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Newsletter of the Water Research Commission

In This Edition



Ever Green

It is after just over four decades of significant service to the both the agricultural and the water sectors, that Dr George Clifford Green retired at the end of November. George commenced his schooling in the Free State. He studied at the University of the Witwatersrand and the University of the Free State.

This quiet-spoken stalwart commenced his career at the Department of Agricultural Technical Services (Citrus and Subtropical Fruit Research Institute) in Nelspruit. Dr Green's innate love of nature as well as his affinity for the lush Lowveld landscape ensured that the initiation into his career got off to a good start. His first Director, Dr Raimund Marloth, son of a famous South African botanist, was "a hard task master, who threw me (him) into the deep end. However, this experience, during the infancy in my career, contributed significantly to my future growth." His work involved components of agrometeorology as well as crop science. Thereafter, he moved to the Department of Agriculture's Soil & Irrigation Institute (SIRI), Pretoria, as Assistant Director in charge of irrigation research before becoming Deputy Director. Dr Green joined the WRC as a Research Manager in 1983. His career at the WRC spans 22 years. However, his association with the WRC already began in 1976 when he helped draft the WRC's master plan for irrigation research. His contribution to the organization will be felt for years to follow. He was appointed Deputy Executive Director in 1994, a position that was extended to that of Deputy CEO when the WRC underwent a process of re-structuring in 2002. George's experience, calm disposition and intellectual flair have endeared him to the research community and, more specifically, the stakeholders of the WRC.

George and his wife, Bev, plan to settle into their new house in Betty's Bay and he will delight in engaging in some of the pastimes that eluded him whilst he was working: walking, hiking, enjoying nature and photography. However, he would still like to keep his proverbial finger on the pulse, as far as remaining involved with the water sector and related issues. He would also like to mentor initiates and novices. How and why do some individuals remain selfless and committed? I found the answer in George.

"I take pride in knowing that I am making a difference both to an organization as well as to people. This acts as a catalyst and spurs me on to continue to add value, especially to the end-user – the people of South Africa. The people who make up the vibrant South African water sector are, in my opinion, people who are dedicated and committed to addressing water-related issues. I urge these individuals to continue with the good work and to build capacity so that the sector can grow exponentially."

George, the entire water sector and the research community and the WRC thank you for your immeasurable contribution. You personally made a difference; you provided leadership and made research relevant. Your image as a role model and mentor will remain legendary. It is hard to imagine the WRC without having you actively involved in its daily functioning. However, we are certain that your association with the WRC and the water sector will remain active and boundless."
Dr Rivka Kfir, CEO of the WRC

When I was a young undergraduate student I was once sent to the WRC to collect information for a project. I was introduced to Dr George Green who made me felt welcome, took me to the library and spent a lot of his valuable time to provide me with the information I needed. He made a great impression on me and became one of my biggest mentors in scientific development. It was through his support that I managed to establish a first class Meteorological group at the University of Pretoria. George, many thanks for the special contribution that you made to my career.
Professor CJdeW (Hannes) Rautenbach, Meteorology Group, Department of Geography, Geoinformatics and Meteorology, University of Pretoria

George, I have known you for over 20 years. As time went by I came to appreciate your immense knowledge and insights more and more. You have been a huge champion for process related hydrology and applied climatology over the years and your way of just saying that quiet word in one's ear did so much for earning the great respect we all have for you. We look forward to still using the enormous fountain of wisdom you have as you step into a well deserved retirement.
Roland E. Schulze, Professor of Hydrology, School of Bioresources Engineering & Environmental Hydrology, University of KwaZulu-Natal

As a young scientist I deeply appreciate the interest you took in my career, and all the encouragement and advice you gave me over the last few years. Thank you for listening so patiently to the many talks I gave on the non-hydrostatic numerical simulations of bubble convection! I think that now you know more about this topic than anyone else in South Africa! I hope to do you proud in the future, by contributing to the study fields of Atmospheric Science and Water Research in our country.
Francois Engelbrecht, Lecturer in Meteorology, Department of Geography, Geoinformatics and Meteorology, University of Pretoria

