

S4 waterbulletin

ISBN 0258-2244

Volume 24 No 6

Desember 1998

AQUATIC ECOSYSTEMS

Weevils chew up red water fern problem

WATERGEHALTE

Korrosie-eienskappe van drinkwater ondersoek

URBAN WATER

Designs for delittering urban stormwater systems

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Call for Papers

Water Wise Horticulture

June 1999

Rand Water would like to host a conference in June 1999, in Gauteng, on the trials and tribulations involved with changing the mind set of a nation to be water conserving. Water is a scarce resource and unless we plan for our future, the horticultural industry and gardeners are likely to be at the losing end.

We welcome papers that will appeal to a wide range of audience in the horticultural (Green) industry. Case studies, new positive opinions, as well as technical papers are requested.

*Please contact Gail Andrews at
Telephone: (011) 900-1580
Facsimile: (011) 900-2108*

AwwaRF

requests proposals

The Awwa Research Foundation (AwwaRF), a non-profit organization dedicated to advancing the science of water, announces the selection of 39 new research projects approved for funding in 1999. AwwaRF sponsors practical, applied research for the drinking water community and, since 1986, has managed research projects worth over \$100 million. The new research projects cover topics including utility management, treatment chemistry, customer issues, distribution system water quality, and source water quality and monitoring. Requests for Proposals (RFPs) will be issued for 30 of the new projects and will be available on the AwwaRF web site (www.awwarf.com) in early March.

*For additional information, contact AwwaRF at
303-347-6211 or 303-347-6117.*

BIOTECHNOLOGY

COURSE PROGRAMME 1999

- **Advanced Course on Downstream Processing**
31 May - 4 June, 1999, Delft University of Technology, The Netherlands
(<http://www.kluyver.stm.tudelft.nl/BODL/ACS.htm>)
- **Advanced Course in Environmental Biotechnology**
16 - 25 June, 1999, Delft University of Technology, The Netherlands
(<http://www.kluyver.stm.tudelft.nl/BODL/ACS.htm>)
- **Advanced Course on Microbial Physiology and Fermentation Technology**
6 - 17 December, 1999, Delft University of Technology, The Netherlands
(<http://www.kluyver.stm.tudelft.nl/BODL/ACS.htm>)
- **EU Advanced Workshop in Biotechnology, Bioethics and Public Perceptions of Biotechnology**
19 - 30 March, 1999, St Edmunds Hall, Oxford University, England (EU grants available)
(<http://www.kluyver.stm.tudelft.nl/BODL/ACS.htm>)
- **Training Course on Quality Assurance and Total Quality Management**
(<http://www.kluyver.stm.tudelft.nl/BODL/TQA/Quality.htm>)
Module 7: EU advanced practical workshop on biological safety in industrial and agricultural biotechnology
22 - 25 March 1999, TNO Nutrition and Food Research Institute, Zeist (EU grants available)

Further information:

Dr Ir LA van der Meer-Lerk, Dr LHP Caro and Dr P Osseweijer, Institute for Biotechnology Studies, Delft Leiden (BODL), Kluyver Laboratory, Julianalaan 67, 2628 BC Delft, The Netherlands.

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Cover: The pond at Austin Roberts Bird Sanctuary covered in Red Water Fern. (Photo: Helene Joubert)

SA Waterbulletin is a two monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source. Editorial offices: Water Research Commission, PO Box 824, Pretoria 0001, Republic of South Africa. Tel (012) 330-0340. Fax (012) 331-2565. WRC Internet address: <http://www.wrc.org.za> Editor: Jan du Plessis (E-mail: Jan@wrc.org.za). Asst Editor: Helene Joubert (E-mail: Helene@wrc.org.za). Ed Secretary: Rina Human (E-mail: Rina@wrc.org.za). Layout: Ronel Urquhart - 4Images. Colour Separations: 4Images. Printing: Beria Printers.



SUBMISSION OF WATER RESEARCH PROPOSALS TO THE WATER RESEARCH COMMISSION (WRC)

The Water Research Commission is extending an invitation to research organisations and individuals to submit water research proposals to the WRC on or before **30 APRIL 1999**.

PLEASE NOTE THAT NO LATE SUBMISSIONS WILL BE ACCEPTED.

The electronic proposal submission system implemented by the WRC, has generally been well received by proposers. The system proved to be effective, resulting in considerable time savings. The system, allowing the submission of research proposals via the Internet, has been updated and is available in an improved and more user-friendly format for submission of research proposals in 1999.

- Guidelines for the completion of the electronic submission system, as well as information about entering research proposals is available on the WRC's web site: <http://www.wrc.org.za> Should you encounter problems with the Internet submission you are welcome to contact Ms Francette Myburgh (Tel (012) 330-0340 or Francette@wrc.org.za).
- Researchers without access to the Internet may, as in the past, submit a hard copy proposal (together with its wordprocessor file on diskette) by hand, post or courier. The

Guidelines for research proposals are available on request from Ms Reinette Kruger at tel. (012) 330-0340.

All proposals received on or before the deadline will be considered jointly after 30 April 1999. Following this date, if necessary, the WRC research manager concerned will liaise with the proposer of a project in order to clarify any vagueness that may exist in the proposal, and finalise it. The proposals will then be subjected to an intensive evaluation procedure. Successful proposals will be tabled for approval at a WRC Board meeting and thereafter referred to the Minister of Water Affairs and Forestry for confirmation of the approval. Those submitting research proposals should note that during the evaluation process, the proposals may also be tabled before a Coordinating Committee comprising of experts in that particular field, or sent out for peer review.

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

Early submission of research proposals will be welcomed.



Launch of Toxic Algal Forum

A Toxic Algal Forum, under the auspices of the Water Research Commission, will be launched at a workshop on **Cyanobacteria in South Africa**, to be held 30 and 31 August 1999.

The workshop is the outflow of a gathering of concerned aquatic scientists and water quality managers in July 1998. The group, which included academics as well as representatives from water purification works and the Department of Water Affairs and Forestry, gathered to discuss aspects of the presence of toxic Cyanobacteria in South African surface waters and the associated risk for different groups of water users.

BLUE-GREEN ALGAL BLOOMS

The group, along with the South African Society of Aquatic Scientists (SASAQS), say that the presence of potentially toxic Cyanobacteria in South Africa's surface waters poses a health risk (to man and beast) and that there is a general lack of awareness and recognition of the potential problem of Cyanobacterial toxicity. Cyanobacteria, commonly known as blue-green algae, are often present in small numbers together with a diverse assemblage of other algae and photosynthetic bacteria which naturally occur in surface waters world wide. However under conditions of warm temperatures, minimal water movement and elevated concentrations of phosphorus in a water body, Cyanobacteria may frequently become dominant and form thick scums of floating algal cells. These dense aggregations of floating cells, termed "blooms", present a number of water quality problems, most often offensive odours and tastes, and sometimes algal toxins.

The predictable occurrence of the above conditions each year in areas where the

problem does occur, has necessitated retrofitting tertiary treatment facilities (with powdered activated carbon) to water treatment plants producing water for household use. Following incidents of low level production of toxins in impoundments which supply water to the Cape Town Metropolitan area, such tertiary treatment facilities were added to three large water treatment plants providing the Cape metropolis with potable water.

In South Africa no incident of human mortality has been reported to date, but a number of stock mortalities due to cyanobacterial toxicosis have been recorded. It seems that livestock in particular are at risk. Prior to 1993 cases of stock losses appeared to be confined to the former Transvaal and Orange Free State, however a number of incidents in the Western and Southern Cape since 1993 has brought the issue of algal toxins to the attention of water managers, scientists and researchers anew.

The problem of Cyanobacteria is not unique to South Africa. However, information about the precise geographic extent and incidence of cyanobacterial toxicity in South Africa is limited. Such information, however, is necessary for the formulation and implementation of management strategies.

MONITORING AND SURVEILLANCE

A draft Cyanobacterial Monitoring and Surveillance Programme has already been formulated by the Institute of Water Quality Studies (IWQS) of the

Department of Water Affairs and Forestry (DWAF). However, the programme requires participation, information, as well as skills and expertise, to succeed.

FORUM AIMS

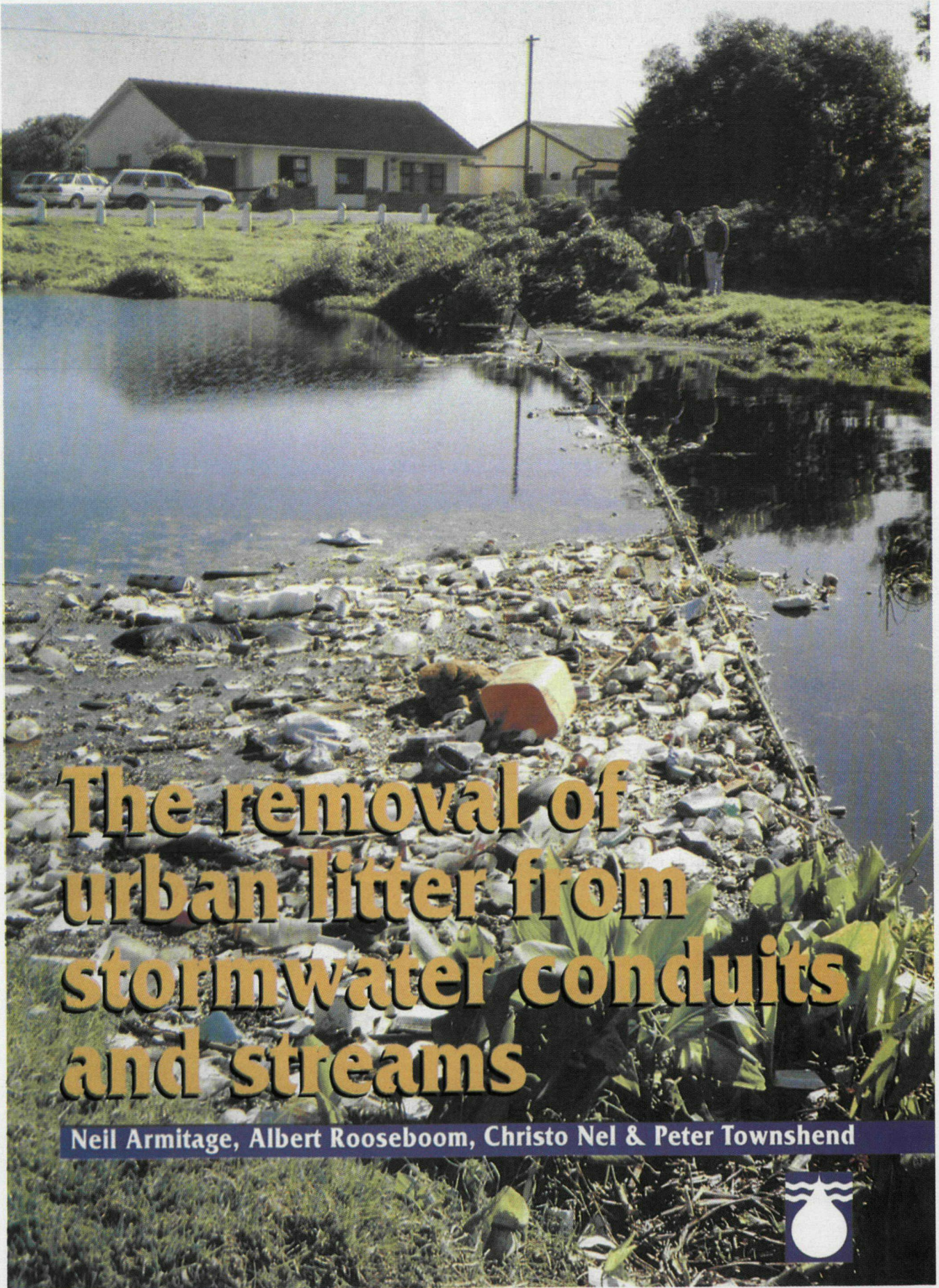
The proposed aims of the Toxic Algal Forum will be:

- to involve all relevant stakeholders
- to promote stakeholder awareness of toxic algae
- to encourage inter-organisational collaboration and co-ordination
- to arrange workshops to facilitate collaboration
- to build and provide a competent toxic algal information database
- to provide a consultancy service to national authorities as well as the water industry
- to make recommendations as regards research priorities and national projects.

For further information on the workshop or forum, please contact:

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The removal of urban litter from stormwater conduits and streams

Neil Armitage, Albert Rooseboom, Christo Nel & Peter Townshend



Removing urban litter from stormwater conduits

"In years to come, archaeologists sifting through the remains of the late twentieth century civilisation might well come to identify this period of history as one of waste - 'the throw-away society'. In South Africa this is most clearly demonstrated by the large quantities of litter that is so often to be seen strewn about public places, where it remains until it is either removed by the local authority or is transported by the wind and stormwater run-off into the drainage system."

This is said in a publication on the removal of urban litter from stormwater conduits and streams, written by a team of the researchers from the University of Stellenbosch (Professor A Rooseboom), the University of Cape Town (Mr NP Armitage), Stormwater Cleaning Systems (Pty) Ltd (Mr C Nel) and Urban Water (Mr PD Townshend).

The researchers say the purpose of the document is to discuss the most appropriate and cost-effective methods of removing litter from the drainage system. They emphasise that the findings of the research "are still somewhat tentative in view of the limited operational experience of many of the structures described in the document".

