

S4 waterbulletin

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WATER QUALITY

SA Cholera outbreaks part of global pandemic

GROUNDWATER

Novel compressed-air pump designed for rural areas

WRC RESEARCH

Masterplan released for health-related water research

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Technology transfer workshop on **THE MANGEMENT OF URBAN IMPOUNDMENTS GUIDELINE MANUAL**

Centurion Council Offices, 28 March 2001

AIM OF THE COURSE

The Urban Impoundment Management Guideline Manual is the product of a research project carried out for the Water Research Commission to investigate the water quality problems most commonly experienced in South African urban impoundments, as well as the management techniques which can be used to address them. The course is designed to lead the participants through the manual, to familiarise themselves with the various management techniques which could be used and to undertake a hypothetical test case using the manual.

WHO SHOULD ATTEND?

The workshop is aimed at those responsible for managing urban impoundments in the local authorities, but it would also be of benefit to developers, planners, community based organisations and any other sector involved in the management of urban impoundments.

COST

The workshop fee is R300 per person (excluding travel and accommodation costs) and includes refreshments and a light lunch. Copies of the manual will be available free of charge to the delegates.

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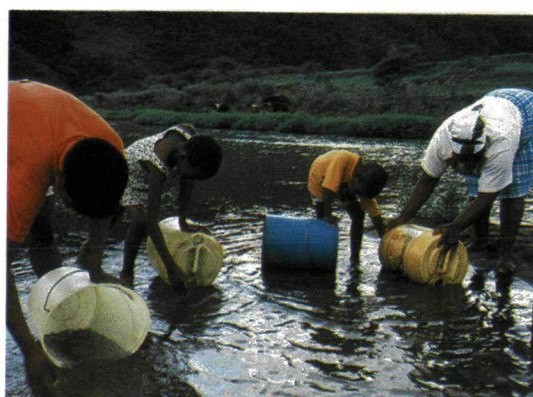
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p 4



p 16



p 18

Contents

WATERFRONT	4	IAH 2000 Congress Hydrogeologists gather in Cape Town
WATERFRONT	8	River Health Programme Workshop shows RHP progress
AGRICULTURAL WATER	10	A closer look at SWB irrigation model
WATER QUALITY	12	Cholera outbreaks in South Africa part of an ongoing global pandemic
WRC RESEARCH	14	WRC Strategic plan for the health-related water issues (HRW) research field
WATER QUALITY	16	Microbial Water Quality in the 21st century
GROUND WATER	18	New "green energy" rural water pump tested
GROUND WATER	23	WRC project evaluates groundwater monitoring
WRC REPORTS	24	New reports published by the Water Research Commission
FEATURES	4	Waterfront
	29	Conferences and Symposia

*Cover: Groundwater – Drilling for water in the Kalahari region (Northern Cape, South Africa).
(Photo: Courtesy of Eddie van Wyk, DWAF)*

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IAH 2000 Congress

Hydrogeologists gather in Cape Town

The 30th Congress of the International Association of Hydrogeologists was held, jointly with the Groundwater Division of the Geological Society of South Africa, at the end of November 2000. The theme was "Groundwater: Past Achievements and Future Challenges". Some 420 groundwater specialists from 38 countries gathered in Cape Town for this event. More than 220 of the delegates represented 16 African countries.

The Minister of Water Affairs and Forestry, Mr Ronnie Kasrils, and Graça Machel, Chancellor of the University of Cape Town and UN Representative, addressed delegates during the opening ceremony.

They commended the hydrogeologists for their excellent work and challenged them to improve the understanding of

groundwater conditions in sub-Saharan Africa, and thereby to contribute to the development and management of groundwater for sustainable water use.

Mr Kasrils said that South Africa would increasingly have to make use of its groundwater resources to balance water supply with demand. Referring to the Table Mountain group aquifer stretching from the Western Cape to Port Elizabeth, he said that effective exploitation of this "hidden treasure" would go a long way to resolving South Africa's problem of water supply in an efficient, cost-effective and sustainable manner, well into the future.

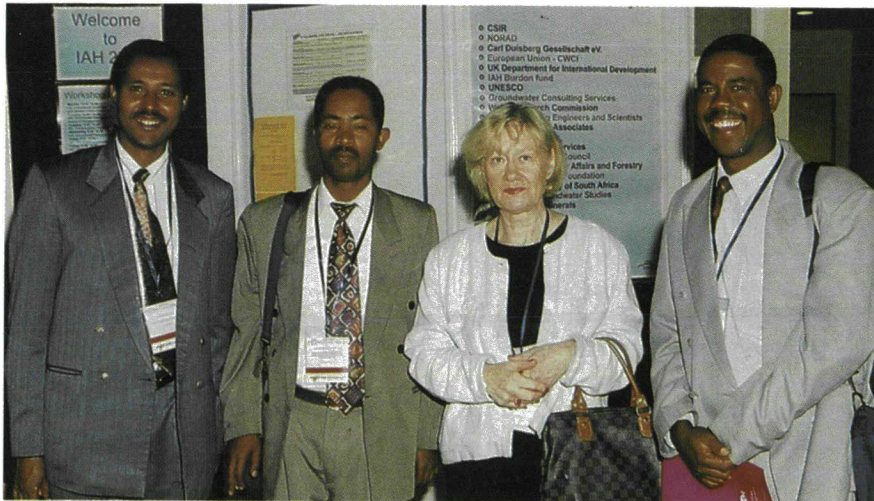
The potential for groundwater exploitation, due to technological advances, has increased considerably since the 1970s. Keynote speaker Professor Stephen Foster of the British Geological

Survey, outlined some of rapid development and achievements in the field of hydrogeology in providing good quality, reliable water for domestic and agricultural use to millions of people around the world. He referred to the dramatic improvements in water management called for by the World Water Forum (March 2000, The Hague, Netherlands), which included a groundwater initiative for sustainable aquifer management. Foster also mentioned the important ecological and environmental role of groundwater, saying that much need to be done to obtain an appropriate balance between the development and conservation of groundwater systems. He briefly looked at the challenges for the 21st century with regard to groundwater resources.

In his keynote address Mr Eberhard Braune, Director of Geohydrology at the



Speakers at the opening session of the congress: Christine Colvin (Chairperson, Organising Committee), Mr Ronnie Kasrils (Minister of Water Affairs and Forestry), Professor Michael Knight (President of IAH), Graça Machel (Chancellor of the University of Cape Town and UN Representative), Prof Stephen Foster (British Geological Survey, UK) and Mr Eberhard Braune (Director of Geohydrology, Department of Water Affairs and Forestry).



From Left: Shiferaw Lulu, Ethiopia, Girum Admusa Nadew, Ethiopia, Christa Stoecklein, Germany and Menhassebo Hiwot from Ethiopia.



From left: Maswuma Zacharia, DWA SA, Agnes Sibara, IGS UOFS, Violet Ramunenyiwa, IGS UOFS and Vhutshilo Masibigiri, National Community Water and Sanitation Institute, Sovenga.



From left: Yasumasa Yamasaki, Japan Pacific Consultants International, Gideon Tredoux and Johan de Beer, both of the CSIR.

Department of Water Affairs, noted that nearly half of the world's population depend on groundwater for drinking water supply and other uses. Accordingly management strategies are required which address the unique characteristics and roles of groundwater and at the same time take the socio-economic development situation in a particular country into account. Focusing on the challenges facing South Africa, he outlined aspects of an emerging groundwater management strategy within the context of the new water policy and legislative framework in South Africa. This will move groundwater from its present low management position to integrated water resource management. He said that groundwater resource protection strategies will have to follow an integrated water resource management approach, addressing groundwater, surface water, quantity and quality together.

The more than 200 papers presented at the congress represents a wide diversity of experience and a great range of expertise. The six main themes were:

- Determination of aquifer parameters, resource assessment and evaluation
- Groundwater modelling and water-well issues
- Chemical and isotopic characterisation of groundwater
- Integrated water resources management, and
- Geotechnical issues and mining.

The complete volume of the papers of the 30th Congress of the International Association of Hydrogeologists has been published under the title "Groundwater: Past Achievements and Future Challenges", edited by Oliver Sililo et.al. (2000). The volume is obtainable from the publisher: A A Balkema, PO Box 1675, 3000 BR Rotterdam, Netherlands. Fax: +31-10-413-5947. E-mail address: balkema@balkema.nl or Website: www.balkema.nl



IAH 2000 Cape Town Statement

1. We, the participants at the Congress, note that:

- Despite the fact that in many situations throughout the world, for both rural and urban communities, groundwater is the sole water resource or is the bridging resource during droughts, its value is too often ignored at both the technical and political level.
- Groundwater resources continue to be degraded by misuse and polluted by poor management or by short sighted and ill-informed land use. Opportunities for future development are thereby lost, normally forever, because of the high cost or technical infeasibility of remediating the groundwater resource
- There are however increasing examples of good practice, with innovative and cost effective ways of developing groundwater within integrated water resource management frameworks.
- Groundwater systems are complex. They are slow to respond and responses may be subtle, widely spread and delayed in time. Solutions need to be tailor made and based on sound baseline data and take full account of social and cultural issues. Citizens, communities and decision makers need to understand and participate in these decisions.
- There is a need to investigate and manage groundwater within basin and aquifer units, even when these cross national boundaries, to ensure that the full economic, social and environmental value of the resource is realized and that it does not become a vehicle for conflict.
- In the pressure to develop new groundwater resources, quality constraints must not be ignored. Quality needs to be a part of every groundwater evaluation and maintaining quality through vulnerability assessments and land use management needs to be part of any implementation plan.
- The full benefits of groundwater in integrated water management will not be achieved if groundwater is merely seen as a supplementary resource; a whole system approach must be used which fully values the storage, quality and widespread availability of groundwater,

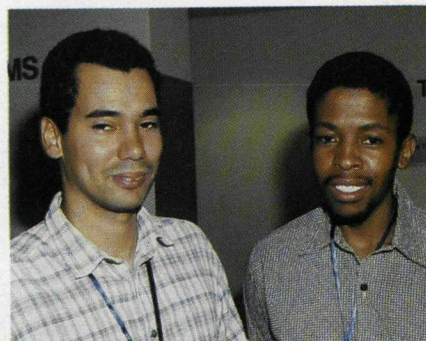
2. We, as groundwater specialists, commit ourselves to:

- Directing our research at the development agenda, tackling relevant issues and ensuring that our knowledge is transferred into practical management outcomes.
- Taking a more active role in promoting groundwater solutions and being more involved with water

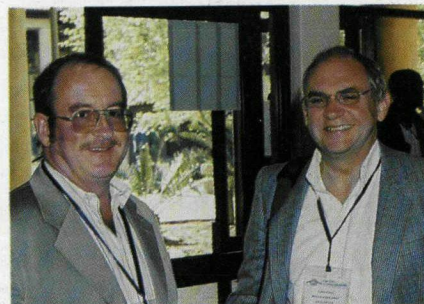
policy issues at all levels.

- Informing and empowering all stakeholders to better manage and protect their groundwater resources through an improved understanding of its role and value.
 - Working more closely with environmental and social scientists to promote multidisciplinary working and to achieve fully integrated solutions which advance sustainable development.
 - Ensuring that sound principles of groundwater science are always applied and to develop and sustain networks to permit better sharing and dissemination of successful solutions
- ## 3. We enjoy the organisations with the UN system, national governments and funding agencies to:
- Recognise the advantages of groundwater solutions for providing cost-effective and socially inclusive solutions for first time rural water supplies.
 - Give adequate emphasis to baseline studies and well-focused monitoring of both groundwater quantity and quality so that opportunities for implementing cost and socially effective solutions are not lost because of lack of reliable planning data.
 - Encourage the use of appropriate innovative technologies for optimal use and protection of groundwater, such as artificial recharge and natural attenuation
 - Facilitate multi-disciplinary collaboration at the regional level to conduct studies of aquifers shared between adjacent states, leading to their sound management for long term water security.
 - Use the skills of the groundwater community to help inform the World Water Assessment Programme now being carried out by the UN Agencies to ensure that our global water resource assessments are fully comprehensive.
 - Promote, through better training and education at both the professional and community level, better management and protection of groundwater resources. Many of the issues we face will not be solved by additional technical studies but by better and more consistent application of the management principles that are already established. The "front-line" managers of groundwater are in the village, the community, and the farm and therefore education needs to be comprehensive and should be an integral part of any groundwater project.

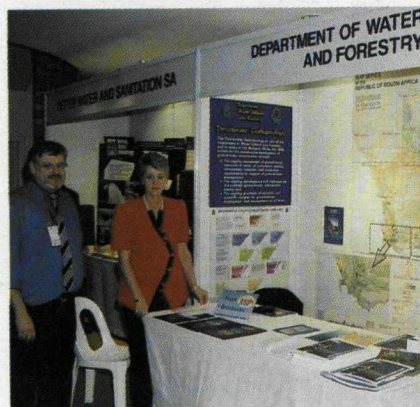
Cape Town, December 2000



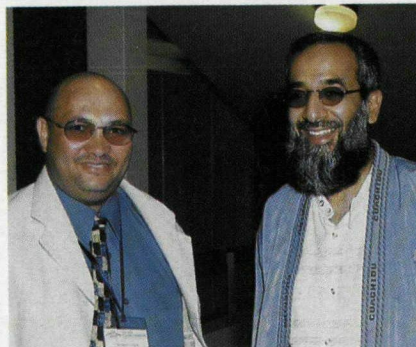
Irené Saayman (left) and Fortune Moabi, both of the CSIR.



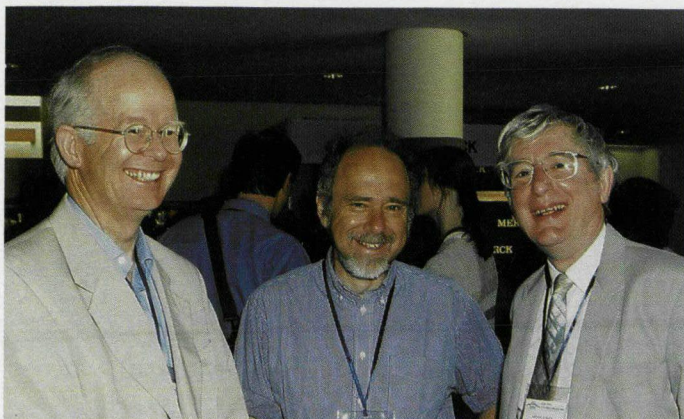
John Farr of Wellfield Consulting Services, Botswana (left) and Denis Peach, British Geological Survey, UK.



