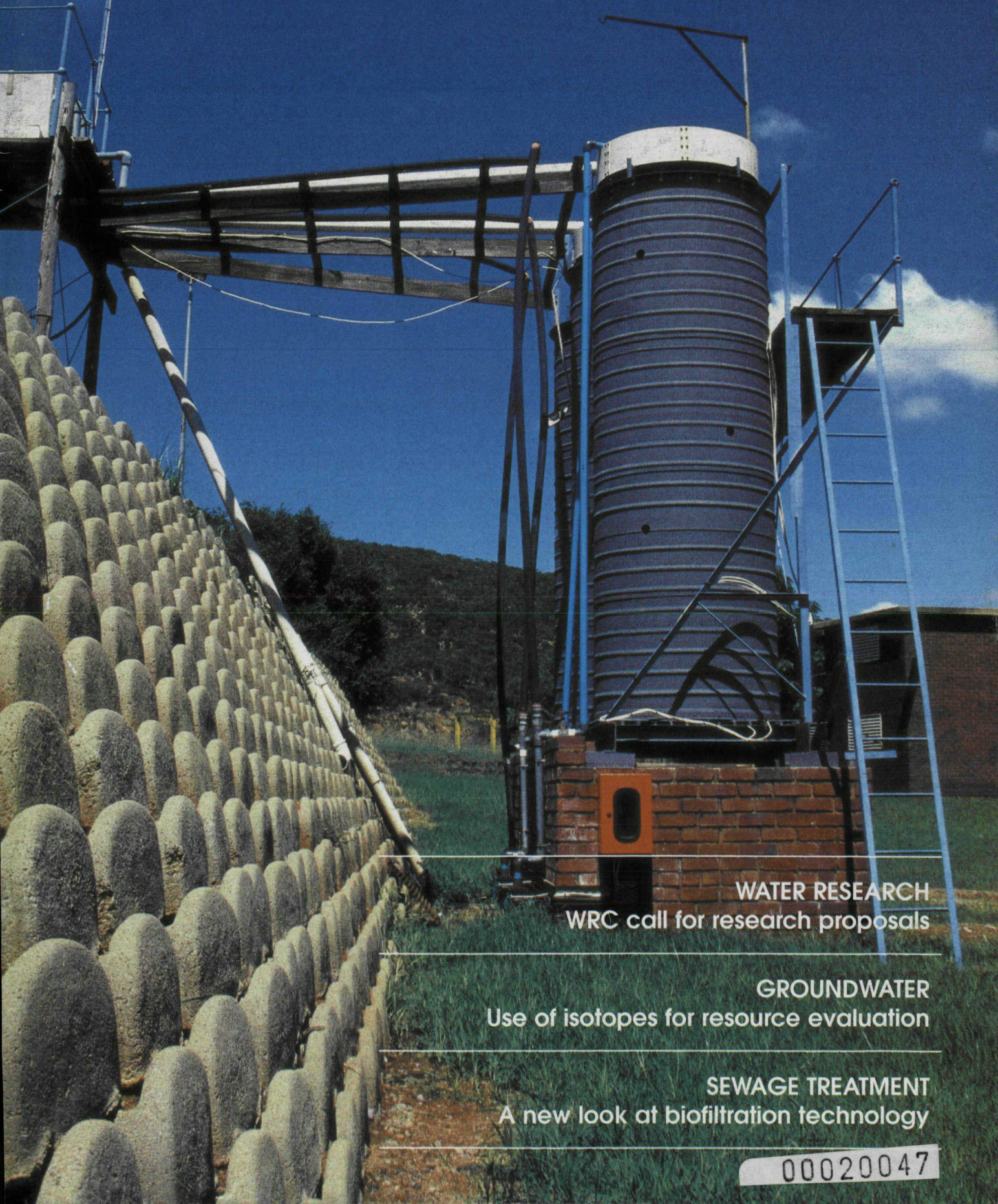


S4 waterbulletin

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Januarie/Februarie 2000



WATER RESEARCH
WRC call for research proposals

GROUNDWATER
Use of isotopes for resource evaluation

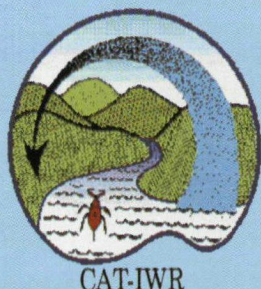
SEWAGE TREATMENT
A new look at biofiltration technology

00020047

ANNOUNCEMENT OF A COURSE IN INTRODUCTORY AND ADVANCED AQUATIC TOXICOLOGY

presented by

**Centre for Aquatic Toxicology
Institute for Water Research
Rhodes University**



*Contributing to
sustainable management of
water resources in southern Africa*

About the course

The application of aquatic toxicology in Ecological Risk Assessment and water resource protection and management is becoming increasingly important in South Africa. With this in mind, CAT-IWR has developed Introductory and Advanced Toxicology courses. The series offers a comprehensive overview of aquatic toxicology and how aquatic toxicological data can be utilized by water resource managers and industry. Lectures provide the theoretical framework for the course while the practical sessions demonstrate the application of the theory. The Introductory Aquatic Toxicology course is an introduction to basic aquatic toxicology and covers such topics as acute and chronic toxicology, testing single substances and whole effluents for toxicity, selecting suitable and relevant test organisms, as

well as designing toxicity experiments and data analysis. The application of aquatic toxicity data in water quality management in South Africa will be introduced. Further application of aquatic toxicology in water resource protection and management, and its application in industry and Ecological Risk Assessment will be demonstrated in the Advanced Aquatic Toxicology course. Experts will lecture on diverse topics such as the role of environmental chemistry in aquatic toxicology and the development of an accredited aquatic toxicology laboratory. The advanced course follows on from the introductory course, but may also be attended by delegates who can prove an understanding of the basics of toxicology.

Where and when

Both courses will be held in Grahamstown
Introductory Aquatic Toxicology:
5 - 10 June 2000
Advanced Aquatic Toxicology:
12 - 17 June 2000

Cost

Course fees for the Introductory Aquatic Toxicology and Advanced Aquatic Toxicology module are **R5 500** each. However, attendance of both courses in the same year will cost **R9 000** (*costs exclude accommodation*).

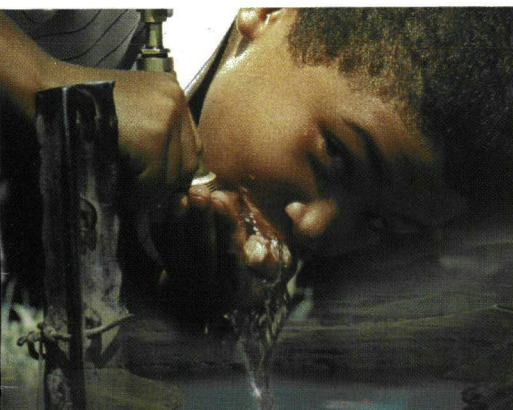
Enquiries

Dr Tally Palmer or
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Dr Nikite Muller
Tel: 046 - 6222428 or 6038532
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E-mail: cat@iwr.ru.ac.za

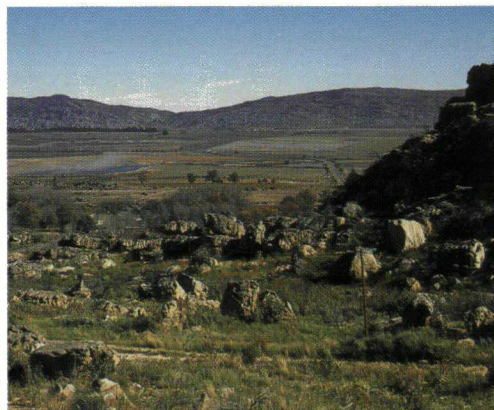


RHODES UNIVERSITY
Where leaders learn

DEADLINE FOR REGISTRATION IS 28 APRIL 2000



p 6



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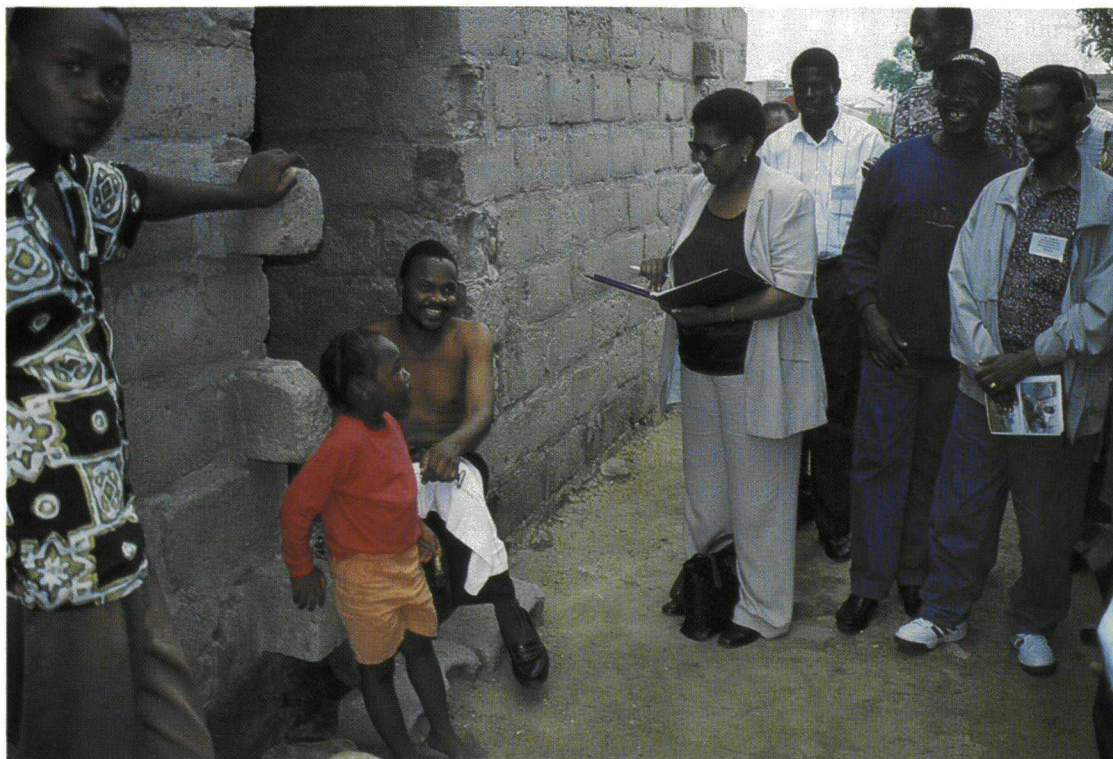
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Cover: A side view of the biofiltration pilot plant at Baviaanspoort (see p 20). (Photo: Jan du Plessis)

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Ms BP Sonjica MP, chairperson of the Parliamentary committee on water, with international delegates, talking to community members on one of the field trips.

Workshop on financing community water supply

The need to extend water and sanitation services to the poor is recognised as critical for Africa's long term development. To explore these important issues the Department of Water Affairs and Forestry (DWAF) and Mvula Trust, an NGO working in the rural water and sanitation field have teamed up with the UNDP-World Bank Water and Sanitation Programme for East and Southern Africa (WSP-ESA) to hold a

regional workshop in White River Mpumalanga at the end of November last year with the theme - Financing of Community Water Supply and Sanitation.

The workshop was the fourth in a series of Country Level Collaboration (CLC) workshops focusing on demand responsive approaches and financing mechanisms. Since 1994 these CLC workshops have gathered together policy

makers, planners and project staff from public agencies, NGOs and the private sector to assess policies and operational approaches for extending sustainable water and sanitation services to the poor. In White River, more than 130 delegates participated in the workshop to review the financing challenge.

A statement summarising key resolutions to be conveyed to policy makers,

Team receives Water Engineering Award

The South African Institute of Civil Engineers (SAICE) recently presented the 1999 Water Engineering Award to the project team responsible for a guide to determine water quality. The guide is the result of a joint initiative of the Water Research Commission (WRC), the Department of Water Affairs and Forestry (DWAF), and the Department of Health, with consultative collaboration from BKS and Ninham Shand. The project team members were Dr Philip Kempster, Dr Annalie Kuhn and Mr Fred van Zyl all from DWAF, Annatjie Oelofse (WRC), Mr Nikisi Lesufi (Dept. of Health), Gavin Quibell (Ninham Shand) and Martin van Veelen (BKS).

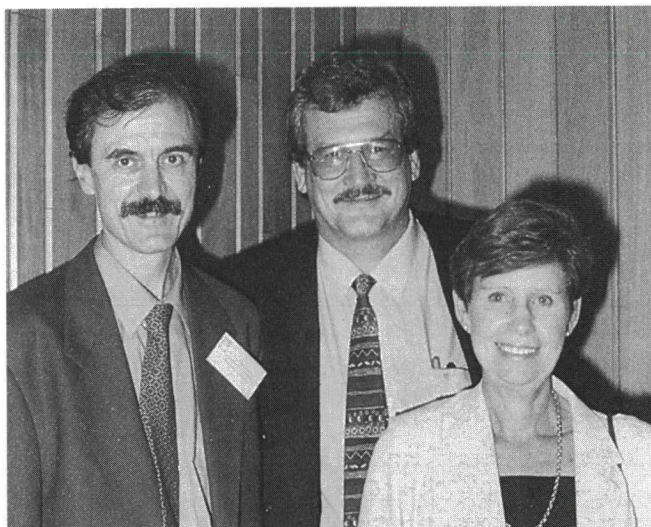
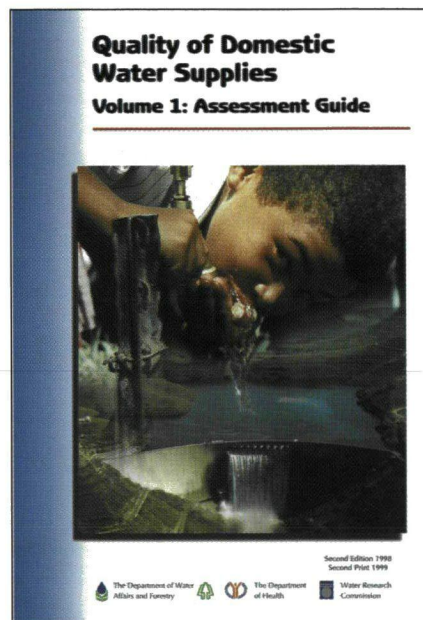
CREATIVE APPROACH

The team was lauded for the creative approach displayed by this well-designed document, as the guide uses a simple colour code system for assessment

and classification of water for domestic use.

