



Fluid Thoughts

WRC CEO, Dhesigen Naidoo



Coming of Age – Moving knowledge to action

The year 2015 sees us entering the milestone of our 21st year of democracy. Our country is a young adult, and none too soon as the challenges that we face are going to require the creativity and adventure of an adolescent as well as the maturity of an adult to be managed successfully. The reality of our water scarcity and our insufficient energy security has become stark. The negative knock-on effects on food and nutritional security as well as health security are increasingly sharpened.

In addition, we are facing this in a time of budgetary tightening and further economic contraction. The temptation in such times is strong to gather all your available resources

and invest in Band-Aid solutions to address the immediate problems and shore up the ability of the state to ensure the social security net. While this might provide short-term relief in many quarters, this does not amount to an investment in our future prosperity and well-being.

We need a combination of short-term interventions to address the immediate challenges and relieve the incredible stress on the water system, while concomitantly developing smart, creative, innovative and sustainable medium- to long-term solutions for both national water security as well as international competitiveness. While some may consider this incomprehensible in the wake

of lead articles on a weekly basis highlighting the precarious nature of South Africa's current water fortunes, others will recall that many of the countries that we today consider highly successful had the beginnings of that growth trajectory in times of extreme hardship.

South Korea (Republic of Korea) is today regarded as one of the world's most successful economies with Korean brands in electronics, motor vehicles and communications being household favourites worldwide. In the modern era, the turnaround of South Korea from a primarily agrarian, largely subsistence economy to become one of the world's leading industrial economies had its genesis in the devastating

civil war of the 1950s with the conscious choice to use the pathway of a knowledge based economy as its path to post-conflict recovery. Similarly, Finland, now regarded as one of the most innovative countries in Europe on the back of such successes as forestry biotechnology, logistics and wireless communication, began its knowledge based innovation journey in the 1990s with its own economic crash precipitated with Perestroika. Until that point, Finland had enjoyed economic success as the gateway for the world to the then isolated Russian economy. From the most basic consumables, to the most sophisticated devices sourced from the Western world, the preferred pathway was through