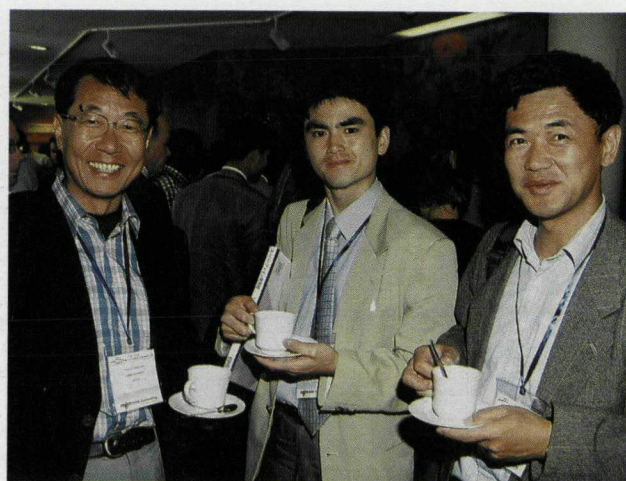
Ernest Bertram and Magriet van Wyk, both from DWAF.



Kevin Pietersen of the Water Research Commission (left) and Haroon Karodia of the Department of Water Affairs.



From Left: Bruce Missrear, Trinity College in Ireland, Ian Acworth, Water Research Lab in Australia and Andrew Skinner, Environmental Agency in the UK.



The delegation from Japan.



Alle van Calker, Eijkelkamp Agrisearch Equipment (left) and Jan Jackman, Barlofco, SA.



From Left: Modesta Banda-Kanjaye, Kabuka Mwatama Banda and Sydney Mainala, all from the Malawi Government.

Groundwater research at the WRC



The strategic plan for groundwater research was updated in 2000. The plan is based on the premise that to find solutions to real world problems will require a collaborative framework. This means breaking down traditional disciplinary boundaries, designing research to support both integrated water resources management and policy making, and communicating research output in an appropriate manner. This will require scientist and other professionals from different disciplines to work together to achieve a common goal.

Groundwater is a national strategic resource that contributes to sustainable development and maintains sensitive ecosystems. However, because it is unseen, it frequently is not properly managed with resulting under- or

overexploitation as well as resource degradation. The National Water Act regards groundwater as a common resource to be managed in a sustainable manner. Recognising these challenges, a vision for groundwater research is:

"The realisation, through excellence in research, of the full potential of groundwater in contributing to equitable and sustainable development in Southern Africa."

New goals for the groundwater field was developed based on identified driving forces, such as alleviation of poverty and promotion of quality of life. The following goals (problem areas) for groundwater research, to be implemented over a 5-year time-frame, were identified:

- ☐ To refocus groundwater characterisation towards integrated water resource management in line with national needs and priorities.
- ☐ To manage groundwater quality with emphasis on the prevention of contamination / pollution.
- ☐ To support activities that develop appropriate professional, institutional and management practices to achieve integrated water resource management.
- ☐ To encourage innovative and imaginative research (lateral thinking) with the potential to contribute to meeting the identified vision of groundwater research.

The Strategic Plan for Groundwater Research can be accessed on the WRC website: <http://www.wrc.org.za>.

River Health Programme

Workshop shows RHP progress

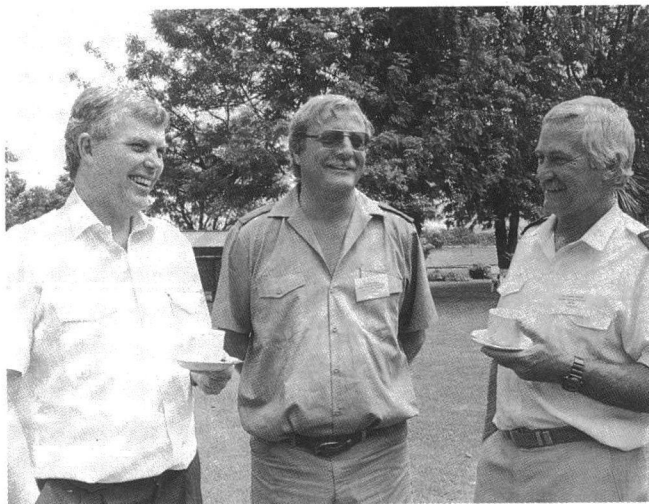
A River Health Programme (RHP) workshop was held during November 2000 at Pretoria. On this occasion the custodians and provincial implementers of the RHP deliberated the road towards national implementation of the programme. According to Dr Dirk Roux, leader of the national co-ordination team, the theme of the two-day event was the creation of an enabling environment to allow internalisation of the RHP within participating organisations.

The workshop started with a meeting of the National Co-ordinating Committee (NCC) of the RHP. During this meeting each "Provincial Champion" reported on RHP activities that has taken place in his/her region. It was clear that significant progress has been made in most provinces, including advances in institutional collaboration and the execution of health surveys on various rivers. It was also striking that each provincial initiative has its own character as far as adoption and implementation of the RHP goes. This character is seemingly introduced through factors such as the style of the local leadership, resource realities within a particular province, the degree of inclusiveness and the institutional composition of the provincial implementation team.

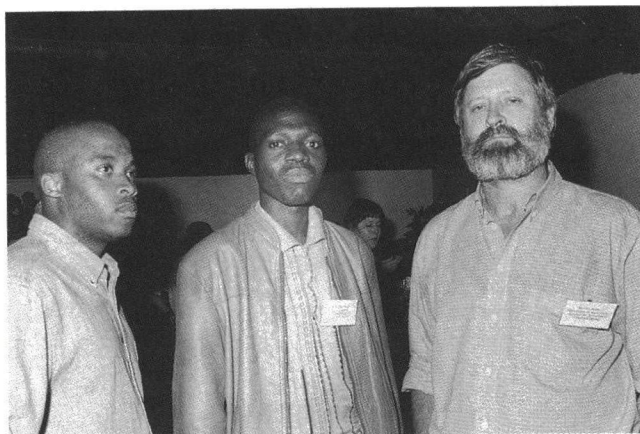
As part of the current "anchoring phase" of the RHP, funded by the Department of Water Affairs and Forestry (DWAF), a number of processes are being developed to assist implementers with operational application of the programme. These include procedures for quality control and continued improvement; a tool (Rivers Database) for data storage and management; as well as procedures for information packaging and dissemination. Further aims of the anchoring phase are to respond to specific training needs and to ensure effective co-ordination and communication of new developments and implementation activities around the country.



Dr Dirk Roux (CSIR) and Vassie Maharaj of the RHP National Co-ordination Team, with Mary-Jean Gabriel of the Institute of Water Quality Studies.



Dr Geoff Cowan (Deputy director, Department of Environmental Affairs and Tourism), with Mick Angliss (Northern Province Department of Agriculture and Environment) and Dr Andrew Deacon (Kruger National Park) enjoying a light moment at the workshop.



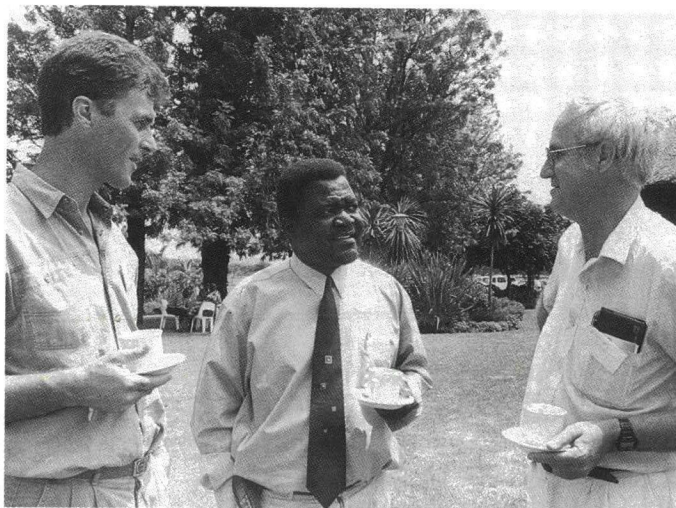
Thabo Masike (DWAF) with Reggy Nkosi and Piet Muller (both from Gauteng Nature Conservation) attended the workshop.

Priorities

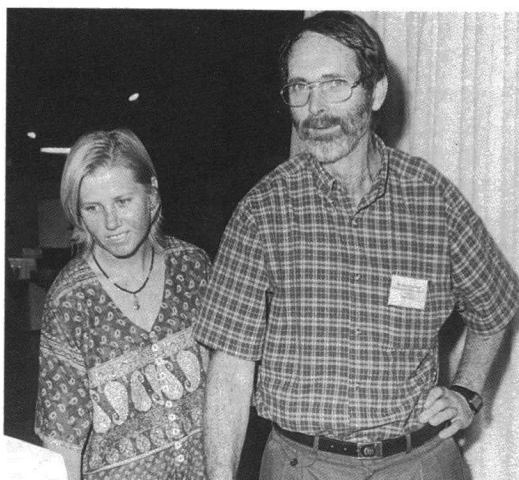
The workshop concluded with a session during which provincial teams expressed their priorities for 2001 regarding implementation of the RHP. These priorities reflected the rich diversity in provincial "make-up" and confirmed the value of flexible implementation models. Where the next step for one province may be to achieve multi-organisational collaboration through formation of a provincial implementation team, another province has a need to collate and capture all available river health data, while some provinces have reached the stage where they are able to produce a "state-of-the-river" report for a particular river system(s).

The levels of leadership, enthusiasm and creativity that are evidently present in provincial implementation teams, together with the committed support from national custodian organisations (DWAF, Department of Environmental Affairs and Tourism, and the Water Research Commission), holds the promise of many RHP highlights in 2001, says Dr Dirk Roux.

For more information, please visit the RHP's official Home Page at <http://www.csir.co.za/rhp> or contact Dr Dirk Roux at tel. (012) 841-2695, or fax: (012) 841-2506.



Dr Chris Dickens (Umgeni Water) Dr Mbangi Nepfumbada (Director, Institute for Water Quality Studies) and Dr Harry Biggs (South African National Parks) having a word during tea break at the workshop.

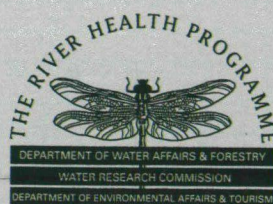


Attending the workshop: Helen Dallas (Southern Waters, UCT) and Mike Silberbauer (Institute for Water Quality Studies) here discussing the Rivers Database computer program.

Background information on RHP

The Department of Water Affairs and Forestry (DWAF) initiated the formal design of the River Health Programme (RHP) in 1994. The main purpose was that the programme should serve as a source of information regarding the overall ecological status of in-stream and riparian biological communities (eg. fish, invertebrates, vegetation) to characterise the response of the aquatic environment to multiple disturbances. The rationale is that the integrity or health of the biota inhabiting the river ecosystems provides a direct and integrated measure of the health of the river as a whole.

As the RHP is intended for national and long-term application, the pro-



gramme has been tailored in recognition of local capacity and the availability of resources such as funds and manpower. The technical specifications of the programme have been kept as simple as possible to encourage adoption and implementation by a broad range of water management institutions. However, the success of adoption and maintenance of the RHP will largely

be determined by the operational effectiveness and efficiency with which the programme can be implemented.

ANCHORING PHASE

The RHP has now entered the anchoring phase where the concept of adoption and implementation of the programme in the provinces must be embraced. The anchoring phase is intended to help the HRP in progressing from a focus on scientific development to becoming a fully incorporated operation of water management institutions. For this reason, the focus of attention must now shift from what to do (product development) to how to do it (process development).

A closer look at improving the SWB irrigation model

A Workshop on the Soil Water Balance (SWB) irrigation scheduling model, developed at the University of Pretoria, was held during November 2000 under the auspices of the Water Research Commission. The aim of the workshop was to gain information from users or stakeholders on how to improve the Soil Water Balance (SWB) model and make it more user-friendly, as well as to discuss training requirements with regard to the use of the model. More than 30 researchers, consultants and current users attended the workshop.

WRC research manager Dr Gerhard Backeberg says that correct irrigation scheduling is essential for efficient water use. In the past the WRC has funded research to develop irrigation scheduling tools, either for planning and design, or for real-time application. However, most of these irrigation scheduling tools have not been used widely and a survey has indicated a need for training in the use of simple and practical irrigation scheduling methods.

REFINEMENT

The SWB model (WRC Report 573/1/99) is the most recently research developed tool for real-time scheduling, however, feedback from users have indicated several difficulties, eg regarding data capture.

Only a small number of people are using the model for irrigation scheduling, while other potential users have experienced problems with installing and adapting it to their particular farming situation. According to Dr Backeberg there is obviously a difference of perception between the researchers and the users regarding the "user-friendliness" of the current model. This indicates a need for further refinement of the model and for formal training course in the use and application of the model.

FOCUS

At the opening of the workshop Dr Backeberg said that the WRC had decided to focus on the use of the SAPWAT and SWB irrigation models.

Prof John Annandale presented the history of the SWB model and gave an overview of the theory on which the SWB model is based. Dr Nico Benadé discussed the software and hardware aspects, while Dr Nebo Jovanovic presented a demonstration of the latest version of the model and the Eto calculator.

A session was given to the experiences and comments of current users of the SWB model. A researcher of the Agricultural Research Council (ARC), Dr Martin Steyn, gave an overview of the research he had conducted on potatoes, and noted the problems and shortcomings that he had encountered in the use of the model. Theresa Volschenk, a researcher at Infruitec (ARC), discussed results from her research project on the calibration and evaluation of SWB for apple and pear trees. She pointed out the problems she experienced and made some recommendations. Neil du Sautoy of the University of the North shared his experience with the SWB model and citrus.

