

THE WATER WHEEL

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HYDROPOWER

Atlas boost for hydropower

WATER LOSS

Study touts AI for water loss tracking

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**WATER
RESEARCH
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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. Subscription is free. Material in this publication does not necessarily reflect the considered opinions of the members of the WRC, and may be copied with acknowledgement of source.

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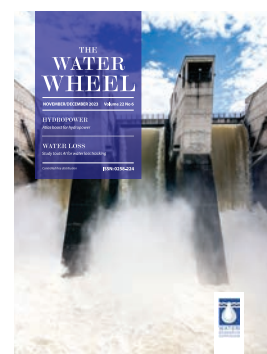
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The Water Research Commission (WRC) has funded the development of South Africa's first hydropower atlas. See article on page 12.

NEWS

SA welcomes adoption of new global framework on chemicals



Minister of Forestry, Fisheries and the Environment, Barbara Creecy, welcomed the new Global Framework on Chemicals, a major outcome of the recent 5th Session of the International Conference on

Chemical Management, held in Bonn, Germany, in September.

The framework is aimed at benefiting stakeholders in developing countries on

the implementation of priority targets to manage chemicals and waste. It provides a vision for a planet free of harm from chemicals and waste, and is operationalised through concrete targets and guidelines for key sectors across the entire lifecycle of chemicals that aim to improve the sound management of chemicals and waste.

The framework calls for, by 2035, a phase out of highly hazardous pesticides in agriculture where the risks have not been managed and safer alternatives are available, and further seeks to strengthen links between the new instrument and climate, biodiversity, human rights and health agendas. It will be financed from contributions from all stakeholders, including the private sector. A dedicated trust fund will be set up and managed by the United Nations Environment Programme

Scientists should play prominent role in water – Deputy Minister



Deputy minister of water and sanitation, David Mahlobo, has urged policymakers to put science at the centre of policy formulations to make informed decisions that will propel the country to greater

heights, thus improving the lives of people for the better.

He was speaking at the opening of the 50th Congress of the International Association of Hydrogeologists, which took place in Cape Town from 19 to 22 September.

According to Mahlobo, a country that does not invest in science will perish and South Africa needs to improve on this aspect. “Scientists and engineers need to make their mark and [impact] direct future policy positions of the water sector, particularly the use of groundwater as an alternative measure that will ensure universal access. We need you to guide

us and take us to task to come up with policies that will get us into finding lasting and sustainable solutions to the water challenges around the globe,” he said.

Mahlobo acknowledged current challenges with regards to assurance of water supply around the country. “Because we have not invested in operations and maintenance, we are experiencing a lot of water losses in our systems, between 30 and 45%. The other challenge is the lack of investment in our infrastructure that matches the population growth and migration from other countries as well as people moving from rural to urban areas.”

South African water specialist announced as next IWA President

South African water expert, Prof Hamanth Kasan has been elected as the next president of the International Water Association.

Prof Kasan was chosen by the IWA Governing Assembly during its meeting on 16 September in Bordeaux, France. He will take office at the end of IWA's World Water Congress & Exhibition taking place in Toronto, Canada, on 11-15 August 2024, when he will succeed the current President, Tom Mollenkopf.

"I am really pleased to have been elected to serve as the next president of IWA.

Having been a part of [the organisation] for a great many years, I know well the power and potential of our association as a member-led organisation." Noted Prof Kasan. "I look forward to taking up the role, working with all governing members, board, strategic council, management and staff for us to ensure further development, growth and impact of IWA."

Among his wider professional activities, Prof Kasan has had a 22-year career at Rand Water, where he was a General Manager. He is Honorary Research Professor at the Institute for Water and Wastewater Technology, Durban

University of Technology, and a Senior Fellow of the Water Institute of Southern Africa. Prof Kasan has a PhD in microbiology, water and environmental engineering.

IWA President Tom Mollenkopf welcomed the President-elect saying: "It is a great pleasure to welcome Prof Kasan back to the Board of the International Water Association as President-elect, following his election by our global Governing Assembly. Hamanth is well known to the IWA membership, having been active in the water sector internationally and across the African region."

