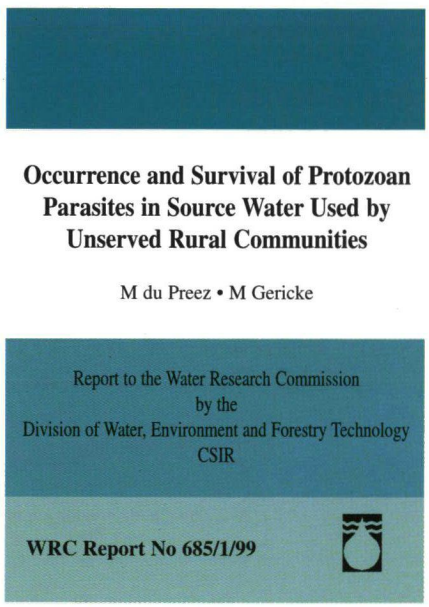
- ❒ raw and unprotected,
- ❒ protected but receiving no treatment, and
- ❒ water samples receiving some sort of treatment.

Water samples of a 100 litre volume were concentrated through wound cartridge filters. The *Crypto/Giardia*-Cell immunofluorescent kit from Cellabs, Australia was used for identifying presumptive *Giardia* cysts and *Cryptosporidium* oocysts in the final concentrate. Viability studies were conducted using seeded chambers suspended in river water at different temperatures. Cyst viability was determined using fluorescein diacetate.

RESULTS

The main results of this study were as follows:

- ❒ A large number of the source and drinking water sampling sites evaluated during the study were contaminated with *Giardia* cysts and *Cryptosporidium* oocysts.
- ❒ In the water samples analysed the *Giardia* cyst counts were higher than *Cryptosporidium* oocyst counts



- ❒ *Giardia* showed no seasonal prevalence, while *Cryptosporidium* occurred seasonally with high counts in summer. Counts increased after heavy rains.
- ❒ Sample analysis showed that human and animal activities at the unprotected water sampling sites adversely affected the microbial quality of the water.
- ❒ Heavy rain or damaged pumps and taps which affected the direct environment of a sampling point, as well as poor operation and management of purification plants, resulted in the occurrence of protozoa in treated water.
- ❒ Chlorination did not preclude the presence of the *Giardia* cysts or the *Cryptosporidium* oocysts.
- ❒ The presence of *Giardia* and *Cryptosporidium* did not correlate with faecal coliform counts, pH or water temperature.
- ❒ Seeded chamber studies in river water indicated that *Giardia* cysts remained viable for approximately six days at 20°C. Cysts were adversely affected at 35°C.
- ❒ Boiling, or heating water to 65°C for two minutes, will inactivate these protozoan parasites.

DISCUSSION

Water treatment

According to the report disinfectants such as chlorine, hydrogen peroxide, chlorine dioxide and ozone are not really effective for the inactivation of protozoan parasites. Heat application is a practical way to inactivate protozoan parasites. Boiling non-turbid water for one minute at sea level will inactivate vegetative cells of bacteria, viruses and cysts of *Giardia*. Even applying moderate heat (65°C for two minutes) will provide drinking water free of viable cysts. Pasteurization has also proved to be effective for inactivation of protozoan parasites. Commercial pasteurisation, 71.7°C for 15 seconds, is sufficient to render *Cryptosporidium* parvum oocysts non-infective .

Protection

Protection of untreated water sources is of great importance. The results obtained during this study clearly indicated that protection of sampling sites was the single most important factor in providing untreated water of high quality. This was highlighted by the results obtained for samples from protected boreholes. These water samples showed little faecal coliform contamination and protozoan parasites were detected only occasionally.

CONTAMINATION

According to the report it is necessary to examine the contributing sources of contamination and the control thereof, in order to set appropriate guidelines for the treatment of source water used by informal communities. The report indicates that the three major contributors to

A 100 litre volume water sample being taken at a protected borehole.

"High tech" chlorination apparatus for the treatment of river water for drinking water use.

A well in a backyard used for drinking water as well as for irrigating a vegetable garden.

oocysts and cysts detected in raw water are infected human beings, infected animals and the contribution from human activities:

- ❒ The contribution from infected human beings consist of:
  - sewage discharge
  - seepage from septic tanks pit latrines, etc.
  - accidental or deliberate defaecation
  - run-off from night soil

- ❒ The contribution from infected animals consist of:
  - pasturing infected livestock
  - infected wild animals
  - watering of infected animals and infected domestic animals

- ❒ The contribution from human activities consist of:
  - disposal of contaminated faeces
  - accidental spillages
  - disposal of infected faeces from abattoirs
  - disposal of sewage sludge to land

The researchers say control of contamination can be effected in terms of the broad control by authorities, as well as control within a community or household. The broader control should consist of monitoring these contributors and their associated activities for the presence of cysts and oocysts. This should provide occurrence data which may be used to determine levels of cysts and oocysts. It should also provide information on the impact the catchment has on raw water. Knowledge of the number of cysts and oocysts likely to contaminate a water-catchment or water-treatment works can be helpful in formulating catchment control policies. Furthermore, knowledge of the viability of cysts and oocysts coupled with catchment control policies can reduce the likelihood of viable protozoan cysts and oocysts entering source waters.

DATA

The researchers reported that the lack of information often impedes the control of contamination and protection of the water supply of informal communities in South Africa. They say access to epidemiological data regarding giardiasis and cryptosporidiosis is necessary to address this problem. This can be accomplished by requiring notification of the diseases. Monitoring hospital laboratories, health clinics and pathological

results will help to identify the prevalence of these diseases within the population. Presently there is no epidemiological data available, which will indicate the correlation between diarrhoea in the community and the presence of *Giardia* and *Cryptosporidium* in the drinking water.

There should be reliable advisory bodies to educate the communities and inform them of the dangers of protozoan parasites and of the positive effects of increased personal hygiene, as the routes of transmission is often the faecal-oral route and from person to person. Immunocompromised patients should be made acutely aware of the potentially devastating effects of cryptosporidiosis.

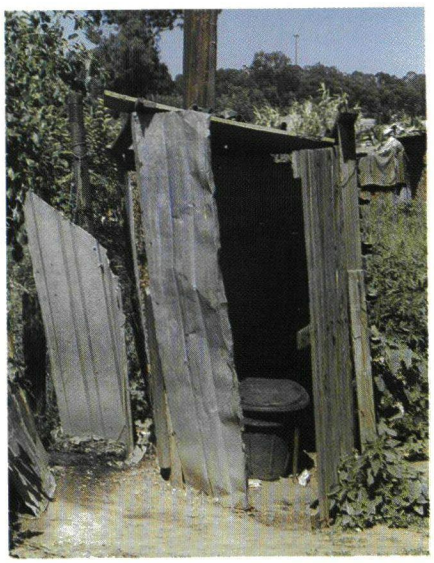
CONCLUSION

The researchers' conclusions can be summarised as follows:

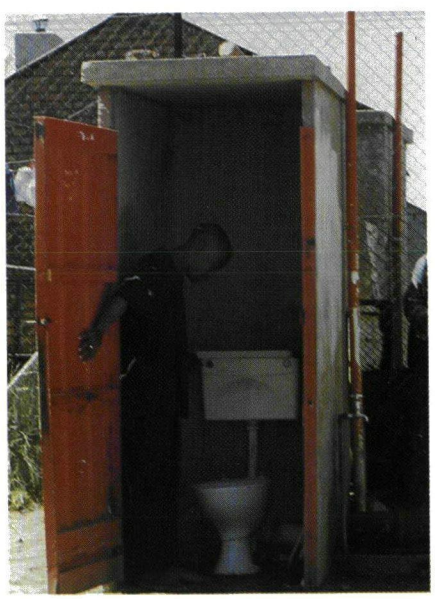
- ❒ Better protection against, and control of, parasitic contamination entering the water supply of informal communities is essential to limit contamination of drinking water.
- ❒ Treatment of water by boiling or heating (65°C for two minutes) will effectively inactivate protozoan parasites and provide drinking water free of viable cysts.
- ❒ Educational programmes, involving communities, to create an awareness of the dangers of protozoan parasites is also necessary. Knowledge of factors that contribute to the contamination of water sources with *Giardia* and *Cryptosporidium*, and of the fact that the diseases are often spread from person to person, can help prevent further pollution.
- ❒ Data and information, on both the occurrence of the parasites as well as the prevalence of the diseases, will be of great help with regard to the effective control of *Giardia* and *Cryptosporidium* contamination.

The report **Occurrence and Survival of Protozoan Parasites in Source Water Used by Unserved Rural Communities** (WRC Report no 685/1/99) is available, free of charge in South Africa, from the Water Research Commission, PO Box 824, Pretoria 0001. E-mail: library@wrc.co. org (Foreign order price: US $15 per copy, via surface mail.)

Pit latrine



Bucket latrine



Flush toilet

How does different levels of sanitation affect the surface water quality in a developing community?