Dave Mynhardt, a consultant, said that



Dr Gerhard Backeberg, WRC research manager chaired the workshop, while Dr Nico Benadé (NB Systems), and Prof John Annandale as well as Dr Nebo Jovanovic (both from the University of Pretoria) were speakers at the opening session.



Users of the SWB model gathered at the workshop: Piet Mynhardt (Loskop Grondvogmetings), Theresa Volschenk (Infruitec), Paul Farrel (farmer) and Dr Martin Steyn (ARC).

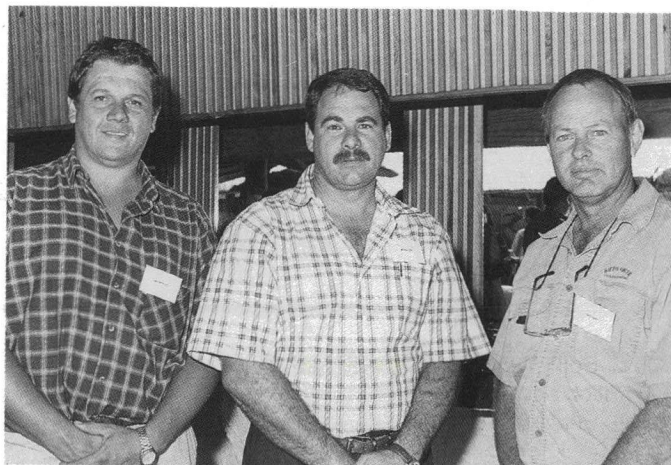
there was a definite need for a programme such as SWB. He pointed out that the farmer was the end-user, and that SWB should be written with the farmer in mind.

He suggested a number of improvements that would render the model more farmer-friendly.

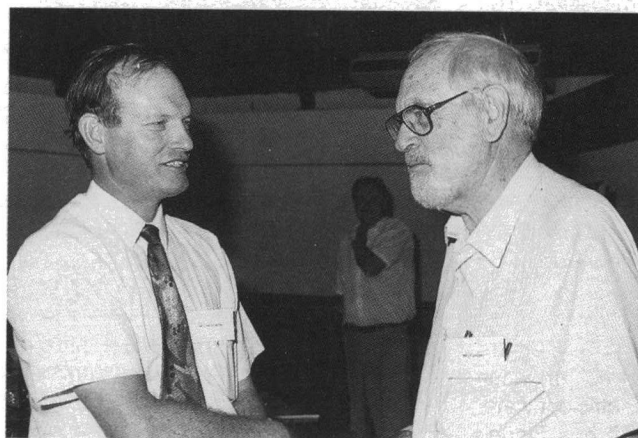
Paul Farrell, a farmer who has been using the SWB model for approximately four years, presented the problems he has experienced and expressed the need for a "helpline". Pieter van Heerden, a consultant, commented as a novice testing the SWB model.

A comprehensive discussion was held about model modifications and improvements, as well as the need for training courses. In conclusion Dr Backeberg noted that this workshop initiated a phase of technology transfer and training for the use of the SWB model.

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Dave Mynhardt (Hoedspruit Besproeiingsbestuur) pictured here with Bertus Kruger (Agriplas, Western Cape) and Banie Swart (SASEX, Komatipoort) at the workshop.



Francois van der Merwe (Dept Water Affairs and Forestry) having a word with Mr Charles Crosby, who developed the SAPWAT irrigation model.

New initiative for African science

Science in Africa is Africa's first on-line science magazine. The magazine has been created by African scientists in response to a need for the communication of science to a general public seeking a deeper understanding of the scientific issues directly affecting African society, as well as to establish a comprehensive source of information on African science for the scientific community.

A wealth of excellent research is conducted in Africa but is often only appreciated by those within the same field of expertise. *Science in Africa* aims to lift the lid on science in Africa through articles on past and current research in a format which is understandable and of interest to both scientists and non-scientists.

Experts on topical scientific issues will provide the right kind of information, facts as opposed to myths, providing African people with the opportunity to understand debates, to discuss and to decide for themselves. Many key areas in science are still the domain of the informed minority. *Science in Africa* will provide a platform for these areas to be explained and discussed, creating more awareness amongst the general public of issues relevant to them. New and exciting technologies and industries will be showcased, jobs and grants in science advertised, details of conferences, meetings and public science lectures and festivals publicised. Links will be provided to science departments in tertiary institutions, as well as government and non-government organizations.

The first edition of *Science in Africa* is now on-line at www.scienceinafrica.co.za. Visit this site for more details and to register your interest to be kept informed of developments at *Science in Africa*.

CONTRIBUTIONS

If you have an article for *Science in Africa*, it may be submitted by e-mail to: editor@scienceinafrica.co.za. The editor, Dr Janice Limson, welcomes your suggestions and any queries you may have by e-mail or by mail to *Science in Africa*, Box 696, Grahamstown, 6139, South Africa. For all other submissions or for advertising write to: info@scienceinafrica.co.za. The official launch of the magazine will be held at the Sasol Scifest in Grahamstown in April 2001.

Cholera outbreaks in South Africa part of an ongoing global pandemic



Prof TE Cloete

In this article Prof TE Cloete and Mr SN Venter from the Department of Microbiology and Plant Pathology at the University of Pretoria, discuss the disease and recommend an ingenious solution for rural areas - solar pasteurisation of water.

Since 1991, between 200 000 and 600 000 cases of cholera, worldwide, are reported annually. These cases form part of the seventh cholera pandemic which started in 1961 in Indonesia. Since the onset of this pandemic, the disease has spread rapidly through Asia and by 1970 it had reached West Africa. From here the disease spread to a number of countries and eventually became endemic in most of the continent. In 1999 Africa accounted for 81 per cent of the cases reported worldwide. South Africa has, until recently, escaped major outbreaks of the disease. This situation has, however, changed dramatically since August 2000 when the first cases of the present epidemic were reported in KwaZulu-Natal. By February 2001 this epidemic has not shown any signs of abating and more than 30 000 cases have been reported with a number of cases also detected in other parts of the country.

INFECTION

Cholera is an acute intestinal infection caused by the bacterium *Vibrio cholerae*. In most cases, the infection causes only mild diarrhoea or no symptoms at all. In some cases, however, patients develop very severe watery diarrhoea and vomiting that can quickly lead to severe dehydration and death, if treatment is not given promptly. Cholera has a short incubation period, from less than one to five days after exposure to high numbers of the bacterium. Most cases of diarrhoea can be treated by giving oral rehydration, but in severe cases, the patients must be given intravenous fluids. Where antibiotics were used, it was found to reduce the volume and duration of diarrhoea.

ITALY

The bacterium responsible for the disease was first described by Pacini in Italy in 1854. Reports of the disease can, however, be traced back to the Indian sub-continent as far back as the early sixteenth century. In 1882 Robert Koch succeeded in cultivating the bacterium. This achievement was the start of more than a century of intense research and investigation of the bacterium and the disease. This resulted in a wealth of information on the ecology of the bacterium as well as the epidemiology and treatment of the disease.

The bacterium is often found in aquatic environments as part of the normal bac-

terial population of brackish water and estuaries. The bacterium has a low tolerance for acidic environments, but grows well under alkaline conditions (pH 8.0 - 9.5). Growth can also be stimulated by the presence of sodium chloride (NaCl).

Not all *Vibrio cholerae* strains are, however, responsible for the disease. The severe form of the disease is only associated with the production of an enterotoxin. Until recently only certain strains of the O1 serogroup, which produced the cholera toxin, were associated with epidemic cholera. All other strains were mostly considered to be non-pathogenic. During the 1990s a new epidemic strain, *V. cholerae* O139 was identified. It is at present still restricted to Asia and it is still unclear whether this strain will spread to other regions, but the threat of a new pandemic cannot be ruled out.

TRANSMISSION

Cholera is transmitted via the consumption of water or food contaminated by the bacterium. Sudden large outbreaks, like the one in KwaZulu-Natal, are usually caused by a contaminated source of drinking water. Bacteria present in the faeces of an infected person is the main source of contamination. Most persons infected with *V. cholerae* do not become ill, but the bacterium can be present in their faeces for 7-14 days. These asymptomatic carriers often act as the source of further infections via the contamination of food and water. Cholera is only rarely transmitted via person-to-person contact. The greatest risk, therefore, occurs in communities characterised by unhygienic conditions, poor sanitation and unsafe drinking water. Effective water supply and sanitation services in most of the formal urban areas are the main reasons why the epidemic has not spread to these areas in South Africa.

PREVENTION

The spread of cholera is best prevented by ensuring that the following three rules are adhered to:

- ☐ good food hygiene,
- ☐ hygienic disposal of human faeces, and
- ☐ a safe supply of drinking water.

Vaccination with the injectable cholera vaccine is not considered to be a viable option in combating the disease. Newly developed oral vaccines are however under investigation. Of the three options mentioned, food hygiene measures is

probably the easiest to implement once the community has developed a basic understanding of the disease through hygiene education. The measures promoted, usually include among others, cooking food thoroughly and avoiding re-contamination with raw foods, water or by means of contaminated surfaces.

The improvement of water supply and sanitation is often more difficult to achieve in affected areas as it also requires technological interventions. In this regard, the Water Research Commission and other research organisations have funded and conducted a number of studies to develop or evaluate appropriate and sustainable technological solutions.

TECHNOLOGIES

Effective microbiological purification of drinking water is an important consideration in the prevention of water-borne diseases and its transmission depending on, amongst other things, the socio-economic conditions as well as the technical requirements and capabilities of a particular area. Different technologies can be considered for treatment of microbiologically polluted water. For example, conventional water treatment processes that are used in developed cities and towns are not appropriate for isolated rural communities and villages of low socio-economic status. In such areas, there is an urgent need to apply practical, simple, inexpensive and sustainable technologies for the production of satisfactory drinking water, especially on a small scale, at the individual and family levels.

The effectiveness of solar pasteurisation as a water disinfection method suitable for the production of potable water in rural areas was researched by the Department of Microbiology and Plant Pathology at the University of Pretoria. Water samples were collected from Tshwane river and the water was then heated by solar energy at different temperatures. Indicators of microbiological pollution including heterotrophic bacteria, total coliforms, faecal coliforms and coliphages were used to monitor the disinfection process. The results indicated that solar pasteurisation can effectively decontaminate (disinfect) water cost-effectively.

For more information please contact Prof Eugene Cloete at the University of Pretoria - tel (012) 420-3265.

WRC Strategic research plan for health-related water issues

Health-related water research was addressed under a number of research fields at the Water Research Commission (WRC) until 1999. However, its increasing importance, has led to the health-related issues now being recognised as a research field in its own right.

The new Health-Related Water Issues (HRWI) research field was established and several workshops were held during 2000 to identify and address the needs of the field. This led to the development of a strategic research plan which will be available on the web page of the WRC (www.wrc.org.za) at the beginning of March 2001. It will be a useful tool during the project proposal phase and will guide project leaders to relevant and necessary research proposals.

PLAN OUTLINE

The strategic plan is presented in five parts:

- Part A - Overview and background
- Part B - Historical run up (1992 to 1998)
- Part C - Transitional phase (1999 to 2000)
- Part D - Implementation phase - Operational issues (2001 onwards)
- Part E - Implementation phase - Administrative issues (2001 onwards)

In **Part A** an overview of water-related health issues is given. The seriousness of the problem is discussed in the South African context and it is shown that research in this field forms a crucial part of the WRC's mandate. This information provides the reader with a global view of the problem, explains the necessity of research in the HRWI field, and shows that the WRC is the appropriate organisation to address these issues.

Part B provides an overview of Water Research Commission investments during the period 1992 to 1998 in health related projects. This information provides the reader with an overview of the range of issues that had been addressed previously in WRC health-related projects.

Part C provides an overview of the consultative process that had taken place during 1999 and 2000 to provide the direction needed to define and structure the HRWI field. Information on projects initiated during this period is also given. This information provides the reader with a clear picture of the transparent process that had been followed, and of recent research in the HRWI field.

Part D provides an overview of the proposed management structure, and gives details of the thrusts (objectives, research categories, the research needs per category, the prioritisation of the needs and a proposed research time scale per thrust to address the needs) and the programmes that had been identified. Information on projects initiated during this period is also given. This information provides the reader with a clear picture of the main thrusts of research that should be funded from the HRWI field, and how it would be managed. It should enable researchers to submit proposals in line with the defined research priorities and time scales.

Part E provides information on administrative procedures that will be put in place, eg. for research performance management, technology transfer, collaboration between research groups, adjudication of research proposals, the allocation of funds and review of this strategic plan.

MANAGEMENT STRUCTURE

The proposed management structure for the WRC's water related health research field is depicted in Figure 1.

RESEARCH FIELD

The Health-Related Water Issues research field aims to combine and focus the health related water research that previously had been funded ad hoc under other WRC research fields. The increasing scope and awareness of water related health problems requires a focused effort towards co-ordinating and

directing research in order to produce the necessary research and expertise that South Africa will need to face future challenges in this research area.

Overall priorities for the research field would be the responsibility of a Co-ordinating Committee. Membership should include representatives of stakeholders (eg. Department of Water Affairs and Forestry, Department of Health, Department of Agriculture, Water Boards and local authorities), of related fields (eg. Medical Research Council, Veterinary Research Institute) and of other WRC research fields and from the focus groups. The tasks of the Co-ordinating Committee would be to keep the needs and the priorities of the field aligned and integrated, to evaluate all research proposals in the field, to advise the research manager, to make recommendations to the WRC Board regarding national and social "cues", to maintain links with other WRC fields and role players and to ensure capacity building and technology transfer.

