

Irrigation research needs:

IRRIGATION IN DEVELOPING COUNTRIES

In contrast to initial expectations, irrigation in many developing countries in Africa does not at present offer a solution to the vagaries of climate or contribute effectively to self-sufficiency of food production.

This is the opinion of Mr J-C Legoupil of *IRAT* (Institute of Tropical Agronomic Research) in France, who presented a keynote address at the recent workshop on research requirements relating to social, economic, and ecological aspects of irrigation development, held in Pretoria under the auspices of the Co-ordinating Committee for Irrigation Research. It was the fifth and final workshop in the series on identifying irrigation research needs, the others having focussed on agronomic, soils, hydrological and engineering aspects, with the common aim of achieving maximum return per unit of water supplied for irrigation.

Because irrigation is relied upon to play an important part in developing certain Black rural areas in Southern Africa, and because of

the high cost of irrigation development and the scarcity of water in the whole region, Mr Legoupil's statement served as a warning that

the use of irrigation as an efficient tool for development still requires much thinking and research. Mr Legoupil, as head of *IRAT*'s research — development division, is responsible for overseas research and development relating to irrigation farming systems. He was therefore well-qualified to introduce the discussion of one important facet of this workshop, viz socio-economic factors which constrain efficient irrigation development, especially in lesser developed areas.

He pointed out that despite considerable initial investment and high running costs, irrigation projects encounter various problems — technical, management, training, agricultural policy, finance — which condemn them to

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Irrigation of citrus orchards in the Kat River Valley, Ciskei.

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Irrigation

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failure. In Africa each year more irrigated land is abandoned than developed.

Prof TJ Bembridge, Head of the Department of Agricultural Extension and Rural Development of the University of Fort Hare, based his agreement with Mr Legoupil on a survey of Third World irrigation projects, particularly in Africa. Regardless of the size of the schemes and with few exceptions, the economic success of these projects generally falls far short of expectations of planners, politicians and development agencies.

Although not many projects have been adequately analysed, Prof Bembridge pointed out that it is nevertheless possible to make certain generalisations about smallholder irrigation in Africa. Failure in general can be attributed to the lack of experience of farmers in irrigation techniques, inadequate briefing of farmers on the production potential of the project and a general lack of motivation. Dr CJ van Rooyen, Agricultural Economist of the Development Bank of Southern Africa, attributed failure, in a large measure, to "gigantism", haste and incompleteness of design of irrigation development projects, unrealistic and over optimistic assessment or appraisal of irrigation prospects, and insuffi-

cient attention to the economic settlement and participation of farmers.

Irrigation projects and developments nevertheless remain a necessity in many developing countries and an increase in food output can only be achieved by an increase in the number of irrigation projects.

"It is imperative, therefore, to define and promote a strategy for hydro-agricultural improvement schemes which encompasses not only the technical and economic aspects, but also the participation and training of farmers involved," Mr Legoupil said. He also expressed some ideas regarding factors which should be taken into consideration, based largely on brief visits he has made to examples of irrigation development projects in various of Southern Africa's Black States.

Traditional farming. Transition from the traditional dryland to an irrigated farming system is perhaps the major problem experienced in irrigation development. It necessitates a change in the lifestyle of the participants who have to move from a family orientated subsistence farming system to a more communal irrigation system. "It has to be fully appreciated that water is not simply an addition to an existing system, but that irrigation demands of the peasant farmer, suddenly inserted into a high productivity system, a complete change in outlook," Mr Legoupil said.

"The pace of adaptation is gradual, governed essentially by the speed at which the technical aspects of the project are mastered. This pace of change is often overestimated owing to insufficient knowledge of the factors responsible for changes at farm level," he continued.

Mr Legoupil stressed that it would be unrealistic to assume that irrigation schemes in developing areas would be economically self-supporting in the initial stages.

"The necessary subsidy will represent the social cost to stabilise the Black rural population. Without this social investment it seems difficult or impossible to prevent or to limit population migration from country to cities with political, economical and sociological consequences."

The traditional land tenure system is a further difficulty often ignored. Irrigation developers and planners should bear in mind the number of people who have to live in the specific area, the need for security of land tenure, aspirations and ability of individual farmers, and possible conflicts due to contrasting interests between the development agency and local authorities and project participants.

Clarity of objectives. According to Prof Bembridge a so-called "top down"-approach can be subjected to a great deal of criticism. When based largely on national and economic objectives only, the goals and needs of the farming popula-

Beter kriteria vir koringbesproeiing beoog

Die Waternavorsingskommissie het onlangs 'n kontrak gesluit met die Departement van Landbouweerkunde van die Universiteit van die Oranje-Vrystaat vir navorsing oor foutiewe gewasfaktore wat by die skedulering van koringbesproeiing gebruik word.

Navorsing vir die projek, wat op 1 Januarie 1985 begin het, sal oor 'n periode van 4 jaar strek en sal 'n aansienlike bydrae tot die doeltreffende aanwending van besproeiingswater maak.

Verdampingsmeterlesings — veral die Amerikaanse Klas A-pan — en ander verdampingsmaat-

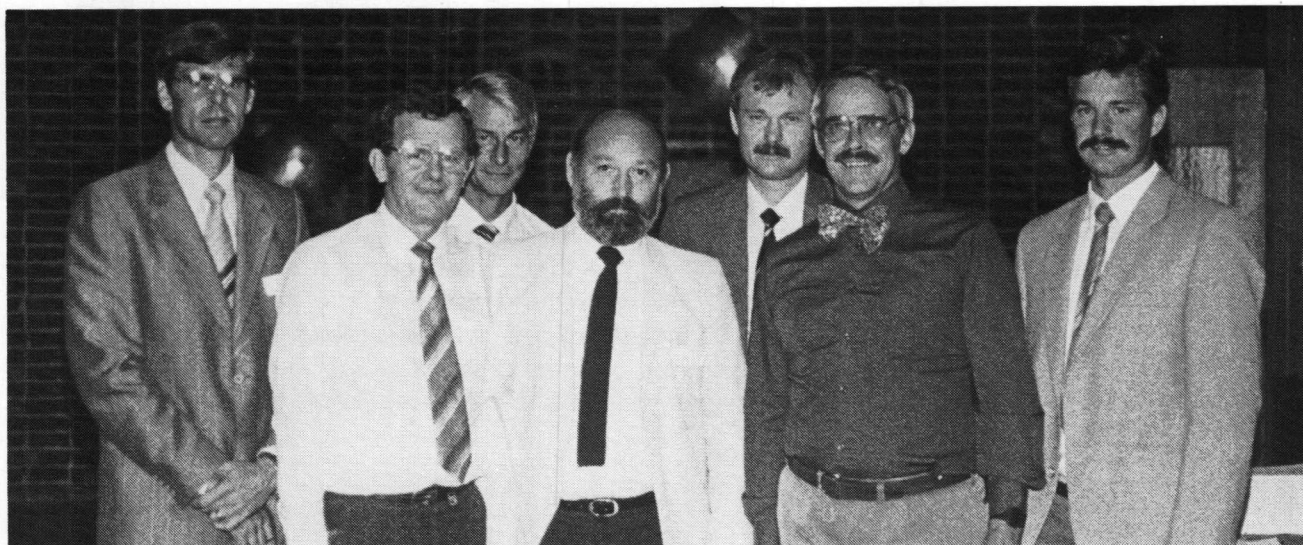
stawwe is vanweë hul beskikbaarheid en eenvoud die fondament waarop byna alle beramings van gewaswaterbehoefte vir beplannings- en skeduleringsdoeleindes berus.

Gewasfaktore sowel as verdampingsyfers word benodig vir die genoemde beramings. Foutiewe faktore het negatiewe implikasies vir beide waterverbruiksdoeltreffendheid en koste van waterverspreiding- en besproeiingstelsels.

Aansienlike korttermyn- en gebiedsvariasies kan in hierdie gewasfaktore voorkom. Omdat navorsers tot dusver nog nie in staat was om riglyne neer te lê vir

aanpassings nie, is hierdie variasies gewoonlik verontagsaam. Foutiewe faktore is te wyte aan die feit dat 'n verandering in atmosferiese toestande nie noodwendig dieselfde effek op die evapotranspirasietempo van 'n gewas het as op die verdampingstempo van 'n verdampingsmeter nie.

Die navorsing sal faktore wat die grootste invloed op die waardes van die gewasfaktore het identifiseer en die verwantskappe tussen hierdie faktore kwantifiseer. Uit hierdie verwantskappe sal riglyne ontwikkel word vir aanpassings in die gewasfaktore waar omstandighede dit vereis.



Mr JC Legoupil (fourth from left) pictured with a few of the delegates at the irrigation workshop. From left: Professor LK Oosthuizen, Professor WE Kassier, Mr JJN Lambrechts, Mr Legoupil, Mr GR Backeberg, Professor JA Groenewald and Mr J van Zyl.

tion are often paid scant attention. He said: "Planners tend to have a macro rather than a micro level approach. It is therefore not surprising to find that farmers often have a passive or negative attitude towards projects."

Mr Legoupil suggested that there should be a clear and specific policy for intensive agriculture based on recognition that Black and White agriculture in the region are complementary.

Pilot schemes. Mr Legoupil pointed out that as a meaningful life-scale test, pilot schemes in the areas destined to be equipped with new hydro-agricultural projects are a necessary stage in the process of irrigation development. Producers selected for the pilot scheme should be representative of all participants and the whole area under consideration.

"In a slightly modified form, pilot schemes are also necessary when existing projects are to be rehabilitated. These pilot schemes would form the basis for research into adaptation and practical training for water utilisation in the wider context of agricultural development," Mr Legoupil said.

He further recommended that a multidisciplinary team ensures management and follow-up of the pilot scheme for a minimum of three years. The pilot project must stay on to support follow-up research and on-going project assessment after implementation of the total project.

Co-ordination of available knowledge and techniques. On this topic Mr Legoupil said: "What is most sadly lacking in developing countries is the ability to co-ordinate techniques, research findings, management and socio-economic data in order to achieve effective application at both project and farm levels."

"Experimentation and application programmes are absolutely vital in order to establish at local level the different possible combinations for cultivation systems, which are technically reliable, economically viable and sociologically adapted, and which can be recommended to the peasant farmer."

Informing the peasant farmer. With regard to project design and installation, farmers should be involved from the conception of the project as well as at its implementation. Operations should be based on the technical and organisational recommendations made by the pilot scheme. Mr Legoupil said that it must be borne in mind that this is naturally a slow process, dependant upon the pace at which the peasant farmer masters the technical aspects of the project.

The long-term aim should be a large scale transfer of responsibilities from the development agency to the irrigation project community according to a clearly defined programme.

Technical follow-up. The lack of technical follow-up in water management occurs too often, Mr

Legoupil warned. It is preferable for follow-up work to be executed by those who initiated the project so that they can make any adaptations required.

Farmers usually lack the necessary skills and knowledge, as well as the necessary training to provide these skills. According to Prof Bembridge planners and managers often assume that farmers will spontaneously acquire the necessary knowledge and skills without long-term training.

Reformulation of objectives. Because irrigation farming is an intensive and dynamic industry, objectives need to be assessed and reformulated from time to time. A group dealing with the evaluation of irrigation development at the workshop expressed the need for retrospective studies of schemes, their original objectives and to what degree they were achieved. Only then can past development be used as a guideline for determining future objectives.

"There is no doubt that by learning from past mistakes," Prof Bembridge said, "problems encountered on irrigation schemes can be solved and irrigation can make a valuable contribution to development in Southern Africa."

In its next issue SA Waterbulletin will feature some of the economical and ecological research needs identified at the workshop by a number of the other invited speakers.

Treatment and disposal of municipal sludge

RESEARCH REPORTS AVAILABLE

In the past, research into sewage sludge treatment and disposal has received only a small fraction of the attention of researchers and designers of wastewater treatment works. The result was that many of the techniques used in this field have developed through experience with only a superficial understanding of factors which influence the performance of various processes. Three reports recently published by the Water Research Commission, will make a definite contribution to this neglected aspect of sludge management and will be extremely valuable for all professionals engaged in the design and operation of sewage treatment plants.

● Sludge dewatering and the treatment of sludge liquors

Selection of the correct sludge dewatering system for a sewage works is a difficult technical decision with significant economic implications. Mechanical dewatering systems frequently require a relatively large initial capital investment, as well as a substantial share of the annual operation and maintenance budget. At the same time many site specific parameters must be evaluated before a final selection can be made.

This research, undertaken by the City Council of Port Elizabeth for the Water Research Commission, has contributed substantially towards a better understanding of the process of dewatering. It reports on an investigation into several alternative ways to dewater sludge under South African conditions and hence provides guidance on available options.

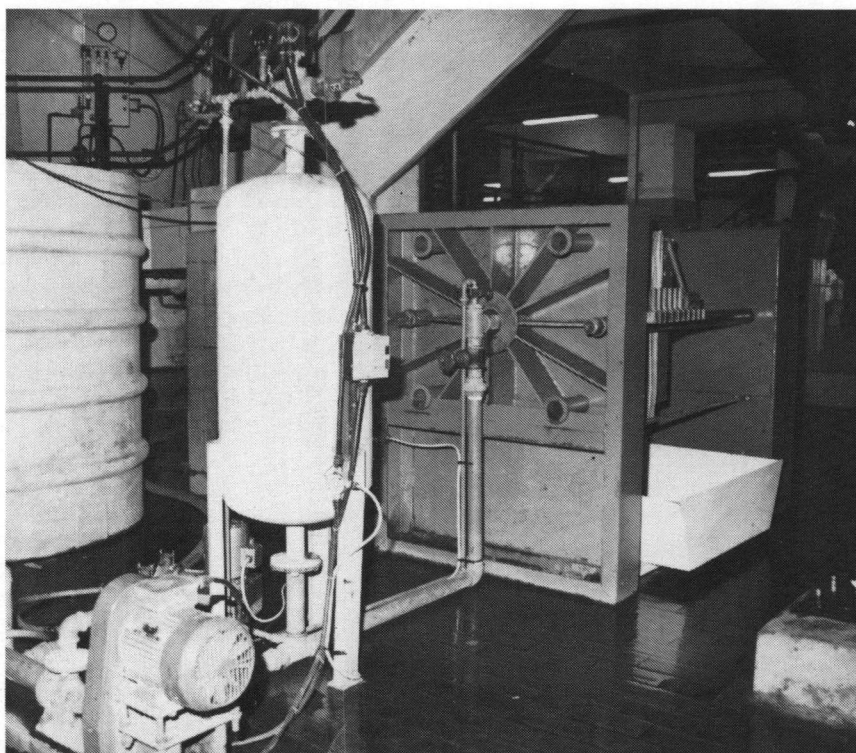
The objectives were primarily to investigate the suitability of various mechanical dewatering plant for the processing of raw and conditioned sludge, the economics of the process, the ability to produce a sludge cake of high solids content and the quality and costs of treating process liquors.

The study has served to highlight the complexity of sludge dewatering systems, the lack of available methods to characterise sludge and hence difficulty in the prediction of dewaterability, the importance of the right choice of equipment, the correct conditioning agent and the major importance that the chemical and physical properties of sludge have on its dewatering characteristics.

In Part I of the final report the results obtained during a full-scale evaluation of the dewatering capabilities of a rotary drum vacuum filter, a filter belt press, a filter plate press and two types of centrifuge are described for both Zimpro thermally conditioned (heat-treated) and non-heat-treated sewage sludges, with and without the addition of a polyelectrolyte conditioning agent. Performance criteria are solids capture, cake dryness, machine capacity and polyelectrolyte consumption but other factors which influence the choice of mechanical dewatering equipment

are mentioned. The effect of heat-treatment reaction temperature and time on sludge dewatering characteristics are demonstrated and certain characterisation test results are related to machine performance.

In Part II, experiments to determine the aerobic biodegradability of the highly polluted waste liquors from the Zimpro process are described and the trend toward anaerobic digestion for the treatment of these liquors is discussed. A detailed assessment of the costs of the Zimpro process is also presented.



The filter plate press, one of the five pieces of dewatering equipment used by the Port Elizabeth Municipality in the study.

● Autothermal aerobic digestion of sludge

Sewage sludge contains a variety of substances and the organic matter in the sludge is a valuable soil improver. However, its universal use in agriculture and horticulture carries with it certain risks to public health and for this reason strict guidelines have been prepared by the Department of Health and Welfare for sludge utilisation. Essentially these guidelines require that sludge be disinfected before it may be used in agriculture and horticulture. The result has been that conventionally treated sludges have been restricted to disposal in land-fill sites or to disposal on the site of the wastewater treatment works thereby causing concern for pollution of surface and underground water resources.

In order to assist local authorities in this respect the Commission embarked upon a programme of national research in this field. One of the research projects undertaken in terms of a contract with the Commission by the City Council of Johannesburg involved research into the effectiveness of autothermal aerobic digestion as a means of disinfection and stabilisation or partial stabilisation of sludge.

The pilot scale work (10m³ reactor) was successfully completed early in 1984. Retention periods of one, two and three days were studied using 50/50 mixtures of primary and thickened waste activated sludges as feed and using automatic control of the oxygen injection system.

The study has shown the autothermal digestion process to be of a very robust nature and quite capable of surviving shock loads such as doubling of the feed rate, a drastic reduction in oxygen injection rate or a complete shut-down for several hours for maintenance purposes without any detrimental effect on the process itself. The process also proved to be very easy to establish.

Temperatures achieved in the process of the order of 60°C were common at retention times as low as one day and temperatures as high as 74°C were measured at times when excess oxygen was fed to the system.

Temperatures of only 40°C – 46°C were achieved when thickened waste activated sludge only was used as the feed stock (i.e. no primary sludge included). These temperatures were insufficient to achieve disinfection.

One of the advantages of the autothermal aerobic digestion process is the high loading rate that can be achieved due to the increased rate of reaction. During the experimental runs tabled in the report the solids loading rates achieved ranged from 9,4 kg Volatile Solids/m³/day to 23,7 kg VS/m³/d at retention times ranging from 3 days to 1 day. If these results are compared with generally accepted figures for aerobic digestion of approximately 1,6 to 4,0 kg VS/m³/d at retention times of 15 to 20 days and those for anaerobic digestion of 1,6 to 6,4 kg VS/m³/d at 15 to 20 day retention, it is evident that autothermal aerobic digestion is capable of accepting much higher loading rates at substantially lower retention times than either of these two well-used digestion processes.

However, interest in the process is as a disinfection and *partial* stabilisation process and not as a complete stabilisation process. The emphasis therefore has been on achieving disinfection temperatures in as short a period as possible. These temperatures have been achieved at one day retention periods with 50/50 mixtures of primary and waste activated sludge. The destruction of volatile solids in the process ranged from 21 – 28% and that of COD from 30 – 38%. Across the range of operating conditions oxygen utilisation varied from 2,5 – 3,7 kg oxygen supplied/kg volatile solids destroyed and efficiency of oxygen utilisation ranged from 86 – 90%.

Since the major cost source for the process is the cost of oxygen, resulting in costs, based on the pilot plant study, varying from R46 to R109 per dry tonne treated (1 day and 3 day retention times), the process could be more economical if it was possible to use a combination of air and pure oxygen or air alone.

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Mr FS Vivier, Department of Health and Welfare, closely inspecting the Vitox oxygen injection venturi of the autothermal aerobic process.

Treatment and disposal of municipal sludge: reports

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The characterisation of sludge

Since one of the major components of sludge treatment is volume reduction, it is difficult to envisage how significant advancements can be made from present day sludge dewatering techniques until the mechanisms which are responsible for binding water in sludge are more fully understood.

Sludges vary considerably in their basic physical, chemical and biological characteristics and the success of one or other treatment process may well depend upon these properties of the sludge. Little is known however, about these properties and their effect on sludge treatment processes and how the processes themselves modify the sludge characteristics.

