

THE WATER WHEEL

November/December 2017 Volume 16 No 6

WRC SYMPOSIUM 2017

*WRC symposium explores innovation to tackle
Nature's extremes*

BLACKFLY

Control on the Orange River

Controlled free distribution

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WATER
RESEARCH
COMMISSION



IMWA 2018
Annual
Conference



11th ICARD | IMWA 2018 Conference

International Conference on Acid Rock Drainage
International Mine Water Association
WISA Mine Water Division

10 - 14 September 2018
CSIR International Convention Centre
Pretoria, South Africa

RISK to OPPORTUNITY

A Green Conference
www.ICARD2018.org
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CONTENTS

04 UPFRONT

14 WATER AND THE ENVIRONMENT

New App a shot in the arm for blackfly control along Orange River

18 HEALTH AND HYGIENE

'Radical shift' needed to reduce risks during pit emptying for workers, households

22 INFRASTRUCTURE

Civil engineering fraternity expresses concern over state of SA's infrastructure

26 WATER AND HEALTH

What's that in your drinking water?

29 BASIC SERVICES

Billions remain unserved as world races towards meeting the SDGs

32 WATER KIDZ

Drink water for a healthy body and a healthy life

34 LAST WORD

WRC celebrates excellence with Knowledge Tree Awards

THE WATER WHEEL is a two-monthly magazine on water and water research published by the South African Water Research Commission (WRC), a statutory organisation established in 1971 by Act of Parliament.

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A new mobile App has been developed to manage blackfly breakouts on the Orange River. See story on page 14.

Cover photo by Koos van der Lende/ Moonshine Media/Africa Media Online.



FLUID THOUGHTS



WRC CEO, Dhesigen Naidoo

Research, development and innovation: Armoury for a new world order

We are meeting in the time of a new world order. This is illustrated by the 2015/16 El Niño – globally the worst in 20 years that plunged America, Africa and Asia into some of the most challenging dry conditions in recent times; and South America into some of its most devastating floods.

While the hot air rhetoric and conflict across the Atlantic divide continues around the future of the global agreements on climate change – Paris and its predecessors; Mother Nature herself, Gaia, shows little consideration for the theatricals of humans. We have seen some of the most devastating Atlantic hurricanes barreling through the Caribbean through the Gulf of Mexico into the North American mainland, mirrored by tropical storms and typhoons ripping through East Asia and the Far East in the Pacific border. South Asia has seen the return of the monsoons with a vengeance, with annual precipitation being delivered in weeks, if not days with dire consequences. Here in South Africa, while we steadily, but very slowly ease out of drought, with the Western Cape struggling through what has been called its biggest drought in 100 years. And this reflects the Southern Africa picture.

At the same time we have seen the steady pattern of changing weather patterns, with this part of the world becoming steadily drier over the past 20 to 50 years, with milder blue wet seasons and increasingly brown, more severe dry seasons. The world had its hottest year in 2015, a few of its hottest months ever in 2016, and a continuing trend in 2017.

The New Normal

While this has been the pattern for the last decade globally, and for the last three in southern Africa, the public discourse is still that of waiting to return to a more familiar time. It is time to consider this as the New Normal. The best science we have available to us in the form of weather and climate prediction says that this is either the new normal – or a very long period of transition to a different weather and climate pattern that may be even harsher on the back of global climate change.

That is why we brought together some of the best minds in the country and around the world to deliberate on this matter at the WRC Symposium, which took place at Birchwood, Ekurhuleni, from 18 to 20 September. The engagements in the plenaries and the specialist parallel sessions led to detailed exploration of the new normal and its implications. Implications at a local to international level. Implications for decision-makers, water managers, water users, business strategy and the community at large.

The best science we have available to us in the form of weather and climate prediction says that this is either the new normal – or a very long period of transition to a different weather and climate pattern that may be even harsher on the back of global climate change.

Adaptation to the new normal

It was important that our deliberations were textured by a solution-oriented vector. We do not want to consolidate the data and information to mourn the new normal, but to work out a range of interventions to enable a sustainable development pathway in the New Normal. This must be characterised as follows:

- A new research agenda and a new way of doing that research not just inter-sectorally and in a transdisciplinary manner, but predominantly in partnership with the practitioner and user communities,
- This is a giant challenge and the little pockets of knowledge and solutions we have in different parts of the world must be brought together with greater impact through smart and generous international collaboration. We will be signing some important agreements this week to further enable that.
- We need to re-visit the regulatory environment and current infrastructure paradigm with vigour. The Millennium Development Goals had a limited global success ratio, primarily because we were trying to solve a 21st century problem with 20th century technology and 19th century operating rules. We cannot abandon the ambitious Sustainable Development Goals to the same fate.
- Enabling sustainable development and ensuring universal access to basic services in the new normal will be characterised by creativity, innovation and system amenable to dynamic adaptation and improvement.
- It also has to be one that is characterised by local actions supported by national and global endeavours. The coal face of the new normal cannot fall victim to the fluctuations of the multilateral mood. Lead locally and allow the multilateral mandarins see the light in catching and empowering human progress in harmony with the environment.

WATER DIARY

Service delivery

November 26-29

The Water Research Commission, together with the Water Institute of Southern Africa (WISA) is hosting the Second International Peri Urban conference, to be held at the Century City Conference Centre, in Cape Town. The theme of this conference is 'Shaping development and sustainability in peri-urban environments'.

Visit: www.wisa.org.za

Water treatment

29-30 November

WISA along with its Process Controllers Division (Western Cape) is hosting the 8th Process Controller Workshop in Bitou Municipality. The theme for the workshop is 'Serving the water sector with professionalism'.

Visit: www.wisa.org.za for more information.

Young water professionals

December 10-13

The eighth International Young Water

Professionals conference will take place in Cape Town under the theme 'Building leaders and making impact'. The conference brings together 450 water, environment and related young professionals from across the globe and showcases how the young water professionals are making impact across the sector as well as offering capacity development and training sessions to further skill our future water leaders to tackle the demands from the water sector.

Visit: <http://iwaywconference.org/>

Water loss

May 7-9 2018

The IWA Water Loss Specialist Group, together with the City of Cape Town, will host the biennial Water Loss Conference and Exhibit at the Century City Conference Centre in Cape Town. The conference will be one of the world's largest water loss conferences and is expected to attract over 500 participants from more than 50 countries.

Visit: <http://bit.ly/2yFwity>

Aquatic Science

June 24-28

The Southern African Society of Aquatic Scientists will be holding its 2018 congress in Cape St Francis Bay resort, in the Eastern Cape. The theme for the congress is 'Aquatic ecology in the Anthropocene'. Enquiries: Petrie Vogel (conference organiser); Tel: (12) 346-0687; Email: admin@savetcon.co.za;

Visit: www.savetcon.co.za

Water resource management

June 24-27 2018

The Water Institute of Southern Africa (WISA) is hosting its biennial conference at the Cape Town International Convention Centre.

Visit: www.wisa2018.org.za

Groundwater – A solution to South Africa's drought

The possibility that drought-stricken areas in South Africa will only survive the current dry spell if the country's groundwater is effectively harnessed as an alternative water supply was one of the critical topics on the agenda at a conference hosted by the Ground Water Division of the Geological Society of South Africa in October.

The 15th Biennial Groundwater Conference, which took place in Stellenbosch, attracted more than 100 local and international delegates. Keynote speakers included John Cherry, Distinguished Professor Emeritus at the University of Waterloo, Canada, and winner of the 2016 Lee Kuan Yew Water Prize, and Prof Bruce Misstear, Associate Professor and Fellow of Trinity College in Ireland. Prof Cherry addressed state-

of-the-art groundwater monitoring techniques while Prof Misstear discussed sustainable development goals and global change as related to groundwater resources development. The conference was opened by Western Cape Premier, Helen Zille.

Groundwater is a prominent topic in the drought-stricken areas of South Africa, particularly the City of Cape Town, where it has been identified as an important alternative water supply. "In times of water scarcity, we are reminded about the need for alternative, sustainable and emergency water supplies," said Chair of the Ground Water Division, Dr Matthys Dippenaar.

"There is no better time for a conference of the groundwater specialists of our

water scarce country than now, while we are dealing with the repercussions of one of the worst droughts in recorded history. We trust that the conference will highlight our ability as a profession to contribute to solutions regarding water supply in our country."



NEWS

Gremlins scramble Water Wheel article

Some layout gremlins scrambled the article, 'Beyond the farm gate: Fruitlook unlocks bigger picture', that was published in the September/October edition of the *Water Wheel*. The corrected article can be found online, Visit: <http://bit.ly/2zKgWSa>. The *Water Wheel* team regrets the error.

Helping municipalities plan for climate change



Responding to climate change is a priority for local governments, as they work to protect the quality of life of the country's most vulnerable residents; to help with this process, SRK Consulting has developed a rapid vulnerability assessment (RVA) tool.

"Understanding climate risks is essential for local government, in particular, to be able to effectively implement adaptation measures for vulnerable communities and sustainable local economic development – in terms of the Durban Adaptation Charter for Local Governments," said Warrick Stewart, SRK Consulting principal environmental scientist. "The RVA tool helps municipalities to understand the links between climate change and local

environmental and socio-economic implications – and to determine the necessary proactive and reactive response measures."

While climate changes are intrinsically linked to climatic events, climate impacts are linked to the existing socio-economic and environmental conditions of a region. SRK environmental scientist, Victoria Braham, therefore highlighted that vulnerability was a function of the exposure of an area to climate change and its sensitivity to the resultant impacts – while its adaptive capacity would cushion such impacts. So exposure, sensitivity and adaptive capacity all had to be carefully measured, and this is where the RVA tool comes into its own.

The City of Mbombela is among those where the tool has been successfully applied. "The municipality appointed SRK Consulting to develop a climate change strategy and implementation plan," noted Khethiwe Malaza, head of the municipality's Environmental Management Unit. "The strategy is meant to guide and equip the city to build climate resilience and improve the community's adaptive capacity."

Some of the actions contained in the implementation plan are already being implemented by the city, said Malaza. "Working with the City of Mbombela, the spatial context of the area was analysed through the municipality's Spatial Development Framework and Integrated Development Plan – breaking each development zone down into economic sectors," explained Braham. "We could then determine the vulnerability per zone and sector by assessing existing and future stresses to the system, by projecting future climate change impacts for the municipality (its exposure), and by determining the degree of sensitivity and adaptive capacity of the system."

The RVA's findings were then used to inform the management actions that the municipality should prioritise in their climate change response strategy.

Values of water must be better understood



Water is the lifeline of our civilisation. Without it, there is no hope of sustaining households, industries, food and energy production, or such key functions as hospitals. Access to safe water is necessary in order to implement the global development agenda.

This was the main message from the closing ceremony of the World Water Week, held in Stockholm in August. Over

3 200 participants from 133 countries attended the event, an annual highlight on the international water calendar.

