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Newsletter of the Water Research Commission

In This Edition

Above the Weather

Predicting weather and weather patterns is no easy task. But, Professor Hannes Rautenbach from the University of Pretoria (UP) seizes the challenge and finds it "fascinating" that "man is able to model climate patterns". His motivation for working in this field is equally fascinating- working with communities "on ground level- getting my hands dirty with African soil!"

Hannes commenced his studies (BSc: Meteorology) in 1982. In September 1999, he graduated with a PhD at UP. He commenced working at the South African Weather Service (SAWS) during his formative years. Initially he had to write many computer programs to manipulate data according to client needs. Upon commencement of post-graduate studies, he investigated the dynamics of a climate model developed by the CSIRO Atmospheric Research, Australia. "This brought me into contact with Prof Johan van Heerden of UP who was a project leader of a number of WRC projects. In 1991 I was appointed as research assistant in these WRC projects – it was the WRC that gave me the opportunity to join the University of Pretoria!"

The main topic that Hannes investigated in earlier research was rainfall estimation from satellite images, radar research and seasonal forecasting. In January 2000 Hannes was appointed coordinator of the Meteorology Group at UP. It was Hannes who initiated a shift of this group to form the Department of Geography, Geoinformatics and Meteorology- a Department that he currently heads as at March 2006. Prof Rautenbach was promoted to Associate Professor in November 2003.

"The Meteorology Group is the only Group in South Africa that offers BSc and postgraduate degrees in Meteorology, and we therefore have strong links with the SAWS in training Meteorologists for South Africa. Apart from the National Weather Service we became the first institution to issue routine numerical weather predictions. This achievement was the result of a recent WRC-funded project."

Hannes regards the WRC as "a key role player in water related research and especially capacity building in South Africa to create new researchers. The way that the WRC manages research projects also ensures that communities benefit from research." A splendid example is the fog water collection project that Hannes oversees in Limpopo Province. This project ensures that an entire school and community derive benefit from water that is sourced using the fog water collection method. Prof Rautenbach is part of the growing number of researchers who contribute to growing the formidable knowledge base that exists at the WRC. Hannes has been a project leader for several WRC projects and he has also served on review panels of other WRC projects. He also serves on the Editorial Board of *Water SA*, an accredited WRC scientific journal that reaches national and international scientists.

Professor Rautenbach recently completed a WRC-funded project related to a numerical weather prediction. This involves constructing computer simulations of air currents and their interaction with land masses. These simulations can be speeded up so that Monday's weather will have been predicted on computer by Sunday. The daily weather forecasts presented by SAWS are the result of predictions based on such a model. The routine numerical weather prediction system that emanated from the WRC project is currently being used in Uganda and offers the Uganda Department of Meteorology in Kampala the opportunity to predict weather and to also assist with shipping schedules over Lake Victoria. This WRC-funded project was offered to the Ugandan government with the help of funding from the British High Commission. The technology is expected to be expanded to other African countries.

Hannes's success would only be possible with the support of mentors and colleagues. Dr George Green (ex-Deputy CEO of the WRC) and Mr Barry Hunt (CSIRO Atmospheric Research) provided Prof Rautenbach with support and guided him in developing his research capabilities. Hannes's liaison with SAWS was a significant contributory factor to his success. In particular, people such as Donny Nadisson, Hajera Kajee, Rezien Benefeldt and Dr Jonas Mphepya were extremely supportive. Professor Robin Crewe (currently Deputy Vice-Chancellor at UP) also supported Hannes in assuming responsibility for the Meteorology group at UP when he mapped out a new path and vision for the department. Last, but not least, Hannes would not have succeeded were it not for a warm and caring family environment.

"My driving force in training and research is to equip people with the knowledge and the motivation to go out and make live easier for other people. I am not seeing my position as that of a high-level person who delegates, but rather as a person who gets involved in research and training activities on ground level. Achievements are gifts from above. Man actually knows very little of nature – use what you know to its full potential to the benefit of communities. And always remember – it doesn't matter how intelligent you are- every person on Earth knows something, or can tell you something, that you didn't know." Wise words from a wise man indeed.

Prof Rautenbach the WRC thanks you for your vast contribution and we look forward to further innovation from you and your Department.