Researcher Lize Pretorius of the Department of Civil Engineering at the Technikon Free State reports on the results of an investigation to determine the effects which different levels of sanitation have on the surface water in a typical developing community. The developing urban community of Bothshabelo in the Klein Modder River catchment proved to be an excellent choice as a study site with different levels of sanitation. A different type of sanitation is in dominant use in each of the subcatchments. The research showed clear correlations between the main sanitation level of a subcatchment and the microbiological pollution emanating from that subcatchment.

All surface runoff inevitably ends in a receiving water body such as a river, a dam or lake, and eventually the ocean. Under natural conditions these water bodies are, in the long term, able to absorb the fluctuations in runoff volumes and quality and a natural balance is maintained. However, human activities, are inclined to amplify the fluctuations and place unrealistic demands on the assimilation capacity of a receiving water body. The effect of stormwater runoff on receiving water can be either a short term shockloading impact

or a long term accumulation impact. An immediate effect of stormwater runoff is microbiological pollution that may pose a health risk and restrict water resource use, recreational use and fishing use of the receiving water. Pollutants that have a long term impact can cause depletion of the oxygen supply or may become available through resuspension, resulting in the disruption of the ecosystem.

There is a growing need for assessment of the impacts of urban and industrial development on the aquatic environment. Environmental strategies to improve environmental quality, without excessive cost, need be designed and implemented. However, in order to design environmental strategies, it is important first to identify sources of pollution, to quantify the possible pollutant load, and to identify the pathways of such pollutants into the aquatic environment.

STUDY AIM

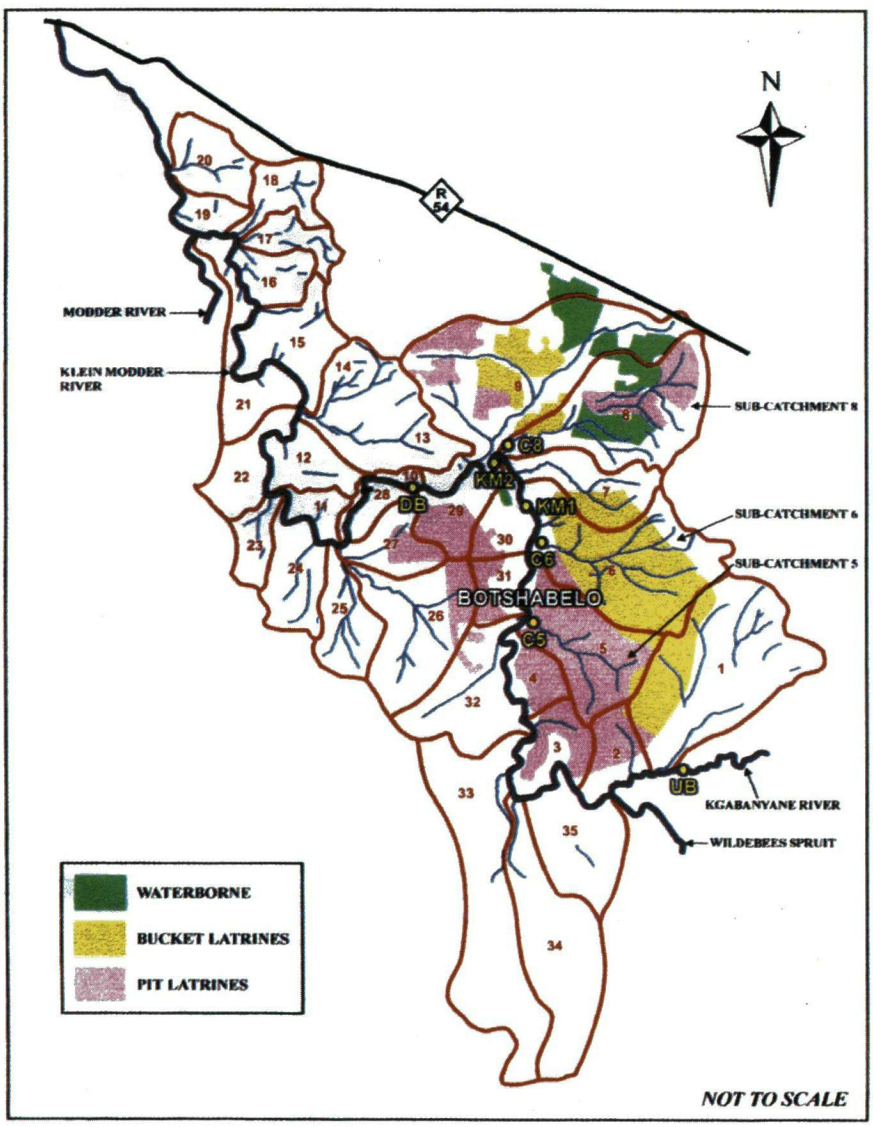
The primary objective of this study was to investigate the effect of various levels of sanitation on the quality of urban stormwater run-off. The Klein Modder River catchment, in the province of the Free State, South Africa, was selected as site for this study. Botshabelo is a large settlement in the catchment of the Klein Modder River. The sprawling township contains various types of developing urban profiles similar to those found elsewhere in developing urban areas in South Africa. The township also has substantial shortcomings in sanitation that could lead to pollution of stormwater run-off.

LEVELS OF SANITATION

The pollution impact of three sub-catchments of Botshabelo, where different levels of sanitation have been installed, was investigated. The typical sanitation systems were waterborne sewage, bucket latrines and pit latrines. The pollution impact was evaluated by means of measured microbiological indicators, which are generally used to define the safety of surface water bodies for human contact. The flood peaks in each catchment were also calculated, and it was established that the hydrological variance, as a factor to influence the variability of the results, could be neglected. The conclusion reached was that the extent of pollution is clearly determined by the level of sanitation systems and the quality of management of these systems.

DATA and RESULTS

All available data on the Klein Modder River catchment, in which the township of Botshabelo is situated, were acquired from the relevant Government Departments and Project Engineers. The catchment was divided into a number of sub-catchments. To assess the contamination of the stormwater run-off from the catchment, sub-catchments 5, 6 and 8 (see map) were chosen from the network. The different levels of sanitation of the sub-catchments are given in **table 1**.



Hydrological network and layout of Botshabelo sanitation system.

Table 1: Different levels of sanitation in sub-catchments.

Sub-catchment	Pit latrines	Bucket latrines	Waterborne systems
C5	6800	400	NONE
C6	360	6820	NONE
C8	NONE	2000	1500

** Compiled from official Town Council figures (1993).*

Table 2 compares the mean levels of microbiological indicator organisms in surface run-off in these three sub-catchments. The comparison of the three sub-catchments in relation to microbiological pollution, indicated that the magnitude of contamination appears to depend more

Table 2: Microbiological indicator organisms in surface run-off.

	FAECAL COLIFORMS			FAECAL STREPTOCOCCI			COLIPHAGES		
DATE	**C5**	**C6**	**C8**	**C5**	**C6**	**C8**	**C5**	**C6**	**C8**
NOV92	75 150	332 767	24 630	8 027	30 060	7 332	22 815	40 920	16 180
DEC92	30 000	88 818	10 900	28 000	47 328	2 479	2 300	5 527	1 018
JAN93	470 000	1 700 000	513 333	123 333	966 667	286 667	63 300	40 500	31 600
FEB93	125 000	2 226 667	85 500	53 332	299 500	11 600	17 950	36 650	7 750
MRC93	840 000	1 485 000	340 000	313 333	440 000	230 000	53 000	188 500	9 160
AUG93	103 000	130 667	1 933	30 667	80 667	347	5 300	33 300	100
Geo. Mean	**117 200**	**298 000**	**36 000**	**31 700**	**52 900**	**2 800**	**10 900**	**22 000**	**4 000**

** Organism counts per 100 ml for grab samples during rainfall on sub-catchments.*

on the degree of infrastructure provided and different levels of sanitation than land use changes like urbanisation.

POLLUTION FACTORS

Reasons for the high level of microbiological pollution in sub-catchment 6 might be due to the following:

❒ Bucket system

The bucket system was introduced as an emergency measure to cope with land invasions and the prohibitive cost of blasting pits in the rock in some areas. During the study period buckets were collected twice per week and emptied at specially constructed vehicle-discharging points on existing sewer lines. This system, during a decade of operation, has constantly been hampered by a host of difficulties such as:

- ❒ a shortage of equipment, notably trucks;
- ❒ a shortage of personnel, particularly drivers;
- ❒ problems with operation at the central bucket washing facility; and
- ❒ industrial and political action, notably so in 1993.

Institutionalised pollution could possibly have taken place, by municipal night soil removers indiscriminately dumping vacuum tanker contents in portions of the river in order to shorten their trips to the vehicle-discharging points.