The basic properties of sludges are poorly understood and acceptable techniques to fully characterise sludges are not available. Those techniques which are available generate data which are not particularly useful in either problem solving or process control.

The aim of this research therefore was to direct attention towards identifying and measuring basic properties and understanding the interrelationships between properties and the overall behaviour of sludge in order to be able to predict process performance and to identify meaningful differences between sludges.

The initial one year pathfinder research project resulted in a three year extension of the work and the establishment of a sludge laboratory at the Cape Regional Laboratory of the National Institute for Water Research.

The study highlighted the complexity of sewage sludge systems, especially in the prediction of sludge dewaterability, and that the physical, chemical and biological properties of sludge have a major influence on the choice of conditioning agent and dewatering equipment and thus on efficient dewaterability of sludges.

The results have contributed to a better understanding of some of the basic characteristics of sludge and of techniques for its characterisation. However, much more research still needs to be done. With respect to physical characterisation, the results indicate that none of the physical parameters investigated (specific resistance to filtration, capillary suction time and centrifuge cake water retention index) were successful in predicting the performance of each type of dewatering operation. Each parameter was found to have its merits in a particular dewatering situation and it is suggested that these three parameters be used in conjunction with each other until more suitable tests have been developed.

Specific conclusions are presented in the final report which relate to methods of characterisation, factors affecting characterisation, limits in their application and modifications to the techniques involved.

Laboratory characterisation tests coupled to full scale dewatering tests carried out at a number of major sewage works throughout South Africa using a variety of types of dewatering equipment have produced valuable information for local authorities. It is stressed in the report, however, that generally, the laboratory characterisation tests do not predict full-scale performance and that the design of laboratory apparatus for the purpose of simulating mechanical dewatering equipment should closely resemble the full-scale process and equipment if realistic predictions are to be obtained.

JE McGlashan
Senior Adviser, WRC

Copies of these reports are available on request from:

The Chairman
Water Research Commission
PO Box 824
Pretoria 0001
Tel: (012) 28-5461

Water loss analysis for Johannesburg

A new project in the field of water loss analysis on municipal distribution systems has been launched by the Water Research Commission, Castle Brass Holdings (Pty) Ltd and the City Council of Johannesburg.

The project will be analysing water losses in selected areas within the Johannesburg Municipal area. These areas will include typical residential, commercial and industrial properties which have been selected on the basis of the pipe material, pipe age, predominant

soil type and water quality they represent.

Work on the first two sites selected, Franklin Roosevelt Park and Montgomery Park, has already started and will be completed by the middle of the year. Thereafter work will be extended to other sites.

Computers and computer software which already exist overseas will be adapted for the project. This approach analyses water losses and enables predictions to be made

regarding the desired frequency of repeat investigations in any particular area and the life expectancy of various types of pipe materials under the soil and water quality conditions existing in the area at the time. Water loss analysis will further enable the costly decision on whether to repair or replace a pipe, to be made with a reasonable degree of confidence.

The project will cover a period of 2 years.

Groundwater:

Atlantis Aquifer Modelled

The second report in a series of three on the applicability of groundwater models as aids in the study and evaluation of South African aquifers was recently published by the Institute for Groundwater Studies of the University of the Orange Free State.

The report entitled: *A preliminary investigation of modelling the Atlantis Aquifer* was prepared by J.L. Müller and J.F. Botha in terms of a contract with the Water Research Commission.

The first of these reports, *Ground-water modelling and parameter identification of the Sishen aquifer* was released by the Water Research Commission in 1983.

The industrial town of Atlantis is situated on the west coast of the Cape Province, approximately 50 kilometres north of Cape Town.

An area of 131 km surrounding the town was declared a national growth point by Parliament in 1973 and development started in 1976.

According to a spokesman for the Divisional Council of the Cape, 140 factories were established in the area since then and the population of the town increased to more than 45 000 by January this year.

At present the increase in Atlantis' water and electricity bill is more than 38 percent per year and the Council expects that within the next 25 years Atlantis will mushroom into a city roughly the size of Port Elizabeth with a population of almost 500 000 people.

The report says that Atlantis depends on ground-water from the sand deposits in its immediate vicinity for its water-supply. In the past various investigations of the groundwater were undertaken. However, the main aim of these investigations was to determine the extent to which this source of water can be exploited before an additional Swartland Divisional Water Scheme becomes necessary.

These investigations have shown that the groundwater potential of the area is quite favourable, to such an extent that this source may be sufficient for a considerable period of time.

The ability of an aquifer to yield a specific quantity of water de-

pends on a number of factors of which the most important are its rate of recharge, storage capacity and method of management. Apart from the storage capacity, very little information exists on the Atlantis aquifer, particularly with regard to a suitable management strategy. There are a number of ways in which the deficiency of the available data can be investigated, but the most direct and possibly the cheapest, is a numerical model. This approach forms the basis of the Atlantis Aquifer report.

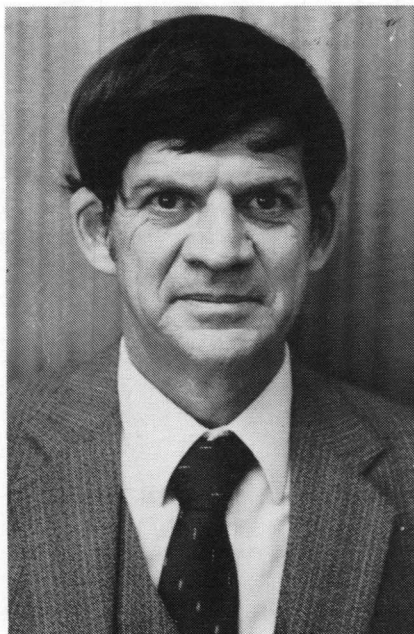
Another advantage of such a model is that it can be applied advantageously in managing an aquifer. However, the scope of the present investigation was much more restricted and can be summarized as follows:

- To construct a numerical model based on existing information, that can describe the physical conditions in the Atlantis aquifer as accurately as possible.
- To delimit areas in the existing information where additional data should be generated in order to facilitate the construction of a management model.
- To study the possibility of sea-water intrusion along the coast line.

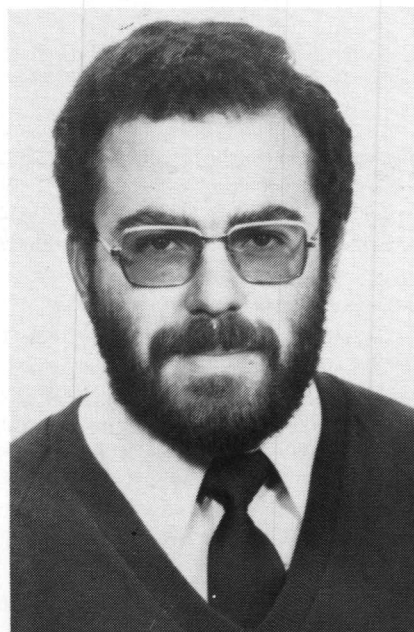
According to Dr Peter Roberts, WRC, the project, as an initial modelling effort, was most successful.

"The extent and the quality of data that would be required, from field measurement, to convert the initial model into a full management model for the system has now been defined. Even so, the initial model has many immediate uses for management in its present form," he says.

The report is available from the Institute for Groundwater Studies, University of the Orange Free State, PO Box 339, Bloemfontein 9300. Tel: (051) 70711.



Professor JF Botha



Mr JC Müller

Water savings:

NEW APPROACH TO THE ACCEPTANCE OF WATER INSTALLATION COMPONENTS

The formation of a *Joint Acceptance Scheme for Water Installation Components* (JASWIC) and the *Plumbing and Sanitaryware Manufacturer's Association of South Africa* (PLASMA) are two important developments arising from a Water Research Commission project on economy measures for urban water distribution systems.

The primary goal of the project which was carried out on behalf of the Commission by the CSIR through its National Building Research Institute (NBRI) together with the South African Bureau of Standards (SABS) was to achieve a meaningful saving of water through the improved design and use of water supply fittings.

Apart from the establishment of JASWIC and PLASMA other significant results are:

- *Draft national water regulations* which were drawn up by the South African Bureau of Standards, and which will be finalised in the next few months.
- *Guidelines on water economy measures for local authorities*, which are being drawn up by the National Building Research Institute and have reached an advanced stage.
- *Hints to householders for saving water in the home*, which have also been prepared by the National Building Research Institute, and are now going to press, and
- *A preliminary list of plants for water conservation gardening in South Africa*, which was published last year by the Botanical Research Institute, Department of Agriculture and Water Supply.

The formation of the *Joint Acceptance Scheme* and the *Plumb-*

ing and Sanitaryware Manufacturer's Association is an important step in the development of a co-ordinated approach to the application of standards for water installation components and will hopefully benefit manufacturers, importers and local authorities as well as the South African public. SA *Waterbulletin* has asked Mr RP Donovan, secretary of JASWIC and Mr RM Burle, vice-chairman of PLASMA to review the objectives and general policies of these two organisations and what they stand for.

TO en UF navorsing 'n stap verder

Die Waternavorsingskommissie het 'n nuwe kontrak in verband met navorsing oor membraanontwikkeling- en vervaardiging vir tru-osmose (TO) en ultrafiltrasie (UF) met die Universiteit van Stellenbosch aangegaan. Die hoofdoel van die nuwe kontrak is om polisulfoon UF-buismembrane, saamgestelde TO-buismembrane en saamgestelde membraan TO-spiraalmodules te ontwikkel tot 'n stadium waar dit vir kommersialisering gereed is.

Die navorsing, wat deur die Instituut vir Polimeerwetenskap onderneem word, is gerig op die ontwikkeling van membrane en modules vir spesifieke toepassings soos die suiwering en ontsouting van verskeie nywerheidsuitvloeiings,

waterherschikulasie by kragstasies, asook waterherwinning uit gesuiverde rioolwater met tru-osmose.

Aansienlike vordering is reeds die afgelope dekade gemaak met die plaaslike ontwikkeling en vervaardiging van membrane veral wat betref die doeltreffendheid en betroubaarheid daarvan asook die beperking van vervaardigingskoste.

Vanweë die potensiaal wat hierdie tegnologie vir die Suid-Afrikaanse waterhuishouding inhou, ondersteun die WNK sedert 1977 navorsing oor die ontwikkeling van plaaslike membraanvervaardigingstegnologie.

In Suid-Afrika was navorsing tot dusver veral gemik op buismembrane en -modules omdat dié teg-

nologie die beste geskik is vir plaaslike toepassings. Dit het gelei tot die kommersialisering van selulose asetaat vir TO-buismodules teen 'n heelwat laer koste as die prys van ingevoerde modules.

Die navorsing is aanvanklik onder twee verskillende kontrakte tussen die WNK en Universiteit van Stellenbosch uitgevoer — oor die chemiese aspekte van membraanontwikkeling en oor die ingenieursaspekte van membraanvervaardiging. Weens die gevorderde stadium van die navorsing is baie nou interaksie tussen die chemiese en ingenieursprogramme noodsaaklik. Die nuwe kontrak sal navorsing nou by wyse van 'n enkele nuwe kontrak tot sy logiese einde voer en sal oor 'n periode van drie jaar strek.



The JASWIC committee at a recent meeting. From left Tom Proudlock, city engineers' department, Port Elizabeth, Peter Scribante, SABS, Neil Macleod, city engineers' department, Durban and Roy Donovan, city engineers' department, Cape Town.

THE JOINT ACCEPTANCE SCHEME FOR WATER INSTALLATION COMPONENTS (JASWIC)

Most local authorities in South Africa have a water by-law, the main objectives of which are:

- The prevention of the pollution of water
- The prevention of waste of water and
- the promotion of safety.

To these ends, one of the provisions of the by-law is that all water installation components shall be approved by the local authority concerned before use in an installation.

Until recently each local authority had its own system for the evaluation of components as acceptable for inclusion in a water installation. This system, whereby an individual approach is made to each local authority by a manufacturer or agent requiring acceptance of a component, causes duplication of work and has often resulted in differing decisions being given due to a lack of uniformity in the evaluation procedures. The increased use of new materials and components, for which in many cases no South African Bureau of Standards specification exists, and also of imported items, has emphasised the difficulties encountered by the individual local authorities in conducting a proper evaluation

and the need for a more co-ordinated and rationalised approach to the problem.

The cities of Cape Town, Durban and Port Elizabeth have now co-operated in the formation of JASWIC. An acceptance committee consisting of representatives of the city engineers of the three cities, the SABS and the WRC, set up in terms of the scheme, now undertakes consideration of all applications for the acceptance of water installation components for the three cities concerned. Any testing of components that may be required by the committee, in order to reach a decision, will be undertaken on its behalf by the SABS.

The general policy adopted by the acceptance committee of JASWIC when considering applications is that compliance with the requirements of SABS specifications, where these exist, will normally be required except where, for technical reasons, this is not possible. The following conditions will, therefore normally be applied.

- **Components bearing a SABS mark.** These will normally be accepted without conditions being imposed.
- **Imported components bearing a standards mark of the country**

or origin. These will normally be accepted without conditions being imposed provided that the specification of the country of origin is certified by the SABS to be directly equivalent to the SABS specification.

- **Components not bearing a SABS mark or a standards mark of the country of origin.** Where a SABS specification exists these will be required to comply with that specification and will be subject to consignment inspection and marking by the SABS.
- **Components for which no acceptable standard specification exists.** These will be subject to consignment inspection and marking by the SABS in accordance with criteria determined by the acceptance committee in consultation with the SABS and/or the Agrément Board.

The committee is also preparing a consolidated list of components previously accepted by the participating local authorities prior to the formation of JASWIC. This is almost complete and should be

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Research reports:

Hydrological studies completed in Zululand

Results of a hydrological research programme undertaken on behalf of the Water Research Commission by the University of Zululand in catchments in North/Eastern Natal and Kwa-Zulu have been published by the WRC.

The results are presented in the form of three separate reports and they cover the principle aims of the research which, according to Mr Dave Cousens, Senior Adviser, WRC, were:

- the development of parametric models to simulate infiltration rates and capacities for various soil-vegetation complexes in the Ntuzi catchment (based on soil series, land-use and topographic characteristics), and the development of a hydrological response unit map.
- the application of the above data and information in the simulation of runoff by means of physiographically based models and other existing models presently being tested in South Africa such as the Wits HRU and Soil Conservation Service (SCS) models.
- the development of data for use in the rational and SCS methods for determination of peak and other storm flows from small catchments with special reference to antecedent base flow and moisture conditions.
- the monitoring of sediment delivery from the catchments for the purpose of establishing relationships between soil loss and the hydrology of the catchments.

In the first volume, entitled **Simulation of stormflow volumes from small catchments**, by AS Hope the estimation of stormflow volumes using two conceptually different procedures was undertaken with particular attention being given to the catchment moisture status

component of each model. Despite the difference in model structure between the two models, namely the SCS and R-index models, a number of common conclusions can be drawn.

Some of the more important results from a modelling point of view are:

- Distributed rather than lumped models produced more accurate estimates.
- Large relative errors were common for estimates of small stormflow events.
- The period of antecedent rainfall optimally associated with the estimation of stormflow volumes varies from region to region. However, the use of ten to fifteen days is suitable for most catchments.

In the second volume, entitled **The influence of infiltration on stormflow in the Ntuzi River Catchment (Zululand coastline)**, by GJ Mulder the following specific objectives were investigated:

- the possibility of using various soil physical parameters for the prediction of certain points on the declining infiltration curve, and,
- to determine the extent to which surface, subsurface and groundwater flow from a hillside contribute to measured stormflow hydrographs.

According to Mr Cousens the data suggest that the mapping of hydrological response units according to homogeneity of slope, infiltration, vegetation and soils would not be suitable for modelling purposes along the Zululand coastline. The data further indicate that a large contribution to the stormflow was from the "groundwater" zone. Surface flow contributions were very low due to the fact that

infiltration capacities usually exceed rainfall intensities. The low runoff response of the hillside plot compared to average responses suggests that most stormflow is generated through runoff from the valley floor of first and second order streams giving support to the variable source area concept propagated by Hewlett.

The third volume, edited by AS Hope and entitled **Selected hydrological studies using multivariate statistical techniques**, contains three preliminary investigations which Mr Hope says in the preface, "were intended to illustrate the use of these statistical procedure in hydrological analyses."

The studies comprise:

- *Calculating runoff from catchment physiography in South Africa.* The results obtained were considered to be highly satisfactory. The analyses have shown that multivariate techniques may be used to regionalise catchments and to assist in developing runoff equations.
- *Estimation of surface soil moisture in the Siaya catchment.* An attempt to use remotely sensed aerial colour and infra-red photography for determining soil moisture was undertaken. The results indicate that, under the very dry conditions prevailing at the time, this technique combined with regression analysis was inadequate for the proposed application.
- *Estimation of streamflow loss by evapotranspiration from the riparian zone.* This preliminary study had indicated that the diurnal fluctuations in the recession limbs of hydrographs from a small catchment may be related successfully to selected variables. However, the study indicated that a better understanding of the processes involved

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Water Installation Components continued

(From page 9)

available by the time that this article appears in print.

It is widely anticipated that the formation of JASWIC will assist manufacturers, importers, agents and the general public by adopting a consistent approach within the areas of supply of the participating local authorities in respect of the

acceptance of water installation components. Any additional information concerning JASWIC as well as copies of the list of components and application forms for the acceptance of components may be obtained from:

The Secretary
JASWIC

c/o City Engineer's Department
PO Box 1694
CAPE TOWN
8000

Telephone (021) 210-3494

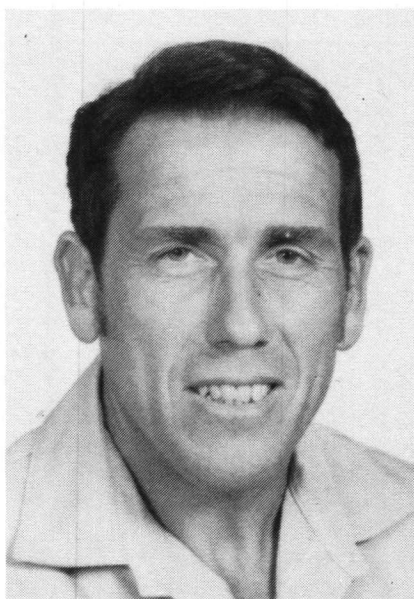
RP Donovan
City Engineer's Department
CAPE TOWN

THE PLUMBING AND SANITARYWARE MANUFACTURER'S ASSOCIATION OF SOUTH AFRICA (PLASMA)

The Association consists of approximately 20 organisations engaged in the manufacture of a wide range of plumbing and sanitaryware products such as baths, ceramicware, hot water cylinders, taps, mixers, valves etc. The broad objectives of the Association are to promote, encourage and protect the interest of members, as well as to deal with matters affecting their common interest.

In particular, the Association wishes to contribute to the orderly evolution of SABS product standards by closer consultation and co-operation with local authorities and the South African Bureau of Standards. The Association maintains that its members, through their in-depth and specific knowledge of South African field conditions in their operational areas, can play an indispensable role in the establishment or revision of product standards, which are in

the best long-term interest of the South African public.



Mr RM Burle

The Association has appointed a committee, comprising: Messrs RW Monthe — chairman (Consolidated Industrial Holdings), RM Burle — vice-chairman (Castle Brass Holdings), MJ Shipton (Armitage Shanks), RT Davidson (Cobra Brassware), D Haslam (Marley Technical Products), S Berkowitz (Nu-World Industries).

Two technical sub-committees to examine the specific needs of cistern and cistern-valve manufacturers and pressure control and safety valve manufacturers have been set up under the convenorship of Mr H Beck (Dutton Plastics) and Mr F Draxl (Castle Brass Works).