“With increasing scarcity, we must recognise the many values attached to water, be it economic, social, environmental, cultural or religious. I believe that by re-valuing water, we will develop a deeper understanding and respect for this precious resource, and thus be better prepared for more efficient use,” said Stockholm International Water Institute (SIWI) Executive Director, Torgny Holmgren.

Throughout World Water Week, links were made between the different values of water, including its monetary value. “I believe we will see more diverse pricing structures in the future, allowing for more economical and efficient use,” said Holmgren.

A growing global population is creating a higher demand for fresh water. Climate-driven changes in weather patterns, leading to extended droughts and devastating floods, further exacerbate pressure on our common water resources. “Efficient use, therefore, is not an option but a must to ensure availability for all of us,” Holmgren added.

Nomvula Mokonyane, South African Minister of Water and Sanitation, stressed that we need to embrace new technologies which support our route towards the realisation of the Sustainable Development Goals and that an appreciation must also be given to new world class technologies emanating from Africa. “We cannot afford to continue to do what we did yesterday and expect to see a different result tomorrow. We must be bold!,” noted Mokonyane.

UKZN prof appointed to National Agricultural Research Forum



Prof Albert Modi, the acting Deputy Vice-Chancellor of the College of Agriculture, Engineering and Science at the University of KwaZulu-Natal (UKZN), has been elected Deputy Chairperson of the National Agricultural Research Forum (NARF).

“It is a great honour to be appointed as NARF Deputy Chair,” said Prof Modi. “This role will allow me to make a significant contribution to the development of South African agricultural science and

technology and, in addition, to pursue the strategic objectives of UKZN.

During his two-year term, Prof Modi will – according to a UKZN statement – provide leadership to the NARF and its Secretariat, and monitor the implementation of the programme of work approved by the organisation in Plenary. This will involve providing leadership and guidance in the achievement of strategic objectives and goals, representing the NARF formally in agricultural research bodies and strategic gathering forums, monitoring implementation of the NARF Plan of Action, chairing meetings and reporting to plenary sessions on the progress and operations of the NARF.

The statement said the role demands ability and commitment to lead agricultural research and technology development to enhance the competitiveness of the agricultural sector and contribute to economic growth and environmental sustainability.

Members of the NARF deliberate on research issues affecting the agricultural sector such as drought, climate change and variability, and their impact on agricultural production, adaptation and mitigation.

The NARF promotes and advocates the use of science, technology and innovation in the agricultural value chain as key enablers for food and nutrition security, poverty alleviation, growth and socioeconomic development.

A crop scientist, Prof Modi champions sustainable agriculture and the value of indigenous knowledge in informing Scientific research. In 2015, he received the Water Research Commission Knowledge Tree Award.

GLOBAL

New Executive Director for International Water Association



Internationally recognised water resource management expert, Kala Vairavamoorthy, has been appointed Executive Director of the International Water Association (IWA).

He took up his position on 25 September, and will be based in the IWA's Global

Operations Office in The Hague, Netherlands.

Vairavamoorthy has a particular interest in urban water issues, combining a strong engineering background with practical international experience. He has published extensively and has a strong international profile working closely with the World Bank, African Development Bank, UN-Habitat, Global Water Partnership and the European Union.

Commenting on the appointment, Diane d'Arras, President of the International Water Association, said: "Prof Vairavamoorthy brings many years of high-level international experience, including as an active and well-respected IWA member. His wide scientific, managerial and cultural experience will be invaluable in shaping the IWA's future strategy. In particular, how we as a global network of water professionals can be instrumental in achieving the

water-related targets of the Sustainable Development Goals."

Vairavamoorthy is joining IWA from the International Water Management Institute (IWMI), where he was the Deputy Director-General for Research. He expressed enthusiasm regarding the IWA appointment, "IWA can help the international water sector navigate a period of rapid change, and its membership is well placed to provide both innovative and well-tested solutions. IWA can also provide critical help to emerging economies in their quest for sustainable water management."

Vairavamoorthy has a PhD and MSc in Environmental Engineering from Imperial College, London and a BSc (Hons) in Civil Engineering from King's College, London. He is a Chartered Engineer and a Fellow of the Institution of Civil Engineers (UK).

Researchers develop cheaper, faster test for E.coli in drinking water

Researchers at the University of Waterloo have invented a fast, affordable way for developing communities to test their drinking water for potentially deadly E.coli.

Unlike current tests that cost tens of Dollars and take up to three days to get back from the lab, the Waterloo invention uses paper strips similar to those in litmus tests to produce results in less than three hours at a cost of 50c.

"This has the potential to allow routine, affordable water testing to help billions of people in the developing world avoid getting sick," said Sushanta Mitra, Executive Director of the Waterloo

Institute for Nanotechnology.

Now being refined by Glacierclean Technologies Inc., a startup company, the test could also improve water safety in remote or rural areas of the developed world and greatly reduce testing costs for municipal treatment systems.

The bottom of the paper strip is laced with sugars, which begins to dissolve when placed in water. E.coli bacteria are attracted by the resulting sugar trail and get trapped in the porous paper when they come into contact with it. As water enters the paper, it carries the trapped bacteria into an area of the strip

containing a mixture of chemicals. The E.coli react with those chemicals and turn the strip pinkish red to signify a positive test.

With high levels of contamination, a result is produced in just 30 minutes. Low levels of contamination take up to 180 minutes. Work is underway to reduce test times.

It is hoped to get the test kits onto the market within the next nine months.

Trailblazer in international water law wins global water prize



Prof Stephen McCaffrey, USA, is named 2017 Stockholm Water Prize Laureate for his unparalleled contribution to the evolution and progressive realisation of international water law.

McCaffrey, Distinguished Professor of Law at the University of the Pacific, McGeorge School of Law, in Sacramento, California, is the single most respected authority on International Water Law. His work continues to influence scholars, legal practitioners and policy-makers and contribute to the sustainable and peaceful management of shared waters.

On receiving news of the prize, Prof McCaffrey said: "Learning about the Stockholm Water Prize literally took my breath away. I am deeply honoured and humbled to have been selected for this prestigious award. But one also stands on the shoulder of others, and I am most grateful to those who have paved the way for me."

In his citation, the Stockholm Water Prize Nominating Committee recognised Prof McCaffrey's "path-breaking leadership and legal scholarship in international water law". He has made a unique contribution in three specific areas: his seminal work on Treaty negotiation; his major scholarly works, including his book, *The Law of International Watercourses*, and his leadership providing expert legal advice, wise counsel, training and facilitation of complex negotiations with a wide range of stakeholders."

Prof McCaffrey has been acting as legal

counsel to states in several negotiations concerning international watercourses. He has served as counsel in many inter-State disputes over shared water resources, for example, between Argentina and Uruguay, Pakistan and India, and Slovakia and Hungary, which have been heard by international courts and tribunals.

He has guided, often multi-year negotiation processes among riparian countries with respect to transboundary water law, for example, on the Nile, Mekong, and Ganges, some with numerous countries involved. Although he has experienced first-hand the potential conflict over freshwater resources, he remains an optimist, pointing to studies that have shown that shared freshwater is generally a catalyst for cooperation rather than conflict.

Prof McCaffrey received his prize during the World Water Week, held in Stockholm at the end of August.

WWF launches last-ditch effort to save world's wild sturgeons



With most sturgeon species heading for extinction, global environmental conservation body, WWF, announced a new global strategy to tackle the threats facing the world's most endangered group of fish. The announcement was made at the 8th International Symposium on Sturgeons which took place in Vienna in September.

Over the past 50 years, sturgeon populations have collapsed around the world due to poaching, habitat

loss, pollution and new dams blocking their migration routes. With numbers continuing to dwindle, every sturgeon species is now classified as endangered on the IUCN Red List, with 17 of the 21 species listed as critically endangered and four categorised as possibly extinct.

"Sturgeons swam with the dinosaurs 200 million years ago, but these extraordinary fish could soon disappear from the earth if we do not halt the illegal fishing and habitat destruction that are driving them towards extinction," said Stuart Orr, WWF Freshwater Practice Leader.

"Beluga sturgeon used to be the biggest freshwater fish on earth, but no one sees giant sturgeon any more: in fact it is very rare to see any sturgeon at all. We've lost some species already and we could lose them all unless governments, communities, scientists and conservationists join forces now," added Orr.

Working with partners in regions of Europe, Asia and North America where sturgeon still survive, WWF aims to help put a stop to the overexploitation of wild sturgeon for caviar and meat, preserve key migration routes, protect and restore critical river habitat, and create breeding centres to restock wild populations.

To achieve these goals, the new, long-term strategy will incorporate a wide range of activities from supporting stronger enforcement of existing laws, including fishing bans, to developing alternative livelihoods for fishing communities and ensuring sturgeon safeguards are included within the investment policies of public and private financial institutions.

THE WATER WHEEL

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NEW WRC REPORTS

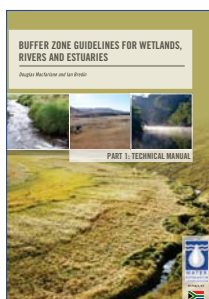


Healthy toilets are possible! School sanitation management handbook

This handbook has been produced as part of a research study titled 'Evaluating the design of existing rural school sanitation infrastructure and developing a model and guidelines for optimal design'. This research project found that many South African toilets are dangerous, dirty and degrading. Some toilets were found to pose a threat to

the very lives of learners, who could fall into the pit and drown. And unpleasant toilets that are not monitored can create a space where the worst of learner behaviour can flourish, placing learners at risk of bullying, abuse and humiliation. All this of negatively affects teaching and learning. This handbook aims to ensure that the basic rights of learners are protected in the toilets. The publication covers, among others, the right to be safe at school, the need for toilets to be clean, the right to dignity and security and special support for special needs (such as menstruating girls and learners with disabilities).

Report No. TT 699/16

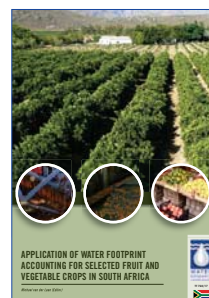


Buffer zone guidelines for wetlands, rivers and estuaries part 1 and 2

These reports are some of the key outputs of a research project funded by the Department of Water and Sanitation, through the WRC. The reports are designed to be used together with a range of accompanying products as part of this project. Part 1 (Technical manual) documents the step-wise assessment procedure developed to determine

appropriate buffer zones for rivers, wetlands and estuaries. This includes the rationale for the approach taken, together with important supporting technical information used as a basis for developing the tools for buffer zone determination. Part 2 (Practical Guide) was developed to assist users with the practical application of the buffer zone tools. It includes field sheets and practical guidance for collecting and interpreting relevant desktop and field information. Supporting information required to assess selected criteria has also been compiled, and includes a range of spatial datasets (shapefile or Keyhole Mark-up Language – KML – format).