The document points out that the strategy for the removal of litter from the stormwater system will have to be two-pronged, aiming to reduce the quantity that finds its way into the system in the first place, as well as removing the balance as efficiently as possible. Whilst the document suggest some ways of reducing the rate of litter deposition in the catchment, large amounts of litter are likely to escape into the drains for the foreseeable future, and for this rea-

son, the bulk of the document focuses on litter removal structures.

It is important for designers to be able to estimate the amount of litter that is currently washed off urban catchments because that will determine the volume of material that the trap must hold, together with the frequency of cleaning. However, it appears that each catchment has a unique litter "footprint" which is indicative of the state of the catchment at the time of measurement. Moreover, studies carried out in South Africa, Australia and New Zealand appear to indicate that litter wash-off rates vary by up to hundred times, with the problem being much worse in South Africa than it is in either Australia or New Zealand. This is probably because of the poor levels of service in many areas of South Africa, combined with the lack of a national environmental ethic. Plastics seem to be by far the biggest single litter problem everywhere. In spite of the uncertainty that surrounds the estimation of the litter load, the researchers make some suggestions for the estimation of litter loads for design purposes.

LITTER TRAPS

The biggest challenge facing the designers of litter traps is that litter can be just about anything - any size, any shape, any density, any hardness. Furthermore, the behaviour of a single item often changes as it moves through the drainage system. Another challenge is that the flow rate in channels changes continuously. A structure might work well at a low flow rate, but not at a high flow rate, or vice versa.

The document discusses the large quantity of research that has been carried out in South Africa, Australia and elsewhere into the problem of the removal of litter from the aquatic system. This included an extensive series of model tests in the hydraulics laboratories at the universities of Stellenbosch and Cape Town.

As a result of this research, seven

devices were identified as showing the greatest promise, namely:

- Side-entry catchpit traps
- The North Sydney litter control device
- The in-line litter separator
- The continuous deflective separation device
- The Baramy gross pollutant trap
- The stormwater cleaning systems structure; and
- The urban water environmental management concept.

The researchers say fences, nets, booms or baffles may also be successfully used to intercept litter in streams provided the peak flow velocities are not too high.

The main criteria governing the choice of trap at any particular location are the maximum flow rate, the allowable head loss, the relative size of the structure, the efficiency of litter removal, the reliability of the device in removing litter without increasing flood risk, its ease of cleaning and maintenance and its cost effectiveness. The researchers evaluate the more promising trapping systems in terms of these criteria. The researchers then recommend a standard procedure for the selection of the trapping system.

However, the removal of litter is costly and should always be carried out as part of a proper catchment management plan. It is better to prevent littering than to remove the litter from the drainage system once it is there.

Copies of the publication entitled **The removal of urban litter from stormwater conduits and streams** (WRC report TT 95/98) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 35, via surface mail).

Researchers investigate corrosiveness of potable water

In a report to the Water Research Commission researchers AG Brits, JC Geldenhuys, AM Kok and DA Baxter of Rand Water say that all potable waters reveal corrosive properties to a greater or lesser extent. They say that although provision is made at water purification plants to produce stable, non-corrosive water, it is not always successful, and corrosiveness also tends to increase with long retention times in distribution systems.

According to the report entitled **The Effect of Water Quality and Chemical Composition on the Corrosion of Mild Steel Pipelines**, raw water quality also differs from one source to another. This is the experience of Rand Water with the use of water from the Tugela-Vaal scheme, and is expected with water coming from the Lesotho-Highland scheme. The changes in chemical composition will also have an effect on the corrosive properties of the water. However, the researchers say that if the factors which influence the corrosiveness of water, can be determined in advance, the water purification process can be adapted to reduce such corrosive properties in the potable water produced.

AIMS

This project aimed

- to increase knowledge regarding the chemical stabilisation of potable water
- to determine the extent to which water need to be treated to ensure that the water quality will remain constant between leaving the purification

plant and reaching the end consumer.

The information gained by addressing these objectives and the application thereof should curb corrosive effects and extend the lifespan of pipe systems, which in turn would result in economic savings in terms of maintenance work and costs.

RESULTS

The comprehensive research as documented in the report included the following: characterisation of a stable, non-corrosive water; identification of the most applicable index for a specific set of water conditions ; determination of possible relationships between chemical composition of potable water and corrosion rates of mild steel; and improvement of water quality reaching the consumer.

During the laboratory tests the effects of different chemical species and compounds (eg chloride, sulphate, nitrate, chlorine, monochloramine, organic flocculants, silicates and oxygen) were determined, as well as the effects of temperature, pH and Calcium Carbonate Precipitation Potential (CCPP) .

Actual corrosion rates were measured on coupons and compared to the value predicted by different indices. Corrosion rates and variations in chemical and physical properties were monitored in continuous flow systems.

CONCLUSIONS

From the results the following conclusions were drawn:

- There is a direct relationship between the corrosion rate of mild steel and the conductivity of the water and hence the total dissolved solids content of water. Temperature also plays an important role. Three equations were developed which allow prediction of the corrosiveness of a specific water towards mild steel. Further important observations were that increasing alkalinity present as bicarbonate leads to a proportional increase in initial corrosion rates caused by a proportional increase in conductivity, and the increasing chloride and sulphate also result in a

proportional increase in corrosion rates of mild steel.

- The chemical composition of water with good protective properties, tested by comparing actual measured corrosion rates with calculated values



The Effect of Water Quality and Chemical Composition on the Corrosion of Mild Steel Pipelines

AG Brits • JC Geldenhuys •
AM Kok • DA Baxter

Report to the Water Research Commission
by
Scientific Services
Rand Water

WRC Report No 259/1/98

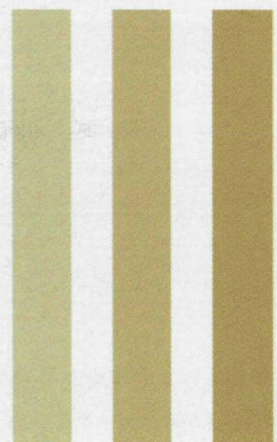
of the indices was determined. The analysis of water which has the potential of being neither corrosive nor aggressive in contact with mild steel, is indicated in the table given below.

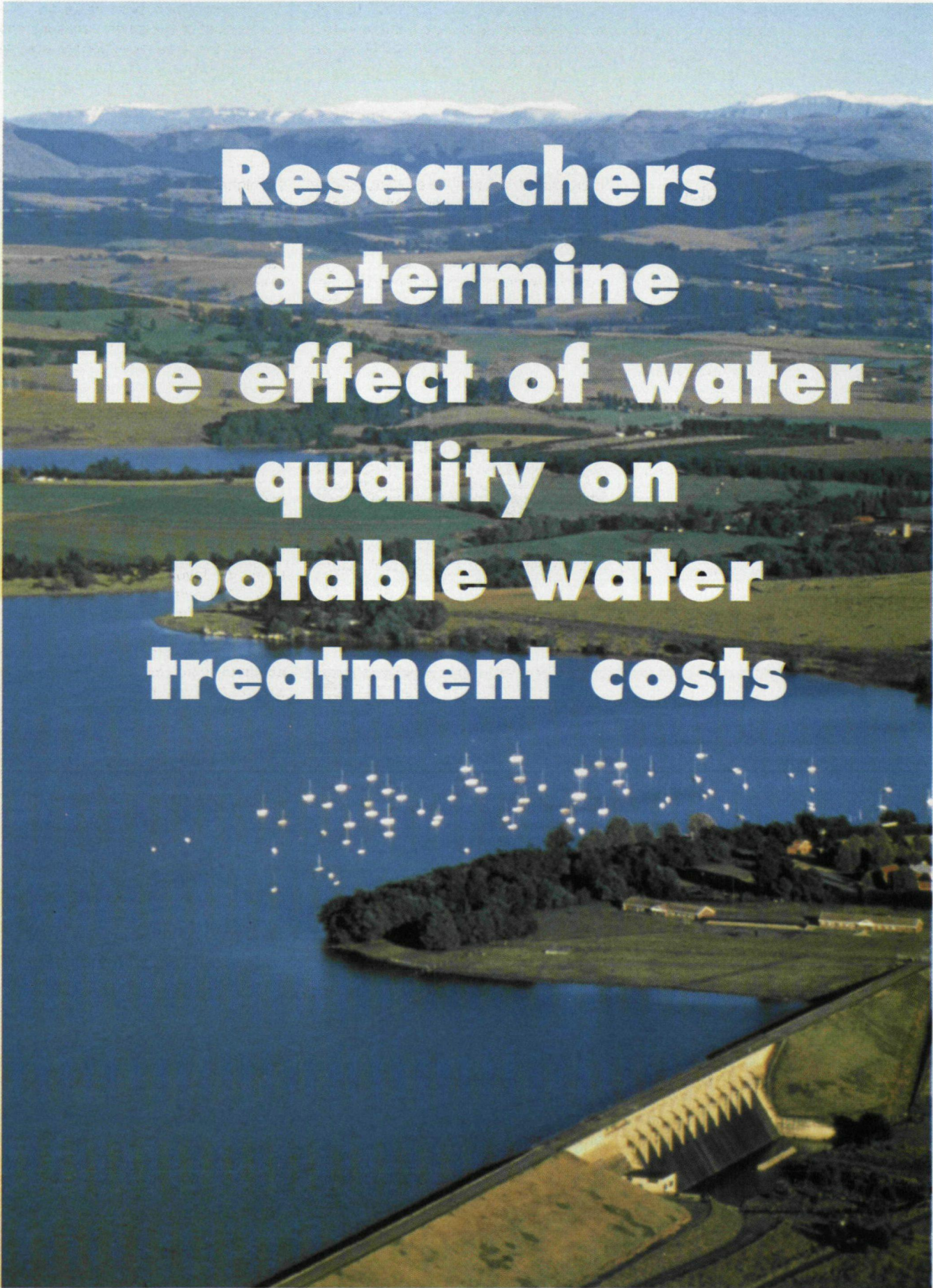
- The CCPP is the only "index" with which the exact amount of calcium carbonate that may precipitate or dissolve, as well as the equilibrium alkalinity and pH, can be determined. It is, therefore, a most useful operational criterium for use in water purification. To obtain a full picture of the nature of water, it is proposed that a combination of indices be used. In this regard computer programs have been developed to calculate the various indices, CCPP, equilibrium alkalinity, pH and corrosion rates.
- The use of non-activated silicate resulted in a decrease in corrosion rate for silicate contents up to 10 mg/l as SiO₂, and an increase in corrosion rate for silica contents exceeding 10 mg/l. Activated silicate led to an increase in corrosion rate. Monochloramine may act as a corrosion inhibitor at a concentration of 1 mg/l.

TABEL. Chemical analyses of stable low corrosive water.

ANALYSIS	RANGE
Conductivity mS/m	14,5 - 17,0
pH	8,3 - 8,6
TDS mg/l	97,4 - 116
Alkalinity as mg/l CaCO ₃	71 - 89
Hardness as mg/l CaCO ₃	69 - 7
Calcium mg/l	19 - 25
Magnesium mg/l	2,6 - 3,4
Sodium mg/l	3,9 - 10,0
Iron mg/l	0,05 - 0,61
Activated SiO ₂ mg/l	4,0 - 9,6
Total SiO ₂	9,0 - 10,0
Ammonia mg/l	<0,05
Nitrate-N mg/l	<0,30
Nitrate-N mg/l	0,11 - 0,69
Sulphate mg/l	<5
Chloride mg/l	<5

The report entitled **The Effect of Water Quality and Chemical Composition on the Corrosion of Mild Steel Pipelines** (WRC Report 259/1/98) with the accompanying CORRATE program on diskette, is available from the Water Research Commission, PO Box 824, Pretoria 0001. (E-mail: library@wrc.org.za) Foreign orders: US \$30 per copy, via surface mail.



An aerial photograph of a large body of water, likely a reservoir, with a dam in the foreground. The water is a deep blue, and the surrounding landscape is green and hilly. In the distance, there are mountains with patches of snow under a clear sky. The text is overlaid on the center of the image.

**Researchers
determine
the effect of water
quality on
potable water
treatment costs**

The Water Research Commission has released the results of a study which was undertaken to better understand the water quality relationships (particularly as they affected algae) in lakes within the Umgeni Water operational area and to see how this water quality affected the cost of treating water from these lakes.

Models were developed relating algal abundance with important water quality variables. In most cases, the models developed were related to algae that are known to adversely affect water treatment. Thereafter lake water quality was statistically examined to determine which factors were most impacting on water treatment, and hence, treatment costs, at selected waterworks. Models were developed relating raw water quality entering respective water works with costs incurred in treating that water.

The study was carried out by PM Graham, CWS Dickens and S Mbowa, all from Umgeni Water.

RESULTS

□ Algae

The researchers say Lake Shongweni appears to be an extreme case of eutrophication - both in terms of its physico-chemistry as well as its algal composition. This created problems in the data analyses (swamping the data) and it was therefore dropped from analyses. The remaining seven lakes, namely, Midmar, Albert Falls, Nagle, Inanda, Henley, Nungwane and Hazelmere formed the focus of the study.

Many of the environmental variables investigated in this study were highly correlated with each other. This created problems in analysing the data. The variation of the original large number of environmental variables (53) could be reasonably accounted for by a smaller number of 'key' environmental variables identified as conductivity, secchi depth, silicon, total inorganic nitrogen, total phosphorus, inflow, temperature, percentage dissolved oxygen and stability. The researchers say these variables

represented the primary aspects of variation in the environmental data and had intuitive biological appeal in that they are often implicated in the literature as influencing algal populations.