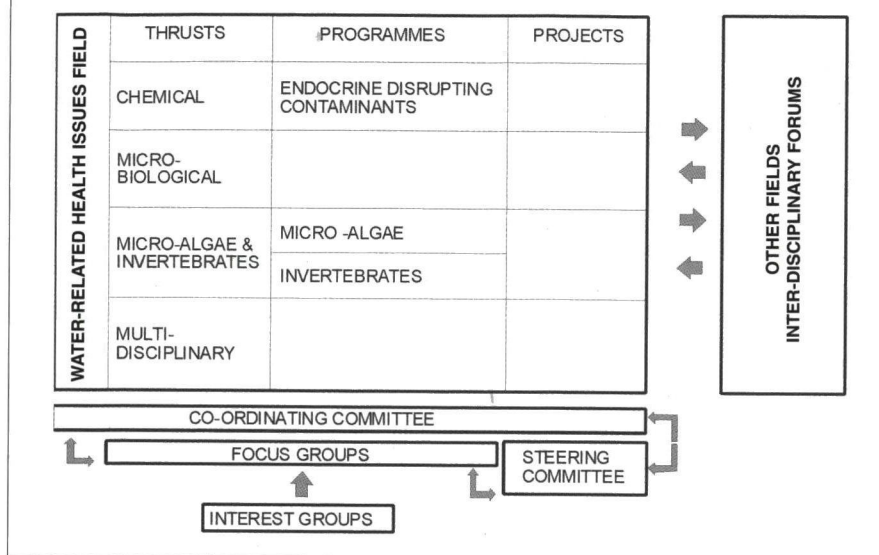
THRUSTS

The Health-Related Water Issues research field was divided into four thrust areas, namely, the Chemical thrust, the Microbiological thrust, the Micro-algae and Invertebrate thrust, and a Multi-disciplinary thrust.

Thrust objectives, research categories and their objectives, needs and their prioritisation per research category and proposed research time scales have been prepared for all the thrusts, with the exception of the multi-disciplinary (generic) thrust which still need to be workshopped.

Under each thrust, provision is made for "open" programmes, "closed" programmes and projects. "Open" programmes would be used to identify real, intermediate or emerging problems in order to understand and gain data on the extent thereof, investigate the remediation steps to be initiated or identify the pro-active precautions to be taken.

FIGURE 1: MANAGEMENT STRUCTURE



"Closed" programmes would consist of individual multi-disciplinary projects of a fixed term and would address specific short term problems experienced. Individual projects would address isolated problems or focus on pilot studies.

FOCUS GROUPS

Focus groups take responsibility for steering the thrusts. Membership of the focus group may consist of a WRC designated convener, informatics representatives, thrust-specific experts/specialists, stakeholders and co-opted members. The tasks of the focus group would be to identify research trends and local needs, to categorise and prioritise research proposals, to advise the WRC research manager, to identify links within the WRC and across disciplines, to integrate priorities, to guide the development of codes of practice, to assist in the strategic management process and to revise the strategic plan on a three yearly basis. The focus groups should be represented on the co-ordinating committee.

PROGRAMMES

At present an Endocrine Disrupting Contaminant (EDC) programme has been identified under the Chemical thrust, and a Micro-algal programme and an Invertebrate programme have been identified under the Micro-algae and Invertebrate thrust. The Microbiological thrust elected not to define a separate programme at this stage. Focus groups would be responsible for steering the programmes.

PROJECTS

The projects that had been identified since the April 2000 submission of proposals for funding from 2001 are listed in the strategic plan document.

Individual projects would have their own Steering Committees. The composition and the functions of the Steering Committee should be as defined in the "WRC Guidebook for Project Leaders".

Projects can be funded as part of the normal proposal cycle (submissions close by end of April for funding in the next year) or in special cases when unique opportunities need to be seized or when urgent issues have to be addressed, the project can be funded as a consultancy.

INTEREST GROUPS

The management structure makes provision for the establishment of subject specific interest groups of specialist researchers and stakeholders to identify research needs and trends in a specific area of concern. These groups could assist the focus groups in their research activities.

Currently four health-related e-mail discussion groups exist:

- ☐ Toxic algal forum including all algal related research
- ☐ *Cryptosporidium* and *Giardia* interest group
- ☐ *Legionella* action group
- ☐ Endocrine disruptors discussion group

INTER-DISCIPLINARY FORUMS

It is of crucial importance that programmes in the HRWI field should not be handled in isolation. Care must be taken to ensure a multi-disciplinary approach and to include and involve all relevant sciences in solving the problems. To this end, links should be established to other WRC research fields.

IMPLEMENTATION PHASE – Operational issues (2001 onwards)

The Index of this phase is as follows:

Chemical thrust

- ☐ Objective
- ☐ Research categories and their goals
- ☐ Needs and priorities per research category
- ☐ Proposed research time scale

Endocrine disruptors programme

Microbiological thrust

- ☐ Objective
- ☐ Research categories and their goals
- ☐ Needs and priorities per research category
- ☐ Proposed research time scale

Micro-algal and invertebrate thrust

- ☐ Objective
- ☐ Research categories and their goals
- ☐ Needs and priorities per research category
- ☐ Proposed research time scale

Micro-algal programme

Invertebrate programme

Multi-disciplinary (generic) thrust

- ☐ Objective
- ☐ Research categories and their goals
- ☐ Needs and priorities per research category
- ☐ Proposed research time scale

Projects or consultancies approved (2001 onwards).

The comprehensive and detailed Strategic Plan document for Health Related Water Issues can be accessed on the WRC website: www.wrc.org.za. You can contact the Research Manager responsible for Health Related Water Research, Mrs Annatjie Oelofse, on e-mail: annatjie@wrc.org.za or tel. (012) 330-0340.

Microbial Water Quality in the 21st century



SN Venter

In South Africa nearly 80 per cent of the population rely on surface water as their main source of water. Mr SN (Fanus) Venter of the Department of Microbiology and Plantpathology at the University of Pretoria looks briefly at the microbial quality of this important water resource.

At the turn of the 20th century, a century marked with major technological developments, many countries in the world, including South Africa, still have severe problems with the microbial water quality of their source and drinking water. Apart from the poor quality levels detected during monitoring, this is also evident from the large number of cases of possible water-borne diseases presenting itself on a daily basis. The pathogens involved include the whole range of microorganisms with viruses such as Rota and Astro virus, bacteria such as *Shigella*, *Salmonella* and *Campylobacter* and the protozoan parasites *Giardia* and *Cryptosporidium*.

The microbial quality of surface water is of great concern for a number of reasons:

- Almost 30 per cent of the population are without proper water supply services, which implies that many of the people still utilise untreated

surface water for domestic purposes. In other situations, the surface water may only be partially treated or the level of microbial pollution may be so high that breakthrough could occur, leading to drinking water of poor microbial quality.

- Many of the streams in South Africa are used for recreational purposes such as swimming and in some rural areas women have direct contact with the water when doing their laundry at the stream.
- Apart from direct exposure to polluted water, indirect contact could also occur. In a dry and hot country like South Africa, surface water is one of the main sources of water used for the irrigation of crops, including vegetables. It has been well-documented that produce such as lettuce and cabbage, which are consumed raw, could be responsible for the spread of water-borne pathogens after irrigation with contaminated water.

CAUSES

A number of causes for the high level of surface water pollution can be identified. According to estimated figures released by the World Health Organization in 1996, more than half of the South African population lacked access to adequate sanitation infrastructures. This often leads to highly contaminated surface run-off during the rainy season. The situation is aggravated by the existence of many inefficient, poorly-maintained or operated sanitation services or where services, which are inappropriate for the local situation, have been implemented. These situations can be noted either as point or diffuse pollution sources.

Certain water-borne pathogens can be transferred between man and animals, therefore pollution from farming with livestock has also become an important area of concern. Typical zoonoses include pathogens such as *Salmonella*,





Campylobacter and *Cryptosporidium*. It is has been estimated that one infected calf or lamb can produce more oocysts per day than a 1000 infected immunocompromised people.

During a study (WRC Report 380/1/96) performed in a peri-urban catchment in Gauteng, levels as high as 107 faecal coliforms / 100 ml water were measured in-stream. In this catchment the two main sources of microbial pollution were identified as the surface runoff from an informal settlement and the discharge of effluent from wastewater treatment works into the river. High levels of enteric viruses and protozoan parasites were also detected on a number of occasions. Along a large stretch of the river, the microbial quality was worse than the guideline value set by the Department of Water Affairs and Forestry (DWAF) for contact recreation.

It is believed that this peri-urban catchment may be representative of the

situation that exists in many other catchments in South Africa. In order to get a better understanding of the situation, DWAF has commissioned the design and implementation of a National Microbial Monitoring Programme for surface water. With the sponsorship of the Water Research Commission, data on four of the high priority areas in the country should be available very soon.

SURFACE WATER QUALITY

Most people agree that the microbial quality of surface water does not have to meet the guideline values set for drinking water. Nevertheless, one of the long-term goals should be to strive towards improving the microbial quality to a level that lies within the target guideline range set for full contact recreation in order to protect the public. There is, however, no clarity on how this goal should be attained.

Presently, most authorities do not

actively manage the microbial water quality. Instead, they rely on natural die-off in the hope that it will improve the quality. It has been noted, however, that due to the high initial levels of contamination and the relatively short retention time in the catchment, bacterial die-off did not markedly improve the quality. Viruses and the survival forms of some of the protozoan parasites are also much more robust and could survive for very long periods in the environment. The contribution of sediment to the overall microbial quality of surface water is not yet clearly understood. A number of reports have indicated that microorganisms, including pathogenic bacteria, may survive very well in sediments and could be released back into the water after the sediments have been disturbed.

MANAGEMENT

A more viable option of managing the microbial quality of surface water would be to improve the quality of point sources discharged into the river. If these sources are treated to an acceptable level, they could have a dilution effect on the water in the river. In South Africa, point sources such as wastewater treatment plants contribute a major portion of the flow, especially during the dry season and should receive the necessary attention.

Measures to improve the microbial quality of non-point source pollution is more difficult. The provision and improvement of sanitation infrastructure should have a noted effect. The ongoing participation of the community in such projects is, however, of vital importance for the success of any such programme. The improvement of the microbial quality of surface water after passing through a natural wetland has been observed on several occasions and the construction of artificial wetlands for limited treatment could also be considered.

With the creation of catchment management agencies as proposed in the new Water Act (1998) the microbial quality of surface water and management strategies to improve it, will hopefully receive the attention it rightly deserves. May the 21st century, therefore, be remembered for the dramatic improvement in the microbial quality of surface water in South Africa, as well as in the rest of the world.

New “green energy” rural water pump tested

The Water Research Commission has sponsored a project for the development of a continuous flow air lift ground water pump for informal settlements using a wind energy storage system. André Brink from “Green Energy Systems” reports.

It is a well-known fact that the earth is running out of its natural energy fuel resources at a rate where it will not have sufficient resources to fulfill the required needs for the Twenty First Century. This means that every possible option to utilise alternative energy sources must be researched as a matter of urgency.

Even in South Africa the supply of basic needs to all people is a central issue in the debate over the reconstruction and development program of the post-apartheid government of national unity of South Africa. Although South Africa is in the advantageous position that it has significant excess generative capacity to accommodate the accelerated electrification drive, the capital investment per service point in rural areas, where the population density is low and settlements widely scattered, does not make electrification through grid extension an economically viable option.

In the South African industry many of the most prominent companies (such as Siemens, Eskom and Shell) are acknowledging this fact, after having established separate dedicated divisions to manage this product group.

WIND ENERGY

Wind energy is, and will always be available as a renewable and sustainable energy source, which has distinguished itself as being reliable in various different applications throughout many years across the world.

The main applications for wind energy have generally been in the generation of electricity power by grid-connected wind turbines. However, even at the very low production cost of these units, wind-generated electricity is not yet fully cost-competitive with coal- or natural- gas-produced electricity for the bulk electricity market. It is because of this cost restraint that Green Energy Systems have approached the wind energy source from a different perspective where the free wind energy is transformed into a controllable energy source by storing energy as compressed air, which in itself is an expensive and sought-after commodity. The safety and versatility of compressed air is appreciated by all the main role-players in the industrial environment, where it is used extensively in various applications.

The novel Green Energy Systems (GES) pump system is based on very simple mechanical technology that results in it being a fairly low cost solution. This assumption can be made, as the method of storing energy is much more cost-effective than other systems that are currently in use, especially if we consider the maintenance cost of the system over the life cycle of the product. The system is virtually maintenance-free, with all working parts being of a simple, wear-free design and available as standard off-shelf items in the market.

The possible applications of this energy-system is widespread as it can be adapted to suit the requirements of each individual application, from a low-cost rural type application to a more advanced system which can be used in an Industrial or mining environment. Ultimately, it can be utilized as a normal household energy system in the same way as the USA is now making more and more use of liquid petroleum gases (LPG) in their normal daily requirements. Compared to these systems used in the USA, wind energy systems are environmentally friendly.

CURRENT SYSTEMS DRAWBACKS

Wind-energy was first utilised through the use of the well-known borehole-windmill system as is generally known throughout the world. This design has been left unchanged and unchallenged for centuries, where it is generally accepted as the ultimate free energy water pumping system. However, this design is mainly a one-function system that can only be utilized for the pumping of water from a borehole situated directly below the wind-driven system. Maintenance of this system is an expensive drawback, where repairs usually result in a time-consuming exercise with rigid piping having to be pulled to surface before the main pump element can be reached. This task might be necessary when performing minor repairs or when replacing pump seals etc. which subsequently results in maintenance being a costly, time-consuming and labour-intensive exercise.

To date, the main development in the field of power generation by means of wind-energy, was dominated by generating direct current, which is then stored in deep cycle batteries. This power is converted into alternating current by means of an

electronic converter and fed into a utility grid. These batteries need to be replaced at regular intervals, and repairs on the electronic systems can only be effected by skilled personnel. All these drawbacks add up to very high operating and maintenance cost over the life cycle of such a system.

It is because of all these mentioned drawbacks on the existing systems that Green Energy Systems have come to the conclusion that, although wind energy in general is relatively cheap compared to other forms of energy, there is a definite need to improve the current systems in operation.



GES PUMP SYSTEM

The GES pump system can be described in terms of its two main components, i.e. the wind energy pack and the submersible pump system.