The Guide, entitled *Quality of Domestic Water Supplies - Volume 1: Assessment guide*, aims to make the rather complex science of drinking water quality clear and present basic water quality knowledge in a user-friendly manner. Information is given in a simplified format so that users will grasp the importance of water quality and the assessment thereof with regard to domestic use and health.

At the official announcement of the guide in February 1999, Prof Kader Asmal, the then Minister of Water Affairs and Forestry, said that it was the dedicated work of the management and technical teams, that realised the dream of producing an assessment guide which would be understandable even for the lay person.



Dr Philip Kempster, Mr Fred van Zyl and Dr Annalie Kuhn from DWAF were particularly pleased with the end result of the project: the published guide.



Mr Nikisi Lesufi and Annatjie Oelofse represented the Department of Health and the Water Research Commission, respectively, on the project team.

Copies of the guide entitled **Quality of Domestic Water Supplies - Volume 1: Assessment guide** (TT101/98) is available, free of charge, from the Water Research Commission, PO Box 824, Pretoria 0001. (Foreign orders: US \$25 per copy via surface mail, or US \$45 per copy via airmail.)

donors and sector actors was released after the workshop. It says that in all African countries public finance available for water and sanitation service development is insufficient, even to provide basic services for the poor at current standards. More efficient and effective mechanisms for financing community services are needed. How funds are channelled matters just as much as how much is spent.

FOSTER INITIATIVES

"Poor communities can, and do, pay for services that they trust and value. Communities, householders (in particular women) and small operators save, borrow and invest for better services. Sector policies should provide an enabling environment to foster their initiatives."

The workshop recommendations are organised along three lines of action:

- ☐ First, more effective use of funds spent by public agencies and donors.
- ☐ Second, better incentives for efficiency, sustainability and the mobilisation

of local resources.

- ☐ Third, facilitating the mobilisation of additional non-public resources.

The statement says financial policies for sanitation should be based on the following principles:

- ☐ The use of public funds for the promotion and hygiene marketing, training, community mobilisation and demonstration;
- ☐ Proper sequencing, starting with schools;
- ☐ Phase-out subsidies for household latrines;
- ☐ Innovative marketing of sanitation solutions for households and communities, and
- ☐ The enforcement of Public Health by-laws.

FINANCING

Social funds have emerged as a major source of financing for community services in several African countries such as

Eritrea, Ethiopia and Malawi. However, "a framework for their collaboration with sector agencies and for incorporation of sector policies in their operational guidelines needs to be defined", the workshop statement says. To make water and sanitation schemes "going concerns" capable of attracting private sector finance they need to be seen as a business selling desired solutions at an affordable price. Success factors include:

- ☐ Well-established and transparent management;
- ☐ Accountability of management and operators;
- ☐ Trust between members;
- ☐ Ownership and security of access to resource;
- ☐ Links with community resources and access to technical assistance.

"The first step is to provide an enabling environment to foster initiatives by communities and independent providers dealing with legal and regulatory constraints, access to finance and capacity building and training."



Seen at the workshop (from left): Dr N Mjoli (Water Research Commission), Ms J Sara (World Bank), a DWAF representative from Mpumalanga and Dr Eugene Mokeyane, adviser to the Minister of Water Affairs and Forestry.

Submission of **water research** **proposals** to the **Water Research Commission (WRC)**

The Water Research Commission invites research organisations and individuals to submit water research proposals to the WRC on or before 30 April 2000.

Please note that as in the past, no late submissions will be accepted.

The electronic proposal submission system implemented by the WRC has been generally well received by proposers. The system proved to be effective, resulting in considerable time savings. This system, allowing the submission of research proposals via the Internet, is now being updated and will be available in an improved and more user-friendly format for submission of research proposals in 2000. Although the WRC prefers the electronic submission of research proposals, researchers without access to the Internet may, as in the past, complete a hard copy proposal and submit it (together with its wordprocessor file on diskette) by hand, post or courier.

The updated proposal submission system will be in place by the end of February 2000. WRC Internet address: <http://www.wrc.org.za>

Should you be interested in making a submission, please access the WRC web page for further details. Guidelines for the completion of the electronic submission system, as well as information about entering research proposals will also be available from the WRC's web site. Should you encounter problems with the Internet submission which are not addressed in



the instructions, you are welcome to contact Ms Francette Myburgh at the WRC - tel (012) 330-0340 or e-mail: fmyburgh@wrc.org.za.

All proposals received on or before the deadline will be considered jointly after 30 April 2000. Following this date, if necessary, the WRC research manager concerned will liaise with the proposer of a project in order to clarify any vagueness that may exist in the proposal, and to finalise it. Hereafter proposals will be subjected to an intensive evaluation procedure. Successful proposals will be tabled for approval at a WRC Board meeting and thereafter referred to the Minister of Water Affairs and Forestry for confirmation of the approval. Those submitting research proposals should note that during the evaluation process, proposals may also be tabled before a Coordinating Committee comprising of experts in that particular field, or sent out for peer review.

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

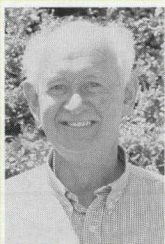
Early submission of research proposals will be welcomed.

Updating workshop held on Anaerobic Process Technology

A one day workshop on Anaerobic Processes was held in November 1999 at the CSIR. All parties affected or interested in the use and application of anaerobic treatment of waste and waste-water, were invited by the WISA Anaerobic Processes Division (APD). According to Dr Marlene van der Merwe-Botha, chairperson of the ADP, the aim of the workshop was to gather all anaerobic practitioners, from academics to process controllers, together, and to review the application of anaerobic processes as treatment technology of problem-

atic waste, sludge and effluents.

Some 80 delegates attended the workshop, which started with an overview of the APD activities during 1999 and the status quo of anaerobic technology in South Africa and internationally. The morning session was dedicated to a number of invited presentations by experts, which gave delegates a better understanding of anaerobic processes and the applications thereof, as well as the successes and restrictions of some recent case studies.

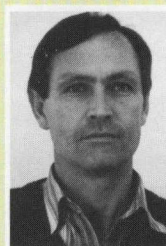


Mr **Allan Batchelor** from Environmentek, CSIR, presented their experiences in the performance of pilot scale carbon supplemented counter flow sulphate reduction, using waste activated sludge as energy source.

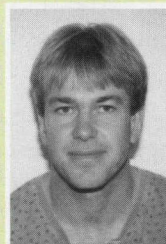


William Pulles' paper highlighted the problems faced in the mining industry regarding management and treatment of contaminated mine water, and focussed on passive treatment systems in the mining industry. This paper emanates from a research project which in its initial phase was funded by the Water Research Commission (WRC), Members of the Chamber of Mines, Escom and Sasol. Anglo Coal subsequently funded the continued research, while the third phase of research is being funded by the Innovation Fund Project of the Department of Arts, Culture, Science and Technology.

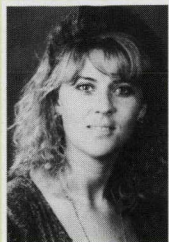
Prof Peter Rose continued the subject in his presentation on biological sulphate removal with sewage sludge as carbon and energy source.



Acid mine drainage and sulphate removal remain a pressing topic. Dr **Jannie Maree** gave an overview of simultaneous biological removal of sulphate and sulphide using sugar as energy source.



Coenraad Pretorius proceeded with a presentation on the integration of anaerobic ponds with biological nutrient removal processes, discussing the Letlhabile and Rietgat sewage treatment plants, respectively.



Dr Marlene van der Merwe-Botha gave a comprehensive presentation on anaerobic pre-treatment of gelatine manufacturing effluent (laboratory and pilot scale), discussing full scale considerations during this project. This plant will be constructed early this year (2000) at one of the Krugersdorp Water Care Works.



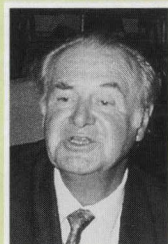
Dr Andrew Wood followed with an overview of opportunities and constraints experienced with high-rate anaerobic digestion of industrial applications in South Africa. Dr Wood emphasised the need for WISA to continue to provide a role in the promotion and development of high rate anaerobic digestion, balanced to the assurance of best practice environmental option (BPEO) and best accessible technology not exceeding excessive costs (BATNEEC), with the clear advantages of municipal infrastructure provision.



Dr Heidie Snyman pursued the much debated topic of permissible sludge disposal to land with her paper entitled "Management of land disposal and agricultural reuse of the current South African guidelines". The process to revisit the 1997 sludge guidelines was also discussed.



The morning session concluded with **Prof At Pretorius** from the University of Pretoria discussing his paper on pH controlled feed-and-demand of high-rate anaerobic systems.

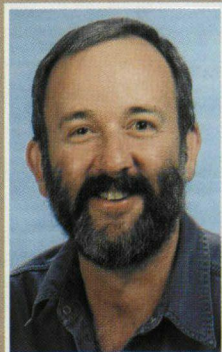


The afternoon session was allocated to **Dr Bill Ross** from Cape Town, who discussed the operating principles of anaerobic digestion, with reference to the **Anaerobic Digestion of Waste-water Sludge: Operating Guide** (WRC Report no. TT 55/92). Attention was given to all the major process elements and the stages of anaerobic treatment and sludge handling. Operating staff and process managers welcomed this overview and expressed their need to attend further assisting workshops on this specific topic. The general feeling is that both process failure and process optimisation require a sound understanding of the science of anaerobic process.

For further information or to obtain the literature presented during this workshop, please contact Dr Marlene van der Merwe-Botha at tel. (011) 413-1030/ 1077.

Please note: Copies of the abovementioned Operating Guide (WRC Report TT 55/92) is available from the Water Research Commission.

Harding receives USA accreditation



Dr Bill Harding

Dr Bill Harding, currently a senior consultant with Southern Water Ecological Research and Consulting based at the University of Cape Town, received a Certified Lake Manager (CLM) accreditation (USA standard) by the North American Lake Management Society (NALMS) at their meeting in Banff, Canada.

Presently there are only about forty Certified Lake Managers in the USA and Canada. Dr Harding's accreditation is the first awarded outside of North America. He says that a rather exhaustive application and assessment process, covering just about every discipline pertaining to lake and wetland management,

preceded this accreditation award.

The accreditation is valid for a period of two years, during which it is expected of the accredited lake manager to continue to develop him or herself in the field of lake and wetland management. This continued development process, again across the various applicable disciplines, is measured by NALMS in terms of credits or so called Continuing Education Units.

For any enquiries please contact Dr Harding at: Southern Waters cc
PO Box 13280 • Mowbray, 7705 • South Africa
Tel. (021) 650-3633 • Fax. (021) 650-38887
Cell 082-802-2637

AWIRA - a new water research unit at UP

In response to the growing need to focus on research into the social aspects of water, the University of Pretoria has recently established a new facility, namely the African Water Issues Research Unit (AWIRU). This research unit has been established in the Department of Political Sciences and is developing a set of international linkages with similar research facilities outside South Africa.

Anthony Turton, a political scientist who has specialised in the politics of water in a Southern African context, has been appointed as the head of the unit. Presently a council of advisors, drawn from experts in the water sector, is being appointed to the Research Unit.

VISION

The AWIRU vision is to support the African Renaissance by developing a scientific understanding of the role of water as a source of both social and economic stability. Therefore the research focus will be on social aspects of water with a strong emphasis on establishing a multidisciplinary capability. In this regard, close cooperation will be given to existing research and teaching activities in the natural sciences. The value of multidisciplinary research involving the social sciences was recently demonstrated in a project in Yemen, where cultural values and traditional customs have been identified as potential legitimising mechanisms for water demand management endeavors. This promises to be an interesting area for new water-related research which is highly relevant to South Africa. The Water Research Fund of Southern Africa (WARFSA), based in Harare, have generously agreed to fund a similar project that AWIRU will be running in Botswana and Zambia from mid-2000.



Mr Abdullahi Elmi, originally from Somalia, is presently a post-graduate student at the African Water Issues Research Unit (AWIRU) at the University of Pretoria.

STUDENTS

With the launch of AWIRU, two foreign post-graduate students have been accommodated at the Unit and others are expected.

Mr. John Aston is a civil engineer from Ireland who has recently completed his M.Sc. in hydrology at Imperial College by doing a dissertation on the surface water / ground water interface as an aspect of instream flow assessment. He is currently doing a small study in the Olifants Basin that has been funded by IWMI. Interestingly enough, Mr. Aston is considering doing his Ph.D. in South Africa with an emphasis on the social aspects of water. Mr. Aston is impressed by the state of the art with respect to instream flow requirement assessments that are emerging from South Africa, and feels that the global community has much to learn from the South African

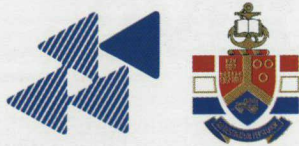
methodology in this regard.