Empowering communities through the law

The Endangered Wildlife Trust (EWT) has launched a new website providing important information in a user-friendly format on the laws that govern land, air, water and species (LAWS) in South Africa.

The new website, www.laws.ewt.org.za, was developed to help non-legal minds decode the complex legal and governance framework relating to the environment in South Africa.

According to the organisation, this complex legal framework is often

confusing for the public to navigate. "Access to meaningful information on the environmental legal and governance frameworks in South Africa is key to citizens ensuring that their rights are upheld, and that they are not contributing to illegal activities, and to ensure good governance by promoting transparency around environmental laws and governance."

The website provides access to and summary notes of current legislation, regulations, policy, judgements, and

international environmental law. All information on the EWT LAWS website is available in five of the country's official languages: English, Afrikaans, isiZulu, isiXhosa, and Sesotho. It is anticipated that as the website expands, the organisation will include live and recorded webinars and expand the texts to other official languages.

The website was made possible through the support of the Lewis Foundation, the British High Commission and the Embassy of Finland.

WRC Executive Manager comes out tops in director assessment

Water Research Commission Executive Manager for Water Utilisation in Agriculture, Prof Sylvester Mpandeli, recently achieved a top score of 85% in an evaluation undertaken by the Institute of Directors South Africa (IODSA).

Prof Mpandeli was evaluated as a Board Member of the South African Weather Service (SAWS). He is also Chair of the Special Project Committee, which deals with the core business of SAWS.

The evaluation was based on five categories, namely ethical characteristics (covering issues such as integrity, competence and responsibility); personal

and social competencies (self-awareness, self-management, social awareness); fiduciary roles and responsibilities (legal obligations, monitoring and evaluation issues); technical competencies (corporate governance and evaluating technical expertise); and contributions at meetings (looking at positive influence, board dynamics and chemistry).

The evaluation was undertaken both by IODSA and fellow Board members. "The results confirm the high level of competency of WRC's senior managers," the organisation said in a statement.



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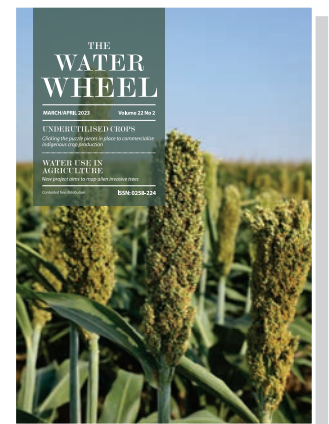
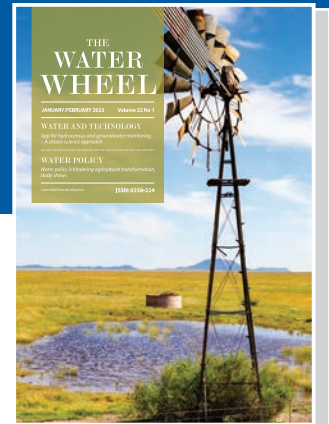
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Water restrictions lifted on parts of Algoa water supply system



The Department of Water and Sanitation has lifted the water restrictions on the Kouga / Loerie sub-system and Groendal sub-system due to improved storage levels in the dams.

Announcing the lifting of water

restrictions for some sub-systems within the Algoa Water Supply System in the Eastern Cape in early October, the department said the recent rainfall had brought significant relief from the protracted drought experienced in the Algoa region, with a significant recovery in

dam levels experienced. A prime example has been the Kouga Dam, which is spilling for the first time since 2015.

"This catchment is of strategic importance to the western parts of Nelson Mandela Bay Metro, Kouga Local Municipality as well as the agricultural sector in the Gamtoos valley," the department said. At the time of writing, the system's recovery showed that the accumulated storage had reached 70%, with Kouga Dam at 101.42%, Churchill Dam at 100.93%, Groendal Dam at 101%, and Impofu Dam at 24.37%. It was anticipated that the Impofu Dam's levels would also increase due to spilling from the Churchill Dam.