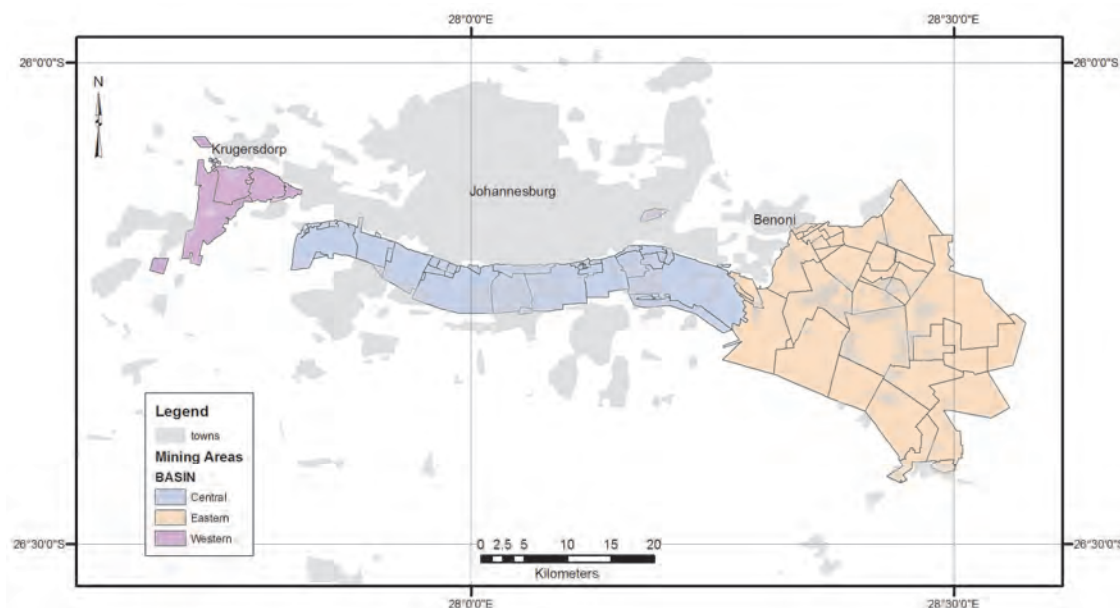


Figure 1

The biggest focus of South Africa's mine-water challenge has been the three large Gauteng basins. The manner in which we tackle the long-term solutions must afford the prospect of not only managing one of biggest pollution challenges, but also the opportunity to become a world leader in solutions for mine-water and brines challenges – a fundamental global challenge for the 21st century. We have the research derived knowledge that gives us formulas for intervention that will not only yield a freshwater resource, but also holds the potential for significant minerals recovery from the polluted mine-water.

the Finnish corridor. Gorbachev's Perestroika and the great thaw in the Cold War saw a rush from the West to interact directly with Moscow and the implications for the Finnish economy were dire. The Finnish response was, as had happened with South Korea before, an active and intensive investment in science, technology and innovation to ensure a much more competitive future to Finland. And what we have seen in the last 25 years was the rise of small, remote Finland to a global player of note. This is a narrative that can be repeated for most countries that occupy the top listings in the World Competitiveness Yearbook. This is also a choice that South

Africa has declared itself on as a matter of official policy and more recently reiterated in the manifesto of the ruling party in the run up to the 2014 national elections.

The year 2015 must be a point of inflection as we up the game toward a more entrenched knowledge based economy. In the water domain the opportunities are enormous and the need is gargantuan – from tackling the challenge of acid mine-water to energy efficient localised wastewater treatment to low/no water sanitation solutions. The achievement of a higher level to water security and the expansion of the frontiers of dignity through accessible safe

sanitation will require us as the water science and technology community to up the game. We need to accelerate our efforts to bring Knowledge to Action. This requires us to more actively package scientifically derived knowledge in a form that brings a much larger group of people into the conversation in a manner that strongly empowers participation and influences decision-making. We also need to expand our efforts to bring laboratory proven solutions to demonstration as the bridge to on-the-ground implementation at scale. In the Water Research Commission portfolio alone we have more than 50 of such candidates. The third vital component of the Knowledge to

Action saga is the deepening and expansion of existing partnerships and the development of new ones. Partnerships across sectors (public and private), across domains and disciplines and covering the entire innovation value chain. Addressing South Africa's immediate water and sanitation challenges while simultaneously building our economic competitiveness is the best recipe to ensure sustainability. Let us use 2015 to build the South Africa Incorporate team that gears us to that prosperous future. A future that ensures a water secure South Africa, with universal access to safe services, and an opportunity to become a world leader in water and sanitation solutions and technologies.

UJ appoints new Executive Dean of Science

The University of Johannesburg (UJ) has appointed Prof Debra Meyer as the new Executive Dean of the Faculty of Science.

Prof Meyer is currently a professor of and the Head of the Department of Biochemistry at the University of Pretoria. She holds a PhD degree in Biochemistry and Molecular Biology from the University of California Davis and a Masters of Science degree in Biochemistry from one of UJ's legacy institutions, the Rand Afrikaans University. She has completed executive management training at the Gordon Institute of Business Science and Harvard Business School.

Prof Meyer has extensive research and teaching experience. She was invited to, or a visiting professor at, numerous international institutions, including the University of California San Francisco, Harvard University, Imperial College and Iowa State University.

Her research has been published in over 80 peer-reviewed international

journals and conference proceedings. Prof Meyer is the recipient of numerous research awards, including the National Research Foundation TW Kambule Awards in 2004 and 2010 and the Academy of Science for the Developing World Award in 2005.

Prof Meyer is also known for presenting the weather on SABC 2 for more than 12 years, and is an avid language and AIDS activist. She recently launched her own television programme on KykNET, called 'Debra deel', which aims to make scientific discoveries and achievements accessible to a general audience.