□ WIND ENERGY PACK

Main body

One of the design criteria identified was that the final design configuration of this energy pack must be very simple mechanical technology, which can be maintained easily, as many of these units will be constructed in rural areas. Therefore, the design and construction is based on very simple mechanical technology, with all maintenance components being readily available nationwide.

The basic design consists of a windwheel, which is mounted

on top of a pressure vessel via a rotating table, i.e. the pressure vessel now acts as the mast for the windwheel. The rotating windwheel drives an open-plan compressor system, which, in turn, forces compressed air into the pressure vessel, acting as the controllable energy source.

A one-way valve situated at the inlet to the pressure vessel allows for maintenance or repairs to be performed on the compressor system without losing any of the already stored energy.

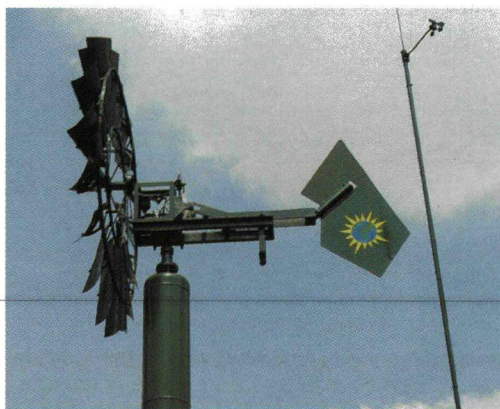
To assure continued ease of maintenance and safety on the pressure vessel system, an automatic water trap release has been introduced on the system. This valve allows the system to release water build-up inside the pressure vessel on a continuous base.

The compressed air (energy) can be released as and when required from a separate "air-tap". As a standard safety feature a pressure release valve is installed which eliminates the possibility of creating an over-pressure situation.

The compressor system, compressor bed and Windwheel assembly is located on a turntable which rotates on visconite bushing that is able to accommodate the lateral pressure forces that are created. This material is used because of its proven life expectations in similar applications. The compressed air is channelled through the centre of the turntable into the pressure vessel with sealing obtained through a pneumatic rotation-seal.

Windwheel - Vane

Following results obtained from continuous data capture of wind conditions i.e. wind speed, direction, maximum during gusts etc. by means of an electronic weather station, the conclusion was reached that more free wind energy can be stored, resulting from continuous lower wind speeds (>4-6m/s) than those stored from higher wind gusts.



Windwheel

The vane configuration (shape and size) that allows for the most effective torque transfer at low to medium wind conditions is the well-known multi-blade system as is found on the standard traditional "Climax"-type wheel arrangement. This system also proves to be a more cost-effective system than the "high-speed Aerofoil" system, which is generally used on other products in the 20th century wind energy scenario, where high revolutions are required for maximum performance, i.e. electricity-generating systems.

Compressor system

The compressor system is designed from a double action actuator(s), which effectively results in two (or four) compressor strokes for each completed turn on the windwheel. This open-plan compressor system lends itself to easy and relatively cheap maintenance and repairs. Should one of the actuators fail, the second unit will still be fully functional, assuring continued operation of the compressor system.

This unique compressor system has been opted for as different size of piston diameters and compression stroke lengths allow for an optimum compressor system per wind region by means of specifying the individual parts which will assure maximum functionality in each scenario of different wind conditions.

An in-line oil vapour lubricator, on the intake of the compressor unit, achieves effective lubrication of the moving parts.

Reservoir/Mast

Two systems are identified:

- ☐ System one is where the reservoir acts as the mast for the complete system. This configuration is mainly used for applications where access to the installation sight is accessible via a vehicle fitted with a crane.
- ☐ System two is used for terrain where access is not as freely accessible. Here a system is used where the windmill stand is of a four-leg design, similar to the current traditional type windmill stand. In this format loose modules can now be applied to the system, allowing for a series build-up to a capacity energy source as required per application.

Protection against high velocity winds and sudden gusts

A wind turbulent protection system allows the system to move out of the wind direction in a vertical plane, when high wind speeds or sudden turbulence is experienced. This approach uses a smaller protected sweeping area as the governing action, and with a lifting tail and resultant flagpole mime feature, the "giro-effect", (which is the main reason for wheel failure on this type of windwheel) is eliminated due to the ability of the complete system to adapt to these severe conditions. This will act as a second line of precaution because the windwheel used has been designed to reach a maximum revolution of 120 rpm, whilst the compressor unit has been designed to operate comfortably up to 330 rpm.

☐ SUBMERSIBLE PUMP SYSTEM

Basic design

The submersible pump is operated with compressed air, of which the utility and dependability is best demonstrated by its universal applications for delivering fresh water with compressed air obtained from the "wind energy pack".

This universal agent, "compressed air" is also utilised as the actuating medium, which operates the pump switching system, delivering water from its natural underground storage directly to the user, without the use of water storage tanks.



To achieve an automated flow of water, a switching device is used, which allows for the delivery of the pump to be of a continuous nature. By automating the pump, the following advantages are now achieved:

- Ability to supply larger volume of water.
- Potential to store water, both underground and on the surface, if required.
- Water on demand can be achieved in both domestic situations as well as township standpipes.

The basic principle of the system consists of a mechanical pressure switch situated inside the head of the pump itself. The system releases pressurised airflow into a pressure chamber of the underground pump when the water chamber is filled with water and closes the air-pressure inlet port to the pump when the unit is empty, allowing the water-head to fill under gravity.

Performance

The capacity performance of the pump is dependent on the capacity of the air pressure vessel, as well as borehole variables. However, a guideline of water delivery capacity is as follows:

Size of pressure (litres)	Litres of water obtainable at one tank full charging of the Pressure Vessel at 7 Bar.			
	15 m lift	24m lift	30m lift	38m lift
445	700	500	351	222
665	1075	740	536	351
814	1221	888	629	444
1165 (Standard size)	1740	1277	907	648
1850	2830	2109	1517	980
1943	2868	2127	1480	1055
2664	4514	3182	2331	1462
3478	5605	3960	2850	1813
3700	5920	4181	3034	1924

Design Criteria

- Pump is able to pump up to a capacity of 56 litres of water

- per minute;
- All plastic and stainless steel parts;
- Positive air valve saves air;
- Uses none of the energy source (air) if well pumps dry;
- No brass components that can deteriorate.

□ POTENTIAL APPLICATIONS

With the pressure vessel under pressure you have a raw energy source which can now be utilised for various different applications. A few of the identified applications are as follows:

- Pneumatic submerged waterpump
- Industrial version for the supply of compressed air to the Industry
- Pneumatic spiral-lift pump
- Vortex Geyser & Fridge system
- Pneumatic generator
- Pneumatic washing machine
- Forced evaporation system
- Pollution rehabilitation through air-sparging

The current system can be utilised to its full potential in all rural areas where it can deliver certain essential services to the under-privileged, such as drinking and warm-water, electricity, refrigeration, etc. to name but a few.

□ POTENTIAL USERS

- Farming community
- Fuel companies
- Local government institutions
- Suppliers of pneumatic equipment
- Mining Industry
- Energy suppliers

□ ADVANTAGES OF THE GES SYSTEM

- Multi functional;
- The windpack can be used to pump water, but can also be used for other applications. (With the pressure vessel at pressure you really have a "raw" energy source which can be utilised as required.)
- Possible to automate the system;
- System can accommodate a setting sequence where it can either pump a specific volume of water at a specific time-setting or, alternatively, it can pump for a pre-set time on a pre-determined set time.
- Resistant to normal element damage;
- Can serve multi-borehole system - the windpack can be constructed in an advantageous position where the wind volume is at its maximum. From this point, a single energy system will be able to supply up to three different boreholes

in the adjacent vicinity. With this principle of the pump being activated through a float control, a "slow" borehole (which under normal circumstances are not usable) can now again be utilised to capacity.

- Only minor maintenance required;
- Used in conjunction with submersible pneumatic pump that is basically maintenance free;
- Does not have to be erected on a borehole but rather at the optimum wind position;
- Functional at very moderate wind availability;
- Major components are available off-shelf;
- Depth of borehole does not influence functionality;
- Power-failures and theft of power cables not a factor;
- Individual optimisation for specific site variables.

□ SAFETY FEATURES

The following safety features have been incorporated into the system:

- A one-way valve situated in the inlet section of the reservoir allows for maintenance and repairs to be performed on the compressor system or windwheel without having to forfeit any of the already stored energy;
- A pressure-release valve, set at 8 – 12 bar maximum, is installed in the airline between the compressor and the one-way valve which eliminates any possibility of a dangerous over- pressure scenario;
- A water trap or water bleeding point is installed at the lowest point in the air tank to drain all moisture that accumulates due to the compression of the air. This watertrap is also designed to blow a release point, should the system at any stage over-pressurise.

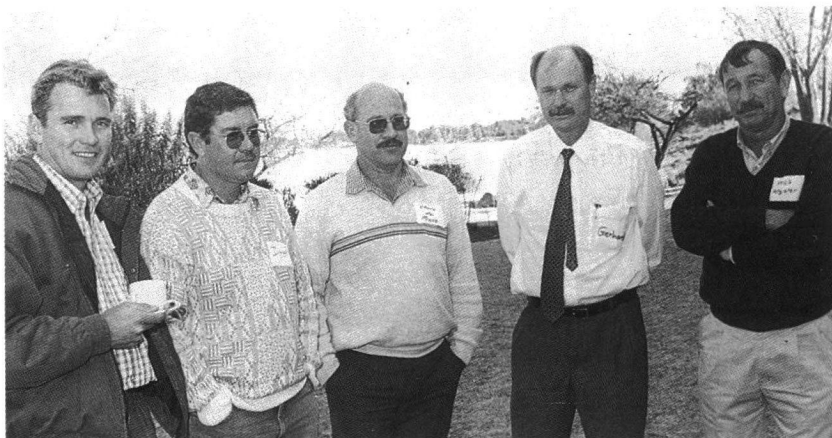
CONCLUSION

The successful application of the Green Energy Systems (GES) pumping system makes it possible to use it in areas where power generation through the use of diesel, paraffin or electricity is not practical or affordable. It also lends itself to the development of groundwater resources in areas where groundwater exhibits poor conditions, and where other means of groundwater abstractions would not be considered to be economical. These would account for situations where the groundwater yield is poor and a number of boreholes have to be run by a single windmill installation to achieve the desired water delivery capacity, and where other means of abstraction, such as electrically-driven pumps are too expensive to consider.

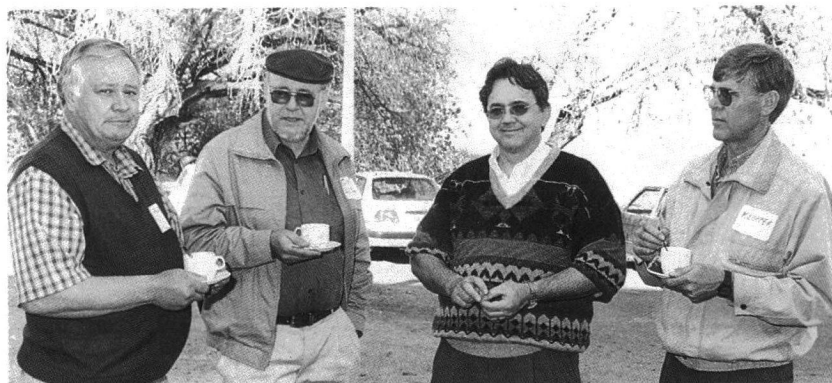
**CONTACT DETAIL: Green Energy Systems - Tel: (012) 345 4756. Fax: (012) 345 4391.
E- mail: mail@greenenergy.co.za Or trabex@global.co.za Website: www.greenenergy.co.za.**

Eerste WNK besprekingsforum oor landbouwaterbestuur in Vrystaat gehou

Die Waternavorsingskommissie (WNK) het in Augustus verlede jaar die eerste van 'n reeks werksessies oor landbouwaterbestuur by Aventura Aldam in die Vrystaat gehou. Die WNK se strategiese navorsingsplan oor waterbestuur in die landbou is deur dr Gerhard Backeberg, die navorsingsbestuurder by die WNK belas met landbouwater, verduidelik en praktiese probleme en navorsingsprioriteite is bespreek en geïdentifiseer. Deelnemers het leierbesproeiingsprodusente, akademië asook verteenwoordigers van die Landbounavorsingsraad (LNR), verskeie staatsdepartemente en privaatorganisasies ingesluit. Die tweede besprekingsforum het in die Noord-Kaap plaasgevind. Volgens Backeberg word daar in 2001 besprekingsforums oor landbouwater beplan vir die Wes-Kaap, Mpumalanga, KwaZulu-Natal en die Oos-Kaap.



Van links: G Teseling, D (Dup) Haarhoff, prof CC (Chris) du Preez, dr GR (Gerhard) Backeberg en JC (Koos) Potgieter.



Akademië van die Vrystaat Universiteit is (van links): prof ATP Bennie, prof MF Viljoen, dr David de Waal van Afrosearch wat die werksessie gefasiliteer het en prof K Oosthuizen.



Teetyd: (van links) Wessel Bühmann, Kobus Nel, Koos Botha en Hans Meiring.



Van links: Jannie Koch, Willie Venter, Pieter van Heerden en Loffie Myburgh.

WRC project evaluates groundwater monitoring

“This Water Research Commission-funded project with its fresh focus and thinking on groundwater monitoring, and monitoring networks is clearly very timeous.” –

Eberhard Braune

Director: Geohydrology

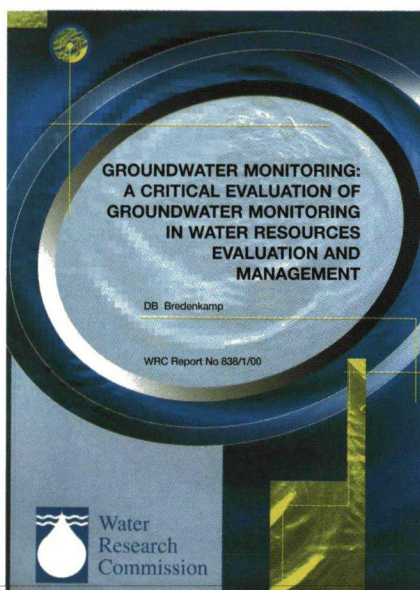
Department of Water Affairs and Forestry

It appears that monthly observations of groundwater levels and rainfall are quite adequate for most groundwater interpretations and assessments, while fewer monitoring stations would be needed for long-term monitoring on a regional scale. These stations would have to be representative of the different aquifer types and climatic regions but could be reduced to about five per aquifer in any region. This is some of the interesting conclusions documented in a report on groundwater monitoring released by the Water Research Commission (WRC) in Pretoria.