The relaxation of water use was set to contribute to the economic recovery in the domestic, agricultural and industrial sectors in the region, the department noted.

Source: SA news

WATER DIARY

Wetlands

23-26 October

The National Wetlands Indaba will take place at the ATKV Buffelspoort, North West Province with the theme 'It's time for wetland restoration'. The indaba is an annual event intended to provide a platform for a cross-disciplinary gathering of practitioners involved with the conservation and sustainable utilisation of South Africa's wetland resources.

Visit: <https://nwi26.org/>

Sustainable development

25-27 October

The 24th WaterNet/WARFSA/GWP-SA Symposium will be held in Zanzibar, the United Republic of Tanzania at the Hotel Verde – Azum Resort under the theme 'Accelerating change: Fostering innovation and integration for sustainable resources management for sustainable

development in East and Southern Africa.

Visit: <https://www.waternetonline.org/annual-symposium/current-theme>

Irrigation and drainage

18 November

The 25th International Congress on Irrigation & Drainage will take place in Vizag, Andhra Pradesh, India.

Visit: <https://icid25congress.in/>

Young water professionals

8-10 November

The 7th Water Institute of Southern Africa (WISA) Young Water Professionals (YWP) conference will take place in Stellenbosch. The conference will provide opportunities for YWPs to learn, build skills and expand their network through oral presentations, poster sessions, workshops and networking opportunities. YWPs will leave with a broad overview of water sector

developments and a clear idea of where the water landscape is heading.

Visit: <https://wisa.org.za/event/7th-wisa-ywp-conference/>

Large dams

15-17 November

The annual conference of the South African National Committee on Large Dams will be held in Gauteng. The conference will offer dam and water resources engineers as well as all contributing to the dam engineering industry importance international, regional and local linkages, networking and exchange of knowledge and experience opportunities. The theme of the conference is 'Dams-a critical resource in present time'.

Visit: <https://sancold.org.za/>

GLOBAL

World seeing an upsurge of cholera – WHO



Comprehensive cholera statistics for 2022, published by the World Health Organization in September, shed light on the scale and extent of the ongoing cholera upsurge.

While data for cholera remain inadequate, cases reported to WHO in 2022 were more than double those of 2021. Forty-four

countries reported cases, a 25% increase from the 35 countries that reported cases in 2021.

Not only were there more outbreaks, but the outbreaks were larger. Seven countries – Afghanistan, Cameroon, Democratic Republic of Congo, Malawi, Nigeria, Somalia, Syrian Arab Republic – have

each reported over 10 000 suspected and confirmed cases. The larger the outbreak, the harder it typically is to control.

Cholera is an acute intestinal infection that spreads through food and water contaminated with faeces containing the bacterium *Vibrio cholerae*. It is closely linked to the lack of adequate safe water and sanitation, due to underdevelopment, poverty and conflict. Climate change too is playing a role in this upsurge as extreme climate events such as floods, droughts and cyclones trigger new outbreaks and worsen existing ones.

Current data for 2023 suggest that this global upsurge is continuing. Twenty-four countries are currently reporting active outbreaks, with some countries in the midst of acute crises.

Source: WHO

Free online courses focus on sustainable urban planning



UrbanShift, the Global Environment Facility-funded partnership led by the United Nations Environment Programme (UNEP) and supported by C40 cities, World Resources Institute and ICLEI (Local Governments for Sustainability),

has launched a new digital platform to enhance knowledge and understanding around integrated, sustainable urban development.

Developing country cities are projected to triple in size in the next decade, making integrated urban development necessary for both people and planet. As such, UrbanShift City Academy, an online learning platform, was designed to train urban practitioners to rethink existing urban systems and develop integrated processes that contribute to building climate-resilient, nature-positive cities.

