

THE WATER WHEEL

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WOODY ENCROACHMENT

Study examines impact of mopane infestation on ecosystem services

DESALINATION

Can desalination aspire to having a global impact?

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Scientists from the South African Environmental Observation Network (SAEON) have been exploring the effects of large-scale changes in vegetation due to mopane encroachment on freshwater resources. Article on page 8.



NEWS

WRC CEO appointed to international advisory board for sanitation

Water Research Commission CEO, Dr Jennifer Molwantwa, has been appointed to the advisory board of the newly established International Water Association (IWA) Inclusive Urban Sanitation network. A task force has also been established.

The initiative is aimed at reshaping the global agenda on urban sanitation over

the coming years, especially in low- and middle-income countries. It forms part of the IWA's work to promote inclusive, resilient, water-wise and sanitation-secure cities.

The advisory board and task force comprise sanitation experts, regulators, strategic partners and members from various global regions in order to secure

a balanced geographical representation and address a wide variety of sanitation challenges. In addition to Dr Molwantwa on the advisory board, there are two South African experts on the task force, namely Jay Bhagwan of the WRC, and Prof Kirsty Carden of the University of Cape Town.

New hydropower policy set to boost electricity production



The Department of Water and Sanitation (DWS) has approved a policy for the utilisation of water and sanitation infrastructure and water resources for renewable energy generation.

This is in response to the global shift towards renewable energy technologies and the ongoing energy crisis.

“The policy empowers DWS to remain within its mandate while supporting the much-needed investment in renewable energy generation in the country. We have a duty as the department to ensure that the nation’s water resources are protected, used, developed, conserved,

managed and controlled as stipulated in the National Water Act,” noted Director-General (DG), Dr Sean Phillips.

In April, the DG, together with a team from Water Use Licence Applications (WULA) met with different stakeholders and independent power producers to take them through the processes of applying for authorisation to generate electricity from existing water infrastructure. According to the policy, the DWS will support the development of hydropower as part of both social and economic development within the context of water scarcity and water infrastructure challenges without

compromising sustainable protection of water resources and water and sanitation services provision.

Dr Phillips also emphasised the principles of the window for water use licence application for hydropower. “We are not going to provide any financial support to the applications during application, construction, operations and maintenance. We are not going to be involved in any of the Eskom processes or own any electricity production. The DWS will solely be responsible for water use licence applications and will ensure that the application processes are competitive, fair, transparent and underpinned by the spirit of equity allocation of water resources in line with the Act.”

The types of hydropower technologies that can be applied for include impoundment; river diversion or run-of-river, pumped storage and floating or kinetic turbines (small-scale generating capacity). In addition, applications for floating solar panels can also be made.

To find out more about water use licence application, Visit: <https://www.dws.gov.za/ewulaas/>

South Africa gets its 29th Ramsar site

Middelpunt Nature Reserve has become South Africa's latest designated Ramsar site.

The reserve is located along the headwaters of Lakenvleispruit, a stream in the Olifants River basin, approximately 14 km from the town of Dullstroom in Mpumalanga. The site is a permanent freshwater valley bottom forming part of the broader Lakenvlei wetland system, most of which is in the Greater Lakenvlei Protected Environment.

Middelpunt Nature Reserve is the only confirmed site in South Africa where the critically endangered white-winged flufftail (*Sarothrura ayresii*) breeds. The only other breeding sites are located in Ethiopia. South Africa is a contracting party to the Convention on the Conservation of Migratory Species of Wild Animals and the Agreement on the Conservation of African-Eurasian Migratory Waterbirds. Under both treaties, the white-winged flufftail receives the highest level of protection.

Middelpunt Nature Reserve also serves as a habitat for a number of other floral and faunal species. In addition, this nearly 10 000-year-old, peat-based wetland provides ecosystem services to the surrounding farming community through water retention, purification and flood attenuation.

Source: *Birdlife South Africa*

Multimillion Rand water-security project launched in Tshwane

The City of Tshwane and the Danish City of Aarhus have officially launched a three-year collaborative project to help improve the metro's capacity to manage its water resources.

"Essentially, this partnership is a window of opportunity for the [municipality] to learn best practices in water security and management from the Danish government," said Tshwane executive mayor, Cilliers Brink, in a statement.

The two cities have agreed to collaborate on water-management projects, such as reducing non-revenue water losses, conducting active leak detection, prioritising pipe replacement, focusing on own water generation and managing wastewater effectively. The Danish Ministry of Foreign Affairs has allocated R33 million to the project. This will go towards funding different study models and concepts that seek to enhance Tshwane's water security. The project will

run until 2026.

"We know that we face many water challenges in Tshwane, such as in Hammanskraal and other parts of Tshwane, therefore, it is important that we work with other world-class cities and learn from them so that we can build a capital city that works for all its people," noted Brink.