Mr. Abdullahi Elmi is a Ph.D. student from KTH (Royal Institute of Technology) in Stockholm. Originally from Mogadishu in Somalia, Mr. Elmi has completed his degree in Civil Engineering with a M.Sc. behind his name, and is now doing his doctoral study into the institutional aspects of various international river basins within the SADC region.

These students also provide an example of the shift in emphasis away from pure engineering to the social and institutional aspects of water, that will be a characteristic of all AWIRU activities.

For more information about AWIRU, please visit the website: <http://www.up.ac.za/academic/libarts/polsci/awira> or contact Mr. Turton by e-mail awiru@postino.up.ac.za or tel.: (012) 420-4486/420-2696.

Strategic Alliance in Water Research



The CSIR and the University of Pretoria (UP) have recently decided to form a strategic alliance in a number of fields. Water research is one of the key areas identified for such a partnership in research and training.

Present at the launch of the strategic alliance in Water Research were: Prof Johan van Zyl (Principal of the University of Pretoria), Dr Peter Ashton (CSIR), Prof Eugene Cloete (UP), Dr Geoff Garrett (President of the CSIR) and Prof Jan Malherbe (UP).



Introductory course in Water Microbiology

To be held at the Division of Water, Environment and Forestry Technology, CSIR, Pretoria

18 - 19 May 2000

The Water Resources Management Programme will present 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 12 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.

For more information or registration, please contact:

Pauline Goubrough • Tel: 012 841 3952 • Fax: 012 841 2506 • E-mail: pgoubrow@csir.co.za

Scientists meet for Shared Rivers Initiative

The Institutional Support Task Team of the Shared Rivers Initiative in the Incomati Basin met during January 2000 in Manzini, Swaziland. The scientists from South Africa, Swaziland and Mozambique present at the meeting, represented the University of Swaziland (UNISWA), the Eduardo Mondlane University (Mozambique), the African Water Issues Research Unit (AWIRU) at Pretoria University, and the Water Research Commission (WRC). The purpose of the meeting was to co-ordinate the activities of the team in preparation for the final report that will be submitted at the World Water Forum gathering in the Hague in March. The team activities are focussed on certain key tasks which need to be assessed in order that a basin-wide management approach can be adopted for the entire Incomati Basin.

INCOMATI RIVER

The Incomati River is a critical resource for all three countries, and is fast reaching a point of being over-exploited, along with a high conflict potential in the basin. A recent field trip by the Task Team along the estuary of the Incomati River, revealed the fact that salt water intrusion is starting to impact on the economic base of the area. A large number of people are resident in the lower Incomati Basin, many of whom are dependent on the river for subsistence. Salt-water intrusion is causing problems for the local farmers, and activities such as rice production and animal husbandry are already being reduced. Many wells are now saline and the productive potential is diminishing. In the middle reaches of the river, the water is used for sugar and timber production. Presently a new dam is being constructed in Swaziland. The upper river reaches are also heavily developed with a variety of users, ESCOM being the most notable user, relying on the resource base. The Incomati Basin is strategically important for all three countries, and as such is heavily dammed.



Photo of the Institutional Support Task Team of the Shared Rivers Initiative in the Incomati Basin. From left to right: Dr. Absalom Manyatsi (University of Swaziland), Anthony Turton (African Water Issues Research Unit at the University of Pretoria), Dr. Joanne Leestemaker (Eduardo Mondlane University), Prof. Hezekiel Mushala (University of Swaziland), Dr. Steve Mitchell (Water Research Commission) and Mr. Fransisco Tavacale (Eduardo Mondlane University). Absent from the photo is Mr. Eugenio Macamo (Eduardo Mondlane University).

There is a strong desire amongst the Task Team members to enable the new climate of peace and co-operation in this region to be enhanced by their work. There are a number of stumbling blocks however, not least of which are the general lack of functioning institutions in certain of the countries, and rapidly changing institutions in others. The impact of the absence of functioning institutions was severe during the recent floods when downstream occupants could not be adequately warned of the approaching water in time. The different legal bases within each country also reflect varying attitudes to water resource management. One of these issues is the definition of what a river basin is. In terms of the SADC Protocol on Shared Watercourse Systems, the emphasis is more on the watercourse itself, whereas an alternative view regards the entire basin as a more appropriate unit. The

latter would involve land use in conjunction with water use, which in turn would impact on the institutional arrangements.

The Institutional Support Task Team is one of four specialised multi-disciplinary teams that are part of the Shared Rivers Initiative. The other Task Teams consist of River Health, Socio-Economic and Decision Support. Their activities are co-ordinated by the Core Team. The whole project is funded by the Swedish International Development Agency (Sida) without whose support, the project would not be possible. Progress on the work of these teams will be presented at the forthcoming Second World Water Forum meeting in The Hague when a World Water Vision will be announced. A presentation will also be made at the forthcoming Stockholm Water Symposium.

Global water movement incorporates vision for Southern Africa

The World Water Council is currently engaged in the development of a World Water Vision that is scheduled to be announced at The Hague during March 2000. This vision is designed to form the foundation of a global water movement, along the same lines as the global environmental movement. It incorporates a number of Regional Visions, one of them being a Southern African Vision. Mr Tony Turton, the head of the African Water Issues Research Unit (AWIRU) at Pretoria University, says that if the objective of establishing a global water movement is attained at this major event on the global calendar within the water sector, the outcome will be of great importance for water resource managers. The World Water Vision is set to establish the normative framework within the water sec-

tor, and is likely to consolidate major milestones such as Agenda 21 and the Dublin Principles, both of which are fundamental components of sustainable development.

GREEN CROSS

Green Cross International, an international non-governmental organisation with an environmental agenda, is coordinating a "Sovereignty Panel" as an integral part of the proceedings at The Hague. This panel is looking at the ramifications of water in international river basins, and is specifically addressing the thorny issue of how to deal with sovereign control or aspirations over water. It is this type of issue that has led to the often spoken about, but never proven,

"Water War" scenario.

Green Cross International has appointed Mr Turton to coordinate a special panel of Southern African representatives to make a presentation at The Hague. The panel will consist of recognised experts and relevant Government Ministers from the SADC Region, who will present their views on "Water for Peace in Southern Africa". The main thrust of the work will therefore be to find the recipe for the prevention of water-related conflict.

For more information about this event, visit the following Websites:

- www.gci.ch
- www.worldwaterforum.org
- www.watervision.org

ICOLD:

Final Bulletin for 20th Congress in Beijing, September 2000

The International Commission on Large Dams (ICOLD) will hold its 20th Congress in Beijing, China, from 19 to 22 September 2000. The following questions will be discussed:

- Question 76: The use of risk analysis to support dam safety decisions and management;
- Question 77: Benefits and concerns about dams;
- Question 78: Monitoring of dams and their foundations; and
- Question 79: Gated spillways and other controlled release facilities, and dam safety.

An international symposium on Concrete Faced Rockfill Dams will also be held on the 18th of September during the Annual Meeting of ICOLD.

Study tours through China will take place before and after the week of the Congress. A Technical Exhibition related to dam engineering is also being arranged.

The Final Bulletin providing full details is now available from the South African National Committee (SANCOLD). Interested persons are requested to contact the Secretary of SANCOLD, Mr. Heinrich Elges, should you wish to receive a copy. His contact details are:

SANCOLD
P.O. Box 3404
Pretoria, 0001

Telephone: (012) 336-8771
Fax: (012) 336-8561
e-mail: caa@dwaf.pwv.gov.za

You can also obtain a copy of the bulletin on ICOLD's web page. The address is <http://www.icold-cigb.org.cn>

大和魂

Seminar on practical toxicology applications

A seminar on Toxicology in the Future, under the auspices of the Aquatox Forum, has been hosted by OEN Enterprises and ERWAT Laboratory Services, at the ERWAT auditorium in Bapsfontein. More than thirty representatives from municipalities, private laboratories and general industry attended the seminar.

Both international experts and local speakers presented practical industrial applications for toxicity assessments in the environment.

Dr Pieter van Eeden, pollution ecologist

at ERWAT, commenced with a presentation on daphnia toxicity testing in the wastewater treatment industries.

Mr Juha Lappalainen, director of Bio Nobile, Finland, delivered a presentation on bioluminescent toxicity screening using *Vibrio fischeri*. Both the conventional method and new approach for solid and coloured samples were discussed. He also introduced the new 'flash method' photo bacteria testing using BioOrbit's 1251 Luminometer.

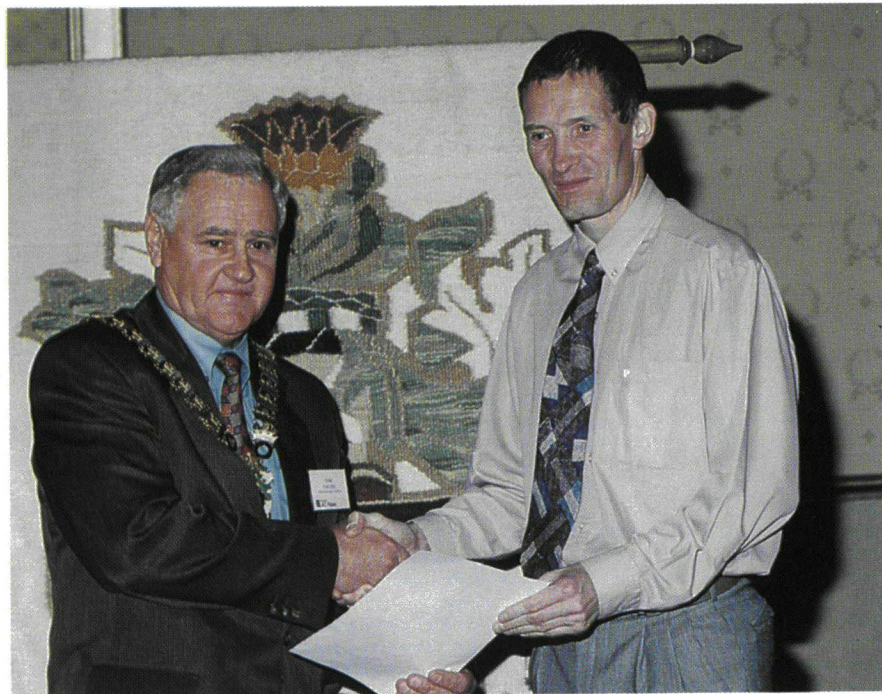
A highly sophisticated technique for on-line toxicity measurement was introduced

by Dr Moldaenke, director of Moldaenke, Germany. This new method is able to monitor the surface of waters with an ultra-sensitive Daphnia Toximeter.

Dr Virta, a lecturer in biotechnology at the university of Turku, Finland, also presented his theory on heavy metal biosensors. The importance of realistic exposure assessments in health risk characterisation was discussed by Dr van Niekerk from Infoto.

For enquiries or further information please contact: Dr Pieter van Eeden at Tel. (011) 929-7014.

IMESA awards best paper



Mr Ronnie McKenzie (right) receives the award for the best paper presented at the Institute of Municipal Engineers of South Africa (IMESA) conference from Mr Tom van Zyl, president of the Institute.

The award for the best paper presented at the Institute of Municipal Engineers (IMESA) conference, held in October last year, went to Mr Ronnie McKenzie from the company Water Resource Planning and Conservation (WRP Ltd) in Pretoria and Mr Jay Bhagwan, research manager at the Water Research Commission for their paper titled "Managing unaccounted for water in potable water distribution systems - recent software developments through the Water Research Commission".

Approximately forty papers were submitted for the conference from which ten were finally selected for presentation.

The winning paper dealt mainly with the software packages that are being developed to assist water suppliers to manage their unaccounted-for water. The night-flow model (SANFLOW) is already available while the pressure management model (PRESMAC) together with the Benchmarking methodology will be released before the middle of the year.

WATER SA celebrates 25 years of refereed excellence

In 1999 the Water Research Commission's scientific journal Water SA celebrated its silver anniversary. To mark the big event a new cover has been designed for the journal.

According to the editor, Ms Ingrid Buchan, it was recognised, shortly after the establishment of the Commission, that a suitable medium would be required to publish the research results of the local water research community, as no other journal dealing exclusively with water existed at the time. It was therefore decided to establish a peer-reviewed scientific water journal, entitled Water SA, which would appear quarterly. Its appearance in 1975 created a forum for South African scientists and engineers to introduce their research results both nationally and internationally.