I first met George when he was Research Manager of a radar rainfall modelling project I did with Alan Seed in 1991. Over the last 15 years of collaboration with him on 10 WRC projects, I have learned how valuable a guide and advisor George is as a Research Manager. He has admirable qualities as a person which include gentleness, humanity and diplomacy. I found that working with George was a two-way exchange and am a better researcher for having worked with him.
Professor Geoffrey Pegram, Civil Engineering Programme, University of KwaZulu-Natal, Durban

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A much younger George in his early days at the WRC

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The South African irrigation fraternity is indebted to you George. Apart from the leading role you have played in directing irrigation research over the last few decades, you have made a significant and lasting contribution through the so aptly named "Green Book". I hope you will now be able to take a well earned break and enjoy the whales from your new stoep!

Prof John Annandale
Professor: Department of Plant Production and Soil Sciences

George, we heartily congratulate you on reaching retirement and our very best wishes go with you and Bev as you progress on a new phase of your life. It is with great pride and satisfaction that we recognize the pivotal part you have played in our lives.

We acknowledge your intellect, your enthusiasm and your unstinting commitment to your colleagues, your science, your family and your country. It is true to say that your insight, patience and perseverance has enabled you to make a great contribution in the areas of irrigation, water management and research management. In addition, you facilitated and supported research in soil mineralogy, soil physics and soil chemistry, contributing significantly to the characterization and understanding of South African soils via the Land Type Surveys. It was a pleasure working with you in the 1970s and early 1980s at the Soil and Irrigation Research Institute, where the research directions you fostered remain active today. We appreciated your intellectual input, good judgment and above all, your sense of humour in tight situations! Foresight and enthusiasm are keys to successful research; may your enthusiasm continue.

While you may reduce your direct involvement in these important areas, we know that your legacy will endure because you have always been exceedingly generous in your encouragement and mentoring of those around you. We have all greatly benefited from your help and guidance and we thank you for it. Our world experience tells us that few match your influential role and support for water, soils and human well being of South Africa.

Well done and thank you. Please visit us in Oz!

John Hutson, Jane Gillooly, Rob and Alison Fitzpatrick, Wayne and Nancy Meyer, Mike and Lillie McLaughlin, Adelaide, Australia

Thanks for all your support over the years and friendly chats on our runs in the Berg. We are really going to miss your efficient and friendly management style. For a man of small stature you really made a huge impact. Make the most of your retirement!

DR CS Everson, CSIR, Senior Scientist

You can certainly look back with satisfaction on a WRC career that did make a difference. Your calm demeanor, professional competence and vision were great assets to the water research sector. These are qualities I always admired during the years I worked with you and I appreciated your wise inputs to the management of the WRC. Cordelia and I wish you and Bev a happy retirement and pleasant memories.

Piet Odendaal
Retired Director, WRC

My best wishes on your well-deserved retirement. I will always remember the our field trip to the banana farmer's irrigation schemes in the Kiepersol district.

Professor Chris Buckley, Head - Pollution Research Group, University of KwaZulu-Natal

As George's wife I am privileged to share George's excitement regarding retirement. Time has deepened the love, integrity and generosity of heart and spirit I've known since we met as teenagers. Every WRC employee has made an indelible mark on his years at the WRC- your caring friendliness will be missed. To George, my husband, friend, and fellow traveler, I wish you years of joy in everything retirement offers. May you revel in sunrises on the mountain and sunsets over the sea, photograph the ever-changing fynbos and wildlife, explore and discover all the nooks and crannies not yet recorded. Thank you for the privilege of loving and sharing life with you.

Mrs Bev Green

George fulfils many roles in our lives as leader, scientist, naturalist, photographer, carpenter, sportsman, musician and grandfather. We have the privilege of having a father and a mentor that walks in greatness, with humility. As we embark on our careers, growing, maturing and starting our own families, we increasingly appreciate the qualities that make you our father, a respected leader and family man. As you prepare for your retirement, we wish you many more rewarding years in your part time professional association with UCT. May you and Bev explore many more unknown trails together, enjoy all of your hobbies and experience life to the full. May you enjoy one another's company in your new home in Betty's Bay and receive joy and fulfillment where the mountain meets the sea.