The report, compiled by DB Bredenkamp from Water Resources Evaluation and Management CC, says much time, effort and money are devoted to the establishment and maintenance of hydrological monitoring networks. Even more attention is given to elaborate storage and retrieval facilities in sophisticated data banks, and to depicting characteristics of aquifers by GIS image processing, which is often performed with limited or unreliable data.

WRC

In the research project, funded by the Water Research Commission, from which this report emanates, the main objectives were as follows:



- To develop guidelines on the broad design of a national groundwater monitoring network, with emphasis on:

- extending the scope and application of monitoring;
- revising the present groundwater monitoring programmes;
- compiling the key issues, findings and perspectives into a manual on monitoring;
- assisting the Department of Water Affairs and Forestry to improve the quality of data on the National Data Base.

The report says that although the study has focused mainly on monitoring in the RSA, the problems, shortcomings, streamlining and optimisation of monitoring are of world-wide concern. Hence the outcome of this study could have a wide impact and should be of benefit to many developing countries where there is insufficient and often unreliable hydrogeological data, and a need to streamline monitoring.

IMPORTANCE

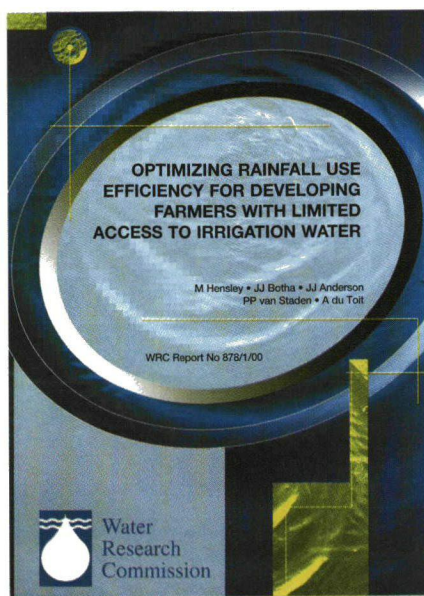
The report says full appreciation of the importance of good measurements is often lacking. This leads to poor motivation of personnel, unreliable data collection, irregular observations, poor control of data quality and the indiscriminate closing of monitoring stations resulting in a loss of valuable information. In other cases, more monitoring stations than necessary are maintained at high costs in limited areas or to study a particular type of aquifer.

- To assess the spatial and temporal requirements of groundwater monitoring and the use of “patchy” data;
- To assess new methodologies for evaluating groundwater monitoring data - in particular the Cumulative Rainfall Departure method;
- To assess the reliability of data gathered during monitoring programmes;
- To develop a new approach for the characterisation of aquifers in terms of recharge and storativity;

Copies of the report entitled **Groundwater monitoring: a critical evaluation of groundwater monitoring in water resources evaluation and management** (WRC report 838/1/00) are obtainable free of charge (in South Africa) from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 30, via surface mail).

New reports published by the Water Research Commission

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



Report 878/1/00 - Optimizing rainfall use efficiency for developing farmers with limited access to irrigation water. Report to the Water Research Commission by the ARC-Institute for Soil, Climate and Water.

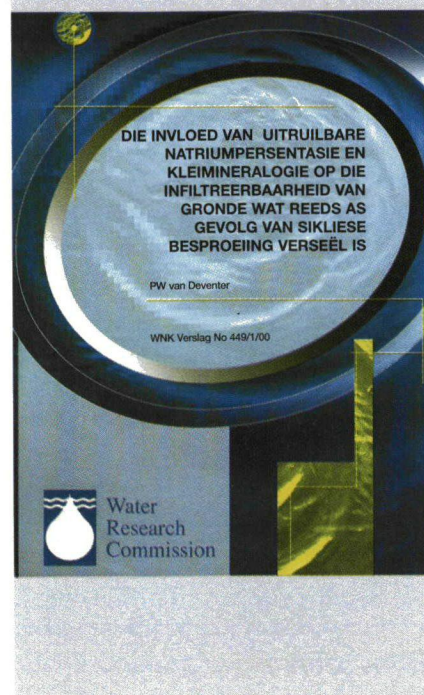
Authors: M Hensley, JJ Botha, JJ Anderson, PP van Staden and A du Toit

Overseas price: US\$ 15 (via surface mail)

The poor crop production of an area east of Bloemfontein in the Free State, earmarked by the state for developing farmers, forms the focus of this report. The reason for the low crop production potential is marginal and erratic rainfall, exacerbated by high runoff and evaporation losses. The hypothesis the researchers tested, was that a production technique combining the water conservation benefits of water harvesting, no-till, basin tillage, mulching and long-fallow would make sustainable crop production possible at a reasonable level for selected crops. Field experiments were conducted over three growing seasons on four ecotopes with maize, sunflower,

sorghum and wheat to test the hypothesis. Detailed soil water content and runoff measurements were made. These measurements enabled the researchers to quantify the water balance and determine precipitation use efficiency. Maize and sunflowers were found to be the best crops. Simulation models of these two crops, calibrated against measured results, were used together with long-term climate data to test the long-term validity of the short-term results from the field experiments.

The results of both sets of tests showed that the water harvesting and basin tillage part of the hypothesis was correct. Indications are that in the long-term, average yield increases compared to conventional tillage of about 50 per cent can be expected from maize and sunflower using the technique tested and described in the report. The authors say although long-fallow has proved its value for very dry seasons, long-term yield predictions indicate that this strategy will be uneconomical. Mulch in the basins has been shown to be beneficial under certain circumstances.



Verslag 499/1/00 - Die invloed van uitruilbare natriumpersentasie en kleimineralogie op die infiltreerbaarheid van gronde wat reeds as gevolg van sikliese besproeiing verseël is. Verslag aan die Watnavorsingskommissie deur die Departement van Plant- en Bodemwetenskappe by die Potchefstroomse Universiteit vir Christelike Hoër Onderwys.

Outeur: PW van Deventer

Prys: Gratis

Goeie besproeiingsbestuur berus op die regte toedieningstempo van water, wat onder andere bepaal word deur die infiltrasietempo van die grond. Om die infiltrasietempo te bereken of te voorspel, word kennis aangaande sekere grondeienskappe benodig. Oppervlakteostande en die hidrouliese gradiënt in die grond is die belangrikste faktore wat hier 'n rol speel. Oppervlakteienskappe verander voortdurend as gevolg van korsvorming. Faktore wat korsvorming

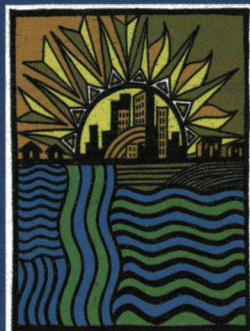
beïnvloed, is waterdruppelgrootte, valhoogte van druppels, toedieningstempo, helling, chemiese eienskappe van die grond en die water (hoofsaaklik die natrium-, magnesium-, en soutkonsentrasies) en die teksturele en mineralogiese eienskappe van die grond. Toenemende korsvorming veroorsaak 'n toename in oppervlakaflaaiing gevolglik ontstaan daar 'n erosiepotensiaal of daar is 'n verlies aan water.

Die verslag bevat die resultate van 'n ondersoek wat daarop gemik was om vas te stel wat die praktiese implikasies van verskillende kleimineralogie, die uitruilbare natriumpersentasie-vlakke, waterkwaliteite en toedieningstempo's op die infiltreerbaarheid van grond is. Al hierdie faktore moet in berekening gebring word by die aanpassing van bestaande besproeiingstelsels of by die ontwerp van nuwe stelsels. Die doel van hierdie aanpassings moet op beter besproeiingsdoeltreffendheid gemik wees sodat hoër waterverbruiksdoeltreffendheid verkry kan word.



WATER RESEARCH COMMISSION

SANITATION SERVICES MODEL MANUAL



PALMER DEVELOPMENT GROUP

Report KV 111/98 - Sanitation services model manual & Report KV 109/98 - Water supply services model manual. Reports to the Water Research Commission by the Palmer Development Group.

Author: Palmer Development Group
Overseas price: US\$ 20 each (via surface mail)

The Water Research Commission appointed Palmer Development Group to undertake an institutional and financial review of water supply and sanitation services in the urban areas of South Africa. The overall objective of this project was to present information and analysis that could help relevant community leaders and decision-makers to guide and promote the extension of services, to enable all people living in the urban areas of South Africa to have adequate and appropriate water supply and sanitation. The project also aimed to facilitate the related processes of financial, institutional and policy changes that the adoption and implementation of relevant strategies would require.

During this project, an investment-tariff model was developed. The purpose of this model was to assist the agencies responsible for water supply in urban areas in the development and evaluation of investment scenarios and tariff policy. This was to be done in the context of the overall goals of eradicating service backlogs as rapidly as possible, whilst maintaining the financial viability of the service.

In early 1996 the Palmer Development Group was commissioned by the Develop-

ment Bank of Southern Africa to develop more "user-friendly" models for the major urban infrastructural services, namely, water, sanitation, electricity, solid waste, roads and stormwater. The outcome of this project was the Combined Services Model, which is a single model that assesses the financial viability to local authorities of alternative residential infrastructure investment programmes in any of all these services. The Combined Services Model is a useful tool in the formulation of integrated development plans, which are now statutory requirements for local governments.

The Water Supply Services Model (SSM) was developed in 1997 as an updated and extended version of the original investment-tariff water model, incorporating additional variables, allowing for inflation and making full use of the experience gained in the development and application of the Combined Services Model. The model has to date been applied in the Winterveld, King William's Town, Harrismith and the (Johannesburg) Southern Metropolitan Structure.

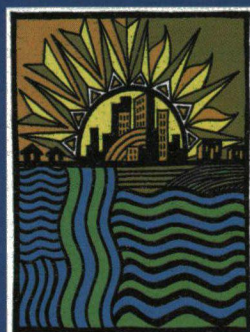
The Sanitation Services Model (SSM) is an updated and extended version of the sanitation component of the investment-tariff model. It can be used as a stand-alone model, but is designed for use with the Water Supply Services Model by means of common inputs and outputs from the latter serving as inputs for the former.

The two manuals are intended to facilitate the understanding and use of the WSSM and SSM models, and should preferably be read in conjunction.



WATER RESEARCH COMMISSION

WATER SUPPLY SERVICES MODEL MANUAL



PALMER DEVELOPMENT GROUP

Report TT 98/98 - Management guidelines for water service institutions (urban). Report to the Water Research Commission by the Palmer Development Group.

Authors: Ian Palmer, Richard Tainton, Bee Thompson and Craig Bekker
Overseas price: US\$ 35 (via surface mail)

This publication aims to assist those involved in providing retail services in the water and sanitation sector to manage these services effectively and efficiently by making available relevant and practical information.

The publication consists of the following modules:

- Module 1 - An introduction to

organisational arrangements for water service providers

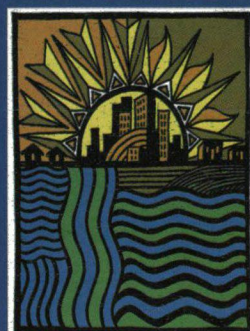
- Module 2 - Preparation of a water services development plan
- Module 3 - Customer profile and demand for services
- Module 4 - Setting water tariffs
- Module 5 - Setting sanitation tariffs
- Module 6 - Reporting procedures for water services
- Module 7 - Reporting procedures for sanitation services

Complementing the guidelines are two software models - WSSM and SSM. The publication incorporates many of the principles in the new Water Services Act and will assist practitioners in meeting some of the requirements of the Act.

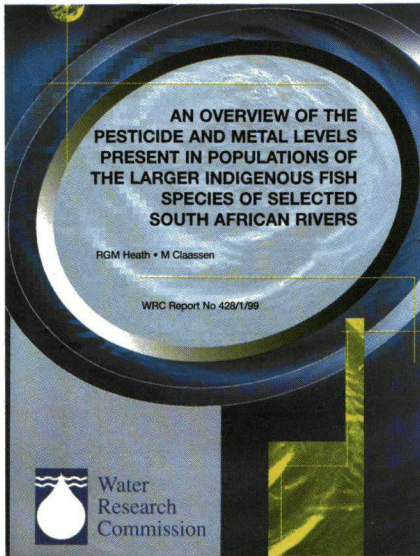


WATER RESEARCH COMMISSION

MANAGEMENT GUIDELINES FOR WATER SERVICE INSTITUTIONS (urban)



PALMER DEVELOPMENT GROUP



Report 428/1/99 - An overview of the pesticide and metal levels present in populations of the larger indigenous fish species of selected South African rivers. Report to the Water Research Commission by the Division of Water, Environment and Forestry Technology, CSIR.

Authors: RGM Heath and M Claassen
Overseas price: US\$ 30 (via surface mail)

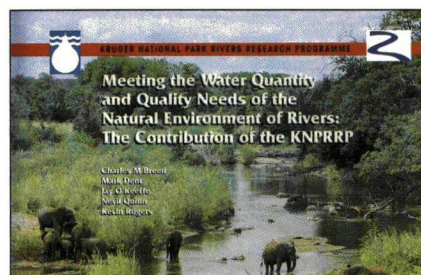
This report focuses on the bioaccumulation of pesticides and metals in indigenous fish species from six southern African rivers.

Chemicals (pesticides and metals) released into the environment are transported and redistributed among the different compartments of the environment. The impacts of these pollutants on aquatic ecosystems are either dramatic and obvious, due to lethal doses, or insidious due to gradual accumulation of lethal concentrations in the body tissues and organs of otherwise healthy organisms. In the latter case, ecosystems quietly and dramatically change. This insidious bioaccumulation which lies at the root of public concern and fear, forms the core of this research.