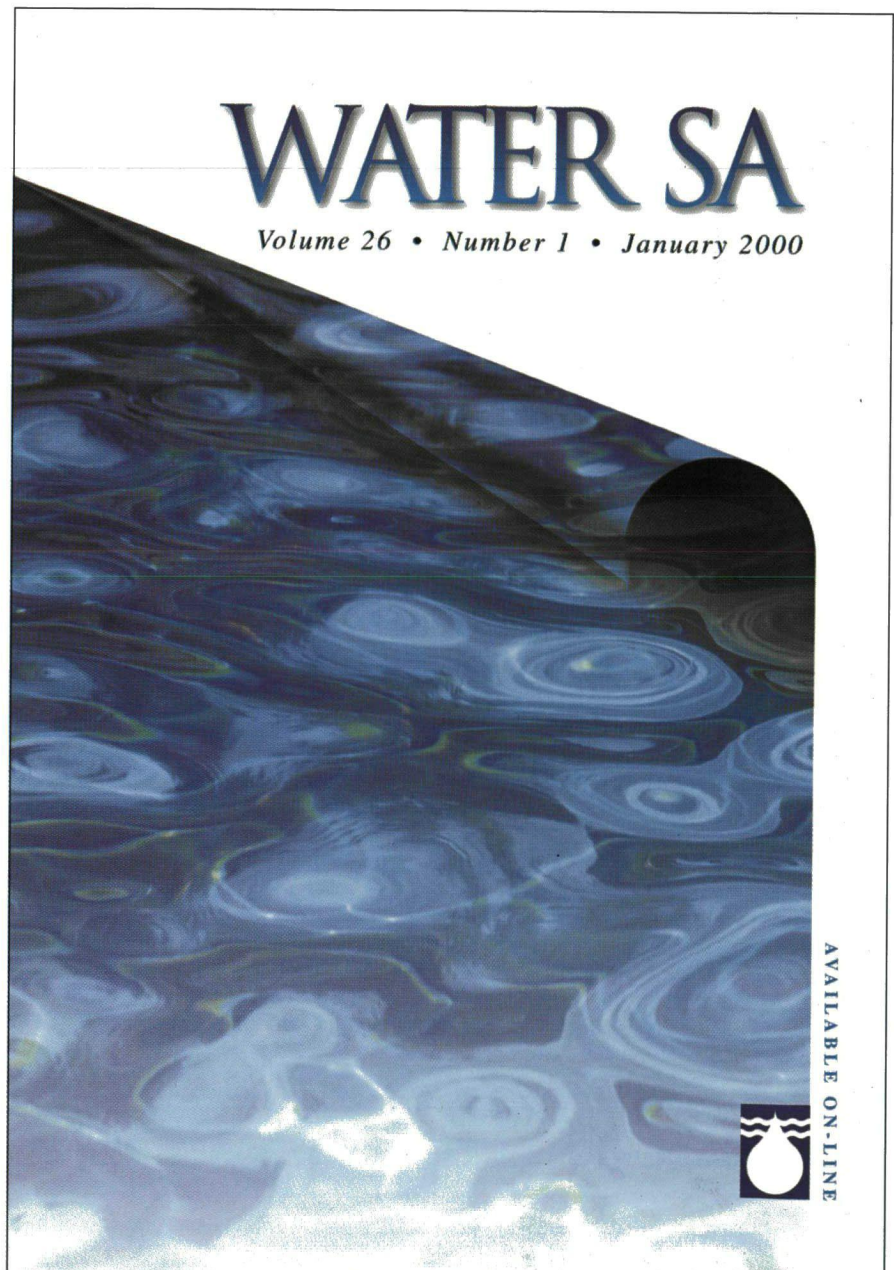
Water SA continues to serve the South African research community in this way, but in recent years it has also had increasing support from overseas authors, as far afield as the Ukraine, Spain, Argentina, Finland, Korea, Turkey, Australia, Belgium, Canada, Thailand, Denmark and the USA.

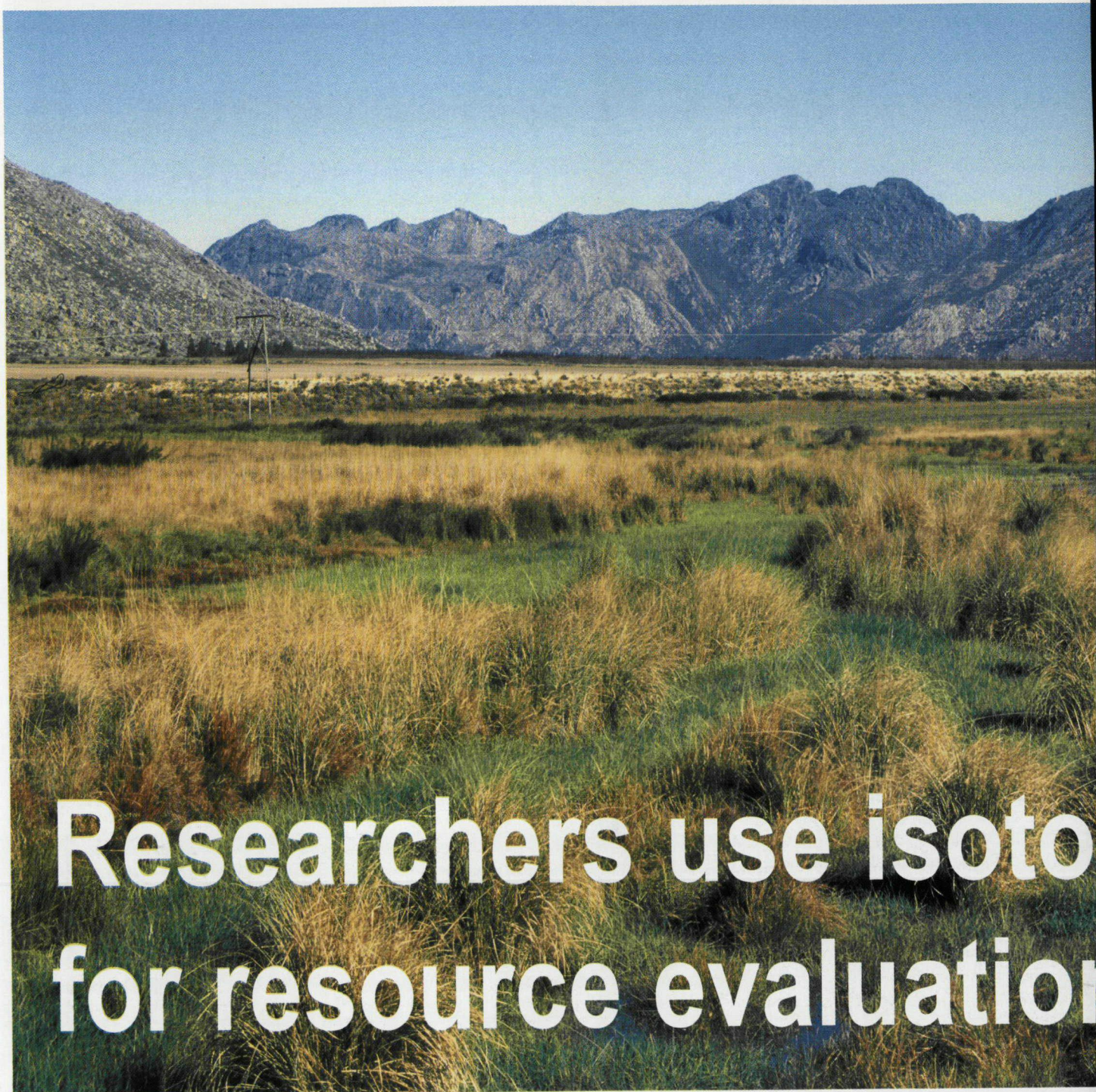
The first edition was published in April 1975 and the three issues for that year averaged 48 pages and seven articles per issue. Since then this volume has increased steadily and in 1999 the average stood at 135 pages and 16 articles per issue. Water SA has an extensive local as well as overseas readership. Currently there are 3 418 subscribers to the journal of whom 895 are abroad. It is covered by all the major international abstracting services who publishes and distribute summaries of articles which appear in Water SA.

Ms Buchan says over a period of 25 years Water SA has moved from the paper era to the electronic era, employing the most advanced publication technologies currently available.

"Since the beginning of 1997 the full text version of the journal is also freely available on the Internet via the WRC website (<http://www.wrc.org.za>). It is of interest to note that this particular section of

the WRC website has attracted the most visitors and in the past few months articles from Water SA have been the most popular file downloads from the site."





Researchers use isotopes for resource evaluation

The Agter-Witzenberg mountain valley area. The mountainous area consists of fractured rock while the valley floor is made up of shales. The valley is visible.

Fractured rocks are the major source of groundwater supplies in South Africa. Reliable resource evaluation in fractured rock aquifers is a developing science not only in South Africa, but worldwide. There exists a need for useful and practical tools with which to evaluate fractured rock aquifer groundwater resources. In a study funded by the Water Research Commission, researchers aimed to use the Table

Mountain Group (the largest fractured rock aquifer system in South Africa) to assess the applicability and usefulness of hydrochemical time-series and isotope time-series monitoring as a tool in fractured rock aquifer resource evaluation. According to the researchers, JMC Weaver, AS Talma and LC Cavé, from the Division of Water, Environment and Forestry at the CSIR, the use of isotopes appears to be a neglected tool in

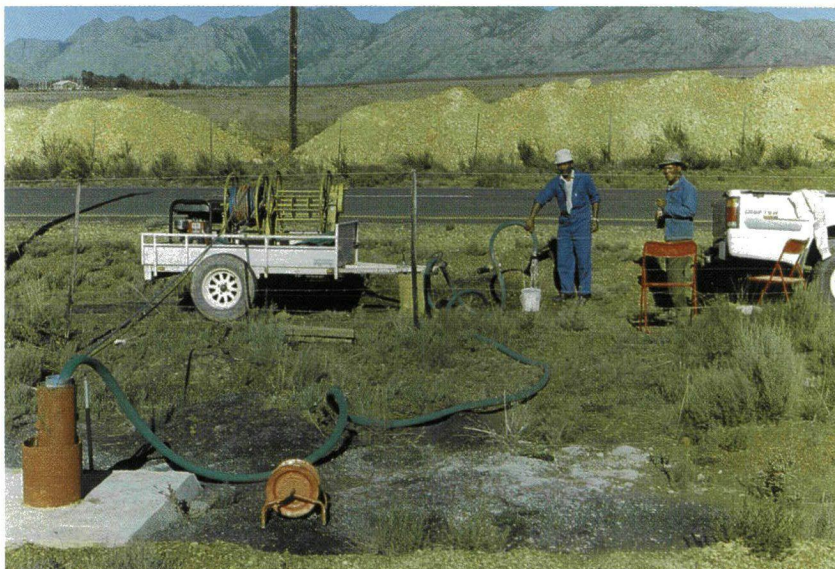
groundwater studies - primarily because geohydrologists are generally not well-grounded in isotope geochemistry.

AIMS

The overall aim of the project was:

- To assess the applicability and usefulness of hydrochemical and isotope time-series monitoring as a tool in

The fieldwork phase of the project...



... water level measurements were taken at the various borehole sites, and



... water samples for chemical and isotopic analysis were collected from the boreholes regularly over a period of two years. At the same time additional surface water and rain water samples were also collected for chemical and isotopic analysis.

fractured rock (Cape Rock) resource evaluation.

The specific aims were to:

- ☐ Relate hydrochemical variations and hydrographs to recharge and resource evaluation of the Table Mountain Group;
- ☐ Relate groundwater isotopes to

hydrochemical variations and hydrographs for the estimation of groundwater residence time and groundwater recharge source areas.

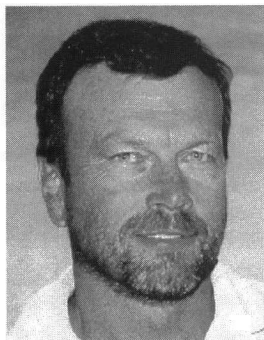
It was envisaged that geochemical and isotopic data could be used to create a groundwater recharge model for this aquifer type. This model would then aid the successful exploitation and management of the fractured rock groundwater

resources in many areas of the Western Cape.

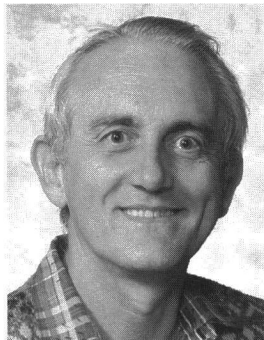
SITES

Two study sites were selected in order to achieve results within a reasonable time span. The requirements for a study site were that:

- ☐ The geology should be reasonably



John Weaver



Siep Talma



Liza Cavé

simple and well-understood, and

- ☐ There should be existing boreholes with some historical data.

The two sites selected were Agter-Witzenberg, a mountain valley north-west of Ceres and Struisbaai, a coastal aquifer near Cape Agulhas on the Cape south coast.

Eleven research boreholes were drilled, funded by the Department of Water Affairs and Forestry, to supplement existing boreholes in covering both areas and to obtain geological information. Sampling networks were established at the sites for the collection of groundwater, rainfall and surface water data. During the field work phase of the project, volume and water level measurements were taken and water samples collected regularly for chemical and isotopic analysis. Data gathered was then checked and stored in a database for processing. Additional data was obtained from automatic recorders at some of the sites. Graphs of hydrochemical and isotopic parameters and time series plots were prepared as an aid to data analysis and interpretation. The information could then be compiled into a conceptual recharge model for this aquifer type.

RESULTS

☐ AGTER-WITZENBERG

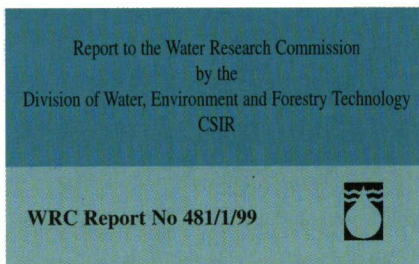
In the Agter-Witzenberg area sampling and analysis commenced in earnest in October 1993 and continued until January 1996. The cross-section of the Valley that was studied consists of a mountainous area (300 metre relief) of the Table Mountain Group quartzites extending into the valley floor. The rest

of the valley floor is made up of Bokkeveld shales. Both shallow and deep boreholes were established to sample each of these features. Na, Cl, alkalinity, ^{18}O , ^{14}C and ^{87}Sr proved to be the most revealing parameters in the sense that their levels in the different boreholes and their variations with time showed useful and more or less consistent patterns.