RM Burle
Castle Brass Holdings
PO Box 4082
LUIPAARDSVLEI
1743

Telephone (011) 664-8150

Procite International exhibition to be held in JHB

The international exhibition for processing, control and industrial technology, PROCITE INTERNATIONAL, is expected to draw more than 200 exhibitors.

Organised by Trade Fairs and Promotions the exhibition will incorporate process engineering, control instrumentation and allied technological developments in mining, chemical and petrochemical developments food, iron and steel,

water and effluent and other major industrial sectors.

The market for process control instrumentation in South Africa is worth about 180 million rand per annum, with seven major end use sectors accounting for more than 85 per cent of the total demand. The size of the market will increase significantly with the upturn in the economy and is expected to reach 300 million rand in two or three

years. Many manufacturing companies have already planned plant upgrades which means increased instrumentation purchases in most cases.

The exhibition will be held from 24 to 28 September 1985 in the National Exhibition Centre, Crown Mines, Johannesburg. For further information contact: Thomson Trade Fairs & Promotions (Pty) Ltd, PO Box 56440, Pinetown 2123. Telephone 789-2144.

The February issue of *SA Waterbulletin* mentioned that results of the National Industrial Water & Wastewater Survey (NATSURV) would shortly become available. Limited space precludes the printing of all information amassed to date, but some extracts are shown here for the interest of readers.

NATSURV: PROGRESS REPORT

One of the prime objectives of the Survey is to present results in a way which will facilitate the comparison of like industries. Ratios based on production or raw material consumption, principally the Specific Water Intake (SWI) and Specific Pollution Load (SPL) are to be used for this purpose. This is a simple and attractive concept but the practicalities revealed by actual questionnaire returns show that it will not be possible to use this procedure without constraints. The enormous diversity of industrial activity and practice, which has become apparent during the first phase of NATSURV operation, has highlighted the difficulty of deciding to what extent industries in the same broad grouping are in fact comparable.

All industries within a group have some common features; these ARE comparable and closer investigation will reveal those parameters which are meaningful. However, that is not to denigrate the appeal to factory management of such simple but superficial measures of water efficiency as SWI & SPL. Monitoring of these parameters may at least promote a closer interest in factory water affairs for the good of all concerned.

It is very fortunate that NATSURV's original terms of reference provided for a most comprehensive accumulation of data from each premises. Without such detail the 'explainability' and thus the value of results to date would have been significantly less.

The seemingly comparable results which are presented in the accompanying tables show wide divergence in some cases. This should not be taken automatically to indicate where gross water wastage is occurring, but rather to show where a closer examination of the questionnaire returns is war-

ranted. NATSURV is sure that the figures presented here will encourage discussion among, and maybe even comment from, mem-

bers of the industries concerned. The confidential nature of the survey precludes the identification of individual factories.

SPECIFIC WATER INTAKE

Meat industry:

The specific water intake for red meat production is based on the cattle unit which is equivalent to 2.25 calves, 8 sheep or 2 pigs.

Product	Abattoir	SWI related to raw materials
		m ³ /c.u.*
Red meat	A	1.3
	B	0.8
	C	1.2
	D	0.9
	E	0.6
		*c.u. = cattle units
		l/chicken
White meat	A	15.0
	B	32.0

Red meat abattoirs A and C use approximately twice as much water as abattoir E, but examination of all the data shows that abattoirs A and C produce both primary and secondary meat products, thus possibly justifying the additional water intake. White meat abattoir A is a small scale rural producer, whereas abattoir B is highly mechanised and processes some thirty times as many birds per month.

Chemical & chemical products industry:

Product	Factory	SWI related to production	SWI related to raw materials
		m ³ /t	m ³ /t
Adhesives	A	10.9	11.1
	B	23.9	25.1
Bitumen emulsion	A	0.5	0.8
	B	0.8	1.4
Detergents	A	1.4	2.3
	B	5.8	20.0
	C	1.0	2.2
Plastics	A	3.8	3.8
	B	—	6.2
Rubber	A	6.2	12.3
	B	18.5	—
	C	22.4	22.4

Fabricated metal products industry:

Activities of the metal fabrication industries range from general manufacturing to specialized heat treatment operations. Water is used mainly for cooling purposes. Variety of size and activity precludes the use of SWI alone to determine their water efficiency.

Product	Factory	SWI related to raw material
		m ³ /t
Components and fabricated items; welding, machining, heat treatment.	A	6.3
	B	5.8
	C	35.6
	D	24.0

Both metal fabrication and the chemical industry produce a wide variety of products using different processes. As a result, the data presented is not always directly comparable and it is necessary to refer to the NATSURV database before any definite conclusions can be reached.

SPECIFIC POLLUTION LOAD

The SPL is determined for the following parameters as appropriate:

(a) Chemical oxygen demand (COD); (b) Suspended solids (SS); (c) Total dissolved solids; (d) Total solids; (e) Nitrogen; (f) Chloride; (g) Total carbon; (h) Inorganic carbon; (i) Organic carbon; (j) Phosphate; (k) Soap, oil and grease; (l) Calcium.

The SPL gives an indication of the load which is placed on the (municipal) purification system and hence determines the cost of effluent treatment to the factory. Only the most common parameters used for this purpose are quoted here.

Meat industry:

Product	Factory	COD	SS
		kg/c.u.	kg/c.u.
Red meat	A	7.5	1.2
	D	2.3	0.8
	E	4.9	1.0
		g/chicken	g/chicken
White meat	A	8.8	8.4
	B	52.1	16.1

Examination of the available data indicates that red meat abattoir D has a sophisticated on-site effluent treatment plant, thus reducing the pollution load of the final effluent. White meat abattoir A has collection and disposal facilities for blood, while abattoir B discharges blood to the effluent stream which results in the much higher COD.

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Waterbeperkings: Onderzoek na gevolge

Die behoefte na 'n ondersoek om meer inligting te bekom oor die sosiologiese en ekonomiese gevolge van waterbeperkings het weer eens duidelik na vore gekom gedurende die afgelope droogte.

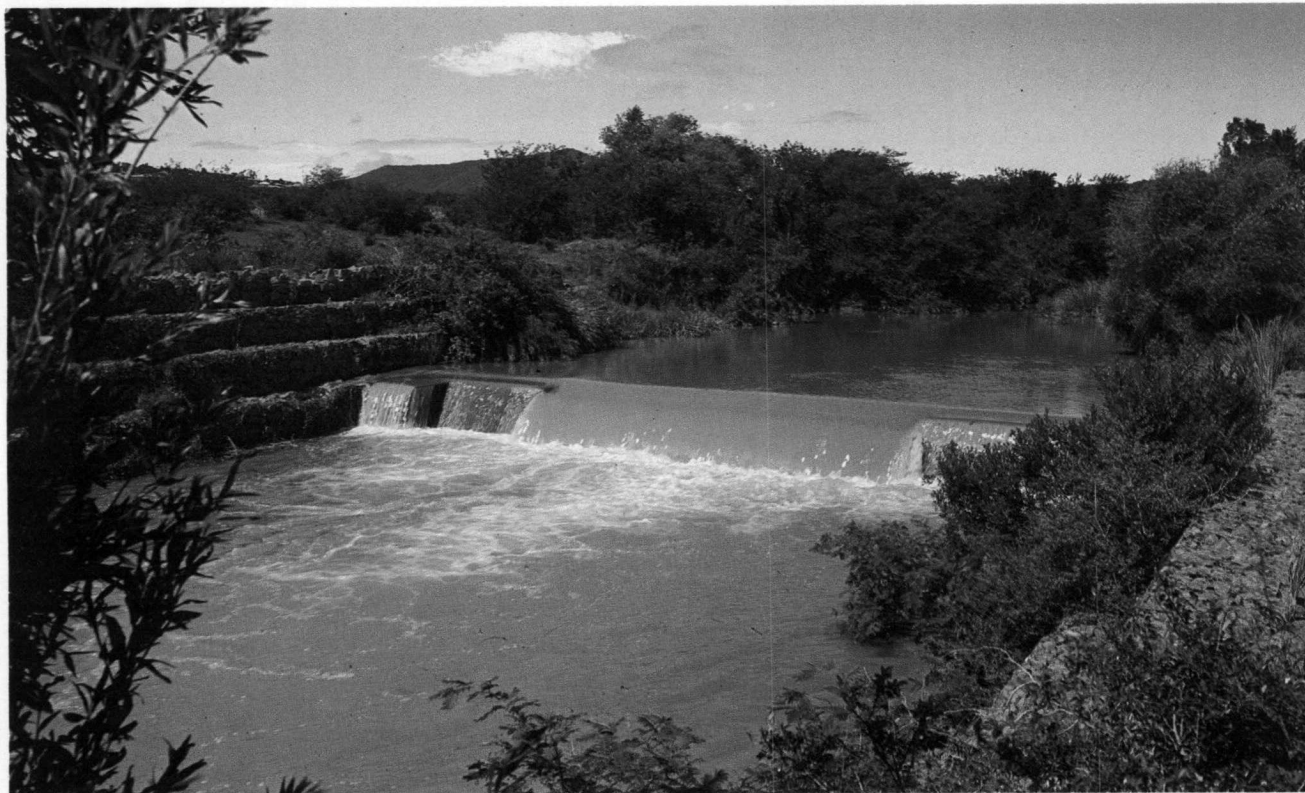
Die aanvaarbare bedryf van waterskemas vereis dat waterbeperkings nie onaanvaarbare ekonomiese verliese of onwenslike verlaging in lewenskwaliteit sal meebring nie. Ten spyte van die gereelde voorkoms van waterbeperkings in Suid-Afrika is baie min of selfs geen inligting beskikbaar oor die presiese gevolge daarvan, of oor die punt waar sulke beperkings vir verskillende sektore nie meer aanvaarbaar is nie.

Die Waternavorsingskommissie het 'n navorsingsprojek geïnisieer oor die sosio-ekonomiese gevolge van waterbeperkings wat oor 'n periode van 2 jaar sal strek.

Die huidige situasie in Suid-Afrika rakende waterbeperkings leen hom ideaal tot 'n ondersoek van dié aard. Nie alleen is alle sektore van die Suid-Afrikaanse ekonomie geraak nie, maar het die graad van beperkings ook gevarieer.

Weens die omvang van die projek en die spoedige benutting van die huidige stand van sake is besluit dat 3 instansies elk verskillende fasette van die projek sal hanteer. Hierdie instansies en hulle verantwoordelikhede is:

- **Instituut vir Sosiale en Ekonomiese Navorsing, Universiteit van die Oranje-Vrystaat:** besproeiingsboerdery, mynbou, elektrisiteitsvoorsiening en die sentrale owerheid;
- **Toegepaste Maatskaplike Studie Sentrum, Universiteit van Natal:** nywerhede en plaaslike owerhede; en
- **Buro vir Marknavorsing, Universiteit van Suid-Afrika:** huishoudings.



Hydrology:

Streamflow modelling of SA rivers

The results of an unusual approach to rainfall/runoff modelling where the researchers have started with streamflow data instead of the usual areal rainfall, are now available.

The research project *Continuous streamflow modelling of South African rivers*, was funded by the Water Research Commission and carried out under the leadership of Professor GG Pegram of the Department of Civil Engineering, University of Natal.

The standard approach to rainfall/runoff modelling, says Dr Peter Roberts, senior adviser, WRC, is to begin with the estimates of areal rainfall and convert them via various mathematical models to estimates of effective rainfall (i.e. that part of the rainfall that becomes streamflow). This effective rainfall is then lagged in time and routed through the stream channels to simulate runoff at the catchment outlet (gauging station).

The objective of the Continuous streamflow modelling research programme was to attempt to

reverse this procedure by beginning with the streamflow data and deconvoluting it to obtain estimates of effective rainfall. The relationship between effective rainfall and areal rainfall would then be studied with the hope of finding a methodology for use in ungauged catchments.



Professor GG Pegram

Dr Roberts says it was hoped that this novel reverse procedure would make it easier to find a stable set of parameters that characterise the relationship between areal rainfall and runoff.

"While the aims of the project have not been completely fulfilled in that the project has not produced a rainfall/runoff model that is notably superior to those already available, the research has produced a series of mathematical techniques, available in the form of computer programs, that will prove to be most useful to hydrologists for a variety of other applications. In particular, they will be of great benefit for short term forecasting (for flood control) and for studies of change in the relationship between rainfall and runoff resulting from human activity."

Copies of the final report are available on request from:

*The University of Natal
Department of Civil Engineering
King George V Avenue
DURBAN 4001*

Tel: (031) 25-3411

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Chemical and chemical products industry:

While nearly all chemical products require water as part of the product or for process utilities, effluents generated can be widely varying or even non-existent. Of the industries so far surveyed, only the manufacture of detergents produced effluents which were classified as industrial.

Product	Factory	COD	SS
Detergents	B	kg/t 41.6	kg/t 1.5
	C	0.32	0.02

Fabricated and metal products industry:

Of the industries so far surveyed in this group, none produced an effluent which was classified as industrial.

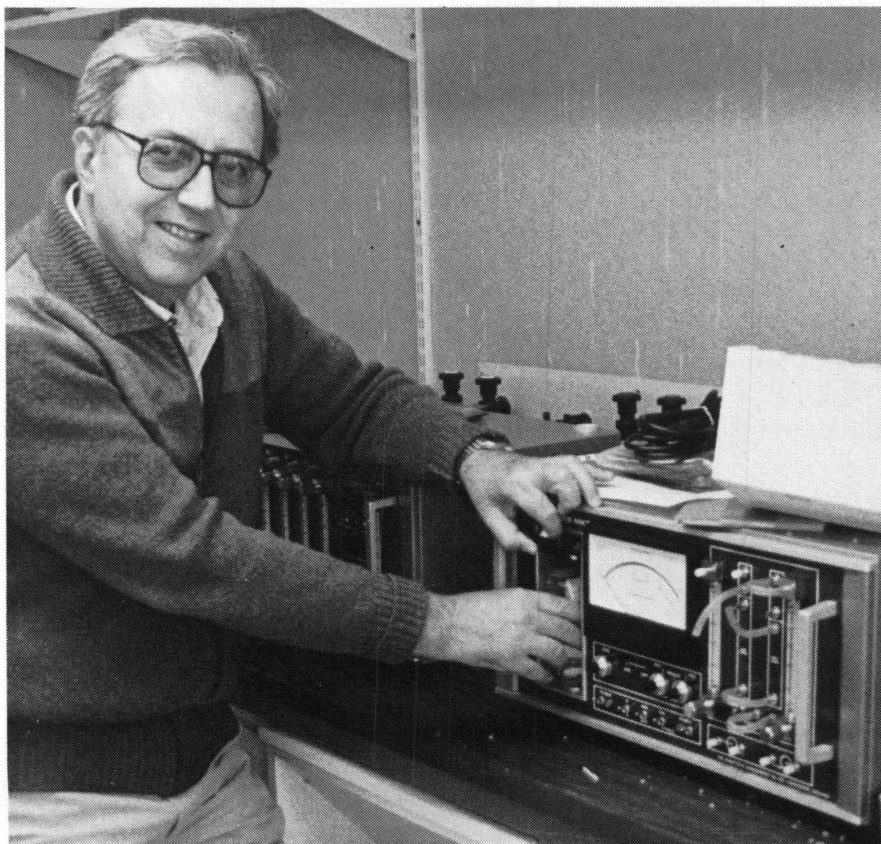
The collection of data is an ongoing process and eventually the database will be used to establish targets for specific water intake and pollution loadings which are reasonably achievable by all industries. The data will also be used to assist factories in improving their water and effluent management.

Border posts "relieves" constructed

The Construction Division of Ballam-Waterslot of Pretoria, was recently awarded the entire contract for the earthworks and construction of septic tanks at the two new border posts situated at Bongola Dam site and Braamnek, Queenstown, on behalf of the Department of Public Works and Land Affairs, East Cape.

The Braamnek septic tank, possibly the largest ever built in Southern Africa, is designed to cope with 3 000 transit personnel per day at peak periods.

The choice of the maintenance-free "Ballam-Waterslot" toilet system for this particular project could not have been more suitable when taking into consideration the shortage of water in the area and the fact that the system uses one litre of water only per flushing; thus, apart from the actual water-saving effect, the disposal of fluids is reduced to an absolute minimum.



Israeli plant expert at SIRI

Professor SH Lips from the Institute for Desert Research, University of Ben Gurion, Israel, working in South Africa on a cooperative research programme dealing with the efficient use of water and nutrients by plants. Professor Lips has been contracted by the WRC for a period of six months to assist the SIRI at Roodeplaat Dam with research.

Professor Lips spent nine months at the University of Cape Town where he worked with Professor OAM Lewis in the Department of Botany and is currently working with Dr AJ van der Merwe and Mr Pedro Berliner at the SIRI.

Het u geweet . . .

Het u geweet dat 'n oester van geslag verander gedurende sy lewensiklus? 'n Jong oester onder een jaar oud is gewoonlik manlik, terwyl die middeljarige stadium gekenmerk word deur 'n afwisseling van manlik en vroulik, min of meer elke jaar. En op sy oudag is die oester hoofsaaklik altyd weer vroulik.

Het u ook geweet dat een oester tot 450 liter water gedurende 'n 24-uur periode deur sy kieuë sirkuleer en sy voedsel, wat uit mikroörganismes bestaan, daaruit filtreer?



Oesterrakke in die Knysna-lagune.

KNYSNA DELIKATESSES VIR DIE FYNPROEWER

Die oester is waarskynlik die bekendste onder die Suid-Afrikaanse weekdiere en word deur restauranteurs opgedien in variasies van rou tot gebraai met tartaresous. Kenmerkend aan oestervleis is sy sappigheid en besondere smaak.

Gesetel aan die oewers van die Knysna-lagune is die enigste oesterteelstasie in Afrika, die Visserij-Ontwikkelingskorporasie van Suid-Afrika (*VISKOR*), asook *Knysna Oyster Company*, 'n oesterboerdery. *SA Waterbulletin* het hulle besoek en fokus in hierdie artikel op beide instansies se werk op die gebied van oesterproduksie.

Teel van oestersraad

Volgens mnr André Genade, hoof van *VISKOR* se navorsingsstasie by Knysna, word ryp oesters by die Knysna-lagune aangehou sodat *VISKOR* nie aangewys is op die natuurlike broeiproses van die oesters nie. Die res van die telery

bestaan uit 'n algkultuureenhed waar voedsel vir die verskillende stadia van die oester gekweek word en 'n nasorgeenheid vir die grootmaak van klein oesters van waar hulle dan in die natuur uitgeplaas word.

Hoewel 'n betreklike jong bedryf in Suid-Afrika, dateer oesterboer-

dery baie eeue terug. Tans is die VSA, Japan, Korea, Taiwan en Frankryk die leiers op die gebied van oesterproduksie. Daar word tans wêreldwyd met ongeveer agt oesterspesies geboer waarvan die drie spesies *Crassostrea gigas*, *Crassostrea virginica* en *Ostrea edulis* die belangrikste is.

Pogings om met oesters in Suid-Afrika te boer dateer terug tot in 1948 toe daar gepoog is om met die Suid-Afrikaanse rotsoester (*Crassostrea margaritacea*) te boer. Gedurende die vyftigerjare word daar ook gepoog om 'n eksotiese oesterspesie te kweek en hoewel hierdie pogings nie ten volle geslaagd was nie meen mnr Genade dit het in daardie stadium getoon dat 'n oesterkwekery in Suid-Afrika goeie potensiaal het.