Says Prof Meyer: "I see my contribution to the future success of UJ through my commitment to an internationally competitive Science Faculty where the levels of research intensity increases constantly and innovative, quality learning and teachings inherently linked to research and grounded in committed community engagement."

New shrimp species discovered in Cape Peninsula water

A tiny new shrimp, called the 'stargazer mysid' by divers because of its eyes' apparent permanent upward gaze, has been found in the extensively sampled waters of False Bay, Cape Peninsula.

The new shrimp species is described in a joint paper by Emeritus Prof Charles Griffiths from the University of Cape Town and international shrimp expert Prof Karl Wittmann, which has been published in the journal, *Crustaceana*.

The shrimp is the ninth *Mysidopsis* species found in southern Africa, and is officially named *Mysidopsis zsilaveczi* after the diver, UCT alumnus Guido Zsilavec, who has made the discovery.

"Though previously unknown to marine biologists, the pretty shrimp is a common sight among divers," said Zsilavec, an avid underwater photographer who brought the shrimp to Prof Griffiths to identify. When he was unable to identify the species samples were sent to Prof Wittmann at the University of Vienna in Austria, who confirmed that it was indeed a new species.

Prof Griffiths was surprised by the shrimp's bawdy colouring and 'fake eyes'.

"They act like the eye spots on moths' wings," he explains.

The divers who first saw the small crustacean, a mere 10 to 15 mm long, calls the shrimp 'stargazer mysid' because its eyes seem to gaze permanently upwards. The apparently large, upward-staring eyes are just a trick of nature, as the eyes of shrimps don't have a pupil or iris.

Instead, they are compound eyes like those of insects and consist of many simple elements that each look in a different direction. The vivid ringed patterns are thought to be there to make the eyes appear to belong to a much bigger creature, and hence to scare off predators.





Letters to the Editor

More research needed of renewable hydropower opportunities in SA

Thank you very much for the rather excellent promotional article introducing the WRC's new hydropower research (*Water Wheel* July/August 2014).

Having the opportunity of being a member of the team researching the subject I would like to highlight a few aspects with regard to implementation and development of small hydropower (SHP) hidden particularly in existing water supply and return flows infrastructure (i.e. hydraulic assets). It is commendable that the WRC recognised the need for the research accounting for the new hydropower technology, particularly small-scale hydropower.

Research in this sphere of energy generation is reaching its momentum, but new constraints were identified that are not all that advantageous for the development of particularly small-scale hydropower. The research conducted to date has determined ways on how to implement the available new technology devices suitable for optimising use of existing water supply and distribution infrastructure to obtain the best utilisation of South Africa's most previous resource.

The hydro-energy generated is a handsome trade-off. The WRC's new report, *Conduit hydropower development guide* (Report No. TT 597/14) provides the guidelines on how to cost and implement well suited and sustainable small-scale hydropower installations, taking into consideration conditions presently prevailing in South Africa.

Implementation and development of hydropower in

South Africa is being constrained by a whole host of challenges, the most stringent being the legal/regulatory requirements relevant primarily to implementation of small-scale hydropower. This is, if compared to other renewable energy technologies (such as wind and solar power), slowing the process of healthy development of most appropriate renewable energy hydropower.

As per the Department of Water and Sanitation's (DWS's) policy the non-consumptive hydropower installations (<20 MW) are required to consider the following charges:

- Hydropower installation integrated within the DWS's infrastructure: a) fixed charge: R10/kW/annum, b) variable charge: R0.01/kWh sent out;
- Hydropower installation developed downstream of DWS's infrastructure and downstream of a dam wall: a) fixed charge: R5/kW/annum, b) variable charge: R0.01/kWh sent out.

Exemplifying for the combined energy output (i.e. kWh sent out) of the new Sol Plaatje and Merino hydroelectric installations in the Free State, the DWS can claim from the independent power producer some R0.6-million annually for the water use besides the fixed charges and all other charges relevant to the other renewable energy technologies.