A two week strike by sanitation workers on the bucket system in January 1993, was certainly one of the main reasons for the high microbiological indicator counts tested at the sampling point in catchment 6 during January 1993. The security threat to municipal workers coupled with municipal strikes compelled the inhabitants to bury the contents from full buckets in shallow furrows. During periods of rainfall these contents were flushed out and overflowed into the river system. Therefore, if the bucket system fails due to industrial strike or equipment failure, very high levels of faecal pollution enter the Klein Modder River when it rains.

❒ Pit Latrines

Even though the level of pollution in sub-catchment 5 (serviced mainly by pit latrines) is lower than sub-catchment 6, the microbiological indicator levels often approached levels found in raw sewage. As these pits essentially function as septic tanks, it has to be emptied on a regular basis. During the study period the current administration did not have sufficient staff and equipment to cope with the number of requests for emptying, consequently the pit latrines filled up and overflowed. In the low-lying areas stormwater entered pits, which overflowed onto the flood plain areas and into the Klein Modder River.

It is evident from the research results that lower levels of pollution, although still significantly high, emanate from the higher income area (situated in sub-catchment 8). In an earlier survey to determine how Botshabelo residents disposed of excrement, the majority of the respondents which did not have waterborne systems indicated that they use open areas for daily latrine needs.

RIVER POLLUTION

There were no remarkable changes in the mean levels of microbiological indicators in the Klein Modder River during dry weather and rainfall that cause no surface runoff. When surface runoff from the catchments did occur during heavier spells of rainfall, there was a significant rise in the levels of microbiological indicators in the riverbed. These contributions evidently originate from the catchments.

The mean faecal coliform values at all the sampling points in the Klein Modder River did not exceed 500 organisms per 100 ml during dry weather. However, during light showers the mean values increased to log 103, except at the sampling point upstream from the township. During heavy rainfall, when surface flow from the catchments contributed to river flow, the mean values for faecal coliforms in the Klein Modder River increased to log 104, except at the sampling point upstream from Botshabelo. The mean values for faecal coliforms during heavy rainfall at all sampling points exceeded safe risk limits in the target guidelines proposed by the Department of Water Affairs and Forestry for the quality of water used for full contact recreation. These values also far exceeded the target guidelines for potable water proposed by the same department.

CONCLUSION

The values obtained during the study period for faecal coliforms and faecal streptococci clearly indicated faecal pollution of the Klein Modder River. It was evident that the densities of both faecal coliforms and faecal streptococci rapidly increased after heavy rainfall, which caused run-off, and therefore suggest that these contributions originated from the township of Botshabelo. This was confirmed by the lower mean values for the sampling point upstream from the township.

For further information please contact : Lise Pretorius at the Department of Civil Engineering and Building, Technikon Free State. Tel: (051) 507-3911 or e-mail: Lpretori@tofs.ac.za

Aspects of hydrological sciences and the new Water Act:

Do plants use water?

Hugo Maaren, secretary of Sanciahs, says that as a hydrologist and agricultural engineer he has always spend a lot of time to better his understanding of the water use by plants. He shares a few thoughts about terminology and definitions with reference to the new Water Act.

Evapotranspiration is a well-understood term in many disciplines. A somewhat ironic situation has now arisen in South Africa. Among the principles underlying the new Water Act most hydrologists were very happy to see the following incorporated:

A.1 "In a relatively arid country such as South Africa it is necessary to recognise the unity of the water cycle and the interdependence of its elements, where evaporation, clouds and rainfall are linked to underground water, rivers, lakes, wetlands, estuaries and the sea".

A.2 "The variable, uneven and unpredictable distribution of water in the water cycle should be acknowledged".

At a recent meeting of the Coordinating Committee for Catchment Hydrology Research it was pointed out that if we talk of water use we should strictly speaking limit ourselves to Section 21 of the Water Act.

"21. For the purposes of this Act, water use includes:
(a) taking water from a water resource;
(b) sorting water;
(c) impeding or diverting the flow of water in a watercourse;
(d) engaging in a stream flow reduction activity contemplated in section 36;
(e) engaging in a controlled activity identified as such in section 37(1) or declared under section 38(1);
(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;
(g) disposing of waste in a manner which may detrimentally impact on a water resource;
(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process

(i) altering the bed, banks, course or characteristics of a watercourse;
(j) removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people; and
(k) using water for recreational purposes."

But to keep the hydrologists happy we have introduced a rather innovative concept of "Stream Flow Reduction Activity" (SFRA), where we implicitly introduce the thinking that there is a difference between a natural "loss" (as most civil engineers like to refer to it), and a man induced water use. Unfortunately, we also seem to be saying that natural vegetation does not use water, and that is of course non-scientific. We need to find an elegant solution to this problem.

Such thinking is probably similar to that regarding the difference between natural and accelerated erosion in geomorphology.

When the water use by alien invading woody plants was recently discussed, we proposed to use the term: "differential water use", meaning the water use over and above some natural base line. Or should we rather go back to basics and talk of natural evapotranspiration as the base line? Water use will only come into the picture if "that activity is likely to reduce the availability of water in a water course to the Reserve to meet international obligations, or to other water users significantly" (Section 36 of the Act).

The bottom line in the above scientific debate (or lack of science) is of course the question of significance. When is a man induced change in evapotranspiration significant enough to qualify as water use?

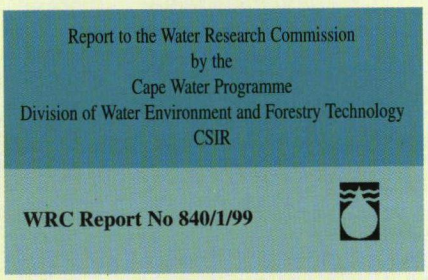
As hydrologists we know that this is the life long challenge ahead of us, how accurate can we get on this issue? And again we need to remind ourselves of the second principle underlying the Water Act: variability. The King is dead; long live the King.

Please note: If you have any contributions regarding the above subject, you are welcome to forward it to the Sanchias News column, SA Waterbulletin. E-mail: hugo or helene@wrc.org.za

New reports published by the Water Research Commission

The following reports are available free of charge (in South Africa) from the Water Research Commission in Pretoria. To order a copy, please contact the librarian, WRC, PO Box 824, Pretoria 0001. Tel: (012) 330-0340. Fax: (012) 331-2565. E-mail: library@wrc.org.za

A GIS-Based Experimental Methodology to Determine the Utilisable Potential of South African Aquifers



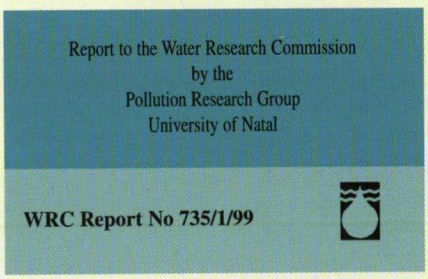
Report 840/1/99 - A GIS-based experimental methodology to determine the utilisable potential of South African aquifers. Report to the Water Research Commission by the Cape Water Programme, Division of Water, Environment and Forestry Technology, CSIR.

Authors: Cape Water Programme
Overseas price: US$ 20 (via surface mail)

The report presents the findings of a research project conducted to develop a methodology for determining the sustainable utilisable potential of South African aquifers. This potential is defined as the volume of groundwater that can be abstracted on a sustainable basis after the requirements of the reserve (the quantity of water required by law to ensure the preservation of the aquifer) have been met. The report provides a summary of the literature survey conducted in the initial phases of the project, it details the methodology developed and a theoretical case study is presented to assist the reader in understanding the methodology. The methodology is then applied to three study areas (aquifers which have already been modelled and for which extensive data have been captured). Discussion, recommendations and conclusions are drawn. Finally, a glossary of relevant terms is included at the end of the report.

The Promotion of the Internet as a Source of Information on Water and Sanitation

N Kibata • CA Buckley • FAO Otieno



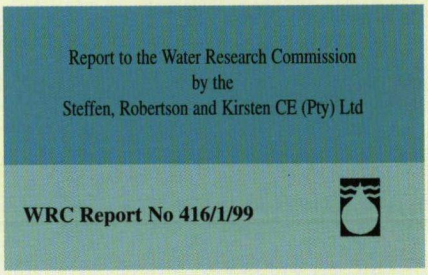
Report 735/1/99 - The promotion of the internet as a source of information on water and sanitation. Report to the Water Research Commission by the Pollution Research Group, University of Natal.

Authors: N Kibata, CA Buckley and FAO Otieno
Overseas price: US$ 20 (via surface mail)

Low level qualitative analysis of the impact of Internet usage in water and sanitation in South Africa was conducted. The research concludes that while a general scope exists for using the Internet to improve on the delivery of services in the water and sanitation sector, steps to enhance the process ought to be taken. The most important one involves improving on the supply side of the water and sanitation communication continuum. The report recommends various approaches for inculcating a culture of Internet usage by primary providers and organisations involved in water and sanitation.

Investigation into the Application and Performance of Constructed Wetlands for Wastewater Treatment in South Africa

A Wood



Report 416/1/99 - Investigation into the application and performance of constructed wetlands for wastewater treatment in South Africa. Report to the Water Research Commission by Steffen, Robertson and Kirsten CE (Pty) Ltd.