“Understanding sustainable urban design is crucial for addressing urban challenges,”

noted Geordie Colville, Chief of the Energy and Climate Branch at UNEP. “The [academy] equips learners to envision cities as socio-ecosystems, blending built and natural environments with the local economy.”

The academy is built around eight free online courses covering topics ranging from climate action planning to sustainable neighbourhood design to circular economy strategies. The courses are available in six languages, including English.

Visit: <https://academy.shiftcities.org/>

Rivers contain hidden sinks and sources of microplastics



Significant quantities of microplastic particles are being trapped in riverbed sediments or carried through the air along major river systems, a new study has shown.

The research, conducted along the length of the Ganges River in South Asia, found on average about 41 microplastic particles per square metre per day settled from the atmosphere. In addition, analysis by scientists found 57 particles per kilogram on average in sediment from the riverbed

as well as one particle in every 20 litres of water.

The research, published in *Science of the Total Environment*, represents the first combined analysis of microplastics in water, sediment and air around a major river system. The research was conducted using samples collected by an international team of experts as part of the National Geographic Society's Sea to Source: Ganges Expedition.

Lead author, Dr Imogen Napper, a Research Fellow at the University of Plymouth and National Geographic Explorer, said: "We have known for some time that rivers are key pathways for the transfer of microplastics to marine environments. However, there has always been uncertainty about the sheer amounts being transported, and whether they represent long-term sinks. This study goes some way to unravelling that mystery, and revealing the true scale of microplastic contamination that our river systems can represent."

In addition to highlighting the overall abundance of particles, scientists found fibres to be the most common type, representing up to 99% of the microplastics discovered in some of the samples analysed. Within this, rayon (synthetically altered cellulose) was the dominant polymer – representing up to 82% of the fibres found in some samples – ahead of acrylic and polyester, and blue was the most common colour.

The sediment samples often contained denser microplastic particles than those found in water and air, and higher population densities correlated with increased microplastic abundance for air and water samples.

• To access the original article, Visit: <https://pubmed.ncbi.nlm.nih.gov/37647965/>

New urban water safety course available

The World Health Organisation has announced the launch of a new self-paced course on the OpenWHO learning platform titled 'Water safety planning for urban water supply systems – an introduction'.

The course emphasises the significance of drinking water safety in urban settings. It outlines the principles and steps crucial for ensuring a reliable and safe water

supply chain. In four modules, participants will learn the fundamental principles of water safety planning, its practical steps and key terms related to urban water supply. The content presents real-world practices that lead to successful water safety planning, particularly highlighting resilience against climate challenges.

Designed by the WHO Regional Office for South-East Asia, the course is a valuable

resource for professionals in water supply, health sectors and government officials. A Certificate of Achievement is available to all participants who successfully complete the course.

To find out more, Visit: <https://openwho.org/courses/water-safety-planning>

NEW WRC REPORTS

The South African hydropower atlas

Hydropower, which utilises the flow of water from existing water infrastructure and rivers to generate electricity, is considered a good renewable energy source and an alternative to fossil fuels. South Africa is acknowledged to be not particularly endowed with the best hydropower conditions as it might be elsewhere in Africa and the rest of the world. However, large quantities of raw and potable water are conveyed daily under either pressurised or gravity conditions over large distances and elevations. An initial WRC scoping study highlighted the potential hydropower generation at the inlets to storage reservoirs. In South Africa there are 284 municipalities, several water supply utilities and mines, all owning and operating gravity water supply distribution systems which could be considered for small-, mini-, micro- and pico scale hydropower installations. Most of these water supply/distribution systems could be equipped with turbines or pumps as turbines, supplementing and reducing the requirements for pressure control valves. The hydro energy may be used on-site and supplied to the national electricity grid or feeding an isolated electricity demand cluster. There are also numerous storage dams in South Africa which release environmental releases or releases water for irrigation purposes which could be retrofitted with turbines to harness the available flow and pressure. The research project's aim was to enhance the uptake of micro-hydro technology, making local stakeholders (private sector, financial sector, government entities, etc.) aware of the opportunities that this technology brings, and the efforts required to get this technology successfully implemented in South Africa. The project provides general information regarding the assessment of hydropower potentials and provides the information required regarding the feasibility of such projects.