All types of hydropower potential in South Africa has been identified and for the first time quantified before the shortages in electricity supply significantly manifested in 2008 by frequent blackouts and prolonged outages. Based on the conclusions of a Department of Energy study commissioned in 2002 along with the subsequent responses of the South African government to the

regional energy crises and to climate change threats, the potential of hydropower development for electricity generation in South Africa is possible. This includes a potential of 70 GWh/year from refurbishment and upgrading of existing hydropower assets; and more than 1 000 GWh/year from retrofitting existing non-powered hydraulic assets, to name just two options.

Some 1 400 GWh/year is a moderate estimate of small-scale hydroelectricity output which can be generated from existing hydraulic assets in the ownership/administration of the state, paratataals, the local government and industry/mining entities. This potential is easily obtainable from the local sources.

All the incentives and enabling environment with regard to the legal/regulatory and financial requirements are at present not promoting small-scale renewable energy projects (< 1 MW) including hydropower. The commercial banks and other lending institutions are reluctant to finance small capacity projects thus forcing potential developers to go on their own with the development, if they can afford such.

The startup capital for hydroelectric capacity of one MW installation, satisfying a project hydrological, geotechnical and environmental requirements can cost a developer between R1-million and R3-million depending on the type of hydropower proposal. However, the hydropower retrofit to existing infrastructure situated within the existing scheme servitude is the cheapest of all other hydropower types of development.

Scrapping the internationally applied REFIT programme and replacing it with the REIPP procurement programme bidding

process promoted the foreign investments in developing an intermittent capacity from other renewable resources such as solar, but seriously retarded the highly local content-based projects, particularly with regard to small-scale hydropower development. For example, a wind-based project is eligible for approval with a provision of three years of wind data in comparison to a small hydropower project which must provide ten years of hydrological data to be considered eligible for consideration in the REIPP procurement programme bidding process.

Further research in utilisation of existing hydraulic assets for the hydropower retrofit should focus on hydroelectricity generation from non-powered dams which are either standalone or situated within some of 40 water transfer schemes. The WRC in collaboration with DWS should speed up further investigation of identified potential hydropower sites. At present there is no suitable blueprint for how such assets can be retrofitted with hydropower devices to comply sufficiently with the national department and National Treasury's requirements and legalities.

It will help if *the Water Wheel* investigates firstly what is the progress and valid policies at present applied by the DWS with regard to the hydroelectricity development at non-powered hydraulic assets. Secondly, what would be the most suitable public-private partnership model to apply in hydropower retrofit of non-powered dams in the ownership/administration of the state.

B Barta, Bryanston
(Letter has been shortened – Ed)

World day celebrates our precious soils



As World Soil Day was celebrated around the world on 5 December, it offered the perfect opportunity for South Africa to reflect on the importance of this oft-forgotten natural resource.

It is not always appreciated that soil is not only teeming

with life, but is responsible for nurturing human life. Virtually all the food crops grown on earth are planted in soil, not to mention fodder for livestock and the large variety of fibre crops which dress us.

South Africa is lucky to have a soil research institute in the form of the Agricultural Research Council – Institute for Soil, Climate and Water (ARC-ISCW).

One of the ways in which natural resources of any area can be utilised, and ultimately protected, is to carry out a survey of the soils occurring and to produce a soil map. The soil maps archived at ARC-ISCW date back more than 100 years.

The first map was produced by the then Cape Irrigation Department. These first maps were of the Olifants River irrigation scheme, in the Western Cape.

At that time maps were produced by hand, with boundary lines first being drawn and then coloured in. Soil maps were made in that way until the 1980s when computers became more widely used.

Descriptions of soils in the soil classification system used in those days were very general (i.e. sand, clay, loam or rock). However, old maps like these can still be used without too much extra field work, and make a valuable contribution to the almost 13 600 soil maps archived at

ARC-ISCW as part of the soil information system national asset.