Low conductivity, low turbidity 'inland lakes' (Midmar, Albert Falls, Nagle and Henley) were identified as distinct from more turbid 'coastal' lakes (Hazelmere, and to a lesser extent, Nungwane). Inanda was characterised by generally higher conductivities but low turbidities. Lakes Midmar, Albert Falls and Nagle neatly demonstrate the change in water quality with progression down the Mgeni River catchment. This progression is characterised by increased conductivities. Inanda, the last lake on the Mgeni system cascade, had the highest conductivities.

Modelling the Water Quality in Impoundments within the Umgeni Water Operational Area and the Consequences for Potable Water Treatment Costs

PM Graham • CWS Dickens • S Mbowa

Report to the Water Research Commission
by Umgeni Water

WRC Report No 615/1/98



Weaker gradients (characterised by total inorganic nitrogen, total phosphorus and inflows) distinguished between Midmar, Nagle and Albert Falls (higher total phosphorus) and Nungwane and Henley (higher total inorganic nitrogen). Inanda was relatively 'mixed', experiencing a range of values for total inorganic nitrogen, total phosphorus and inflows.

Lakes with similar water quality are more likely to respond similarly to management. The reduced set of 'key' environmental variables explained a low (16 per cent) but statistically significant ($P < 0.01$) portion of the variability in the algal data. Of these variables, total inorganic nitrogen, silicon, temperature, inflow and secchi were the most impor-

tant in explaining algal variability. This low amount of explained variation is not unusual for large multi-genera ecological data. Not all algae had appreciable amounts of their variability explained by analyses.

Anabaena and *Mycrocystis* (important blue-green algae) were responding to the higher (20 - 25°C) temperatures and inflow volumes associated with late summer conditions (January to April). They were also generally more abundant at the lower end of the total inorganic nitrogen (TN) gradient (low TN:TP ratio < 20). Under these conditions they may become sufficiently abundant to cause water treatment problems (taste and odour formation).

Navicula, as well as *Spermatozopsis* and *Mallomonas* were responding to higher silicon ($>5\text{mg}/\ell$) and TN ($>0.5\text{mg}/\ell$) and lower temperatures (15 - 20°C) and inflows. Cool (15 - 20°C) clear waters (with high secchi depths, i.e. $>1.5\text{m}$) with low total phosphorus ($<20\mu\text{g}/\ell$) favour *Crucigena* whilst waters generally low in TN ($N < 0.5\text{mg}/\ell$) and Si ($<5\text{mg}/\ell$) favour *Melosira*, *Scenedesmus*, *Cyclotella* and *Tetraedron*. These waters are also generally clear (secchi $>2.0\text{m}$) and have lower water column stability. *Cyclotella* and *Cosmarium* are abundant in autumn (March/ April) whilst *Spermatozopsis* is likely to be more abundant in spring (August to October).

Unfortunately, little may be said about *Chlorella*, a dominant or sub-dominant species in many lakes, as its variability is not well explained by the measured environmental variables. Some (unmeasured) factors, associated with seasons, appeared to be important in terms of its abundance and distribution.

The researchers say that from an algal composition point of view, lakes Hazelmere, Nungwane and Inanda (and to a lesser extent Nagle) are most dissimilar from each other. The difference appears primarily associated with low water clarity (high turbidities or low secchi depths). Given that they are all on entirely different river systems (except Nagle and Inanda on the Mgeni River), with different water qualities, this is not surprising. There is an interesting trend, as illustrated by the algal composition of lakes, from generally upper catchment (Henley) down the Mgeni system sequentially to the coastal lakes (Nagle and Inanda).

Within the bounds of the data *Chlorella* and *Anabaena* are the only algae which are ever really numerically and proportionally abundant in lakes. There are large shifts in algal populations during the late summer period (February/March) through to midwinter (June/July) with another large shift again in early summer (September to November) through to late summer. The following genera most exemplify these shifts: *Chlorella* and *Anabaena* (increase in abundance in late summer), *Cyclotella* and *Cosmarium* (increase in autumn - March/April) and *Spermatozopsis* (increase in spring). The researchers say these shifts are most probably associated with stratification changes in the water column.

Classical multiple regression modelling of important algae against environmental variables was unsuccessful, with the predictive ability of all multiple regression models poor. The semi-quantitative empirical models, developed in ordination analyses, provided the best available predictive models for algae/environment relationships.

□ Treatment costs

Lake water quality clearly has a significant impact on the cost of treating water in each of the major waterworks examined. The cost of treating water per megalitre (M) is the highest at the Hazelmere waterworks (R41) followed by the Durban Heights (R28), DV Harris (R25) and Wiggins waterworks (R22). The cost of treating water in the Hazelmere system is almost double the others.

However, the researchers say that within the range of the data analysed, abiotic water quality factors generally affected water treatment more significantly than algae, except where potentially powerful taste and odour forming algae (principally *Anabaena*) were present. The Nagle/Durban Heights waterworks system is most affected by taste and odour problems.

The model derived for the Hazelmere water works explains 79 per cent of the variation in chemical treatment costs. The model predicts actual costs quite well and can be easily applied in simulation exercises.

Abiotic water quality factors have a particularly significant impact on treatment costs at the Hazelmere waterworks.

Treatment costs increase when turbidity, total aluminium, manganese, suspended solids, potassium, sulphates and total organic carbon concentrations in lake Hazelmere water increase. Likewise, costs rise with lower water pH and alkalinity levels. Algae have a relatively minor impact on treatment costs at the Hazelmere waterworks.

Hazelmere is the only system analysed with water treatment problems associated with manganese (necessitating the use of a powerful oxidant, such as chlorine dioxide - which also increases treatment costs). During periods of lake turnover (when the water column destratifies) manganese (in the reduced form) should be very carefully monitored to limit its potential impact on water treatment (and hence costs). A management strategy that reduces the turbidity of lake Hazelmere would reduce water treatment costs at the Hazelmere waterworks, according to the researchers.

The model estimated for the Durban Heights waterworks explains some 64 per cent of the variation in chemical treatment costs. The model predicts actual costs well (except during occasional peak cost periods) and can be easily applied in simulation exercises. Treatment costs increased when levels of turbidity, suspended solids, total organic carbon, conductivity, total water hardness, potassium, nitrates and coliform bacteria rise in the raw water. Treatment costs rise with a fall in raw water pH and alkalinity (increasingly acidic conditions, requiring lime dosages to achieve a 4mg/l calcium carbonate precipitation potential).

High numbers of the algae *Anabaena* and *Mycrocystis* in lake Nagle has a major impact on treatment costs at the Durban Heights water works, particularly when they are producing taste and odour compounds. The results show that iron, manganese, total phosphorus and *E.coli* do not add significantly to treatment costs. Initially the policy implications may be that resources should not be wasted on these apparent problems. However, it is a well-known fact that total phosphorus has the potential to have a marked effect on algal abundances (particularly the blue-green algae which traditionally cause taste and odour problems).

The DV Harris waterworks model

explains 67 per cent of the variation in chemical treatment costs. Treatment costs increase when levels of alkalinity, total hardness, manganese and conductivity in lake Midmar fall. Treatment costs also rise with declining numbers of *Chlorella*. Conversely, costs rise with higher concentrations of potassium and numbers of coliforms and *E.coli*. Results show that turbidity, silicon, suspended solids and total organic carbon do not significantly affect treatment costs at the DV Harris waterworks. This indicates that raw water in this system is traditionally clean with costs principally driven by the need to disinfect and stabilise (lime) the water. The "trend variable" in the DV Harris model indicates that over time treatment costs have been increasing in this system.

The Wiggins waterworks model explains 79 per cent of the variation in chemical treatment costs. Treatment costs at the Wiggins waterworks increase with an increase in water turbidity, total aluminium, iron, suspended solids, nitrates, total organic carbon, total dissolved solids, silicon, coliform numbers, conductivity, total water hardness, potassium, nitrates, *Microcystis* and *Anabaena*. Conversely, treatment costs diminish with an increase in water pH and dissolved oxygen in the water. Again the "trend variable" indicates that over time treatment costs have been increasing in this system.

The researchers say the study quantifies how an integrated catchment management strategy that would reduce both point and diffuse nutrient loads and turbidity in the lakes could reduce water treatment costs at the respective waterworks.

Water treatment cost prediction models developed have the potential to assist in catchment management by providing the tools for cost/benefit type analyses of the impact of land-use change on water treatment costs.

Copies of the report entitled **Modelling the water quality in impoundments within the Umgeni water operational area and the consequences for potable water treatment costs** (WRC report 615/1/98) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 30, via surface mail). E-mail order address: tineke@wrc.org.za

Phages do it

Microbiological analytical procedures for the identification and quantification of viruses are generally tedious, time-consuming and expensive. However, a research team of the Department of Medical Virology of the University of Pretoria has successfully evaluated and improved detection methods for phages as indicators for water quality. The techniques which they applied and optimised have proved

suitable for the quantitative enumeration of phages in waste water, river water, seawater and dam water, as well as the sensitive, routine qualitative monitoring of treated drinking water supplies. The report to the Water Research Commission, entitled **Evaluation of the Application of Bacteriophages as indicators of Water Quality** documents the research by WOK Grabow, A Vrey, M Uys and JC de Villiers.

The main aim of the project was to evaluate and optimise the application of bacteriophages (or phages) as indicators of water quality in practice. According to Professor Grabow phages closely resemble human viruses in a number of aspects, and have attractive features for application as cost effective and practical indicators of water quality.

PHAGES

Bacteriophages (or phages) are viruses which infect bacteria. The host bacteria support the replication of the phages. In terms of size, morphology, structure, composition and mode of replication, phages closely resemble human viruses. The nucleic acid content of phages, as in the case of human viruses, is solely single or double-strand DNA or RNA. Many phages are detectable by simple and inexpensive techniques which yield results within 24 hours, and are therefore particularly suitable/useful for water quality monitoring purposes.

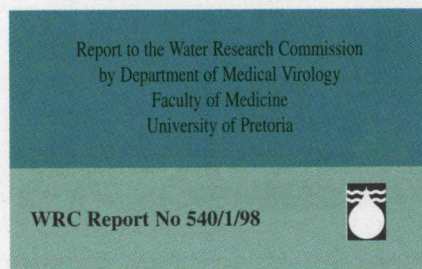
The researchers studied the behaviour of selected phages and groups of phages in comparison to that of human viruses and other indicators in water environments and water treatment processes. The researchers also gave special attention to the numbers of phages in waste water and polluted water sources, and their survival in these environments. According to the report the research results left no doubt

as to the meaningful application of phages as water quality indicators.



Evaluation of the Application of Bacteriophages as Indicators of Water Quality

WOK Grabow • A Vrey • M Uys •
JC de Villiers



RESULTS

Treated drinking water from various points in the Rand Water treatment system was analysed for human viruses, phages and bacterial indicators of faecal pollution. The results showed that phages are valuable indicators of the absence of viruses, and of the efficiency of water treatment processes.

The phages have been shown to

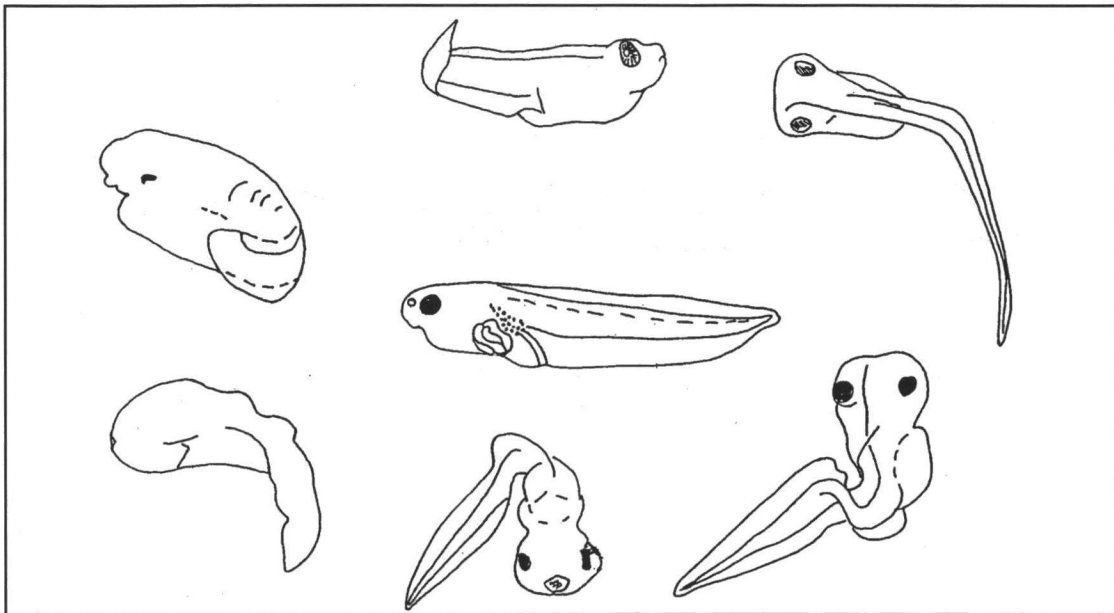
generally outnumber human viruses in most water environments and it would be reasonable to conclude that the absence of phages is under most conditions a reliable indication of the absence of human viruses.