Report TT 106/98 - Meeting the water quantity and quality needs of the natural environment of rivers: the contribution of the Kruger National Park Rivers Research Programme (KNPRRP). Report to the Water Research Commission by a team of researchers from different institutions in the water field.

Authors: Charles M Breen, Mark Dent, Jay O'Keeffe, Nevil Quinn and Kevin Rogers
Overseas price: US\$ 5 (via surface mail)

The KNPRRP has delivered much of what is required for the sustainable management of South Africa's rivers. For example,



considerable progress has been achieved in setting operational goals. With the help of conservation agencies, a detailed protocol has been developed with regards to conservation goals. This protocol was tested in an application to Kruger National Park

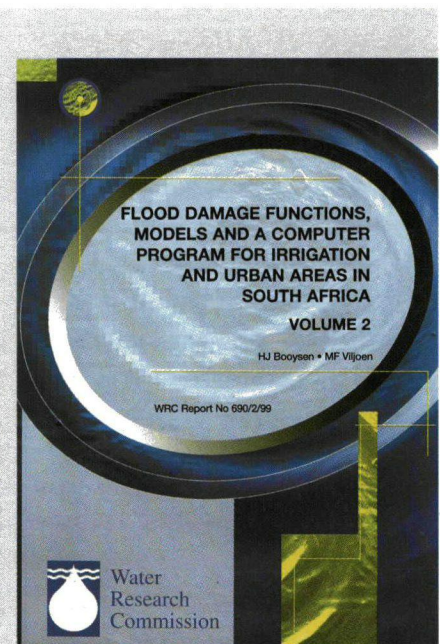
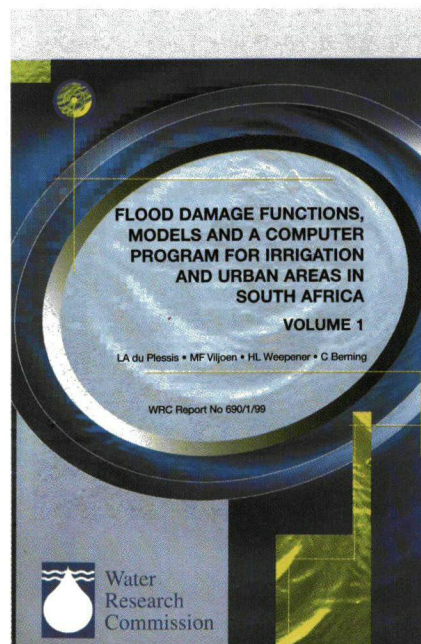
rivers. It has received wide acclaim and has been adopted by several conservation authorities. Included in the process is a goal-maintenance system, which monitors performance against the objectives. Apart from the fact that these techniques are directly relevant to the KNPRRP, they can also be used in other environmental management agencies, such as those responsible for integrated catchment management.

Topics discussed in the document include the complexity of river management, better prediction of physical and biological processes and responses, new approaches to addressing the problems of scale, etc.

Report 690/1/99 - Flood damage functions, models and a computer program for irrigation and urban areas in South Africa. Report to the Water Research Commission by the Department of Agricultural Economics at the University of the Orange Free State.

Authors: LA du Plessis, MF Viljoen, HL Weepener and C Berning
Price: Volume 1 - US\$ 35 and Volume 2 - US\$ 30 (both prices via surface mail).

The report describes the development of a user-friendly flood damage simulation model - FLODSIM - which can be applied cost-effectively in flood sensitive irrigation-areas in South Africa to determine economic benefits of different combinations of flood and flood damage control measures as part of a sustainable integrated flood plain management system. In this way, more effective flood management plans can be formulated and implemented.



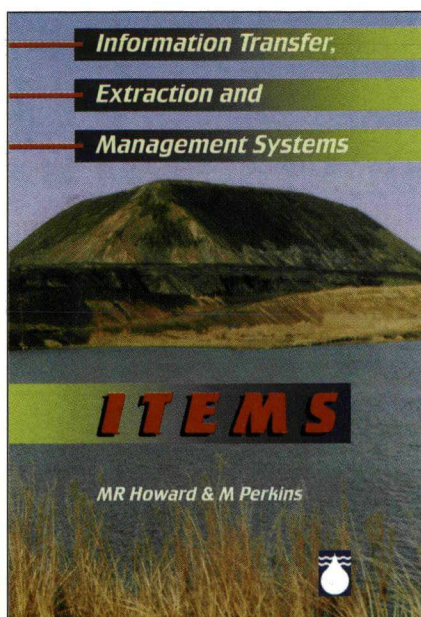
Report TT 94/98 - Information transfer, extraction and management systems (ITEMS). Report to the Water Research Commission by Pulles, Howard & De Lange Inc.

Authors: MR Howard and M Perkins

Overseas price: US\$ 70 (via surface mail). This includes the report together with a software program on CD-ROM.

Pressure is mounting on regulators and mine operators to address the negative impacts of mining on the water environment. Millions of rands are spent annually on mining related research which could help them to do so but most water users are unaware of this ever-increasing mass of useful information. Others find that use and accessible information, generally in full written report format, is difficult and time-consuming.

This project aimed at partly solving some of these problems with a computerised Information Transfer Extraction and Management System (ITEMS) which gives users access to local and international information



on mine water quality, management, treatment and research.

The information requirements on the mining industry, government departments and other interested organisations were investigated

and assessed and a range of databases available worldwide and locally were accessed and evaluated. The result is ITEMS - 18 databases, containing approximately 200 tables of data each holding between 20 and 100 records. The total computer file size of the database is 90 Mb.

An uncluttered interface has been developed and a simple step-by-step procedure elicits the specific information required. Software is on CD for ease of installation.

The ITEMS system enables users to obtain access to information, which includes the following:

- DWAF water quality guidelines
- International water quality guidelines
- Water chemistry calculations
- Relevant research projects undertaken
- Manual to assess and manage the impact of mining on surface water quality
- Manual on current mine-water management and treatment practices
- Extended literature database on mine water

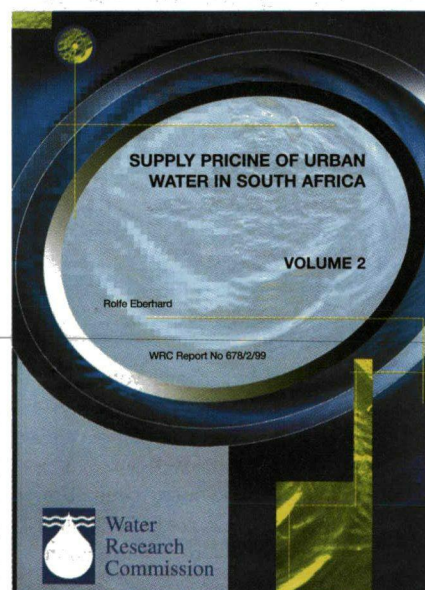
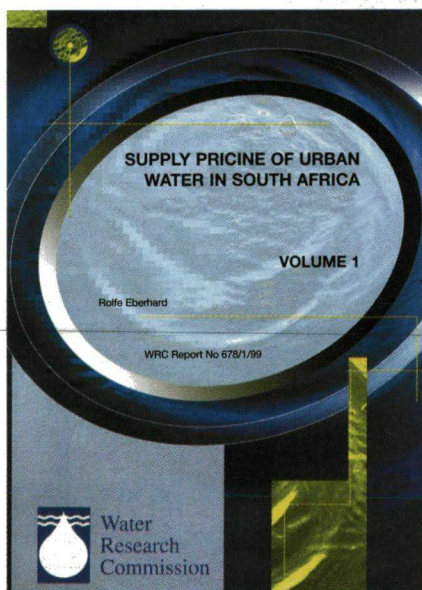
Report 678/1/99 and 678/2/99 - Supplying pricing of urban water in South Africa. Report to the Water Research Commission by the Palmer Development Group.

Author: Rolfe Eberhard

Overseas price: Volume 1 - US\$ 15 and Volume 2 - US\$ 20 (both via surface mail)

These reports form part of the Water Research Commission funded project titled "Pricing water as an economic resource: implications for South Africa". The researcher examined water pricing issues related primarily to urban water use, including the wholesale of water to (or by) local government.

The principle objectives of the project were as follows: To review water pricing theory; to review the international practice of water pricing; to review and assess available methodologies (and to develop new methodologies as necessary) to aid in the process of establishing water pricing policies and setting wholesale and retail water tariffs in South Africa; to recommend policies for, and an approach to, urban water pricing in South Africa and to assess the implications of the policies and approach with reference to an urban case study in South Africa - Grahamstown, in this instance.



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.

2001

JANUARY	FEBRUARY	MARCH	APRIL
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Die Watnavorsingskommissie plaas hierdie kalender om te help met die koördinering van watergebeurtenisse in Suid-Afrika.

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

Adres:
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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.

2002

JANUARY	FEBRUARY	MARCH	APRIL
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SOUTHERN
AFRICA

2001

MEMBRANES

MARCH 25 - 28

The 4th WISA-MTD symposium and workshop with the theme "Membranes -Science & Engineering" will be held in Stellenbosch.

Enquiries: Dr EP Jacobs, Institute for Polymer Science, University of Stellenbosch. Tel: (021) 808-3178.

PROCESS WATER

APRIL 3 - 5

The ESKOM international conference on power plant chemistry and process water treatment will take place at the Eskom Conference Centre in Midrand, Gauteng.

Enquiries: D Dalgetty, Senior Consultant Power Plant Chemistry. Tel: (011) 629-5056.

GROUNDWATER

APRIL 9 - 11

A short course in "The principles of the investigation of contaminated sites", including investigation strategies, risk assessment, quality assurance, safety and health protection, will be held at the Institute for Groundwater Studies, the University of the Free State.

Enquiries: Kornelius Riemann, Institute for Groundwater Studies, University of the Free State, PO Box 339, Bloemfontein 9300. E-mail address: Kornelius@igs-nt.uovs.ac.za

AQUIFERS

APRIL 12

A short course on "Tracer tests in fractured aquifers" consisting of single well tests - point dilution test, injection withdrawal test, and multiple well tests - radial convergent test, natural flow test, will be presented at the Institute for Groundwater Studies, University of the Free State.

Enquiries: Kornelius Riemann, Institute for Groundwater Studies, University of the Free State, PO Box 339, Bloemfontein 9300. E-mail address: Kornelius@igs-nt.uovs.ac.za

ENVIRONMENTAL
MANAGEMENT

MAY 8 - 10

A short course on environmental

management will be held at the Post-Graduate Centre of the University of Pretoria.

Enquiries: Ms Tanya de Bruin. Tel: (012) 362-5118/9. Fax: (012) 362-5285. E-mail: tanya.ce@up.ac.za

SASAQS 2001

JULY 1 - 6

The 36th conference of the Southern African Society of Aquatic Scientists will be held at Aventura Eco Eiland in the Northern Province. The theme will be "Aquatic ecology and resource management in Southern Africa".

Enquiries: Mr P Fouche. Tel: (01596) 28383. E-mail address: pso@caddy.univen.ac.za

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

SANITATION

AUGUST 20 - 24

The 27th WEDC conference with the theme "People and systems for water, sanitation and health" will be held in Lusaka, Zambia.

Enquiries: Professor John Pickford, WEDC, Loughborough University LE11 3TU, England. Fax: (44) 01509 211027. E-mail: j.a.pickford@lboro.ac.uk

ENVIRONMENTAL
MANAGEMENT

SEPTEMBER 18 - 20

A short course on environmental management will be held at the Post-Graduate Centre of the University of Pretoria.

Enquiries: Ms Tanya de Bruin. Tel: (012) 362-5118/9. Fax: (012) 362-5285. E-mail: tanya.ce@up.ac.za

2002

RIVER SYSTEMS

MARCH 3 - 8

The 4th international ecohydraulics symposium with the theme "Environmental flows for river systems" will be held in Cape Town.

Enquiries: Conference Secretariat, Southern Waters Ecological Research and Consulting (Pty) Ltd. PO Box 13280. Mowbray 7705. Fax: (021) 6503887. E-mail address: conference2002@southernwaters.co.za. Website: <http://www.southernwaters.co.za>

HYDROLOGY

MARCH 18 - 22

UNESCO's 4th international conference on Flow Regimes from International Experimental and Network Data (FRIEND) with the theme "Bridging the gap between research and practice" will be held in Cape Town.

Enquiries: Juanita McLean, Institute for Water Research, Rhodes University, PO Box 94, Grahamstown 6140. Tel: (046) 622-4014. Fax: (046) 622-9427. E-mail: Juanita@iwr.ru.ac.za

DESERTIFICATION

APRIL 8 - 10

An international symposium on alternative ways to combat desertification - Connecting community action with science and common sense - will be held in Cape Town.

Enquiries: Mary Seely, Desert Research Foundation of Namibia, PO Box 20232, Windhoek, Namibia. Tel: +264 61 229855. Fax: +264 61 230172. E-mail: mseely@drfn.org.na

OVERSEAS

2001

WATER EXHIBITION

APRIL 3 - 5

The central Asia water exhibition will be held in Almaty, Kazakstan. Enquiries: Worldexpo Ltd, 8 ul. Sniadekich, PL-85-011 Bydgoszcz, Poland. Tel: 011-48-52-3253031. Fax: 011-48-52-3253030 or 3212713. E-mail: officemtplk.byd@targi-fair.com.pl

ENVITEC

MAY 14 - 17

Messe Düsseldorf will host

Envitec, a trade fair on environmental protection, occupational health and safety, in Düsseldorf, Germany.

Enquiries: Messe Düsseldorf GmbH, Postfach 101006, D-40001 Düsseldorf, Germany. Tel: +49 (0) 211/4560-01. Fax: +49 (0) 211/4560-668. E-mail: info@messe-duesseldorf.de Web: www.messe-duesseldorf.de

ALGOLOGICAL

MAY 14 - 18

The 12th Hungarian algological meeting will take place in South Hungary.