Call: WRC success stories

Were your postgraduate/undergraduate studies achieved through WRC support? Have you been the recipient of some form of support that enabled you to follow a career path or complete your studies? The WRC will be publishing a booklet on students/ professionals who have achieved greatness through WRC support. If you one of such people or are aware of such people, please submit names, contact details and a short description to: yuveng@wrc.org.za

Water Research Commission

Adams Value

Dr Shafick Adams joined the WRC in September as a Research Manager in KSA: Water Resource Management. Shafick was born in Gauteng and decided to study at the University of the Western Cape (UWC).

He completed his MSc (Cum Laude) and whilst working as a researcher at the Earth Sciences Department at UWC, he registered for his PhD. He has been involved with WRC projects while he was completing his PhD. Upon completion of his PhD, he accepted a Senior Lecturer position at UWC. He was responsible for developing and teaching most of courses on hydrogeology and environmental geology at undergraduate and graduate levels.

Shafick is proud to be associated with the WRC, and he is ecstatic about working for the WRC.

"The diversity in the current projects is a good indicator of the strategic role the WRC has in the management of South Africa's water resources and related systems. I always say that I am a product of the WRC: most of the research that I was involved in was funded by the WRC. There are hundreds of students in South Africa who benefited from the role of the WRC - a direct result of the WRC's strong focus on capacity building."

This enthusiastic young man is eager to implement innovative research ideas at the WRC. "Technological forecasting is an area that I would like to explore in the future - for this we need accurate input data, refinement of existing techniques and closer interaction between different scientific fields."

Shafick was rapidly absorbed into the WRC family and he feels at home already. Shafick, the WRC welcomes you and we hope that your stay will be a long and rewarding one.

Winners Circle

Ndala Duma was recently appointed as WIN Programme Manager.

Puleng Mlambo studied Information Science (BA and BA Honours) at the University of Pretoria, and then worked as an IT trainee at the CSIR where she dealt with Knowledge Management and website design. She also worked as a webmaster and Electronic Communication and Marketing at various organizations. Puleng is passionate about her position at WIN-SA. She says "To WIN-SA, aligning ourselves with best practice knowledge, information and customer relationship management practices, using technology as best as we can in order to reach our targeted clients, therefore assisting them in

achieving excellent service delivery by making informed and effective decisions."

Farewell Aveen

Aveen Rampershad joined the WRC in April 2003. After approximately three years of service, he has opted to join The Innovation Hub as Chief Financial Officer. Aveen, the WRC wishes to thank you for your loyal service and the innovative systems that you put in place. We at the WRC are sad that you are leaving us, but we wish you success and a bight future.

Welcome Reshmili

Ms Reshmili Frank, who recently joined Nokia, has returned to the WRC as Director: Human Resources and Administration. Welcome once again, Reshmili.

The WRC @ the SA Youth Water Prize Function

The WRC attended the SA Youth Water Prize Prize-Giving function on 11 August in Imbali, Pietermaritzburg. The national winners were Nompilo Mahlobo and twin sisters Thobile and Thokozani Mbanjwa (from left to right in photo). Ms Lani Van Vuuren (WRC), editor of *The Water Wheel,* was one of the judges. The WRC sponsored the main prize: computers were handed over to all the finalists.

Courses at UP

Environmental Management
9 - 11 October

A short course on environmental management will be held at the Post Graduate Centre of the University of Pretoria.
Enquiries: Ms Leona Barnard. Tel (012) 420 3842. Fax (012) 362 5285. E-mail: leona.ce@up.ac.za

Air Quality Management
12 - 13 October

A short course on air quality management and dispersion modelling will be held at the Post Graduate Centre of the University of Pretoria.
Enquiries: Ms Leona Barnard. Tel (012) 420 3842. Fax (012) 362 5285. E-mail: leona.ce@up.ac.za

WRC Hosts National Press Club

The WRC hosted the National Press Club on 31 August at the WRC offices. Guests included journalists, editors and communication practitioners. The function also showcased some WRC research projects such as wetting front detectors, climate change and water quality. This took the form of displays and demonstrations. Research Managers and Directors were on hand to answer questions and to be a part of the stimulating discussion that emanated from a presentation by Dr Kevin Pietersen.