Author: A Wood
Overseas price: US$ 20 (via surface mail)

The majority of constructed wetlands operating in South Africa appear to have been designed with information based upon reports on overseas systems, or simple rule-of-thumb assumptions. In many cases this approach has resulted in systems failing to meet design objectives which is seen as limiting the more widespread acceptability of the technology. To address this issue the Water Research Commission sponsored an investigation into the performance of constructed wet-

lands for wastewater treatment.

The project identified a number of established constructed wetlands treating domestic waste waters which were investigated in some detail. This was undertaken (i) to provide an overview of how the systems perform relative to their design objectives, (ii) to identify factors affecting the performance of alternative configurations and operational approaches, (iii) to assess opportunities for improving the relative performance of the different treatment approaches and (iv) to provide general recommendations for the future implementation of the technology in South Africa. This report summarises the final results and conclusions.

High Resolution Space-Time Modelling of Rainfall: The "Strings of Beads" Model

Report to the Water Research Commission
by the
Department of Civil Engineering
University of Natal

WRC Report No 752/1/99

Report 752/1/99 - High resolution space-time modelling of rainfall: the "string of beads" model. Report to the Water Research Commission by the Department of Civil Engineering, University of Natal.

Authors: G Pegram and A Clothier
Overseas price: US$ 25 (via surface mail)

A valuable measure of the country's potentially available water resources is through rainfall measurements. These measurements help with the quantitative definition of drought and possible climatic change, besides providing information for the design of structures such as spillways, bridges, culverts, channels, stormwater drains, etc. On-line measurements of rainfall can help reduce the potential damage of floods. The calculations of run-off from flood-producing storms can be projected into the future to forecast flows in sensitive areas in flood-plains near rivers and through water-bodies stored behind dam walls.

Traditionally, rainfall measurement has been made using 120 mm and 200 mm diameter raingauges scattered randomly over the country. In South Africa the largest proportion of these were (and still are) read by volunteer observers at 08:00 each day and the daily totals collected by the South African Weather Bureau. There was a time (during the 1950s) when 4 500 or more of such gauges were "live" on any particular day, but the number of the daily read raingauges has dropped to 1 750 in 1999 with less than 600 of these reporting daily for the public good, and the numbers are still diminishing.

There is thus a need for remote sensing of rainfall using radar and satellite imagery. These technically advanced, relatively recent innovations provide detailed information about rain rates over large areas in sequences of images which are recorded typically at five minute intervals from radar and thirty minute intervals from satellite platforms. They thus have the potential to provide detailed information (in space and time) of rain rates which can be used in many applications.

The reason for modelling the rainfall process is so that possible future scenarios can be artificially generated to conduct "what-if" investigations. Because of the relatively recent advent of remote sensing of rainfall in South Africa, the radar records are quite short (three to five years) and do not provide, in themselves, an objective basis for some aspects of decision-making. However, there is a relatively large archive of data collected from daily read rain gauges which are too sparse, in many instances, to provide the spatial detail required in some analyses, but give the information needed to quantify the variability of the rainfall processes over a long time-base. It is therefore prudent and desirable to marry the long-term (but poor spatial) information in the archive of daily raingauge records with the finely detailed (but short) records obtained from radar. The report documents the crafting of a robust, adaptable model which is statistically correct and visually realistic when compared to typical radar images of areal rainfall.

Practical Application of Special Waste Co-Disposal with Municipal Refuse at the Coastal Park Landfill Bioreactor
Volume 1
PH Novella • RH Ballard • JG Stow • WR Ross
GE Blight • K Vorster

Report to the Water Research Commission
by the
Directorate: Water and Waste
Waste Management Department
Cape Metropolitan Council

WRC Report No 606/1/99

Report 606/1/99 - Practical application of special waste co-disposal with municipal refuse at the Coastal Park landfill bioreactor: Volume 1. Report to the Water Research Commission by the Directorate: Waste Management Department, Cape Metropolitan Council.

Authors: PH Novella, RH Ballard, JG Stow, WR Ross, GE Blight and K Vorster
Overseas price: US$ 35 (via surface mail)

The report explores the potential of landfill sites in South Africa to act as final depositories for special wastes at minimal environmental risk. The term special waste refers to both liquid and solid industrial wastes which are potentially hazardous to living organisms (such as metallic wastes, for instance). Special wastes are not permitted for discharge into the sewerage system as they would deleteriously affect the conventional biological purification process. Wastes of this nature have to be treated separately for inactivation prior to disposal in a containment landfill site. However, many areas do not have such special waste treatment and disposal facilities and the problem is often circumvented by illegal dumping into the sewer, the stormwater system or onto vacant ground with subsequent pollution of ground and surface water resources.

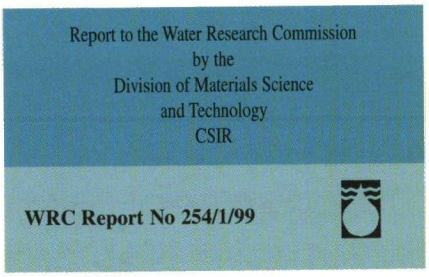
The co-disposal of special wastes with general wastes in sanitary landfills is being practised in many overseas countries, especially in drier areas which have a perennial water deficit. However, different approaches to co-disposal have led to quite different experiences and attitudes,

with the result that different perceptions of the values and dangers of the co-disposal practice have developed. The major perceived problems are the possible generation of a more polluted leachate.

In comparison, the co-disposal of special wastes with general wastes in sanitary landfills in South Africa has not been widely implemented to date, due to various reasons. Therefore, the Water Research Commission sponsored an investigation into the matter with the objective of developing practical operational criteria for the landfill co-disposal of selected special waste with general wastes. This could assist smaller landfill operators where only general waste landfills occur and where small volumes of special wastes must be disposed of.

Research on the Effects of Varying Water Quality on the Corrosion of Different Pipe Materials in the PWVS/Klerksdorp Areas

C Ringas • FJ Strauss • J Gnoinski • BG Callaghan



Report 254/1/99 - Research on the effects of varying water quality on the corrosion of different pipe materials in the PWVS/Klerksdorp areas. Report to the Water Research Commission by the Division of Materials Science and Technology, CSIR.

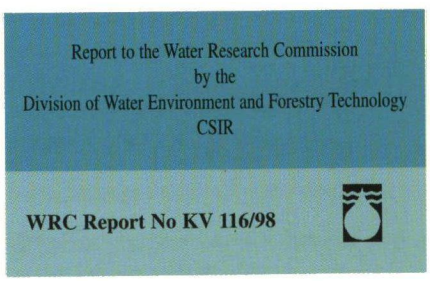
Authors: C Ringas, FJ Strauss, J Gnoinski, BG Callaghan
Overseas price: US$ 30 (via surface mail)

Over the past 30 years the mineral pollution of the water in the Vaal River increased to such an extent that the Water Research Commission initiated an investigation into the sources and extent of this mineral build-up and its possible effects on the most industrialised regions of South Africa.

The report looks at the corrosion characteristics of water introduced from sources other than the Vaal River, as well as blends of these waters with Vaal River water, on the performance of pipes in the Pretoria-Witwatersrand-Vereeniging-Sasolburg (PWVS) and Klerksdorp areas. The aim was to fully characterise the corrosive effect of the present water supply to the PWVS and Klerksdorp areas before the introduction of waters from other sources such as the Tugela River and the Lesotho Highlands Water Scheme could adversely affect existing pipework. The authors also tried to correlate water chemistry (and related indices) to actual corrosion studies in South Africa and evaluated the need for dezincification-resistant fittings for various water types in order to determine whether present restrictive practices are relevant and necessary.

Explanatory Notes for the Aquifer Classification Map of South Africa

R Parsons • J Conrad



Report KV 116/98 - Explanatory notes for the aquifer classification map of South Africa. Report to the Water Research Commission by the Division of Water, Environment and Forestry Technology at the CSIR in conjunction with Parsons and Associates Specialist Groundwater Consultants.

Authors: R Parsons and J Conrad
South African price: R68.40 (for the report and a map), includes sales tax and postage.
Overseas price: US$ 25 (via surface mail)

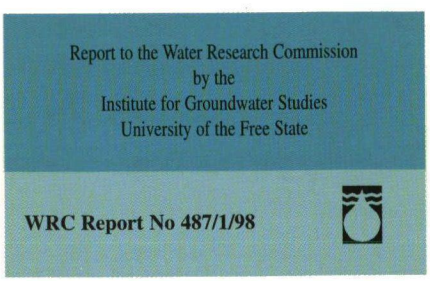
The Department of Water Affairs and Forestry's initiative to develop a strategy for managing groundwater quality required that an aquifer classification system be developed to provide a framework to support the regulatory system being developed.

Significant effort has already gone into mapping the country's groundwater resources. Examples are: the National Groundwater Resources of the Republic of South Africa map produced by Vegter in 1995 for the Water Research Commission, regional 1: 500 000 scale hydrogeological maps produced by the Department of Water Affairs and the National Groundwater Vulnerability map prepared by Reynders and Lynch in 1993.