Report No. TT 715/1/17 (part 1) and TT 715/2/17 (part 2)

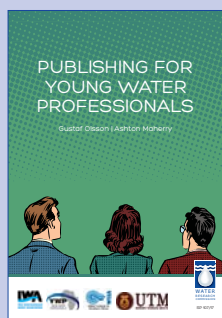


Application of water footprint accounting for selected fruit and vegetable crops in South Africa

This research report represents the first in a series of WRC projects on water footprint assessments for different crop types, and focuses on fruit and vegetable crops. Prior to this study, a review of the applicability of water footprints in South Africa was commissioned and published by the Commission (**Report**

No. TT 616/14), which identified several potential benefits as well as shortcomings in the use of water footprints. The research conducted in this project, therefore, aimed not only to estimate water footprint metrics for important fruit and vegetable crops, but also to explore the use of different water footprint assessment approaches and to interpret the usefulness/ applicability of the information generated.

Report No. TT 722/17



Publishing for Young Water Professionals

A new guideline, *Publishing for Young Water Professionals*, is now available from the Water Research Commission (WRC). The guide, authored by Gustaf Olsson and Ashton Maherry, is the product of the Young Water Professionals (YWP) publications workshop previously conducted in Malaysia and South Africa. The workshops have been organised by the International Water Association (IWA)-YWP National Chapters, in cooperation with IWA and the Water Institute of Southern Africa, supported by the WRC in South Africa and Universiti Teknologi Malaysia. The workshop highlighted a need for publication guidelines for YWPs. The contents of this book aim to advise and guide young people towards successful publication of their papers. The authors have created an easy-to-read guidelines. Content covered in the guideline include language and style, writing the paper, plagiarism and cheating, the submission process, and the review process, among others.

Report No. SP 107/17

WRC SYMPOSIUM EXPLORES INNOVATION TO TACKLE NATURE'S EXTREMES

The Water Research Commission (WRC) successfully hosted its third biennial symposium with the theme 'Adaptation to the new normal' at Birchwood, in Ekurhuleni, earlier this year.

In response to the occurrence and frequency of extreme weather events, such as drought and flash floods, that have placed even more stress on South Africa's already limited water resources, the event brought together thought leaders, industry experts, government officials, young water professionals and innovators to exchange knowledge and map out bold interventions that would facilitate South Africa's adaptation to the challenges faced by the water sector.

During his opening address, WRC CEO, Dhesigen Naidoo, said the symposium took place at the time of a new world order where extreme weather and climate was becoming the order of the day. The 2015/16 El Niño event, one of the worst on record, brought large-scale droughts across South Africa. At the time of the symposium, Cape Town was still battling extreme drought conditions, and making emerging plans before its water resources ran out in March. Further afield, severe hurricanes, such

as Irma and Maria, led to large-scale devastation to parts of the US and the Caribbean, while monsoons killed at least 1 400 and displaced thousands more in East Asia.

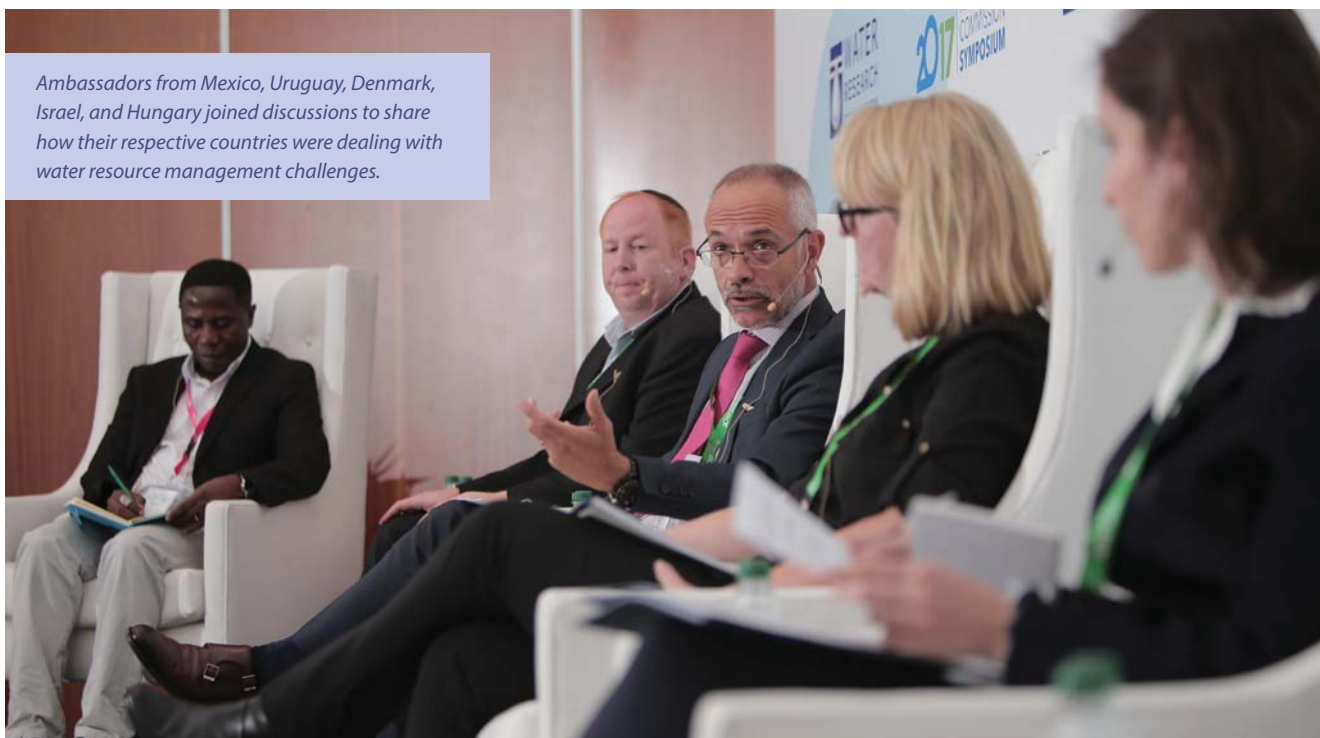
Instead of waiting for the world to return to "normal" there needed to be acceptance that, due to phenomena such as climate change, these extreme weather events were parts of a "new normal" being experienced around the globe, the CEO noted. Science, technology and innovation had a huge role to play in overcoming the challenges of a new world. "We do not want to consolidate the data and information to mourn the new normal, but to work out a range of interventions to enable a sustainable development pathway in the new normal. We need to engage this phenomenon in a way that empowers us to deal with this in a way to survive it and create the kind of world we want to see."

The symposium addressed questions such as what should the new research agenda be, how to design research programmes in a way so that all stakeholders are included, how to extract information from the pockets of excellence already in



WRC Chair, Dr Nozi Mjoli, welcoming delegates to the symposium.

Ambassadors from Mexico, Uruguay, Denmark, Israel, and Hungary joined discussions to share how their respective countries were dealing with water resource management challenges.



existence around the world, and how to organise for increased international collaboration so that we do not face these challenges in isolation.

Addressing the same symposium remotely, Minister of Water and Sanitation, Nomvula Mokonyane, reminded delegates about the reality of the rise of extreme weather patterns due to climate change and a growing global population. "These challenges require robust responses to ensure the required outcomes."

At the same time, governments around the world were tackling the ambitious targets as set by the United Nations Sustainable Development Goals. According to the minister, there was an expectation from the South African government that research and technology institutions, such as the WRC, science councils and universities, would come up with knowledge and solutions that could be translated into practical solutions to enhance water-supply, particularly to vulnerable groups.



WRC CEO, Dhesigen Naidoo, being interviewed by Rowena Baird of SAFM.

However, the new normal was not only filled with challenges, but also with opportunities, said Mokonyane. "This milieu

offers additional opportunities for new entrepreneurs to enter the economy, particularly women and young people." The department, through programmes such as the Women in Water Programme, was building the necessary capacity and skill among women-owned businesses to tackle South Africa's water challenges.



WRC CEO, Dhesigen Naidoo, and CEO of the Namibian National Commission on Research, Science and Technology, Enid Keramen, following the signing of a Memorandum of Understanding between the two entities.

The first day of the symposium also included the signing of a Memorandum of Understanding between the WRC and the Namibian National Commission on Research, Science and Technology. The MoU serves as a framework that will coordinate and support water research and innovation collaborations between the two countries, building on existing partnerships between the two countries' governments. The WRC plans to strengthen its partnership in the Southern African Development Community and ultimately Africa as a whole to jointly address the challenge of water scarcity and inability to provide the human right of clean drinking water and sanitation for all.

WATER AND THE ENVIRONMENT

New App a shot in the arm for blackfly control along Orange River

*A Water Research Commission (WRC)-funded research project has developed new tools to help reduce Orange River blackfly outbreaks.
Article by Sue Matthews.*



During the last outbreak along the Lower Orange River in 2011, blackfly caused losses of livestock estimated at some R300 million. Lambs were particularly affected, many having been trampled to death by sheep huddling together to protect themselves from the biting insects, or prevented by their mothers from suckling. Like mosquitoes, it is only the female blackfly that bites as she needs a blood meal for egg development, and any soft and exposed skin on teats, eyes, ears and lips comes under attack. The resulting pain, together with the constant annoyance of circulating flies, inhibits feeding and mating, leading to loss of condition and reduced lambing. Secondary infection of the wounds or allergic reactions sometimes even cause the death of the animal.

The economic impact of blackfly outbreaks is not limited to livestock farming though. The irrigated agriculture and tourism sectors are also affected through lost productivity of farmworkers

and visitors avoiding outdoor activities. These problems may occur anywhere along a 1 200 km stretch of the middle and lower Orange River, from Hopetown to Sendelingsdrif.

Blackfly have always been present along the Orange River, but only developed pest status after the construction of the Gariep and Vanderkloof dams in the 1970s. This is because the female flies lay their eggs close to rapids, where the larvae will be able to filter food particles from the flowing water with their retractable head fans. Releases from the dams to generate hydroelectric power and supply irrigation schemes provide a relatively constant, year-round flow of water laden with organic matter, creating ideal conditions for the larvae.

This knock-on effect first became apparent on the Vaal River – the Orange River's main tributary – following the completion of the Vaal Barrage in 1923, the Vaalharts Diversion Weir in 1936 and

the Vaal Dam in 1938. Frequent blackfly outbreaks occurred after 1950, and a particularly severe one in 1963 prompted the first efforts to control blackfly populations in 1965, using DDT. That control programme was suspended two years later due to the detrimental impact of DDT on non-target species.

During the 1970s the first flow manipulation trials were conducted at the Vaalharts Diversion Weir and Vanderkloof Dam, but although successful in reducing larval numbers in the river reach immediately downstream, it was recognised by the mid-1980s that this would be an impractical method of controlling blackfly. The most effective time to cut off flows was during the winter dry season, when releases were most needed by Eskom and agricultural water users, plus the dams were too far from blackfly-affected areas lower in the catchment to fine-tune control.

Since the early 1990s, the Orange River Blackfly Control Programme has relied on spray application via helicopter of two larvicides. Vectobac® is a granule formulation of *Bacillus thuringiensis* subsp. *israelensis* (*Bti*), a soil bacterium isolated from dead mosquitoes retrieved from a stagnant pond in Israel in 1976 and now used to control mosquitoes and blackflies worldwide. It is non-toxic to humans and environmentally safe, but its effectiveness is reduced in strongly flowing, turbid rivers. Abate® – an organophosphate with the active ingredient temephos – is more suitable in these conditions, but repeated application has resulted in larval resistance, so its use has been scaled back.