The techniques for reliable and sensitive routine water quality monitoring have been described and evaluated in detail.

The research team worked in close collaboration with the International Organisation for Standardisation (ISO), as well as with leaders in the field in a number of laboratories abroad. Modifications to ISO standard techniques, as suggested by the research team, have been accepted and are now recommended by the ISO.

Copies of the report **Evaluation of the Application of Bacteriophages as Indicators of Water Quality** (WRC Report 540/1/98) are available, free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (E-mail: library@wrc.org.za) Foreign orders: US \$20 per copy, via surface mail.

Tadpoles indicate water quality



Some abnormalities associated with **Deltamethrin**. The sketches are not to scale. A control tadpole is in the centre. Typical abnormalities include bent or twisted tails, and a failure of the early embryo to develop.

The Water Research Commission (WRC) has recently released a baseline study report which deals with monitoring of water quality using tadpoles. In the report researcher Professor Andrew Channing of the Department of Biochemistry at the University of the Western Cape, says that tadpoles can readily be identified, and, since they are naturally present in almost all drainages, can provide a low-cost alternative to chemical analyses for routine surveys and water quality monitoring.

Ecotoxicological studies are becoming increasingly important internationally as more and more chemical compounds are being released on to the market. Not only is it impossible to analyse for all compounds, but some react synergistically with others, causing them to have a greater influence than might be suggested by the concentrations of the individual compounds. Therefore, the use of living organisms to test for water quality is both cheaper and more satis-

factory than chemical analysis, as organisms are able to detect (very) low levels of toxicity in water, says Dr Steve Mitchell, research manager at the WRC.

Tadpoles are known to be sensitive to toxins in the environment, and once the tolerances of individual species are known, the composition of the tadpole community of a water body will indicate the quality of the water in which they are living, and also the fitness of the water for use as a drinking and household source.

AIMS

The specific aims of this project were to:

- Determine the diversity of tadpoles in the major catchments in South Africa
- Provide a user-friendly method for the identification of tadpoles
- Place tadpole collections in a major museum, from which working reference collections can be drawn
- Determine sensitivities of certain tadpoles to pollutants like heavy metals and agricultural chemicals.

Such information and knowledge will enable trained field staff to rapidly assess the quality of water in a stream, and its safety for human consumption.

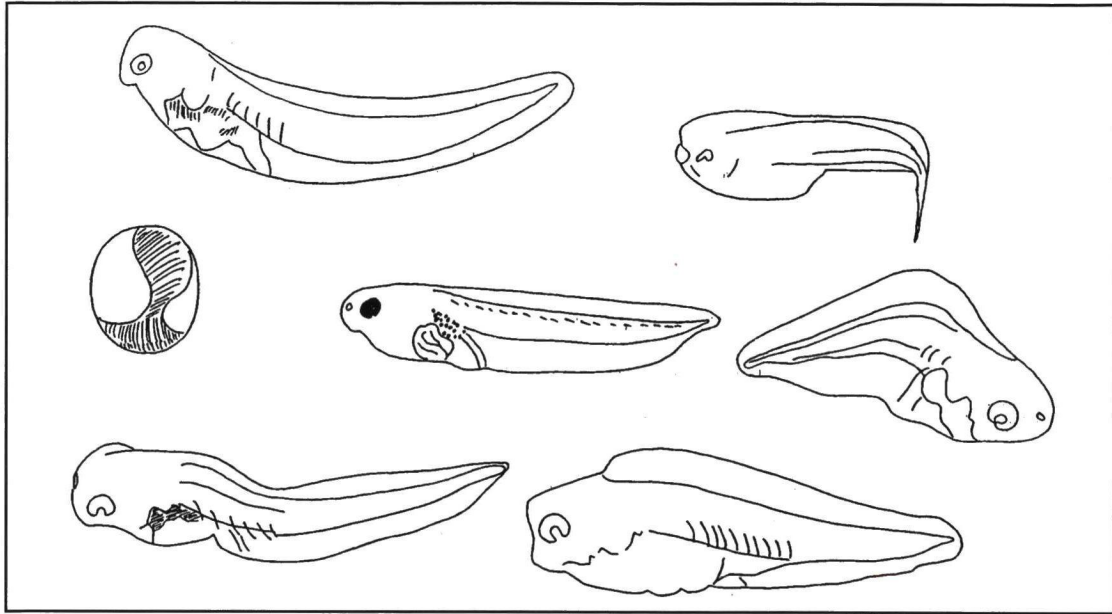
Tadpoles as Bio-indicators of Stream Quality: A Baseline Study

A Channing

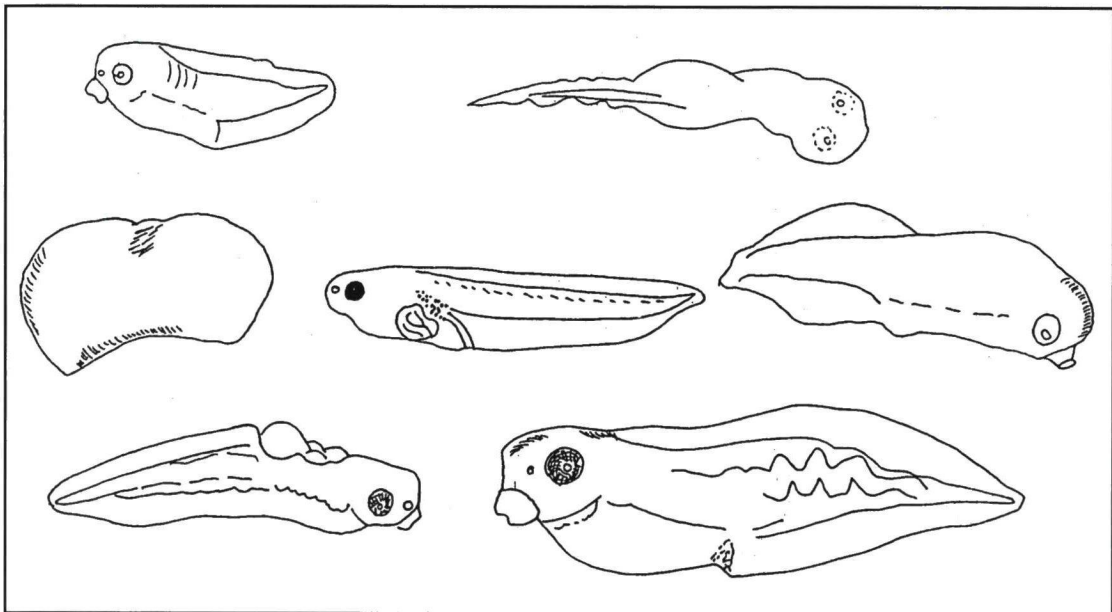
Report to the Water Research Commission
by the
Department of Biochemistry
University of the Western Cape

WRC Report No 718/1/98





Some abnormalities associated with in **Dichlorovos**. Sketches are not to scale. A control tadpole is in the centre. Typical malformations include bent tails, edema, partial eye development and head shape.



Illustrations of some developmental abnormalities associate with **Mancozeb**. The sketches are not to scale. A control tadpole is in the centre. Typical malformations include edema, lack of tail development, corrugated tail, and a gap in the vertebral column.

RESULTS

The results as presented in the report may be divided into two sections. The first section covers a literature review, the classification of tadpoles, their distribution and seasonality. The distribution maps, descriptions and an identification key for 36 species of tadpoles are clearly presented and easy to follow.

The second section deals with a number

of locally used insecticides, fungicides and a herbicide, describing their use, known ecotoxicology and environmental fate, as well as the malformation effect of each on the development of *Xenopus* (platanna) tadpoles using the FETAX (Frog Embryo Teratogenesis Assay - *Xenopus*) test. The sensitivities of tadpoles to the test chemicals obtained in the second part are revealing, when considering the quantities of these chemicals marketed in the country.

Copies of the report, **Tadpoles as Bio-indicators of Stream Quality: A Baseline Study** (WRC Report 718/1/98) are available, free of charge, from The Librarian, Water Research Commission, PO Box 824, Pretoria 0001. E-mail: library@wrc.org.za (Please remember to supply your postal address !) Foreign orders: US \$20 per copy, via surface mail.

Researchers have recently had excellent results with biological control of red water fern following the release of a tiny weevil to eradicate this invasive alien water plant. The weevil *Stenopelmus rufinasus* was first released on a mat of red water fern at the Austin Roberts Bird Sanctuary in Pretoria, only after thorough research and careful scrutiny, and the approval of the authorities. Within a short period of time the tiny weevil effectively cleared the pond at the sanctuary of the red water fern covering it. The weevil has since been released on heavily infested water bodies around the country with great success.

Dr Martin Hill, researcher at the Plant Protection Research Institute of the Agricultural Research Council (ARC), said to *SA Waterbulletin* that to date these little insects have been released at some 40 sites around the country and that "there has been a significant reduction in the mats of red water fern covering the water surface, within a few months". At



BEFORE... Researchers releasing weevils on a mat of Red Water Fern at the Austin Roberts Bird Sanctuary.

some of these sites mats of red water fern were up to 30 cm thick.

The release of the frond-feeding weevil was the outcome of a research project funded by the Water Research Commission and undertaken by the Plant Protection Research Institute of

ARC. The project report by Dr Hill, entitled **the Potential for Biological Control of the Floating Aquatic Fern *Azolla filiculoides* Lamarck (Red Water Fern/Rooivaring) in South Africa**, documents the research done preceding the eventual release of *Stenopelmus rufinasus*.



Close-up indicating the actual size of Red Water Fern, and some of the *Stenopelmus rufinasus* weevils before release.

AIM

The objectives of the research project were to identify the natural enemies of *Azolla filiculoides* in its region of origin, and to import and screen them as possible biological control agents of the weed in South Africa.

The Red Water Fern (*Azolla filiculoides*) is indigenous to South America, but is now distributed world wide where suitable conditions occur. First recorded in South Africa in 1940, it is now a widespread weed and problem in South Africa because of a lack of natural enemies. The presence of enriched waters have also contributed to its establishment throughout the country, with dense infestations causing severe degradation of aquatic ecosystems.

PROBLEMS

The increasing abundance of *A. filiculoides* over the last ten years in conservation, agricultural, recreational

and suburban areas is cause for great concern, says Dr Hill. Among the major problems caused by the dense mats of the weed (5-20 cm thick) on still and slow moving water bodies in South Africa are:

- reduction in the quality of drinking water caused by bad odours, colour and turbidity;
- promotion of the development of waterborne, water based and water related diseases;
- increased siltation of rivers and dams;
- loss of water by evapotranspiration through the weed surface;
- reduction of useful water surface area for recreation (fishing, swimming and water skiing) and water transport;
- deterioration of the aqua biodiversity

(e.g. the near extinction of the eastern Cape Rocky fish (*Sandilia bansii*) due to a dense mat of *A. filiculoides* covering one of its last habitats;

- clogging of irrigation pumps;
- drowning of livestock;
- reduction in the water flow in canals used for irrigation.

BIOLOGICAL CONTROL

According to the report the biology of *A. filiculoides* precludes it from being controlled manually or mechanically, while chemical control in the aquatic environment is undesirable and should be avoided where possible. Therefore biological control is the only sustainable control method for this weed

RESULTS

The frond-feeding weevil, *Stenopelmus rufinasus* was imported into quarantine

for testing as a potential natural enemy for *A. filiculoides*. Favourable biological characteristics of *S. rufinasus* include a high rate of increase, long-lived adults, a high per capita feeding rate and the capability of several generations per year. Host specificity of this insect was determined by adult starvation and oviposition tests on 26 plant species in 15 families. Feeding, oviposition and larval development was only recorded on the *Azolla* species tested (*A. filiculoides*, *A. pinnata* (collected in Kwazulu-Natal) *A. pinnata* (collected in Namibia) and *A. nilotica*). *A. filiculoides* proved to be significantly the most suitable host for the weevil. The low percentage larval survival on *A. nilotica* and *A. pinnata* (Namibia) would prevent the weevil from establishing on them in the field. Although, the percentage larval survival on *A. pinnata* (Natal), despite being half of that on *A. filiculoides* was cause for concern. *A. pinnata* (Natal) has a weedy phenology

The Potential for the Biological Control of the Floating Aquatic Fern *Azolla filiculoides* Lamarck (Red Water Fern/Rooivaring) in South Africa

MP Hill

Report to the Water Research Commission
by the
Plant Protection Research Institute
Agricultural Research Council

WRC Report No KV 100/97



in South Africa and is thus of low conservation status and therefore, in the unlikely event that some damage is

inflicted on this plant in the field, it may be considered as a fair trade-off for the predicted impact of *S. rufinasus* on an aggressive exotic weed.

Dr Steve Mitchell, research manager at the Water Research Commission pointed out that the weevil *S. rufinasus* will not drive *A. filiculoides*, or *A. pinnata*, to extinction. However, it will control the excessive proliferation of *A. filiculoides* and limit the abovementioned problems caused by this invasive alien water plant.

The report **The Potential for the Biological Control of the Floating Aquatic Fern *Azolla filiculoides* Lamarck (Red Water Fern/Rooivaring) in South Africa** (WRC Report KV 100/97) is available, free of charge, from the Water Research Commission, PO Box 824, Pretoria 0001 (E-mail: library@wrc.org.za) Foreign orders: US \$20 per copy, via surface mail.