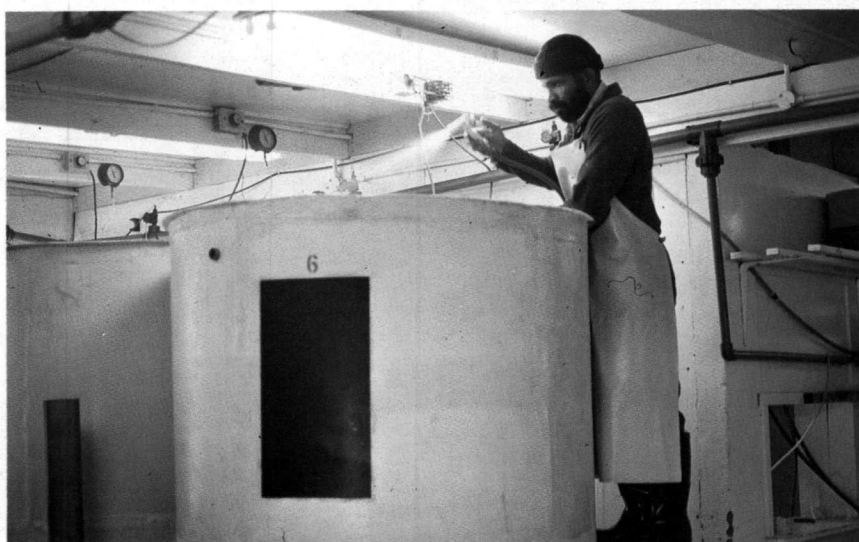
In 1963 inisieer VISKOR 'n navorsingsprogram vir die kweek van oesters in die Knysnariviermond waar daar aanvanklik gekonsentreer is op die ontwikkeling van broeitegnieke vir die Suid-Afrikaanse rotsoester. Volgens mnr Genade het die rotsoesterlarwe egter getoon dat dit te sensitief is vir sekere toestande wat van tyd tot tyd in die broei-eenheid ondervind word.

Die Stille Oseaanoester (*Crassostrea gigas*) word in 1973 ingevoer en onder identiese toestande is bevind dat die reaksies van hierdie oester meer positief was as dié van die Suid-Afrikaanse rotsoester. Dit reageer byvoorbeeld makliker op broeistimuli, het sterker larwes en metamorfoseer in 'n korter periode. Hierdie oester kruis glad nie met die inheemse soorte nie en is dit derhalwe veilig om met hom te boer in Suid-Afrika.

Mnr Genade sê sedert die toevoeging van die Stille Oseaanoester tot die oesterbedryf verteenwoordig dit 80 per sent van die oesters wat op die Suid-Afrikaanse mark versprei word.

Die produksie van oestersaad sluit 'n hele reeks hoogs tegnologiese prosesse in wat vir Suid-Afrikaanse toestande ontwikkel en aangepas is deur VISKOR. Mnr Genade sê ryp Stille Oseaanoesters word in die Knysna-lagune aangetref vanaf September tot vroeg Desember. Omdat mannetjies en wyfies nie vooraf onderskei kan word nie, word hulle in 'n kuitbak geplaas waar hulle deur temperatuur gestimuleer word totdat geslagselle verkry is.

"Deur middel van 'n swart agtergrond in die kuitbak is dit moontlik om mannetjies en wyfies waar te



(Heelbo) Mnr André Genade van VISKOR, by 'n algkultuureenheid. Verskillende algspesies dien as voedsel by die grootmaak van larwes en oestersaad.

(Bo) Larwetenks wat gebruik word vir die grootmaak van oestersaad vanaf bevrugting tot die volggroeide larwestadia.

DELIKATESSES VIR DIE FYNPROEWER

(Van bladsy 17)

neem wanneer die geslagte onderskei kan word. Hierna word hulle geskei en toegelaat om klaar te kuit in individuele 5 liter bekere," sê mnr Genade.

Hy beweer verder dat ongewenste onsuiverhede eers van die ova verwyder word deur 'n siftingsproses voordat dit kunsmatig bevrug word waarna die bevrugte eiers in 1 000 liter tenks geplaas word vir ontwikkeling.

Voeding in die vorm van alge word geïnisieer na 48 uur wanneer vryswemmende larwes, elk met twee skulpe, ontwikkel. "Parallel met die produksie van oesterlarwes," sê mnr Genade, "word alge op 'n gereelde basis geproduseer om te dien as kos vir oestersaad en larwes.

"Daar word tans 15 algspesies in voorraad gehou, waarvan 5 algemeen gebruik word, en hoewel die alge nie noodwendig die beste groei bewerkstellig nie, bied dit wel die betroubaarste resultate. Die oester se dieet word op verskillende groeistadia gewysig."

Volgens mnr Genade sal die larwes vir ongeveer 3 weke in die tenks bly waarna hulle metamorfoseer en aan plastiekplate vasheg. Na een dag word hulle afgeskraap en word as los oestertjies groot totdat dit bemark word.

Soos in enige ander bedryf word probleme van tyd tot tyd ondervind en die oesterbedryf is geen uitsondering nie. Mnr Genade sê dat waterkwaliteit by die teel van oesters baie belangrik is veral gedurende die eerste agt dae van die larwes se ontwikkeling wanneer hulle nog sensitief is. Die

waterkwaliteit kortwiek soms taling en is 'n probleem wat tans nog ondersoek word. Indien *VISKOR* nie genoeg oestersaad kan voorsien aan sy mark nie, voer hulle dit van goedgekeurde oorsese teelstasies in.

Polidora, 'n skulpparasiet, is nóg 'n probleem wat sporadies voorkom wanneer oesters verder in die natuur grootgemaak word. "*Polidora* is 'n modderwurm wat die oesterskulp gebruik as vesting en modder vergader wat 'n modderblaas op die oesterskulp vorm," sê mnr Genade. "Hoe groter die modderblaas hoe moeiliker is die oester bemarkbaar. Die oester gebruik sy energie om die irritasie teë te werk wat die vleisgehalte van die oester nadelig beïnvloed," sê hy.

Bemarking

Die bemarking van die oesters word nie deur *VISKOR* self waargeneem nie, maar deur *Knysna Oyster Company* wat die oesters op vingernaal grootte van *VISKOR* aankoop.

Produksiebestuurder van *Knysna Oyster Company*, mnr Vosloo Pienaar brei meer uit oor wat met die oester gebeur nadat dit van die teelstasie gekoop is. "Nadat die oester van *VISKOR* aangekoop is, word hy teruggeplaas in sy natuurlike omgewing in houters in die lagune.

"Twee tipes rakstelsels word wêreldwyd gebruik waarin oesters in die natuur teruggeplaas word. Die eerste stelsel, wat byvoorbeeld in Japan gebruik word, is die heeldyd onder die water. *Knysna Oyster Company* gebruik die sogenaamde tussengetyrakstelsel wat in relatief vlak gebiede opgerig word," sê mnr Pienaar.

Die oesters word op die rakke binne plastiek nethouers geplaas wat verhoed dat die oesters nie wegspoel nie. Die aantal oesters in die plastiek nethouers wissel van gebied tot gebied. Volgens mnr Pienaar word die drakapasiteit van die rakke bepaal deur die fitoplankton (die oesters se voedsel), in die water. Op sy beurt sal die fitoplanktonkonsentrasie in die water afhang van die watervloei. "Dit is belangrik om 'n goeie water-



Oesters reg vir die mark. Dit neem die gemiddelde oester ongeveer twee tot drie jaar om bemarkingsgrootte te bereik.

groeigebied te kies," sê mnr Pienaar.

Hy beweer verder dat die tussengetytrakstelsel by Knysna ongeveer 'n half tot een miljoen oesters per hektaar kan dra.

Solank as wat watertemperatuur warm genoeg is vir voeding sal oesters konstant groot volumes water filtreer vir voedsel waarin bakterieë en ander mikroörganismes voorkom. Die meeste van hierdie bakterieë is skadeloos, maar indien water besoedel is, kan gevaarlike bakterieë ook deur die oester geabsorbeer word. Hoewel *Knysna Oyster Company* nog nooit 'n oester bemark het wat gevaarlik vir 'n mens se gesondheid kan wees nie, word alle oesters nietemin gereinig as voorsorgmaatreël.

Die doel van reiniging is om die oester die geleentheid te bied om ontslae te raak van enige moontlike skadelike bakterieë wat hy in sy dermkanaal mag hê. "Die metode wat gevind is om hulle te behandel teen moontlike siektes is sterilisasie," sê mnr Pienaar.

Die drie basiese sterilisasietegnieke wat gebruik kan word, is chloor, osoon of ultravioletligte waarvan laasgenoemde by Knysna aangewend word. Die oester word dan vir 48 uur in besoedelvrye water aangehou wat deur ultravioletbestraling gesuiwer is.

Dit neem ongeveer twee tot drie jaar vir die oester om 'n bemarkingsgrootte te bereik. Volgens mnr Pienaar bemark hulle ongeveer 100 ton oesters per jaar en is produksie spesifiek gemik op die spyskaartmark. Volgens inligting word 'n groot deel van die varsoestermark in Suid-Afrika deur *Knysna Oyster Company* voorsien.

Oesters vars gekoop, sê mnr Pienaar, bly vir drie dae vars teen kamertemperatuur en 'n week by 4-6°C.

Figure busters

SA Waterbulletin apologises for letting some incorrect figures on the loose in the article on aquaculture in Taiwan. The correct figures are: The prawn industry in Taiwan is worth approximately **8 million US dollars** per year and more than **750 tonnes** of the giant fresh water prawn are produced annually.

CONTROL ANALYSES MANUAL PUBLISHED FOR OPERATORS

The National Institute for Water Research (NIWR) of the CSIR has recently published the Afrikaans version of a manual on control analyses for operators of conventional water plants. An English version has been prepared for publication and will be published if there is sufficient demand.

The manual gives step-by-step analytical methods for carrying out the following physical and chemical analyses: Colour, turbidity, pH, electrical conductivity, total dissolved solids, alkalinity, total hardness, calcium hardness and free and total chlorine. Procedures for stability calculations, flocculation tests and determination of chlorine demand are also given.

The Afrikaans version of the manual (K72) is obtainable from the Librarian, NIWR, CSIR, PO Box 395, Pretoria 0001, on prepayment of R6,00 + GST. Please quote code number 620-99510.

WATER AND SANITATION DEVELOPMENT UNIT ESTABLISHED

TEBA (the black employee recruiting arm of the Chamber of Mines) has funded a Water and Sanitation Development Unit project. The project will be undertaken by the Institute of Natural Resources (INR), University of Natal. The TEBA donation, made in 1984, amounts to R55 550.

The unit will be established in June 1985 at INR's demonstration farm Nansindlela near Cato Ridge, Natal. Facilities available to the unit will include an office, workshop, lecture room and a fully equipped demonstration trailer for field work. All field work will be conducted in black areas.

In October 1984 Mr John Anderson was appointed as the Unit's project leader.

Working in co-operation with the KwaZulu Department of Agriculture and Forestry the Unit has established the following objectives:

- To train community operators in skills necessary for water resources development.
- To encourage community organisation in developing and running water supply and sanitation projects.
- To provide moral and logistic support to community organizations in maintaining and expanding water resources and sanitation infrastructure.
- To incorporate appropriate technological solutions in the training programme and to evaluate their effectiveness.

The continuing drought in South Africa has served to emphasize the crucial importance of water supplies and sanitation in both the rural and peri-urban environments of Natal/KwaZulu. The extreme shortages of trained skilled personnel to supervise water resources development (spring protection, reservoir construction, well-sinking, pipeline laying, etc) has been identified by all parties concerned with water development in Natal/KwaZulu as one of the most serious limiting factors to development. Furthermore, trained personnel for siting and supervising the construction of adequate latrines (e.g. ventilated improved pit (VIP) latrines) are at present virtually non-existent.

The Institute of Natural Resources believes that a Water and Sanitation Development Unit could make a significant contribution to solving some of these problems.



Sandile Dam, Ciskei, built at a total cost of R21 million.

Water supply and sanitation

CISKEI FIGHTING A HARD BATTLE

"In the Republic of Ciskei considerable progress has been made towards providing the entire population with safe and sufficient water supply, but the implementation of the Water Decade goals of piped water and sanitation facilities for all in Ciskei by 1990 is an enterprise of gigantic proportions and will not easily be achieved." This was said by Mr Trevor Balzar of the Department of Public Works, Ciskei, when he spoke at a seminar on technology transfer in water supply and sanitation in developing areas held recently at King William's Town in the Eastern Cape.

The seminar was organised by the South African National Committee of the International Water Supply Association in collaboration with the National Institute for Water Research and the Government of the Republic of Ciskei.

Supporting Mr Balzar's view in a paper on the health aspects of water supply and sanitation in

Ciskei Mr LM Mbambani of the Ciskei Department of Health, said that out of a Ciskeian population of just over one million, it was estimated that only 20 per cent of the population, mainly in the urban areas, have access to adequate supplies of reticulated water.

"The rest of the population relies on boreholes, natural springs and stock dams for their drinking water," he said.

Mr Mbambani said that the solu-

tion to the present and future supply needs was seen as the provision of regional water supply schemes which would supply water to a greater number of people.

"Studies which were completed in 1982 showed that 24 regional water supply schemes at a cost of R210,2 million would be required to meet the water needs for the Keiskamma River Basin which covers 2 700 km² or about two-thirds of the whole of Ciskei.

According to Mr Balzar there are at present three types of water supply schemes in Ciskei:

● Basic schemes to rural areas

"The smallest of these basic schemes are boreholes equipped with hand pumps. Some schemes consist of a pumping station extracting raw water from a river and pumping it into a reservoir to ensure that water is available for the surrounding population.

"The Department is at present engaged in the construction of more sophisticated borehole schemes in the rural areas. These schemes consist of one or more boreholes equipped with windmills or diesel pumps which deliver water directly into reservoirs from where it is distributed to stand-pipes in the villages."

● Intermediate schemes

"Institutions (e.g. hospitals and colleges) outside of the urban areas are supplied with water from schemes which could be classified as being intermediate schemes.

"These schemes consist of sedimentation tanks, slow sand or polyurethane filters. Aluminium sulphate is used as a coagulant, lime for pH adjustment and HTH for chlorination. Pumps are either diesel or electrically operated.

"During the drought of the preceding years Ciskei purchased five mobile water purification plants: three units with a capacity of 6m³/h and two with a capacity of 8m³/h.

"These units were used in various areas of Ciskei. Water was extracted from stock watering dams, purified and then distributed by motorised water tankers to areas of need."

● Regional schemes

"All of the urban areas in Ciskei are supplied with water from regional schemes. These regional water schemes are also combined with the local schemes to supply water to the rural areas.

"All of the water purification plants for the regional schemes are rapid gravity sand filtration units preceded by chemical treatment and sedimentation. Aluminium sulphate or ferric chloride are used as

"Quotes" from the conference . . .

"Appropriate technology involves a sound knowledge of basic principles. It does not imply the application of inferior methods or techniques; on the contrary, the simplicity called for demands a greater depth of understanding of fundamentals."

Dr FA van Duuren
Hill, Kaplan, Scott, Pretoria

Most policy-makers, and the engineers etc. that advise them, are not aware of how conditioned they are by "conventional solutions" when it comes to decisions on water supply and sanitation. Frequently, the minimum allowable level of service is set too high, resulting in a lucky few receiving a luxury service and, when the cash soon runs out, the rest get little or nothing . . .

. . . Planning to meet the goals of the "Water Decade" has led most governments and international agencies to re-think their criteria in terms of a "Decade Approach" in which developments are designed to be affordable by the community to be served and are thus *replicable* by that community without its relying on large injections of funds from outside . . .

. . . The chosen technology must be: Technically *appropriate*, socially *acceptable* and financially *affordable*. Or, put another way: What is the cheapest technically feasible technology that users will accept and can maintain and that the local authority is institutionally capable of operating?"

. . . It is much easier to talk about (community involvement) than to achieve. The correct concept is "Community Participation" which means that the community should be able to choose the range and quantity of services that are to be provided and devise a means of mobilising the resources needed to develop and then to operate the scheme. More commonly, however, it consists of exhorting the locals to contribute free labour to a pre-determined scheme in order to reduce the government's share of the costs. Realistically speaking, where finance is limited planners should attempt to consult the community on its priorities.

Mr Barry M Jackson
Urban Sanitation Improvement Team
Maseru, Lesotho

Adequate water supply for drinking and sanitation purposes is rated as highly important for both social and economic development in the developing states of Southern Africa. This is born out by the fact that the *Development Bank of Southern Africa* is at present appraising water supply and sanitation related loan applications from its participating states in excess of R300 million.

Dr Simon S Brand
Development Bank of Southern Africa, Sandton.

. . . The efficient management of large irrigation schemes is difficult to achieve anywhere, but the problems are compounded when such a scheme is established, as a foreign and unknown technology in a developing country. As a result, in Africa south of Egypt, major

(To page 24)

(To page 24)



Typical flat Free State terrain bordered by mountains, on which the project is carried out.

Visiting scientists at Bethlehem weather

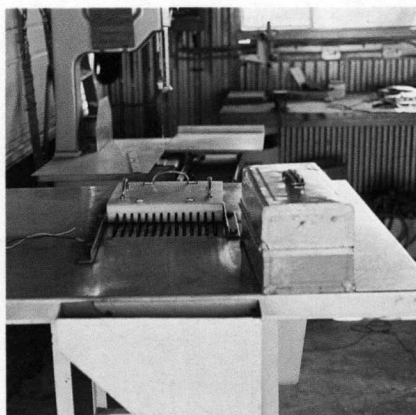
For the past eight years research on precipitation is being conducted in the Bethlehem area, Orange Free State, by the Weather Bureau in collaboration with the Water Research Commission.

The Commission's contribution is by way of secondment of some research staff while the Weather Bureau provides the infrastructure and the bulk of the financial support.

Three visiting scientists recently joined the research team at Bethlehem. They are Dr Terry Krauss, the new project leader who comes from the Alberta Hail Research Programme in Canada and Dr Andrew Heymsfield and Mr Edward Neish, both from the National Centre for Atmospheric Research (NCAR) in Boulder, Colorado, USA.

Dr Heymsfield, a well-known physicist, will look at various aspects of cloud modelling and microphysical measurements in the Bethlehem clouds while Mr Neish will assist with aircraft instrumentation and radar calibration.

A close-up of the machine used to cut dry ice blocks into small cubes for cloud seeding.





*Part of the Bethlehem research station. The huge white "ball" is the **radome** which houses the project radar. The radar is used to record the three dimensional characteristics and behaviour of clouds in the area.*

research project

Below: (From left) Dr Terry Krauss, from Canada, the new project leader of the Bethlehem precipitation research project, Dr Andrew Heymsfield and Mr Edward Neish, both from the USA.

On top of the aircraft the decelerator can be seen which is used to slow down the airstream (by a factor of 11) to enable natural ice particles to be collected from the clouds.



Ciskei fighting a hard battle



A labour intensive rural water supply scheme in the Ciskei.

(From page 21)

coagulants. In some cases polyelectrolytes are also used. Lime is used for pH adjustment and gaseous chlorine for chlorination."

With regard to the Ciskei's future plans for water supply Mr Balzar said that the Ciskei is at present preparing a national water plan for the country. This plan will not only determine the policies for water resources development and management in Ciskei, but will also suggest a programme of development to meet the long-term objectives.

Mr Balzar said that it was acknowledged in Ciskei that water cannot be regarded as a free commodity forever and that the cost of water supply schemes must be recovered where possible.

"When a reasonable price has been paid for water it will reduce the possibility of misuse and contribute to the overall economy of the scheme," he said.

"Quotes" from the conference . . .

(From page 21)

schemes tend to be characterised by failures in meeting target yields, economic projections and human development intentions. In India and Pakistan half of the 10 million hectares of developed irrigation land is affected by a rising water table, and waterlogging and salinity are severe on one million hectares. The World Bank reports that already-developed irrigation land in Africa is being lost through mismanagement at a greater rate than new land is being developed.