Top left: *Dikeledi Mbele assisting with the raffle*
Top right: *John Dini chats to guests*
Bottom left: *Guests at the function*
Bottom right: *Prof John Annandale demonstrates the wetting front detector*

The WRC Hosts IAP Global Water Programme

As part of the InterAcademy Panel (IAP) Global Water Programme, the WRC, on behalf of the Academy of Science of South Africa (ASSAf), organized a three-day workshop (16-18 August). The objective of the workshop was to bring together water researchers and high-level water managers to discuss major problems faced presently by them and to find possible solutions to these problems.

At the Cutting Edge

The WRC attended the Tshwane University of Technology (TUT) research and innovation showcase on 25 August. Presenters outlined an array of research projects which were completed at TUT. One of the presenters (and an award winner), Professor Jonathan Okonkwo, is also involved in WRC-funded research projects.

The WRC @ the University of Venda

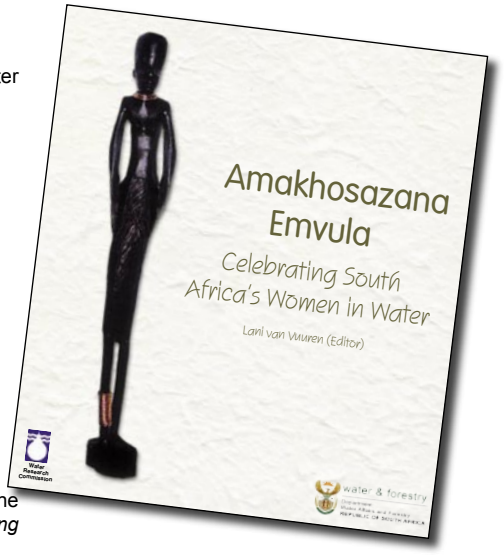
The School of Agriculture, Rural Development and Forestry: University of Venda (UNIVEN) held an Open Day on 11 August. The WRC was one of the exhibitors at this event. WRC publications (WRC reports, magazines and career guides) were distributed. Students at the university also found the WRC career guide, *Water @ Work* helpful.

Top: *Stanley Liphadzi at the WRC exhibition stand*
Left: *Students at the University of Venda exhibition stand*

Women in Water Awards 2006

The Minister of Water Affairs and Forestry, Ms Lindiwe Hendricks, hosted the 2006 Women in Water Awards on 11 August 2006. The winners were:

Category	Name
Research	Dr Terry Everson
Management and Policy: Water	Ms Mpharu Johanna Hloyi
Management and Policy: Sanitation	Ms Carol Zulu
Management and Policy: Forestry	Ms Rally Moropa
Education: Water	Ms Toni Belcher
Education: Forestry	Ms Neliswa Mbelwa
Education: Sanitation	Ms Babalwa Eunah Koko
Community Development: Water	Ms Louisa Johanna Hendricks
Community Development: Sanitation	Ms Malindi Chauke
Community Development: Forestry	Ms Thamsanqa Elgia Zimu



Two of the researchers, Dr Everson and Ms Belcher, are involved with WRC-funded projects. The WRC, together with DWAF, also produced a publication entitled *Amakhosazana Emvula: Celebrating South Africa's Women in Water*.

What's New

Report No 1439/1/06; 1439/2/06; 1439/3/06 (Contractor: CSIR)

Pathogen destruction in urine diversion sanitation systems;
Use and acceptance of urine-diversion sanitation systems in South Africa;
Use of human excreta from urine-diversion toilets in food gardens: Agronomic and health aspects

To handle faeces and urine separately should not be a great problem, as each human produces about 500 litres of urine and 50 litres of faeces a year. The problem arises only when these two substances are mixed together and flushed into a pipe with water to form sewage. Dealing with 550 litres of polluted, dangerous and unpleasant sewage in a conventional waterborne system may use as much as 15 000 litres of pure water. Urine diversion (UD) sanitation technology is based on the concept of keeping these two substances separate. The main advantages of this approach are, firstly, that valuable nutrients such as nitrogen, phosphorus and potassium are found in urine, and secondly, the dangerous pathogens present in faeces are more easily isolated from the environment. The report series commences with a general overview of the South African sanitation experience, with specific reference to on-site technologies and the relationship between sanitation, the environment and public health. Design and management practices for UD toilets are then investigated, with examples from both South Africa and abroad. This is followed by a review of perceptions and experiences of UD toilet users around the world in order to establish how they are affected by design, implementation practices or other factors. Agricultural and horticultural practices that re-use human excreta are examined, with experiences from various countries being described. This is followed by a review of the health aspects of UD toilets, with particular attention being paid to the re-use of urine and processed faeces in food gardens.