AFTER... The surface of the pond at Austin Roberts Bird Sanctuary, cleared from the Red Water Fern infestation by the weevil (*Stenopelmus rufinasus*).



Direction and Planning

Aquatic ecosystems research

The new Water Act (36 of 1998) now emphasizes the aquatic ecosystem as an integral part of the water resources in South Africa. This shift in focus regarding the management of water resources has accordingly brought about a shift in the research priorities in this field. Currently there are several initiatives underway, which are supported by the Water Research Commission (WRC), and aimed at identifying the medium to longer term research needs in the field of Aquatic Ecosystems Research. Where the research is aimed specifically at addressing management needs, the WRC is working closely with the end-users of the research.

□ Research Thrust for Managing Rivers

The Research Thrust for Managing Rivers (RTMR) has grown out of the working conference held in Pietermaritzburg last year to define a National Rivers Initiative. The current phase of development involves two steps. First a number of government departments and science councils have been approached. Each person approached was requested to submit a brief description of (max.) three priority research needs concerning rivers within the field of their activities. Next these will be collated for wide circulation and comment. We plan to have this document finalised by early April. If you wish to receive a copy, either to comment on or in its final form, please request it from Dr Steve Mitchell at the Water Research Commission by letter, fax or e-mail.

□ Research Programmes

The Water Research Commission (WRC) has taken the decision to adopt a programme approach for part of its research funding activities. Each of these research programmes will be very specifically focussed on needs. This means that each research programme can be thoroughly planned before implementation, and that each person involved in a research programme will know what part they are to play in the final development of the product before the programme starts. Research programmes will therefore be strongly demand driven.

Programmes offer an effective means of building capacity in the research field being addressed, and the WRC has made the strategic decision that each programme will have a capacity building component.

The WRC will however retain a substan-

tial portion of the funding committed to any research field for funding ad hoc projects, as this is the most common source of innovation. The long term survival of South Africa, with its projected water shortage and population increase, depends on the development of innovative technologies for water management.

□ Ecological Reserve: Identify research needs

The Department of Water Affairs and Forestry has committed a lot of resources to implementing the Water Act, and an aspect of specific interest to limnologists is the determination of the ecological reserve. The Water Research Commission is in the process of developing a research programme to address certain of the research needs arising from this initiative. The first step in this process was to hold a workshop to identify the research needs around the implementation of the environmental reserve, and the programme will be developed from the outcome of this workshop.

□ Estuaries: Identify research needs

A workshop is planned to identify the research needs of estuaries.

The outcome of the abovementioned workshops, together with that of the RTMR will guide the future research direction of aquatic ecosystems research.

For more information please contact:

□ Dr SA Mitchell
Water Research Commission
Tel: (012) 330-0340
Fax: (012) 331-2565
steve@wrc.org.za

The dynamics studied of why people won't pay for basic water supply projects

A current major initiative by the government is the provision of a basic water supply service to ensure that everyone in South Africa has access to 25 litres of safe water per day within 200 metres of their home. Millions of rands have already been committed to this water initiative which involves national, provincial and local levels of government as well as parastatals, non-governmental organisations and private firms. A key principle of the initiative is that services should be provided and paid for in a manner which does not require ongoing government funds to keep them running.

As time went by one of the more serious problems experienced with the delivery of services was the failure of many rural community water supply schemes. The failure normally manifested in communities withholding payment which had been negotiated when the projects were initiated.

To study the reasons for this non-compliance from the perspective of community members, the Water Research Commission, contracted Lynette Dreyer & Associates, a team of sociologists.

The researchers analysed rural community water supply projects implemented by the Mvula Trust NGO in the three poorest provinces in South Africa - Northern Province, Eastern Cape and Kwazulu-Natal.

REPORT

According to the final report released by the Water Research Commission, the research team, comprising the project leader and a guide familiar with the language and customs of each province, visited the villages in which the projects were situated unannounced. Interviews were conducted with ordinary villagers,

village leaders and water committees on water matters, including the project.

The researchers found that the collapse of water projects happened for various reasons - both direct and indirect. However, the study pointed to problems with the conceptualisation of the national water rural community supply initiative. The water supply programme was designed to provide each household with clean water within 200 metres of their dwelling. This was intended to meet the basic water needs of the villagers and for which they were to pay operations and maintenance costs. In the projects studied, agreements were negotiated with elected community representatives (who comprised a water committee) while community members were trained to manage the project as well as the ultimate water scheme. The research found that many communities already had their basic needs for water met and wanted a higher level of service than the national water supply programme envisaged. The projects that were successful were located in villages with a dire need for water and who benefited appreciably from the project. When the communities who felt that their basic need for water was already satisfied (even if it was not clean water), found that their expectations for a higher level of service (which they interpreted as a tap in their own yard) would not be met, they withdrew their payments.

Another problem regarding the conceptualisation of the water delivery programme, is the assumption that community cohesiveness is a valid basis for the election of a water committee with whom outsiders can negotiate and conclude agreements. The research casts doubt on this assumption. In the cases where there did appear to be significant community cohesion, the cohesion itself was sometimes the last straw leading to

the collapse of the project. In these cases, the community preferred to abandon the project rather than risk internal conflict over water matters.

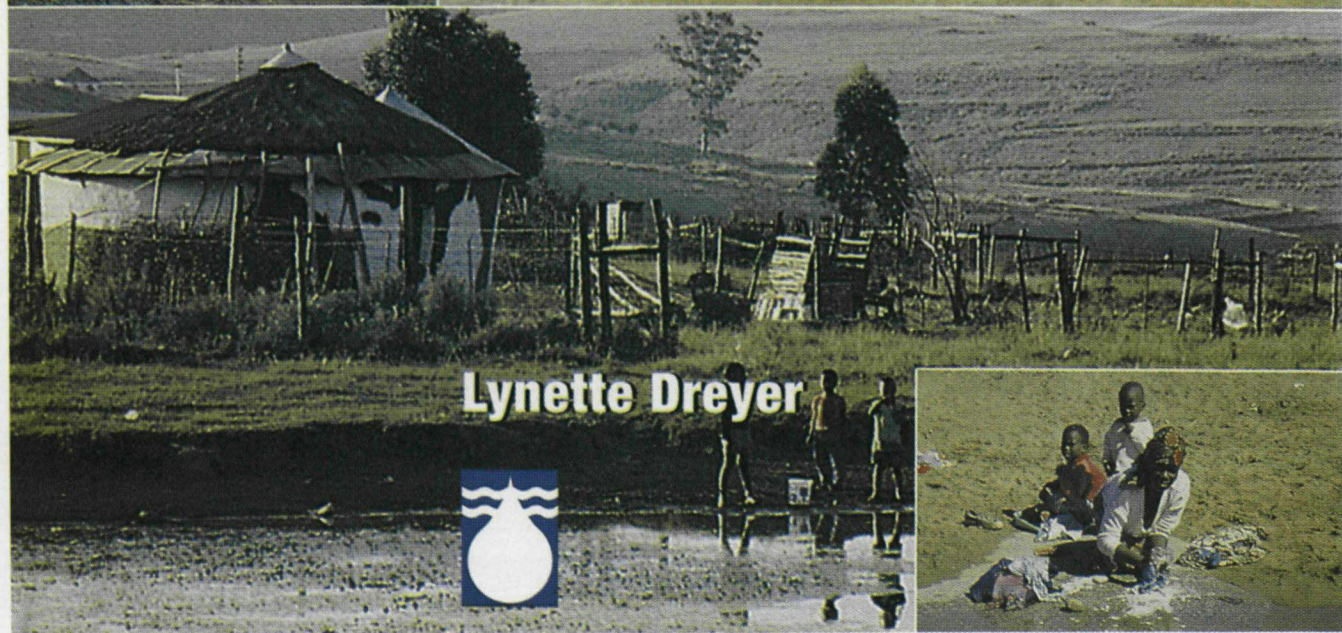
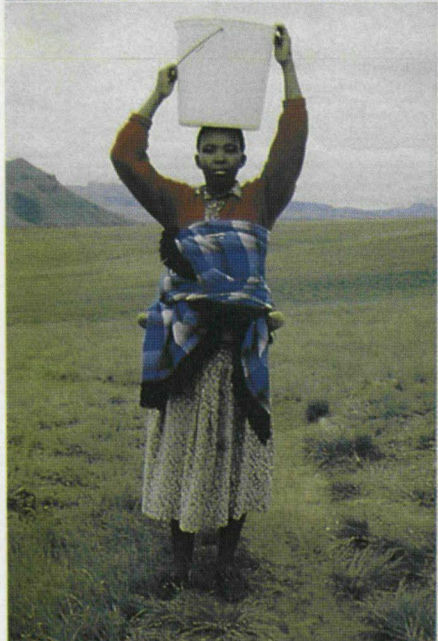
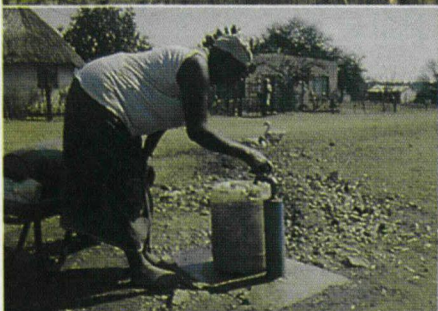
The report says within the projects themselves there were a number of reasons for project failure. These included: weak community leadership, lack of communication between the water committee and the community, lack of project management expertise, impatient and ill-advised engineering consultants, unequal benefits from the water scheme to community members, no means of forcing community members to pay, multi-village schemes which are too difficult for water committees to manage, a low level of service, unwillingness to give money to fellow villagers and the role played by various organisations.

Affordability, although used as an excuse, did not appear to be the real reason for community non-compliance with projects.

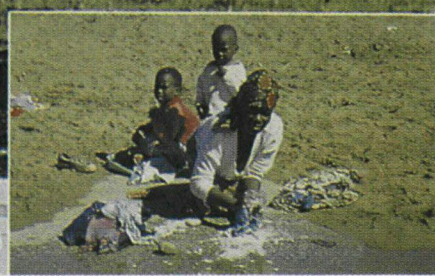
The report recommends that the national water initiative be adjusted to provide for a higher level of service where communities feel their basic need for water has already been met. This would entail taps in each yard where the water source can support this. Users should pay towards the higher level of service as well as the operations and maintenance costs, preferably by prepayments.

Copies of the report entitled **The dynamics of community non-compliance with basic water supply projects** (WRC report TT 93/98) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 20, via surface mail).

The Dynamics of Community Non-Compliance with Basic Water Supply Projects



Lynette Dreyer



First Announcement and Call for Papers

NINTH SOUTH AFRICAN NATIONAL HYDROLOGY SYMPOSIUM



Hydrology and Water Resources in Southern Africa

29 - 30 November 1999

University of the Western Cape, Cape Town

*Organised for SANCIAHS and SAICE Water Division
by Department of Civil Engineering, University of Stellenbosch
and Department of Earth Sciences, University of the Western Cape.*

OBJECTIVES

To support integrated water resource management (IWRM) in the region by providing a forum for hydrologists, aquatic scientists, water resources engineers and catchment managers from Southern Africa for:

- reporting of findings from both fundamental and applied studies related to IWRM and catchment management;
- sharing of general research results or of work-in-progress in the hydrological and aquatic sciences;
- promotion of understanding of technical and scientific issues surrounding implementation of the new National Water Act of South Africa (Act 36 of 1998).

SYMPOSIUM FORMAT

The Symposium will extend over 2 days and consist of oral presentations during plenary sessions each morning and during parallel sessions each afternoon. Parallel sessions will deal with defined topics, where possible. Adequate time will be allowed in all sessions for discussion. The emphasis will be on feedback to the presenters. A key-note address related to the Symposium objectives will initiate each day's plenary session. Poster presentations are encouraged

and special arrangements for viewing and discussions surrounding posters will be included in the programme.

CALL FOR PAPERS

Oral or poster presentations are invited on topics relevant to the objectives of the Symposium. Prospective authors should note the following:

- An abstract of about 500 words must be submitted before 17 May 1999, which should outline the scope and contents of the paper and summarises the major results and conclusions.
- Papers will be selected for oral or poster presentation by the symposium editorial panel and authors will be advised of acceptance by 1 July 1999.
- Final papers must be submitted in electronic format in MS Word 97 by 15 September 1999.

It is the intention of the organisers to provide each delegate with a bound paper copy of the proceedings and to lodge the proceedings on a Web page.

EXHIBITING and ADVERTISING

Organisations wishing to exhibit books, software or equipment, or to advertise,

should indicate their interest on the registration form included in the SA Waterbulletin

FEES AND ACCOMMODATION

Further details will be mailed during July 1999 to those responding to this first announcement. The registration fee is expected to be approximately R750 (R400 for full-time students), excluding accommodation, which will be available at the University, or in local guest houses or hotels. Accommodation in a University Residence is expected to cost about R100 per day, including breakfast.

REGISTRATION and ENQUIRIES

Included in this issue of the SA Waterbulletin please find the symposium registration form as a separate loose insert. For further enquiries please contact :

- Dr André Görgens
Tel: (021) 808-4356

or

- Julie Haarhoff
Tel: (021) 808-2100
Fax: (021) 808-4351
E-mail: jhaarhof@ing.sun.ac.za

Improved electronic project proposal system now available

Web address: <http://www.wrc.org.za>

Researchers wishing to submit proposals electronically to the WRC for the funding of research projects, can now use the improved project proposal system available on the Internet web site of the WRC. Input procedures have been refined and simplified following the feedback and comments received from researchers who have used the previous electronic proposal submission system. The number of screens required to enter the information has also been reduced, to create an easy-to-complete and user-friendly system.