Since 1912, many irrigation schemes have been mapped. South Africa is the only nation in Africa that has a systematic, digital soil survey of the whole country, including the semi-desert and mountainous areas. To complement this, a database of over 15 000 soil profiles, along with soil analysis data (such as soil pH, texture and degree of weathering) has allowed soil scientists in South Africa to build up a large body of knowledge about soils of this country, and how to best use and conserve them.

With the completion of the national land type survey in 2002, South Africa became one of the few nations in the world where the soils of the whole country have been mapped and digitally processed at 1:250 000 scale.

In addition to being the custodian of this knowledge, the ARC-ISCW provides specialised inputs into a range of environmental impact assessments to try and ensure that economically important development does not take place unnecessarily on valuable high potential agricultural soils, which are extremely scarce in South Africa.

Source: ARC

New government system to streamline licensing process

Government is rolling out the 'One Environmental System' aimed at streamlining licensing processes for mining, environmental authorisations and water use.

Under this system, the Minister of Mineral Resources will issue environmental authorisations and waste management licenses for mining and related industries. The Minister of Environmental Affairs will be the appeal authority for these authorisations.

The Ministers of Environmental Affairs, Mineral Resources as well as Water and Sanitation have agreed on fixed timeframes for the consideration and issuing of the permits, licenses and authorisations in their respective legislation. The agreed time period is 300 days for the issuing of permits, licences and authorisations. In the event that a decision to issue a license is appealed, an additional maximum period of 90 days is provided.

South Africa to get water from Zambezi River?

Minister of Water and Sanitation, Nomvula Mokonyane, has met with her Zimbabwean counterpart, Minister of Environment, Water and Climate, Saviour Kasukuwere, to investigate the feasibility of pumping water from the Zambezi River to South Africa.

The South African Minister also attended a signing ceremony of the Certified Agreement on the Cooperation on Water Resources Management and

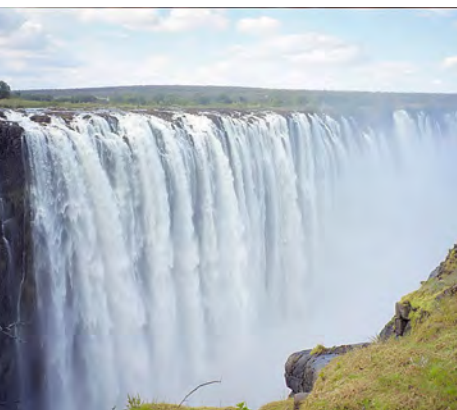
the establishment of the Joint Water Commission between South Africa and Zimbabwe.

The significant ceremony comes after a joint agreement by the two governments to undertake a technical study to evaluate the possible water resource developments and transfer options from Zimbabwe to South Africa. The proposed pipeline will draw water from the Zambezi River to Cowdray Park in Bulawayo whereafter it will run to South Africa.

"The agreement will adopt a three-phased approach. The first is to determine the viability of water resource development options at reconnaissance level, taking into account the latest information on hydrology and environmental needs," said the Department of Water and Sanitation.

Phase 2 is the pre-feasibility study of the preferred options identified in Phase 1, while Phase 3 will be centred on the feasibility study of the preferred options from Phase 2.

Source: SAnews.gov.za



Revamp allowing Atlantic water supply infrastructure to rise again

The City of Cape Town has announced extensive infrastructure refurbishment and preventative maintenance to the local water supply infrastructure in Atlantic.

The programme is being tackled simultaneously to a leak detection and water education programme.

The primary source of water for the area is an extensive system of boreholes and filtration systems, where water from an underground aquifer is extracted and treated to drinking standards, then stored in the Pella and Hospital reservoirs for distribution. The pumps that extract

this underground water, as well as components of the water treatment works, are being serviced to ensure that future unplanned interruptions in water supply are minimised.

While the maintenance teams are working in the area, the City water department's conservation unit is embarking on a programme to convey water savings messages and create awareness of water scarcity. Cape Town is a water scarce region and, as such, residents play a crucial role in ensuring there is enough water to go around.

Source: City of Cape Town

Let us all work towards South Africa's sustainable water future

South Africans all have a role to play in ensuring there is water for all, writes Gideon Wolfaardt.