Periodic spraying over an 800 km stretch of river is timed to take place before larval numbers build up to problem levels. Staff from the Department of Agriculture, Forestry and Fisheries (DAFF) offices in De Aar and Upington monitor larval densities on rocks and reeds in about a dozen sites in the river according to a 10-point scoring system developed by Dr Rob Palmer in the early 1990s. Larval densities exceeding a threshold score of 6 indicate that the river reach should be sprayed without delay. Despite these efforts, occasional outbreaks still occur – prior to the 2011 one, there was an outbreak in 2000-2001, when river levels were higher than normal.

The recently completed WRC project, conducted by Dr Nick Rivers-Moore with Dr Palmer was aimed at improving prediction of blackfly outbreaks – and hence help prevent them – by refining a Bayesian network probability model and enabling members of the public to contribute data. The latter has been achieved by developing a mobile phone application, called 'Muggies', which is available for both iOS and Android from the Apple App Store or Google Play respectively. All the contents and features are mirrored on a website (<http://muggies.org>) for those who don't use smartphones or prefer to view the content on a larger screen.

The App and website allow users to upload photos or video clips of blackfly larvae on reeds and rocks in the Orange River and adjacent irrigation canals, and pinpoint their position on an interactive map. Example photos illustrating Palmer's Scoring System are provided, and users are invited to score their site if they feel confident enough to do so. There is also a four-point Fly Worry Index, ranging from 0 = no flies to 3 = extreme level of

annoyance, but the accompanying instructional videos explain that this is aimed at sheep farmers. Also developed by Dr Palmer in the 1990s, 0 more specifically refers to sheep grazing and resting peacefully, while 3 describes worse-case scenarios where sheep stop grazing, lambs die and rams won't mate.



Blackfly larvae attached to reed, with a larval density score of 10 according to Palmer's Scoring System.

A text box is provided to fill in any other useful information, and users are requested to identify their economic sector – livestock, grapes, citrus, tourism, government or other. In future, it is intended that users will be able to view the collated monitoring data and predictions on blackfly outbreaks, as well as a calendar showing the spraying schedule. Local farmers have previously expressed unhappiness about not being informed by DAFF as to when spraying would occur.

Involving stakeholders in this way increases monitoring coverage and improves estimates of the time lag between high densities of larvae and outbreaks of adult blackflies. It also allows for verification and refinement of the Bayesian network outbreak probability model, the development of which formed the main component of the research project.

A Bayesian network, also known as a belief network, is a type of probabilistic graphical model that can be used to build models from data and/or expert opinion. It essentially consists of multiple cause-and-effect relationships, and is an ideal tool for representing relationships among variables, even if the relationships involve uncertainty, unpredictability or imprecision.

Dr Rivers-Moore explains that each monitoring data record will be added to the existing Bayesian network as a case file.

"The more cases you've got, the stronger your cause-and-effect relationships are, so in theory the accuracy of your predictions gets better," he says.

An earlier version of the model was developed by Dr Rivers-Moore in a previous WRC pilot project, and focused mainly on the effect of flow volume. The current version included temperature and turbidity as additional variables, because temperature is known to be a major factor in determining the size and duration of blackfly larvae and pupae, while different species are understood to have particular turbidity preferences.

The model revision involved collating and analysing existing monitoring data – including longer term flow data from various gauging weirs along the Orange River – as well as collecting new data at 14 monitoring sites along a 600 km stretch of river downstream of Vanderkloof Dam. At each of these sites, loggers were installed to record temperature on an hourly basis, turbidity data was collected weekly using a clarity tube, and four sampling trips spread over a year were undertaken to assess seasonal changes in the relative abundance of different blackfly species.

Incorporating all this additional data in the model revealed that turbidity, which is influenced by both flow volume and temperature, is a key driver triggering switches in blackfly species populations. At high turbidity *Simulium chutteri* and *Simulium damnosum* – the species that account for most of the pest problems – are more likely to occur. However, an increase in water clarity, typically associated with reduced flows, favours other species that are not regarded as major pests. This is due to differences in the structure of the larvae's filter-feeding fans, which affect their ability to capture food particles and withstand strong flows. The blackfly species switch is accompanied by an increase in benthic algae, and a crusting on rocks that appears to be a mix of diatoms and calcium carbonate.

The model also showed a negative correlation between *S. chutteri* and *S. damnosum*, indicating that only one of these

species dominates at any one time at a site, with the other species largely competitively excluded.

"I suspect what naturally would have happened in the past is that the system would have periodically had lower flows, when water clarity would have increased, algae would have come in and non-pest species would have dominated," says Dr Rivers-Moore. "Then conditions would have built up again to favour 'chutteri' and 'damnosum' – with whatever got there first, colonising successfully – so there would have been a constant patch dynamics scenario. But with post-impoundment flow regulation, those kind of resets occur four times less frequently, so now it's just 'chutteri' and 'damnosum' constantly."

Cooler water temperatures during autumn and winter have the effect of reducing the number of generations of blackfly, but favouring large larvae that develop into more fecund adult females, increasing the potential for blackfly outbreaks in spring.

"The top two sites, Douglas and Prieska, are colder than the rest, so the larvae there would get much fatter," notes Dr Rivers-Moore. "Douglas is close to the Vanderkloof Dam, so you hardly get any blackfly there because they're flushed out by the hydroelectric flow releases, whereas Prieska has less flow variability and good reed growth, so that's one of the real problem sites."

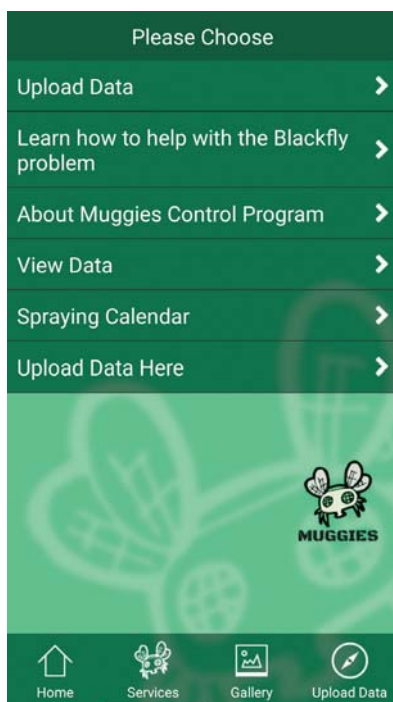
"The control programme has improved the situation a lot from what it was, there's been good research by various people along the way – much of it funded by the WRC – and DAFF has done good work with their monitoring."



A larval density score of 6 indicates that larvicide spraying should be conducted without delay.



Project leader, Dr Nick Rivers-Moore, with MSc students, Sashin Naidoo and Esther Ndou, conducting fieldwork for the blackfly research project.



The Muggies App for smartphones allows users to learn more about the blackfly problem and the associated control programme, and to upload and view data such as photos, location and larval density scores. All the content can also be accessed via the website, <http://muggies.org>

He adds that he has heard horror stories of what larval populations were like in the 1980s, before the blackfly control programme began.

“The control programme has improved the situation a lot from what it was, there’s been good research by various people along the way – much of it funded by the WRC – and DAFF has done good work with their monitoring. The purpose of this project was to try to put it all under one umbrella, which I think it has done in terms of developing a predictive framework for blackfly outbreaks, but the issue now is who’s going to take it up.”

Dr Rivers-Moore explains that there is a cost involved in hosting the Muggies website and App, and somebody would need to be kept on a retainer to respond to queries, collate the data, update the model, audit it to see if the predictions are agreeing with the monitoring, and liaise with the farmers about whether the outbreaks are being contained. Because of the uncertainty around a sustainable source of funding, the tools have not been widely promoted as yet, although an article about them was published in the *Landbouweekblad* in September.

Clearly, involving stakeholders in data collection to address a problem that directly affects them is a worthwhile citizen science initiative, while the model outputs would be useful for improved planning of control efforts. If you can help with sponsorship, contact Dr Rivers-Moore by emailing muggiescontrol@gmail.com.

HEALTH AND HYGIENE

'Radical shift' needed to reduce risks during pit emptying for workers, households

New ways must be found to reduce the risks emptying pits poses to sanitation workers and households in the communities they work in. This is the conclusion from a recently completed project funded by the Water Research Commission (WRC).

Article by Jorisna Bonthuys.



The approach followed during pit emptying needs a radical shift from a “public works” attitude to an understanding of faecal sludge being a hazardous material that poses serious health risks to communities. This is the view of Bobbie Louton, lead author on the recent study.

Research on this topic was conducted by Partners in Development, in collaboration with the University of KwaZulu-Natal, on behalf of the WRC. The study titled *Understanding and addressing the exposure of workers, the public and the environment to pathogens during pit emptying* looked at ways pathogen contamination happens during pit emptying.

The researchers also considered practical ways to reduce contamination risks during this process. Louton's collaborators in this project were David Still, Lorika Beukes and Danica Naidoo.

The study is relevant anywhere an on-site sanitation system (that requires a pit for sludge) is used.

The research included a detailed case study of pit emptying at ten homes, interviews with household members and sanitation workers, as well as an analysis of samples collected from surfaces and pits. Workers involved in desludging of dry pit latrines in the eThekweni Metro Municipality (in KwaZulu-Natal).

The researchers also gathered data about helminthic (intestinal worm) infections amongst 96 adult volunteers in the Eastern Cape. The team focused on people infected (and reinfected) with *Ascaris lumbricoides* (roundworm), *Trichuris trichiura* (whipworm) and *Taenia spp* (tapeworm). These species are “indicator organisms” used to determine the presence of faecal pathogens in risk assessments. They are also the most common helminths found in the chosen study area.

In addition, the researchers tested some household cleaning agents to determine if they can deactivate helminth eggs.

“Worldwide, it is being acknowledged that sanitation efforts need a game change to provide safe, more hygienic and appropriate options to people in the developing world.”

Changing the sanitation game

“The danger we face from our own excreta is a problem as old as the human race,” the report states. “Despite our remarkable achievements as a species on many fronts, the problem of how to safely manage our excreta is far from solved: Nearly one in four of the world’s population still defecates in the open. And ‘the open’ – empty lots or undeveloped land where people may choose to defecate if they don’t have access to a toilet – is rapidly giving way to population growth, increasing the risk of exposure to disease.”

Worldwide, it is being acknowledged that sanitation efforts need a game change to provide safe, more hygienic and appropriate options to people in the developing world. This is also true in many parts of South Africa where people still rely on on-site sanitation approaches (including pit latrines).

Since 1994, large-scale infrastructure programmes have been underway to build ventilated improved pit (VIP) latrines (among others) to achieve national service delivery goals. Current estimates show that around a third (30%) of the entire South African population rely on VIP toilets and related systems. On-site and off-site sanitation create different challenges and risks for workers who empty pits, maintain sewers or operate treatment works.

