SA waterbulletin

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WATER MANAGEMENT
New decision making tool developed for water managers

WATERSUIWERING
Magnetiet as vlokmiddel in watersuiweringsprosesse – resultate

HYDROLOGY
Channel deformation studied in alluvial rivers

AFRICAN WATER CONFERENCE & EXHIBITION

6 - 9 JUNE 1994

NATIONAL EXHIBITION CENTRE
JOHANNESBURG

PROGRAMME

Venue	Organising Association	Topic
Monday 6 June		
Hall 1	Mine Water Technical Division, WISA	Mine Water Management
Hall 2	Institute of Waste Management	A workshop on the "Minimum requirements for handling waste", as published by the Department of Water Affairs and Forestry.
Hall 3	Membrane Technology Technical Division, WISA	Electro-Membrane Processes
Tuesday 7 June		
Hall 1	Southern African Industrial Water Association	Industrial water treatment workshop
Hall 2	Sludge Management Technical Division, WISA	Sewage sludge management in the context of current legalisation
Hall 3	Water Scientists Technical Division, WISA	The role of scientists in water purification.
Wednesday 8 June		
Hall 1	Pipeline Interest Group of southern African Corrosion Institute	Practical rehabilitation of pipelines
Hall 2	Nutrient Removal Technical Division, WISA	Appropriate operating technologies for African conditions
Hall 3	South African Chemical Institue.	Chemistry and water quality
Thursday 9 June		
Hall 1	Water Distribution Technical Division, WISA	Water supply and rapid urbanisation
Hall 2	Southern African Society of Aquatic Scientists	South African riverine water quality: management and current research
Hall 3	To be confirmed	

Prof Chris Buckley of the University of Natal will also be organising three computer modelling courses based on his Water Research Commission projects during the conference period. This will be held at a different venue. The three courses are: Chemical speciation; Modelling of reverse osmosis; Modelling of the residence time distribution. For further information please fax your details to Prof Buckley at 031 260 1118.

For more conference details, please contact:
Sally Keeling, Focus Conferences, PO Box 31368, Braamfontein 2017.
Tel (011) 643 4824/8 Fax (011) 642 6011.

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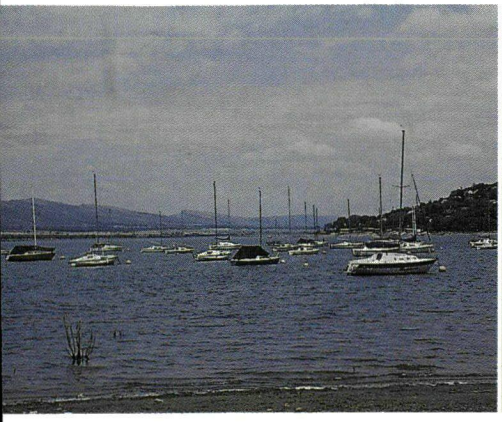

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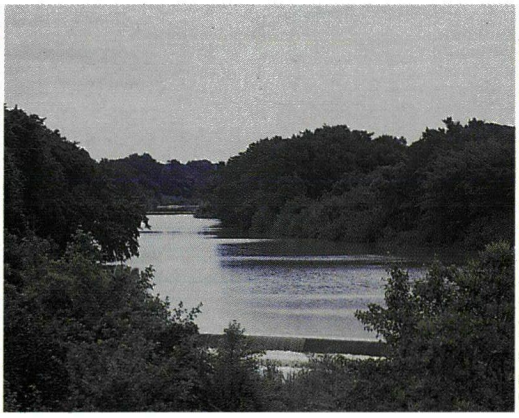

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Cover: The lower Berg River in the Western Cape (Photo: Helene Joubert)

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. Editor: Jan du Plessis. Asst Editor: Helene Joubert. Ed Secretary: Rina Human. Layout: Cover to Cover, Pretoria. Colour Separations: Lithotechnik. Printing: Beria Printers.

Delegates successfully "digest' international symposium

The seventh International Symposium on Anaerobic Digestion held in Cape Town during January was indeed international. The symposium was very well attended by some 300 delegates of which 160 were international delegates representing 41 countries.

The symposium was opened with a word of welcome by the madame mayor of Cape Town, Alderman Patricia Kreiner. She expressed her delight in Cape Town being the host city for this international symposium as well as noting the number of professional women active in this field of science and technology and attending the AD '94 symposium.

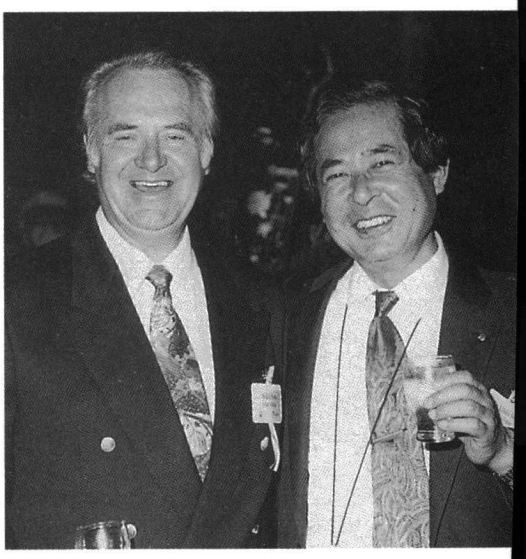
Professor Willy Verstraete of Belgium, in his opening address, said that South Africa has an outstanding reputation with regard to water treatment research and technology. He was in particular interested in "the vast experience in this country in both high-tech and low-tech approaches" and recalled the pioneering role of South African scientists in the field of anaerobic digestion saying that concepts varying from the anaerobic filter to the upflow sludge reactor to the membrane coupled digester "all saw the light in this country".

A packed programmme of 81 oral papers and 89 poster papers dealt with many different aspects of anaerobic digestion. Main themes amongst others were: process control, applied fundamentals, full-scale treatment, industrial effluent, solid wastes, landfills, biogas aspects, sulphate removal, thermophilic treatment, membrane-assisted processes and reactor design.

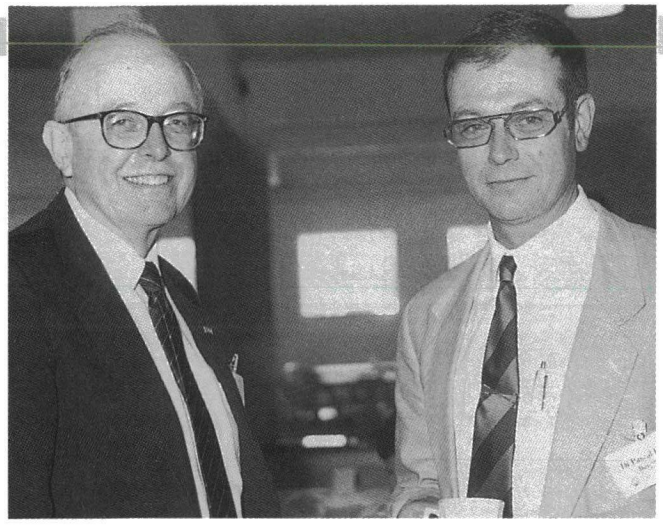
The main conclusions of the symposium were that anaerobic digestion technology has progressed considerably during the past two decades, offering solutions to waste management as well as environmental pollution control, with exceptional progress in applying anaerobic digestion to a wide variety of wastes, ranging from domestic waste water to concentrated industrial effluents and solid substrates.

A word of thanks and appreciation is due to Dr Bill Ross and his good wife Suzanne for their effort and dedication in organising a very successful symposium including the technical tours.

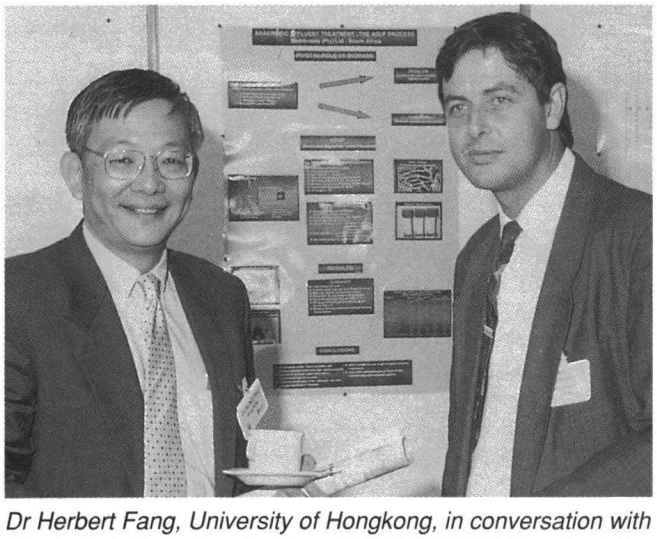
The Mayor of Cape Town, Alderman Patricia Kreiner with Prof Willy Verstraete of the University of Gent, Belgium, at the opening of the AD '94 symposium.



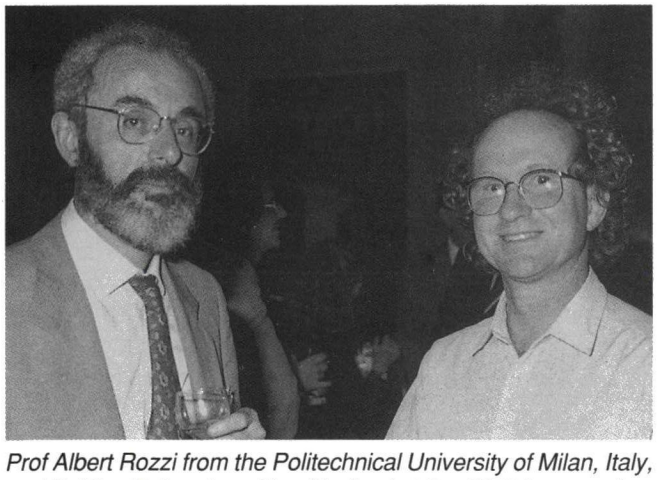
The inimitable Dr Bill Ross, Chairman of the AD'94 organising committee, and Dr Eiichi Mikami from the National Institute of Bioscience and Human Technology, Japan.



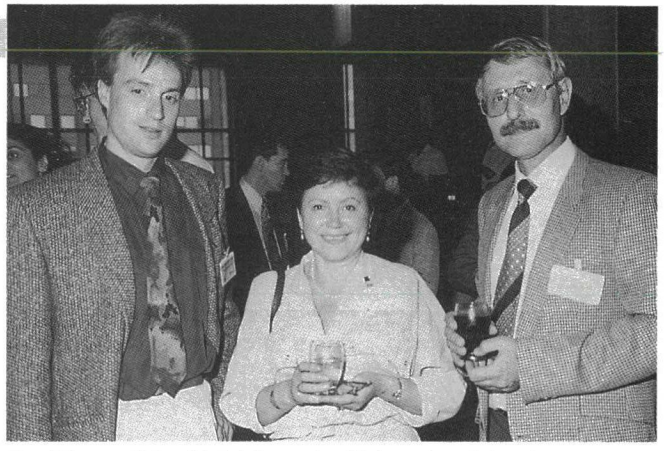
Familiar foreign faces: Prof Fred Poland (USA) and Dr Pascal Pipyn (Belgium) once again attended an anaerobic digestion symposium on South African soil. Welcome back!



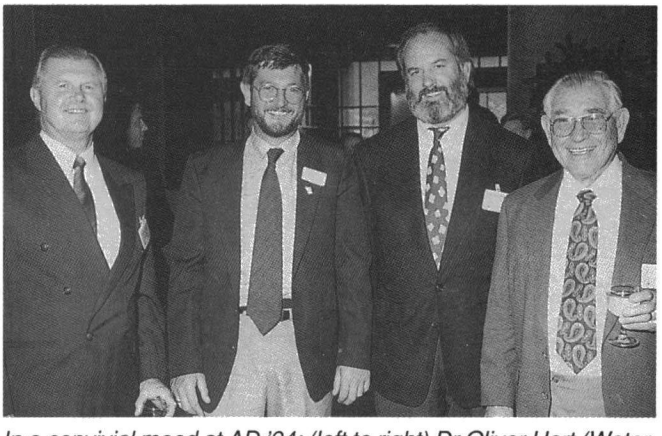
Dr Herbert Fang, University of Hongkong, in conversation with Danie Nel, Executive director of MEMBRATEK (Paarl), at the technical exhibition.



Prof Albert Rozzi from the Politechnical University of Milan, Italy, and Dr Tico Cohen from New Zealand at the AD '94 symposium in Cape Town.



Prof Trevor Britz (right) from the University of the Orange Free State, was delighted to introduce Dr Alla Nozhevnikova (centre) of the Russian Academy of Science at the symposium, with them is Dr Jules van Lier from the University of Wageningen, the Netherlands. (Prof Britz says the only sure means of communications with Dr Nozhevnikova in Russia is by E-mail on computer).



In a convivial mood at AD '94: (left to right) Dr Oliver Hart (Water Research Commission, SA), Dr Ed Jacobs (University of Stellenbosch, SA), Mr Bailey Green and Prof William Oswald, both from the University of California (Berkeley), USA.

Dr Luiz Monteggia of the University Rio Grandé do Sul, Brazil, and his wife Edilaine Monteggia (centre) at the AD '94 symposium in conversation with Ms Lilian Evison, University of Newcastle, UK.

Comparing apples with oranges

New tool should help managers evaluate different policy options

A new decision making tool which can help water resource managers to evaluate different (and often conflicting) policy options ("apples and oranges") has been developed through a WRC funded research project at the University of Cape Town (UCT).

The new procedure has been termed scenario-based policy planning by the researchers, TJ Stewart, L Scott and K Iloni, at UCT's Department of Statistical Sciences and makes it possible for decision makers to express value judgements by means of direct comparisons between specific alternative policy options, the consequences of which are specified as far as possible.

The researchers say this project arose out of a recognition of an existing need within water resources management and of a new technology that had the potential for addressing that need.

The need was for a justifiable and credible means of achieving an equitable balance between the conflicting requirements of society when developing new water schemes or allocating water between competing uses, such as irrigation, public recreation and wildlife conservation, for instance.