Report No TT 255/06 (Contractor: Partners in Development CC)

The use of key performance indicators in the benchmarking of rural water supply schemes: An aid to the development of meaningful local government capacity

Substantial sums of money have been spent in the past on training community committees to manage their water supply schemes effectively. As these projects have moved into the operational phase, it has been realised that training in itself does not ensure that projects will be properly managed. There are scores of different Performance Indicators that are encountered in government reporting systems. The problem is that these are typically too numerous and varied to help the council official who needs to know the answers to critical questions. The challenge is to develop simple and effective reporting systems which can be used to report to communities as well as to the relevant authorities. The set of KPIs must pictorially depict trends in strategic

areas such as service performance, financial health and accountability. With such a system in place, monthly visits from municipal officials can become more effective occasions for communication, problem identification and problem solving. This study contains very useful, practical methods for field management of rural water projects. During the course of this study a number of monitoring initiatives taking place around South Africa have been reviewed. At community level, systems of KPI recording are needed which are simple, practical and effective. During the course of this research a method of KPI recording at community level using standard data sheets and standard charts was tested. These sheets and charts are filled in by hand, which means that it is not essential to have computer facilities to do basic management. It was found that community level administrators could understand and work with this system, although only the simpler KPIs were tried out. With a longer term management commitment, there is no reason why more complex KPIs could not be tackled. A set of basic benchmarks for rural water supply in South Africa was investigated. In order to convey the meaning of KPIs, they should be displayed graphically over time. In so doing, trends can be observed, and it can be deduced whether the scheme being observed is stable, getting worse or getting better. Even at the community level administrators should be taught how to record and plot simple but vital KPIs.

Report No TT 264/06 (Contractor: The Mvula Trust)

The WRC Community based health and hygiene model and implementation kit

The most sustainable manner of delivering services to a community would be to get the community involved at all stages of such delivery. Research carried out in the Eastern Cape and Limpopo provinces shows that a Community-Based Health and Hygiene Model (CBHHM) can address serious, impact-reducing gaps in the way crucial health and hygiene are currently being implemented by service providers. The CBHHM consists of a summary process flow chart for community-based health and hygiene programming. This summary flow chart is linked to an implementation kit which consists of flow charts for each stage of health and hygiene and tools. The CBHHM and its attendant implementation kit provide structured guidance and tools for each stage of the health and hygiene programme; clarifies roles and responsibilities for optimal utilization of human and scarce financial resources and optimizes socio-economic development through skills transfer and remuneration for work done.

Report No TT 161/05 (Contractor: Pollution Research Group)

Applicability of waste minimization clubs in South Africa: Results from pilot studies

Cleaner production is a means of generating less waste through industrial activity. It encompasses pollution prevention and waste minimization. One method of promoting cleaner production in industry is through the formation of waste minimization clubs. By forming a club, companies worked synergistically to reduce waste and save money and water. Two such pilot plants were formed in KwaZulu-Natal. Amazing results were realized following the outcomes of this project: The impact of industrial waste on water resources has been reduced dramatically; Emissions to air and land have also been reduced; energy is used more efficiently, resulting in a reduction of greenhouse gases emitted to the atmosphere as well as a reduction in water and coal consumption. Following this success, a number of new clubs have begun or are in the planning stages.