“Much of the effort around improving health through improving sanitation currently focuses on the provision of adequate toilets to all,” Louton states. “However, if during the process of removing excreta from on-site sanitation systems workers are exposed to pathogens or the household environment becomes contaminated, the gains made through the provision of sanitation will be compromised.”

With over 2 million VIPs and other on-site sanitation systems being implemented in South Africa since 1994, many thousands

of these systems are now also reaching capacity. When toilets fill up, householders are, effectively, left without sanitation – increasing the likelihood of open defecation. The big question is: What to do next? What happens when the pit is full?

Due to water scarcity, dry on-site sanitation is also likely to remain a permanent part of our national sanitation reality. And while global initiatives to end open defecation have often made the assumption that where basic sanitation is provided open defecation is eradicated, this appeared to not be the case in the local context. Another WRC-funded research project Louton worked on found that open defecation is still a huge problem in many communities, one of the reasons being the perception that VIP toilets are not safe to use. The lack of basic municipal services, as well as a lack of adequate knowledge of disease transmission, contribute to more ways in which faecal contamination spread. The practice of geophagia (the intentional eating of soil) may also contribute to the spread of pathogens (including helminth) from contaminated soil.

Risks faced by sanitation workers

All workers (involved in pit emptying) should be considered to be potentially infected with helminths, and all pits should be assumed to contain helminth eggs.

Extensive contamination of household surfaces and exposure of workers to sludge occurred during pit emptying activities observed in this study. Pathogens were found in pit sludge, on household surfaces in the pit emptying environment and on workers’ clothing and skin.

This pit sludge can contain a range of bacteria, worms, protozoans and viruses that could be harmful to the people who come into contact with it – and some of these can survive for many years outside of a host. The consequences of infection by some of the organisms can be dire: diarrhoeal diseases remain the second leading cause of death among children under five years globally, killing more young children than AIDS, malaria and measles combined.

In South Africa, diarrhoea is a leading cause of morbidity and mortality among children and is responsible for approximately 20% of deaths among children under the age of five. Children from low-income families are nearly ten times more likely to die from diarrhoea than children from more privileged homes. Persistent diarrhoea is associated with an 11-fold increase in mortality for children with HIV compared to uninfected children.

In the South African context, where rates of infection with HIV and TB are high, the consequences of diarrhoeal diseases or loss of nutrients due to parasites like these can be dire. Children are particularly at risk of worm infections, and their stools tend to carry a higher pathogen load than do those of adults. People with compromised immune systems, as well as the elderly, are especially vulnerable to the risks of pathogen contamination during pit emptying.

The research results are therefore particularly worrying, Louton believes. Visual observations of pit emptying revealed extensive and repetitive contamination of household environments. This happens when workers’ protective gear (boots and gloves)

comes in contact sludge. Repeated contact with contaminated surfaces (e.g. tools and bins) and household surfaces, as well as between contaminated surfaces or equipment and workers' bodies, also occur.

Diseases from sludge can get into the human body in different ways. "If there is dry, dusty sludge, workers could breathe some of bacteria and viruses, or worm eggs, contained in it into their lungs," Louton explains. "If it splashes, these could get into their eyes or noses. If something sharp in the sludge cuts them, germs could get into their bloodstream." Most commonly, ingestion occurs after dermal contact – when contaminated hands touch the mouth. Hands may transfer contamination to the mouth during eating, smoking, drinking or when a worker wipes his or her face, the study shows.

The rate of helminth contamination linked to pit emptying is high. Helminth eggs were found in nine of the ten pits and at all ten households studied in eThekweni. These eggs were found on the walkway at all the sites studied and on the cover and lip of the pit at 80% and 70% sites respectively. The eggs were also found on the gloves and bottom of the boots of 80% of the pit emptiers sampled, on the hands of 70% and inside the masks of 20% of pit emptiers tested.

Stool samples from residents and sludge samples from pit latrines studied also show helminth infections are present in the study population. The research showed 15% of the 96 adults study participants from the rural Eastern Cape had at least one type of helminth in their gut.

"These worms can be very dangerous for children because it

can cause nutritional deficiencies as well as impaired physical and cognitive development among children," Louton explains. "Some worms can even find their way into your brain and cause problems or even death."

Because of the high incidence of helminth infections and other diseases, sludge in South Africa must be assumed to be highly pathogenic, says Louton. "Removing sludge is a hazard not only to those removing it but to the householders, whose environment can become contaminated." Helminth eggs and other pathogens in sludge have been found to survive for many years – over 15 years, in some cases - in the pit.

Education, management needed

It appears the understanding of most people interviewed was very poor when it comes to how intestinal worms and diseases linked with sludge contamination are spread.

Some logistical challenges were also identified which, if not resolved, can compromise the safety of workers and the communities they work in. This includes the need for personal protective equipment, site conditions, transport and workers' welfare needs, for instance. Workers need specific equipment on site to ensure their safety and to help break the cycle of contamination during pit emptying.

While protocols and the necessary equipment to protect workers and the environment often were not in place, the workers also did not always take the steps available to them to protect themselves. This indicates a lack of adequate knowledge about the hazards contained in sludge and how to contain them, a lack of commitment or the motivation to apply what

Lani van Vuuren



Contractors must equip workers adequately with the equipment and supplies they need to protect their health.

Courtesy Susana



Above and bottom right: Visual observations of pit emptying revealed extensive and repetitive contamination of household environments.

they knew. Also, enforcement of health and safety protocols on the job was not adequate to ensure safe work practices, the report shows.

Proper inspections and also areas or regional depots where workers can wash themselves and their gear can be disinfected are needed. "If local government lacks the resources – or fails to manage the resources properly – to train, equip and supervise its sanitation workers – the process of servicing sanitation systems may itself open up new routes of exposure," the report states. This means employers must provide training, appropriate safety equipment, supplies and facilities, safety protocols and enforce best practices on the job.

Authorities are responsible for a pit emptying programme to ensure that the health and safety budget provides for the training, equipment and supervision necessary to minimise the exposure of workers, the public and the environment to sludge during pit emptying activities. Engineering and administrative controls must according to the researchers also be put in place by the municipality and the contractor to ensure that risks of exposure are eliminated and reduced wherever possible.

"Contractors must equip workers adequately with the equipment and supplies they need to protect their health, the health of the public and the environment."

Contractors must equip workers adequately with the equipment and supplies they need to protect their health, the health of the public and the environment. Furthermore, workers must be trained in a basic understanding of routes of disease transmission, hygiene and work practices and protocols that minimise exposure.

While every measure should be taken to prevent the contamination of surfaces during pit emptying, provisions are needed for decontaminating surfaces should contamination occur. For site work, disinfectants which can be used on skin, household surfaces, protective wear, and soil are essential. Also, disinfectants are required for cleaning skin, clothing, boots, masks, tools, sheets, bins and vehicles after work.

Wiping contaminated surfaces with cloths soaked with water, Jik, Domestos or Pine Gel was found to remove eggs manually but did not deactivate *A. lumbricoides* eggs. Soaking with Domestos or Jik for at least an hour at a dilution of at least 50% was required to achieve deactivation of at least 95% of the eggs. Disinfectants may be poured directly onto sludge spills; however, they may be quickly deactivated by the presence of organic material and cannot be assumed to sanitise the spilled sludge.

"The elephant in the room is the funds to deal with this silent cycle of contamination and its impacts", says Louton. "Given that pressure on water resources is only going to increase, we need to understand that onsite sanitation is here to stay. Government needs to commit the resources to ensure that those with onsite sanitation are not exposed to greater health risks than those with sewerage sanitation through the pit emptying process."



Lami van Vuuren

INFRASTRUCTURE

Civil engineering fraternity expresses concern over state of South Africa's infrastructure

Despite Government's great strides in enhancing the country's infrastructure over the last 23 years, particularly to the poorest citizens of the country, South Africa's infrastructure is seeing a general deterioration, mainly as a result of a lack of operations and maintenance. This is according to the 2017 Infrastructure Report Card for South Africa, published by the South African Institution of Civil Engineering (SAICE) earlier this year.

Article compiled by Lani van Vuuren.



In its latest Infrastructure Report Card, the third in a series (the previous report cards were published in 2006 and 2011), SAICE awarded South Africa's public infrastructure an overall grade of D+. According to the compilers of the publication, this overall grade indicates that South African infrastructure is generally at risk. "This grade reflect an ongoing and unchanged norm of poor maintenance and insufficient engineering capacity in the public sector, as commented on in both the 2006 and 2011 report cards," note the compilers, which included Malcolm Pautz, Kevin Wall and Sam Amod.

Previous Infrastructure Report Cards discussed the severe impact of South Africa's poor application of systems, maintenance practices and the engineering skills shortage in government.

Unfortunately, these problems remain as serious today. Within this context, the latest report also discusses three interrelated factors that critically affect the condition of infrastructure – the institutions that are tasked with their creation and care, the distribution and effectiveness of skills within these bodies, and the availability and appropriate use of data and information to influence decisions.

The message emerging from these discussions might appear gloomy. Data is the raw material for meaningful policy development, but compared to international best practice, its availability and proper use is dismal in South Africa. Institutional knowledge, memory and leadership have the power to transition a developing nation into a winning one, yet we have

more examples of failure than success in this regard. Innovative procurement and funding processes are possible, but these require even greater capacity embedded within the public sector to control, implement and manage,

Engineering and management skill, capability and collaboration are not efficiently leveraged to overcome the inherent shortages of capacity in South Africa. These factors, separately and in combination play a significant role in the conditions of South African infrastructure.

Yet, as the Infrastructure Report Card points out, there are signs of positive change. South Africa is a developing country with limited resources, but the standards to which much infrastructure is built, and the level of formal commitment as reflected by our Constitution, are certainly world-class. "The engineering profession is finally seeing meaningful rates of gender and racial transformation – a welcome shift that should augment its ability to serve the nation. There are also institutions and data managers showing commitment to excellence, service and competence, which can serve as aspirations for others willing to improve."