It is suggested that researchers interested in using the proposal submission system, should consult the **Guidelines** (also available on the web site) **before** starting to enter data into the system. To reduce the time spent on the Internet, large blocks of text (e.g. for *Motivation* or *Capacity Building*) can be prepared in a word processing program and 'Copy and Paste' Windows functions used to transfer to the electronic proposal submission system.

Please note the following:

Language

Only submissions which have been prepared in English and according to the WRC guidelines, will be considered.

Proposal registration

The first step is to register your proposal by supplying a suitably indicative short title. The system will respond by automatically allocating a unique ID number. **Remember to make a note of this number - it will be needed to access the proposal for editing.**

Text formatting

The database supporting the WRC Proposal system does **not** allow for the use of word processor formatting (i.e. bold, italic, underlining, sub- and superscripts, indents, tabs, etc.) Please do not use these in any text entered into the system.

Punctuation

Refrain from using punctuation when entering financial amounts or dates, (e.g. commas or dashes for separating rands and cents). Amounts should be rounded off to the

nearest R100. All date entries should be of the type: dd/mm/yyyy.

Budgets

Note that budget entries for researcher salaries and the work programme (tasks list) will only become active once the names and organisations of researchers have been added and the work programme completed.

Navigation

Navigating through the various sections and pages of the proposal system is easy if you use the navigation bar at the top of each screen page.

Data entry

Remember to press the UPDATE button on each individual page after data entry or editing, so as to save your modifications to the system. Otherwise, the changes will be lost.

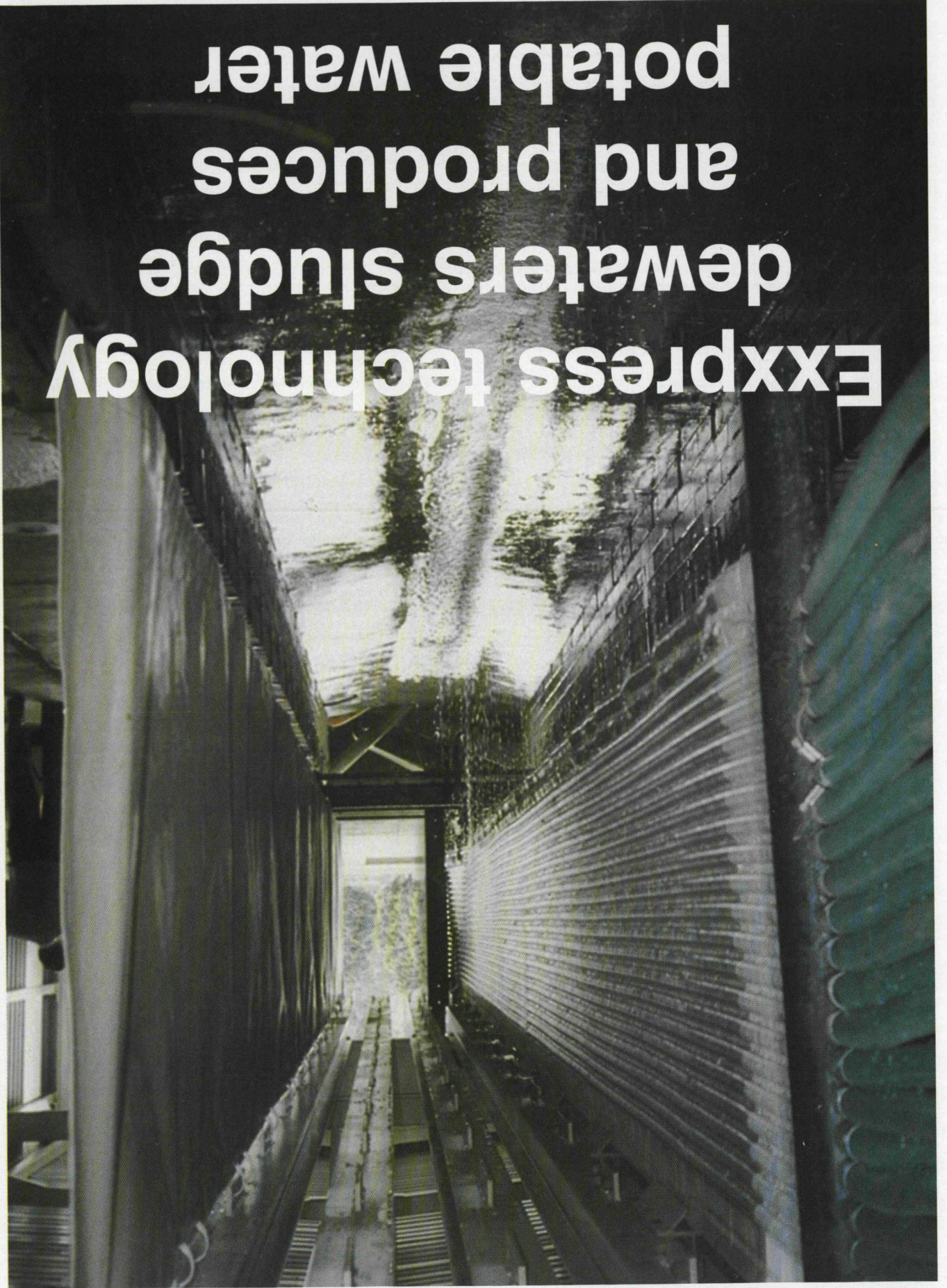
Help

When using HELP, click the BACK button of your Internet browser to return to the data entry pages.

Contact person:

Francette Myburgh
E-mail: fmyburgh@wrc.org.za

Express technology dewaterers sludge and produces potable water



P.O.T.A.B.L.E W.A.T.E.R

The Tubular Filter Press (TFP) Unit for the dewatering of sludges at the H.D. Hill waterworks in Pietermaritzburg has been in operation since 1987 and the technology, for which the Water Research Commission holds the patent, has been given the trade name Exxpress by the licencees, HTW Hi-Tech Water.

The Exxpress process, apart from its ability to dewater sludge, can also be used to provide potable water quality water from river water (without the addition of chemicals) at high fluxes and low energy consumption. To demonstrate this capability of the TFP unit and to rectify operational problems and weaknesses in the original design of the existing plant, a submission was made to the Water Research Commission for a project to pursue further experimental work at Umgeni Water's Process Evaluation Facility.

A report on the project, written by MJ Pryor and DJ Mullan from Umgeni Water and published by the Water Research Commission, says that to achieve the objectives and improve the design of the tubular filter press, a number of specific areas were identified that required attention. These included:

- Improving the design of the Tubular Filter Press to reduce the occurrence of cloth splits and tube blockages, and to address aspects of manifold layout to improve the flow distribution and cleaning.
- Developing a commercially operational unit for waterworks sludges and providing a detailed design of the new plant.
- Monitoring the capital and operating costs and comparing these to similar processes in industry.
- Assessing the performance of the new design by extended operation during the project.

- Assessing the use of the new design for potable water production.
- developing techniques for determining design parameters for the TFP by extending the proposed filtration model and incorporating this into a design procedure.

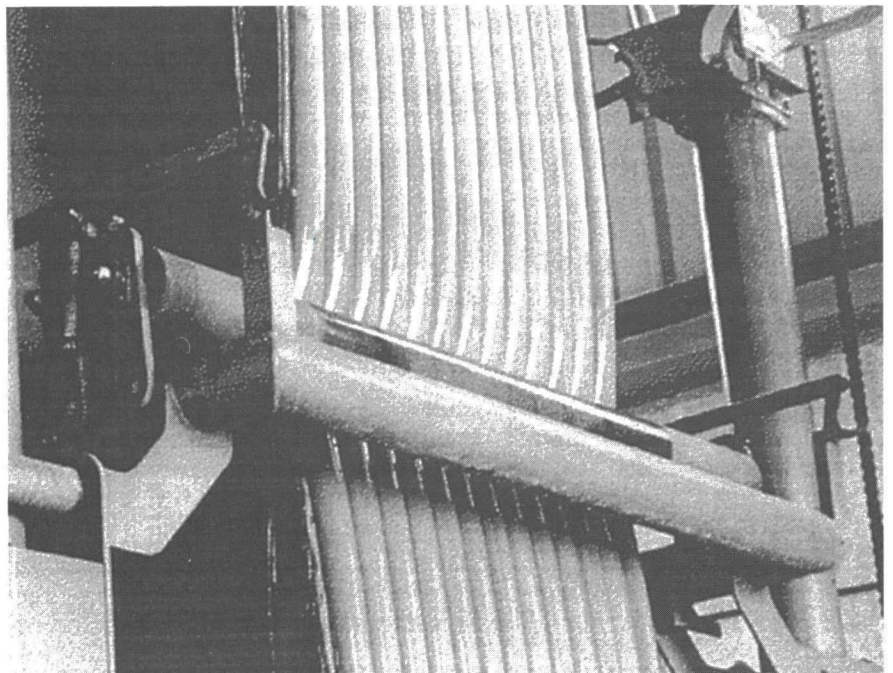
VERTICAL DESIGN

A designing sub-committee was convened to address specific aspects of the design, and it was proposed that a vertically mounted tube, shorter in length and of larger tube diameter be used. A single tube pilot plant was constructed at the Process Evaluation Facility to demonstrate the feasibility of the proposed configuration. Following successful small-scale vertical tube trials, detailed mechanical drawings were approved for the manufacture and assembly of a full-scale demonstration unit at Umgeni's Wiggins Waterworks.

Construction of the unit was completed during September 1995 and was successfully demonstrated to delegates attending the International Water Supply Association (IWSA) Conference in Durban. As the supply of curtain fabric material had to be negotiated with Gelvanor Textiles, the plant was initially operated using single tubes of another

material. This material eventually split and when replaced with curtains manufactured by Gelvanor Textiles, no further tube splitting was experienced. The operation of the Vertical Tubular Filter Press is detailed by the following stages.

- Filtration cycle - Feed sludge is pumped into the tubes under pressure. The formation of a filter cake occurs rapidly on the inside of the tubes, and the permeate is directed to a collection tank. The highly resistive nature of the filter cake causes a reduction in the filtration rate (flux) until an operating limit is reached.
- Tube discharge - Once a final permeate flux has been achieved the tube discharge is initiated. The discharge valve at the bottom of the tubes is opened and the tubes are emptied onto a conveyer belt. In this way, thin sludge is returned to the feed tank and filter cake is separated for waste disposal.
- Flush cycle - Sludge from the feed tank is then pumped at a high flowrate through the tubes and any remaining cake is washed onto the conveyer belt. The efficiency of this is dependent on the thickness and nature of the cake. This may not totally clean the inside of the tubes



The vertical tubular filter press.

which would result in a continual build-up of residue causing a decrease in the performance of the unit with time.

- Roller action - A double roller is provided which squeezes the double row of tubes together, creating a restriction through which the flushing fluid is pumped. The increase in velocity through the restriction ensures a reliable and consistent cleaning of the tubes. It has been found that under certain operating conditions the rollers may not be necessary. Once complete the operating cycle is repeated.

RESULTS

The performance of the filter has been reasonable producing cake concentrations between 20 and 30 percent solids (m/m), at cake recoveries of up to 75%. Although a trend of increasing cake solids with increasing pressure and increasing feed concentration was observed, the nature of the sludge from Wiggins was variable over this period. The suspended solids in the raw water, the amount of bentonite, lime, hypochloride and coagulant addition all have an effect on the nature of the sludge which will impact on the performance of the unit for sludge dewatering.

The cake recovery during cleaning was found to be dependent on the filtration time (or the final filtration rate before cleaning) as a sludge which has been allowed to equilibrate will be more resistant to the vigorous effects of flushing. A softer cake will reslurry more easily and will pass through the conveyor belt thereby lowering the cake recovery, or more significantly will remain on the inside of the filter tubes resulting in a significantly shorter filtration time and poor performance. The production rate was found to be dependent on filtration pressure, feed solids concentration and final flux allowed before flushing.

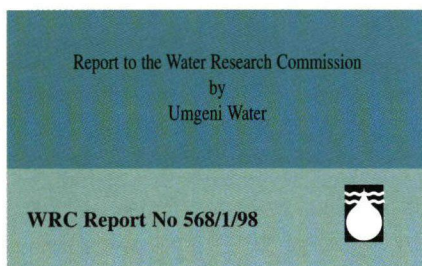
The plant operation was found to be highly dependent on the sludge characteristics, not only with regard to the filtration cycle (cake formation) but also the flush cycle (cake removal). Cake recovery is a complex function of operating pressure, final flux and feed solids concentration. In order to optimally operate a tubular filter not only should the filtration characteristics be determined, but also the recover "characteristic function". It was found

that under certain operating conditions, flushing without the use of a roller may be sufficient to effectively remove the cake from the tubes. This may not always be the case as the sludge characteristics were found to vary considerably during the operation of the plant.



The Development of an Exxpress Unit for the Dewatering of Waterworks Sludges and the Production of Potable Water

MP Pryor • DJ Mullan



Tube blockages (previously experienced at H.D. Hill) were completely eliminated by increasing the tube diameter to 60 mm and decreasing the tube length. The increased tube diameter did not result in any occurrences of tube splitting or failure using the fabric produced by Gelvanor. Cake release and conveyance out of the tubes improved as the vertical orientation of the tubes assisted this by collapsing during the flush cycle.