Report No 1353/1/06 (Contractor: Tlou & Mallory Engineering and Management Services (Pty) Ltd)

An investigation of different farm tenure systems and support structure for establishing small-scale irrigation farmers in long term viable conditions

This study sought to review the land tenure systems and support structures in South Africa, to identify constraints and opportunities relating to land tenure and support structures, with a view to developing a framework for sustainable settlement on small-scale irrigation schemes. The study method included the collection and analysis of existing international and local literature on land tenure, security of tenure and support systems. This was supported by case studies of existing small-scale irrigation schemes with specific focus on the Eastern Cape Province. Two schemes were selected for detailed study and interviews were conducted with selected key informants and farmers including relevant government departments in the province, and civil society groups. The other issues researched were the financing, marketing and management support systems for smallholder irrigation schemes (SIS) in order to ensure that they become sustainable and the farmers themselves take ownership of these schemes. In terms of production it was clear that small-scale irrigation farmers need access to markets where they can sell sufficient quantities of produce at prices that will enable them to make a worthwhile return on their investments and farming efforts. An analytical framework was developed to provide a basis for understanding the dynamics of the development of SISs. It was demonstrated that this framework provided insight into the interaction of various elements such as intensification/extensification and increased productivity/increased land size. Each step in this development path was carefully considered, the impacts on land tenure systems as well as all other support systems (production, marketing, irrigation, financing, institutional and social) were evaluated and appropriate recommendations were made on this basis.

Report No 1479/1/06 (Contractor: CSIR)

A scoping study to evaluate the fitness-for-use of greywater in urban and peri-urban agriculture

Greywater production was estimated at 858 Mm^3 for the year 2000, based on Census 2001 data and some knowledge on average water consumption figures for different socio-economic groups. An estimate derived from DWAF's National Water Resources Strategy data for municipal water consumption, indicated 1 224 Mm^3. The average (1 040 Mm^3) was thus accepted as the likely greywater production in urban and peri-urban areas. By assuming a very high irrigation requirement of 10 $\ell/m^2/d$, it was calculated that the communities relying on a community stand or a tap in the yard, could irrigate an area of approximately 17 m^2 per dwelling, while communities with piped water directly to their homes, could irrigate an area of approximately 35 m^2 per dwelling with the greywater they produce. Significant quality differences were found between the different types of greywater and between different locations in the Cape peninsula. The highest quality came from the bathroom, the second highest from clothes washing, and the poorest quality from dishwashing activities (the kitchen). Except for nitrogen, constituent concentrations in the local study were higher than those reported internationally. Faecal bacterial concentrations in kitchen greywater were significantly higher than in greywater from the laundry or the bathroom, in agreement with studies done in Arizona. According to the South African Water Quality Guidelines, greywater from the bathroom and laundry are only suitable for restricted crop irrigation. It is recommended that greywater from the kitchen (excluding rinse water) not be used for irrigating plants. A preliminary assessment of greywater reuse by unsewered poor communities in the Eastern Cape Province indicated that households use between 20 to 150 ℓ water per day. Greywater is mostly thrown outside the house onto the ground, but 5% reported using greywater for watering their grass. Not all plants and soils are suitable for irrigation with greywater, so careful

identification of suitable crops and soils and appropriate irrigation management guidelines will be needed by householders intending to use greywater. Preliminary guidelines in this regard are presented in the report. It also reports on the potential positive and negative impacts of greywater irrigation and policy implications at regional, municipal and household levels.

Report No 1175/1/06 (Contractor: NCE cc)

The application of risk assessment modeling in groundwater for humans and livestock in rural communal systems

During the course of the research it was observed that in rural communal livestock production systems, communities were exposed to hazardous concentrations of elements, such as bromide, selenium, lead, cadmium, strontium, fluoride, nitrate and iodine. This study was, therefore, formulated to identify and propose management options for key water quality hazards in rural communities. The initial objective of the study was to utilize the software tool CIRRA (Constituent Ingestion Rate Risk Assessment) Version 2.03 to develop formal procedures for addressing water quality related hazards and risks for humans and livestock in rural communities within rural communal production systems. Targets were set to investigate the possible benefits of applying a generic level assessment followed by site-specific sampling in order to achieve this. The methodology for the study included sampling to perform biological experiments, investigating the extent of the hazards in groundwater in other communities in South Africa, and developing and proposing a system for managing naturally occurring water-related hazards in rural communities. The research observed the occurrence of geochemical anomalies, assessed as potentially hazardous chemical constituents (PHCC), in predominantly groundwater used for agricultural and domestic uses. The study found in point of use samples in rural communities at concentrations that exceed the local and international guideline limits by several orders of magnitude. These pose significant hazards to the recognized norms for water use for both domestic and animal uses. A generic level water quality risk assessment is recommended as the first step in determining baseline exposures required for the identification of constituents in the geochemical environment that may contribute to adverse effects on health, productivity, and product quality in animal users, and for health-related norms for domestic users. Any potential hazards identified then require further investigation regarding the water, user, environment and nutrition in order to ascertain the hazard posed by the presence of toxic constituents. This approach is addressed in detail by a proposed model that is a tool for Hazard Management for Rural Water Sources (HMRWS) and functions as a multidisciplinary effort between groups with specializations and commonalities, within a discreet functioning units that may be linked for various reasons (geographical and technical) referred to as a HUB.