Water resources

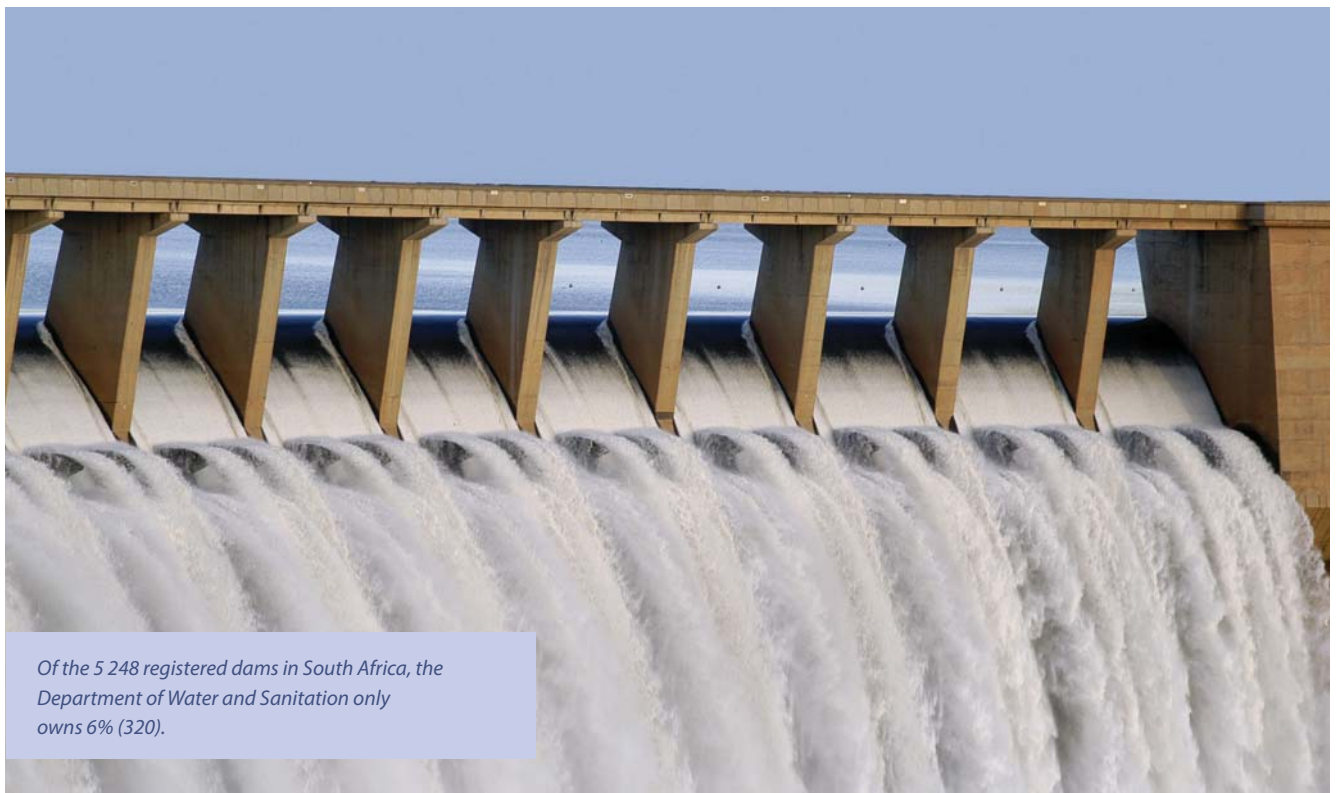
Growth in population has seen increased demand for freshwater resources, which has put a strain on available bulk supplies. This has been exacerbated by the recent drought in different parts of the country. Current water usage already exceeds the reliable yield of existing water infrastructure, and the marginal cost of future expansions is rising rapidly. As a consequence, although South Africa uses less than 40% of the country's total renewable water resources, much of this is not available at the required assurance level, and thus economic and physical water scarcity is a reality, the Infrastructure Report Card points out.

"Growing water shortages mean that alternative sources will have to be considered. Chief among these water reuse, aquifer water resource exploitation and desalination, some of which are energy-intensive and expensive. There is little clarity on who will bear the costs, and whether the charging structures will adequately serve both resource conservation and equity goals.

A number of new schemes, to address future water problems, are in various stages of preparation. The largest of these, the second phase of the Lesotho Highlands Water Project (LHWP), is some five to seven years behind schedule, which will place the urban and industrial heartland of South Africa at risk in the event of further drought. The augmentation of supplies to Cape Town has also been considerably delayed. Similarly challenges are reported from the Umgeni system where the proposed bulk supply from a new uMkhomazi Dam is likely to be late, not least because of the substantial bulk transition requirements. In addition, supplies to Nelson Mandela Bay Metro have been limited due to the multiyear delay in completing the Nootgedacht pipeline, which would provide additional supplies from the Orange River scheme.

In these and other cases, responsibility is usually shared between the Department of Water and Sanitation (DWS) and other authorities. Funding is a major reason for delays. The DWS has inherited a number of dams from former homelands, many of which require rehabilitation. A number of these dams suffer from inadequate spillway capacities and some from structural instability.

In general, according to the Infrastructure Report Card, the major water resources infrastructure is not only ageing, but there has been further deterioration as a result of insufficient maintenance and inadequate ongoing capital renewal. Management



Of the 5 248 registered dams in South Africa, the Department of Water and Sanitation only owns 6% (320).

failures have also been signalled in budgeting, operations and maintenance, as witnessed in the transmission and transfer systems in the Western Cape, the Vaal River Eastern Subsystem Augmentation Project (VRESAP), and the Thukela-Sterkfontein transfers. In other instances contracts have been awarded in excess of budgets or against the evidence of better cost-effective technical options.

A worrying trend is the fact that some divisional DWS organograms still reflect a 50% vacancy rate, particularly of engineering posts. In the past, the presence of experienced professional engineers in senior and top management was a key element in enabling strategic and day-to-day decision-making, facilitating efficient operations. The rapid turnover of Directors-General (DGs) (eight, including Acting DGs since 2009), and other senior staff further contributes to poor performance.

According to the Infrastructure Report Card, the water resources sector now faces a similar crisis to that of the electricity generation sector a decade ago. It is important to recognise that it is also a crisis caused essentially by poor management at both national and local level – poor planning, unnecessary delays in implementation and a concerning decline in institutional competence. Other contributory issues include financial constraints at both national at local level, irresponsible consumption patterns, and wastage directly due to the poor condition of some infrastructure. The recent drought has exacerbate and exposed these weaknesses.

Water-supply services

Water-supply services, in the form of water treatment works, pump stations, reservoirs and reticulation, are mainly the

responsibility of the local government sphere. South Africa met the 2015 Millennium Development Goal targets. However, the new challenge is to achieve the Sustainable Development Goals, which focus on the reliability and safety of water supplies, and the safe and effective management of human waste.

A recurring theme that hampers achievement of service delivery goals is inadequate capability of service providers to fulfil their responsibilities, according to the Infrastructure Report Card. “Delivering new infrastructure, operating and maintain it, and eventually renewing or replacing it, are complex activities. Appropriately competent and skills persons, however, are in short supply in the public sector, especially in rural areas. This is exacerbated in that infrastructure has been provided in setting where there is no financial capacity to hire the qualified staff needed, nor to provide the requisite levels of operation and maintenance spending.”

Despite these challenges, in all of the metropolitan municipalities and in many towns as well, the water supplied to households is of top quality – not many countries are able to boast that water can be drunk from the tap without treatment.

One of South Africa’s main water management challenges is non-revenue water, which represents the water lost through physical leakage of commercial losses. About 31% of piped water does not reach consumers because of leaks in the network system. If commercial losses are included, then total loss is closer to 40%, much of it due to failed systems and political unwillingness to enforce cost recovery and debt collection.



Despite the challenges experienced in the water-supply sector South Africa’s tap water quality generally remains world-class.



With the exception of mainly metropolitan-managed wastewater treatment works, South Africa's sewage treatment facilities are generally in a worrying state.

Sanitation

In 2014, the DWS took back responsibility for household sanitation provision from the Department of Human Settlements. At the time of writing, an updated delivery status verification process was underway, but provisional figures indicated that, although the percentage unserved is declining, due to population growth the absolute number of the unserved has remained relatively constant since 1994, at about 4 million households.

If the sanitation backlog is to be eradicated, then additional finances, combined with appropriate project management skills and effort, will be required. Political pressure to provide full waterborne sanitation as a basic level of sanitation is severely impacting the cost of service provision in parts of the country, as well as slowing down service delivery, the Infrastructure Report Card notes. "Waterborne sanitation services cannot be provided effectively unless there is adequate and reliable water supply, so further investment in that dimension will often be wasted and the untreated wastewater crisis will simply get worse."

According to the latest results of the DWS Green Drop certification process, 30% of large wastewater treatment works are in a critical condition, implying that millions of litres of untreated or inadequately treated sewage are illegally discharged into rivers and streams each day. Water treatment and wastewater treatment works are generally in poor condition, thus increasing the environmental health risk, with 66% of all wastewater treatment works requiring short- to medium-term interventions, 35% requiring capacity upgrades and 56% requiring additional skilled operating and maintenance staff.

The most common problems experienced at wastewater treatment works are poor design of treatment plant or individual processes, processes not operated according to design criteria, breakdown of equipment, inadequate technical backup, change in raw water quality, poor planning of operations, and insufficient resources.

The skills required to operate and manage sophisticated technologies are often scarce outside major urban centres. Downstream users and ecosystems subsequently bear the consequences in the form of high pathogen loads, eutrophication, and higher treatment costs to achieve potable water standards.

The status of sanitation infrastructure in the country is of grave concern. This is mainly related to communities served with waterborne sewerage systems where maintenance, refurbishment and upgrading of collection and treatment infrastructure have been neglected over the years. An increasing number of sewage failures are occurring within municipalities, which cause blockages in pipelines, overloading of manholes, flooding of community areas and leading to degradation of neighbouring services.

To download the *SAICE Infrastructure Report Card for South Africa*, visit <http://saice.org.za/wp-content/uploads/2017/09/SAICE-IRC-2017.pdf>

WATER AND HEALTH

What's that in your drinking water?



We all know the importance of drinking enough water every day. Some of the many benefits of drinking water are that it improves skin complexion, flushes out toxins, maintains regularity and boosts the immune system. But there may be substances in our water, whether we prefer tapped or bottled, that may not be so beneficial to our health, as a University of Pretoria study illustrated.

Article by Louise de Bruin.

South Africa is one of the few countries in the world where tap water is still regarded as relatively safe to drink, particularly in big cities such as Pretoria and Cape Town. However, the maintenance of water treatment facilities is expensive and this is not always effectively carried out – especially in smaller municipal areas.

While water treatment plants have different 'cleaning' processes, most facilities are focused on the microbial quality of the water. Ensuring *E.coli* and faecal coliform are removed from water is a number one priority, as stipulated criteria in the water guidelines of the country. But there is more than just this to think about. The long-term chronic exposure to certain chemicals can have serious effects on a person's health and even the health of their progeny.

Chemicals get into our water systems by way of direct discharge into water, sewage and wastewater effluent, leaching from land fill sites, agricultural and storm water runoff and accidental spills. Some of these chemicals are known as endocrine disrupting chemicals or EDCs and have negative effects on a person's endocrine system.

The endocrine system chemically controls the various functions of cells, tissues, and organs through the secretion of hormones by endocrine glands. Endocrine glands include the adrenal glands, parathyroid gland, pituitary gland, and thyroid gland, as well as the ovaries, pancreas and testes. This is a very complex system that controls hormones and their receptors, with some only activating during specific stages of the lifecycle, such as foetal development or puberty.

“Health risk assessments revealed acceptable health and carcinogenic risks associated with the consumption of the water and these results compared well to other countries.”

Physiological developments controlled by hormones include growth, metabolic processes, sexual functions and a person's ability to resist disease. EDCs disturb the hormonal system in several ways, mimicking natural hormones by binding to and activating the receptors; blocking the receptors to prevent the natural hormones from binding or by affecting the synthesis or transport of hormones.