This report is intended as a reference to the approach and techniques used to developed the Aquifer System Management Classification map, Aquifer Vulnerability map and Aquifer Contamination Susceptibility map. The principal purpose of the maps is to facilitate national planning.

Karoo Aquifers
Their Geology, Geometry and Physical Properties

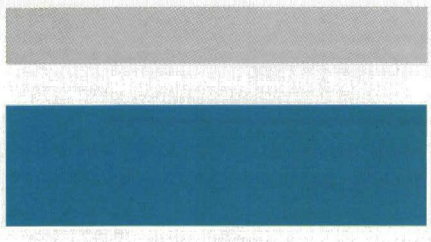
JF Botha • JP Verwey • I van der Voort
JJP Vivier • J Buys • WP Collinston • JC Loock



Report 487/1/98 - Karoo aquifers - their geology, geometry and physical properties. Report to the Water Research Commission by the Institute for Groundwater Studies at the University of the Free State.

Authors: JF Botha, JP Verwey, I van der Voort, JJP Vivier, J Buys, WP Colliston and JC Loock
Overseas price: US$ 35 (via surface mail)

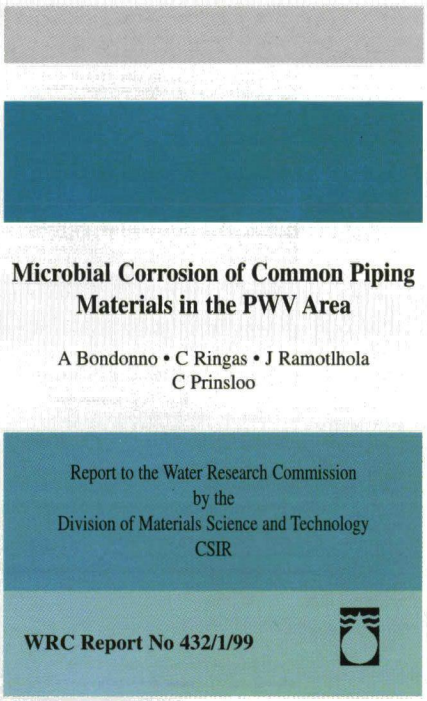
The common view in South Africa is that Karoo aquifers do not contain vast quantities of groundwater. However, large volumes of groundwater are pumped from mines and the basements of buildings daily, in areas underlain by the Karoo sediments, which is not what one would expect from aquifers with a limited yield. An attempt is made in this report to explain this apparent discrepancy. The explanation could only be achieved by reinterpreting some characteristics of the Karoo landscape, particularly the presence of dolerite dykes. The interpretation is somewhat controversial but it allowed the authors to explain the physical behaviour and properties of the aquifers concisely and consistently.



Report 535/1/98 - Use of filamentous fungi for the purification of industrial effluents. Report to the Water Research Commission by the Department of Chemical Engineering, University of Pretoria.

Authors: TH van der Westhuizen and WA Pretorius
Overseas price: US$ 20 (via surface mail)

This report summerises the results of an investigation into the use of a novel micro-screening process to convert industrial effluent COD into a saleable product. The report describes the development of the process on one specific effluent containing low acetic acid with inhibiting substances which made conventional biological treatment difficult. The process is, however, equally suitable for a large range of effluents in many of the organic industries world-wide.



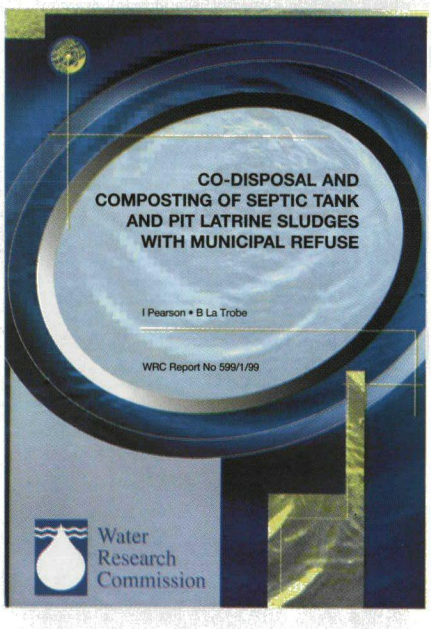
Report 432/1/99 (Volume 1) - Microbial corrosion of common piping materials in the PWV area.

Report 432/2/99 (Volume 2) - Microbial corrosion of pipe linings. A set of reports to the Water Research Commission by the Division of Materials Science and Technology at the CSIR.

Authors: A Bondonno, C Ringas, J Ramotlhola and C Prinsloo
Overseas price: US$ 40 (via surface mail) for the two reports.

Corrosion of potable water distribution pipelines not only affects the integrity of the system, but can also influence water quality by the release of corrosion products into the system. Severe corrosion can lead to leaks and bursts with the associated costs of water loss and pipe replacement.

The objectives of this study were to determine to what extent micro-organisms are involved in the corrosion of common piping materials in potable waters and how widespread the problem is in the PWV/Klerksdorp area. In the second study the researchers tried to critically determine whether various coating/lining systems were susceptible to microbiological attack; to determine the effects of sulphate reducing bacteria in the degradation of coating/lining systems and to recommend remedial measures if microbiologically influenced corrosion proved to be occurring on the lining systems.



Report 599/1/99 - Co-disposal and composting of septic tank and pit latrine sludges with municipal refuse. Report to the Water Research Commission by the Division of Water, Environment and Forestry Technology, CSIR.

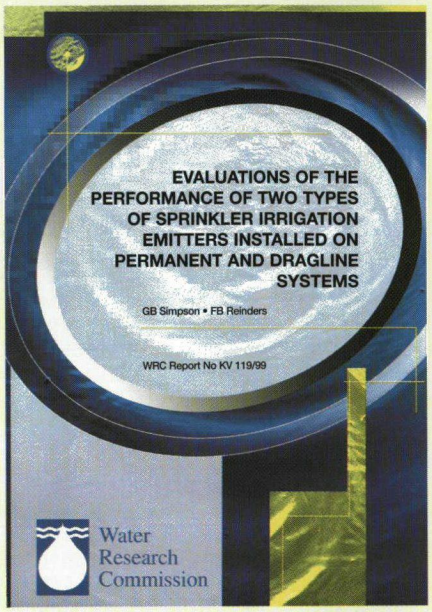
Authors: I Pearson and B La Trobe
Overseas price: US$ 15 (via surface mail)

An important maintenance aspect of on-site sanitation systems is the disposal of sludges from pit latrines and septic tanks when these are full and ready to be emp-

tied. Where large sewage treatment works are located nearby, the on-site sanitation sludges could be added to the inlet of the works without significantly affecting the operation of the plant. However, in many cases the closest treatment works is small and the addition of extra sludge could disrupt the biological processes of the works, or alternatively there is no sewage treatment works in close proximity to the site. In such cases, past practice has been to either move the latrine superstructure to a new site without emptying the old pit (in the case of pit-latrines), or to bury the sludges. (Some unscrupulous contractors have gone so far as to dump the sludges in open veld or dongas or even into large river systems. Reports from other parts of Africa indicate that the latter option is chosen in certain cases even by larger municipal authorities.)

In legislating and enforcing more environmentally acceptable sludge disposal methods, penalties should be balanced by incentives. One such incentive is the composting of sludge to produce an acceptable, safe soil conditioner and fertiliser. This is all the more significant in rural and peri-urban areas where agricultural activity forms a significant part of daily activities and food sustainability.

This report deals with the co-composting of pit latrine and septic tank sludge with domestic refuse, particularly garden wastes, as a viable and environmentally friendly disposal method, as well as a method of recycling these wastes for useful purposes.

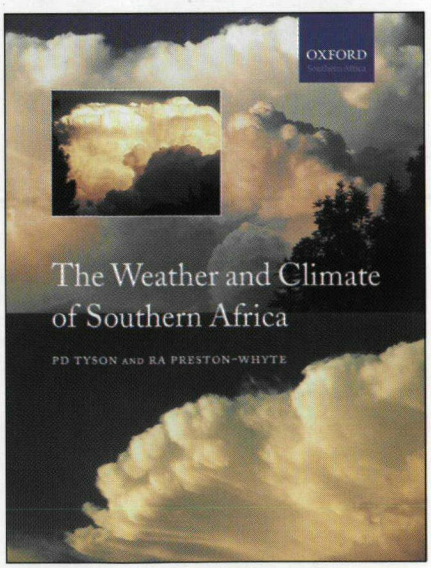


Report KV 119/99 - Evaluations of the performance of two types of sprinkler irrigation emitters installed on permanent and dragline systems. Report to the Water Research Commission by the ARC-Institute for Agricultural Engineering.