"And now may the grace of our Lord Jesus Christ, the love of God and the fellowship of the Holy Spirit be with you, now and forever more".

With all of our love,

Steven and Alida,
Neville, Rene, Carol-Lynne and Jonathan

George has many of those virtues which we all appreciate more and more as the years go by. He is quiet, dependable, modest, caring, helpful, practical and honest. George is the sort of friend who "goes around saying nice things about you behind your back." George, if you don't know this, please hear it We appreciate you.

A Friend of George Green

Minister Sonjica launches WRC Project No K5/1496

Minister Sonjica surrounded by admirers at the packing shed at Fort Beaufort

Minister Sonjica flanked by Mr Zolile Keke (DWAF) and Luyanda Nkayi ((Balfour Village)

Minister Sonjica meets members of the Kat River Community Forum

Project No K5/1496, A Stakeholder Driven Catchment Plan for the Kat River Valley, was officially launched by the Minister of Water Affairs & Forestry, Ms Buyelwa Sonjica, on 20 October. The project, funded primarily by the WRC, was led by Rhodes University, Institute for Water Research (IWR). Much of the research was aimed at initiating the formation of catchment management groups. These endeavours have been based on the enabling framework of the National Water Act of 1998.

Minister Sonjica complimented the various stakeholders, especially the cachment forum members and the Kat River Water Users Association. The Minister's visit was a great morale booster for members of the catchment forum. The tour also included a visit to the Riverside citrus packing shed, where Minister Sonjica was welcomed with great enthusiasm by workers. The driving force behind the event was Sharon Birkholz from the IWR. The event was also televised on SABC 1 and SABC 2.

What's New

Report No TT 246/05 (Contractor: CSIR, Boutek)
Ecological sanitation-Literature review

"Conventional" sanitation options may be suited to certain situations, but in other circumstances where both water and space are scarce, there is a clear need for permanent, emptiable toilets which do not require water. Such circumstances are becoming increasingly common. Sanitation can no longer be a linear process where excreta are hidden in deep pits or flushed downstream to other communities and ecosystems. Sustainable and ecological sanitation requires a holistic approach. The literature review begins 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 urine diversion (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.

Report No TT 248/05 (Contractor: University of Pretoria)
Guidelines for irrigation water measurement in practice

The main objective of the project was to develop guidelines for the correct choice, installation and management of water measuring devices by Water User Associations (WUAs) for canal, pipeline and river distribution systems. A series of field visits to important irrigation areas in South Africa as well as visits to a number of measurement equipment manufacturers and the relevant government departments were undertaken. A comprehensive literature study of flow measurement in irrigation was also conducted. It was found that suitable measuring devices are available, but in order for them to be used successfully, they need to be installed correctly, well maintained, and read accurately. The guidelines that were compiled are aimed at implementing this approach successfully in practice, and gives a detailed description of the actions that need to be taken. There is currently no policy to guide WUA's in this regard and it is hoped that this report will provide some guidance to policy-makers.

Report No TT 249/05 (Contractor: University of Fort Hare)
Guidelines for ensuring sustainable effective disinfection in small water supply systems

This study evaluated a combined-monochloramine disinfection process for the inhibition of bacterial and biofilm regrowth in a laboratory-scale system. The emphasis was based on the maintenance of an effective residual disinfectant throughout the water system. The bactericidal effectiveness of the process relied on coliforms, heterotrophic plate count and total bacteria. The study aimed at ensuring sustainable effective disinfection in a small rural water supply of Alice in order to improve the quality of potable water in the rural community and to make significant progress toward compliance with bacteriological quality standards at the point of consumption. The results of the study revealed that a combined chlorine-monochloramine process resulted in a longer residual monochloramine that could be detected up to 7 and 28 d in groundwater and surface water respectively after using initial free chlorine of 2.5 mg/ℓ followed by 1.5 mg/ℓ initial monochloramine. While coliforms persisted up to 3 and 28 d in chlorinated surface water and ground water respectively, complete elimination of coliforms occurred within 1 d in the combined chlorine-monochloramine water system. A combination of chlorine and monochloramine was found to provide an effective treatment for the inhibition of bacterial growth and biofilm formation in the laboratory-scale-unit as long as monochloramine concentrations persist to *ca* 0.2 and 0.35 mg/ℓ in ground water and surface water systems respectively. Less than 1 bacterial count was detected in combined water systems and on the surfaces of piping materials exposed to the combined chlorine-monochloramine water systems. Chloramination as a second disinfection process for inhibiting bacterial growth in drinking water system was statistically proven to be the safest water purification process.