When following the news and world events, one cannot be blamed for concluding that society merely moves from one crisis to the next. While some of these crises are confined to a relatively small geographic area, with regional effect, others such as water scarcity reach much wider.

Although those living in areas with sufficient infrastructure for water supply and sanitation may hardly notice the impact of water scarcity, it has become a stark reality for many others. In fact, billions of people experience severe water-related challenges, which are typically linked with other environmental, political and socio-economic forces that further perpetuate the problem. The provision of clean water and sanitation stands out amongst these water-related challenges.

Access to improved sanitation facilities such as proper toilets remains a global concern with 2.5 billion people in developing countries still affected. It should therefore come as no surprise that the World Toilet Organisation (WTO) has intensified its efforts to raise awareness amongst the general public about the serious lack of sanitation worldwide. These efforts have eventually led to the globally celebrated World Toilet Day on 19 November.

The theme for the 2014 World Toilet Day was 'Dignity and Equality'. This is of particular relevance to Africa, where it is estimated that only 58% of the continent's population has access to safe drinking water, which means more than 300 million people in Africa do not have access to clean water. Considering the World Health Organisation's estimate that 80% of all sickness in the world is due to unsafe water and poor hygiene, the challenge is clear.

Management of water and wastewater

South Africa is not spared in this regard. In a recent SA Human Rights Commission (SAHRC) report following provincial hearings in all nine provinces in 2012/13 on access to water and sanitation, it was concluded that "Despite flattering statistics presented by government about community access to water and sanitation, many communities experience a 'starkly different reality'". Amongst the most common complaints were defective and non-working infrastructure, broken taps, leaking pipes and toilets that were never maintained or repaired, as well as comments about water and wastewater treatment plants that were poorly maintained and not designed to meet the needs of a growing population.

Overall, it was indicated that more than 1 in 10 households (1.4 million) do not have sanitation services and that at least a quarter of households in formal areas do not have adequate sanitation because of the deterioration of water-supply networks, which was exacerbated by a lack of technical expertise to ensure effective operation and maintenance.

Alarming, it was found that water provision in 9% of municipalities was in crisis "with an acute risk of disease", with a further 38% at high risk of deteriorating into crisis. Actions by government and the private sector to address these problems are therefore needed, and deserve recognition where initiatives are underway.

Improving our water and wastewater treatment plants as well as our water-supply networks is crucial because even though we consume 61% more water than the world average, we live amongst the 30 driest countries in the world.

Recognised by the Water Research Commission as one of South Africa's most limiting resources in the 21st century, the growing gap between water supply and increasing demand by agriculture, major industries such as mining and power generation, as well as large and expanding urban centers, is of particular concern. It seems that the country will increasingly be faced with the challenge to make difficult choices with potentially serious economic, social and environmental consequences. All of these will impact on the availability of water for household use.

Realising that South Africa's water crisis requires a multi-pronged solution, the Stellenbosch University Water Institute coordinates work on the physical, socio-economic, socio-political and technical aspects related to the crisis, and in so doing highlights its complexity. We recognise the task at hand, and although we don't have all the answers, we know that one sure way to bring relief is water conservation; a simple, effective strategy that is too often ignored by decision-makers as well as the general public, which is portrayed by high levels of water wastage, water unaccounted for, incompetent operation and poor maintenance of facilities.

While it is only natural to look at governments, NGO, employers and the like to address the problem, we all have a role to play – from fixing that leaking toilet or reporting it (and in the process saving up to 1 000 litre water per day!), promoting water saving devices, and celebrating the well-deserved recognition that this life-saving device finally got. For inspiration, read one of the many toilet stories available online or follow the advice by some experts to sit on the toilet if that is the only place where you can close your eyes for a few minutes ... and breathe.

Prof Gideon Wolfaardt holds the ERWAT (East Rand Water Care Company) Research Chair in Wastewater Management and is Director of the Stellenbosch University Water Institute.