Professor DR Tapson
University of Fort Hare, Eastern Cape

In an economic evaluation the most difficult part seems to be the selection of a meaningful economic yard stick against which feasibility could be measured.

Inflexible first-world economic yard sticks do not always fit into a dynamic development policy and might even severely hamper development. The only meaningful indicator should be "what is the alternative" as it is highly unlikely that all the indirect benefits and proceeds could be quantified and included in the evaluation process, to the long-term detriment of development.

Mr JC De Korte
O'Connell, Manthè and Partners, Cape Town.

New WRC Projects

Irrigation: The University of Fort Hare, Eastern Cape, is to undertake a 4-year research project, at a cost of R412 000, aimed at gathering data on the moisture retention qualities of various soil types and the moisture-absorbing characteristics of various agricultural plants. The project leader is Professor MC Laker, head of the Department of Soil Sciences at the University.

Microfiltration: The Pollution Research Group at the University of Natal, Durban, will carry out a 3-year research project at a cost of R422 200 to develop support systems for cross-flow microfiltration. The Group will also evaluate the technical performance of the systems on industrial waters and wastewaters. The project leader is Mr Treffry-Goatley.

Groundwater: The Institute for Groundwater Studies (IGS) of the University of the Orange Free State and the Department of Water Affairs will join forces in the mathematical modelling of the Grootfontein Compartment in the dolomites of the Western Transvaal. The one year project is estimated to cost R17 500 and will be under the supervision of Dr JF Botha.

IGS will also carry out a 4-year research project on the exploitation potential of Karoo aquifers at a cost of R745 000. The objective of the research programme is to provide the water resource engineer with a method of obtaining an estimate of the exploitation potential of an aquifer in the semi-arid Karoo regions without having to conduct a full geohydrological investigation of the area. The study will be undertaken in areas near De Aar and Dewetsdorp, and the project leader is Professor J. Kirchner.

Sludge Bulking: A project on the full-scale evaluation of preventative and remedial methods for the control of activated sludge bulking will be undertaken by the Water Resources and Public Health Engineering Group in the Department of Civil Engineering, University of Cape Town. The 3-year project at a cost of R184 000 will be under the leadership of Dr G Ekama.



By die algemene jaarvergadering van die Instituut vir die Bestryding van Waterbesoedeling (IBWB) (SA Tak) is mnr Piet Odendaal, hoofadviseur van die Waternavorsingskommissie ingehuldig as voorsitter vir 1985. Hier bespreek hy saam met mev S van Biljon (pasafgetrede voorsitter) en dr Lukas van Vuuren (regs) 'n handleiding vir waterwerke-operateurs wat dr Van Vuuren namens die NIWN aan die Instituut oorhandig het.

REDAKTEUR BEDANK

Mnr Anton Prinsloo wat tien jaar lank redakteur van die Waternavorsingskommissie se tydskrif *SA Waterbulletin* was (sedert die stigting van dié blad in Augustus 1975), het onlangs die pos van senior mede-redakteur aanvaar by die Buro van die Woordboek van die Afrikaanse Taal (WAT), Universiteit van Stellenbosch. Mnr Prinsloo het verlede jaar 'n meestersgraad aan die Universiteit van Suid-Afrika verwerf met 'n studie oor Afrikaanse besproeiingstaal. Die titel van sy verhandeling was: Taal as middel tot tegnologie-oordrag: Afrikaans by besproeiingsnavorsing.

Afgesien van sy leidende rol met die uitbouing van die *SA Waterbulletin* was mnr Prinsloo allerweë bekend vir sy gewilde rubriek *Finally* wat gereeld vol water-kwinkslae en "onbesoedelde" poësie op die agterblad van die Bulletin verskyn het.

Ons wens graag namens die lesers van *SA Waterbulletin* vir mnr Prinsloo en sy gesin alle voorspoed toe met dié nuwe loopbaan.



Mnr AF Prinsloo

Sanciahs news/nuus

NEWS FROM THE SOUTH AFRICAN NATIONAL COMMITTEE FOR THE INTERNATIONAL ASSOCIATION OF HYDROLOGICAL SCIENCES

NUUS VAN DIE SUID-AFRIKAANSE NASIONALE KOMITEE VIR DIE INTERNASIONALE GENOOTSKAP VAN HIDROLOGIESE WETENSKAPPE

SURFACE HYDROLOGY MASTER PLAN

In the February 1985 edition of *SA Waterbulletin* it was announced that a working group had been established by the Water Research Commission for the systematic development of the 'master plan' for surface hydrology. The group got together for the first working session on 3 and 4 April this year. The session was most productive and initial decisions concerning the following have been taken:

A "soapy" model

The Water Systems Research Programme, University of the Witwatersrand, has developed a kinematic model for simulating flow from catchments and streams. The model is called 'KOMO'. Although this anagram really stands for kinematic overload flow model, it is more likely to be associated with a well-known South African washing powder. The computer model is a two-faced one. It simulates both surface flow and interface flow.

The micro-computer program was originally developed for a catchment in Transkei hence the K in OMO. The model is incidentally being used in a real-time situation receiving rainfall data from a telemetry system and predicting dam water levels for operation of a hydro-electric station.

D STEPHENSON

Professor of Water Engineering
Wits

- The field of "surface hydrology" which has to be covered by the master plan has been defined. This field, which as expected turned out to be very wide, was divided into smaller manageable, although inter-related, components for the actual development of the master plan. These will be integrated in the final document. The plan will include those aspects sometimes considered not to be part of surface hydrology *per se*, these being water resources research and/or engineering hydrology.
- Information for the plan will be obtained from knowledgeable people throughout South Africa by means of the well-known Delphi technique. These knowledgeable experts will form respondent groups and a separate group will deal with each component of the research field. Respondent groups will be identified by the working group.
- The information thus received will be structured and the priorities formalised by means of the Analytic Hierarchy Process. This should provide for stability and continuity of the research needs and priorities over time. The plan will however be reviewed regularly and updated when necessary.
- Deadlines have been set for the task.

* 1 June 1985: A statement of intent will be tabled before the Co-

ordinating Committee for Hydrological Research (CCHR)

* 1 June 1986: The draft master plan will be tabled before the CCHR for comment and recommendation.

* 1 September 1986: The final draft master plan will be tabled before the Water Research Commission for comment and signing.

* 1 January 1987: The master plan will be published and distributed.

The next meeting of the working group will be held on 13 May 1985. Respondent group and Delphi questionnaires for the different research components will be formulated then.

It is hoped that this master plan will lead to more effective decision making. Thereby, we hope that the research which is undertaken in terms of the plan will help provide for the optimum development and management of the surface water resources of Southern Africa. The working group sees the research, and therefore also the research plan, being used by water resource strategists, developers and managers. These 'customers' will no doubt come from all sorts of organisations including central government and private enterprise such as Water Affairs and Consulting Engineers.

Because of this potentially widespread use and the importance of the plan, the working group is relying on the chosen expert respondents to give the task the attention it deserves. The respondents will be announced at

some later stage, probably together with the plan to give them their due acknowledgement for their contribution.

It will be so nice when this plan comes together!

DWH Cousens, Senior Adviser, WRC

PS: Hydrological Symposium

According to the organisers of the second *South African National Hydrological Symposium*, which will be held in Pietermaritzburg from 16 to 18 September this year, there has been an excellent response to their call for papers. More than 50 abstracts have been received so far, and the organising committee are now trying to make arrangements to accommodate as many papers as possible.

Persons wishing to attend the symposium should please complete the registration form in this Bulletin and return it to Professor RE Schulze, University of Natal, as soon as possible.

Effluent disposal on land

An information bulletin entitled *Guidelines for the disposal of effluent on land in South Africa* has been published by the Soil and Irrigation Research Institute.

The purpose of this publication is to offer guidelines for the disposal of effluents on land.

Although there is a great diversity of effluents, more than 95 per cent of them can be accommodated within four main categories in so far as their effects on soil are concerned. These are sewage effluent, ammonium rich effluents, high organic matter, low sodium adsorption ratio (SAR) effluents and alkaline high SAR effluents. The most common sources of these effluents are listed.

It is further indicated that certain kinds of soils are more suitable than others for the disposal of specific types of effluent and, thus, that there are definite desired

soil/effluent combinations. Recommendations for the disposal of the various effluents on land are given.

Sewage effluent is virtually harmless and can be disposed of on almost all soils without having to apply soil amendments. At the other end of the scale are the alkaline high SAR ones in which the use of soil amendments such as gypsum is essential, and few soils, mainly red clays, are suitable for this purpose.

Finally, it is stated that availability of suitable effluent disposal sites be taken into account when choosing a location for an industry that produces effluent requiring disposal on land.

Copies of this publication are available from:

The Director, Agriculture Information, Private Bag 144, Pretoria 0001.

CALL FOR PAPERS

International Symposium on

•Flood Frequency And Risk Analyses•

m a y 1 8 — 2 1, 1 9 8 6

**Louisiana State University
Baton Rouge, LA 70803-6405 USA**

Floods constitute a persistent and serious problem in the United States as well as many other parts of the world. They are responsible for losses amounting to billions of dollars and scores of deaths annually. Virtually all parts of the U.S. — coastal, mountainous and rural — are affected by them. Heavy prolonged rains, rapidly melting snow, high winds accompanying hurricanes or tropical storms, high tides, dam breach and land subsidence are some of the causes of flooding. The problem of flooding is further compounded by land use changes and human interference with natural systems. Two aspects of this problem that have long been topics of scientific inquiry are flood frequency and risk analyses due in part to their application to a wide spectrum of problems pertaining to water resources planning, coastal zone management and urban development. It is therefore appropriate to pause and ask, Where we are? Where we are going? and Where we ought to be going as regards the technology of flood frequency and risk analyses?

**Enquiries: International Symposium on Flood Frequency and Risk Analyses
Department of Civil Engineering
Louisiana State University
Baton Rouge, LA 70803-6405
USA**

First freshwater crayfish in South Africa

Freshwater crayfish are an internationally sought after gourmet dish. It is only quite recently, however, that the potential of freshwater crayfish has been recognised locally. What began as an interesting hobby for Mr Gerald Cubitt, a co-director of *Amanzi Marron Farm*, Southern Cape, resulted in a full-time profession.

Freshwater crayfish species, which add up to 300, are mostly farmed within the USA, Europe and Australia and may vary in size from the *Cambarellus shufeldti*'s 25 mm to the giant Tasmanian crayfish's mass of 6 kg.

The red swamp crayfish (*Procambarus clarkii*) is the most extensively cultured crayfish species in the USA. The dock side value of the 1981 crop in Louisiana, USA, was estimated around 45 million US dollars.

During 1981 prices for freshwater crayfish in Scandinavia and France were between 17 and 25 US dollars per kilogram. To meet local demand Sweden even has to import 2 000 tonne of freshwater crayfish annually.

The three largest freshwater crayfish occur in Australia, namely the giant Tasmanian crayfish (*Astacopsis gouldi*), the Murray crayfish (*Euastacus armatus*) and the marron (*Cherax tenuimanus*).

Marron originate from a small area in Western Australia. According to a publication on South African aquaculture by Dr O Safriel and Prof MN Bruton, marron are "readily marketed through the restaurant trade in Australia and in 1982 growers were paid 16 Australian dollars per kilogram for live marron. Since the lifting of an embargo on the export of live marron in 1980, marron have been exported to the USA, Japan, Europe and South Africa."

At Amanzi, the marron farm near Wildernis in the George district, there are some 35 breeding ponds for the marron ranging in size from approximately 800 to 1 000 square metres.

What makes the marron so special in the field of freshwater crayfish and why did Mr Cubitt decide on this species which is often also referred to as the freshwater lobster? Mr Cubitt explains: "Of the three larger freshwater crayfish species the marron is the most



A marron (*Cherax tenuimanus*). This freshwater crayfish's tail constitutes 40 per cent of its total mass.

suitable for aquaculture purposes. The marron's large tail constitutes 40 per cent of its total mass and the claws 19 per cent, which in effect means that it provides more flesh than the marine lobster (tail 32 – 34 per cent of total mass) or than the average freshwater crayfish (tail 20 per cent of total mass).

"Comparing the freshwater crayfish to the marine lobster," Mr Cubitt says, "the freshwater crayfish has an advantage in growth rate as well. It breeds in its second year while its marine counterpart takes approximately 7 to 8 years to mature."

Mr Cubitt describes the marron as a temperate species performing at its best in water temperatures ranging between 17°C and 22°C. He says that growth is inhibited at temperatures below 12°C and that the mortality risk increases at temperatures higher than 30°C.

The ideal breeding conditions for

the marron occur during spring. Although most of the female marron are in berry during October some have been found to be in berry as early as the end of August. "One female can carry approximately 2 000 juveniles per kilogram weight," Mr Cubitt says. "Due to the high rainfall experienced in the George district, lime shortages in the water may occur from time to time affecting the growth."

Predators such as otters, cormorants and platannas are also a problem. Certain measures are being taken to keep the otters from entering the rearing ponds, tyres are put into the ponds as shelters for the marron and a scarecrow serves as a deterrent for the cormorants.

According to Mr Cubitt marketing of the marron will commence this year if all goes according to schedule.



'n Paar besoekers afgeneem tydens die inligtingstoer deur die Vlakplaats-suiweringswerke, Boksburg.

Die Munisipaliteit van Boksburg het onlangs 'n geslaagde opedag vir chemiese fosfaatverwydering by die Vlakplaats Waterbesoedelingsbeheerwerke aangebied wat deur meer as 300 belangstellendes bygewoon is.

Betrokkenes, waaronder, stad-singenieurs, chemici, konsultingenieurs, verteenwoordigers van staatsdepartemente, industrialiste en voorsieners van chemikalieë en apparaat, was die geleentheid gegun om 'n uitstalling met toerusting vir chemiese fosfaatverwydering te besigtig, na vier kort referate te luister en 'n toer deur die suiweringswerke mee te maak.

Die superintendent van Boksburg se rioolwerke, mnr Hennie Basson, sê hulle het landwyd versoeke ontvang wat voorgestel het dat soortgelyke opedae in ander provinsies ook aangebied word. Hy sê uit die navrae wat ontvang is, blyk dit duidelik dat 'n behoefte aan meer inligting oor beskikbare tegnologie by rioolwatersuiwering bestaan.

Baie probleme by rioolwerke ontstaan omdat tegnologie nie reg benut word nie, meen mnr Basson. Hy voel dat betrokkenes, ten opsigte van die verkoop van produkte sowel as die bedryf daarvan, nie

altyd die nodige tegniese kennis beskik oor die produkte nie, wat verskeie probleme in die praktyk tot gevolg het. Meer opedae is nodig waar bemerkers hulle produkte kan uitstal en demonstreer sodat dié wat in die praktyk staan beter kennis kan bekom van beskikbare tegnologie. Opedae bied ook die ideale geleentheid om probleme wat in die praktyk voorkom te bespreek, sê mnr Basson.

Indrukke

SA Waterbulletin het aan sommige persone wat die verrigtinge bygewoon het gevra na hulle indrukke van die dag. Volgens mnr L Skiotus, rioolingenieur van Springs Munisipaliteit, het die vlak wat tegnologie bereik het op die gebied van fosfaatverwydering hom beïndruk, veral die gebruik van vloeimeters.

Beide die superintendent en tegnoloog van Welkom Munisipaliteit, mnre JJP Jacobs en JW Gerber, was dit eens dat die dag interessant en leersaam was. Mnr Jacobs sê die uitstalling het 'n bydrae gelewer tot inligting wat hulle nog kortgekom het. Mnr Gerber was beïndruk deur die ontwikkeling op die gebied van elektroniese vloeimeters en die verskeidenheid wat nou te koop aangebied word.

Op die vraag wat chemiese dosering en behandeling hulle werke addisioneel gaan kos, het mnr WN Rossouw, assistent-hoof: Watersuiwering en Chemiese Dienste van Benoni Munisipaliteit, gesê die lopende koste per jaar sal tussen 250 000 en 400 000 rand wees. Behandelingskoste sonder chemiese dosering beloop 11,8 sent per kiloliter wat na toediening van ferrichloried verhoog sal word na 14,8 sent per kiloliter.

Volgens mnr Dries Louw, hoof-chemikus by Boksburg Munisipaliteit, is behandelingskoste by hulle werke 5 sent per kiloliter, terwyl chemiese dosering 'n addisionele 1 sent per kiloliter beloop.

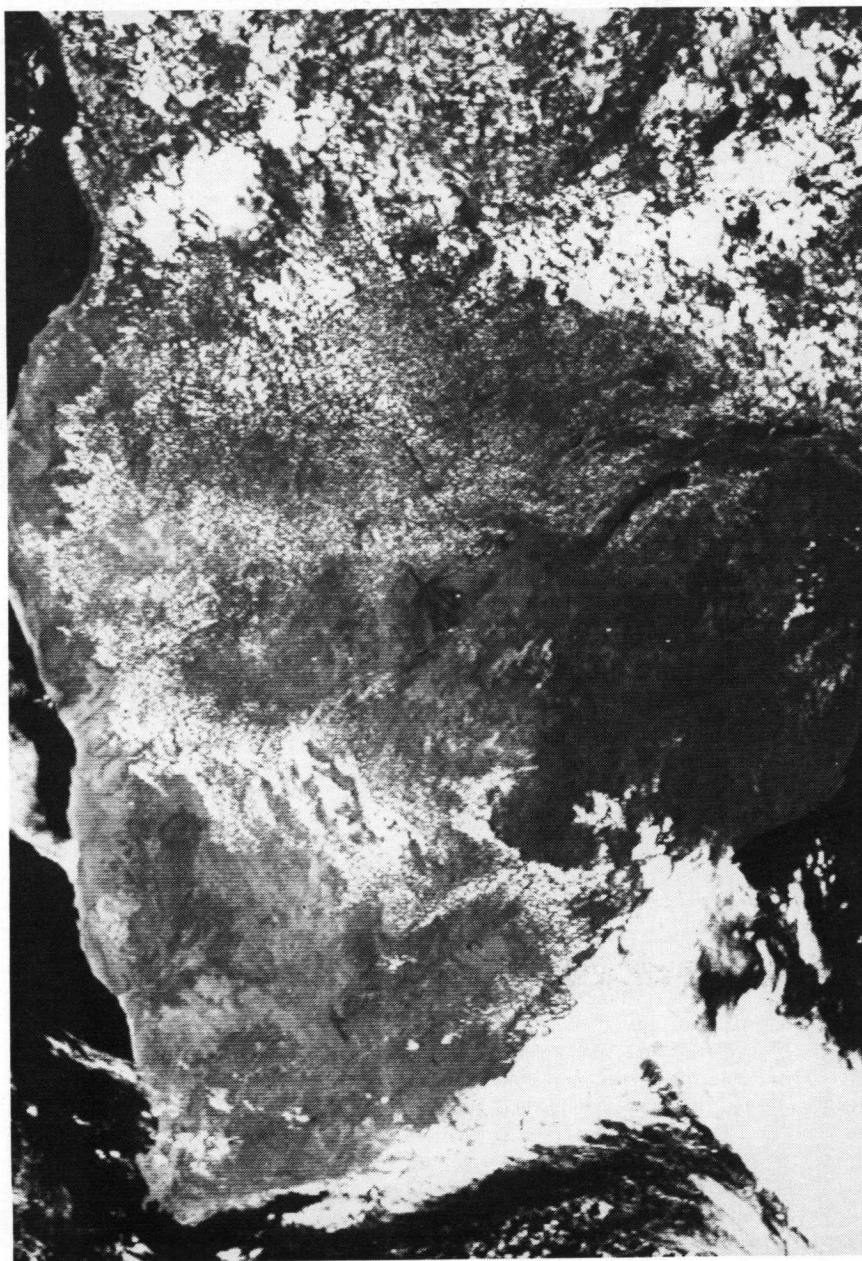
Verskeie munisipaliteite het gesê dit is vir hulle in hierdie stadium nog nie moontlik om te sê wat hulle behandelingskoste na chemiese behandeling van uitvloeisel sal wees nie.