WRC report no. TT 916/23

Web link: <https://bit.ly/3PVMVH3>

Link to atlas: <https://bit.ly/3cmuiJu>

Scoping study to explore hydro potential in the nearby vicinity of Baakens River and the lake

The electrification of urban areas in South Africa, including many informal settlements, reached its culmination during recent years. However, the electrification of rural areas still has a long way to go before most of the rural communities could be provided with reliable and sustainable electricity supply. The national electricity grid, managed by the parastatal Eskom, has been experiencing problems caused by various reasons, particularly since 2008. The research project's aim was to enhance the uptake of micro-hydro technology, making local stakeholders (private sector, financial sector, government entities, etc.) aware of the opportunities that this technology brings and the efforts required to get this technology successfully implemented in South Africa. A municipal hydropower development tool was developed to assist municipalities with the identification and development of hydropower sites in their area. The tool was developed based on the pre-feasibility phase of the hydropower development process. As a case study, the sites within the Nelson Mandela Bay Municipality were identified based on a pre-feasibility analysis.

WRC report no. 3087/1/23

Web link: <https://bit.ly/3rVMBA6>

Towards liveable neighbourhoods by redesigning using water sensitive design

It is known that water sensitive design (WSD) can regenerate urban catchments to bring multiple benefits, such as enhancing ecological health, securing water resources, increasing recreational opportunities, enhancing ecological and human health, reducing of urban heat island, mitigating floods and offering a range of economic benefits. But how can WSD spatially be integrated in an existing city setting given prevailing constraints? Located in Cape Town, the purpose of this study was to generate spatial WSD proposals that are responsive to the social inequity and informality challenges of a Global South city context. The empirical context of this study was Hangberg, a low income and informalising neighbourhood located at the edge of a biodiversity conservation area on the slopes of the Sentinel Mountain.

WRC report no. 2801/1/23

Web link: <https://bit.ly/3FiYmDB>

Hybrid water supply systems and conjunctive use in the context of water sensitive settlements: A case study of Sekhukhune District Municipality, Limpopo Province

As water demands approach the total renewable freshwater availability, each drop of freshwater gets increasingly valuable, hence the need for efficiency and intensity in its management. Given that demand will continue to increase, there is a need for innovative supply and demand management to achieve economic, environmental and social sustainability. To meet the demand gaps, there is need to develop robust tools to deliver on the alternative, but suitable sources of water sustainably. This can be achieved through a mix of centralised and decentralised water supply systems as well as a mix of conventional and alternative water sources to meet water demand loads sustainably. The mix is referred to as hybrid water supply systems and is situation-dependant, hence it varies from one settlement to another. The tenets of the hybrid water supply and management systems are anchored in the principles that define the water sensitive urban design (WSUD) and sustainable drainage systems (SuDS). This study aimed to develop a set of critical frameworks for hybrid water supply systems that are generic in nature but utilise information for Sekhukhune District Municipality and literature as the basis/functional units of the study. The frameworks developed include the following: a generalised domestic rainwater harvesting potential and rainwater harvesting systems selection framework; framework of water energy nexus analysis for a rainwater harvesting system; global warming potential analysis framework; and a framework for developing stormwater harvesting systems and monitoring. A mathematical model for conjunctive use of surface water and groundwater in the municipality was also developed and tested.