Examples of products that may contain EDCs include pesticides and fungicides, pharmaceutical agents such as oral contraceptives, personal care products, industrial solvents and their by-products and plastics and plasticizers. We are exposed to such chemicals daily, through air, food, dermal absorption and water. Disorders related to EDC exposure range from genital malformations, obesity, Type 2 Diabetes and endocrine related cancers, including testicular, prostate, breast, ovarian, endometrial and thyroid cancers.

Dr Catherina van Zijl, senior medical natural scientist of the Environmental Chemical Pollution and Health Research Unit of the Faculty of Health Sciences at the University of Pretoria, evaluated the levels of selected EDCs in drinking water in South Africa as part of her PhD study under the supervision of Prof Tiaan de Jager and Dr Natalie Aneck-Hahn. In this study, funded by the Medical Research Council (MRC), Dr Van Zijl analysed the differences between tap water and bottled water, in an attempt to see which has fewer EDCs and is the safer option to drink.

The focus of the study was a comparison of the estrogenic activity and levels of estrogens, bisphenol A (BPA), nonylphenol (NP) and phthalates between tap and bottled water. These EDCs have been reported in tap and bottled water from various countries.

“While water treatment plants try to treat the water as best as possible, water facilities were not designed to remove EDCs,” explains Dr Van Zijl. Water treatment processes do remove EDCs to some degree, which include methods such as activated carbon, ultraviolet irradiation, reverse osmosis and bio-degradation.

Activated carbon is one of the most effective ways of removing EDCs, but it is expensive. “Even if all the EDCs are removed by water treatment processes, sometimes the way water is transported might contribute to the contamination of the water we drink. When PVC pipes are used to transport water, BPA can migrate from the pipes into the water,” she notes.

So is bottled water the way to go? While plastic is a major source of many problems on this planet – pollution has become such a global problem there are five huge garbage patches in the oceans – the majority of bottled water manufacturing companies bottle their water in polyethylene terephthalate or PET containers, regarded as a safer plastic that does not contain BPA. In fact, bottled water companies do not even test for BPAs, NPs and phthalates because they say the plastics they use do not contain these health risk causing plastics.

BPA is found in certain plastics and the linings of metal food and beverage cans. It is even found in receipt paper. The endocrine disrupting effects of BPA include secondary sexual changes, neuro-behavioural alterations and immune disorders with foetal exposure. BPA exposure is also linked to fertility problems, cardiovascular disease, diabetes, obesity and liver dysfunction.

NP is used in the manufacturing of plastics and surfactants used in detergents and emulsifiers for household and agricultural applications. They can be found in food packaging, cleaning and skincare products. It has toxic and estrogenic activity and found to cause feminization of aquatic organisms and also decrease male fertility.

Phthalates are used as plasticisers, solvents and additives in various consumer products, including food and personal care products. Because phthalates are not covalently bonded to the plastics in which they are used, they continuously release from the products, explains Dr Van Zijl. Exposure increases the risk of insulin resistance; it is associated with decreased sex hormone levels and has other adverse effects on the human reproductive system. While phthalates are metabolised and excreted fairly quickly out of our bodies, it is the chronic exposure and combination of these materials that is a reason for concern.

While water bottle companies claim to be free of these chemicals, studies have found EDCs in water bottled in PET containers. Dr Van Zijl explains there are several reasons why this might be the case: the source water might have been contaminated; contamination might have occurred during the production process – cleaning products used in the filling system; or the bottle itself or the cap might be the cause for the contamination. Increased temperature and exposure to sunlight can also influence bottled water, causing substances in the plastic to leach into the water.

In her study, Dr Van Zijl evaluated ten distribution points of tap water in Pretoria and ten in Cape Town. She also collected water samples seasonally in order to account for seasonal variations on the quality of water. She further analysed ten of the most popular bottled water brands in South Africa, making sure the water came from a variety of sources, such as spring water, dolomite lakes, treated water from different areas, as well as including different treatment methods. Bottled water was also stored at 20°C and 40°C to see whether temperature had an effect on the levels of the target chemicals.

Tests included bioassays to indicate the total estrogenic activity of each sample as well as chemical analysis to determine the

concentrations of specific EDCs. The chemical analysis was conducted at the Central Analytical Facilities (CAF) laboratory at the University of Stellenbosch, as part of a collaborative study with the University of Stellenbosch and the CSIR. This data was used to do a health risk assessment, in collaboration with Bettina Genthe from the CSIR, Natural Resources and the Environment, Stellenbosch, to determine the human health and carcinogenic risks associated with the consumption of the tap and bottled water. Estrogenic activity was higher in tap water which indicated these water treatment facilities were not able to remove all the activity. BPA, DINP (a phthalate) and EE2 (synthetic hormone) were higher in bottled water and estrogenic activities increased in some of the bottled water when exposed to increased temperature of 40°C.

However, health risk assessments revealed acceptable health and carcinogenic risks associated with the consumption of the water and these results compared well to other countries, giving both tap water and bottled water the green light. While this is a sigh of relief, Dr Van Zijl notes that this study only tested for estrogenic activity and not other hazardous chemicals that might affect the thyroid and androgenic activities in the human body. These tests were also only conducted in two large cities and smaller municipalities' treatment processes are not of the same standard.

So, should we drink bottled water? Statistics show between 1999 and 2012 there was a 315% increase in South Africa in the consumption of bottled water. This is certainly the more expensive choice and, as Dr Van Zijl's study showed, chemicals can migrate into the water from the bottle. Plastic bottled water carries a very high carbon footprint, taking up to 450 years to decompose. However, it can be a good option when tap water is not available or of poor quality. It is also a healthier alternative to other bottled beverages filled with sugar.

It comes down to personal choice, says Dr Van Zijl, but advises that should you choose to drink bottled water, it should be an informed and responsible choice. Make sure the bottle has the South African National Bottled Water Association (SANBWA) logo. SANBWA adheres to stringent quality standards, complies with environmental standards and is actively involved in facilitating the recycling of PET bottles. Always store water in a cool, dry place and use within the expiry date. Do not reuse PET bottles because this increases the chances for chemicals to leach into the water and make sure your bottle does not contain PVC (do not use bottles with no 3 recycling code on the bottle). Most importantly, think of something bigger than yourself, think of the planet and recycle.

This article was first published by the University of Pretoria, www.up.ac.za

BASIC SERVICES

Billions remain unserved as world races towards meeting the SDGs

Some three in ten people worldwide, or 2.1 billion, lack access to safe, readily available water at home, while six out of ten or 4.5 billion, lack safely managed sanitation. This is according to the latest Joint Monitoring Programme (JMP) report, Progress on drinking water, sanitation and hygiene: 2017 update and Sustainable Development Goal baselines. The JMP is a joint initiative of the World Health Organisation (WHO) and the United Nations Children's Fund (UNICEF).



The JMP has produced regular estimates of global progress on drinking water, sanitation and hygiene since 1990. The 2017 update is the most comprehensive assessment to date, and establishes the first global estimates for the Sustainable Development Goals (SDG) targets that deal with access to sustainable water and sanitation services.

The SDG targets call for universal and equitable access for all, which implies eliminating inequalities in service levels. The targets also include hygiene, which was not addressed in the Millennium Development Goals. The new targets also specify that drinking water should be safe and affordable, and that sanitation should be adequate. They include explicit references to ending open defecation, and to the needs of women and girls and those in vulnerable situations.

Safely managed drinking water and sanitation services means drinking water free of contamination that is available at home when needed, and toilets whereby excreta are treated and disposed of safely. Basic services means having a protected drinking water source that takes less than thirty minutes to collect water from, using an improved toilet that does not have to be shared with other households, and having handwashing facilities with soap and water in the home.

The overriding conclusion from the latest status report is that too many people still lack access, particularly in rural areas. "Safe water, sanitation and hygiene at home should not be a privilege of only those who are rich or live in urban centres," said Dr Tedros Adhanom Ghebreyesus, WHO Director-General. "These are some of the most basic requirements for human health, and

Basic services

all countries have a responsibility to ensure that everyone can access them.”

Billions of people have gained access to basic drinking water and sanitation services since 2000, but these services do not necessarily provide safe water and sanitation. Many homes, healthcare facilities and schools also still lack soap and water for handwashing. This puts the health of all people – but especially young children – at risk for diseases, such as diarrhoea.

As a result, every year, 361 000 children under five years of age die due to diarrhoea. Poor sanitation and contaminated water are also linked to transmission of diseases such as cholera, dysentery and hepatitis A, and typhoid.

“Safe water, effective sanitation and hygiene are critical to the health of every child and every community – and thus are essential to building stronger, healthier and more equitable societies,” noted UNICEF Executive Director, Anthony Lake. “As we improve these services in the most disadvantaged communities and for the most disadvantaged children today, we give them a fairer chance at a better tomorrow.”

Significant inequalities persist

In order to decrease global inequalities, the new SDGs call for ending open defecation and achieving universal access to basic services by 2030. Of the 2,1 billion people who do not have safely managed water, 844 million do not have even a basic drinking water service. This includes 263 million people who have to spend over 30 minutes per trip collecting water from sources outside the home, and 159 million who still drink

untreated water from surface water sources, such as streams or lakes.

In 90 countries, progress towards basic sanitation is too slow, meaning they will not reach universal coverage by 2030.



IN 2015,
most countries
in Africa had
less than 50%
COVERAGE
WITH BASIC
handwashing facilities.

WaterAid/Layton Thompson



Only 39% of the global population use a safely managed sanitation service.

Handwashing critical to Africa's future – AMCOW Chief

The African Ministers' Council on Water (AMCOW) has described handwashing as a critical element in Africa's plan for the future.

In a message delivered on Global Handwashing Day (15 October), AMCOW Executive Secretary, Dr Canisius Kanangire, urged Africa to "stand up and ensure every child has access to handwashing tools and services". According to him, handwashing remains one of the most effective measures of avoiding illnesses and spreading bacteria and viruses to others.

With diarrhoea and pneumonia together accounting for almost 3,5 million child deaths annually, and 42% of this estimate occurring in Africa, Dr Kanangire believes that the time to start washing our hands is now. Handwashing with soap is estimated to reduce incidents of diarrhoea by 30% and respiratory infections by 21% in children under the age of five.

The AMCOW chief further reiterated his organisation's commitment to handwashing as an integral part of its water, sanitation and hygiene interventions following the proactive step taken by African Ministers responsible for sanitation at the 4th AfricaSan Conference in Dakar, Senegal, through the 4th and 6th Commitments of the N'gor Declaration.

The declaration commits African governments to ensuring strong leadership and coordination at all levels to build and sustain governance for sanitation and hygiene across sectors, especially water, health, nutrition, education, gender and the environment; and ensure inclusive, safely-managed sanitation services and functioning handwashing facilities in public institutions and spaces.

Of the 4,5 billion people who do not have safely managed sanitation, 2.3 billion still do not have basic sanitation services. This includes 600 million people who share a toilet or latrine with other households, and 892 million people – mostly in rural areas – who defecate in the open. Due to population growth, open defecation is increasing in sub-Saharan Africa and Oceania.