Die sprekers wat tydens hierdie geleentheid opgetree het was Dr HNS Wiechers (Watnavorsingskommissie), mnr JvR Stander (Besoedelingsbeheer, Departement Waterwese), dr C Viljoen (Randwaterraad), mnre AS Louw, H Basson (Boksburg Munisipaliteit) en WV Alexander (Scott en de Waal).

"The low pressure system west of the country is deepening and moving slowly eastwards. It will start to affect the South-Western Cape from tonight causing cloudy and cooler conditions with rain and a fresh north-westerly wind during this forecast period." Tomorrow's weather. But what about a forecast for next week or next month? Is long-term weather forecasting at all possible? Mr HJC van den Berg, Director of Weather Forecasting Services of the Weather Bureau, spoke at a water symposium earlier this year revealing some of the possibilities and limitations related to this topic. The symposium was presented by Thompson Publications at the Rand Afrikaans University.

LONG-TERM WEATHER FORECASTING

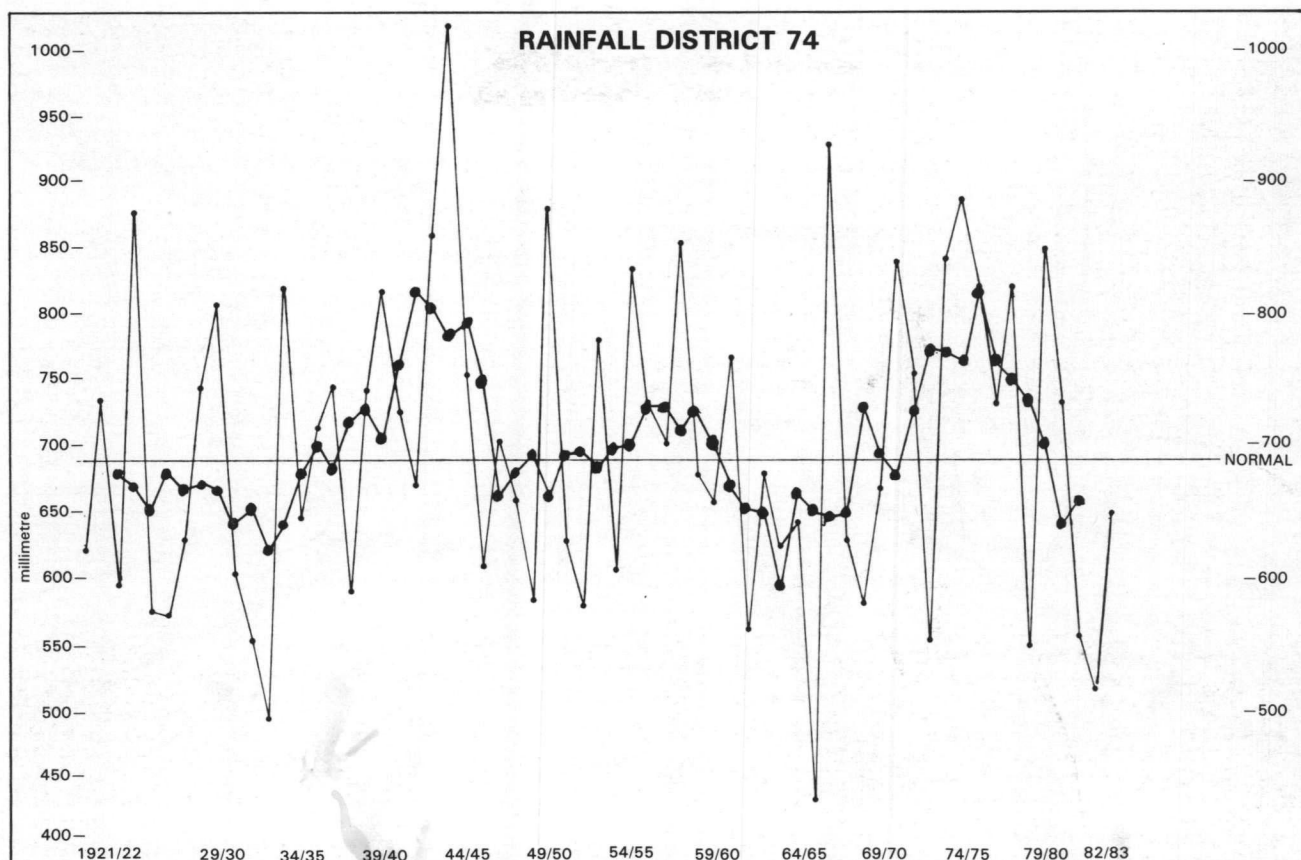
by
HJC van den Bergh



The Weather Bureau's forecasts for 24 to 48 hours ahead are based on the analysis, on a real-time basis, of actual weather reports received from the whole Southern Hemisphere. These reports are received at four internationally fixed times daily and are analysed by a powerful mainframe computer. By means of a sophisticated mathematical model, based on the physical laws governing atmospheric processes, the computer calculates the future movement and development of weather-bearing systems, that is the high and low pressure systems, for up to 48 hours in advance.

Long-term forecasts

The question arises as to why this process could not simply be carried through to arrive at forecasts for a week or a month ahead. The reason is that the atmospheric processes are extremely complex and even in the best mathematical models use is made of approximations by ignoring small terms in the equations which will not affect the forecast in the short term. However, if one goes beyond 48 hours the omission of these small terms becomes progressively more important and your forecast soon becomes unrealistic. It is therefore generally acknowledged that there is an upper limit of ten days for the deterministic type of forecasting. In the Northern Hemisphere weather services are achieving a fair amount of success with forecasts up to 5 days ahead.



Graph of rainfall for the PWMVS area and part of the Highveld up to Leslie.

In the Southern Hemisphere, of which 80 per cent is ocean area nearly void of meteorological data, we are at a great disadvantage and our data base for the numerical forecast is totally inadequate. So, for instance, within a radius of 2 500 km around Gough Island there is no other fixed weather station, i.e. in an area of nearly 20 million km².

In the large areas, where there is no data, estimates have to be made. The inaccuracy of such estimates is progressively magnified the longer the forecast and the experience is that forecasts of 72 hours and further are becoming progressively less reliable the longer the period.

World Climate Programme

If it is assumed that this forecasting method cannot be applied for monthly or seasonal forecast, then some other way must be found, for there is clearly a growing and pressing need for such forecasts in the light of the growing world population and the limited food and

water resources of the world. The World Meteorological Organization has therefore launched a World Climate Programme with a view to stimulate research in this direction on an international scale. The problem is vastly bigger than that of short-term forecasting. Climatic models will have to be found making use, not of the current weather systems, but of physical factors that determine the long-term variations in sea-surface temperatures, fluctuations in solar activity, volcanic dust in the atmosphere, the increase in the carbon dioxide concentration and ozone variations, the amount of snow and ice cover of the globe. Even changes in the vegetation cover may in the long-term play a significant role. These factors are interactive and compound the problem even more. Some climatic models have been developed overseas but we are still far from the ultimate answer.

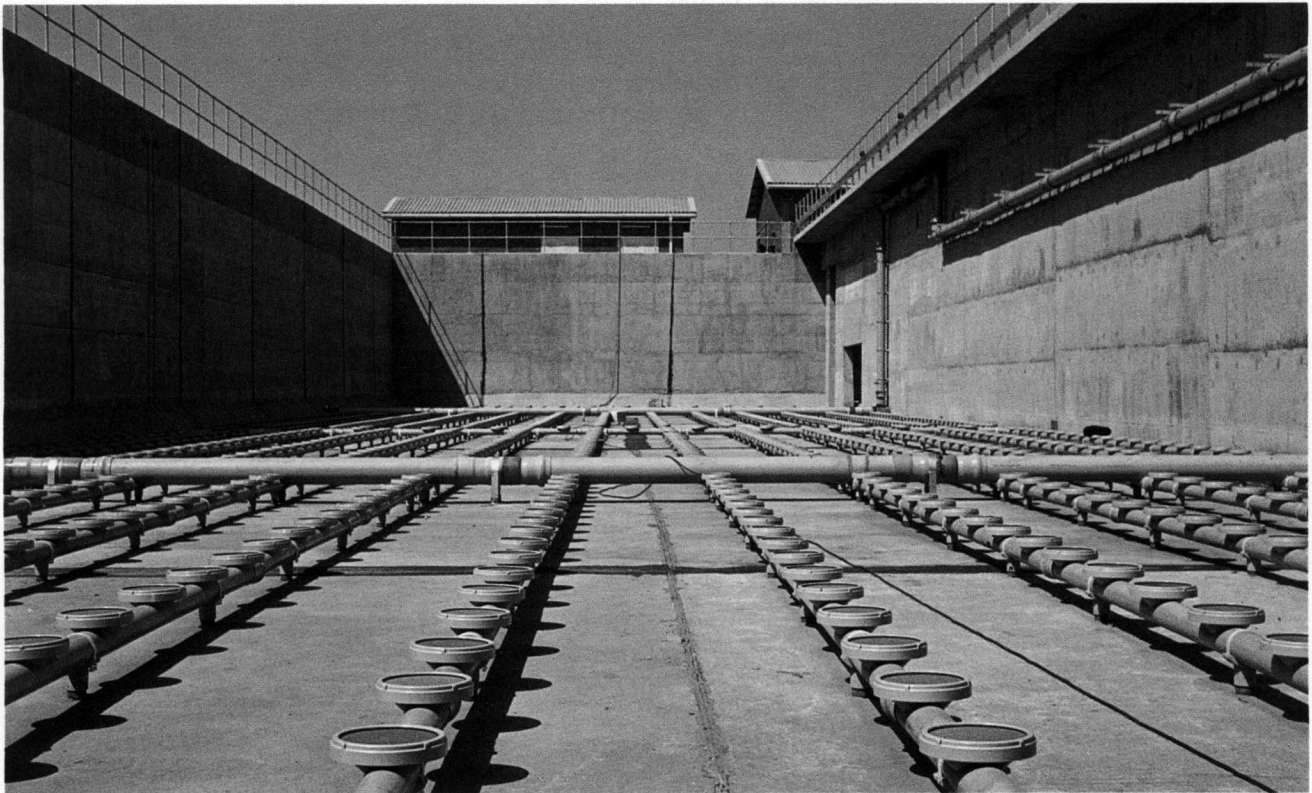
Statistical approach

Another approach is the purely statistical one. In other words, if

we analyse the past 50 or 100 year's records, is it perhaps possible to find periodicities? This field of study has received attention from many researchers for a century and longer and still we have no real fool-proof result. Statistical analyses yield different cycles of say 10, 14 and 18 years, mostly depending on the researcher's preference, or combinations of these. It is not disputed that there is a rough cycle of average dry periods followed by average wet periods but there are so many exceptions in every period that some statisticians, in despair, claim that the rainfall from year to year is nearly completely random.

The graph of rainfall for the PWV area and part of the Highveld up to Leslie between 1921/22 and 1982/83 illustrates this clearly. The five-year running mean gives a rough cycle of 15-20 years but the exceptions are so many that one simply cannot forecast a particular dry year even in a dry cycle or vice versa. A good case in point is the very wet summer of

(To page 42)



Fynborrelbelugters onder in die hoofbelugtingsbak.

Leeuwkuil-waterherwinningswerke:

WATERGEHALTE IS DIE WAGWOORD

'n Rioolwerke waarvan die gesuiwerde riooluitvloeisel só skoon is dat dit amper aan drinkwaterstandaarde voldoen, is onlangs op Vereniging in Transvaal geopen.

Die Leeuwkuil-waterherwinningsaanleg wat 20 megaliter rioolwater per dag kan behandel en teen 'n koste van nagenoeg R8 400 000 opgerig is, is spesiaal op versoek van die Randwaterraad ontwerp om hoëgehalte uitvloeisel te lewer wat aan die Raad se strengste veiligheidsstandaarde vir ontvangwaters kan beantwoord.

Dié hoë standaard is nodig aangesien die behandelde uitvloeisel van die aanleg via die Leeuwkuil-spruit na die stroomgebied van die Barrage terugvloei waar baie van die PWVS-gebied se drinkwater onttrek word.

Om te verseker dat die Randwaterraad se standaard gehandhaaf word, het die stadsraad van Vereniging besluit om 'n waterherwinningsaanleg pleks van 'n konvensionele rioolwaterwerke te bou.

Tydens die amptelike opening van die Leeuwkuilwerke het dr James Barnard van die firma Meir-

ing & Vennote, wat vir die prosesontwerp van die werke verantwoordelik was, die volgende beskrywing van die nuwe waterherwinningsaanleg gegee:

Inlaatwerke

Alle rioolwater word na een sentrale punt op die aanleg gepomp. Meganiese siwwe verwyder die lappe en ander groot voorwerpe, waarna die rioolwater deur 'n ontgrintingsiklone vloei. Grint en swaar organiese materiaal sak hier uit en word met behulp van 'n lugpomp uitgepomp, gewas en ver-

wyder. Hierna vind vloei-meting en verdeling van die vloei tussen die ou en die nuwe aanlegte plaas.

Primêre besinktenks

Die vloei wat na die nuwe aanleg afgekeer word, vloei dan na twee hoogbelaste primêre besinktenks (elk 18 m in deursnee). Die besinktenks het 'n sywaterdiepte van 3 m en is voorsien van skrapers wat die besinkte slyk na 'n hopper skraap van waar dit afgetrek en na die ou aanleg gepomp kan word vir vertering in die opgegradeerde verterders. Voorsiening is gemaak vir

die hersirkulasie van 'n gedeelte van die slyk na die inlaat van die besinktenks sodat vetsure wat in die slyk vorm, uitgelooë kan word. Hierdie vetsure word benodig om die slyk te kondisioneer vir die verwydering van fosfate. Die bowater van die besinktenks word vermeng met die teruggevoerde slyk van die finale besinktenks en na die biologiese reaktor gevoer.

Biologiese reaktor

Die biologiese reaktor behels die vyffase-Bardenpho-proses. Dit bestaan uit die volgende onderverdelings

Anaërobiese bak	1 764 m ³
Eerste anoksiese bak	2 268 m ³
Belugtingsbak	6 100 m ³
Tweede anoksiese bak	2 020 m ³
Herbelugtingsbak	1 475 m ³

Anaërobiese bak

Hierdie bak is verdeel in twee dele, elk voorsien van een roerder om 4 kW energie aan die mengslyk oor te dra. Die mengslyk word deur 'n skag na die bodem van die eerste gedeelte gestuur en vloei dan opwaarts na 'n oorloop, van waar dit weer na die bodem van die tweede bak gestuur word. Voorsiening is gemaak vir 'n omloop indien hoë vloeitempo's ondervind sou word wat die retensietyd in die bak mag verkort. Vanaf die tweede gedeelte van die bak vloei die mengslyk na dié punt waar mengslyk gehersirkuleer word van die belugtingsbak van die eerste anoksiese bak, sodat intieme vermenging van al hierdie vloeië kan plaasvind. Die doel van hierdie anaërobiese bak is om kontak te bewerkstellig tussen die fosfaatopnemende bakterieë en die asynsuur wat in die geaktiveerde primêre besinktenks gevorm is ten einde die fosfaatopnemende bakterieë te kan bevoordeel.

Eerste anoksiese bak

Die goedvermengde slyk word hier toegelaat om onder anoksiese toestande te denitrifiseer en so doende die nitrate af te breek wat in die belugtingsbak gevorm is. Twee roeders wat elk 4 kW energie na die mengslyk oordra, is geïnstalleer. Geen belugting word voorsien nie.

(Na bladsy 34)



Die westelike aansig van die chemiese huis met kitsvermenging, flokkulasiekamers en opgeloste lugflottasie-eenheid vir die indigting van die aktiefslyk.



Outomatiese terugwassandfilters (onder konstruksie). Voor is die plastiese partisies vir die individuele selle op die vloer en die gate waardeur rouwater na die filter gevoer word.



Voltooide sandfilters en bewegende brug, volledig met terugwaspompe. (Sien sandfiltrasie).

Leeuwkuil

(Van bladsy 33)

Belugtingsbak

Hierdie bak vou langs die eerste anoksiese bak terug tot by die punt waar twee aksiale pompe geplaas is om die belugte mengslyk na die anoksiese bak te pomp. 'n Ander arm volg deur na die tweede anoksiese bak en al die mengslyk wat nie teruggepomp word nie, vloei hierlangs.

Die belugtingsbak is voorsien van ongeveer 5 000 belugtingstene (178 mm deursnee elk), gemonteer op 'n rooster van plastiese pype wat stewig in die vloer geanker is en waardeur lug vanaf die blaserhuis voorsien word. Die stene breek die lug in fyn borrels op wat stadig boontoe styg en suurstof in die water oplos. Die opgeloste suurstof word deur die bakterieë gebruik vir energie en metabolisme. In die proses word die suurstof omgeskakel na water, terwyl die grootste gedeelte van die organiese verbindings in die water afgebreek word na kooldioksied en water. Ammoniakverbindings word in nitrate omgesit. Die selle groei en vermeerder en moet gereeld afgetrek word om hulle getalle te beheer.

Die lug word voorsien vanaf die blaserhuis deur 'n stelsel van vlek-vrye staalpepe om korrosie te voorkom. Instrumente is voorsien vir die meting van die lugvloei na die verskillende sones in die belugtingsbak asook vir die meting van die opgeloste suurstofkonsentrasie in die mengslyk sodat hierdie konsentrasie beheer kan word, eerstens vir kragbesparing en tweedens om dit moontlik te maak om nitrate te verwyder. Die metings word gekontroleer met behulp van 'n mikroprosesseerder in die kontrolekamer.

Tweede anoksiese sone

Vanweë die vereiste verwydering van nitrate, bo en behalwe die fosfate, is voorsiening gemaak vir 'n tweede anoksiese sone. Normaalweg word slegs roeders voorsien en in hierdie geval is daar twee roeders wat elk 4 kW energie aan die mengslyk oordra.

Daar is egter gevalle waar sekondêre vrystelling van fosfate in hierdie bak plaasvind en om dit te verhoed, is ook growweborrelbelugters geïnstalleer om die toestande so te reël dat die anoksiese toestand slegs genoegsaam sal wees vir die verwydering van nitrate, sonder die vrystelling van fosfate. Ses rye Helixors is vir hierdie doel voorsien en enige aantal kan aangeskakel word.

Herbelugtingsone

Hierdie laaste gedeelte van die biologiese reaktor is voorsien van fyn-borrelbelugterstene. Hulle sorg dat die mengslyk wat na die finale besinktenks gevoer word aërobies bly en dat fosfate nie gou vrygestel sal word nie.

Mengslyk hersirkulasie

Twee aksiale pompe is voorsien wat elk in staat is om 700 l/s mengslyk vanaf die belugtingsbak na die eerste anoksiese bak te pomp sodat nitrate uit hierdie vloei verwyder kan word. Normaalweg word net een van die pompe benodig en een is as 'n bystandseenheid voorsien.

Finale besinktenks

Die mengslyk word by die uitlaat van die herbelugtingsbak in drie gelyke dele verdeel en na drie finale besinktenks (elk 26 m in deursnee en met 'n sywaterdiepte van 3,5 m) afgelaat. Die besinktenks het koniese bodems en is 5,4 m diep in die middel. Die mengslyk word onder die vloer deur na die stilbak in die middel gevoer en daarvandaan deur vertikale gleuwe radiaal uitgelaat. Die slyk sink na die bodem van waar dit na die sentrale hopper geskraap word deur skrapers wat aan 'n roterende brug hang. Die slyk word afgetrek na die skroefpompstasie vir terugpomp na die anaërobiese bak van die reaktor.