Report No 1072/1/05 (Contractor: University of the North-West, Research Group for Separation Science and Technology)
Bio-polymeric heavy metal adsorbing materials for industrial wastewater treatment

A particular area of concern is the release of heavy metals by the industrial sector into sewage streams and natural waters. Owing to the financial value of some heavy metals it is also important to recover these metals from wastewater. In this study, the removal and recovery of heavy metals using the biosorbent chitosan (made from the chitin shells of shellfish) to circumvent these problems is investigated on bench scale. As part of the project, a membrane was also manufactured from the biosorbant and its efficacy evaluated. A novel adsorption model has been developed, from which it could be concluded that the chitosan has the largest affinity to copper, followed by lead, nickel, zinc and cadmium. Chitosan formed into membranes or immobilised onto an alumina base proved not be as successful as the beads. A preliminary cost estimate showed that this technology could be competitive with activated carbon, provided that the beads could be made to tolerate more regeneration cycles than what is the case currently.

Report No 1257/1/04 (Contractor: University of Stellenbosch)
Hydraulics of estuarine sediment dynamics in South Africa

The aims of this project were to formulate a hydraulic description of sediment transport processes through the estuary during tidal cycles as well as during floods; to formulate a hydraulic description of flushing efficiency of estuaries with or without mechanical breaching of the mouth, and to develop guidelines to determine and manage the estuarine water reserve to ensure a long-term equilibrium estuarine morphology. Sediment flushing occurs during floods, and the opportunity to take measurements during a flood did not occur during the course of the project. However, it was shown that mathematical modelling does predict sediment movement, and the modelling of marine sediment ingress was verified by field measurements. Predictions on flood-induced sediment movement could not be verified due to the absence of floods during the study period. Scouring of an estuary mouth during breaching was both measured in the field and modelled. It was shown that the effectiveness of the process increases considerably with the amount of water in the estuary at the time of breaching, with the higher water levels before breaching creating a wider, deeper mouth and the mouth to remain open for longer.

Report No 1017/1/05 (Contractor: University of Cape Town)
Development of a biomonitoring method using protozoans for assessment of water quality in rivers and ground waters and seasonal/ephemeral waters

Groundwater is an important source for domestic supply, and it is susceptible to pollution or contamination from a number of sources. Biomonitoring has been demonstrated to be a cost-effective method for assessing the health of surface water resources and there is a need for an equivalent method for assessing the health of groundwater that is to be used for human consumption. The project aims were to identify protozoans which could potentially be used in the biomonitoring of groundwater and non-perennial rivers and to establish whether those taxa which are cosmopolitan respond to water quality variables in the same way as they do elsewhere in their distribution range. Internationally, ciliates have been the protozoan group of choice for biomonitoring, and these were selected here as well. Little work has been done in South Africa, but much more work has been done in Europe, the United Kingdom and the United States of America. Preliminary results reveal that the European Saprobic Index provides expected results in South African rivers, but the results from wetlands are less clearly correlated. This research indicated that protozoans do offer a viable option for biomonitoring. The fact that they encyst means they can provide information on antecedent conditions in dry rivers and wetlands, and their very rapid responses make them candidates for assessing water quality conditions over short periods in ephemeral systems.