Good hygiene is one of the simplest and most effective ways to prevent the spread of disease. For the first time, the SDGs are monitoring the percentage of people who have facilities to wash their hands at home with soap and water. According to the new report, access to water and soap for handwashing varies immensely in the 70 countries with available data, from 15% of the population in sub-Saharan Africa to 76% in western Asia and northern Africa.

Additional key findings from the report include:

- Many countries lack data on the quality of water and

sanitation services. The report includes estimates for 96 countries on safely managed drinking water and 84 countries on safely managed sanitation.

- In countries experiencing conflict or unrest, children are four times less likely to use basic water services, and two times less likely to use basic sanitation services than children in other countries.
- There are big gaps in service between urban and rural areas. Two out of three people with safely managed drinking water and three out of five people with safely managed sanitation services live in urban areas. Of the 161 million people using untreated surface water, 150 million live in rural areas.

SDG Goal 6: Ensuring availability and sustainable management of water and sanitation for all

- By 2030, achieve universal and equitable access to safe and affordable drinking water for all.
- By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations.
- By 2030, improve water quality by reducing pollution, eliminating dumping and minimising release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally.
- By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity
- By 2030, implement integrated water resources management at all levels, including through transboundary cooperation as appropriate.
- By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes.
- By 2030, expand international cooperation and capacity-building support to developing countries in water- and sanitation-related activities and programmes, including water harvesting, desalination, water efficiency, wastewater treatment, recycling and reuse technologies.
- Support and strengthen the participation of local communities in improving water and sanitation management.

To download the report, *Progress on drinking water, sanitation and hygiene: 2017 update and SDG baselines*,

Visit: https://www.unicef.org/publications/index_96611.html



Drink water for a healthy body and a healthy life

All living things need water to survive, even humans! More than half of our bodies are made up of water – it is what makes up the majority of our blood, digestive juices and sweat, and it is found in our organs and muscle cells.



Now that South Africa is entering its hot, summer season, it is very important that we take care of our bodies by drinking water regularly. Apart from keeping us alive, water is very good for our bodies. Our bodies have many important functions that require water. For instance, our blood, which contains a lot of water, carries oxygen to all the cells of our bodies. Without oxygen, those tiny cells would die and our bodies would stop working.

Water is also in lymph, a fluid that is part of our immune systems. This helps us fight off illness. We need water to digest our food and get rid of waste as well. Water is needed for digestive juices, urine, and poop. Water is also the main ingredient in our perspiration. Besides being an important part of the fluids in our bodies, water is needed by each cell to function normally.

So what happens when you drink water regularly?

Firstly, you immediately feel refreshed. Quenching your thirst happens rather quickly, usually within the first sip of or two of water. This is because when you drink water, your taste buds signal to your brain that water is coming to feed the parched cells, and signal feeling satiated when you have had enough to drink.

Water can make you have more energy. Many times, people feel fatigued because they haven't had enough water to drink.

Instead of reaching for a caffeinated drink, like coffee, try a big glass of water instead. Water keeps your bodily systems functioning at their best and perks you up to get over that afternoon slump.

By hydrating your insides, you can look better on the outside. If you do not get enough water, your skin becomes dry, your wrinkles are deeper and your overall complexion looks duller. Although drinking water isn't a cure-all for all of your skin woes (sorry teenagers), it will definitely brighten your face and help fight inflamed skin. Water also helps our brains to focus. Since your brain is made up of 80% water, it is no wonder proper hydration keeps your brain functioning at its best.

Even our bones need water. Water keeps the cartilage (the rubbery material that coats our bones) around our joints hydrated and supple, ensuring that our joints stay lubricated. It also protects our spinal cord and tissues, keeping us healthy from the inside out.

Water further helps to flush out toxins from your body. Since your kidney's job is to filter out waste from your blood, the more efficient they are, the more toxins are being eliminated. To keep your valuable kidneys in tip-top shape, keep that water glass nearby.

How much water do children need?

The amount of water a child needs depends on how active they are, the weather temperature, and their overall diet and health. As a general guide, children up to eight years should have a minimum of four to five cups of water a day. Children above eight-years-old require at least six to eight cups of water a day.

We don't just get water from the tap. Any fluid we drink will contain water, but water and milk are the best choices. Lots of foods contain water too. Fruit contains quite a bit of water (think about a juicy peach) – watermelons are about 90% water. Vegetables also contain water.

One of the easiest ways to tell if you are getting enough water is to check your urine when you go to the bathroom – the darker the colour, the more dehydrated you are. On the contrary, if your stream is regularly a light yellow, almost clear colour, that means you are drinking plenty of fluids.

If you are not sure whether your water supply is safe to drink you should boil the water before you drink it or clean your teeth with it. We are lucky in South Africa that most of our tap water is safe to drink. So, drink up!

Sources:

- *Watch what would happen if you didn't drink water,* <https://www.youtube.com/watch?v=9iMGFqMmUFs>
- www.kidshealth.org
- www.healthy-kids.com.au
- www.eatthis.com/whatp-happens-body-drink-water/



What is dehydration?

Our bodies need water to work properly. When you lose too much water by being very active, when it is hot, or when you are sick you can become dehydrated. When you are dehydrated it means that your body doesn't have enough water to keep it working the way it should. You take in water by eating or drinking, and lose this water again when you urinate, sweat, have diarrhoea or throw up. You even lose a little water when you breathe. What are the signs of dehydration? Being thirsty is the first clue. You may also be dehydrated when you feel lightheaded, dizzy or tired, have a rapid heartbeat or have a dry mouth and lips. Another sign of dehydration is not peeing as much or having dark or strong-smelling urine. The best ways of preventing dehydration is by drinking water often, especially if you are very active, and when it is hot. If you are sick, keep taking small sips of drinks like water and juice. Foods such as fruits and vegetables, contain water as well.

I don't like the taste of water what do I do?

It is much healthier to have plain water than sugary sodas or fruit juice. However, some people (especially children) may not like the taste of water. If you are one of those people that doesn't like the taste of water, you can remedy this by adding a little healthy flavour. This you can do by adding a slice of lemon or lime to your water. You can also use herbs such as mint or spices such as ginger to flavour your water. Another good idea is to freeze fresh fruits and use them as ice cubes in your water.



Children younger than eight years need to drink at least four cups of water a day.

WRC CELEBRATES EXCELLENCE WITH KNOWLEDGE TREE AWARDS

One of the highlights of the Water Research Commission (WRC) Symposium 2017 was the third WRC Knowledge Tree Awards. The awards celebrate men and women who have had a major impact in their pursuit for excellence in the water science domain. Recipients were acknowledged based on the impact their research has made in the following categories: transformation and redress, sustainable development solutions, empowering of communities, informing policy- and decision-making, human capital development in the water science sector, new products and services for economic development, and innovation.

This year's winners were:

- In the transformation and redress category: Prof Faizal Bux, Director of the Institute for Water and Wastewater Technology at the Durban University of Technology;
- In the sustainable development solutions category: Cate

Nimanya from Water for People, Uganda.

- In the empowerment of communities category: Dr Bongani Ncube of the Centre for Water and Sanitation Research at the Cape Peninsula University of Technology;
- In the informing policy and decision-making category: Ms Namhla Mbona from the South African National Biodiversity Institute;
- In the human capital development category: Prof Lise Korsten, from the Department of Microbiology and Plant Pathology and Dr Eyob Tesfamariam, from the Department of Integrated Plant and Soil Sciences both at the University of Pretoria (UP);
- In the new products and services category: Prof John Annandale from UP and David Still of Partners in Development; and
- Innovation: Dean Hodgkiss, innovator of the LookSeeDo tool.



Prof Faizal Bux (centre), receiving the WRC Knowledge Tree Award from WRC CEO, Dhesigen Naidoo (left) and WRC Deputy Chair, Prof Sibusiso Vil-Nkomo.



Cate Nimanya (centre) with her award, flanked by WRC CEO, Dhesigen Naidoo, and WRC Board member, Dr Ntombifuthi Nala.



Dr Bongani Ncube (centre) was congratulated by WRC CEO, Dhesigen Naidoo and WRC Board member, Dr Ntombifuthi Nala.



Namhla Mbona receiving her award from WRC Deputy Chair, Prof Sibusiso Vil-Nkomo, while WRC CEO, Dhesigen Naidoo, looks on.



Prof Lise Korsten (centre) receiving her award from WRC CEO, Dhesigen Naidoo and WRC Board member, Dr Aldo Stroebel.



Dr Eyob Tesfamariam receiving his award from WRC CEO, Dhesigen Naidoo and WRC Board member, Dr Aldo Stroebel.



David Still (centre) received his award from WRC CEO, Dhesigen Naidoo, and Energy and Water Sector Education and Training Authority CEO, Errol Gradwell.



Dr Amit Pramanik from USA's Water Environment Research Foundation (right) handed the award to Dean Hodgkiss, while WRC CEO, Dhesigen Naidoo, looked on.

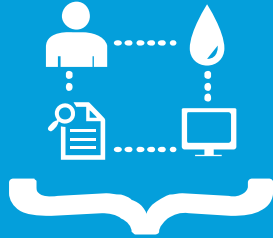
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AIMS TO

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SERVICE OFFERINGS FROM WADER

<p>01</p>  <p>Some funding for technology demonstrations</p>	<p>Matchmaking with municipalities, innovation players, funding organisations & investors</p> 	<p>05</p>
<p>02</p>  <p>Access to information on a range of technologies</p>	<p>Growth of SMMEs and enterprise development</p> 	<p>06</p>
<p>03</p>  <p>Credible technical information</p>	<p>Technical advice using scientific protocols</p> 	<p>07</p>
<p>04</p>  <p>Opportunities to connect/link with other entrepreneurs/innovators/test bed partners</p>	<p>Driving innovations in priority areas of the Water RDI Roadmap and the NWRS II</p> 	<p>08</p>

KEY STAKEHOLDERS FOR WADER

 <p>Entrepreneurs/innovators</p>	 <p>Water boards/utilities/municipalities</p>	 <p>SMMEs</p>	 <p>Investors/funders (local and international)</p>	 <p>Government departments</p>	 <p>Technical consultants</p>
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DEEPLY ROOTED IN SOUTH AFRICA WATER SOCIETY

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The Water Research Commission not only endeavours to ensure that its commissioned research remains real and relevant to the country's water scene, but that the knowledge generated from this research contributes positively to uplifting South African communities, reducing inequality and growing our economy while safeguarding our natural resources. The WRC supports sustainable development through research funding, knowledge creation and dissemination.

The knowledge generated by the WRC generates new products and services for economic development, it informs policy and decision making, it provides sustainable development solutions, it contributes to transformation and redress, it empowers communities and it leads various dialogues in the water and science sectors.

The WRC Vision is to have highly informed water decision-making through science and technology at all levels, in all stakeholder groups, in innovative water solutions through research and development for South Africa, Africa and the world.

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