Voorsiening is gemaak vir die afrekking van opdrifels. Die besinkte water word afgetrek oor V-kepe in die omtrekkorlooprand om goeie verspreiding van die water deur die tenk te verseker. Die water word versamel in die geut om die omtrek van die bakke en na die chemiese behandelingseenheid afgelaat.

Skroefpompe

Twee skroefpompe is geïnstalleer om die slyk wat van die finale besinktenks afgetrek word na die anaërobiese bakke te pomp. Normaalweg word net een van hierdie pompe benodig terwyl die ander 'n bystandseenheid is. Een pomp loop gedurig en die aftrek van die slyk word deur verstelbare hekke beheer.

Chemiese behandeling

Voorsiening is gemaak vir die toevoeging van 'n flokkuleermiddel en polimere asook vir die koagulasie en flokkulering van die water voordat dit na twee chemiese besinktenks gestuur word vir besinking. Die flokkuleermiddel word in massa voorsien in 'n opgaartenk en met behulp van doseringspompe toegedien. Die polimere moet in die chemiese huis aangemaak word en kan dan ook op dieselfde manier gedoseer word. Die koagulant word toegedien gevolg deur kitsvermenging en flokkulasie. Besinkte chemiese slyk word gehersirkuleer om die vlokvorming aan te help. Daarna verdeel die vloei na twee chemiese besinktenks wat identies is aan die finale besinktenks, maar net ietwat vlakker.

Aangesien verwag word dat die opgeloste fosfate in die uitvloeisel ten alle tye aan die standaard sal kan voldoen, is die hoofdoel van die koagulering om die standaard vir chemiese suurstofbehoefte (CSB) (30 mg/l in die somer en 35 mg/l in die winter) te handhaaf. Na optimalisering van die proses sal die dosis ferrichloried wat benodig word hopelik nie 20 mg/l oorskry nie. Dit mag selfs moontlik wees om die standaard slegs deur sandfiltrasie te kan bereik.

Volgens dr Barnard is dit moeilik om in hierdie stadium te voorspel wat die totale koste van die chemiese behandeling sal wees, maar dit word geskat op ongeveer 2,45 c/m³.

Sandfiltrasie

Twee outomatiese terugwasfiltereenhede is vir die polering van die chemiese aanleg se uitvloeisel voorsien. Hierdie eenhede bestaan

(Na bladsy 36)

HYDROLOGICAL INVESTIGATION OF RURAL CATCHMENTS IN NATAL: RESULTS RELEASED

Two final reports entitled:

- 1) *Hydrological models for application to small rural catchments in Southern Africa: refinements and development* by RE Schulze and
- 2) *Improved estimates of peak flow rates using modified SCS lag equations* by EJ Schmidt and RE Schulze

have recently been released by the Water Research Commission (WRC).

The reports are based on research results generated during a programme of hydrological research undertaken in terms of an agreement between the WRC and the Department of Agricultural Engineering, University of Natal.

The aims of the research were:

- The continuation of the hydrological data collection programme in selected gauged rural catchments in Natal to improve modelling of rainfall-runoff relationships with special reference to flood events.
- The development of the Soil

Conservation Service (SCS) method of determining flood hydrographs, and its application to South African conditions, including the production of tables showing the hydrological properties of soils.

- The development of rainfall/soil moisture deficit data for Southern Africa.
- The determination of the effects of changing land-use practices on:
 - a) Annual runoff volume expressed as a percentage of annual precipitation.
 - b) Annual soil and nutrient losses.
- Observations on soil and nutrient losses from small catchments for the determination of non-point source pollution modelling techniques, utilising the Universal Soil Loss equation and hydrological parameters.

Report no 1 forms the major contribution of this project.

The report focuses on:

- refinements to the Soil Conser-

vation Service (SCS) model for improved performance.

- hydrological characteristics of soils in Southern Africa where each of 501 soil series was classified for hydrological modelling purposes.
- the development of the "ACRU" (Agricultural Catchments Research Unit) model for the simulation of rainfall/runoff relationships, supplementary irrigation requirements and seasonal crop yields. The model has been structured to be highly sensitive to land-use changes.

Report no 2 focuses on the second aim outlined above viz. the improvement of the SCS model. Using the improved lag equations markedly improved estimates of peak flow rates can be obtained by use of the SCS technique.

Copies of the reports are available, on request, from the Chairman, Water Research Commission, PO Box 824, Pretoria 0001.

or

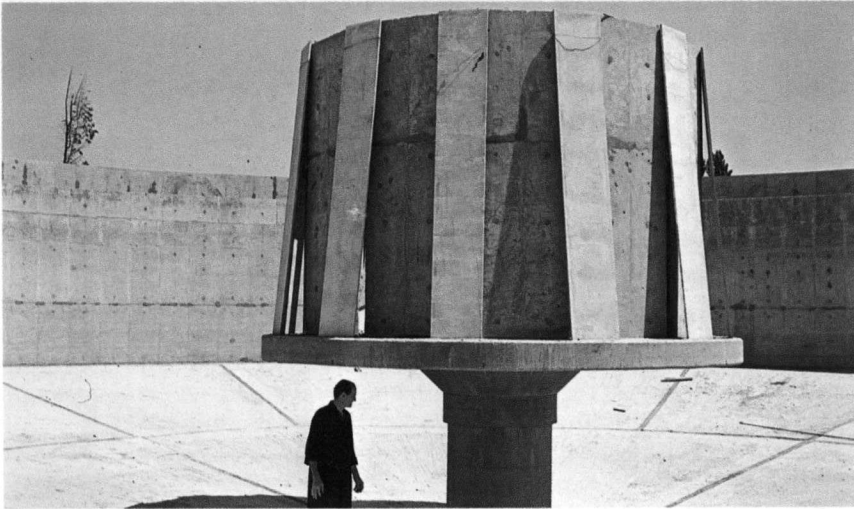
The Head, Department of Agricultural Engineering, University of Natal, PO Box 375, Pietermaritzburg 3200.

AWWA representatives visit South Africa

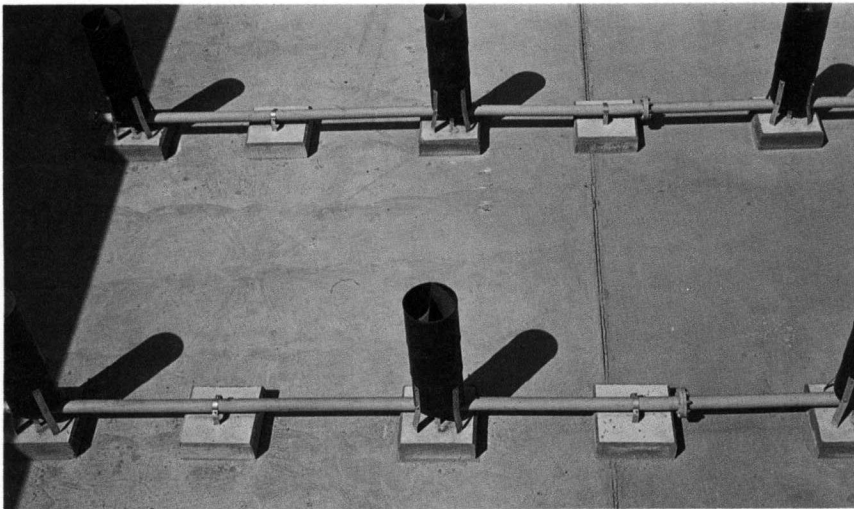


From left: Mr J de Wet (SA Association of Consulting Engineers), Dr JP Kriel (WRC), Dr MJ Pieterse (WRC), Mr WH Richardson (AWWA), Mr PE Odendaal (WRC), Mr PA Schulte (AWWA), Mr WCS Legge (Department of Water Affairs) and Mr CM Spence (SA Association of Consulting Engineers).

Leeuwkuil-werke



Spesiaal ontwerpte stilbak vir aanlegte met fosfaatverwydering. 'n Kenmerk van die stilbak is dat dit die water sywaarts versprei pleks van ondertoe soos normaalweg. Dit is om nie die slyk waar die fosfate vrygestel word, te versteur nie.



Helixor growweborrelbelugters vir die belugting van die tweede anoksiese sone, indien nodig.

(Van bladsy 34)

uit 'n groot aantal individuele selle waarvan die lengte gelyk is aan die breedte van die filtereenheid. Die selle is ongeveer 180 mm wyd. Die selpartiesies loop regdeur tot op die vloer van die eenheid en die selle kan individueel teruggewas word deur 'n pomp wat op 'n bewegende brug gemonteer is. Die terugwaswater word opgevang deur 'n skerm wat ook met die brug verbind is en oor die sel beweeg. 'n Tweede pomp lig die terugwaswater in 'n geut. Die beweging van

die arms en die pompe kan geaktiveer word deur 'n tydsakelaar of deur die meting van die drukverlies deur die filter.

Chlorering

Aangesien die aanleg bedryf sal word om baie lae ammoniakkonsentrasies te handhaaf, is breekpuntchlorering moontlik. 'n Monitor sal die vry chloor bepaal en die chlorering daarvolgens reël. 'n Kontakbak is voorsien met 'n oorloop wat met teëls bedek is sodat die kwaliteit van die water ook visueel geïnspekteer kan word.

Finale houdam

Daar is 'n houdam voorsien vir die terughou van die uitvloeisel vir ten minste 48 uur sodat die water na 'n pan afgelaat kan word indien probleme sou ontstaan. Wanneer iets verkeerd sou loop, kan die water onmiddellik na die pan afgekeer word. Indien gevind word dat die water in die houdam reeds van so 'n gehalte is dat dit nie afgelaat kan word nie, kan dit ook na die pan leeggemaak word. Die dam kan dan weer met water gevul word wat aan die vereistes vir aflating voldoen.

Blaserhuis

Die blaserhuis is voorsien van ses blasers van die *Roots*-tipe, volledig met driefase-filters vir die ultrafiltrering van die lug, asook met inlaat- en uitlaat-klankdempers.

Vyf kleiner blasers is gekies om in die wisselende suurstofbehoeftes te kan voorsien sonder gesofistikeerde toerusting. Dus, hoewel die aanskakeling en afskakeling van belugters deur die komper beheer kan word, kan ook teruggeval word op tydsakelaars om blasers in te bring soos verlang.

Voorsiening is gemaak vir 'n bystandskragopwekker wat voldoende krag sal lewer om een van die blasers te kan bedryf.

Opgelostelugflottasie

Hierdie eenheid is voorsien vir die indigting van die slyk voordat dit na die verteerders gepomp word. Mengslyk word direk van die belugtingsbak afgetrek sodat die slykretensietyd (SRT) volumetries gereël kan word. Die mengslyk word dan vermeng met gehersirkuleerde water wat onder druk versadig word met lug. Die lug wat uit oplossing vrykom, kleef aan die slykdeeltjies wat dan boontoe sweef en só groter indigting verskaf as wat anders moontlik sou kon wees. Twee indigters, elk met 'n deursnee van 8 m is voorsien. Een van die eenhede kan indien nodig, die totale slyk van hierdie aanleg hanteer.

Monitering en kontrole

'n Mikro-prosesseerder is geïnstalleer om die suurstoftoediening op

(Na bladsy 38)

STABILIZED SOIL AS A MATERIAL IN DAM CONSTRUCTION

"In view of the current drought and recession in South Africa the use of soil-cement as a material in dam construction should be actively investigated."

This is the opinion of Dr JA Robertson who recently completed his doctorate on the viability of stabilized soil as an alternative material for construction of large dams. Dr Robertson is a civil engineer currently in private practice. Due to the scope of the investigation, Dr Robertson eventually concentrated in his research on soil-cement.

The research was undertaken with sponsorship from, amongst others, the Water Research Commission, Department of Water Affairs and the Cement Industry.

Soil was obtained from a site for which designs for earthfill and concrete dams had been prepared and at which a buttress dam was under construction. Of the two residual felsite soils obtained from this site, Dr Robertson found the less weathered soil, closer to the dam site more suitable for soil-cement. These soils were tested in a preliminary test program.

Costs of the soil-cement dam were found to compare favourably to alternative designs. "Considerable savings could have been effected had a soil-cement dam been erected in place of the concrete dam constructed on the site from which the soil used in this research was collected," Dr Robertson says.

The laboratory program which was eventually undertaken includ-

ed wetting and drying, permeability, leaching, unconfined compression and tension, direct shear, oedometer and heat of hydration tests. "Tests were conducted with test periods of up to 900 days," Dr Robertson says.

The cement contents investigated ranged from 5 to 20% cement by dry mass of soil in the majority of tests with 10% adopted as standard.

Dr Robertson found that wetting and drying cure led to an increase in compressive strength and resistance to leaching. While leaching occurs under high gradients, the long term tests showed that leaching was unlikely to present a significant threat.

Results of unconfined compression tests were found to compare favourably with the results of other workers and for other materials.

The results of the triaxial compression tests indicated that unconsolidated undrained tests on

unsaturated specimens can be used for routine triaxial testing. The angle of internal friction is found to increase with increases of cement content up to 5% and to remain constant thereafter.

From results of direct shear tests it was found that despite the reduced ultimate strength of construction joints, the residual strength of the material was unaffected.

As a result of oedometer tests conducted with specimens subjected to a loading program designed to simulate embankment construction and reservoir operation, three moduli for use in design and related to the unconfined compressive strength of the material, are proposed.

Dr Robertson says the heat gain characteristics of soil-cement obtained from heat of hydration tests agree well with reported values for cement and concludes that no thermal problems are anticipated.



A typical soil-cement placing train ploughing a soil-cement slope protection on an embankment dam in the USA. Similar equipment would be used in constructing the soil-cement dam envisaged by Dr JA Robertson.

Leeuwkuil

(Van bladsy 36)

die aanleg te beheer. Die lesings van drie suurstofmeters word na die eenheid gesein. Die gemiddelde waarde word geneem en blasers word hiervolgens aan- of afgeskakel. Indien die lugtoevoer van een blaser te veel sou wees, kan lug afgeblaas word deur 'n spesiale klep. In geval van probleme kan die beheer oor die suurstoftoevoeging oorgeneem word deur tydsake-laars.

Die prosesseerder sal ook rekord hou van die suurstoflesings van al die probes oor 'n periode van 36 uur en van gemiddelde waardes oor die hele tydperk van bedryf. Verder sal dit aandui watter motors op die aanleg loop, watter afgeskakel is en watter gestaak het.

'n Ammoniakmonitor is voorsien om die bedryf van die aanleg te kontroleer. Indien die opgeloste suurstofkonsentrasie voldoende is, geen meganiese probleme ondervind word nie en die ammoniak in die uitvloeisel merkbaar styg, kan dit beteken dat gifstowwe die werke binnekom. Hierdie stelsel is gekies vanweë die nitrifiserende organismes se gevoeligheid vir gifstowwe. Die bakterieë dien dan ook as bio-monitors. As onraad vermoed word, kan die uitvloeisel dadelik afgekeer word na die pan tot tyd en wyl vasgestel is wat die probleem veroorsaak het.

Anaërobiese vertering

Die bestaande verteederders was onvermeng en onverhit. Die kapasiteit van die verteederders is meer as verdubbel met behulp van vermenging en verhitting. Verhitting geskied deur middel van hitte-uitruiling vanaf 'n warmwaterketel sodat kragopwekking ook later oorweeg kan word. 'n Moderne gashouer met 'n membraan is voorsien vir die berging van die gas.

Koste van die Aanleg

Die koste van die aanleg was soos volg:

Siviele werk R5 600 000, meganiese toerusting R1 850 000, elektriese toerusting R950 000, groot-totaal R8 400 000.



Professor Vorster oorlede

Professor PJC Vorster, voormalige hoofadviseur van die Waternavorsingskommissie, is onlangs skielik aan 'n beroerte-aanval op Pietermaritzburg oorlede waar hy sedert sy aftrede in 1983 gewoon het. Hy

was 61 jaar oud. Prof Vorster was in Suid-Afrika bekend vir sy werk op die gebied van landbou-ingenieurswese en besproeiingsnavorsing. Hy word oorleef deur sy vrou en vier kinders.

Symposium on Water Purification

The Division of Hydraulic and Water Engineering of the South African Institution of Civil Engineers in collaboration with the National Institute for Water Research is presenting a symposium at the CSIR Conference Centre on 30 September 1985.

This symposium is intended to give engineers the opportunity to get acquainted with the latest technology in drinking water purification.

The keynote address will be delivered by Mr LD Hobbs, Chairman of the Rand Water Board, and topics to be discussed include:

- water quality considerations,
- problems in the treatment of

soft water,

- energy requirements for large scale coagulation/flocculation,
- new developments in flotation for drinking water,
- moving bridge filter,
- ozonation: the South African scene,
- organohalogen precursors: removal and control,
- sludge dewatering and
- concrete lining of steel pipes.

Full details on the symposium are available from the Chief Director, NIWR, P.O. Box 395, Pretoria 0001, telephone (012) 86-9211 extension 2231 (Mr P. Coombs or Mrs. R. Oellermann).

SOUTH AFRICAN NATIONAL COMMITTEE FOR THE INTERNATIONAL ASSOCIATION OF
HYDROLOGICAL SCIENCES (SANCIAHS)

SECOND SOUTH AFRICAN NATIONAL HYDROLOGICAL SYMPOSIUM,

PIETERMARITZBURG, SEPTEMBER 16-18, 1985

Following the highly successful first South African National Hydrological Symposium held in Pretoria in September 1983, SANCIAHS is organising a second national hydrological symposium.

Venue : University of Natal, Pietermaritzburg (as part of the University's 75th Anniversary celebrations)

Dates : Papers : September 16 and 17, 1985 (Mon and Tues)

Excursion : September 18 to De Hoek and Cathedral Peak Hydrological Research Stations.

Topics :
Hydrological modelling
Statistical hydrology
Water resources management
Irrigation
Catchment management
Hydrological processes
Sediment studies
Hydrometeorology
Geohydrology
Land use effects
Urban hydrology
Floods/Droughts

Costs : Registration : R50, including social functions.
Students R20

Excursion : R30

Accommodation : University Residence R25, including lunches.
Hotels R40 — R60, according to rating.

Enquiries : Dr PJT Roberts (012) 28-5461 or Prof RE Schulze (0331) 6-3320



SANCIAHS — SECOND NATIONAL HYDROLOGICAL SYMPOSIUM REGISTRATION

Name : _____

Address : _____

☐ I wish to receive further information about the Symposium.

☐ I wish to attend the excursion.

☐ I wish to reserve accommodation in a University residence.

Please return as soon as possible to

Prof R.E. Schulze
Department of Agricultural Engineering
University of Natal
Pietermaritzburg
3201

TOERUSTING

Ten einde 'n inligtingsdiens aan ons lesers te lewer, verwelkom die redakteur bydraes vir publikasie (beperk tot ongeveer 300 woorde en een of twee foto's en diagramme) deur vervaardigers en verspreiders van nuwe toerusting en prosesse wat met die bevordering van water-aangeleenthede verband hou.

Sulke bydraes word egter ontvang of gepubliseer met dien verstande dat: (1) die betrokke vervaardiger of verspreider wat die bydrae lewer, verantwoordelik bly vir die inligting of menings daarin vervat en vir aansprake ten opsigte van daardie toerusting en prosesse; en (2) publikasie daarvan nie impliseer dat die redakteur of die uitgewer of die Waternavorsingskommissie die inhoud van so 'n bydrae aanbeveel of daarmee in ooreenstemming is nie.

Lesers wat meer inligting verlang, word versoek om direk met die vervaardigers of verspreiders in verbinding te tree.