The new technology was a development in the management science literature of an assemblage of techniques which are broadly classified as Multiple Criteria Decision Making tools. These tools are used to develop (usually computer-based) decision support systems which can guide managers, policy planners, or other interested parties, towards the finding of a solution which achieves in some sense the maximum level of satisfaction of all conflicting goals and interests. They assist in identifying the key value judgements which have to be made amongst the usually confusing mass of data which tends to be generated in the evaluation of any policy alternative and provide means of comparing "apples and oranges" in a logically justifiable manner.

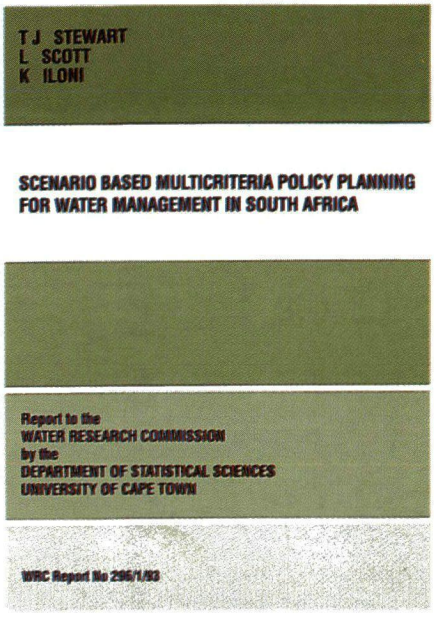
The researchers say a preliminary perusal of the literature regarding multiple criteria decision making developments in the 70s and 80s revealed that much of the stimulus for this work came from water resource planning problems, particularly in the USA. Therefore, it seemed that the field of multiple criteria decision making could and should be able to provide precisely the means needed for ensuring just consideration of all costs and benefits, direct, indirect and intangible, when assessing water resource policy decisions in South Africa.

AIMS

With this background, the research project was formulated with the following overall aims:

- To establish a formal and quantified hierarchical structure of water planning and management goals, representing a consensus of opinion amongst all major users of water, which can be used in assessing alternative water policies and plans.
- To investigate and to develop procedures whereby such goal structures can be integrated into formal decision support systems in which the outputs of various systems models can be evaluated in terms of their contributions to management goals.
- To demonstrate the relevance of the multi-criteria decision support system approach in water planning, by implementing and testing an operational decision support system for at least one problem setting, as a "demonstration" project.

According to a final report on the project released by the Water Research Commission, the broad research methodology adopted was to formulate an initial prototype procedure for the second aim and then to attempt its implementation for the Sabie-Sand River catchment area. In this way problems with the decision support procedure could be identified quickly, and the procedure itself updated to rectify such problems. In the end, the analysis of the policy planning problems was based on realistic, but still somewhat hy-



Copies of this report entitled **Scenario based multicriteria policy planning for water management in South Africa (WRC report 296/1/93)** are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (Please note: Overseas price is $25.)

pothetical policy options for the region. This became necessary as complete and comprehensive policy proposals were not available: in fact, the researchers say, it became evident that any decision support procedure must include support for the process of generating a broad range of potential policies. What emerged from this research was a new procedure which the researchers have termed scenario-based policy planning. This procedure draws not only from the multiple criteria decision making literature, but also from the modern concept of scenario analysis. The procedure is fully described in chapter 4 of the WRC report, but in outline contains the following features:

- A process of identifying policy elements and thereby the ranges of policy scenarios which can feasibly be implemented.
- Use of experimental design procedures to generate a representative set of feasible policy scenarios (called the background set) typically 50 - 200 in number: consequences of each of these would be evaluated in sufficient detail to be able to specify each scenario comprehensively for the purpose of direct comparisons by representatives of different interests.
- Use of formal multiple criteria decision making methods to make a further selection from the background set of plus minus seven scenarios (called the foreground set) for direct value assessments.
- Comparisons of scenarios within and between interests, using computer assisted multicriteria decision support aids: initially attention is focused on eliminating less generally acceptable scenarios, while later this attention shifts towards identifying possible consensus.
- Alterative repetitions of the third and fourth steps, continually refining the foreground set in the search for the most generally acceptable scenarios.

DECISION CONFERENCES

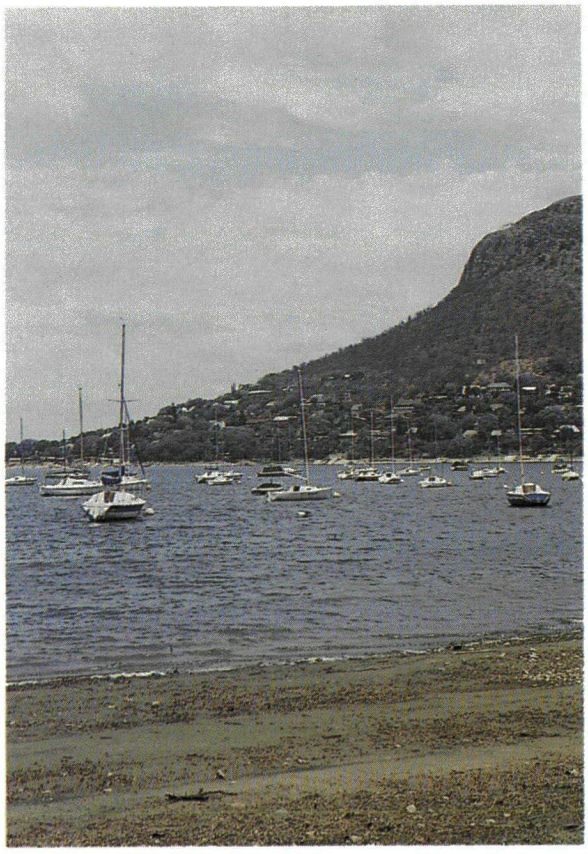
The proposed procedure makes extensive use of workshops or "decision conferences" at which representatives of different interests explore their own value judgements and preferences, in the context of well-defined scenarios. These preferences are expressed by aligning the scenarios along a 0 - 100 scale (sometimes termed a "thermometer" scale). These scales are comparable between interests and criteria, irrespective of how tangible or intangible they may be, and thus serve to identify areas of serious disagreement or of possible compromise. The fourth step of the procedure includes formal decision support for this between-interest comparison as well. A number of these workshops were conducted as part of the research, in order to establish the usefulness of the approach.

CONCLUSIONS

According to the report the overall conclusions from the research can be summarised as follows:

- Conventional methods for multiple criteria decision making do not directly offer a means of systematically addressing the less tangible costs and benefits to society of water policy decisions. Multicriteria decision analysis techniques are nevertheless useful for eliciting value judgements concerning all societal interests, by a process of direct comparisons of seven to plus minus two comprehensively defined *policy scenarios*, expressed on a "thermometer" (i.e. 0 - 100) scale. The resulting measures are comparable across interests and provide one of the few, if not only, justifiable means of comparing intangible costs and benefits with each other and with tangible costs and benefits. This conclusion is supported by experience with evaluating hypothetical policy scenarios for the Sabie-Sand River region.
- Existing software support is available to implement the comparative measurements described above. The VISA package (Visual Interactive Sensitivity Analysis for multiple criteria decision aid) appears to be the most appropriate software to use at this stage. Workshops using this software can be constituted with little effort, to facilitate the process of rating policy scenarios on "thermometer" scales, both within relatively homogeneous interest groups (to assess their value preferences) and globally (to identify potentially acceptable consensus policies). The researchers recommend that this approach be taken into immediate use whenever a relatively small number of policy alternatives need to be evaluated and compared.
- In the longer run, the systematic and comprehensive scenario based policy planning procedure is recommended. The full software support for this procedure has yet to be developed, but

Different (and often conflicting) water uses..



Recreation . . .

the feasibility of individual steps has been demonstrated (although further research to refine certain of these steps is recommended).

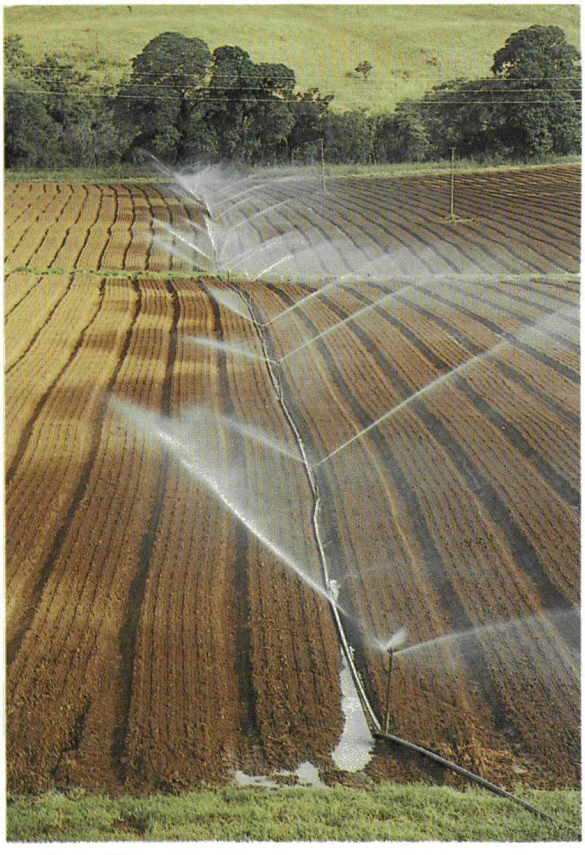
FUTURE RESEARCH

The state of the art of multicriteria decision analysis has been substantially extended by this work, in the sense that no previous literature has attempted any general framework which addresses the particular problems of application to resource planning. Such problems include the complexity of models for computing the consequences of specific policies and the need to integrate subjective evaluations of the intangible issues with more objective data when the range of possible policy options is very large.

The report says future research is still needed:

- To refine certain technical steps in the procedure itself and to incorporate the procedure into a fully operational computerised decision support system;
- To integrate the procedure with GIS or similar technologies for the most effective display of scenarios; and
- To test the procedures in real-life policy planning.

The researchers say that all these research needs are included as objectives in a new project accepted by the Water Research Commission (for the period 1993 to 1995) under the title "The development of procedures for decision support in water resources management".



and irrigation.

Submission of research proposals to the Water Research Commission

Voorlegging van navorsingsvoorstelle aan die Waternavorsingskommissie

As in the past the Water Research Commission (WRC) is extending an invitation to research organisations to submit water research proposals to the WRC with a view to funding thereof during 1995. Unlike previous years the final date for submissions will be 30 April 1994.

PLEASE NOTE THAT LATE SUBMISSIONS WILL NOT BE ACCEPTED UNDER ANY CIRCUMSTANCES

The growing number of research proposals being received by the Water Research Commission and the time pressure involved in processing and evaluating the submissions, also made it necessary to change the format in which proposals should be submitted. Instead of proposals in summary form as was required in the past, detailed complete research proposals must now reach the WRC by 30 April 1994. As an aid in this regard the WRC's "Guidelines for compiling research proposals" is available for information and use by researchers.

The WRC would like to encourage submissions in an electronic format, where possible. For this reason, a computer disk containing a pre-compiled submission form will be made available on request. Those researchers wishing to avail themselves of this opportunity should contact the WRC in this regard and specify the type and size of disk required (floppy 360K/1,2 Meg or stiffy 720K/1,4 Meg).

All proposals received will be considered jointly after 30 April 1994. Following this date, if necessary, the WRC research manager concerned will liaise with the proposer of a project in order to clarify any vagueness that may exist in the proposal and to finalise it. The finalised proposal will then be considered at a meeting of the Commission and a recommendation will be made to the Minister of Water Affairs and Forestry regarding the funding thereof.

Researchers in the water field are encouraged to discuss potential research proposals with the WRC's research managers prior to submission.

Soos in die verlede rig die Waternavorsingskom-missie (WNK) 'n uitnodiging aan navorsingsinstansies om met die oog op finansiering van die navorsing vanaf 1995, voorstelle vir waternavorsingsprojekte by die WNK in te dien. Anders as in vorige jare is die sluitingsdatum vir die indiening van die voorstelle 30 April 1994.

LET ASSEBLIEF DAAROP DAT LAAT INDIENINGS ONDER GEEN OMSTANDIGHEDE AANVAAR SAL WORD NIE.