Authors: GB Simpson and FB Reinders
Overseas price: US$ 15 (via surface mail)

The report reviews evaluations performed on three sprinkler systems as they are utilised in-field to determine their hydraulic performance in terms of applying water to the crop. The systems evaluated were two impact sprinklers operating on a dragline system and the black pop-up Floppy sprinkler, which was developed in South Africa, on a permanent layout.

By determining the efficiency of sprinkler irrigation emitters in their associated design layout, guidelines can be established for selecting emitters, particularly in water scarce regions.



New book

The Weather and Climate of Southern Africa

by PD Tyson and RA Preston-Whyte

ISBN 0 19571806 2
FORMAT 240 x 170 mm
408 pages R225,00

This publication is probably the most comprehensive text available on Southern Africa's weather and climatic patterns.

First published in 1988 as The Atmosphere and Weather of Southern Africa, the book offers an introduction to the structure of the atmosphere and detailed, well-illustrated discussions on the physics of meteorology, measurement, weather systems, ocean-atmosphere interactions, pollution, climatic change and forecasting.

This new edition features fully revised, up-to-date information, over 380 figures and photographs and an extensive glossary of key terms.

With a new emphasis on the growing field of climatology, this book is especially pertinent to environmental studies on the developing countries of Southern Africa and the relationship of the subcontinent to global weather and climatic patterns. The book is an invaluable resource for those in the field and an important, authoritative textbook for students in environmental sciences.

Professor PD Tyson is the Director of the Climatology Research Group at the University of the Witwatersrand and a former member of the Water Research Commission.

Professor RA Preston-Whyte teaches in the School of Life and Environmental Sciences at the University of Natal, Durban.

Ordering details
Order from your nearest bookseller or contact Oxford University Press, Southern Africa Customer Services, PO Box 12119, N1 City, Cape Town 7463.
Telephone: (021) 595 4400.
Fax: (021) 595 4430/1.
E-mail: oxford@oup.co.za

JASWIC now accessible via WRC web site

http://www.wrc.org.za

Full details of all water services components and materials as accepted by JASWIC (Joint Acceptance Scheme for Water-Services Installation Components) may now be accessed through the WRC's web site.

Most local authorities and water services institutions in South Africa have Water and Sewage By-Laws of which the main objectives are:

- the prevention of the pollution of the water supplied to the consumer
- the prevention of waste of water.

One of the provisions of the By-Laws is that all water and drainage installation components shall be approved by the local authorities concerned before being used in any installation. Until 1984 each local authority had its own system for the evaluation of components as acceptable for inclusion in a water installation and these have been enforced with varying degrees of thoroughness. The procedure, whereby a separate approach was made to each local authority by a manufacturer or agent requesting acceptance of a component, caused duplication of work and often resulted in differing decisions being given owing to a lack of uniformity in the valuation procedures.

The original idea for the creation of an acceptance committee of local authorities to consider applications for the acceptance of water installation components, grew out of a series of discussions between the City Engineers of Cape Town, Durban, Johannesburg, Pretoria and Port Elizabeth who recognised the benefits to their respective local authorities of co-operation in this matter.

EVALUATION AND APPROVAL

Independent testing and evaluation of water installation components and materials are an essential part of the JASWIC system. In view of their expertise in such matters, the South African Bureau of Standards was asked to undertake this work. To avoid any conflict with the SABS mark scheme the Bureau merely conducts initial tests and inspections against JASWIC requirements and issues certificates of conformance. Approval for inclusion in the List of Accepted Components is a JASWIC prerogative.

This list of approved JASWIC components is now available for consulting, browsing and searching via the web site of the Water Research commission.

DATABASE

The database allows searching for products approved by JASWIC in the following categories:

- Product names
- Names of applicants for approval
- Names of manufacturers of components
- Application numbers

SEARCH

When the database is searched for e.g. product names, products may be selected from a list of component types. Under the listing 'Water meter' entries are displayed (see Figure 1). Clicking on a water meters supplied by a specific company, brings full details of the product listed, e.g.

Viewing details of application number 962/1	
Product	Water meter
Service type	Water
Catalog ref	Multijet 15mm & 20 mm
Specification	SABS 1529/1
Manufacturer	Trumax Associates
Importer	
Distributor	
Applicant	Premier Valves (Pty) Ltd
Date received	26/04/1995
Receipt number	0830-3928-9786
Receipt date	5/05/1995
Date circulated	/ /
Status	ACCEPTED
Expiry date	/ /
Notification date	14/06/1995
Quit/close	

For enquiries about JASWIC and the components database, please contact:
The SecretaryTel.(031) 302 4707
JASWICFax(031) 302 4699
c/o Durban Metro Water Services
E-mail: barrypo@durban.gov.za
PO Box 1038
Durban 4000

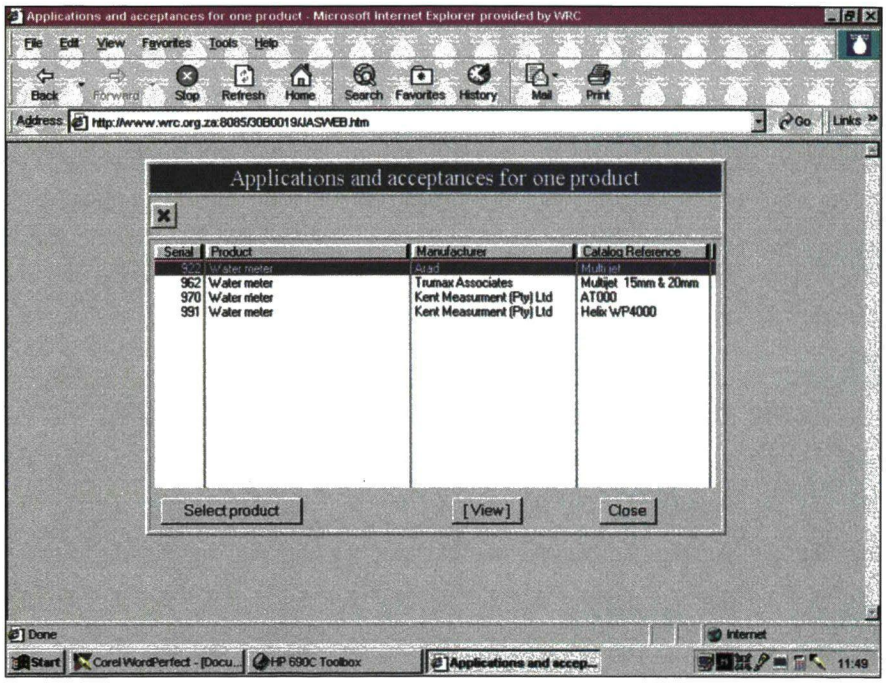


Figure 1: Searching the JASWIC Components List for 'Water Meters'.

SA WATERKALENDER

The Water Research Commission is placing this calendar in order to assist with the co-ordinating of water events in South Africa.

You are invited to send information about conferences, symposia or workshops to the SA Waterbulletin.

Address:
The Editor,
SA Waterbulletin,
P.O. Box 824,
0001 Pretoria
Tel (012) 330-0340
Fax (012) 331-2565

Legend:
- ❍ An SA Water Event arranged for these dates.
- ❑ 2nd SA Water Event scheduled for these dates.
- × 3rd SA Water Event scheduled for these dates.

See conferences and symposia pages for events.

2000

JANUARY

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Die Waternavorsingskommissie plaas hierdie kalender om te help met die koördinering van watergebeurtenisse in Suid-Afrika.

Alle belanghebbendes word uitgenooi om inligting aan SA Waterbulletin te stuur.

Adres:
Die Redakteur
Posbus 824
0001 Pretoria
Tel: (012) 330-0340
Fax: (012) 331-2565

Gids:
- ❍ Een SA Watergeleentheid vir hierdie dae.
- ❑ 'n Tweede SA Watergeleentheid vir dié datums.
- × 'n Derde SA Watergeleentheid vir dié datums.

Sien Konferensies- en Simposiumbladsy vir aangeduide geleenthede.

2001

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SOUTHERN AFRICA

2000

SULPHATE REMOVAL
AUGUST 22 - 23
A technology transfer workshop on biological sulphate removal will be held at the CSIR Conference Centre in Pretoria.
Enquiries: Ms Fransisca Bakker, Wates, Meiring & Barnard, PO Box 6001, Halfway House 1685. Tel (011) 254-4822. Fax (011) 315 0317. Cell 082 897 9996. E-mail: fransiscab@wmb.co.za

WATER AFRICA
AUGUST 22 - 24
The Water Africa 2000 conference will be held at Crown Plaza, Sandton. Theme - Building global strategies for water development and investment.
Enquiries: Zinhle Mpungose - tel (011) 463 2802. Fax (011) 463 - 6000. E-mail address: zinhlem@aic-africa.com

ENVIRONMENTAL AUDIT
AUGUST 28 - SEPTEMBER 1
The next ISO 14001 environmental auditor training course will be held at Eskom Conference Centre in Midrand. The course is accredited by EARA UK and presented by Aspects International UK.
Enquiries: Crystal Clear - tel (011) 882 3368.