The addition of lime to a waterworks sludge was found to improve the filterability of the sludge by altering the sludge characteristics. This was determined by C-P cell tests, and evident during the continuous operation of the Vertical TFP. The addition of lime can have a negative impact on the plant operation as the pH of the sludge and permeate increases significantly, and fouling of the woven tube fabric may occur due to the precipitation of calcium carbonate. Wall friction in the C-P cell tests was investigated to determine if this was significant for waterworks sludges, and whether the standard C-P cell test was accurate in determining sludge characteristics. Although wall friction was observed, the difference in the sludge characteristics obtained did not

appear to be significant. This can only be fully ascertained once these parameters are incorporated into the model and the model prediction is compared to an operating system.

A new generalised "Area Contact" model has been proposed for the constant pressure compressible cake filtration. Solution methodologies have been developed to regress for cake characteristics from operating plant data and to account for the period of pressurisation at the start of the filtration cycle. Once the software has been totally developed the accuracy of the "area contact model" can be determined.

The vertical tubular filter press (single tube pilot plant) was operated in dead end filtration mode to assess the use of the new design in raw water filtration for the production of potable water. It was shown that a precoat of limestone is required to reduce the turbidity of the raw water to below 1 NTU, but the efficiency of precoating in dead end mode (in a vertical tube) was poor. This process was clearly not adequate when compared to the Crossflow Microfiltration process for potable water production.

In meeting the objectives of the project a Vertical Tubular Filter Press was designed and developed for the dewatering of waterworks sludges. The limitations of the previous design, especially the tube blockages were totally eliminated and provided the process can operate without the use of rollers for sludge removal and tube cleaning a reliable and inexpensive process has been developed.

The use of the new vertical configuration operating in "dead end" is not recommended for potable water production as the effectiveness of pre-coating using limestone is poor, and the turbidity of the final water occasionally exceeds the guidelines for potable water (< 1 NTU).

Copies of the report, summarising the research results, entitled **The development of an Exxpress unit for the dewatering of waterworks sludges and the production of potable water** (WRC report 568/1/98) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$ 25, via surface mail).

Guidelines published for the treatment of Cape coloured waters

In the southern coastal zones of South Africa, organically coloured surface waters, defined as any natural water containing organic matter which gives rise to a yellow to brown colour, are used as the main source for the supply of drinking water.

Colour, as is the case with taste, odour and turbidity, forms a primary quality parameter when water is supplied from any raw water source for human consumption. People consider clear and colourless water as the minimum requirement when the water is to be used for drinking purposes. This is the case regardless of whether the colour or turbidity has any health implications or not. Organic colour in water is therefore aesthetically unacceptable to the consumer.

In South Africa the treatment of coloured surface waters for potable use is to a large extent still done empirically, and it seems that there is a lack of knowledge at water treatment plants about the character and properties of the water.

This lack of information has given rise to many problems such as poor colour removal resulting from the underdosing of coagulants when the quality of the raw water changes, wasting of chemicals because of overdosing of chemicals and lime by inexperienced operating personnel, high aluminium residuals in the final water to the consumer as a result of poor pH control when dosing aluminium sulphate, discolouration of water caused by iron and manganese precipitates, the formation of undesirable disinfection by-products when these waters are chlorinated, the production of large volumes of sludge with poor dewatering characteristics and ineffective stabilisation of the final water leading to corrosive and aggressive attack on the water supply networks. These problems necessitated a scientific investigation from which practical solutions, in the form of guidelines for design engineers and operating personnel, could be made available. A project,

funded by the Water Research Commission, was consequently carried out by two researchers: CD Swartz, a private engineer, and HA de Villiers from the Division of Water, Environment and Forest Technology at the CSIR in Pretoria. The project consisted of investigations of full-scale water treatment plants in the southern and western Cape, discussions with consultants and water suppliers, characterisation of raw waters and bench-scale tests performed on selected raw waters found in the study area.

identify the problems that are experienced with the treatment of coloured waters in the Cape, and to propose practical measures, in the form of design and operational guidelines, to solve these problems. Chapter 5 lists the problems associated with the treatment of coloured waters, identified during the survey of treatment plants in the Cape and during discussions with water suppliers and consultants.

In chapter 6 an overview is given of the treatment processes that can be used to treat coloured water. The conventional treatment processes of coagulation followed by settling, filtration, disinfection and stabilisation are discussed in some detail, while an overview and the results of local research are presented for the technologies such as membrane processes, chemical oxidation (in particular ozonation and combinations thereof) and dissolved air flotation that are currently finding application in the treatment of coloured water.

Chapter 7 discusses the need for and importance of well-designed operational and monitoring programmes for small and larger plants. Chapter 8 lists upgrading considerations for existing colour removal plants. The issues concerning the treatment and disposal of sludge derived from colour removal treatment plants are discussed in chapter 9.

In the last chapter (chapter 10) the guidelines for treatment of coloured waters are presented. This includes criteria for the selection of suitable treatment processes, a summary of process configurations and specific guidelines for the different unit treatment processes used in colour removal treatment plants.

Copies of the report entitled **Guidelines for the treatment of Cape coloured waters** (WRC Report 534/1/98) can be ordered free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: US\$30, via surface mail).

Guidelines for the Treatment of Cape Coloured Waters

CD Swartz • HA de Villiers

Report to the Water Research Commission
by the
Division of Water Environment and Forestry
Technology
CSIR

WRC Report No 534/1/98



GUIDELINES

A report which summarises the research results and which also provides guidelines for addressing the problems experienced with the treatment of coloured waters is available from the Water Research Commission.

The report begins with an overview of the nature, origin and occurrence of colour in surface waters (chapter 2) and why it is necessary to treat these waters if it is to be used for drinking purposes (chapter 3). Chapter 4 describes the work that was done under the project to

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.

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

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

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

Gids:

- Een SA Watergeleentheid vir hierdie dae.
- 'n Tweede SA Watergeleentheid vir dié datums.
- 'n Derde SA Watergeleentheid vir dié datums.

Sien Konferensies- en Simposiumbladsy vir aangeduide geleenthede.

1999

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SOUTHERN
AFRICA

1999

COASTAL ENGINEERING

APRIL 19 - 23

The 5th international conference on coastal and port engineering in developing countries with the theme "Sustainability in Coastal and Port Engineering" will be held in Cape Town.

Enquiries: COPEDEC 99, PO Box 452, Stellenbosch 7599. E-mail: deidre@iafrica.com. Tel: (021) 886-4496. Fax: (021) 883-8177.

NEW WATER ACT

MAY 24 - 28

A short course dealing with the new water act and water quality management will be held at the Department of Chemical Engineering (Division Water Utilisation), University of Pretoria. Course fee: R3 500 (VAT exclusive). The fee includes course notes, refreshments and lunches, but excludes accommodation.

Enquiries: Ms E Otto Tel: (012) 420-3566. Fax: (012) 362-5089.

WATER AFRICA

MAY 30 - June 2

The Water Africa exhibition and conference will be held in Cairo, Egypt. The conference theme will be "Reconciling policy and practice: water and wastewater after 2000".

Enquiries: Tracey Nolan, Water Africa, 37 Upper Duke St, Liverpool L19DY. Tel: +44 (0)151 709 9192. Fax: +44 (0)151 709 7801/3262. E-mail: africon@robert.demon.co.uk Web site: <http://ace.merseyworld.com>

WATER WISE

JUNE 1999

Call for papers. See advertisement in this Bulletin.

WATER BILL

JUNE 7 - 9

A short course entitled "The National Water Bill survival kit" will be held at the University of Potchefstroom.

Enquiries: Mrs Dydré Greeff, Section for Training Co-ordination, PU for CHE. Tel: (018) 299-2714 or 299-2715. Fax: (018) 299-2726. E-mail: aokdg@puknet.puk.ac.za

SASAQS

27 JUNE - 1 JULY

The 35th conference of the Southern African Society of Aquatic Scientists (SASAQS) with the theme "Research, conservation and management of aquatic resources in Southern Africa" will be held in Swakopmund in Namibia.

Enquiries: Shirley Bethune or Kevin Roberts, Department of Water Affairs, Private Bag 13193, Windhoek, Namibia. Tel: 00264 61 296 +3025 or +3240. Fax: 264 61 208 7160 or 264 61 232861 E-mail: bethunes@mawrd.gov.na OR robertsk@mawrd.gov.na

AIEPS '99

JULY 4 - 8

The African international environmental protection symposium incorporating the fourth Southern African anaerobic digestion symposium will be held at the Imperial Hotel in Pietermaritzburg.

Enquiries: Dr Richard A Daneel, Soil and Pollution Research Services CC, Suite 101, Postnet X6, Cascades 3202. Tel: (0331) 962-696. Fax: (0331) 962-696. E-mail: soil&pol@sprs.co.za

WATER PURIFICATION

AUGUST 2 - 6

A short course on the operation of small-scale water purification and sewage plants will be held at the Department of Chemical Engineering (Division Water Utilisation), University of Pretoria. Course fee: R3 500 (VAT exclusive). The fee includes course notes, refreshments and lunches, but excludes accommodation.

Enquiries: Ms E Otto Tel: (012) 420-3566. Fax: (012) 362-5089.

RIVER MANAGEMENT

AUGUST 10 - 11

A conference on integrated management of river ecosystems: an international experience will be held in the Kruger National Park at Skukuza.

Enquiries: Dr Mark Dent, Computing Centre for Water Research, University of Natal, Pietermaritzburg, Private Bag X01, Scottsville 3209. Tel: 0331-260-5177. Fax: 0331-260-6288. E-mail: dent@aqua.cwvr.ac.za

WATER QUALITY

AUGUST 16 - 20

A short course on water quality management will be held at the University of Potchefstroom.

Enquiries: Mrs Dydré Greeff, Section for Training Co-ordination, PU for CHE. Tel: (018) 299-2714 or 299-2715. Fax: (018) 299-2726. E-mail: aokdg@puknet.puk.ac.za

AFRIWATER '99

AUGUST 18 - 20

The South African water, waste and environmental exhibition will be held at the Gallagher Estate in Midrand, Gauteng. Rates: R675/m²; Services package: R155/m² (consisting of a shell scheme, carpets, fascia board with company name -not logo, 1 x 15 amp power point (shared power), 2 x spotlights, stand cleaning and editorial in the official visitor guide.

Enquiries: Avé Delpont, TML Reed Exhibitions, PO Box 182, Pinegowrie 2123. Tel: (011) 886-3734. Fax: (011) 781-1270. E-mail: sue.philipson@tmltrade.co.za.

IRRIGATION

AUGUST 24 - 26

The SABI national congress with the theme - Irrigation in the next millennium - will be held in Bloemfontein.

Enquiries: Ms Riana Lombard. Tel: 021-854-8817.

DROUGHT MANAGEMENT

SEPTEMBER 20 - 22

An interdisciplinary international conference on integrated drought management - "Lessons for Sub-Saharan Africa" will be held at the CSIR Conference Centre in Pretoria. Call for papers.

Enquiries: Conference Planners, PO Box 82, Irene 0062. Tel: 667-3681. Fax: 667-3680. E-mail: confplan@iafrica.com

SLUDGE HANDLING

SEPTEMBER 20 - 24

A short course on biological and chemical sludge handling and disposal will be held at the Department of Chemical Engineering (Division Water Utilisation), University of Pretoria. Course fee: R3 500 (VAT exclusive). The fee includes course notes, refreshments and lunches, but excludes accommodation.

Enquiries: Ms E Otto Tel: (012) 420-3566. Fax: (012) 362-5089.

MEMBRANE TECHNOLOGY

SEPTEMBER 26 - 29

The 3rd WISA membrane technology division workshop with the theme - Membrane develop-

ments in waste minimisation, water treatment and the process industry - will be held at the Drakensville Resort. For further details see advertisement in this Bulletin.

CORROSION

SEPTEMBER 26 - OCTOBER 1

The 14th international corrosion congress with the theme "Cooperation in Corrosion Control" will take place in Cape Town. A trade exhibition will also be held for the duration of the congress. Enquiries: The Secretary, The Corrosion Institute of Southern Africa, PO Box 966, Kelvin 2054. Tel: (011)8025145. Fax: (011) 8043484. E-mail: norust@future-jhb.co.za

2000

WATER SUPPLY & SANITATION

FEBRUARY 21 - 25

The 10th UADE/UAWS congress with the theme "Partnerships and sustainable development in the water supply and sanitation sector" will be held in Durban.

Enquiries: UAWS Administrative Secretary, 01 BP 1843 Abidjan, Cote d'Ivoire. Tel: +225 241443. Fax: +225 242629. E-mail: uadewup@africaonline.co.ci

WISA

MAY 28 - JUNE 1

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

IRRIGATION

OCTOBER 22 - 27

The 6th international micro-irrigation congress together with the 51st IEC meeting of the International Commission on Irrigation and Drainage (ICID) will be held in Cape Town. Call for papers.

Enquiries: The Congress Secretariat, PO Box 36815, Menlo Park 0102. Tel: (012) 344 0390. Fax: (012) 344 5643. E-mail: reservations@parkgables.co.za.