Geochemistry and Isotopes for Resource Evaluation in the Fractured Rock Aquifers of the Table Mountain Group

JMC Weaver • AS Talma • LC Cavé



A conceptual flow model for the water movement in the Agter-Witzenberg aquifer could be set up. The main flow components consists of recharge in the mountains (to the extent of 50 per cent of the rainfall) which discharges at the base of the mountain and drains away in streams, with some ponding as well. Some isotope enrichment occurs during ponding. Recharge from surface water occurs mainly in summer when farmers draw down the water levels in neigh-

boring boreholes dramatically. The isotope differences between the mountain recharge and the evaporated stream water provide a useful tracer, with chloride and alkalinity, to follow the movement of these water types.

The contact between the Bokkeveld shales and the Table Mountain Group quartzites is a zone of relatively high hydraulic conductivity providing a mixing conduit for the recharged storm water and the deep seated older (up to a few thousand years) groundwater which has the ^{18}O signature of the rainfall recharge in the high mountain areas. Variations of chemical and isotopic parameters from this contact zone are due to the different seasonal mixing regimes.

☐ STRUISBAAI

Struisbaai was initially regarded as a suitable test aquifer since it is an isolated block of Table Mountain Group quartzites bounded by faults and the sea, and thus could be studied in isolation. It became evident from analysis of the results of the first year, that the Struisbaai aquifer was not suited for the aims of this project. There were no meaningful seasonal variations in any of the isotopic or hydrochemical parameters. Sample collection was therefore abandoned at this site.

The conclusion from the work at Struisbaai is:

- ☐ The salinity observed in groundwater at Struisbaai is due to wind-blown sea-salt;
- ☐ Using the chloride balance method, groundwater recharge is estimated as five to 16 per cent of the annual rainfall;

- ❑ ^{14}C analysis of borehole water indicates that the groundwater flow is from the inland towards the sea which confirms the conceptual hydro-geologic model;

- ❑ Isotopes have provided some useful additional information in understanding the aquifer at Struisbaai.

CONCLUSIONS

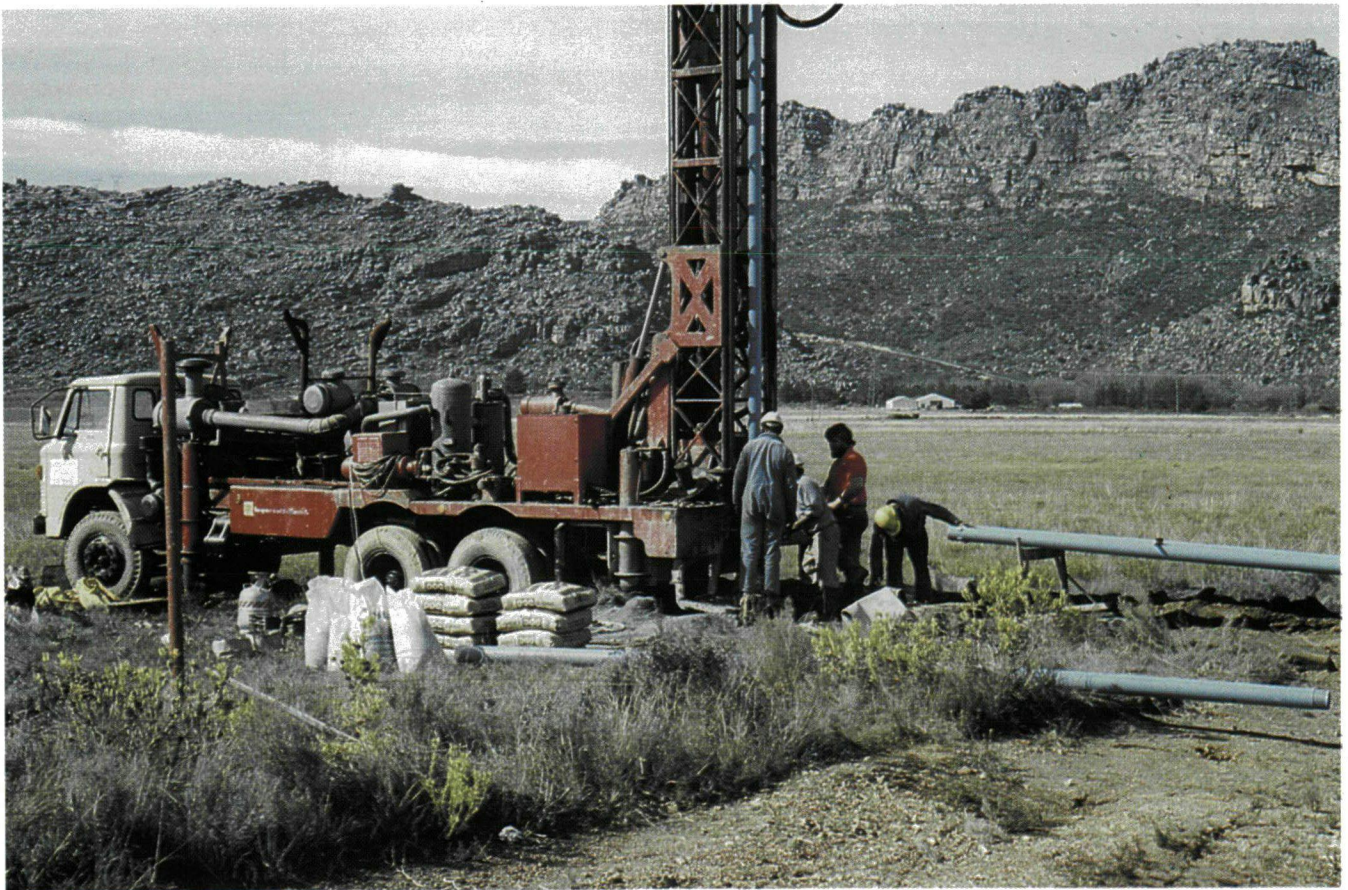
The following conclusions are drawn by the researchers in the report to the Water Research Commission:

- ❑ Chemistry and isotopes shows that groundwater flow does occur in the medium-seated zone of the aquifer;
- ❑ Summer pumping and winter-recharge aquifer management methods can be applied to the Table Mountain Group;
- ❑ Recharge during winter is quite high (~ 50 per cent), which means that this potential recharge can be recovered in summer.

Copies of the report entitled **Geochemistry and Isotopes for Resource Evaluation in the Fractured Rock Aquifers of the Table Mountain Group** (WRC report 481/1/99) are available free of charge from the WRC, PO Box 824, Pretoria 0001. (Overseas price: US\$ 35.00 - via surface mail).



Some properties of the water samples have to be analysed immediately, requiring fresh water samples straight from the borehole head.



Agter-Witzenberg mountain valley. A number of boreholes were specially drilled and equipped for this project to sample certain water strikes. The drilling was funded by the Department of Water Affairs and Forestry.

Biofiltration in South Africa revisited

The use of biofiltration technology for the treatment of domestic sewage and industrial effluent is widespread, especially in the municipal sector in South Africa. A large number of sewage treatment plants use biological filters either as the core treatment process or in combination with other unit treatment processes.

Unfortunately, the process is relatively inflexible and requires large filter media volumes to achieve an acceptable effluent quality, especially during winter. Meanwhile, the activated sludge process

has become more popular due to better operational control and its ability to remove nutrients (such as nitrogen and phosphorus) microbiologically.

However, recent experience has indicated that the integration of biofiltration and activated sludge processes is frequently the most economical approach to upgrade an existing plant. Integration of the processes allows optimal use of the strong points associated with each of the individual processes.



A general view of the Biofilter Pilot Plant at the Baviaanspoort Water Care Works.

Copies of the final report summarising the research results, entitled **High Rate Biological Filtration** (WRC Report 569/1/99) are available free of charge (in South Africa) from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 20, via surface mail).

These comments are made in a report on the application of high rate biological filtration processes to municipal wastewater treatment, released by the Water Research Commission in Pretoria. The report has been compiled by two researchers, AM van Niekerk and WG Rudert, from Wates, Meiring and Barnard (Pty) Ltd in Midrand.

The researchers say although biofiltration has not received much research attention in South Africa, there was a renewed interest in fixed-film reactors in America and Europe in the last few years.

"The biofiltration solids contact (BFSC) process is an example of the recent innovations introduced to the conventional biofiltration process. The BFSC-process is a modification of the conventional biological filtration process. The process involves continuous recirculation of humus sludge to an aerated contact basin. Blending of humus sludge and biofilter effluent in the contact basin results in enhanced flocculation and improved phosphate removal."

The researchers say that in South Africa biofiltration plants and periodic upgradings of these plants still employ design criteria which were developed more than twenty years ago.

"Therefore the development of more realistic design approaches and criteria could result in substantial capital cost saving and more reliable production of a high quality effluent."

Biofilters are relatively simple to construct and operate. Local materials can be used to build the filters, including natural stone and labour-intensive construction techniques.

The researchers say some of the more common, but inaccurate, perceptions about biological filters are that:

- ☐ Biofilters cannot produce high quality effluent, low in chemical oxygen demand (COD) and suspended solids;
- ☐ Biofilters cannot effectively nitrify and cannot compete with other technologies in this regard; and
- ☐ Biofilters require a lot of land and cannot be constructed as a compact plant.

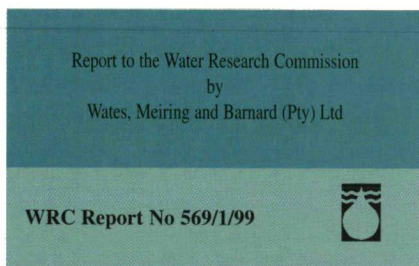
"Despite the fact that a biofilter contains a solid media, taking up a large fraction

of the reactor volume (typically 40 to 50 per cent in the case of natural stone filters), the biofilter may still contain 5 - 7 kg/m³ of biomass. This biomass concentration is therefore typically higher than in most suspended culture bioreactors, such as activated sludge containing 2 - 4 kg/m³. The general observation, however, is that some micro-organisms in a conventional low rate biofilter are less viable compared to the micro-organisms in a suspended culture.



High Rate Biological Filtration

AM van Niekerk • WG Rudert



"The production of excess (waste) bio-sludge from a biofilter is also relatively low compared to other types of reactors. This can be ascribed to the rich diversity of micro-organisms resident on a biofilter. The complex food chain includes the lower ranks of bacteria and algae to a variety of metazoa, including rotatoria,

nematoda, insecta, etc. However, biofilter performance suffer in the event of shifts in the microbial population. Rapid increases in the number of animals such as snails or Daphnia at the upper ranks of the food web could result in rapid loss of biomass by grazing. These animals may also excrete fine, colloidal and unsettlable particles to the biofilter effluent, which reflects in a poorer quality effluent.

"Fixed film processes, such as biofilters, typically have few controllable process parameters. The sludge age can, for example, not be adjusted as in the case of activated sludge to control nitrification. The lack of control has in general not been a serious problem in carbon removal from domestic sewage."

RESEARCH PROJECT

The Water Research Commission contracted Wates, Meiring and Barnard to investigate and establish operational and design criteria for two modifications to the conventional biofiltration process, namely, the high-rate recirculation process directly around the biofilter and the biofiltration solids contact (BFSC) process modifications.

The specific aims of the biofilter recirculation research were to:

- ☐ establish the hydrodynamic characteristics of high-rate recirculation biofilters
- ☐ assess the performance of biofilters receiving high-rate recirculation with respect to COD/BOD removal, nitrification and denitrification.
- ☐ investigate the degree of biofilm con-



A top view of the Pilot Plant biofilters. The three biofilters were packed with three different media size fractions: small, medium and large.

tol which can be achieved including the solids production from biofilters.

- evaluate the influence of stone media size and grading on biofilter performance.

The BFSC-process modification was investigated to:

- establish the influence of different process parameters on the final effluent suspended solids concentration. These process parameters included:
 - clarifier underflow recycle rate
 - contact time in BFSC-box
 - solids concentration in BFSC-box
 - air supply to BFSC-box
- investigate the more efficient use of metal salts to remove phosphate when incorporating the BFSC-process.

The research was aimed at the practical application of the technology. Pilot-scale work at the Pretoria Baviaanspoort Water Care Works was conducted using settled sewage without further augmentation or modification. Several full-scale plants using medium/high rate biofiltration were also analysed to investigate the practical application of the process. An economic evaluation of the high rate biofiltration process was conducted to confirm the financial viability of the process.

RESULTS

■ Hydrodynamic characteristics of bio-filters:

The liquid retention, hydraulic residence time (HRT) and residence time distribution in bio-filters were investigated at different hydraulic loading rates. In general it was concluded that:

■ The HRT of biofilters:

- was relatively short (several minutes) compared to other bio-treatment processes such as activated sludge (several hours);
- increased sharply at low hydraulic loading rates and decreased at high loading rates;
- increased as the filter media size decreased;
- based on tracer information gave more representative values than when it was based on liquid retention which could lead to underestimation of actual retention time.
- on full scale installation, with intermittent dosing of sewage was much longer than the continuous dosing of

the pilot plant filters.

■ Carbon removal characteristics of biofilters:

- The carbon removal increased as the organic loading rate onto the filter increased;
- Smaller media size biofilter was more effective in carbon removal per unit volume of filter compared to the large media biofilter, but all, irrespective of media size, had similar carbon removal rates per unit surface area of filter media;
- Recirculation at high organic loading rates did not give benefits, but it can improve the performance of biofilters receiving an intermediate organic loading rate;
- Smaller media sizes generated less solids per unit carbon removal compared to larger media sizes.