WASTECON
SEPTEMBER 5 - 7
The Institute of Waste Management will hold its biennial conference and exhibition with the theme "Integrated waste management in the new millennium" at Somerset West, near Cape Town.
Enquiries: Conference Secretariat, PO Box 3483, Tygervalley 7536. Tel: (021) 99 3172. Fax: (021) 99 4707. E-mail address: wastecon2000@mweb.co.za Website: www.weirenvig.co.za/wastecon2000

ENVIRONMENTAL MANAGEMENT
SEPTEMBER 19 - 21
A Course on environmental management will be held at the Post Graduate Centre of the University of Pretoria.
Enquiries: Mr Francois Friend. Tel 082 554 8900. Fax (012) 362-5173. E-mail: ffriend@postino.up.ac.za

AQUACULTURE
SEPTEMBER 26 - 29
The 5th Aquaculture Association of Southern Africa (AASA) symposium - Aquaculture Africa - will be held in Pretoria.
Enquiries: Congress Secretariat, Private Bag X519, Silverton 0127. Fax: (012) 804 0753.
E-mail: Elmarie@ing1.agric.za. Web site: www.arc.agric.za

IRRIGATION
OCTOBER 22 - 27
The 6th international micro-irrigation congress together with the 51st IEC meeting of the International Commission on Irrigation and Drainage (ICID) will be held in Cape Town.
Enquiries: The Congress Secretariat, PO Box 36815, Menlo Park 0102. Tel: (012) 344 0390. Fax: (012) 344 5643. E-mail: reservations@parkgables.co.za.

AGROCHEMICALS
OCTOBER 25 - 26
A workshop on the control of adverse impacts of fertilizers and agrochemicals will take place in Cape Town, South Africa.
Enquiries: Prof A Mermoud, Institute of Soil and Water Management (IATE), Swiss Federal Institute of Technology, 1015 Lausanne, Switzerland. Tel: +41-21-693-3726. Fax: +41-21-693-3739. E-mail address: andre.mermoud@epfl.ch

GROUND WATER
NOVEMBER 1 - 3
A course - an introduction to ground water - will be presented at the University of the Witwatersrand in Johannesburg.
Enquiries: The Secretary, Ground Water Division, GSSA. Tel: (012) 803-1545. E-mail: gwd@icon.co.za. An enrolment form is available in this Bulletin.

VAAL RIVER
NOVEMBER 7 - 8
The Vaal River Conference 2000 will be held at the Vaal Riviera Resort near Vanderbijlpark.
Enquiries: Lesley Stephenson, Division of Continuing Engineering Education, University of the Witwatersrand, PO Box 327, WITS 2050. Tel: (011) 716-5091. Fax: (011) 339-7835. E-mail: stephenson@egoli.min.wits.ac.za Website: www.cee.co.za

HYDROGEOLOGY
NOVEMBER 26 - DECEMBER 1
The International Association of Hydrogeologists' (IAH) XXX Congress 2000 with the theme Groundwater: Past achievements and Future challenges will be held at the University of Cape Town.
Enquiries: Conference Secretariat, IAH 2000, Conferences *et al*, PO Box 452, Stellenbosch 7599. Tel: (021) 886-4496. Fax: (021) 883-8177. E-mail address: deidre@iafrica.com. Web: http://fred.csir.co.za/conferences/iah/

2001

SASAQS 2001
JULY 1 - 6
The 36th conference of the Southern African Society of Aquatic Scientists will be held at Aventura Eco Eiland in the Northern Province. The theme will be "Aquatic ecology and resource management in Southern Africa".
Enquiries: Mr P Fouche. Tel: (01596) 28383. E-mail addrress: pso@caddy.univen.ac.za

AFRIWATER EXHIBITION
AUGUST 15 - 17
The international African water, waste & environmental exhibition will be held at Gallagher Estate, Midrand.
Enquiries: Craig Newman, TML Reed Exhibitions. Tel: (011) 886-3734. Fax: (011) 789-6497.
E-mail: craign@tmlreed.co.za

AFRIWATER SEMINARS
AUGUST 15 - 17
The Water Institute of Southern Africa will organise a series of half-day seminars on pertinent topics at the Gallagher Estate in Midrand.
Enquiries: Roelien Bakker, WISA. Tel: (011) 805 6368. Fax: (011) 315 1258. E-mail address: conference@wisa.co.za

OVERSEAS

2000

GIS
SEPTEMBER 2 - 8
The 4th international conference on integrating geographical information systems and environmental modelling will be held in Alberta, Canada.
Enquiries: GIS/EM4, University of Colorado, Boulder, CO 80309-0216, USA. Tel: +303 497 6330. Fax: +303 497 6513. Web: http://www.colorado.edu/research/cires/banff/

MINE WATER
SEPTEMBER 11 - 15
The 7th international mine water association congress with the theme: "Mine water and the Environment" will be held in Katowice-Ustron, Poland.
Enquiries: Dr Andrzej J Witkowski, University of Silesia, Bedzinska Str 60, 41-200 Sosnowiec, Poland. E-mai addressl: awitkows@us.edu.pl Tel: +48 32 291 6888. Fax: +48 32 291 5865.

WATERMATEX 2000
SEPTEMBER 18 - 20
Watermatex 2000 conference with the theme "System analysis and computing in water quality will be held in Gent, Belgium.
Enquiries: Prof Peter Vanrolleghem, Biomath Department, University of Gent, Coupure Links 653, B-9000 Gent, Belgium. E-mail address: peter.vanrolleghem@rug.ac.be Tel: +32 9 264 5932. Fax: +32 9 223 4941.

FLOODS
SEPTEMBER 20 - 23
An international symposium on flood defence will be held in Kassel, Germany.
Enquiries: DIV Ashauer, c/o Universitat Gh Kassel, PO Box 101380, D-34109 Kassel, Germany. Tel: +49 561 804 3203. Fax: +49 561 804 3952. Web: http://www.unikassel.de/fb14/wasserbau/symposium2000/

WATER MANAGEMENT
SEPTEMBER 25 - 28
An international workshop on information for sustainable water management will be held in Nunspeet, the Netherlands.
Enquiries: Van Namen & Westerlaken, PO Box 1558, 6501 BN Nijmegen, the Netherlands.
E-mail: regmtm.III@congres.net. Tel: +31 24 323 4471. Fax: +31 24 360 1159. Web address: http://www.minvenw.nl/rws/riza/bcm/projecten/mtm-3/mtm-3.htm

WATER TREATMENT
SEPTEMBER 26 - 29
A conference on "Innovations in classic and conventional water treatment processes" will be held in Amsterdam, the Netherlands.
Enquiries: KIWA NV Research and Consultancy, PO Box 1072, 3430 BB Nieuwegein, The

Netherlands. Tel: +31 30 6069532. Fax: +31 30 6061165. E-mail: jschippe@kiwaoa.nl

SURFACE WATERS
OCTOBER 1 - 4
An international conference on agricultural effects on ground and surface waters with the theme "Research and policy at the edge of science and society" will be held in Wageningen, the Netherlands.
Enquiries: Joop Steenvoorden, Postbox 125, 6700 AC Wageningen, the Netherlands. E-mail: j.h.a.m.Steenvoorden @sc.dlo.nl Tel: +31 317474 311. Fax: +31 317 474812. Web site address: http://www.sc.dlo.nl

WATER RESOURCES
OCTOBER 2 - 6
An international workshop on integrated water resource management will be held in Denver, Colorado, USA.
Enquiries: International Affairs Team, D-1520, US Bureau of Reclamation, PO Box 25007, Denver, Colorado 80225. Tel: 303-445-2127. E-mail: lprincipe @do.usbr.gov

MEMBRANES
OCTOBER 3 - 6
An international conference dealing with membranes in drinking and industrial water production will be held in Paris, France.
Enquiries: IWSA Secretariat, 1 Queen Anne's Gate, London SW1H 9BT, Great Britain. Tel: +44 171 957 4567. Fax: +44 171 222 7243. E-mail: IWSA@dial.pipex.com

RIVER BASINS
OCTOBER 9 - 12
An international workshop on runoff generation and the implications for river basin management and modelling will be held in Freiburg, Germany.
Enquiries: IAHS/ICT Workshop 2000, University of Freiburg, Fahnenbergplatz, D-79098, Freiburg, Germany. E-mail address: uhlenbro@uni-freiburg.de Tel: +49 761 203 3546 Fax: +49 761 203 3594.