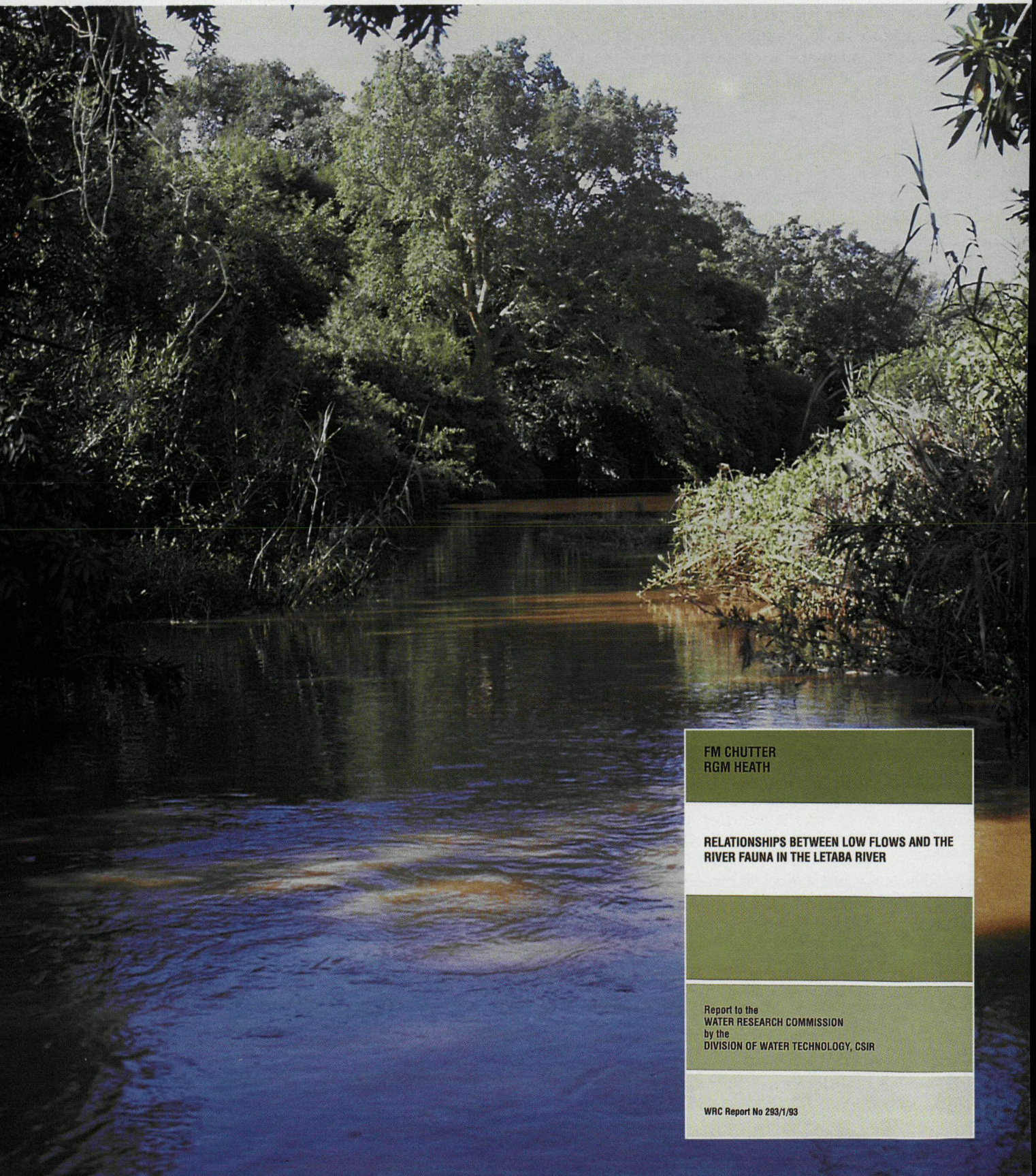
Die toenemende aantal voorleggings wat die WNK ontvang en die gepaardgaande toename in tydsdruk om navorsingsvoorstelle te prosesseer, het dit ook nodig gemaak dat die formaat van die voorleggings verander. In plaas van die opsommende navorsingsvoorstelle wat in die velede ingedien is, moet gedetailleerde volledige navorsingsvoorstelle die WNK nou reeds teen 30 April 1994 bereik. As gids in hierdie verband is die WNK se "Riglyne vir die opstelling van navorsingsvoorstelle" op aanvraag beskikbaar.

Die WNK wil sover moontlik indiening van voorleggings in 'n elektroniese formaat aanmoedig. 'n Vooraf-opgestelde vorm op rekenaardisket sal op versoek vir hierdie doel beskikbaar gestel word. Navorsers wat van hierdie geleentheid gebruik wil maak, moet asseblief die soort en grootte van die disket spesifiseer (sagteskyf 360K/1,2 Meg of stiffie 720K/1,4 Meg).

Alle voorstelle sal gesamentlik na 30 April 1994 oorweeg word. Indien nodig, sal die betrokke WNK-navorsings-bestuurder na die sluitingsdatum met die indiener van die voorstel in verbinding tree ten einde onduidelikhede op te klaar en die voorstel af te rond. Uiteindelik sal hierdie finale voorlegging tydens 'n vergadering van die Kommissie oorweeg en 'n aanbeveling oor die finansiering daarvan aan die Minister van Waterwese en Bosbou gemaak word.

Navorsers in die waterveld word aangemoedig om moontlike navorsingsvoorleggings met die WNK se navorsingsbestuurders te besprek voor dit aan die WNK voorgelê, word.

LETABA RIVER SURPRISES RESEARCHERS



The water flow required in a river to maintain its ecological integrity has come to be regarded as the key issue in the management of the conservation status of South African aquatic ecosystems.

This question of flow requirements and river management is particularly applicable to the rivers of the eastern Transvaal Lowveld which flow through South Africa's major nature conservation area, the Kruger National Park. The waters of all these rivers are increasingly exploited, mainly because of high population growth and intensive irrigation agriculture in their catchment areas, and consequently there is cause for concern regarding the continued existence of these water courses as riverine ecosystems in the Kruger National Park.

The most severely affected of these rivers is the Letaba which is impounded by the Fanie Botha Dam near Tzaneen and which currently only flows seasonally in the Kruger Park after widespread and heavy rain in its catchment.

To study the effect of reduced water flows on riverine ecosystems the Water Research Commission contracted the Division of Water Technology at the CSIR in 1990 to conduct a research project on the relationships between low flows and the river fauna in the Letaba River.

The researchers, FM Chutter and RGM Heath, concluded from their study that many components of the river's fauna can tolerate the present highly modified flow regime even to the point where the river ceased flowing in certain sections for a short period.

However, they say, gratifying as this observation may be, it would be unwise to infer from this that river flows can freely be modified to the point where the river regularly ceases to flow for days on end.

The report, Relationships between Low Flows and the River Fauna in the Letaba River (WRC report no 293/1/93), describing the project is now available on request from the Water Research Commission, PO Box 824, Pretoria 0001.

Please note: Overseas orders will be charged US $ 20,00 per copy.

The flow of the naturally perennial Letaba river, as it crosses the Lowveld towards the Kruger National Park, is regulated by the Fanie Botha Dam at Tzaneen. For several successive years, at the height of the drought period in the mid-1980's, the flow of the Letaba river ceased before it reached the western boundary of the Park. However, the flow of the river near the Fanie Botha Dam never ceased during this period of drought due to the fact that the river channel is used to carry water to the extensive irrigation areas downstream of the dam. Therefore there is a gradient of permanent flow from west to east in this stretch of the river.

AIMS

The aims of this project were

- To identify the combinations of minimal flow, depth, and current speed in the Letaba River which allow the occurrence of a natural river fauna, taking water chemistry and temperature into account. The natural river fauna would be measured in terms of the species diversity and the occurrence of key species.
- To compare the present conditions as identified to estimates of the natural (unmodified by man) flow and cross section of the river, in order to give a first estimate of minimal low flow requirements for habitat diversity and ecosystem maintenance as a proportion of the natural flow and river size.
- To collaborate with other researchers studying the ecology of rivers in the Eastern Transvaal and Kruger National Park by providing comparative data on a highly man-modified and regulated river. Impacts on the Letaba River would , if possible, be used as a background for the prediction of ecological impacts on presently non-regulated rivers.

The project was designed to focus on those benthic macroinvertebrates which are obligate current dwellers, that is the community dwelling in parts of the river bed in which there are hard substrata in strong currents (eg. rapids). These invertebrates would be the first to be impacted by declines in the flow to very low levels. Although fish are more mobile and probably more tolerant to a wider range of conditions (though a few species seem to be virtually restricted to fast-flowing water), it was decided also to attempt to record the complete diversity of the fish fauna in the river.

SAMPLING

The Letaba River was visited at 3 monthly intervals over a period of two years and samples of the water, the invertebrate communities of the rapids and the fish population were collected. The quality of the Letaba River water was unimpaired in all respects except that it had a high turbidity at times. Flow data only became available sometime after the field work had been completed. A study of the flow records showed that, contrary to what the researchers saw on field visits, there were two occasions during the study period when the flow of the river ceased. This occured in November 1990 (3 consecutive days) and in August 1991 (11 consecutive days). In both cases scheduled sampling visits to the river took place within less than two weeks of the resumption of flow in the river.

The effect of flow cessation on the rapid-dwelling invertebrates was carefully assessed by means of a thorough comparison of the communities collected before and after the event at sampling

points, both where flow cessation was most certain not to have occurred and where flow cessation almost certainly did occur. It seems that the short period of flow cessation had no measurable impact on the species richness in the river, except for a small impact on the relative abundance of Orthoclad Chironomidae which increased, and Tricorythid mayflies which decreased in abundance.

According to the researchers it would appear that seasonal pools in sandy areas of the Letaba River bed form important refuges for many of the fish species when the flow of the river is very low. It is suspected that these pools are maintained by seepage of water through sand. For this to occur, movement of water down the river channel is necessary, albeit within the sand. High summer flows or floods allow the fish to move back into the river from the seasonal pools.

Dr Peter Reid (WRC recearch manager), Ralph Heath and Dr Mark Chutter (Watertek, CSIR) and DS Joubert (Dept Water Affairs) on a surveillance fieldtrip of the Letaba River.

CONCLUSIONS

The researchers concluded that the study showed that the present fauna of the river can survive under the current flow regime, including the short periods of flow cessation in the lower river which occurred during the study. This flow regime really came into effect in 1988, when, as a result of negotiations between the National Parks Board and the Letaba Irrigation Board, it was agreed to maintain a minimum flow of 0.5 m3/s at the western boundary of the Kruger National Park. One important and unanswered question is whether the present fauna of the river is representative of the original fauna or whether there have been species losses. It seems that the only way in which this question can be answered, is to compare the Letaba River fauna with that of the Sabie, when the results of the present study of the Sabie River, also funded by the Water Research Commission, becomes available.

Another important unanswered question relates to the role of large flows in maintaining the river channel in its present state. If there were to be radical changes to the river channel, such as colonisation by extensive reed beds, changes in the river fauna could be expected.

According to the researchers the fact that below the Fanie Botha Dam the river is used to transport irrigation water to the irrigation areas, implies that there is permanent flow in part of the river below the dam, which provides a refuge for many components of the river fauna at times of severe drought stress. It was further concluded that the current dwelling components of both the invertebrate and the fish fauna have adaptations, which allow them to survive short periods when their preferred normal habitat is eliminated. A relatively short-term study such as this project can only provide information on short-term changes. The researchers say that it would be advisable to maintain low intensity surveillance of the Letaba River biota, lest there be important longterm trends of change which have yet to be detected. Longterm studies on the response of the river ecosystem to the modified flow regime are needed if the flow pattern is to be managed for the continued maintenance of the present ecosystem.

Aerial view of the Letaba river in seasonal flow.

Study published on channel deformation in alluvial rivers

The results of a study which can be used to predict aggradation (deposition) and degradation (erosion) of sand bed stream channels in a simplified way has recently been published by the Water Research Commission (WRC) in Pretoria.

The results emanate from a research project funded by the WRC and called **The development of a model to simulate flow in alluvial rivers**.

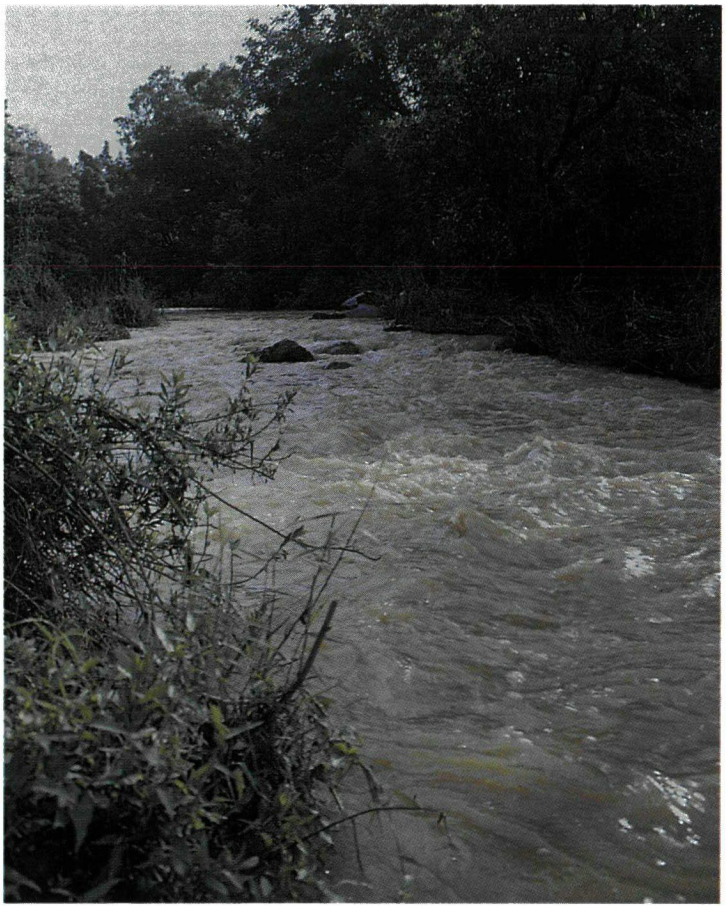
The researchers, A du P le Grange of BKS consulting engineers and A Rooseboom of the Department of Civil Engineering at the University of Stellenbosch, say the deposition and erosion of sand bed stream channels can be predicted by means of either an empirical approach (based on Parker's theory) or a fundamental approach as developed in this study.

"The empirical approach can only predict an average top width of a river and a flow depth without any indication of channel shape. The fundamental approach, on the other hand, can be used for predictions of top width, bottom width, average flow depth as well as channel shape.

The researchers say that although top width may be under-estimated, the methodology could be improved in future research by allowing for bank retreat, bank material characteristics and bank vegetation.

"Such a geomorphological model could easily be linked to the more sophisticated open channel hydraulic flow models to predict loose boundary channel flow behaviour.

Copies of the report summarising the research results (WRC Report 236/1/93) are available free of charge from the Water Research Commission, PO Box 824, Pretoria 0001. (The overseas price for the report is $30.)