■ Evaluation of full scale intermediate rate biofiltration:

- Existing biofilters may have substantially under estimated treatment capacity in terms of carbon removal, as the two treatment plants that were monitored exceeded the design criteria;
- Nitrogen removal by nitrification and denitrification was observed given that the presence of available carbon compounds to drive the denitrification process was essential for the high degree of denitrification.
- These filters required polishing treatment such as secondary biofilters or

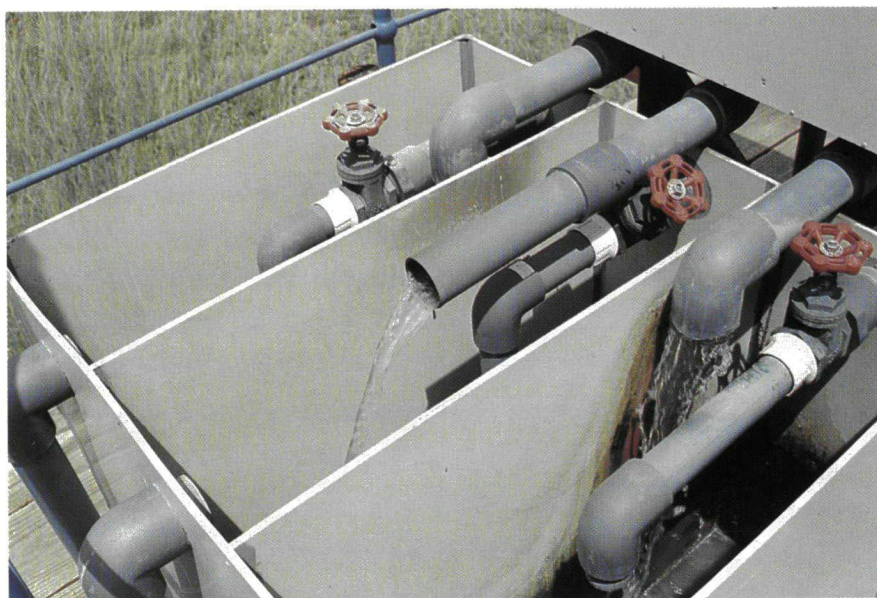
activated sludge before discharge of the final treatment.

■ Economic potential for application of high rate biofiltration:

- An economic analysis confirmed that it was an efficient and cost-effective approach, although the capital construction cost in combination with polishing activated sludge was higher than the other process technologies, but the operating and maintenance was lower;
- Existing biofilters may be upgraded at relatively low cost to high rate applications which could increase the reliable treatment capacity and life of an existing plant.



The recirculation pump installations seen at the back of the biofilters.



The Pilot Plant Biofilters' Inlet Flow Splitting Box.

Hydrologists take a look ahead

The ninth SANCIAHS symposium was held at the University of the Western Cape, from 29 to 30 November 1999. Some 130 participants listened to 46 papers, which covered a wide variety of subjects under the following main topics:

- ☐ Integrated water resources management
- ☐ Impact studies relevant to integrated water resource management
- ☐ Decision support for IWRM
- ☐ Catchment hydrological processes
- ☐ Remote sensing and forestry
- ☐ National Water Act complementation
- ☐ Environmental flow requirements

Mr Hugo Maaren, Secretary of the Sanciahs committee says "The quality of the papers and the preparation of the presentations was excellent". "We want to commend all the speakers in this regard". Everybody kept within time limits, which allowed for some interesting questions to be raised and discussed.

At the closure of the symposium the following general impressions were raised:

- ☐ A number of new people, especially of the younger generation, attended and this bodes very well for integrated water management in South Africa.
- ☐ Several papers, and the opening key note address by Barbara Schreiner in particular, focussed the mind on the South African situation: There is a great need for development and poverty eradication. The role of integrated water management needs to address this.
- ☐ Planning and water management need to take cognisance of the scale issue in time and space. Management issues vary from broad national to local detail. The challenge ahead is to arrive at meaningful

vertical integration, aggregation and dis-aggregation, without losing the integrity of the whole!

- ☐ Linked to the above is the realisation that the precise impact of human activity is very site-specific. Jacky King illustrated this by mentioning how a management decision of a 2°C change in the temperature of water released from an impoundment to promote the spawning of fish, proved to be successful in one year, but failed the next year. Another example is the water use of trees, which is very much regulated by the availability of water in the landscape and as such also show high spatial variability.
- ☐ There are many new stakeholders who need to be empowered to take part in the process of IWRM. Each target audience has its own information needs. One can almost sense that a new discipline in informatics is coming where GIS will play an increasingly important role.
- ☐ The implementation of the new Water Act will force many of us to move and work outside our comfort zones and traditional fields of expertise. We are entering an era of life-long learning by doing. However, to support this process of learning we need to implement a process of monitoring the outcomes of our management decisions.
- ☐ Multi-disciplinary centres of expertise need to be encouraged and supported with a strong networking component.

Mr Maaren says that if the above issues are compared with the outcomes of symposia several years ago, it already illustrates how the implementation of the new Water Act is providing a very strong incentive for co-operation between the various active role players in hydrology and water management.



New reports published by the Water Research Commission

The following reports are available free of charge 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: orders@wrc.org.za

Modelling Extreme Rainfall over Southern Africa

AM Joubert • SJ Crimp • SJ Mason

Report to the Water Research Commission
by the
Climatology Research Group
University of the Witwatersrand

WRC Report No 805/1/99



Report 805/1/99 - Modelling Extreme Rainfall over Southern Africa. Report to the Water Research Commission by the Climatology Research Group, University of the Witwatersrand.

Authors: AM Joubert, SJ Crimp and SJ Mason
Overseas price: US\$ 20 (via surface mail)

The aim of this research project was to improve the existing understanding of the processes responsible for the generation of heavy rainfall over southern Africa. Several heavy rainfall events over this region has been examined, including tropical cyclone Demoina (late January 1984) and the floods of February 1996. Also included in the project was an assessment of a seasonal rainfall forecast for January-April 1996 over southern Africa produced by the United Kingdom Meteorological Office, which failed to predict the forthcoming flood event. Lastly, an assessment of the ability of a nested regional climate model to simulate present-day rainfall over southern Africa is presented.

An important component of the project has been the combination of numerical modelling and kinematic trajectory analysis methods to improve the understanding of the source and transport of moisture associated with extreme rainfall events. The analyses presented in the report identify the subtropical western Indian Ocean as an important moisture source for heavy rainfall events. This

finding is contrary to earlier research, which suggested that the tropical equatorial Indian Ocean was the primary source of moisture for (particularly late) summer rainfall over the region.

The Commonwealth Scientific and Industrial Research Organisation's (CSIRO) Division of Atmospheric Research limited area model (DARLAM), nested within the CSIRO's general circulation global climate model, has been used to provide high-resolution, process-based simulations of present (and future) climate over the southern African region. In general, the regional climate model is able to simulate regional climate detail much better than the forcing general circulation model, although significant problems exist in the simulation of daily rainfall totals and frequencies. DARLAM simulates too much rain and too many rain days over much of the eastern parts of southern Africa, and the over-estimate is most severe over regions of steep orographic gradient such as the escarpment region of South Africa. While simulated circulation adjustments associated with above-average rainfall are realistic, the over-estimation in the number of rain days, and hence total daily rainfall is related to the model's inability to simulate accurately the processes associated with uplift and rainfall production along steep orographic gradients. Further model development will be required before it can be used with confidence to provide reliable estimates of changes in daily rainfall statistics over the southern African region.

An Investigation into Phytoplankton Blooms in the Vaal River and the Environmental Variables Responsible for their Development and Decline

AJH Pieterse • S Janse van Vuuren

Report to the Water Research Commission
by the
Department of Plant and Soil Sciences
Potchefstroom University for CHE

WRC Report No 359/1/97



Report 359/1/97 - An Investigation into Phytoplankton Blooms in the Vaal River and the Environmental Variables Responsible for their Development and Decline. Report to the Water Research Commission by the Department of Plant and Soil Sciences, Potchefstroom University for CHE.

Authors: AJH Pieterse and S Janse van Vuuren
Overseas price: US\$ 30 (via surface mail)

The Vaal River is a eutrophic system on account of high chlorophyll-a and inorganic nitrogen and phosphorus concentrations as well as high primary productivity rates. Massive developments of phytoplankton are experienced in certain sections, resulting in aesthetic problems, health hazards, water treatment problems and problems in water distribution systems. Consequently, the causes and consequences of phytoplankton assemblages in the Vaal River were investigated.

The study showed that a variety of phytoplankton species (at least 124 species and varieties) occurred in the Vaal during the study period.

Green algae showed the greatest species diversity. The greatest diversity of Cyanophyceae species were present at the Barrage, while the greatest diversity of Euglenophyceae species were present at the Balkfontein sampling locality. The phytoplankton community was dominated mainly by diatoms and green algae (which succeeded each other), as well as by blue-green algae during warmer periods.

Different species succession patterns were demonstrated for different sampling points. At the Barrage, Parys and Balkfontein different species succeeded one another within relatively short time spans. At Stilfontein a smaller number of species succeeded one another, possibly indicating more stable environmental conditions at this locality in the river.

During the summer periods diatoms tended to dominate in the Vaal River from January to August of each year, while the green algae were dominant from September to December. Domi-

Next page

nance of diatoms during January to April and in December, can be ascribed to blooms of *Meliora granulata*. Concentrations of unicellular centric diatoms were usually low during the summer periods, but they often dominated during the cold-water winter periods. Blue-green algae frequently occurred during the mid and late summer months of each year, especially at the Barrage, Stilfontein and Balkfontein sampling localities.

The total dissolved salts (TDS) concentration in the Vaal River is high, with an average annual maximum of about 650 mg per litre and a minimum concentration of about 400 mg per litre. The mean annual TDS concentration for the study period was about 520 mg per litre which is approximately four times higher than the global mean salinity of river water. Salinity, however, was not the primary variable influencing algal growth, but dinoflagellate representatives (responsible for red tides in the ocean) occurred more frequently in high salinity water, while blue-green algae occurred in water with relatively low salinities. Growth and carbon assimilation experiments indicated that different algae showed

different sensitivities to dissolved salts. Of the three algal species investigated, *Cyclotella meneghiniana* (a diatom) was the most sensitive and *Monoraphidium circinale* (a green alga) the least sensitive to increased dissolved salts.

All the results from the study support a conceptual model that assumes that phytoplankton growth in the Vaal River is controlled by fluxes of solar energy, but fluxes of plant nutrients apparently affects the flow of energy into the algal cells. The application of the principal component analysis (PCA) method to investigate associations between physical, chemical and biological variables resulted, amongst others, in the elucidation of seasonal aspects of algal growth, showing higher algal growth during colder months. Should changes in the seasonality occur, i.e. should summer blooms replace winter blooms or should different years show different associations, PCA analyses will be able to identify and quantify the changes and differences in terms of their statistical significance. However, the statistical comparison between phytoplankton and environmental changes is only the first step in linking species

dynamics to changes in a complex environment.

A light-temperature dependent model to simulate algal blooms in the Vaal River was developed, but more information is required on the ecological behaviour of the river as well as growth requirements of specific algae. The model is based on two assumptions, namely that the water is eutrophic and that the growth and death of algae are dependent mainly on the available light and temperature of the water. Weekly averaged temperature and the total suspended solids concentration were considered as inputs. The calculated chlorophyll-a concentration values agreed fairly well with measured values in qualitative as well as quantitative terms during the three years of the investigation. By taking into account the possible effects of dissolved silicon concentration, it was possible the quality of simulation of algal growth and algal blooms in the river.

This study on the Vaal River is of general significance to all scientists interested in aquatic ecology and the utilisation and management of inland waters.

Investigation into Total Organic Halogen Formation After Disinfection of Drinking Water by Chlorine

E Meintjies

Report to the Water Research Commission
by the
Scientific Services
Rand Water.

WRC Report No KV 117/99



Report KV 117/99 - Investigation into Total Organic Halogen Formation After Disinfection of Drinking Water by Chlorine. Report to the Water Research Commission by the Scientific Services Department of Rand Water.

Author: E Meintjies
Overseas price: US\$ 20 (via surface mail)

Rand Water utilises chlorination and chloramination as methods of disinfection to ensure the microbiological safety of the water it produces and supplies to more than nine million consumers. The formation of disinfection by-products is one of the major issues facing present-day water treatment technology and drinking water quality control. The by-products of chlorine disinfection are mainly inorganic chlorides but also include both volatile and non-volatile organo-halogen complexes. Although the major inorganic components are well characterised, the specific organic components are largely an unknown factor.

The number and diversity of halogenated organic compounds which can be found in water makes their individual measurement a practical impossibility. Despite the diversity of their general properties, halogenated organics have one common property by definition: the presence of at least one halogen atom. This property has been utilised in methods developed to measure organic halogen compounds as a group determinant. The parameters of purgeable organic halogens (POX) and adsorbable organic halogens (AOX) are popular choices.

Trihalomethane (THM) formation, which constitutes part of the volatile organo-halogen complexes formed, has been well-researched and measured by Rand Water. In view of the growing importance of the non-volatile organic compounds produced by the reaction of chlorine with organic substances, a total organic halogen analyzer was purchased by Rand Water to study the range of total organic halogen concentrations in drinking water.

The aim of the study was to determine the concentration levels of total organic halogen throughout the Rand Water distribution system. Samples were taken at four different sites. These sites were selected to include samples which were taken directly after chlorination (twenty minute contact time); samples which had been exposed to free residual chlorine for six hours; samples which were taken directly after chloramination at the booster stations and samples collected from the distribution system itself (4 - 36 hours after chloramination).