SA Waterbulletin
PO Box/Posbus 824
Pretoria 0001

EQUIPMENT

As an information service to our readers, the editor welcomes for publication contributions (limited to approximately 300 words and one or two photographs and diagrams) by manufacturers and distributors of new equipment and processes related to the promotion of water affairs.

Any such contribution is, however, received or published on the understanding that: (1) the relevant manufacturer or distributor submitting the contribution is responsible for the information or opinions expressed in it and the claims made therein for that equipment or those processes; and (2) its publication does not imply that the editor or publisher or the Water Research Commission underwrites or is in agreement with the contents of such contribution.

Readers who require further information are requested to contact the manufacturer or distributor direct.

VALVES FOR POWER STATIONS



Tenders totalling R250 000 for valves to be installed in a 37,6 km pipeline between the Kriel and Kendal power stations have been awarded by the Department of Environment Affairs to Ainsworth Engineering (Pty) Ltd, of Denver.

This represents about two-thirds of the total valve requirements for the scheme, the remainder being shared by four other valve manufacturers, while the total value of the project exceeds R10-million.

Water from the Usutu River Government Water Scheme, which is fed by the Westoe, Morgenstond and Jericho dams, will enter the first section of the new pipeline at the Kriel power station. This section will be a 5,6 km gravity main, with a nominal bore of 1,2 metres, which will feed the water into two reservoirs and a pumping station to be built at the Malta power station.

The water will then be pumped for 32 km along a 900mm rising main to the Kendal power station.

Ainsworth Engineering will supply 244 of the 259 valves to be used on the scheme, all of which are required to meet specifications for a guaranteed useful life of 45 years.

In terms of the tender award they are required to provide dependable and drop-tight operation at all times, despite the fact that they will be exposed to all weather conditions and will be operated only at long intervals.

These include 14 sleeve-type jet dispersion valves with a 200mm nominal bore capable of handling pressures of up to 2,5 MPa.

Enquiries:
Ainsworth Engineering (Pty) Ltd
PO Box 25653
Denver
2027
Tel: 615-7190

CHEMICAL DOSING PLANT

Trials at Boksburg's Vlakplaats Works and Daspoort, Pretoria, have shown conclusively that correct chemical dosing is effective in maintaining the phosphate level of the effluent below 1 mg/l.

A new packaged chemical dosing plant for phosphate removal, being produced and marketed by Lektratek (Pty.) Ltd. of Potchefstroom, is based on principles found to be effective at Boksburg and Pretoria. The most significant refinements are the controls which have been developed and designed by Lektratek over a lengthy period.

During the development of the controls one major factor arose. In order to make optimum use of the accurate chemical dosing facilities provided by the Mono metering pumps it was necessary to make provision for the variations in phosphate levels in the effluent. A phosphate correction curve has been developed by Lektratek as part of their control system.

Based on the hourly phosphate levels in the effluent, obtained from analyses at the sewage purification works, a mean phosphate concentration is determined.

The basic chemical metering rate is set for this level. The hourly variations above or below this mean level are set on the phosphate correction curve in the control panel. As the level of phosphate varies throughout the day the correction curve, in conjunction with the rate of flow measurement, automatically adjusts the chemical dosing rate accordingly.

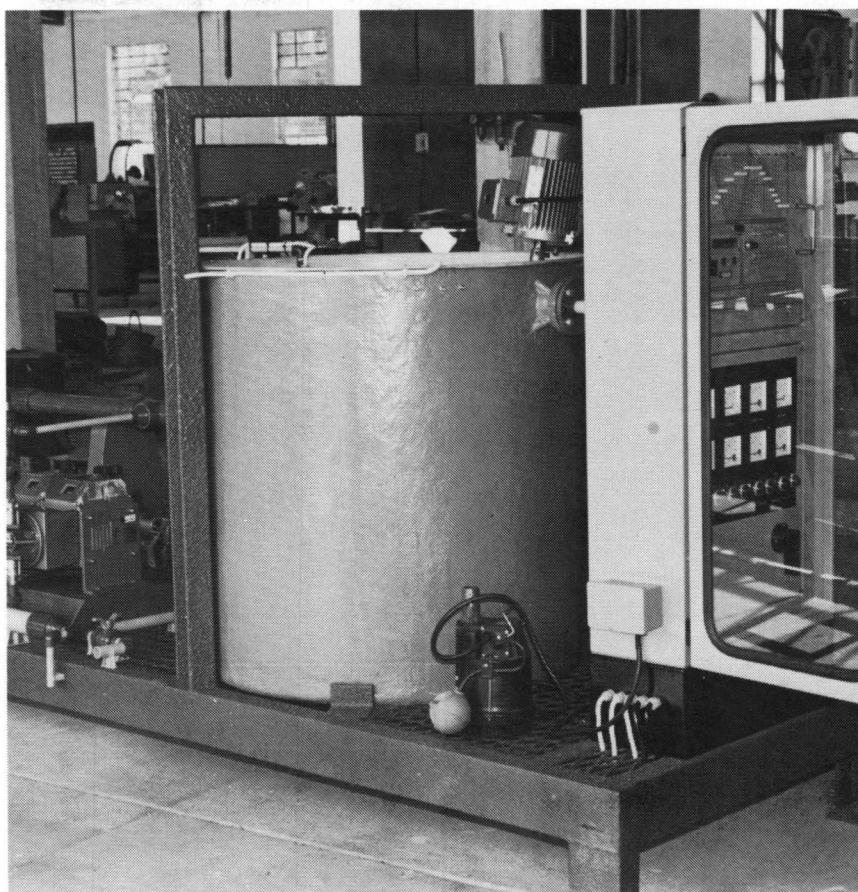
Since very accurate dosing of the chemicals can be achieved large chemical cost savings are made.

In medium to large sewage purification works these savings can amount to 20% or approximately R30 000 per year. The difference in capital cost between the Lektratek plant and a simple basic dosing system without accurate control can be recovered in a few months because of lower chemical costs.

The research and development work on the Lektratek phosphate removal plant is now complete and a unit is installed at Boksburg's Vlakplaats Water Pollution Control Centre. Here interested parties will be able to inspect it operating.

The main component of Lektratek's package plant are pre-built, assembled on a frame and tested as a unit at the factory before despatch to site thereby enabling the site installation to be done in the minimum of time.

A unique feature of the controls is in the solid state switching of all motors and pumps which has been specially designed and manufactured by Lektratek of Potchefstroom. This type of switching results in better reliability and the minimum amount of wear.



Weerkunde- en Hidrologiewoordeboek

'n Woordeboek vir die vakgebiede Weerkunde en Hidrologie het die lig gesien. Die woordeboek is saamgestel deur die Vaktaalburo en Department Nasionale Opvoeding in samewerking met Departement Vervoer.

Vanweë die tweeslagtigheid van die woordeboek moes al die randgebiede betrokke inaggeneem word en dek terme 'n wye front. Terme onder Hidrologie sluit randgebiede in soos byvoorbeeld Chemie, Grondkunde, Plantkunde, Oseanologie, Limnologie en Geologie. Die randgebiede onder Weerkunde is onder meer Fisika, Chemie, Sterrekunde, Lugvaart en Skeepvaart.

Elk van die twee vakgebiede is eers afsonderlik in lysvorm afgehandel voordat dit tot een woordeboek gekonsolideer is.

Die samestelling van die woordeboek het ook gepaard gegaan met probleme en harde dinkwerk. Heel-

wat van die ysverskynsels op land en ter see is byvoorbeeld betreklik onbekend aan Suid-Afrikaners en is gevolglik nie tevore in Afrikaans onderskei nie. Voorbeelde in dié verband is: ruigryp (hoar-frost), witryp (white frost), skelm ryp (black frost) en waaisneeu (driven snow).

Weens die dinamiese ontwikkeling van beide Weerkunde en Hidrologie sal die woordeboek nie altyd op datum kan wees nie. 'n Goeie voorbeeld is die vinnige ontwikkeling van satellietweerkunde wat feitlik daagliks nuwe terme genereer en die al groter rol wat die rekenaar in Weerkunde en Hidrologie speel.

Die woordeboek is verkrygbaar by:

Die Staatsdrukker
Privaatsak X85
PRETORIA
0001

Prys: R34,80 + AVB

Enquiries:

Lektratek Marketing
PO Box 20170
NOORDBRUG
2522
Tel (01481) 2-1747/9

Training manual available

The NIWR has recently published a ***Manual on Water Purification Technology*** after numerous requests from organizations concerned about the training of water and wastewater treatment plant technicians. It is intended primarily as a text book for students enrolled for the National Diploma in Water Care.

At present, owing to a lack of prospective students, only four technikons in South Africa are offering this course; namely Pretoria, Cape Town, Witwatersrand and Mabopane East.

The *Manual* was written by dr JH Denysschen, formerly Head of the NIWR's Technological Applications Division, under the guidance of an editorial committee. Dr LRJ van

Vuuren and Messrs RJ Drews, JS Wium, J Coetzee, J Maree and JJ Schoeman of the NIWR made contributions. Prof WA Pretorius, Faculty of Engineering, University of Pretoria, was responsible for one of the chapters and served on the editorial committee.

The 178-page *Manual* has a chapter on each of the following: Drinking-water sources and standards; water treatment technology; pretreatment processes; flocculation; sedimentation; filtration; disinfection; corrosion and stability control; and special treatment processes. The *Manual* is obtainable from the Librarian, NIWR, PO Box 395, Pretoria 0001 at a cost of R15,00 plus GST, payable in advance (please quote code number 620 9942 9).

Exhibition

The International Processing, Control and Industrial Technology exhibition will be held in Johannesburg from 24 to 28 September 1985. The exhibition will incorporate process engineering, control instrumentation and allied technological developments in major industrial sectors.

Enquiries: Thomson Trade Fairs & Promotions (Pty) Ltd., PO Box 56440, Pinegowrie 2123. Telephone 789-2144.

Zululand

(From page 10)

and variables which need to be measured is required before a high percentage of the variance could be accounted for.

The three volumes of the final report are available, on request from:

The Chairman, Water Research Commission, PO Box 824, Pretoria 0001.

or

The Head, Hydrological Research Unit, University of Zululand, Private Bag X1001, Kwalang-ezwa 3886.

WEATHER FORECASTING

(From page 31)

1966/67 in the dry decade of the 1980's. In that summer the Vaal Dam was only 28 per cent full on 14 December 1966 and yet overflowed on 11 February 1967.

The recent El Nino phenomenon that coincided with weather extremes world-wide has focussed the attention of meteorologists on the importance of the interaction between ocean and atmosphere. Although it was found that 3 out of 4 El Nino's in the past 50 years were associated with below normal rainfall in the summer-rain areas of South Africa there were important exceptions. So, for instance, the El Nino in the Pacific had disappeared by the summer of 1983/84 and yet our rainfall did not return to normal.

TOGA

With a view to a better understanding of the ocean-atmosphere interactions, the World Meteorological Organization launched a global programme for collecting data on a real-time basis on sea-surface temperatures and pressures in the tropical oceans in January 1985 (Code name TOGA). Several hundreds of drifting weather buoys will be launched, especially in the Southern Hemisphere, to achieve this aim. South Africa will also be participating in this project. Since 1977 we have been deploying weather buoys in the southern oceans and at present 18 are in operation, providing pressure and temperature data from areas where conventional weather stations are non-existent.

In conclusion it must be stressed that, even if we eventually find it possible to make useful seasonal and longer term forecasts, South Africa will remain a country with limited water resources and recurring serious rainfall deficiencies. Careful and meticulous planning to make the maximum use of the available water will therefore remain a top priority in this country.

WATER'S OWN "OSCAR"

An in-house audio visual production, *The main connection*, has won Wessex Water three awards at the British Industrial and Scientific Film Association.

According to *Water Bulletin* the authority was one of very few non-professional entries accepted in the final of a competition dominated by big names such as BP and British Airways.

Newsletter published

The IAHR/IAWPRC Joint Committee on Urban Storm Drainage decided to produce a periodic newsletter. The aim of the newsletter is to promote an exchange of information on urban storm drainage to the international research community. Copies of the first issue, dated December 1984, are now available.

Persons interested in obtaining copies of the first and future issues of the newsletter, should write to:

**Mr HC Chapman
Water Research Commission
PO Box 824
Pretoria 0001**

INTERNATIONAL CONFERENCE

NEW DIRECTIONS AND RESEARCH IN WASTE TREATMENT AND RESIDUALS MANAGEMENT

June 23-28, 1985
The University of British Columbia
Vancouver, B.C. Canada

Enquiries: Dr HNS Wiechers, WRC, PO Box 824, PRETORIA 0001.
 Tel: (012) 28-5461

INVENTORS AWARD FOR WATER

A project called International Inventors Award IIA was initiated in Sweden in 1976 for the purpose of stimulating innovation for development.

Water has been selected for one of the award areas for 1986, and involves an amount of 250 000 SEK — approximately 27 000 US dollars. The

last day for nomination for the award is August 1, 1985.

Inventors cannot nominate themselves — this can only be done by certain individuals. Further information can be obtained from: International Inventors Awards IIA, PO Box 16020, S-10321 Stockholm, Sweden.

Unusual plant found

According to an American scientific journal published by the Water Pollution Control Federation a marine plant found in temperate and tropical climates, the Coon Tail, has been found to remove 96 per cent of phosphates and 97 per cent of ammonia from wastewater and to reduce biological oxygen demand by 95 per cent.

Scientists at the Tamil Nadu Water Supply and Drainage Board in India conducted certain experiments on water bodies heavily used for bathing. As a result of the natural biochemical processes of the plant water remained clear.

Scientists are looking at the efficiency of the plant in treating industrial wastes.



Third International Workshop
Durban, South Africa
27 April — 3 May 1986

GAP is a small working group of international experts whose objective is to understand the process of photosynthesis, the factors that control it and to develop and improve methods for measuring it in aquatic ecosystems.

The theme of the Third International Workshop is **Respiration and its effects on the measurement of aquatic primary productivity**. The GAP Workshop will be a hands-on exercise where scientists from many disciplines and from around the world will be working side by side calibrating and comparing their techniques on sea water and clear and eutrophic impoundments.

Enquiries: Dr Richard Robarts Chairman, Organising Committee, c/o Symposium Secretariat S371, CSIR, PO Box 395, Pretoria 0001, Republic of South Africa.

CONFERENCES AND SYMPOSIA

HYDROLOGY

The 4th international hydrology symposium will be held from 15 to 17 July 1985 in Fort Collins, USA. The theme at the symposium will be *Multivariate analysis of hydrologic processes*.

Enquiries: HW Shen, Hydrology & Water Resource Program, Engineering Research Centre, Colorado State University, Fort Collins, Col 80523, USA.

SBWRM — ISRAEL '85

An international symposium on scientific water management will be held from 19 to 23 September 1985 in Jerusalem.

Enquiries: KENES, PO Box 50006, Tel Aviv 61500, Israel.

ACID RAIN

An international symposium on acidic precipitation will be held from 15 to 20 September 1985 in Muskoka, Canada. The symposium will include a tour of the Dorset Acid Rain Research Centre.

Enquiries: Muskoka Conference '85, 112 St Clair Ave West, Suite 303, Toronto, Ontario, Canada M4V 2Y3.

AGRICULTURAL WASTES

The 5th international symposium on agricultural wastes will be held in Chicago from 16 to 17 December 1985. Papers will include research reports, case studies and state-of-the-art reviews.

Enquiries: American Society of Agricultural Engineers, 2950 Niles Road, St Joseph, Michigan 49085-9659, USA.

WATER TECHNOLOGY

A conference and exhibition on the Mediterranean region with emphasis on pollution control and North African water supply will be held in Monte Carlo, Monaco from 24 to 27 February 1986.

Enquiries: International Conferences & Exhibitions Ltd, 6 Porter Street, Baker Street, London W1M 1HZ, UK.

CONFERENCES AND SYMPOSIA

WASTE TREATMENT

An international conference on new directions in and research on waste treatment and residuals management will be held in Vancouver, BC, from 23 to 28 June 1985.

Enquiries: Dr WK Oldham, Conference Chairman, University of British Columbia, Department of Civil Engineering, 2325 Main Mall, Vancouver, BC, Canada V6T 1W5.

LIMNOLOGY

The 1985 LSSA Congress will be held from 1 to 5 July 1985. *Enquiries:* Jenny Day or Brian Davies, Zoology Department UCT, Rondebosch 7700.

GROUNDWATER

A symposium, *Groundwater 85* will be held in Pretoria from 1 to 3 July 1985.

Enquiries: Organizing Secretary, Groundwater 85, PO Box 8856, Johannesburg 2000.

BIOTREATMENT

A seminar on the Modelling of Biological Wastewater Treatment will be held in Copenhagen, Denmark from 28 to 30 August 1985.

Enquiries: Prof M Henze, Department of Environmental Engineering, Technical University of Denmark, Building 115, DK-2800 Lyngby, Denmark.

HUMAN WASTES

The IAWPRC's first Asian conference on treatment, disposal and management of human wastes will be held at the International House of Japan, Tokyo, Japan, from Monday 30 September to Friday 4 October 1985.

Enquiries: The Japan Organizing Committee of First Asian Conference of IAWPRC, c/o Japan Society on Water Pollution Research, Yotsuya New Mansion, 12 Honshio-cho, Shinjuku, Tokyo 162, Japan.

DESALINATION

The 2nd World Desalination Congress and Exhibition will be held in Bermuda from 17 to 23 November 1985.

Enquiries: International Desalination Association, c/o WSIA, PO Box 387, Topsfield, MA 01983, USA.

NITRATES

An international congress on nitrates in water will be held from 20 to 22 November 1985 in Paris, France.

Enquiries: Mrs Janine Lindenbaum, Compagnie Générale des Eaux, 52 rue d'Anjou 75384 Paris Cedex 08. FRANCE.

ENGINEERING

An international symposium on advances in water engineering will be held from 15 to 19 July 1985 in Birmingham, England.

Enquiries: Dr THY Tebbutt, Department of Civil Engineering, University of Birmingham, PO Box 363, Birmingham B15 2TT, England.

THE GEOLOGICAL SOCIETY OF SOUTH AFRICA

GROUND WATER DIVISION

GROUNDWATER '85 RESOURCE ASSESSMENT, MANAGEMENT AND CONSERVATION

VENUE: PRETORIA UNIVERSITY
DATE: 1-4 JULY 1985

TOPICS

- Ground water in fractured rocks
- Karst hydrology
- Ground water and mining
- Hydrochemistry and pollution
- Tracers in resource evaluation and protection
- Mathematical models: calibration; application
- Novel techniques and approaches
- Crisis hydrogeology: drought relief

EXCURSION (2nd July)

An excursion will be organised to the West Rand Dolomite Area. Visits and discussions will centre on: hydrogeology of dolomite compartments, ground water abstraction for urban use, dewatering by the goldmines, research into ground water recharge, pollution, subsidence and sinkhole formation. The excursion will be led by several leading experts and promises to be both scientifically and socially rewarding.

EXHIBITION (1st - 4th July)

An exhibition of technical and scientific equipment will be incorporated with the poster presentations. Prospective exhibitors are invited to contact the Organising Secretary.

Registration fee for the symposium, lunches, teas and excursion R100.

Telephone enquiries to:

RJ Connelly (011) 832-1201
R Meyer (012) 86-9211 ext. 2440

SA WATERBULLETIN

SA Waterbulletin is 'n kwartaallikse nuusbrieff oor water en watervorsing wat uitgegee word deur die Suid-Afrikaanse Waternavorsingskommissie (WNK), 'n statutêre organisasie wat in 1971 by Wet gestig is.

Intekening is gratis. Stof in dié publikasie weerspieël nie noodwendig die oorwoë menings van lede van die WNK nie, en mag hergebruik word met erkenning van die bron.

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Redakteur: Jan du Plessis
Asst-redaktrise: Marietta Theron
Red. sekretaresse: Rina Human

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