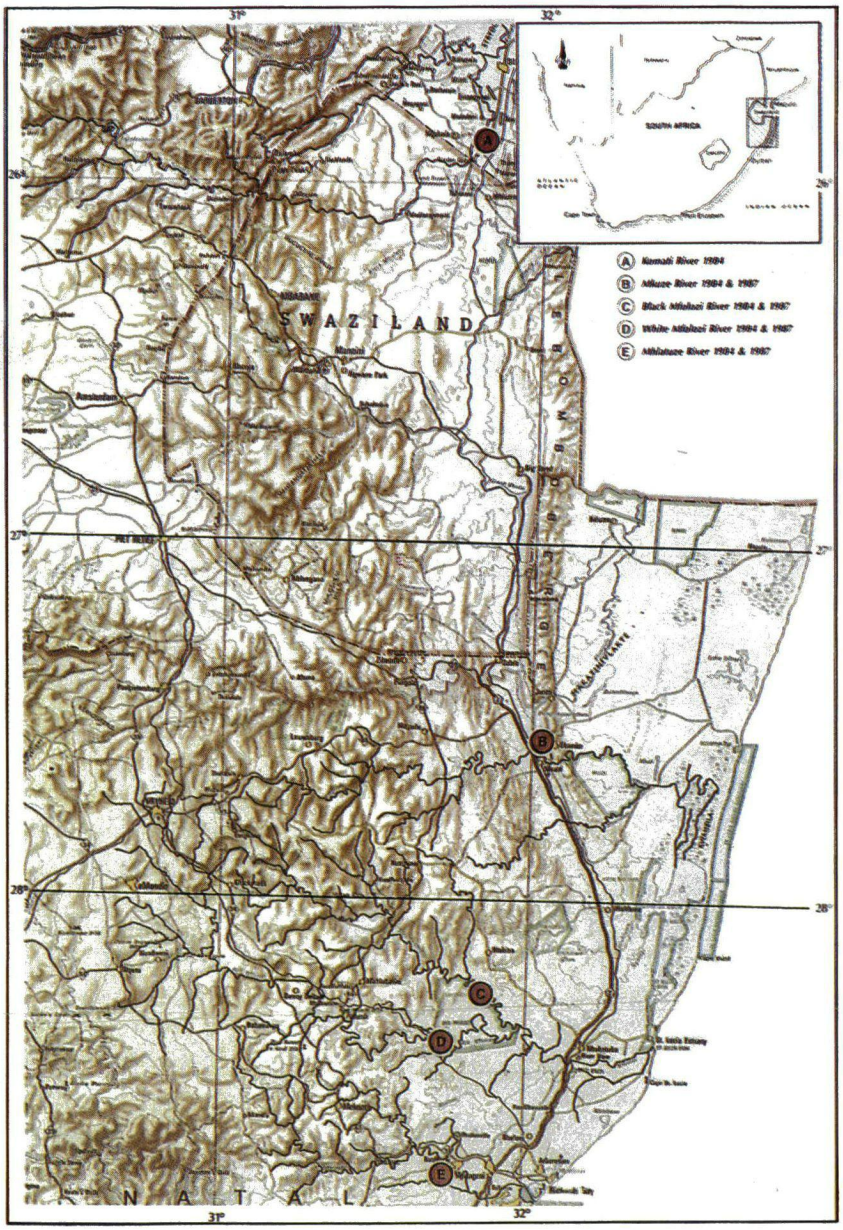


The geometry of an alluvial river channel is determined by the interaction between the flowing water, the sediment load and the composition of the river bed and bank materials.

Since earliest times rivers have played key roles in most civilisations. Various human projects have, therefore, been undertaken for the utilisation of river run-off and to reduce the destructive power of floods.

A river course is often considered to be static, that is, unchanging in shape, dimensions and pattern. However, the flow in a river generally varies with time and, as a result, the river is continually changing its position and shape as a result of hydraulic forces acting on its bed and banks. These changes may take place slowly or rapidly and may be caused by natural environmental changes or by man's activities.

The geometry of an alluvial river channel is determined by the interaction between flowing water, the magnitude and characteristics of the sediment load as well as the composition of the bed and bank materials.



Field site locations for the alluvial river study.

A DU P LE GRANGE
A ROOSEBOOM

THE DEVELOPMENT OF A MODEL TO SIMULATE CHANNEL DEFORMATION IN ALLUVIAL RIVERS

Report to the
WATER RESEARCH COMMISSION
by
BKS INC

WRC Report No 236/1/93

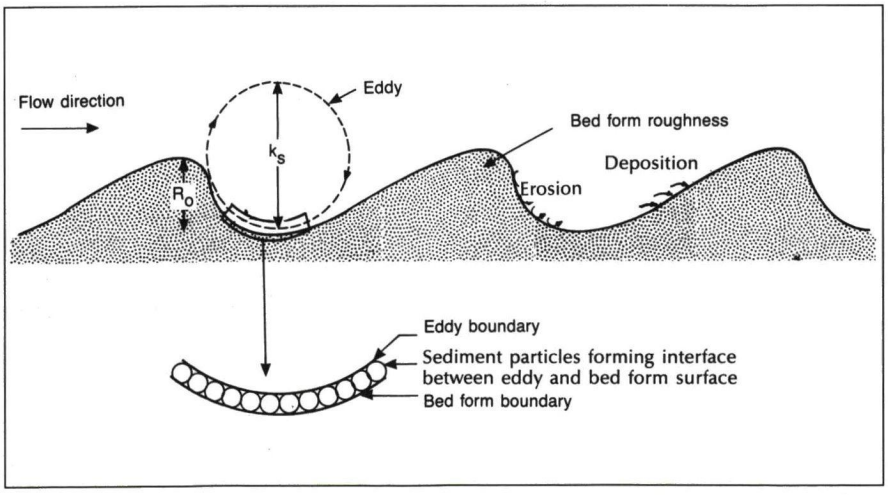
of considerable research and continues to be of great practical interest. As many of the numerous attempts are dissimilar in their approach to the problem, it is not surprising that the equations that have been developed give significantly different results when used for design purposes.

The report says that although several computational models exist in the literature, none of these has been developed from a well founded theory. The only models of an acceptable nature are those based on extremal hypotheses or variational principles. Although these models apparently provide an attractive solution to river regime problems, they will have to be redefined to meet certain objections before they can be used in computational hydraulic models. Thus, existing mod-

The report published by the Water Research Commission says the general problem of alluvial channel stability revolves around the question as to how a river channel with deformable boundaries react to changing water and sediment discharges.

A model which can be used to predict equilibrium alluvial river behaviour which will facilitate investigations into alluvial river behaviour and will be of assistance in river engineering work is discussed in the report.

The problem of determining a stable or equilibrium cross-sectional geometry for an alluvial channel has been the subject



Interaction between sediment particles and eddies in a river channel.

The Black Mfolozi River in northern Natal.

els of flow in mobile boundary channels have only limited applicability, leaving room for further improvements in the area of model development for mobile boundary flows.

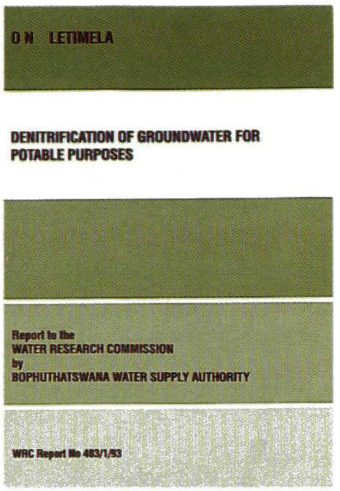
The report says consensus does not exist regarding the relationship which should be used to determine channel geometry or stability. A general model for describing the hydraulic geometry of a river is therefore being sought. The aim of this research project was to develop a general mathematical hydraulic model which could be used to solve problems in the field of river engineering related to the deformation of river channels under varying flow conditions.

Although any self-adjustable channel possesses five degrees-of-freedom within which change can take place through the processes of aggradation and degradation, i.e width, depth, velocity, slope and sinuosity, these variables are insufficient to depict the hydraulic geometry of an alluvial river channel uniquely. Thus, the research emphasis was on the river regime stability problem, that is, the determination of the equilibrium geometry of a river's cross-section, which can be formulated as follows:

"Given a discharge and accompanying known sediment size, what width, depth and bed slope will the river channel adopt in order to convey both the water and sediment from one point to another if the discharge is to flow between banks and over a bed, all consisting of the river's own sediment?"

Severe floods caused extensive damage to rivers in Natal during 1984 and 1987. The floods which occurred in the Komati, Mkuze, Black Mfolozi and White Mfolozi rivers during 1984 together with the 1987 flood in the Mhlatuze River were the largest on record in these rivers and caused extensive bed and bank erosion.

The Department of Water Affairs and Forestry performed surveys on these rivers after the floods. From the recorded maximum flood levels it was possible to determine peak discharges that had occurred and to compare these values with the depths and widths to which the alluvial rivers had been eroded. This information was used in an attempt to verify the empirical and fundamental approaches regarding alluvial river behaviour as



Researcher investig ground water for po

The nitrate content of a large part of Bophuthatswana's ground water does not conform to the SABS maximum allowable standard for nitrates (10 mg/l NO_3-N).

This prompted the Water Research Commission to financially support a study by Mr ON Letimela of the Bophuthatswana Water Supply Authority in which he addressed the problem of nitrates in drinking water in general and evaluated methods for reducing the nitrate content of borehole water to acceptable concentrations.

A report summarising the results of the study is currently available from the Water Research Commission, PO Box 824, Pretoria 0001. The report is called **Denitrification of Ground water for potable purposes (WRC Report 403/1/93)**.

Mr Letimela says in the report it is clear from evidence presented that nitrates and related compounds, when consumed in concentrations exceeding 10 mg/l NO_3-N can have a variety of detrimental effects on humans and animals. Some of the documented effects are methaemoglobinaemia, cancer, slowing of motor reflexes, hypertension and increased aggression.

The fact that significant effects can be detected in infants consuming water having only slightly more nitrate than the current standard of 10 mg/l NO_3-N, means that potential drinking water with nitrate concentration more than the current standard must be pretreated for nitrate removal before it can be supplied to the consumer.

Three general principles of nitrate removal exists, namely, chemical reduction, ion-exchange and biological denitrification. Due to a generally low earning capacity and lack of expertise in the rural population of Bophuthatswana, biological denitrification seems to be a more suitable method of nitrate removal for such a population as it is relatively simple to operate.

Although practically any readily available electron donor (carbon source) could be used for biological denitrification in general, Mr Letimela says his study has shown that for potable water, electron donors are limited to those that will produce an acceptable end product. He says it was found in this study that methanol and ethanol gave practically similar denitrification results, while molasses added a colour to the water which makes the final water unacceptable for potable and other domestic uses.

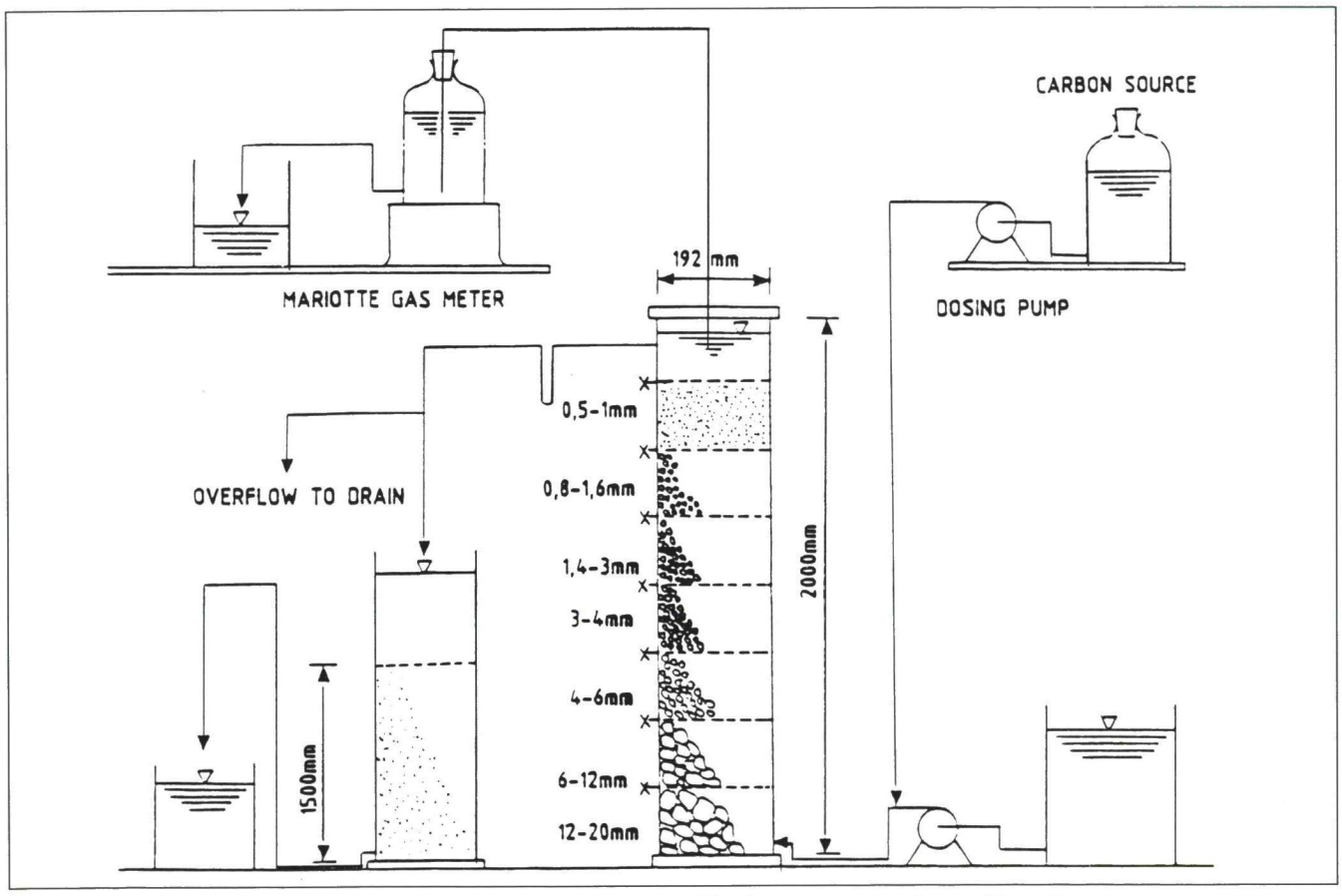
The results obtained indicate that virtually

ates denitrification of BOP rable purposes

complete denitrification occurred at a carbon-nitrogen ratio of 1,5:1. Due to the poisonous nature of methanol, it is recommended that for practical purposes a C:N ratio of 1:1 is used. The data obtained shows that denitrification in packed bed reactor is nearly completed at a hydraulic retention time of one hour and more. A relatively small and inexpensive packed bed reactor with methanol as carbon source at C:N ratio of 1:1 and a hydraulic retention time of one hour is recommended for the rural areas of Bophuthatswana.

Mr Letimela says a comparison of results of inoculation with a mixed and pure culture indicates a higher percentage of nitrate removal with a pure culture than a mixed culture under the same operating conditions. No potential pathogens were observed in the final water where the packed bed reactor was inoculated with a pure culture. This finding shows that unlike a mixed culture of activated sludge, a pure culture of denitrifiers, *Alcaligenes* species in this case, can safely be used for denitrification of potable water.