WRC report no. 2534/1/23

Web link: <https://bit.ly/46xAMzc>

Understanding bound water content and water binding strength in faecal sludge from on-site sanitation technologies and human faeces

Dehydration allows for the reduction of the volume and mass of faecal waste considerably and can cause the deactivation of pathogens. There is a need to improve the actual dehydration methods (dewatering and drying) and develop innovative technologies that are adapted to the faecal material and socioeconomic context. The aim of this project was to characterise the moisture boundness in faecal sludge, i.e. how moisture can be found in the sludge structure matrix and its interactions with the solid material. The understanding of moisture boundness will be greatly beneficial to improve the dewatering and thermal drying processes. The investigation was led by the Water, Sanitation and Hygiene Research and Development Centre, University of KwaZulu-Natal. The first part of the project consisted of the analysis of the results from previous investigations that give an indication of the moisture boundness in faecal materials and the compilation of the extracted information to formulate the first explanations of moisture boundness in the faecal materials. The second part of the project is generated a new set of data through experiments to obtain a more detailed and insightful representation of moisture boundness based on a multi-dimensional study. This work was done by conducting experiments following different approaches to characterise moisture boundness, including the determination of the sorption isotherms and the hydraulic properties. For this study, faecal sludge from different on-site sanitation facilities within the eThekweni municipality (Durban metropolis, South Africa) was used.

WRC report no. 3086/1/23

Web link: <https://bit.ly/3rULPTW>

Development of a South African national input database to run the SWAT model in a GIS

An important requirement for hydrological modelling is spatial input datasets, including topographic data, land use-cover interactions, soil properties, and climate conditions. The combination of models and remote sensing techniques within a geographic information system (GIS) framework is commonly utilised to assess hydrological processes such as streamflow, water erosion, sediment yield dynamics and nutrient inputs/ outputs. A major limitation to model application in South Africa, however, is the lack of standardised geo-spatial and open-source datasets developed for South African vegetation and soil types. This study collated multiple geo-spatial datasets at a national scale and interpreted/formatted the data for use as baseline input to run the Soil and Water Assessment Tool (SWAT) in any catchment in South Africa. ArcSWAT is a graphical user interface for SWAT and ArcGIS software extension, streamlining access to key databases and facilitating the preparation of input datasets.

WRC report no. 3053/1/22

Web link: <https://bit.ly/3QjYJt>

Development of a regionalised approach to estimate areal reduction factors and catchment response time parameters for improved design flood estimation in South Africa

Event-based deterministic design flood estimation methods are the most commonly used by practitioners in ungauged catchments. In the application of these event-based deterministic methods, it is acknowledged that both the spatial and temporal distribution of runoff, as well as the critical duration of rainfall, are influenced by the catchment response time. Typically, all complex, heterogeneous catchment processes are lumped into a single process to enable the estimation of the expected output (design flood) from causative input (average areal design rainfall and catchment response time). Design point rainfall estimates are only applicable to a limited area and for larger areas, the average areal design rainfall depth is likely to be less than the maximum design point rainfall depths. Areal Reduction Factors (ARFs) are used to describe this relationship between point and areal rainfall, i.e. design point rainfall depths are converted to an average areal design rainfall depth for a catchment-specific critical storm duration (response time) and catchment area. The overall objective of this project is to develop a regionalised approach to estimate ARFs and at-site catchment response time parameters for improved design flood estimation in South Africa

WRC report no. 2924/1/23

Web link: <https://bit.ly/3QktzN5>

Integrating ARD prevention and mine waste minimisation: soil fabrication from coal waste

Rehabilitation post mining requires revegetation of lands and potentially of waste dumps. Both require availability of fertile soils, typically excavated and transported from surrounding areas, with associated cost and environmental impact. Stockpiled soils may contribute to the soils available for revegetation but are typically no longer fertile and not in sufficient amount to comply with the requirements of the environmental management and rehabilitation programme. In this study, the research team focused on the potential for technosols, fabricated from fine coal waste and organic amendments, with or without bioaugmentation, to be constructed and applied as a soil substitute. This work was motivated threefold: by the need for increasing quantities of high quality, regenerative fertile soils for mine rehabilitation; by the desire to reduce excavation of natural soils and its associated environmental impact; and by the potential to re-purpose low-risk mine wastes, to both reduce the need for excavation of virgin materials and to reduce the waste disposal burden.

WRC report no. 2844/1/23

Web link: <https://bit.ly/46CQdWL>

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