HYDROGEOLOGY

NOVEMBER 26 - DECEMBER 1

The International Association of Hydrogeologists' (IAH) XXX Congress 2000 with the theme Groundwater: Past achievements and Future challenges will be held at the University of Cape

Town. **Call for papers:** send a 200 word abstract in English before 30 July 1999 to the IAH 2000 Conference Secretariat. Enquiries: Conference Secretariat, IAH 2000, Conferences et al, PO Box 452, Stellenbosch 7599. Tel: (021) 886-4496. Fax: (021) 883-8177. E-mail: deidre@iafrica.com.

OVERSEAS

1999

SITE REMEDIATION

MARCH 21 - 25

A conference on contaminated site remediation with the theme "Challenges posed by urban & industrial contaminants", organised by the Centre for Groundwater Studies, will be held in Fremantle, Western Australia.

Enquiries: The Secretariat, PO Box 568, Kalamunda Western Australia 6076. Tel: (61) 08 92919306. Fax: (61) 08 9291 9978. E-mail: petrconf@iinet.net.au.

SLUDGE MANAGEMENT

APRIL 8 - 10

A conference on "Sludge management for the 21st century - a value-added renewable resource" will be held in Fremantle, Western Australia.

Enquiries: Dr K Mathew, Murdoch University, Murdoch WA6150, Australia. Tel: (08) 9360 2896. Fax: (08) 9310 4997. E-mail address: mathew@essun1.murdoch.edu.au.

WASTEWATER PLANTS

APRIL 19 - 21

The 4th IAWQ specialised conference on small wastewater treatment plants will be held in Stratford-upon-Avon, England.

Enquiries: E Wellingham, Conference Secretariat, Field End House, Bude Close, Nailsea, Bristol BS48 2FQ, England. E-mail: confsec@dial.pipex.com. Fax: +44-1275-853311. Web address: <http://www.iawq.org.uk/conferen/crypto.htm>.

BIOREMEDIATION

APRIL 19 - 22

The 5th international symposium on in-situ and on-site bioremediation will be held in San Diego, CA, USA.

Enquiries: The Conference Group, 1989 West Fifth Ave Suite 5, Columbus, Ohio 43212-1912, USA. Tel: +614 424 5461. Fax: +614 488 5747. E-mail: conferencegroup@compuserve.com.

CRYPTOSPORIDIUM

APRIL 19 - 23

A conference on minimising the risk from cryptosporidium and other waterborne particles will be held in Paris, France.

Enquiries: Mrs Edith Weitz, Generale des Eaux, 52 rue d'Anjou, 75008 Paris, France. Tel: +33 1 4924 6587. Fax: +33 1 4924 6217. E-mail address: edith.weitz@cgeaux.com. Web address: <http://www.iawq.org.uk/conferen/crypto.htm>.

WETLANDS

MAY 1999

An international workshop on the development and management of flood plains and wetlands will be held in Beijing, China.

Enquiries: Dr Tan Ying, IRTCES, PO Box 366, Beijing 100044, China. Tel: +86 10 6841 3372. Fax: +86 10 6841 1174. E-mail: irtces@public2.bta.net.ca

ISOTOPE TECHNIQUES

MAY 10 - 14

An international symposium on isotope techniques in water resources development and management will be held in Vienna, Austria.

Enquiries: IAEA-SM-361, Vienna International Centre, PO Box 100, Wagramer Strasse 5, A-1400 Vienna, Austria. Tel: +43-1-2060(0) plus extension. Fax: +43-1-20607. E-mail: official.mail@iaea.org

IRRIGATION

MAY 12 - 14

An international symposium on new approaches in irrigation, drainage and flood control management will be held in Bratislava, Slovak Republic.

Enquiries: Slovak National Committee of ICID, Vrakunská 29, 825 63 Bratislava, Slovak Republic. Fax: +421 7 248 946. Tel: +421 7 293 528. E-mail: vuzh@vuzh.sk

DIFFUSE POLLUTION

MAY 16 - 21

An IAWQ international conference on diffuse pollution - Solutions and Innovations - will be held at the Sheraton Perth Hotel in Western Australia.

Enquiries: Dianne McLeod, Convention Link, PO Box 257, South Perth WA 6951. Tel: +61 8 9450 1662. Fax: +61 8 9450 2942. E mail address: convlink@wantree.com.au. Website: www.environ.wa.gov.au

WATER ENVIRONMENT

JUNE 2 - 4

An international symposium with the theme "The learning society and the water environment" will be held at UNESCO's headquarters in Paris.

Enquiries: Pierre Hubert. Fax: 33(0)1 44 275125. E-mail: hubert@cig.ensmp.fr

FOREST INDUSTRY

JUNE 6 - 10

The 6th IAWQ symposium on forest industry wastewaters will be held in Tampere, Finland.

Enquiries: Ms Sirpa Sandelin, Water and Environmental Engineering, Tampere University of Technology, PO Box 541, FIN-33101 Tampere, Finland. Tel: +358 3 365 2567. Fax: +358 3 365 2052. E-mail: forest99@butler.cc.tut.fi

WATER QUALITY

JUNE 7 - 11

A short course on the design of water quality monitoring networks will be presented at Colorado State University, Fort Collins, Colorado.

Enquiries: Thomas G Sanders, Programme Coordinator, Environmental Engineering, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Fax: (970) 491-7727. Tel: (970) 491-5448. E-mail: TGS@engr.Colostate.Edu. Web site: <http://www.engr.colostate.edu/depts/ce/>

ACTIVATED SLUDGE

JUNE 14 - 18

The 11th annual short course on activated sludge process control will be held in Estes Park, Colorado.

Enquiries: Thomas G Sanders, Programme Coordinator, Environmental Engineering, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Fax: (970)

491-7727. Tel: (970) 491-5448. E-mail: TGS@engr.Colostate.Edu. Web site: <http://www.engr.colostate.edu/depts/ce/>

ANAEROBIC DIGESTION

JUNE 15 - 18

The second international symposium on anaerobic digestion of solid waste will be held in Barcelona, Spain.

Enquiries: II-ISAD-SW, Apdo. Correos 30124, E-08080 Barcelona, Spain. Tel: +34 929 920 591. Fax: +34 91 975 1180. E-mail: congres@waste.qui.ub.es. Web address: <http://www.ii-isad-sw.ub.es>

IMPACT ASSESSMENT

JUNE 15 - 19

The 19th annual meeting of the international association for impact assessment will be held in Glasgow, Scotland.

Enquiries: IAIA Executive Office, North Dakota State University, Hastings Hall, PO Box 5256, Fargo, ND 58105-5256 USA. Fax: +1 701 231 1007. E-mail: jhowell@ndsuxext.nodak.edu

HAZARDOUS MATERIALS

JUNE 22 - 24

A short course on the management of hazardous materials - a managers training course - will be held at the Colorado State University in Colorado.

Enquiries: Thomas G Sanders, Programme Coordinator, Environmental Engineering, Department of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Fax: (970) 491-7727. Tel: (970) 491-5448. E-mail: TGS@engr.Colostate.Edu. Web site: <http://www.engr.colostate.edu/depts/ce/>

HUMIC SUBSTANCES

JUNE 24 - 25

An international workshop on the removal of humic substances from water will be held in Trondheim, Norway.

Enquiries: Professor Hallvard Odegaard, Department of Hydraulic and Environmental Engineering, Norwegian University of Science and Technology, NTNU, N-7034 Trondheim, Norway. Tel: +47 7359 4759. Fax: +47 7359 0544. E-mail: Hallvard.Odegaard@bygg.ntnu.no Web address: <http://www.iawq.org.uk/conferen/humics>

THE WATER INSTITUTE OF SOUTHERN AFRICA (WISA)

BIENNIAL CONFERENCE AND EXHIBITION
SUN CITY, SOUTH AFRICA
28 May to 1 June 2000



FIRST ANNOUNCEMENT AND CALL FOR PAPERS

Date and Venue

The WISA biennial conference for the year 2000 will be held at Sun City, in the North West Province from 28 May to 1 June 2000. The Conference will commence on the Sunday with a social Meet and Greet, followed by three days of parallel technical sessions, and will conclude with a number of technical visits. A series of keynote and plenary sessions will be scheduled throughout the conference.

Call for Papers

Anyone who is interested in making a presentation at this conference, either orally or by means of a technical poster, who need not necessarily be members of WISA, are invited to submit a short abstract (**maximum of one page**) of their proposed presentation by 31 July 1999.

It is imperative that the title of the paper, the author's name, organisation, address, telephone, fax and e-mail address appears on the same page. Papers will undergo a peer review process, and will be accepted with the understanding that the main author or co-author will personally attend the conference and present the paper. Please note there will be no reduced registration fee for authors or presenters.

Deadline Dates

Receipt of Abstract	31 July 1999
Authors Advised of Acceptance	30 September 1999
Submission of Full Paper	14 January 2000
Conference Commence	28 May 2000

Exhibition

An exhibition – a showcase for all water orientated organisations – will be held concurrently with the conference. Exhibitors are assured of ample opportunities to interact with the conference delegates. Since space will be limited, potential exhibitors are encouraged to make a reservation as soon as possible by contacting the conference organiser, Roelien-M Bakker.

Enquiries

All enquiries with regard to the conference should be directed to:
Roelien-M Bakker

WISA
PO Box 6011
Halfway House
1685

Telephone: (011) 805 6368
Fax: (011) 315 1258
E-mail: conference@wisa.co.za

WISA 2000 REPLY FORM

Please return by 31 July 1999 to: WISA, PO Box 6011, Halfway House, 1685, or Fax to: (011) 315-1258, or visit our web site and complete on-line at: www.wisa.co.za

By returning this form, you are indicating your interest in the conference without any obligation.

Surname
Initials Title (Dr/Mr/Ms etc)
First Name
Organisation
Postal Address
..... Postal Code
Country
Telephone
Fax.....
Cellular Phone
E-mail

I am interested in:

- Making an Oral Presentation
 - Making a Poster Presentation
- in the following session:**
- Anaerobic Processes
 - Analytical Equipment and Techniques
 - Aquatic Ecosystems
 - Collection and Reticulation Systems
 - Community Water Supply and Sanitation
 - Consumer Education
 - Customer Services
 - Education and Training
 - Environmental Aspects
 - Groundwater Management
 - Health Related Aspects
 - Industrial Water and Effluent
 - Information Technology
 - Legislation
 - Management and Institutional Affairs
 - Marine Disposal
 - Membrane Technology and Applications
 - Mine Water Quality Management
 - Nutrient Removal
 - Potable Water Treatment
 - Plant Operation
 - Public Participation
 - River Basin Management
 - Role of Water Scientists
 - Sludge Management
 - Social Impacts
 - Urban Runoff
 - Wastewater Technology
 - Watercare
 - Water Distribution
 - Water Quality Management

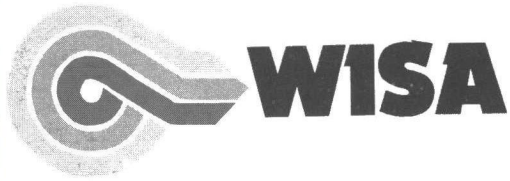
Other (Please Specify)

Please find attached 3 copies of a ONE-page abstract of my proposed presentation.

- I wish more information on exhibiting at the conference

Sponsored by Brooke Patrick
(Publishers of Water Sewage & Effluent)
Issued January 1999

3rd WISA MTD Workshop



First announcement and call for papers

The Water Institute of South Africa - Membrane Technology Division
announce the biennial specialist workshop :

Membrane Developments in Waste Minimisation, Water Treatment and the Process Industry

September 26 - 29, 1999

WORKSHOP OBJECTIVES

WISA - MTD arranges a biennial specialist workshop to present an overview of the most recent developments of membrane technology in South Africa. The workshop brings together research scientists, engineers, managers and operators from water supply companies, industries, government departments, consulting firms, research institutes, universities and suppliers of membrane technology. The theme of the workshop will cover the application of membranes in drinking and industrial water purification, effluent treatment with particular emphasis on waste minimisation, biotechnology and other process applications.

PRELIMINARY LIST OF TOPICS

1. Drinking and industrial water treatment and water reuse
2. Sea water and brackish water
3. Organic matter and biofouling
4. Particulate fouling and scaling
5. Optimisation of operation, fouling control and backwashing
6. Membrane integrity monitoring
7. Waste minimisation
8. Bioseparations and biotechnology

COURSES

Two courses will be arranged for the third day of the workshop. The topics of the courses will be decided over the next few months and some guest lecturers may be invited to present specific topics.

WISA MTD biennial General Meeting

This meeting will be held during the workshop. The main objectives are to report back on MTD activities and finances, to elect a new Management Committee for the following term and to consider the MTD Strategic Plan.

PRE-REGISTRATION

All potential participants are requested to pre-register as soon as possible by sending their name, address and contact details (incl email) to Dr S Burton. Registration forms and further information will be mailed only to those who have indicated an interest in attending the workshop.

SUBMISSION OF ABSTRACTS

Authors wishing to present a paper or poster are invited to send an abstract containing 500 to 750 words on a disk or by email as WordPerfect or MSWord documents, to the address below. Include a title, the authors' names and addresses, and no more than two diagrams or tables. Please also indicate for which topic(s) the abstract is intended.

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email : chsb@warthog.ru.ac.za

DEADLINE for the submission of abstracts is 31 May 1999. Authors will be notified by 30 June 1999 as to whether their paper has been accepted for oral or poster presentation. The abstracts will be published in the form of a proceedings and will be made available to delegates at registration.