Enquiries: Dr KT Kiss. E-mail: kis7972@helka.iif.hu OR kisskeve@ludens.elte.hu Web: <http://falco.elte.hu/ALGA/MAT.htm>

LEAKAGE CONTROL

MAY 16 - 18

A conference dealing with a systematic approach to leakage control and water distribution systems management will be held in Brno, Czech Republic.

Enquiries: Institute of Municipal Water Management, Faculty of Civil Engineering, Brno University of Technology, Zizkova 17, 602 00 Brno, Czech Republic. Tel: +4205 41147721. Fax: +4205 41147728. E-mail: valkovic@water.fce.vutbr.cz

WETLANDS

MAY 27 - JUNE 1

The 22nd annual meeting of the society of wetland scientists will be held in Chicago, IL, USA.

Enquiries: Web: <http://www.sws.org/chicago/>

DESALINATION

MAY 28 - 31

A European conference on desalination and the environment water shortage will be held in Lemesos (Limassol), Cyprus.

Enquiries: Miriam Balaban, Science and Technology Park of Abruzzo, Via Antica Arischia, 1 67100 L'Aquila, Italy. Tel: +39 0862 3475 308. Fax: +39 0862 3475 213. E-mail address: miriam.balaban@aquila.infn.it

AUTOMATION

JUNE 3 - 7

The first International Water Association (IWA) conference on instrumentation, control and automation (ICA), including sensors, will be held in Malmö, Sweden, and Copenhagen, Denmark.

Enquiries: Professor Gustav Olsson, Department of Industrial Electrical Engineering and Auto-

mation, Lund Institute of Technology, Box 118, S-22100 Lund Sweden. E-mail address: gustaf.olsson@iea.lth.se. Web: <http://www.iea.lth.se/ICA2001>

WATERSHED MANAGEMENT

JUNE 10 - 15

A symposium on diffuse/nonpoint pollution and watershed management will be held in Milwaukee, USA.

Enquiries: Professor Vladimir Novotny, Institute for urban environmental risk management, Marquette University, Milwaukee, WI 53201-1881, USA. E-mail: novotny@execpc.com Tel: +414 288 3524. Fax: +414 2887521.

ACTIVATED SLUDGE

JUNE 13 - 15

A conference on micro-organisms in activated sludge and biofilm processes will be held in Rome, Italy.

Enquiries: Prof C Tandoi, CNR Water Research Institute, via Reno 1, 00198 Rome, Italy. E-mail: tandoi@irsa1.irsa.rm.cnr.it Tel: +61 73365 4645. Fax: +61 7 3365 4620.

AWWA 2001

JUNE 17 - 21

The AWWA 2001 annual conference and exhibition will be held in Washington DC, USA.

Enquiries: David Rossiter, AWWA, USA. E-mail: rossiter@awwa.org Web: <http://www.awwa.org/tande>

URBAN WATER

JUNE 18-21

A conference on the "Frontiers in urban water management: deadlock or hope?" will be held in Marseille, France.

Enquiries: Dr J Alberto Tejada-Guibert, Division of Water Sciences, UNESCO, 1 rue Miollis, 75732 Paris Cedex, France. Tel: +33 1 4568 4096. Fax: +33 1 4568 5811. E-mail: symposium2001@unesco.org

COASTAL ZONE

JUNE 18 - 20

The 4th international symposium on computer mapping and GIS for coastal zone management will be held in Halifax, Nova Scotia (Canada).

Enquiries: Coastgis2001@agc.bio.ns.ca Web: <http://www.agc.bio.ns.ca/coastgis2001/>

GROUNDWATER

JUNE 18 - 21

The 3rd international conference on groundwater quality will take

place at the University of Sheffield, United Kingdom.

Enquiries: Jenny Chambers, Department of Civil and Structural Engineering, University of Sheffield, Mappin Street, Sheffield S1 3JD. E-mail: gq2001@sheffield.ac.uk or visit the website: www.shef.ac.uk/~gq2001/

STORM DRAINAGE

JUNE 25 - 27

The 4th international conference on innovative technologies in urban storm drainage - Novatech 2001 - will be held in Lyon-Villeurbanne, France.

Enquiries: Elodie Brelot, GRAIE, BP 2132, Villeurbanne, Cedex, France. Tel: +33 4 7243 8368. Fax: +33 4 7243 9277. E-mail: graie@urc-hu.insa-lyon.fr Web: <http://www.insa-lyon.fr/Services/graie/nova1gb.htm>

FRESHWATERS

JULY 5 - 8

The Fenner conference on the environment: Biodiversity conservation in freshwaters - same landscape, different perspective, will be held in Canberra, Australia.

Enquiries: Arthur Georges. E-mail: director@aerg.canberra.edu.au

TOXICOLOGY

JULY 8 - 13

The 9th international congress on toxicology will be held in Brisbane, Australia.

Enquiries: Congress secretariat. E-mail: ictx2001@im.com.au Fax: +61 73369 1512.

FOG COLLECTION

JULY 15 - 20

The second international conference on fog and fog collection will be held in St John's, Newfoundland, Canada. The conference will focus on the physics, chemistry, meteorology, forecasting and remote sensing of fog; fog deposition and the interaction of fog with vegetation; dew research, fog collection projects in developing countries and the negative effects of fog on commercial offshore activities.

Enquiries: Dr Robert Schemenauer (Conference Chair), PO Box 81541, 1057 Steeles Avenue West, Toronto, Ontario M2R 2X1, Canada. Fax (1 416) 739 4211. E-mail: robert.schemenauer@ec.gc.ca

CYANOBACTERIA

JULY 16 - 20

The 5th international conference on toxic cyanobacteria will be

held in Noosa, Qld, Australia.

Enquiries: E-mail: ictcv@bne.clw.csiro.au OR website: <http://lurac.latrobe.edu.au/botbm/cyanotox.html>

WEDC

The 27th Water, Engineering and Development Centre (WEDC) conference with the theme "People and systems for water, sanitation and health" will be held in Lusaka, Zambia.

Enquiries: Prof J Pickford, WEDC, Institute of Development Engineering, Loughborough University, Leicestershire LE11 3TU UK. Tel: +44 (0) 1509 222885. Fax: +44 (0) 1509 211079. E-mail: WEDC@lboro.ac.uk Web: <http://www.lboro.ac.uk/wedc>

ALGAL WORKSHOP

JULY 23 - 25

The 3rd Australian algal workshop will be held at Coopers Plains in Brisbane, Qld, Australia.

Enquiries: E-mail: Glenn.McGregor@dnr.qld.gov.au

BIOGEOCHEMISTRY

JULY 30 - AUGUST 3

The 6th international conference on the biogeochemistry of trace elements will take place in Guelph, Ontario, Canada.

Enquiries: ICOBTE, c/o Dr Les Evans, Conference Chair, Department of Land Resource Science, University of Guelph, Ontario, Canada N1G2W1. E-mail: icobte@lrs.uoguelph.ca

AQUACULTURE

AUGUST 5 - 7

The European Aquaculture Society (EAS) will hold a symposium with the theme "aquaculture in Europe" in Trondheim, Norway.

Enquiries: <http://www.easeonline.org>

WATER IN HISTORY

AUGUST 10 - 12

A symposium on the role of water in history and development will be held in Bergen, Norway.

Enquiries: Alv Terje Fotland, Centre for Development Studies, University of Bergen, Stromgaten 54, N-5007 Bergen Norway. Fax: +47 5558 9892. E-mail: Alv.Fotland@sfu.uib.no

STOCKHOLM WATER SYMPOSIUM

AUGUST 13 - 16

"Water security for the 21st century - building bridges" will be the theme of the 2001 Stockholm Water Symposium to be held in Sweden.

Enquiries: Symposium Secretariat, Sveavagen 59, SE-113 59 Stockholm, Sweden. Tel: +46 8 522 139 75. Fax: +46 8 522 139 61. E-mail: sympos@siwi.org Web: www.siw.org

EVAPOTRANSPIRATION

AUGUST 13 - 25

A short course on the determination of evapotranspiration from satellite data and applications in water management will be held in Enschede, the Netherlands.

Enquiries: Mrs R Hummel, ITC, PO Box 6, 7500 AA Enschede, the Netherlands. Tel: +31 53 487 43 05. Fax: +31 53 487 43 36. E-mail: wres@itc.nl

ITC COURSES

SEPTEMBER 2001

The International Institute for Aerospace Survey and Earth Science (ITC) in the Netherlands will present the following courses: Environmental systems analysis and management for water resources; Watershed management, conservation and river basin planning; Groundwater resources evaluation and management as well as short courses in Applied hydrogeology and Groundwater modelling.

Enquiries: AM van Lieshout. Tel: +31 534 874 306. Fax: +31 534 874 336. E-mail: lieshout@itc.nl

ANAEROBIC DIGESTION

SEPTEMBER 3 - 5

A conference on anaerobic digestion titled AD2001 will be held in Antwerp, Belgium.

Enquiries: Lood FM van Velsen, NVA, PO Box 70, 2280 AB Rijswijk, the Netherlands. Tel: +31 24 3284282. Fax: +31 24 3604737. E-mail: sf@haskoning.nl

ICHTHYOLOGY

SEPTEMBER 3 - 7

The 10th European conference on ichthyology will be held in Prague, Czech Republic.

Enquiries: Website: <http://www.eci-x.iapg.cas.cz>

MEMBRANE TECHNOLOGY

SEPTEMBER 9 - 13

A conference on membrane technology for wastewater reclamation and reuse will be held in Tel-Aviv, Israel.

Enquiries: Gideon Oron, Ben-Gurion University of the Negev, Blaustein Institute for Desert Research and Environmental Water Resources, Kiryat Sde-Boker 84990, Israel. Tel: +972 7 659 6901. Fax: +972 7659 6909. E-mail: mmbrnext1@bgumail.bgu.ac.il



TENTH SOUTH AFRICAN NATIONAL HYDROLOGY SYMPOSIUM

www.ccwr.ac.za/sanciahs2001/

"Southern African Hydrology: Past, Present and Future"

26 - 28 September 2001, University of Natal, Pietermaritzburg

Organised for SANCIAHS by

*School of Bioresources Engineering & Environmental Hydrology, University of Natal Computing
Centre for Water Research and CSIR, Environmentek*

OBJECTIVE AND THEMES

To celebrate the 10th South African National Hydrology Symposium the aim is to highlight the role of hydrologists, water resources engineers, aquatic scientists and catchment managers in the past, present and future development, management and study of the southern African region's water resources, through the following sub-themes:

- * Hydrology and Integrated Water Resources Management
- * Incorporating social and environmental concerns in decision-making and Modelling
- * Hydrology, land-use and ecosystems
- * Prediction and coping with change: Hydrological Data
- * Education in Hydrology

CALL FOR PAPERS

Papers are invited which address one of the above topics. Participants intending to present a paper or poster are requested to send an extended abstract, a maximum of two pages in length, to the conference secretariat. Authors should identify whether the paper is for oral or poster presentation and under which topic the paper is submitted. Papers will be selected following a review of submitted abstracts. Books, software and equipment will be exhibited. Organisations wishing to exhibit or to advertise, should contact the organisers without delay.

DEADLINES

30 April 2001Receipt of abstracts by conference secretariat
30 May 2001Authors notified of accepted abstracts
30 July 2001Submission of papers to editors

SYMPOSIUM FORMAT

The Symposium will extend over 3 days and consist of oral presentations during plenary sessions and parallel sessions as well as a field trip on the afternoon of the 2nd day. The Symposium will be preceded by a "meet, greet, eat and register" opportunity on the evening of 26 September 2001. The traditional SANCIAHS Dinner will take place on the evening of 27 September 2001.

STUDENT PRIZES

A prize will be awarded to the best paper and best poster presented by a full-time student.

FEES AND ACCOMMODATION

The registration fee will be of the order of R500.00. This fee will include the cost of teas/coffees, lunches, the "meet & greet", the field trip, the Dinner and the Proceedings, but excludes accommodation. Full-time students will be offered a reduced rate. Delegates must make their own accommodation arrangements. (A list of local hotels and B&Bs will be available on the conference website).

REGISTRATION AND SUBMISSION OF PAPERS

Please submit papers and registration enquiries to:

Ms N Mabasa, Computing Centre for Water Research, University of Natal, Pietermaritzburg, Scottsville, 3209

Tel: (033) 260-5178 • Fax: (033) 260-6288 • E-mail: mabasa@aquac.cwr.ac.za

General enquiries: Dr Graham Jewitt • Fax: (033) 260-5818 • Tel: (033) 260-5490 • E-mail: jewittg@nu.ac.za

Short course in SASS

A rapid method of

Water Quality Assessment

Main course: 14-16 May 2001
Refresher course: 18 September
Sabie, Mpumalanga

AIM

The aim of the course, presented by Afridev Consultants, is to provide practical experience in applying the SASS biomonitoring method.

COURSE

The course will be presented in English by a team of experts including Dr Mark Chutter who developed the SASS method.

The course will focus on the practical application of the SASS method, from planning to reporting. Aspects covered will include site selection, habitat assessment, equipment, safety, sampling procedures, invertebrate identification, data analysis and reporting, and quality control.

The course will consist of a main course lasting 3 days, and a 1-day refresher course 4 months later.

VENUE

The course will be held at Merry Pebbles, on the banks of the Sabie River at Sabie, Mpumalanga.

WHO SHOULD ATTEND

ENQUIRIES

For full details and registration please contact:
Dr Rob Palmer
PO Box 4349, White River, 1240
Tel & Fax: 013-751 1533
Cell: 082-574-4486
Email: afridevr@iafrica.com

Anyone interested in water quality management and the practical application of SASS, including people from government, industry, non-government organisations, consulting firms, and research institutes. The number of attendees will be restricted.

Participants must be able to swim, and should bring waders and clothing suitable for working in rivers.

FEES

The course fee, including the refresher course and a sampling equipment set, is R5,000 (vat excluded) payable before 1 May 2001.

The fee includes meals and accommodation for two nights for the main course, and meals accommodation for one night preceding the refresher course. The fee excludes transport to the venue.

CERTIFICATE

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



AFRIDEV
ASSOCIATES



Reg. No. 916 628507