Report No 1323/1/05 (Contractor: CSIR, Environmentek)
Analysis of groundwater level time series and the relation to rainfall and recharge

In this project selected groundwater level and monthly rainfall time series information were analyzed by correlating the groundwater level records with the Standardized Precipitation Index (SPI) values derived for South African rainfall data. SPI is a single numeric index based on the probability of precipitation for any time scale. Analysis of the record period found notable correlation between the groundwater and rainfall datasets. An outcome of this project is that a methodology has been proposed to calculate a "Recharge Index". A number of factors are calculated with each being given a weight. The total weight is then a relative indication of the rate of recharge. The method proposed is still very subjective and a great deal of additional work needs to be done to develop this into a reliable way to turn the "Recharge Index" into a realistic representation of effective recharge.

Report No 1388/1/05 (Contractor: University of Pretoria)
Application and conceptual development of genetic algorithms for optimization in the water industry

This study evaluated the application of genetic algorithms (GAs) in the optimisation of different components of water supply projects and conceptually developed the procedures for the implementation thereof. Based on the available literature study, as well as the feedback from water supply authorities, the need for the application of GAs as an optimisation technique in the water industry was defined. The study provides the conceptual development of procedures to implement GAs as an optimisation technique for water resources assessment and network optimisation. It also conceptualised the optimisation problems that were identified and conceptually developed the required procedures for the implementation of GAs in these areas.

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

Launch of WRC Knowledge Review

The WRC Open Day took place at the Senate Hall, University of Pretoria on 3 October. The event showcased WRC projects during the last financial year. The WRC *Knowledge Review* was launched at this event. This was followed by a short symposium dealing with popular topics such as:

- Climate change
- Rainwater harvesting
- Capacity-building in the SA water sector

The winners of the SA Youth Water Prize from Setjabe Se Maketse Combined School in Bloemfontein were also present to discuss their project that won them the International Youth Water Prize in Stockholm, Sweden.

Visitors at the WRC Open Day

Pontso Moletsane, Motobele Motshodi and Sechabe Ramabenyane

The WRC's Open Day in KwaZulu-Natal (KZN)

The WRC held its Board meeting at the University of KwaZulu-Natal (UKZN) in Durban on 1 September. This was followed by a media briefing, where the WRC CEO, Dr Rivka Kfir, briefed the media in KZN about the WRC.

Thereafter, the WRC Open Day commenced at the main library at UKZN. The first session involved about 200 learners from local schools who were exposed to displays, models and videos with a distinct career focus. Mark Horan from UKZN operated a hydrological model to demonstrate the water cycle and the various water users. Prof Pillay (DIT) demonstrated membrane technology. Invited guests included academia, students, learners, educators, journalists and Government officials (provincial and local Government).

On 2 September the WRC Board members, a journalist and some WRC staff members went on a technical tour of WRC research sites. Prof Chris Buckley was a driving force for this component of the Open Day, which proved to be very successful and informative.

Left: *Mark Horan demonstrating the hydrological model*
Top right: *Ms Matsabu and a jovial resident during the technical tour*
Bottom right: *Prof Bawa (D. Vice Chancellor- research, knowledge production & partnerships UKZN) addresses guests*

Two Day Course on Strategic Sanitation Planning and Technology Choice

These two-day sessions will be held at four venues in the country as follows:

• Pretoria	23 and 24 January 2006
• Cape Town	26 and 27 January 2006
• East London	20 and 31 January 2006
• Durban	2 and 3 February 2006

For more information contact:

Mmule Majola at win-sa@wrc.org.za or Sandra Fritz at sandraf@wrc.org.za .

WRC Co-ordinates Welcome Function

Mr Jabu Sindane, the recently-appointed Director-General (DG) of the Department of Water Affairs and Forestry (DWAF), was the guest of honour at a function held on 25 October in Pretoria. The WRC co-ordinated the function where key stakeholders in the water sector pledged their support to the new DG and delivered messages of welcome. Amongst them were organizations such as the Department of Provincial and Local Government (DPLG), South African Association of Water Utilities (SAAWU), DWAF, Mvula Trust, District Water Services Managers Forum, South African Local Government Association (SALGA), LGW Seta, National Treasury, Water Institute of Southern Africa (WISA), Water Information Network (WIN) as well as the donor community.

Top left: *Entertainers in action*

Bottom left: *Dr Kfir (WRC CEO) presenting Mr Sindane with a gift*

Bottom: *Guests at the welcome function*