Loskop water project to benefit Limpopo, Mpumalanga communities

Water and Sanitation Minister, Senzo Mchunu, says 21 villages in Mpumalanga and Limpopo are set to benefit from the Loskop Regional Bulk Water Supply Project.

The R1.67 billion project is currently underway to abstract raw water from Loskop Dam and supply water to 21 villages under Thembisile Hani Local Municipality in Mpumalanga, and to eight villages in Moutse-East under Elias Motsoaledi Local Municipality in Limpopo. Thembisile Hani municipality has been

experiencing challenges with water supply due to not having access to a water source.

"The implementation of Loskop Bulk Water Supply Scheme will ensure that the municipality has a source of water and that it is reticulated to residents. It is for this reason that the department has undertaken to construct the 30 km-long pipeline that will abstract and transfer water from Loskop Dam in Limpopo and direct it to Thembisile Hani. This is coupled with the construction of a

water treatment plant and reservoirs that will bring relief, and ensure that the municipality has sustainable supply to its residents," noted Mchunu.

Source: *SANews.gov.za*



NEW WRC REPORTS

[Groundwater]

Governing groundwater in city regions: Water metabolism and actor networks in the cases of Cape Town and Nelson Mandela Bay

Patterns of growing urban water demand and increasing drought risk intersect in a context of infrastructure deficits, construction delays and insufficient maintenance in many of South Africa's metropolitan municipalities. Groundwater is being turned to in times of crisis as a quick solution to supplement supplies and make up surface water deficits, both by public water service providers and private water users, including domestic, commercial and industrial users. Exploiting groundwater during crises, as an urgent and reactive measure, gives rise to poorly coordinated regulation of increasing users and usage, and fragmented management of aquifers. This undermines the sustainability with which groundwater resources are used and managed, putting both aquifers and those reliant on groundwater at risk of over-depletion and pollution. Designing interventions and innovations that ensure sustainable management of these resources requires systems-thinking, where the city is understood as a system of interdependent actors and flows of water. This study focused on the metropolitan municipalities of Cape Town and Nelson Mandela Bay (NMB) as 'learning laboratories' to co-produce a more comprehensive understanding of each urban water system. The focus was on how groundwater links with other urban water flows, what actors influence these water flows, and how things may change under various climate change and land use scenarios. The work is framed within the idea and the policy goal of cities transitioning to become water sensitive cities characterised by adaptive, multi-functional infrastructure providing access to diverse water sources, urban design that reinforces water sensitive behaviours, and equitable communities that are resilient to climate change.

WRC Report no. 3066/1/23

Web link: <https://bit.ly/42XDts2>

[Wastewater management]

Innovative decentralised and low-cost treatment systems for optimal urban wastewater management (IDOUM)

The reuse of treated wastewater is increasingly seen as one of the solutions to tackle the water scarcity problem. Yet, using reclaimed water for non-potable purposes and particularly to irrigate food crops, presents an exposure pathway for antibiotics and Antibiotic Resistant Bacteria and Genes (ARB&Gs) to enter the human food chain. This project aimed at: i) establishing monitoring strategies based on the data-derived prioritisation of a set of indicator contaminants and pathogens for domestic wastewater, and ii) developing energy-efficient, cost-effective, and robust treatment systems for the decentralised production of treated wastewater, mainly from domestic wastewater. In this study, this was achieved through monitoring the antibiotic resistance profiles in passive wastewater treatment using a novel algal consortia. The second component was the assessment of any remediative capacity that passive treatment has on antibiotic resistance.

WRC Report no. 2950/1/22

Web link: <https://bit.ly/42Vc8Xb>

[COVID-19]

Development of a framework for water quality-based COVID-19 epidemiology surveillance for non-sewered communities

As part of the efforts to stop the spread of this virus, the detection of SARS-CoV-2 in municipal sewage was successfully proven both internationally and in South Africa. Environmental surveillance of municipal sewage offers the benefit on population-level data for monitoring COVID-19. In certain cases, researchers have shown the presence of SARS-CoV-2 virus in municipal sewage before the first clinical detection in a country. Developing countries which have lower sewerage coverage are not able to access this useful tool in their pandemic response. The main aim of this project was to develop a sampling framework for COVID-19 surveillance in non-sewered communities. The sampling framework is based on field observations of non-sewered environments and include aspects such as ideal sampling points, sampling method (random vs. systematic), sample types and potential areas of virus concentration that would be later correlated to virus detection in the laboratory. This includes, for example, standing pools, greywater plumes and communal stand-pipe pools. The sampling framework will serve as standardized operating procedure for SARS-CoV-2 sampling and subsequent detection.