CLIMATOLOGY
OCTOBER 16 - 20
ECAC 2000: the 3rd European conference on applied climatology will take place in Pisa, Italy.
Enquiries: Antoinetta Falci, CNR-IATA, via Caproni n.8, 50145, Florence, Italy. Tel: +39 055 301504. Fax: +39 055 308910. Web site: http://www.lamma.rete.toscana.it/ecac2000/

POLLUTION
OCTOBER 16 - 18
The IEP 2000 conference on issues in global change - conflicting demands on water, air and land resources in a changing global environment will be held in Lisbon, Portugal.
Enquiries: Gill Heaton. E-mail: gill.heaton@virgin.net Web site: http://www-elsevier.nl/locate/iep2000

WASSER BERLIN
OCTOBER 23 - 25
Congress Wasser Berlin 2000 will be held in Berlin.
Enquiries: The Organiser, Wasser Berlin 2000, Messedamm 22, 14055 Berlin. Tel: +49 30 3038 2085. Fax: +49 30 3038 2079. E-mail address: wasser@messe-berlin.de Web address: http://www.messe-berlin.de

WATER MANAGEMENT
OCTOBER 24 - 25
A conference with the theme "Water management for the 21st century - learning from the 20th century experience" will be held in Berlin, Germany.
Enquiries: IWA Headquarters, Wasser Berlin Conference, Alliance House, 12 Caxton Street, London SW1H 0QS, UK. E-mail address: hannah.clark @iwsa.org.uk Tel: +44 207654 5500 Fax:+44 207654 5555.

WATER QUALITY
NOVEMBER 5 - 8
The AWWA 2000 water quality technology conference will be held in Salt Lake City, UT, USA.
Enquiries: Clare Haas, AWWA, USA. E-mail:chaas@awwa.org Tel: +303 347 6194 Web address: http://www.awwa.org/tande /awwaconf.html

WEDC
NOVEMBER 5 - 8
The 26th WEDC conference with the theme "Water, sanitation and hygiene - challenges of the millennium" will be held in Dhaka, Bangladesh.
Enquiries: Prof John Pickford, WEDC Loughborough University, LE11 3TU, England. E-mail: j.a.pickford@lboro.ac.uk Fax: +44 1509 211027.

CLIMATE
NOVEMBER 6 - 10
The 2nd SPARC general assembly on stratospheric processes and their role in climate will be held in Mar del Plata, Argentina.
Enquiries: SPARC Office. Fax: +33 164 474316. Web: http://www.aero.jussieu.fr/~sparc/

WATER POLLUTION
NOVEMBER 11 - 16
The 7th international conference on wetland systems for water pollution control will be held in Lake Buena Vista, Florida, USA.
Enquiries: Mandy Padgett, University of Florida, Institute of Food and Agricultural Sciences, USA. E-mail: mrp@gnv.ifas.ufl.edu Tel: +352 392 5930. Fax: +352 392 9734. Web site: http://www.ifas.ufl.edu/~conferweb/wpc/

WATER SUPPLY
NOVEMBER 15 - 17
The 5th international symposium on water supply technology will be held in Kobe, Japan.
Enquiries: Secretariat, c/o Congress Corporation, Congress Bldg, 3-6-13 Awaji-machi, Chuo-ku, Osaka 541-0047 Japan. Tel +81 6 6229 2595. Fax +81 6 6221 3071
E-mail: wst2000@congre.co.jp

REMEDIATION
DECEMBER 4 - 8
The 2000 Contaminated site remediation conference will be held in Melbourne, Victoria, Australia.
Enquiries: The Conference Secretariat, PO Box 257, South Perth 6951, Western Australia. Tel: +61 8 9450 1662. Fax: +61 8 9450 2942. E-mail address: convlink@ wantree.com.au. Web: http://www.clw.csiro.au/CGS/conf/2000CSRC/

GROUNDWATER
DECEMBER 13 - 16
A conference on groundwater - a transboundary, strategic and geopolitical resource - will be held in Las Vegas, Nevada, USA.
Enquiries: Bob Masters. E-mail: rmaste@ngwa.org Web address: http://www.ngwa.org/education/agwse2.html

WATER RESOURCES
DECEMBER 19 - 21
An international conference on integrated water resources for sustainable development will be held in Roorkee, India.
Enquiries: Dr B Soni, ICIWRM 2000, National Institute of Hydrology, Roorkee-247 667, India. E-mail: iciwrm@cc.nih.ernet.in Tel: +91 1332 72106. Fax: +91 1332 72123. Web: http://www.nih.ernet.in

2000

SEWERS
FEBRUARY 5 - 8
The 2nd international conference on interactions between sewers, treatment plants and receiving waters in urban areas (INTERURBA II) will be held in Lisbon, Portugal.
Enquiries: Conference Secretariat. E-mail: gaby@civil.ist.utl.pt Tel: +351 1841 8365. Fax: +351 1849 7650.

SLUDGE
MARCH 25 - 28
A symposium on sludge management entering the 3rd millennium - industrial, combined and water works residues will be held in Taipei, Taiwan.
Enquiries: Dr DJ Lee, Department of Chemical Engineering, National Taiwan University, Taipei 106, Taiwan. E-mail address: djlee@ccms.ntu.edu.tw Tel: +886 22362 5632. Fax: +886 22362 3040.

ODOURS
MARCH 25 - 29
The 2nd IAWQ symposium on odours with the theme "Measurement, regulation and control techniques" will be held in Sydney, Australia.
Enquiries: Dr John Kaiyun Jiang, Centre for Water and Waste Technology, School of Civil Engineering, University of South Wales, Sydney 2052, Australia. E-mail: johnj@unsw.edu.au Tel: +61 2385 5452. Fax: +61 2313 8624.

WETLANDS
MAY 27 - JUNE 1
The 22nd annual meeting of the society of wetland scientists will be held in Chicago, IL, USA.
Enquiries: Web: http://www.sws.org/chicago/

WATERSHED MANAGEMENT
JUNE 10 - 15
A symposium on diffuse/nonpoint pollution and watershed management will be held in Milwaukee, USA.
Enquiries: Professor Vladimir Novotny, Institute for urban environmental risk management, Marquette University, Milwaukee, WI 53201-1881, USA. E-mail: novotny@execpc.com Tel: +414 288 3524. Fax: +414 2887521.

FIRST ANNOUNCEMENT

ANAEROBIC PROCESSES DIVISION OF THE
WATER INSTITUTE OF SOUTHERN AFRICA

TECHNOLOGY TRANSFER WORKSHOP *on* BIOLOGICAL SULPHATE REMOVAL

CSIR, Pretoria
22 - 23 August 2000

WORKSHOP FOCUS:

The workshop will address one of the most pressing environmental topics facing the mine-and industrial wastewater sectors currently - sulphur polluted waste and wastewater. The workshop will concentrate on biological technologies for the treatment of wastewater, and liquids.

The event will actively involve international leading expertise and local key role players in this specialist field. Special attention will be given to the recently published "Environmental Technologies to Treat Sulphur Pollution", presented by one of the authors, Dr Hulshoff-Poll (The Netherlands).

TOPICS:

Sulphur cycles, treatment of sulphurous components, formation of sulphuric acid in sewers, anaerobic sulphate processes, biological sulphate removal, novel developments, treatment of AMD, biological remediation of inorganic wastewater, management tools, treatment of S-containing gases / solids / sediments, biodegradation of sulphur, metal-sulphur interaction, microbial aspects, corrosion, case studies and practical applications.

WHO SHOULD ATTEND:

Managers, practitioners, scientists and engineers from mining and industrial sector, government and local authority officials, academics and researchers.

WORKSHOP FEES:

WISA members: R1 200
Non-WISA members: R1 400
(Cheques payable to WISA)
Please make your own accomodation arrangements

ENQUIRIES:

André van Niekerk
Wates, Meiring, Barnard
Tel: (011) 254 4800
Fax: (011) 315 0317
E-mail: andrevn@wmb.co.za

Marlene van der Merwe-Botha
Krugersdorp Water Care Works
Tel: (011) 413 1030
Fax: (011) 413 1022
E-mail: marlenev@yebo.co.za

INTRODUCTORY COURSE
in
WATER MICROBIOLOGY

Division of Water,
Environment and Forestry Technology
CSIR • Pretoria

12 to 15 September 2000

The Water Resources Management Programme, CSIR, is presenting a course for people in the water industry who need to know more about the basic techniques used in the microbiological analysis of water. The course is recommended for industries, municipalities, government departments, water boards and water bottlers.

The course will be limited to a maximum of 10 participants to ensure personal attention. They will be trained in the basic concepts of health related water microbiology. The theoretical (theory 25% and lectures 15%) and the practical (60%) aspects to be covered will include:

- Detection and enumeration of indicators of pollution (heterotrophic plate count, total and faecal coliforms, faecal streptococci, coliphage and the confirmation of *E. coli.*
- Demonstration of the detection of other pathogens in water (viruses, parasites and *Legionella*).
- Interpretation and reporting of results.
- Lectures on water purification and water disinfection, the importance of the chemical composition of water and their related health implications, the geology and hydrology of ground water.
- Quality control and laboratory safety.

A certificate of attendance will be issued on completion of the course.

Should you be interested, please contact:
Pauline Coubrough
Tel: (012) 841 3952
Fax: (012) 841 2506
E-mail:pcoubrou@csir.co.za

Water, Environment and Forestry Technology
CSIR