In general, an increase in total trihalomethanes (TTHM), purgeable organic halogen and adsorbable organic halogen concentrations were observed when comparing samples which had been exposed to free residual chlorine after a 20 minute contact and the samples taken immediately prior to chloramination at the booster stations (approximately a six hour contact time). A surprising aspect of the results was that, under conditions soon after the first chlorination, the measured TTHM values were dramatically lower than the measured POX values. No significant increase in TTHM, POX and AOX was measured at the booster stations directly after chloramination. A different picture emerged when samples were taken in the distribution system. Results showed no increase in concentrations for the three variables measured in one part of the study, another part of the study showed a dramatic increase in AOX concentration and a third set of analyses showed a significant loss of AOX in the distribution system. The AOX/TTHM and AOX/POX ratios appear to have consistent equilibrium values for each group of pipes and sampling points.

Although no guideline value has been set for POX concentrations in potable water, these concentrations can be compared to measured levels of TTHM. The guideline value which Rand Water uses against which to evaluate TTHM results is that of the United States Environmental Protec-

Turn over

tion Agency (TTHM 100 µg/l). No TTHM results, and therefore by inference, no POX concentrations, obtained during this study exceeded this guideline value.

At present, Rand Water has not accepted a guideline value against which to evaluate AOX con-

centrations and the Dutch guideline value of 100 µg/l was thus used. When compared to this value less than ten percent of the determinations done on samples during this study exceeded an AOX concentration of 100 µg/l.

The concentration of AOX was found to be up to

five times higher than the levels of POX in the chlorinated waters. These findings indicate that the production of AOX is more significant than the production of POX in chlorinated waters. Rand Water Scientific Services will incorporate POX and AOX measurements of drinking water into their routine monitoring programme.

Groundwater Contamination as a Result of Developing Urban Settlements

A Wright

Report to the Water Research Commission
and the
Cape Water Programme
Environmentek
CSIR

WRC Report No 514/1/99



Report 514/1/99 - Groundwater Contamination as a Result of Developing Urban Settlements. Report to the Water Research Commission by the Cape Water Programme, Environmentek, CSIR.

Author: A Wright

Overseas price: US\$ 25 (via surface mail)

South Africa has not escaped the demographic phenomenon of rapid urbanization experienced by developing countries. The result has been the development of vast informal settlements in and around existing centres.

The effect that these settlements have on the environment, and in particular on groundwater, is relatively unknown. The Water Research Commission recognised the need for a clearer understanding of the South African situation and commissioned the CSIR to undertake an initial assessment to ascertain if urban groundwater contamination, as a result of informal settlements, is a national problem or not.

The initial situation assessment was based on published literature and surveys, personal contact with researchers as well as brief visits to areas in Cape Town, Port Elizabeth, Durban and Gauteng. South African areas differed from other developing cities in that they are largely residential and do not include any formal industrial activity. The informal settlements could be grouped into several categories based on hydrogeological criteria - a primary aquifer that is considered a water resource (e.g. Cape Town Area), a secondary aquifer that is considered a water resource (e.g. Bloemfontein area), an aquifer that acts an environmental agent (e.g. Durban area) and the dolomitic aquifers in the Gauteng.

The selection of metropolitan areas in turn ensured that all the different types of housing and sanitation options were present. Case studies were undertaken in three areas, namely, Cape Town (Spandau Camp and Khayelitsha), Durban (Besters Camp) and North West Province (Winterveldt). The Department of Water Affairs and Forestry in turn agreed to undertake similar studies in Gauteng (Botleng and Poortjie).

The case studies showed that the complex array of human activity found in these areas, coupled with the general lack of infrastructure and sanitation, creates the potential for a multitude of pollution sources - the most important being on-site sanitation systems, garbage disposal and collection sites, water supply points, communal meeting sites, informal trading sites and stormwater drainage systems.

The individual source areas acted as point sources, but because of their density within the

urban catchment tend to collectively act as a diffuse pollution source. The most significant pollutants were nutrients (nitrogen and phosphorous species), pathogenic micro-organisms (helminths, protozoa, bacteria and viruses) and biodegradable organics (proteins, carbohydrates and fats). Other pollutants commonly found in urban areas such as heavy metals and refractory organics were not found and reflects the lack of industrial activity and level of poverty. The resultant impact on groundwater quality depended very much on the hydrogeological setting. Contamination occurred irrespective of the hydrogeology, but was only considered a major problem where the groundwater aquifer constituted a resource.

Groundwater contamination occurred extensively in the unconfined sandy aquifers of the coastal zone. The contamination was, however, generally restricted to the shallow groundwater and the plume seldom impacted much beyond the boundary of the settlements. Groundwater abstraction seldom took place within these informal settlements and the greatest danger was surface ponding due to rising water levels during the rainy season. However, a health problem could occur, should large scale abstraction take place in adjacent areas.

Granitic terrains are another area in which groundwater constitutes an important resource. The weathered zone above the bedrock constitutes a shallow aquifer which is extensively exploited on a local scale. The study showed that these aquifers are easily contaminated as a result of informal settlements - on-site sanitation representing the main source of pollution. Groundwater abstraction should only be permitted in these areas if boreholes comply with the Department of Water Affairs' guidelines.

Shallow groundwater in the other hard rock environments was generally found to have limited importance as a water resource. Although the shallow groundwater was contaminated by the different point sources, it never extended much beyond the source area. The only real danger existed where springs, used for local water supply, occurred in or down gradient of a settlement. The Besters Camp case study near Durban indicated that the in-site up-grading of existing informal settlements in these environments reduces the potential for groundwater contamination. This is, however, done at the expense of stormwater quality.

The study did not investigate the deeper, secondary aquifers. These aquifers are, however, considered relatively safe from the typical informal settlement type pollution unless a direct link (e.g. a fault/fracture zone and poorly constructed boreholes) exists between the aquifer and the informal settlement.

HYDROGEOLOGICAL MAP SERIES OF THE REPUBLIC OF SOUTH AFRICA

1: 500 000



Prepared by the Department of Water Affairs and Forestry



The following South African 1 : 500 000 General Hydrogeological maps and brochures are available as from April 1999

MAPS:

- 2330 Phalaborwa • 2526 Johannesburg
- 2730 Vryheid • 3321 Oudtshoorn
- 2928 Durban
- 3126 Queenstown
- 3324 Port Elizabeth

BROCHURES:

- 3126 Queenstown
- 3324 Port Elizabeth
- 3321 Oudtshoorn

The General Hydrogeological maps provide a synoptic overview of the hydrogeological character of the area by processing groundwater-related data according to a standard legend.

Each single A0 map sheet comprises:

MAIN MAP:

Groundwater occurrence (borehole yields and aquifer type) superimposed on a lithological background
(Scale 1 : 500 000)

INSET MAPS:

- Distribution of borehole data (Scale 1 : 2 000 000)
- Elevation above sea level (Scale 1 : 2 000 000)
- Mean annual precipitation (Scale 1 : 2 000 000)
- Groundwater quality (Scale 1 : 1 500 000)

SCHEMATIC CROSS-SECTION:

A schematic illustration of typical modes of groundwater occurrence (Not to scale)

ACCOMPANYING BROCHURE:

Provides additional information concerning groundwater occurrence and related matters

Price:

R50.00 per map } (VAT, postage and
R50.00 per brochure } packing included)

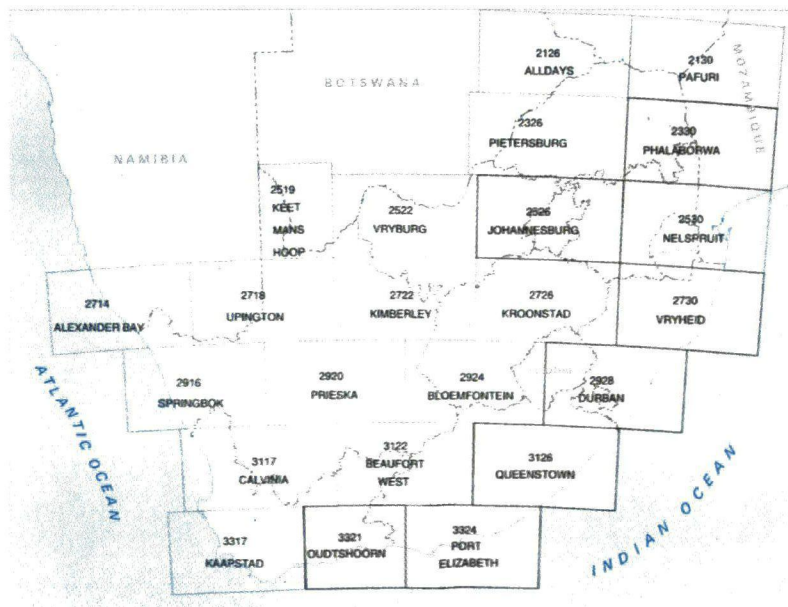
Copies of the maps and brochures are obtainable from:

Ms. M. van Wyk
Department of Water Affairs and Forestry
Directorate: Geohydrology
Private Bag X313
Pretoria
0001

Tel: (012) 338 7849

Fax: (012) 328 6397

E-mail: WB3@dwaf.pwv.gov.za



Website: <http://www-dwaf.pwv.gov.za>

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 | FEBRUARY | MARCH | APRIL |
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Die Watnavorsingskommissie plaas hierdie kalender om te help met die koördinerings 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

WATER WEEK

MARCH 20 - 26

The South African Water Week will be held throughout the country during the third week of March 2000.

Enquiries: Department of Water Affairs and Forestry, Communication Services Division, Private Bag X313, Pretoria 0001. Tel: (012) 336-7500. Fax: (012) 324-6592.

CEMSA 2000

MARCH 27 - 29

The 2nd international conference and exhibition on integrated environmental management in South Africa will be held in East London.

Enquiries: Creative Public Relations, PO Box 18227 Quigney, East London 5211. Tel: 0431 437267. Fax: 0431 26914.

GEOCHEMISTRY

APRIL 24 - 29

The 5th international symposium on environmental geochemistry will be held in Cape Town

Enquiries: Ms Jodi Fyfe, Post-graduate Conference Division, UCT Medical School, Anzio Road, Observatory 7925. Tel: (021) 406 6407. Fax: (021) 448-6263. E-mail: jfyfe@medicine.uct.ac.za

WATER & SANITATION

MAY 9 - 12

A specialised exhibition with the theme "Rural Development Technology Africa 2000" will be held at the EXPO Centre, NASREC, Johannesburg.

Enquiries: Specialised Exhibitions, Box 82196, Southdale 2135. Tel: (011) 835-1565. Fax: (011) 496-1161. E-mail address: charlene@specialised.com

WATER & WASTE

MAY 23 - 26

A specialist conference on managing water and waste in the new millennium - the challenges for developing areas - will be held in Midrand.

Enquiries: Roelien-M Bakker, IWA Conference, PO Box 6011, Halfway House 1685. Tel: (011) 805-6368. Fax: (011) 315-1258. E-mail: conference@wisa.co.za

WISA

MAY 28 - JUNE 1

The Water Institute of Southern Africa (WISA) will hold its biennial conference and exhibition at Sun City.

Enquiries: Roelien-M Bakker, WISA, PO Box 6011, Halfway House 1685. Tel: (011) 805 6368. Fax: (011) 315 1258. E-mail: conference@wisa.co.za

WATER RESOURCES

JUNE 7 - 9

The 4th biennial congress of the African division of the International Association of Hydraulic Research (IAHR) on conserving and sharing water resources in a water scarce environment will be held in Windhoek, Namibia.

Enquiries: Congress Secretariat, Ms Marelise Serfontein, PO Box 9870, Windhoek, Namibia. Tel: +264-61-251014/272031/254281. Fax: +264-61-272032/251014. E-mail: namlink@iwwn.com.na

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, Tygervally 7536. Tel: (021) 99 3172. Fax: (021) 99 4707. E-mail address: wastecon2000@mweb.co.za Website: www.weirenvig.co.za/wastecon2000

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

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

AFRIWATER EXHIBITION

AUGUST 15 - 17 2001

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 2001

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

WATER

MARCH 11 - 17

The 10th world water congress is to be held at the Melbourne

Convention Centre, Melbourne, Australia.

Enquiries: Lisa McNaught, ICMS Pty Ltd, 84 Queensbridge Street, Southbank, Victoria, Australia 3006. Tel: +61 3 9682 0244. Fax: +61 3 9682 0288. E-mail: worldwater@icms.com.au

WATER FORUM

MARCH 17 - 22

The second world water forum and ministerial conference will be held in the Hague, the Netherlands.

Enquiries: E-mail: secretariat@worldwaterforum.org Fax: +31 70348 6792.

GLOBAL RESOURCES

MARCH 19 - 23

Water 2000 conference and expo with the theme - Guarding the global resources - will be held in Auckland, New Zealand.

Enquiries: E-mail address: water@nzwwwa.org.za Tel: +64 9636 3636. Fax: +64 9636 1234. Web: http://www.nzwwwa.org.nz/w2000.htm

MEMBRANES

MARCH 27 - 29

An international conference on membrane technology in water and wastewater treatment will be held in Lancaster, England.

Enquiries: Elaine Wellingham, Field End House, Bude Close, Nailsea, Bristol BS48 2FQ England. E-mail: confsec@dia.pipex.com Tel: +44 1275 853311. Fax: +44 1275 853311.

REMOTE SENSING

APRIL 3 - 7

A symposium titled Remote Sensing 2000 will be held in Santa Fe, NM, USA.

Enquiries: Dr Jerry C Ritchie, Hydrology Laboratory, Room 104, Building 007, USDA/ARS/ BARC-West, Beltsville, Maryland 20705-2350, USA. E-mail: jritchie@hydrolab.arsusda.gov Tel: +301 5047490. Fax: +301 5048931.