WRC report no. 3062/1/22

Web link: <https://bit.ly/3BK7Lm0>

[Estuaries]

Restoration of estuaries using a socio-ecological systems framework

The South African National Biodiversity Assessment 2019 indicated that our estuaries are under severe pollution pressure and that improvement of water quality as a key intervention would lead to significant improvement in estuary health and associated benefits that society derive from them. Innovative approaches are needed to remove wastewater inputs from estuaries to improve estuary health because both general and special standards result in high nutrient input and eutrophication. The research focused on the restoration of estuary water quality using the Swartkops Estuary as a case study. The objective of the project was to develop a socio-ecological systems framework for the restoration of estuaries. Restoration is the process of assisting the recovery of damaged, degraded, or destroyed systems. Restoration occurs along a continuum and ranges from reducing impacts to remediation, rehabilitation, and ecological restoration. The Swartkops Estuary was chosen as the study site as it is nationally important. It is one of few permanently open estuaries with large intertidal salt marshes and available nursery habitat for fish. Swartkops Estuary is also recognised internationally as an IBA (Important Bird and Biodiversity Area).

WRC report no. 3061/1/22

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

[Greywater management]**Accessible greywater solutions for urban informal townships in South Africa**

The URBWAT project initiated an iterative design process for greywater infrastructure, i.e. small-scale constructed subsurface flow wetlands (CWs) in an informal settlement in Johannesburg, where sanitation services are currently limited. In the project, three greywater treatment CWs were built, monitored, rebuilt and maintained in collaboration with residents in the area. Multiple pressures and (competing) goals operating in a dense settlement with little space for infrastructure meant that the physical context and the use of the CWs changed rapidly. Therefore, it became clear that building structures that were more multi-functional (thinking of water collection, washing, and channelling multiple types of water) resulted in a higher use. The results from the project can inform planning processes aiming at addressing wastewater issues in urban slums with limited availability of sanitation services.

WRC report no. 2953/1/22

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

[Sanitation]**Development of an in-situ faecal sludge solar dryer at pilot scale**

Thermal drying is an efficient treatment method for sludge treatment for volume reduction and disinfection, but it requires a high input of energy. The use of solar thermal energy for drying proposes could reduce drastically the energy consumption, leading to a significant cost reduction. Even though an important number of solar drying technologies have been deployed in the food and agriculture sectors and some applications of solar thermal drying exist for sewage sludge treatment, this option has not been enough exploited for faecal sludge treatment, with only a few cases greenhouse drying beds reported in literature. This latest project was about the development, testing and evaluation of two prototype solar thermal drying technologies for the treatment of faecal sludge, namely a greenhouse-type solar dryer and a screw conveyer, and it included a pre-feasibility study. The present project is the continuation of a previous WRC project (**K5/2582**) that demonstrated the great potential of the application of solar thermal energy for faecal sludge drying.

WRC Report no. 2897/1/22

Web link: <https://bit.ly/3oeT4o5>

[Hydropower]**Market analysis to determine the extent and potential of water-to-energy market in South Africa (Waste and Small/Micro Hydro)**

The concept of water and waste to energy has been around for decades. When considering that wastewater is a carrier of over 50% of waste resources that is either lost or unrecovered materials, energy or water. However, despite global reports estimating that the waste to energy market value was US\$28.4 billion in 2017 and would increase to US\$42.7 billion by 2025, there has been limited implementation in South Africa

despite projects being identified as technically and financially viable. There is significant potential to generate energy from water and wastewater sources and references within the global market suggest that these projects can be successfully executed at scale. The study was positioned to undertake a market analysis of various water to energy applications in South Africa and understand the market size and the challenges within this market. The overarching objective was to develop a strategy that would attract investment in water to energy projects and unlock the potential within this area of the water value chain. The recommendations from the study include a roadmap that will catalyse investment for these projects and enable their successful implementation

WRC report no. 3004/1/21

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

[WEF nexus]**Developing a Web-based and GIS-enabled WEF nexus integrative model – Final Synthesis Report**

Strategic resources such as water, energy, food, and land are under pressure from changes in climate and socioeconomic conditions and silo-based management approaches. This has led to the pursuit of integrated resource management approaches: the water-energy-food (WEF) nexus. The WEF nexus approach acknowledges the inextricable links between WEF resources to maximize and minimize their synergies and trade-offs. This short-term project was part of the WRC's goal to promote the WEF nexus research and implementation in South Africa. To bridge the gap between WEF nexus theory and practice, the global aim of this study was to develop a web-based and GIS-enabled integrative WEF nexus analytic model, iWEF. Specifically, the work reviewed state-of-the-art WEF nexus models tools and developed, tested and disseminated a web-based GIS-enabled WEF nexus analytical tool applicable at different scales. Thus, the scope of this work involved (i) reviewing existing WEF nexus tools and their characteristics, including geospatial analytic capabilities in literature, (ii) developing the web-based and GIS-enabled iWEF modelling tool, (iii) testing the iWEF model in case studies at different scales, and (iv) disseminating the iWEF model to potentially interested public users.

WRC report no. 3059/1/22

Web link: <https://bit.ly/3q0v0FM>

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