Report No 1356/1/06 (Contractor: ARC)

Guidelines for the selection and use of various micro-irrigation filters with regards to filtering and backwashing efficiency

The results of the field evaluations and the laboratory tests provided a greater understanding of the performance of filters and the requisite management principles for the different type of filters under various water quality situations. Field evaluations were carried out in four seasons over two years, on six filter models, on 29 farms in five regions around the country. The dirtiness index (DI) of the water sources in the five regions ranged from clean (DI < 1%) to very dirty (DI = 43%) and the filters managed to clean the water to a DI level of between 0,15% and 10,0%. The filtration efficiency of the filters varied between 31,0% to 96,6%. In laboratory tests, three disc filters, two sand filters and three automatic filters were intensively tested over a period of one and a half years. Friction loss, filtration capacity and performance (filtration and backwash efficiency, variability efficiency between filters and impact of different cleaning operations efficiencies) were tested. The research resulted in guidelines for the selection and use of filters. The guidelines provide specific information regarding: the choice of filter in relation to water quality and the irrigation system; the choice of equipment; design principles; and the commissioning of filters; operation of filters; and maintenance of filters.

Report No 1437/1/06 (Contractor: Rural Support Services)

An identification and review of the factors in rural water services that facilitate and impact on local economic development in the Eastern Cape

The current framework for delivery does not allow for the facilitation and promotion of economic development. This is particularly problematic given the current context of unemployment and poverty in rural areas. This study endeavoured to identify the factors that both facilitate and impact on local economic development (LED) both during and after the implementation of water services projects, in an attempt to address poverty and underdevelopment in rural areas. Improved water supplies can lead to both direct and indirect opportunities for improved productivity. More water, of better quality and provided more reliably, can provide the water needed for productive activities such as irrigation of a backyard or community vegetable garden or for micro-enterprises such as hair salons or brick manufacture. Indirect gains may sometimes be even more important than direct benefits in that they can apply to both water-based and non-water-based activities where saved time and money can be invested in activities that bring positive returns to capital or labour. It is clear that without specific training being provided to rural communities on LED there is unlikely to be a significant shift in the understanding of LED and the improvement of rural economies. It is recommended that community members are exposed to awareness raising and training on the importance and meaning of LED. In addition, community members should be capacitated to understand the IDP process and their roles and responsibilities in relation to the development of the IDP. Poor service delivery by both government and the private sector continues to hamper appropriate development in rural communities and this is an obvious threat to LED. The main constraining factors for economic development in the communities under study are poor infrastructure, lack of access roads, insufficient water and extreme poverty.

Other new reports (Synopses to follow in the next edition)

1334/1/06
Skill comparison of some dynamical and empirical downscaling methods for southern Africa from a seasonal climate modelling perspective

1446/1/06
On-line real-time enzyme diagnostic system for the detection and monitoring of faecal contamination of water intended for drinking purposes

KV 174/06
National wetland inventory: Development of a wetland classification system for South Africa

TT 261/06 & TT 262/06
Guidelines for the utilisation and disposal of wastewater sludge
Volume 1: Selection of management options
Volume 2: Requirements for the agricultural use of wastewater sludge

TT 193/06
Salinity, Sanitation and sustainability. Volume 3: Integrated algal ponding systems and the treatment of domestic and industrial waste-waters

TT 276/06
Discussion paper on cross-sector policy objectives for conserving South Africa's inland water biodiversity

Reports can be ordered at:
orders@wrc.org.za