METEOROLOGY

APRIL 3 - 7

The 6th international conference on southern hemisphere meteorology and oceanography will be held in Santiago, Chile.

Enquiries: Patricio Aceituno, University of Chile, Casilla 2777, Santiago, 6511227, Chile. E-mail: aceituno@shmo.chile 2000.cl

WASTEWATER

APRIL 4 - 7

A CIWEM millennium conference

- wastewater treatment: standards and technologies to meet the challenges of the 21st century will be held in Leeds, England. Enquiries: Zena Hickinson, AE Technology Transfer, School of Civil Engineering, University of Leeds, Leeds LS2 9JT, UK. E-mail: z.hickinson@leeds.ac.uk Tel: +44 113 2332308. Fax: +44 113 2332243.

WATER RESOURCES

APRIL 9 - 12

An international symposium on integrated water resources management will be held in California, USA.

Enquiries: Prof Miguel A Marino. Tel: +1 530 752 0684. Fax: +1 530 752 5262 Web address: <http://www.conferences.ucdavis.edu>

WASTE MANAGEMENT

APRIL 28 - MAY 1

Aqua Abu Dhabi will organise a conference with the theme "Waste Management for a better environment" in Abu Dhabi, United Arab Emirates.

Enquiries: Conference Chair, Aqua Abu Dhabi, PO Box 3487, Abu Dhabi, United Arab Emirates. E-mail: aqua2k@emirates.net.ae Fax: +971 2 790218.

WATER RESOURCES

APRIL 30 - MAY 4

An international conference on water resources in extreme environments will be held in Anchorage, AL, USA.

Enquiries: Douglas Kane, University of Alaska, Fairbanks AK99775, USA. E-mail address: ffdk@aurora.alaska.edu Fax: +907 474 7979. Web address: <http://www.awra.org>

WATER SERVICES

MAY 3 - 5

An international conference on the global marketing of water services - comparing quality service characteristics and customer satisfaction - will be held in Torino, Italy.

Enquiries: Noema srl, Via Orefici 4, 40124 Bologna, Italy. E-mail: noema1@alinet.it Tel: +39 051 230385. Fax: +39 051 221894.

GROUNDWATER

MAY 8 - 10

The International Association for Hydraulic Research will hold an international symposium on groundwater in Saitama, Japan. Enquiries: Dr H Kazama, Saitama University, 255 Shimo-ohkubo, Urawa, Saitama 338-8570, Japan. Tel: +81 48 858

3568. Fax: +81 48 855 1378. Web: <http://www.hgl.saitama-u.ac.jp>

LAKE MANAGEMENT

MAY 17 - 21

The 8th international conference on the conservation and management of lakes will be held in Copenhagen, Denmark.

Enquiries: Conference Bureau, Herlev Ringvej 2C, DK-2730 Herlev, Denmark. Tel: +45 4492 4492. Fax: +45 4492 5050.

CHLORINATION

MAY 21 - 24

The 2nd international conference on the remediation of chlorinated and recalcitrant compounds will take place in Monterey, CA USA.

Enquiries: The Conference Group, 1989 West Fifth Avenue, Suite 5, Columbus, Ohio 43212-1912, USA. E-mail: 102632.3100@compuserve.com Tel: +800 783 6338. Fax: +614 488 5747.

ACHEMA 2000

MAY 22 - 27

The 26th exhibition-congress and international meeting on chemical engineering, environmental protection and biotechnology will be held in Frankfurt am Main, Germany.

Enquiries: Dechema. Tel: +49 (0) 697564-261. Fax: +49 (0) 697564201. Internet: <http://www.woice.de> E-mail address: woice@dechema.de

IRRIGATION

MAY 23 - 25

A conference and exhibition - Irrigation Australia 2000 - will be held in Melbourne, Victoria, Australia.

Enquiries: Rodney Cox, Exhibitions and Trade Fairs, PO Box 232, Chatswood NSW 2057 Australia. Tel: +61 2 9413 3322. Fax: +61 2 9413 3303. E-mail: syd@etf.com.au

WATER ECOLOGY

MAY 30 - JUNE 2

ECWATECH 2000 will hold the fourth international congress and exhibition with the theme "Water ecology and technology" in Moscow, Russia.

Enquiries: Exhibition Management and Congress Secretariat, PO Box 173, Moscow 107078 Russia. Tel: +7 0959 753 423. Web address: <http://www.sibico.com/ecwatech/>

WATER SURFACES

JUNE 5 - 8

The 4th international symposium

on gas transfer at water surfaces will be held in Miami Beach, Florida, USA.

Enquiries: Gayl van de Bogart, University of Miami, 4600 Rickenbacker Causeway, Miami FL 33149, USA. Web address: <http://cheyenne.rsmas.miami.edu/gas2000.html/>

GROUNDWATER 2000

JUNE 6 - 8

A conference with the theme Groundwater 2000 will be held in Copenhagen, Denmark.

Enquiries: MiaCon Meeting and Conference Services, Helsingvej 23, DK-2830 Virum, Denmark. E-mail: gw2000@isva.dtu.dk Tel: +45 45 859727. Fax: +45 45 839727. Web address: <http://www.isva.dtu.dk/grc/gw2000/>

AWWA

JUNE 11 - 15

The AWWA 2000 annual conference and exhibition will be held in Denver, Colorado, USA.

Enquiries: David Rossiter, AWWA, USA. E-mail: rossiter@awwa.org Tel: +303 3476209. Web: <http://www.awwa.org/tande/awwaconf.html>

GIS

JUNE 14 - 16

The 2nd international conference on GIS (Geographic Information Systems) for the 21st century will be held in Lisbon, Portugal.

Enquiries: Gabriella Cossutta, Ashurst Lodge, Ashurst, Southampton SO40 7AA, United Kingdom. E-mail: gcossutta@wessex.ac.uk Tel: +44 2380 293 223. Fax: +44 2380 292 853. Web: <http://www.wessex.ac.uk>

IRRIGATION

JUNE 20 - 24

An international conference on the challenges facing irrigation and drainage in the new millennium - meeting human and environmental needs through sustainability, rehabilitation and modernisation will be held in Fort Collins, CO, USA.

Enquiries: US Committee on Irrigation and Drainage, 1616 17th Street, 483 Denver, CO 80202, USA. E-mail: stephens@uscid.org Fax: +303 6285431. Web: <http://www.uscid.org>

FLOW ANALYSIS

JUNE 25 - 29

The 4th international conference on flow analysis will take place in Warsaw, Poland.

Enquiries: Prof Marek Trojano-

wicz, Department of Chemistry, University of Warsaw, Pateura 1, 02-093, Warsaw, Poland. E-mail: trojan@chem.uw.edu.pl Tel: +48 22 8223532. Web: <http://www.congress.pbp.com.pl/flow/>

OCEAN DYNAMICS

JULY 2 - 7

The international union of theoretical and applied mechanics symposium on the advances in mathematical modelling of atmosphere and ocean dynamics, will be held in Limerick, Ireland.

Enquiries: PF Hodnett, University of Limerick, Ireland. E-mail: iutamlim@ul.ie Web: <http://www.ul.ie/~iutamlim/>

WASTEWATER

JULY 3 - 6

The 3rd international symposium on wastewater reclamation, recycling and reuse will be held in Paris, France.

Enquiries: Ms Nicole Couesnon, GBE, Université Montpellier II, cc057, 34095 Montpellier cedex 05, France. E-mail: wrrr.2000@dstu.univ-montp2.fr Tel: +33 4 6714 3310. Fax: +33 4 6714 4774.

IWA

JULY 3 - 7

The first world congress of the new International Water Association (IWA), formed by the merger of the International Association on Water Quality (IAWQ) and the International Water Services Association (IWSA), will be held in Paris, France.

Enquiries: Aghtm-cfrp, 83 Avenue Foch - B.P. 39.16, 75761 Paris - Cedex 16 - France. Tel: +33 (0)1 53701351 or 53. Fax: +33 (0)1 53701340. E-mail: aghtm@aghtm.org

AQUATIC ENVIRONMENTS

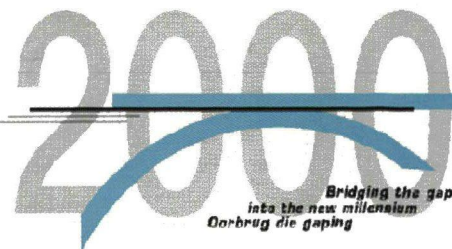
JULY 3 - 7

A conference on new trends in water and environmental engineering for safety and life: eco-compatible solutions for aquatic environments will be held in Capri, Italy.

Enquiries: Terra, Dept IAR, Hydraulic Div, Politecnico di Milano, Italy. E-mail: terra@marina.iar.polimi.it Fax: +39 2 23996298.

first announcement

CALL FOR PAPERS



Two day Conference VAAL RIVER 2000

7 & 8 November 2000
On the Vaal, Gauteng

Organised by SAICE (Water Engineering Division) and Vaalco,
in association with WISA and the Water Research Commission.

CONFERENCE FOCUS

The Conference will focus on one of the most important rivers in South Africa - the Vaal River, and concentrate on the impact of the new legislation on the Vaal River system and its catchment. It will actively involve a range of stakeholders. It is planned to be informative for both the technical and the not-so-technical minded, to disseminate information on the status of water resources in the Vaal River catchment, highlight various legislative, water resource management, social and technical issues, and discuss advances in water management science.

TOPICS

Vaal River issues that could profit from discussion include:

- Community water supply and sanitation
- Projected water requirements
- The effect of demand management
- Environmental requirements, the water reserve and IFRs
- The place of irrigation
- System analyses
- The National Water Balance model
- Economic impacts
- New developments in modelling the above
- The effect of water pricing policies
- Water quality issues and their effect on water requirements
- The impact of CMAs
- Effect of other recently promulgated legislation (including interaction with environmental policy)

ABSTRACT SUBMISSION

Papers and Posters are invited that would address the topics above and the programme will consist of a combination of invited keynote speakers and paper sessions. Abstracts should not exceed 300 words. Please provide the proposed paper title first (centred), followed by the authors' names and addresses. You are requested to e-mail the abstracts for attention of Lesley Stephenson to: stephenson@egoli.min.wits.ac.za.

DEADLINES

Receipt of Abstracts:
6 March 2000

Acceptance of Abstracts:
3 April 2000

Draft Papers Required:
2 August 2000



WATER
RESEARCH
COMMISSION

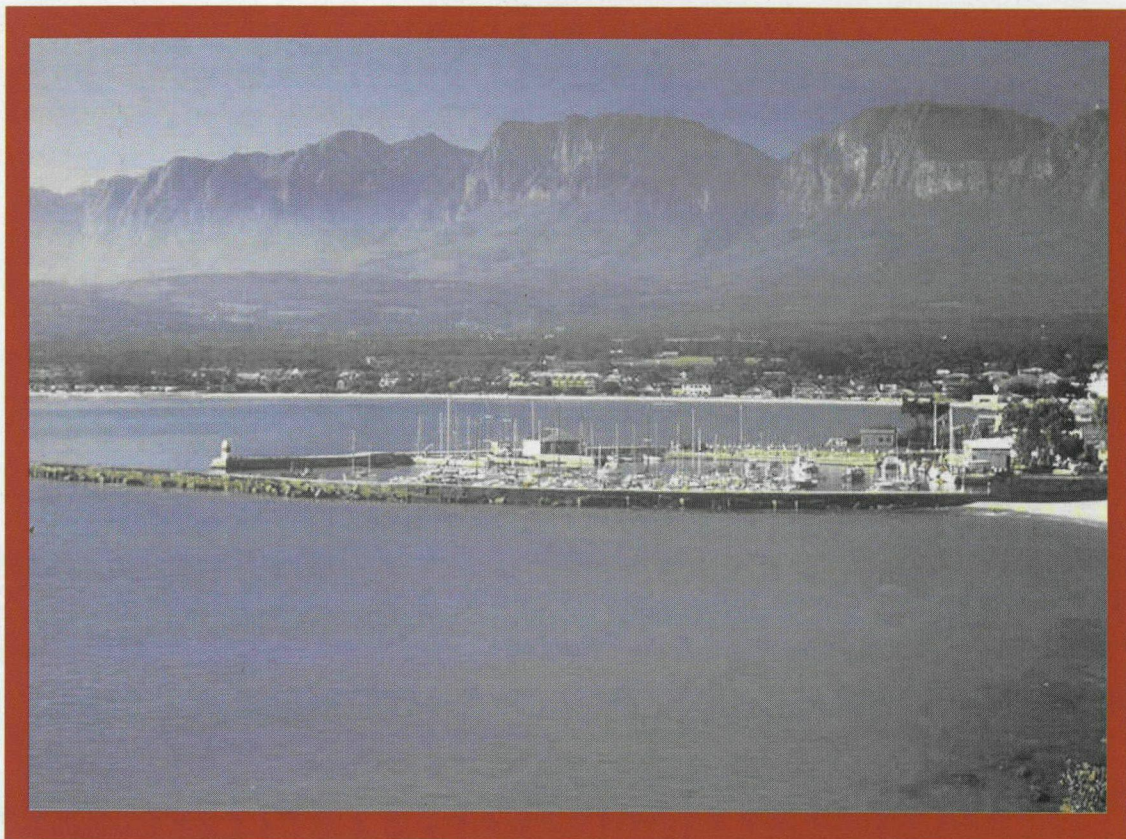
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BIENNIAL CONFERENCE AND EXHIBITION

"Integrated Waste Management in the New Millennium"
5-7 September 2000
Somerset West, near Cape Town
SOUTH AFRICA

WASTECON 2000 SECRETARIAT

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Organised by the
INSTITUTE OF WASTE MANAGEMENT