Biological denitrification has shown to be a cheaper method of nitrate removal than ion exchange. For the treatment of raw water of 60 mg/l NO_3-N and design capacity of 10 m^3/day, the approximate costs are R1.83/m^3 and R1.50/m^3 for ion exchange and biological denitrification respectively. A design capacity of 20 m^3/day results in treatment costs of R1.11/m^3 and R0.95/m^3 for ion exchange and biological denitrification respectively. Biological denitrification is therefore recommended over nitrate removal by ion exchange.



Biological nitrate removal with a packed bed reactor – experimental layout.

Navorsers kyk na SA magnetiet as vlokmiddel in watersuiweringsprosesse

"Daar bestaan 'n nis in die Suid-Afrikaanse watersuiweringsnywerheid waarin die magnetietproses 'n ekonomies kompeterende alternatief vir ander suiweringsprosesse kan bied. Hierdie nis lê, waarskynlik in die volgende:

- Drinkwaterbronne waarvan die water 'n hoë kleur, laer troebelheid, lae alkaliniteit en lae pH het.
- Nywerheidsuitvloeisels met hoë kleur, veral vanaf organiese oorsprong, en met lae pH.
- Suur mynwater."

Dit is die mening van navorsers aan die Universiteit van Pretoria (UP) wat onlangs die potensiaal van magnetiet as vlokmiddel in watersuiweringsprosesse ondersoek het. Die navorsers, FW Becker en WA Pretorius, van die departement chemiese- en omgewingsingenieurswese by UP, sê, navorsing oor die gebruik van verpoeierde magnetiet as herbruikbare flokkuleer- en adsorbeermiddel in watersuiweringsprosesse is reeds in talle lande soos Australië, Brittanje, Nederland, Japan en ander uitgevoer.

"Die navorsing toon dat magnetiet suksesvol aangewend kan word om verskeie onsuiwerhede uit water te verwyder. Die belangrikste is kleur, troebelheid, fosfate, swaarmetale, bakterieë, virusse, chemiese suurstofbehoefte, yster, mangaan, aluminium en ander kontaminante. Daar is ook al volskaalse watersuiweringsaanlegte gebou wat op die magnetietsuiweringsproses berus. Een hiervan is as die **Sirofloc proses** gepatenteer."

Volgens die navorsers word daar jaarliks groot hoeveelhede magnetiet as byproduk by verskeie myne in Suid-Afrika geproduseer, waarvan slegs 'n klein gedeelte kommersieel benut word.

"Die benutting van magnetiet vir watersuiweringsprosesse kan dus voordelig wees vir beide die watersuiweringsbedryf en die magnetietprodusente in Suid-Afrika."

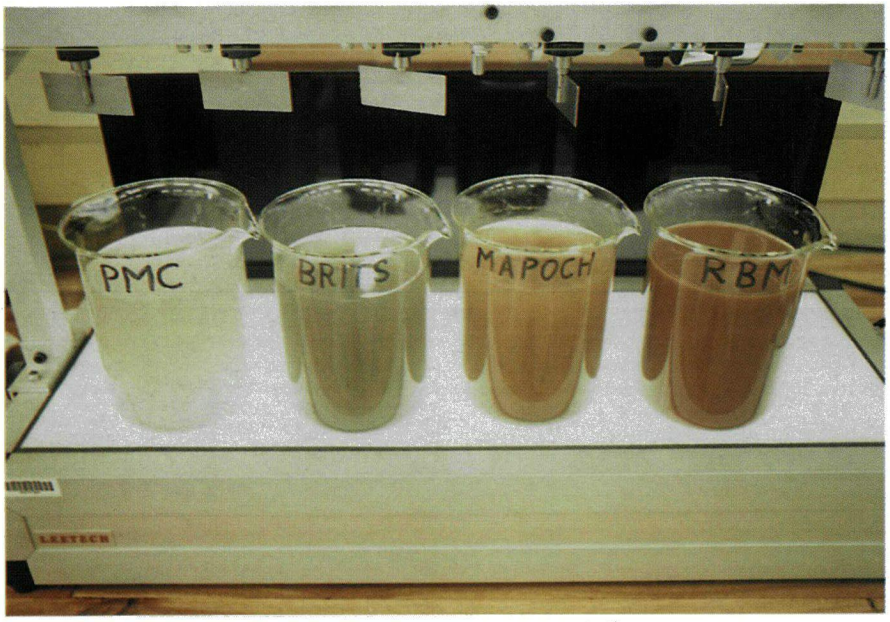
'n Verslag waarin die vernaamste resultate van die projek opgesom word, is onlangs deur die Waternavorsingskommissie vrygestel. Kopieë van die verslag getiteld **Magnetiet as vlokmiddel in watersuiweringsprosesse** (WNK verslag 473/1/93) is gratis verkrygbaar vanaf die Waternavorsingskommissie, Posbus 824, Pretoria 0001.

Magnetiet is 'n mineraal wat in verpoeierde vorm as 'n relatief inerte herbruikbare adsorbeer- en flokkuleermiddel in watersuiweringsprosesse benut kan word. Die elektrostatiese lading op magnetiet kan sodanig gemanipuleer word dat dit as destabiliseerder gebruik kan word van kolloïdale partikels en ione wat teenoorgestelde ladings as die magnetiet dra. Verder dien die magnetiet as kern vir vlokvorming en chemiese presipitasie.

Weens die magnetiseerbaarheid en demagnetiseerbaarheid van magnetiet kan dit in gedemagnetiseerde vorm in water gesuspendeer word totdat destabilisasie en uitvlokking van onsuiwerhede voltooi is. Die magnetiet word daarna gemagnetiseer sodat individuele partikels magnetie aan mekaar vaskleef en swaar vlokke vorm wat meer as tienvoudig vinniger besink as vlokke wat met konvensionele koagulasie en flokkulasie gevorm is.

Baanbrekerswerk vir die gebruik van magnetiet in watersuiweringsprosesse word in Australië gedoen. Die toepassings wat hieruit gevolg het, het reeds gelei tot die bou van volskaalse watersuiweringsaanlegte in sowel Australië as Brittanje. Ander ontwikkelings in Japan en Nederland het gelei tot die gebruik van magnetiet vir swaarmetaal- en fosfaatverwydering uit water.

Die verslag sê, sover bekend, word magnetiet nie as adsorbeer- en vlokmiddel vir watersuiwering in Suid-Afrika benut nie, en dit terwyl Suid-Afrika 'n oormaat magnetiet beskikbaar het. Navorsing was dus



Magnetiet se eerste waswater uitskot.

F W BECKER
W A PRETORIUS

MAGNETIET AS VLOKMIDDEL IN WATERSUIWERINGSPROSESSE

Verslag aan die
WATERNAVORSINGSKOMMISSIE
deur die
DEPARTEMENT CHEMIESE- EN OMGEWINGSINGENIEURSWESE
UNIVERSITEIT VAN PRETORIA

WNK Verslag No 473/1/93

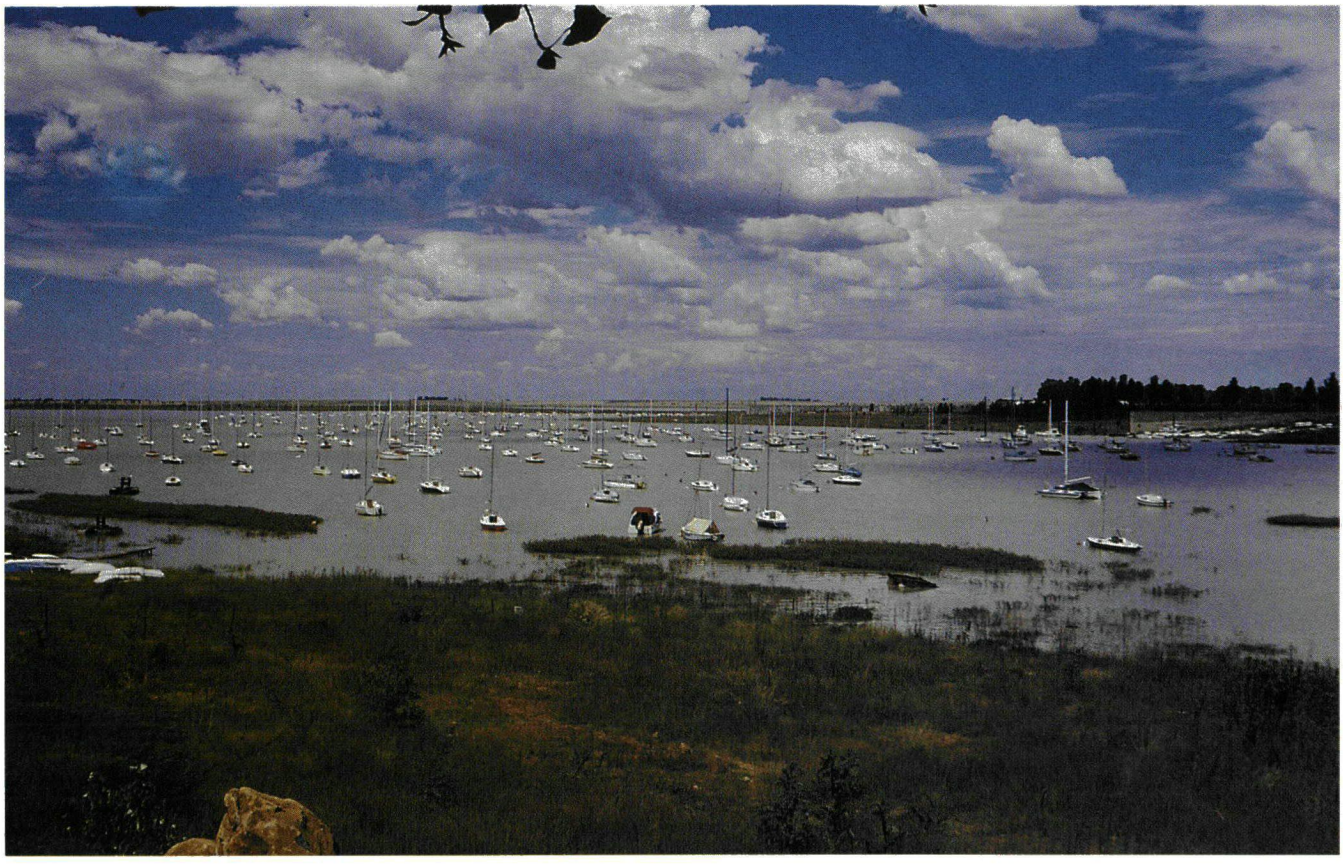
nodig om die toepaslikheid van hierdie tegnologie in Suid-Afrika aan te spreek.

VERSLAG

Die navorsingsverslag wat deur die Waternavorsingskommissie versprei word, bied die volgende:

- 'n Literatuurstudie waarin die eienskappe van magnetiet, 'n beskrywing van die Sirofloc proses, ander gebruike van magnetiet in watersuiwering en die voorkoms van magnetiet in Suid-Afrika aangespreek word.
- Karakterisering van magnetiet wat van verskillende bronne in Suid-Afrika afkomstig is.
- 'n Beskrywing van die voorbereiding van magnetiet voordat dit vir watersuiwering aangewend kan word.
- Die veldsterktes en toerusting benodig vir die demagnetisering van magnetiet.
- 'n Spektrum van die magnetietproses se vermengingsvereistes in terme van snelheidsgradiënte.
- 'n Onderlinge vergelyking van die watersuiweringsvermoë van magnetiet wat van verskillende mynbougebiede afkomstig is.
- 'n Uiteensetting van laboratorium bekertoetsprosedures ingevolge waarvan die magnetietproses eksperimenteel evalueer kan word.
- 'n Demonstrasie van die geskiktheid van Suid-Afrikaanse magnetiet, veral die Phalaborwa magnetiet, vir gebruik in watersuiweringsprosesse.
- Aanbevelings vir verdere navorsing.

Paneel van individuele roerders. (Roerspoed is individueel verstelbaar. Roerspoedinstelling is m.b.v. 'n elektroniese tachometer gedoen).



Soil-buffering of rain-water salinity in the Vaal Dam catchment

The Water Research Commission has published a report presenting the results of a one-year study to assess the way in which the soils of the Vaal Dam catchment react to so-called atmospheric acid deposition.

The deposition consists mainly of additions of sulphate and other solutes from the atmosphere to the soil and modifies the salt load in runoff from the catchment.

According to the report the objectives of the study were to:

- collect and investigate the sulphate retention capacity of representative soils in the Vaal Dam catchment;
- compare the soils with soils elsewhere to find out whether sulphate enrichment from atmospheric additions may have taken place; and
- explore the possibility of describing the salt flux through the soil mantle of the catchment by means of computer models.

The researchers, MV Fey and SA Guy, from the Department of Agronomy at the University of Natal, say in the report that all these objectives have been met, although the modelling work was curtailed when it was discovered that the scope for chemical (as opposed to purely physical) prediction of solute movement is limited unless new subroutines are written into the models.

The study began with the computer processing of information on land types of the area, obtained from existing maps and memoirs. This allowed the areal extent of each soil series occurring within the catchment to be calculated. Soil series were then grouped into a small number of *ad hoc* classes based on profile morphology, texture and other properties. A manageable number of representative soils (19 profiles) was then sampled in the field and characterised physically and chemically in the laboratory.

The soils were subsequently investigated in detail with respect to their sulphate retention characteristics by contacting them with sulphate-containing solutions (dilute sulphuric acid or neutral salts) in different ways: as saturated pastes, as dilute suspensions, or by leaching through columns. Chemical composition data from rainfall monitoring stations in the catchment were used as a basis for deciding on appropriate concentrations of the equilibrating solutions.

According to the report it was found that the saturated paste data were of little value in estimating sulphate sorption because the narrow soil:solution ratio would have required unrealistically large sulphate concentrations for the estimation of sorption capacity. Sulphate retention capacity was therefore determined initially using data from dilute suspensions (equilibration of 4 g soil with 200 ml of a solution containing about 6 mg per litre sulphate). This wide soil:solution ratio is equivalent to 50 years of rainfall (1 000 mm per annum) reacting all at once with a one metre thick soil mantle.

The sulphate retention capacity of most of the soils could not be determined accurately by this method because of low sorptivity and the simultaneous desorption of significant concentrations of sulphate already present in the soil. Furthermore, many of the soils treated in this way were prone to strong clay dispersion and the supernatants proved impossible to clarify sufficiently for analysis of sulphate by ion liquid chromatography.

However, after having accurately estimated sulphate sorption capacity of the most sorptive soil by the suspension equilibration method described earlier, the report says it was possible to rank all of the soils on a relative scale by measuring their retention behaviour with the much more sensitive leaching column method, which also proved to be free of the clay dispersion problem. This measurement consisted of counting the number of pore volumes of leachate required before the breakthrough of sulphate occurred (as measured by an upturn in electrical conductivity which had been correlated with sulphate concentration) from an influent sulphuric acid solution containing 12 mg per litre sulphate. The sulphate retention characteristics of all the soils was thus estimated and then related to land type data (broad classes of soils and their depths) so that a relative index of sulphate retention could be calculated for each of the subcatchments. This index will be valuable in monitoring the historical and future trends in the Vaal Dam water quality by

Atmospheric acid deposition could play a role in modifying the Vaal River's salt load

comparing it with the runoff composition in each of the monitored subcatchments.

According to the report the soils of the catchment show some signs of having possibly been influenced already by the enhanced atmospheric additions of sulphate which characterise the eastern Transvaal Highveld, in that they contain twice as much sulphate, relative to total dissolved solids in the saturation extract, as a comparable set of soils from southern Natal. A more systematic and extensive sampling will be needed, however, the report says, to ascertain whether this trend is not confounded by a maritime influence.

SULPHATE RETENTION

The report says the overall capacity of the catchment soils to retain sulphate, and thus limit the translation of atmospheric additions into an increment of salts in the drainage, is small.

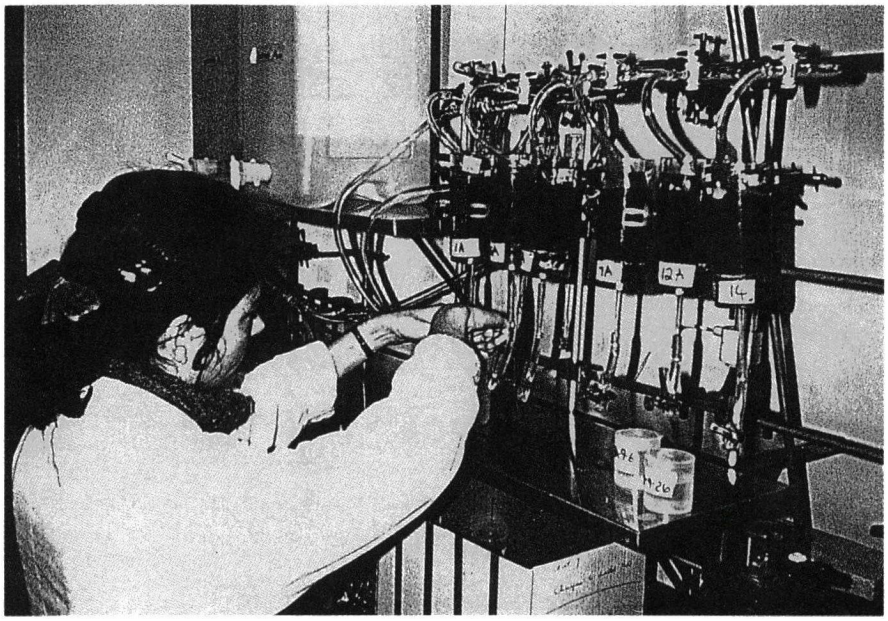
Most of the soils studied had a negligible capacity to retain sulphate. As much as two-thirds of the catchment consists of soils having less than 40 per cent of the maximum retention capacity for any one catchment (nominally about 11 g per m^2 in Wilge 1 catchment), while only about one-sixth of the catchment's area is taken up by subcatchments with a significant capacity to retain sulphate. These subcatchments are the wettest, however, and will consequently make a disproportionate contribution to water quality in the dam.

Soil acidity, and especially the acid saturation of the exchangeable cation suite, appears to relate strongly to sulphate sorption capacity. This commonly measured property may prove to be an effective means of extrapolating the results of this study to other areas in South Africa, although the relationship needs to be tested against a larger number of soils because the relationship could be confounded by the fact that sulphate may accumulate in less weathered soils as soluble salts, simply on account of a lower degree of leaching.

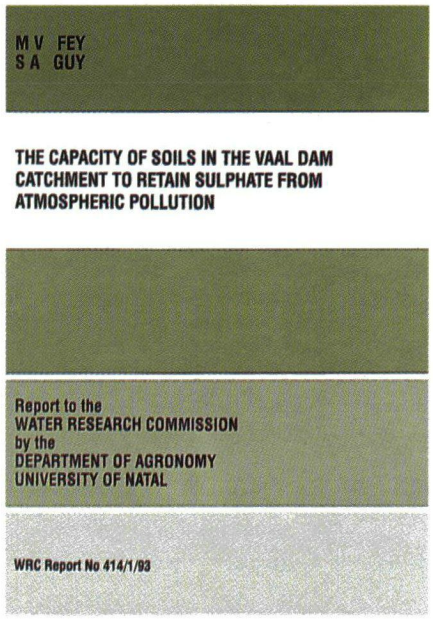
The report says the prognosis made by previous researchers regarding drainage water salinisation resulting from atmospheric additions of sulphate to soils of the catchment, warrants discussion in the light of these new results.

On the one hand, it seems clear that sulphate retention by the soil mantle is insufficient to invalidate the assumption of mass equivalence between sulphate input from the atmosphere and total dissolved solids output in the drainage water. On the other hand, after considering the data pertaining to water-soluble salts, it is difficult to anticipate a degree of atmospherically induced salinisation, even in the longer term, which would be detectable above the natural background concentration of salts being released by normal leaching processes. This suggest that factors such as climatic variation, which will alter - both seasonally and over longer periods - the degree of dilution of the natural salt flux in the catchment, may have a greater impact on the water quality changes than will air pollution.

The report says the question which remains to be answered, however, is whether the soluble salt (and sulphate) concentrations in the Vaal Dam catchment soils are indeed of natural origin, or whether their almost twofold greater magnitude, on average, than that of the southern Natal soils is a legacy of increased anthropogenic impact over the past few decades. A new research programme initiated by ESKOM is examining the geographic distribution of soluble salts and sulphate in South African soils. Hopefully this will shed some light on the matter.



Soil columns connected to manifold leading from constant head reservoir of leaching solution. This method was used to estimate the sulpahte retention characteristics of Vaal Dam catchment soils.



Copies of the report entitled The capacity of soils in the Vaal Dam catchment to retain sulphate from atmospheric pollution (WRC report 414/1/93) are available on request from the Water Research Commission, PO Box 824, Pretoria 0001. (Overseas price: $20).

SOUTH AFRICAN WATER INFORMATION CENTRE

The development of InfoAccess, Worldnet Gateway and the WATERLIT CD-ROM has resulted in many users from the academic and research communities, who have the necessary computer links at their disposal, conducting their own literature searches. Mrs Angela Rethman, manager of SAWIC, says that an interesting trend they have noticed at SAWIC is the increasing number of literature search requests from business and industrial concerns.

Users should please note that searches need not necessarily be limited to WATERLIT. A comprehensive range of scientific and business databases is available through SAWIC, together with the expertise to obtain the maximum benefit from these.

Another effective means of keeping up to date with the latest publication of scientific and technical developments, is to subscribe to an alerting service. Information required from technical, business and scientific articles is provided as a monthly set of references from a database profile. For more specific and detailed information, such as information on new products, competitors, news items on specific topics etc, a customised service can be designed. Please contact SAWIC for more details. (Tel: (012) 841-3083)

HELP US TO HELP YOU

SAWIC indexers scan a very wide range of more than 700 local and international journals, reports and conference proceedings, however, some items are bound to be missed or overlooked. Mrs Rethman says that conference proceedings in particular, are often difficult to obtain and it would be greatly appreciated if anyone who attends a relevant conference would loan a copy of the proceedings to SAWIC for about three weeks to enable the indexers to process the information. It would also be greatly appreciated if SA Waterbulletin readers/WATERLIT users would forward copies of any of their publications which are not currently indexed on the SAWIC data-base. SAWIC can provide a list of your publications already on WATERLIT on request.

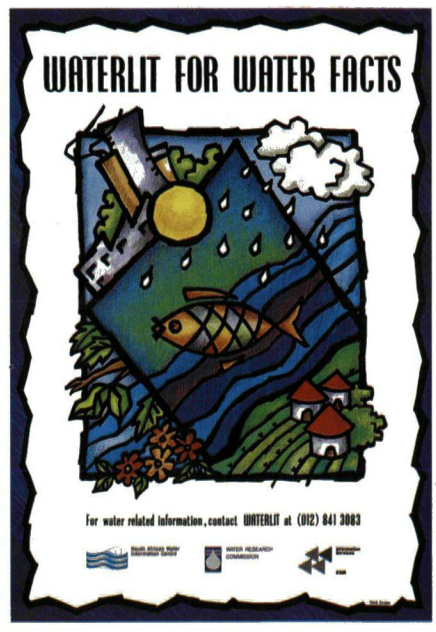
Feedback from users is vital in the building of an effective database. When all searches were carried out in-house it was a simple matter to monitor the types of information being requested. With the introduction of user access to the database we are dependant on communication with these users. Some users are very helpful in this respect, however, more comments and suggestions would be greatly appreciated. By acknowledging WATERLIT in your publications you will also help to bring the database to the attention of potential users.

STUDENT TRAINING

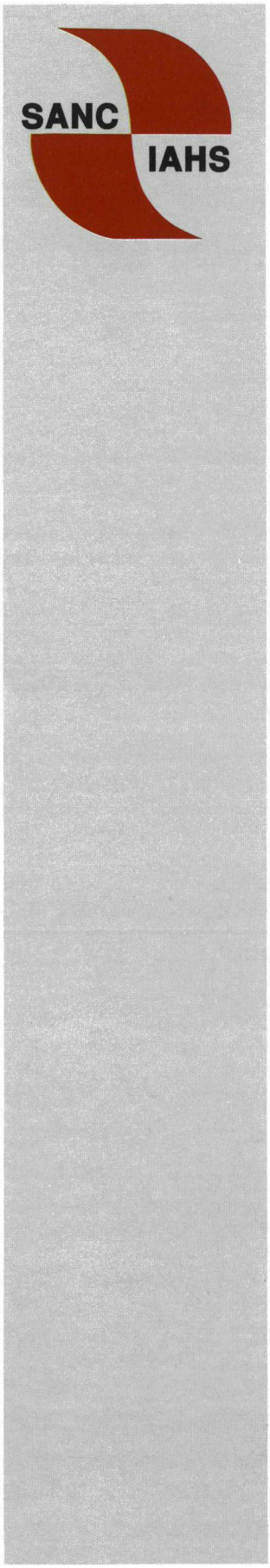
SAWIC staff are always available to discuss information services with individuals or groups. Pretoria University and the University of the Witwatersrand are two organisations which realise the value of these services and arrange for annual presentations to their students in water-related engineering courses. An understanding of the value of efficient literature searches can save students a great deal of time and lead to a higher standard of research reports and assignments. As many of the universities now have the WATERLIT CD-ROM available for their students, it is important that the principles of searching the database are explained clearly to them so that they are able to use this resource effectively.

COURSE

CSIR Information Services is planning to present a course on Sources of Water Information. The course will give an overview of the main sources of water information, including printed publications, online and CD-ROM databases, organisational sources and databanks available in Southern Africa. Topics covered by these sources, accessibility and the costs involved in each will be discussed. Online searching through the Worldnet Gateway will be covered in more detail. Various sources will be available for hands-on practise. A minimum of 8 people is required for each course. Possible dates for the courses are 17 May and 9 August. For more information, please contact Wendy Hartmann. Tel: (012) 841 4728. Fax: (012) 86 2869.



This poster is available free of charge from SAWIC, PO Box 395, Pretoria, 0001.



International Association of Hydrological Sciences:

SCIENTIFIC COMMISSIONS & COMMITTEES

The following news item has been received from the Sanciahs secretary, Mr Hugo Maaren.

In the September issue of the IAHS Newsletter reports were published of almost all the meetings held during the Assembly in Yokohama. However, reports presented by IAHS Commissions and Committees were not included. A short summary of these reports is therefore given here.

ICSW

The Surface Water Commission co-sponsored the MAB/IHP Workshop on Groundwater/ Surface Water Ecotones, Lyon, France (July 1993) and the FRIEND Conference in Braunschweig, Germany (October 1993). Future meetings that will be co-sponsored are: IHP/ UNESCO Symposium East-West, North-South Encounters on the State of the Art in River Engineering Methods and Design Philosophies (St Petersburg, Russia, May 1994). ICSW is responsible for IAHS involvement with the International Decade for Natural Disaster Reduction, but for the time being no special working group has been formed. A joint Commission will be set up on Crater Lakes. ICSW is further involved in the WCP-Water project A.1. A rapporteur is dealing with the subject of reconstructing climate and related hydrological issues for the Maunder Minimum Period (1675-1715). The Commission publishes a Newsletter that is distributed to the National Commission Correspondents.

ICGW

Since the last Assembly, the Groundwater Commission has been involved in quite a number of meetings as a co-organizer or as a co-sponsor. For instance: Symposium on in situ Bioremediation, Niagara-on-the-Lake, Canada (September 1992); Conference on Application of GIS in Hydrology and Water Resources Management, Vienna, Austria (April 1993) and the Conference on Groundwater Quality, Tallinn, Estonia (September 1993). Future meetings in which the Commission will be involved are: 2nd Conference on Groundwater Ecology, USA (April 1994); Conference on Future Groundwater Resources at Risk, Helsinki, Finland (June 1994); Symposium on Assessing and Managing Health Risks from Drinking Water Contamination, Rome, Italy (September, 1994); Conference on Groundwater Quality: Remidiation and Protection, Prague, Czech Republic (May 1995), and finally, jointly with the GIS Division of ICRSDT, the Conference on the Application of GIS in Hydrology and Water Resources, Vienna, Austria (April 1996). The Groundwater Commission was involved in the preparation of IHP-V of UNESCO and it has a liaison function for IAHS with the International Association of Hydrogeologists and the International Association for Hydraulic Research (IAHR).

ICCE

The following meetings were sponsored by the Commission on Continental Erosion: Symposium on Erosion, Debris Flows and Environment in Mountain Regions, Chengdu, China (July 1992); Symposium on Erosion and Sediment Transport Monitoring Programmes in River Basins, Oslo, Norway (August 1992). Future meetings sponsored by this Commission are: Variability in Stream Erosion and Sediment Transport, Canberra, Australia (December 1994) and, jointly with ICT, the Symposium on Tracers in Arid Zone Hydrology, Vienna (November 1994).

ICCE is representing IAHS on the International Coordinating Committee on Reservoir Sedimentation (ICCORES); other participants in this programme are IAHR, the International Association on Water

Quality, the International Commission on Large Dams and the International Research and Training Centre for Erosion and Sedimentation.

ICSI

The most important task of the Snow and Ice Commission was the participation in a number of international programmes such as the IGBP, IHP-IV and WCP-Water. The ICSI Working Group on Snow Chemistry was active in analysing the present state of its research field and published a monograph on it. Two new ICSI Working Groups were established, one on "Snow Ecology" driven by biology with snow physicists and chemists as members, and the other on "Snow Atmosphere Chemical Exchange". Another study made by this commission was on: mass balance measurements of glaciers. The World Glacier Monitoring Service, which is directed by ICSI started a series of bulletins on worldwide glacier mass balance measurements.

One of the contributions of ICSI to the IHP is the World Atlas of Snow and Ice Resources which is expected to be published in 1994 or 1995. Another IHP project is: snow and ice hydrology in specific areas and regions with special attention to long-term variations in water storage. Special attention is being given to Central Asia. At present ICSI is preparing for its 100th anniversary in 1994!

ICWQ

A main past activity of the Water Quality Commission was its contribution to the Hydrochemistry 1993 Symposium, in Rostov-on-Don, Russia (May 1993). The symposium was a contribution to IHP-IV project H3.2. Planned activities are the sponsoring and some aid in organizing a Symposium on Particulate Matter in Rivers and Estuaries (Reinbeck, Germany, March 1994) and a Symposium on Time-scales of Human Loading Quality Response of Large Water Bodies (Linkoping, Sweden, autumn 1994). ICWQ is also supporting the Symposium on Urban Water Quality Management in Poland (June 1996). Michel Meybeck, the President of ICWQ, is working on a Benchmark publication on water quality.

ICWRS

The Water Resources Systems Commission sponsored the following meetings: Symposium on Stochastic and Statistical Methods in Hydrology and Environmental Engineering (in memoriam to Prof. Unny), Waterloo, Canada (June 1993); Workshop on Expert Systems in Water Resources, Bologna, Italy (June 1993); International Conference on Environmentally Sound Water Resources Utilization (organized by the Asian Institute of Technology and the International Water Resources Association (IWRA), Bangkok, Thailand (November 1993). The following meetings will be sponsored: IHP meeting on Risk and Sustainable Water Development, Karlsruhe, Germany (June 1994); the International Conference on Integrated Water Resources Management, Amsterdam, The Netherlands (September 1994); Conference on Sustainable River Development, Wallingford, UK (September 1994); International Symposium on Environmental and Socio-economic Consequences of the Development of Water Projects, Moscow, Russia (1994).

It has also been decided to hold a joint session "Water Resources Management under Increasing Uncertainty" with IWRA in Cairo (1994).

A suggestion has been made to set up a Working Group on Re-assessment of Reservoirs as a Means of Sustainable Development. The funding and implementation of the group will be considered and a decision will be taken at the Boulder Assembly.

The Commission publishes a Newsletter for distribution to the National Commission Correspondents.

ICRSDT

The Remote Sensing and Data Transmission Committee co-sponsored the Workshop on Snowmelt Runoff Modelling, Berne, Switzerland (June 1992), and made a large contribution to the Hydro-GIS'93 Conference in Vienna (1993), which has already been mentioned under ICGW activities. The Committee was represented at the COSPAR meeting in Washington (September, 1992).

Planning is underway for a Seminar on Application of Remote Sensing Techniques to Hydrology in Developing Countries; locations under consideration are Brazil, Thailand and Kenya.

Thorkild Thomson has been appointed as the Chairman of ICRSDT's Remote Data Transmission Division and Ivan Johnson is Chairman of the GIS Division. Finally it must be mentioned that the ICRSDT Secretary publishes a Newsletter in the spring and fall of each year for distribution to the Commission Correspondents.

ICT

The Tracer Committee sponsored the 6th International Symposium on Water Tracing, Karlsruhe, Germany (September 1992) and the Symposium on Application of Isotopes Techniques in Studying Past and Current Environmental Changes in the Hydrosphere and Atmosphere, Vienna, Austria (April 1993).

The Committee will organize, jointly with the International Atomic Energy Agency, a Workshop on the Application of Tracer Methods in Arid Zone Hydrology, Vienna (August 1994) and a Symposium on Particulate Matter in Rivers and Estuaries, Hamburg, Germany (March 1994).

A questionnaire "Application of Tracers in Hydrology" was sent out to 800 persons. 26% responded of which two thirds are interested in active collaboration with ICT.

ICASVR

The Atmosphere-Soil-Vegetation Relations Committee is the lead organization for IHP-IV Project H1.1. The Committee has also close links with the IGBP/BAHC core project and with WMO-OHP. A publication was issued on ICASVR-related activities (June 1992).

A ICASVR/IHP meeting was convened in Toulouse in conjunction with the IGBP/BAHC scientific conference (November 1992). A book is planned on Land-surface Processes on the Development and Use of SVAT (Soil Vegetation-Atmosphere-Transport) Models.

ICASVR is sponsoring a Workshop on Scale Issues in Hydrological and Environmental Modelling, Robertson, Australia (December 1993).

CALL FOR PAPERS

APPROPRIATE OPERATING TECHNOLOGY FOR SEWAGE TREATMENT UNDER AFRICAN CONDITIONS

The Nutrient Removal Division of WISA will hold a one-day mini-symposium on 8 June 1994 in conjunction with the International African Water Technology Exhibition and Conference at Nasrec, Johannesburg. (See page 2 of this Bulletin.)

The symposium will address such facets of sewage treatment as low cost sanitation, design and operation of sewage treatment systems, contract operation, equipment and package plants.

If you would like to contribute a paper, please send an abstract to:

Dr SA Mitchell
Water Research Commission
Fax (012) 331-2565.

Closing date for abstracts is
1 April 1994.

Abstracts will be reviewed by the Executive Committee, and those considered most appropriate will be selected.

Leather research institute honours Hart

A new wastewater treatment pilot plant built with a R1,27 million grant from the Water Research Commission at LIRI Technologies in Grahamstown, will be named after one of the WRC's research managers, Dr OO Hart.

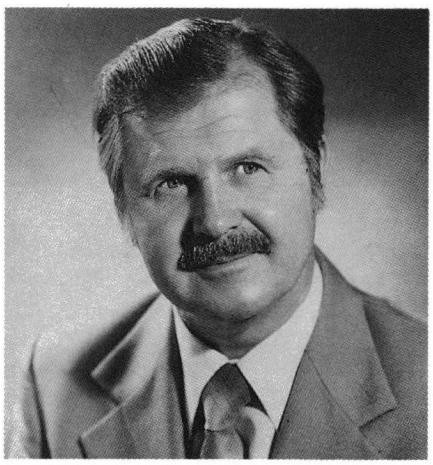
According to the Director of LIRI, Professor Peter Rose, the new plant will be known as the Oliver Hart Environmental Research Unit in recognition of Dr Hart's longstanding service to LIRI and the tanning industry.

Construction of the plant is expected to be complete by June this year.

New technology under development at LIRI for tannery waste water treatment will be evaluated, including the study of the effects of recycled chromium and treated water on high quality leather production.

Professor Rose says the research programme will aim at closing the technology gap to complete a "closed cycle production objective" for tanneries, enabling them to meet impending environmental compliance standards for international marketing.

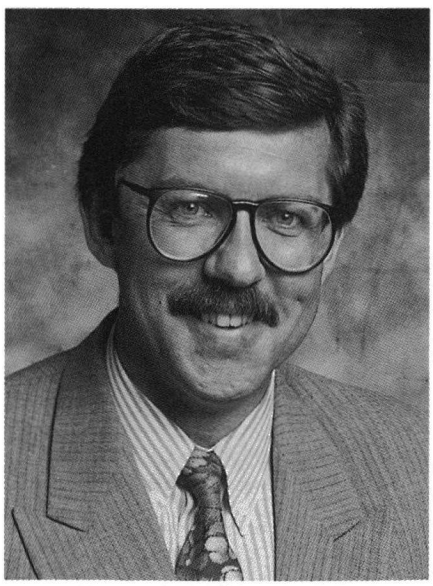
Apart from urgently needed research in this area, the Unit will be able to undertake development work to evaluate treatment and process methods prior to implementing costly projects.



Dr Oliver Hart, Research Manager at the Water Research Commission.

The facility will also be used for the training of waste water treatment plant operators and waste management personnel working in the leather industry. Correspondence and contact block-release courses will be offered in these fields, covering the theory as well as the practical and analytical aspects required.

Research issues will include water recovery and recycling for process use, chrome recovery, desalination, sludge dewatering and composting, tertiary treatment by high rate biofiltration and algal



Professor TE Cloete, UP.

CLOETE HEADS UP'S DEPT OF MICROBIOLOGY AND PLANT PATHOLOGY

Professor TE Cloete has been appointed as the Head of the Department of Microbiology and Plant Pathology at the University of Pretoria, as from 1 January 1994.

Professor Cloete is the former president of the SA Industrial Water Association and recipient of the SA Industrial Water Association's Award for research (1991) and also received the SA Corrosion Institute award for research on microbiologically influenced corrosion in 1993. Currently he is co-ordinating a group of international scientists on behalf of the International Association on Water Quality, in order to compile a scientific and technical report on biological wastewater treatment. Professor Cloete is also a member of various national and international scientific societies and serves on a number of international scientific committees.

processes for low cost effluent treatment.

Design

While the unit has the versatility to cover a wide range of options the basic design caters for the primary segregation of waste waters into three main streams, namely:

- The alkaline lime/sulphide liquors,
- The acidic chrome liquors and
- The remaining liquors on discharge from the drums. All the exhaust liquors are screened to remove coarse solids prior to discharge into separate collection sumps.

Professor Rose says the dewatering and disposal of tannery sludges have been a long-standing problem. Disposal options will be studied, including a range of treatments such as composting and soil conditioning.

"Strenuous efforts are needed to develop alternatives to the disposal of chemical sludges to landfill - a route with a very limited future in coming years," he said.

Desalination of tannery effluents i to be investigated at various stages of water treatment to determine its feasibility and economic advantages. The resulting brine will be assessed for algal ponding, while desalinated waste water will be used for leather production.

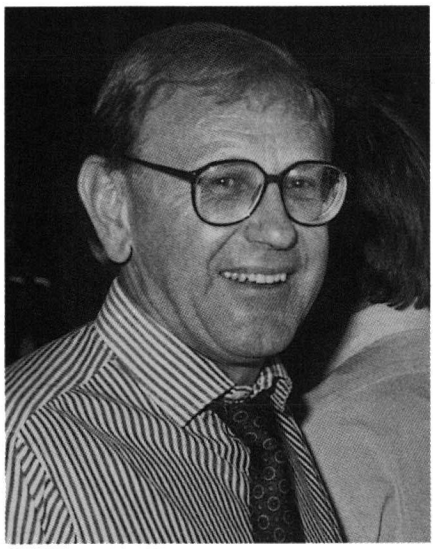
SOIL LOSS EQUATION REVISED

The well-known American modelling tool, the universal soil loss equation, has been revised by the US Department of Agriculture.

According to Water Newsletter (16893) the soil loss equation, first published in 1959, considers rainfall and runoff, soil erodibility, land slope, vegetation and landowner practices to predict average annual erosion.

The new version will use more specific data for rainfall, freezing and thawing, surface roughness, crop residue cover and decomposition as well as soil moisture.

Schulze promotes SA hydrological research overseas



Professor Roland Schulze of the Department of Agricultural Engineering at the University of Natal.

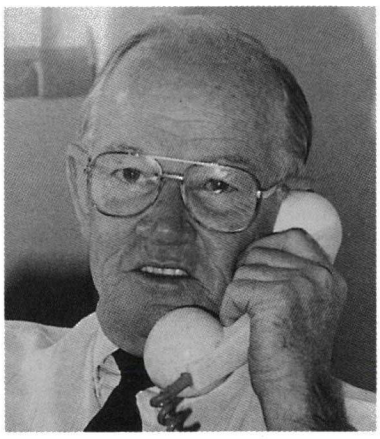
Roland Schulze, Professor of Hydrology in the Department of Agricultural Engineering at the University of Natal in Pietermaritzburg, spent the second half of 1993 on sabbatical. He was based in Germany for several months where, as one of the project leaders of the International Working Group on Hydrological Modelling, he undertook research on hydrological simulation with the ACRU model, which now operates at Bonn University. During his stay in Bonn he was one of the invited speakers and chairmen at a NATO Advanced Research Workshop on "Climate change and world food security". Later in the year he presented a paper in Bratislava/Slovakia to the Focus 4 working group on Biospheric Aspects of the Hydrological Cycle, which is one of the core projects of the International Geosphere-Biosphere Programme. In November/December he visited Australia, where he attended the International Forest Hydrology Symposium in Canberra and a conference on Scale Issues in Hydrological and Environmental Modelling, at both of which he presented work on research he and the hydrology research team in the Department of Agricultural Engineering have undertaken. He also lectured at the Universities of Melbourne and New South Wales.

STUDENTS

Professor Schulze says the hydrological research group at the University of Natal attracts a steady stream (no hydrological pun intended! he adds) of overseas graduate students who undertake collaborative research in the Department of Agricultural Engineering.

"Greg Kiker, a Fulbright scholar from the University of Florida, recently left again for the USA, after successfully `hybridising' the CERES and ACRU modelling systems for use in agriculturally related global climate change studies." Currently Mark New, a PhD student from Cambridge, is working with Professor Schulze for 15 months on climate change impacts in hydrology and Silke Knust from Münster University in Germany is working with Dr Stefan Kienzle on erosion/ sediment yield modelling with GIS.

MET PENSIOEN



Mnr Johan du Preez het die einde van Februarie, na bykans 46 jaar in die Staatsdiens, by die Waternavorsingskommissie met pensioen afgetree. Namens die WNK wens ons mnr du Preez 'n aangename en voorspoedige rustyd toe.

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 koördinering van watergebeurtenisse in Suid-Afrika.

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

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

Gids:

- ○ Een SA Watergeleentheid vir hierdie dae.
- □ 'n Tweede SA Watergeleentheid gereël vir dié datums.
- ✗ 'n Derde SA Watergeleentheid gereël vir dié datums.

Sien Konferensies- en Simposiumbladsy vir aangeduide geleenthede.

1994

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SOUTHERN AFRICA 1994

WATER QUALITY

APRIL 12 - 13

A workshop with the theme "Practical application of water quality management" will be held at the Port Elizabeth Technikon.
Enquiries: Dr Ansie de Kock, Chemistry Department, Port Elizabeth Technikon, Private Bag X6011, Port Elizabeth 6000. Tel: (041) 504 3526/3281. Fax: (041) 504 3422.

WATER TECHNOLOGY

JUNE 6 - 9

The 1994 international African water technology exhibition and conference, Afriwater, will be held at the National Exhibition Centre, Johannesburg.
Enquiries: Natalie Sanders, McNaughton Victor CC, PO Box 31368, Braamfontein 2017. Tel (011) 643-4824/8 Fax (011) 642-9860.

SASAQS

JULY 13 - 15

The annual conference of the Southern African Society of Aquatic Scientists will be held at the SAB Institute for Coastal Research at the University of Port Elizabeth.
Enquiries: Dr Eileen E Campbell, Congress Secretariat, Botany Department, University of Port Elizabeth, PO Box 1600. Port Elizabeth 6000. Tel (041) 504-2329. Fax (041) 53-2317.

WATER ENGINEERING

JULY 14 - 15

A symposium entitled "50 years of water engineering in South Africa (a tribute to Prof Des Midgley)" will be held at the University of the Witwatersrand, Johannesburg.
Enquiries: Ms C Bernard, c/o Dr SJ van Vuuren, BKS Inc, PO Box 3173, Pretoria 0001. Tel (012) 209911 Fax (012) 20 9220.

CORROSION CONTROL

AUGUST 29 - 31

The sixth international corrosion conference entitled "Cost effective corrosion control into the 21st century" will be held at the Elangeni Hotel in Durban.
Enquiries: SA Corrosion Institute, PO Box 77, WITS 2050. Tel (011) 802-5145 Fax: (011) 804-3484.

WASTECON '94

SEPTEMBER 27 - 29

A conference on waste management will be held in Somerset West, Western Cape.
Enquiries: WASTECON '94, PO Box 1303, Cape Town 8000. Tel (021) 400 2423 Fax (021) 25 3848.

ENVIRONMENTAL MANAGEMENT

OCTOBER 18 - 21

The 2nd Southern African international conference on environmental management will be held at Victoria Falls in Zimbabwe.
Enquiries: SAICEM 2 Secretariat, c/o PO Box BW 294, Borrowdale, Harare, Zimbabwe. Tel (263) 4 739 822. Fax (263) 4739 820.

ICOLD

NOVEMBER 1 - 5

The 62nd executive meeting of ICOLD will be held at the Elangeni Hotel in Durban.
Enquiries: Mrs Ginny Eslick, ICOLD 1994 Organising Committee, PO Stamford Hill, 4025 Durban. Tel (031) 233 494 Fax (031) 232 405.

ICOLD

NOVEMBER 6 - 11

The 18th ICOLD congress will be held at the Durban Exhibition and Conference Centre.
Enquiries: Mrs Ginny Eslick, ICOLD 1994 Organising Committee, PO Stamford Hill, 4025 Durban. Tel (031) 233 494 Fax (031) 232 405.

ANALYTICA '94

DECEMBER

The second national symposium on analytical science will be held early in December 1994 in the Western Cape. Theme: "Toward the Welfare of Man and his Environment".
Enquiries: Dr IM Moodie, ANALYTICA '94, c/o PO Box 19070, Tygerberg 7505. Fax (021) 932-4575.

1995

RIVER MANAGEMENT

MAY 14 - 19 1995

The IAWQ conference on river basin management will be held in the Kruger National Park.
Enquiries: Dr Ben van Vliet, Watertech, CSIR. Tel (012) 841-2237 Fax (012) 841-4785.

HYDROLOGY

SEPTEMBER 4 - 6

The 7th national southern African hydrological symposium will be held in Grahamstown.
Enquiries: Prof Denis Hughes, Institute for Water Research, Rhodes University, Grahamstown 6140. Tel (0461) 24014 Fax (0461) 25049. E-mail: Denis @ iwr.ru.ac.za.

IWSA

SEPTEMBER 9 - 15

The 20th biennial congress and exhibition of IWSA will be held in Durban.
Enquiries: Mrs Ginny Eslick, Congress International, 18 Rapson Road, Morningside, Durban 4001. Tel (031) 233 494. Fax (031) 232 405.

OVERSEAS 1994

INDUSTRIAL WASTE

MAY 9 - 11

The 49th annual Purdue University Industrial Waste Conference will be held at the University in Indiana, USA.
Enquiries: Ms Cynthia S Dalton, Conference Secretary, School of Civil Engineering, Purdue University, 1284 Civil Engineering Building, West Lafayette, Indiana 47907-1284, USA. Tel (317) 494-2194 Fax (317) 496-1107.

WATER SUPPLY

MAY 15 - 20

An IWSA regional conference entitled Water Supply 2000 "Rehabilitation" will be held in ZHrich, Switzerland.
Enquiries: ZHrich Water Supply, Hardhof 9, PO Box CH-8023 ZHrich. Tel (*1) 435 2111 Fax (*1) 435 2557.

GROUNDWATER

MAY 23 -25

The 8th National Groundwater outdoor action conference and exposition will be held in Minneapolis, Minnesota, USA.
Enquiries: National Groundwater Ass. PO Box 182039, Dept. #017, Columbus, OH 43218-2039, USA. Tel (800) 551-7379 or (614) 761-1711 Fax (614) 761-3446.

WATER QUALITY

JUNE 6 - 10

A short course on "The design of water quality monitoring networks" will be held at the Colorado State University.
Enquiries: Thomas Sanders, Environmental Engineering, Dept of Civil Engineering, Colorado State University, Fort Collins, CO 80523. Fax (303) 491 7727. Tel (303) 491 5448.

DAM SAFETY

JUNE 6 - 17

An international dam safety, operation and maintenance seminar and study tour will be held in Denver, Colorado, USA.
Enquiries: American Water Foundation, PO Box 480632, Denver CO 80248-0632. USA. Tel (303) 628-5516. Fax: (303) 628-5469.

GROUNDWATER

JUNE 13 - 16

An international conference on future groundwater resources at risk will be held in Helsinki, Finland.
Enquiries: Ms Tuulikki Suokko, FGR 94, National Board of Waters and the Environment, PO Box 250, SF-00101 Helsinki, Finland. Fax: +358 0 4028 345.

WINERY WASTEWATERS

JUNE 20 - 24

An international specialised conference on winery wastewaters will be held in Narbonne, France.
Enquiries: Dr Rene Moletta, INRA, Boulevard du General De Gaulle, 11100 Narbonne, France. Fax: (33) 68 32 89 10.

NCP WASTE WATER DAY

NCP CA as supplier of Chlorine and Ferrichloride to waste water plants realises that there is continual development in your industry.

NCP CA thought it appropriate to invite experts in their various fields to share their knowledge with you on 11 May 1994.

PROVISIONAL PROGRAMME

09:00	Registration at NCP Club, Chloorkop, Kempton Park.
09:30	Welcome and NCP overview – Mr Philip Bromley-Gans (General Manager: NCP Chlor Alkali)
10:00	Current and prospective water standards – speaker to be announced
10:45	Refreshments
11:45	Critical aspects of phosphate removal – Mr Dries Louw (General Manager – Operations: ERWAT)
12:00	Topic and speaker to be announced
12:45	Effective wastewater disinfection – Prof At Pretorius (Division Water Utilisation Engineering, University of Pretoria)
13:30	Everybody is invited to attend an informal lunch which wll take the form of a braai.

For further information please contact Mrs Hannie Cronjé:
Tel (011) 921-3334 Fax (011) 976-4114

PALMER
DEVELOPMENT GROUP

WATER SUPPLY TO DEVELOPING URBAN COMMUNITIES IN SA – 3 IMPORTANT WORKSHOPS

As part of a Water Research Commission funded project on water supply to developing urban communities in South Africa, the Palmer Development Group will be holding three workshops for people responsible for providing, operating and maintaining water and sanitation systems (mainly engineers, planners, officials and those involved in the field of urban development).

The workshops will provide an opportunity for the research team to put across the findings regarding water provision, in particular:

- Access to an adequate water supply in South Africa and in each region;
- Evaluation of water supply options, including the various technologies which are in use, standards which are applied and methods of recovering costs;
- Proposals for action in order to improve the water supply situation;
- Recommending guidelines for providing water services.

The views of delegates at the workshop regarding key areas for action and guidelines will be considered an important contribution to the project.

The workshops are being sponsored by the Water Research Commission and there will be no charge for attendance. However, delegates will need to make their own travel arrangements and provide their own accommodation where necessary.

The venues cater for a maximum of 70 people only and applications will be admitted on a first come first served basis. The closing date for applications is 15 April 1994.

THE VENUES

Cape Town
St John's Hostel, Upper Kloof Street
20 May 1994
09:00 - 16:00

Johannesburg
Delta Environmental Centre, Victory Park
27 May 1994
09:00 - 16:00

Durban
Rob Roy Hotel,Hillcrest
3 June 1994
09:00 - 16:00

ENQUIRIES AND REGISTRATION

Frances Cullinan, Palmer Development Group
PO Box 53123, Kenilworth
7745 Cape Town
Tel (021) 797-3660 Fax (021) 797 3671.

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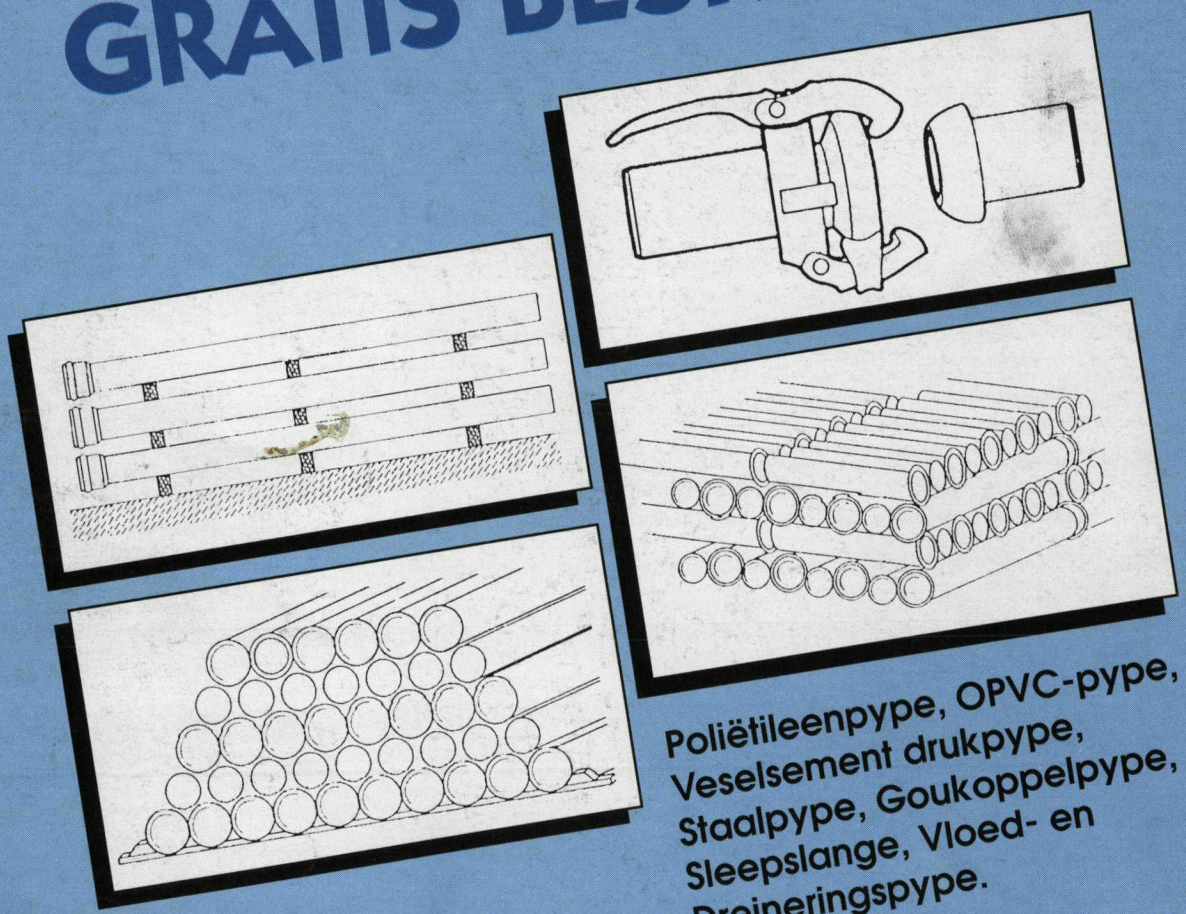

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- Watter pyp en grootte om te gebruik
- Waar en wanneer om pype te gebruik
- Hoe om die verskillende pype te gebruik

☐ Hierdie inligting en nog baie meer is nou saamgevat in 'n pyphandleiding.

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