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A review of South Africa's WATER SECTOR

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List of abbreviations and acronyms

AfDB	African Development Bank
AMCOW	African Ministers Council on Water
AMD	acid mine drainage
AWF	African Water Facility
CDP	Carbon Disclosure Project
DWS	Department of Water and Sanitation
GDP	gross domestic product
GHG	greenhouse gas
GHS	General Household Survey
GWI	Global Water Intelligence
HLPW	High Level Panel on Water
INHR	Institute of National Hydraulic Resources
ISS	Institute of Security Studies
IVRS	Integrated Vaal River System
LCTPi	Low Carbon Technology Partnership Initiative
LHWP	Lesotho Highlands Water Project
NBS	nature-based solutions
NRW	nonrevenue water
NWA	National Water Act
NWRS	National Water Resource Strategy
NW&SMP	National Water and Sanitation Master Plan
OECD	Organisation for Economic Cooperation and Development
REIPPPP	Renewable Energy Independent Power Producer Procurement Programme
RWH	rainwater harvesting
Saice	South African Institution of Civil Engineering
SDG	Sustainable Development Goal
Stats SA	Statistics South Africa
TCTA	Trans-Caledon Tunnel Authority
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
VRES	Vaal River Eastern Subsystem
Vresapp	Vaal River Eastern Subsystem Augmentation Project
WBCSD	World Business Council for Sustainable Development
WEF	World Economic Forum
WfA	Water for Africa
WRC	Water Research Commission
WSA	Water Services Act

Key developments

September 2017: South Africa's Department of Water and Sanitation and its Cuban counterpart agree to extend the two countries' cooperation in the water sector to 2023. Under an earlier agreement, concluded in 2015, South Africa hired 35 Cuban water engineers, geohydrologists, hydrologists and water supply specialists to work in all the country's nine provinces.

November 2017: Then Water and Sanitation Minister Nomvula Mokonyane gazettes government's intention to merge Umgeni Water and Mhlatuze Water into the KwaZulu-Natal Water Board to improve service delivery.

November 2017: The African Ministers Council on Water endorses the Moroccan-developed Water for Africa Initiative, which aims to mobilise the international water and climate community for the implementation of a priority action plan to improve access to water on the continent.

February 2018: Cape Town introduces Level 6B water-use restrictions, which limit per capita water use to 50 ℓ/d, amid concerns that the city is at risk of reaching the so-called Day Zero – when most taps will be turned off – in a few months.

May 2018: Surveys conducted by rights organisation Afriforum find that the water supplied by municipalities in Limpopo and the northern part of Gauteng is clean. The surveys, however, highlighted that sewage water in seven Limpopo towns did not comply with microbiological standards, while six sewage treatment plants in northern Gauteng were found to be noncompliant.

May 2018: The Nelson Mandela Bay municipality announces a reduction in the number of bucket toilets in use in the metro from about 30 000 in April 2015 to only 8 562.

June 2018: A national statistical service Statistics South Africa survey reveals that 62 042 families across South Africa relied on bucket toilets in 2017.

June 2018: Multilateral development finance institution the African Development Bank announces that climate financing from the world's six largest multilateral development banks increased to a seven-year high of $35.20-billion in 2017, a 28% increase on the previous year.

June 2018: Research group Global Water Intelligence says global investments of $449-billion will be needed each year between 2018 and 2030 to meet the water and sanitation access objectives of the United Nations' Sustainable Development Goal 6.

July 2018: A study conducted by researchers at the North-West University finds that drinking water in the Gauteng metros of Johannesburg and Tshwane is contaminated with microplastics. The study finds that rivers and boreholes in the province and in the North West are similarly polluted.

August 2018: The Department of Environmental Affairs establishes a task team to investigate the feasibility of gradually banning the importation of microbeads, which are among the microplastics found to have polluted rivers, boreholes and tap water in Gauteng and the North West.

August 2018: The Department of Water and Sanitation announces that it intends to implement an 80% water restriction in the Eastern Cape to avoid a natural disaster in the province.

August 2018: The Kouga municipality, in the Eastern Cape, announces its plans for water-shedding in the towns of Hankey and Patensie to conserve the little water in the Kouga dam, which supplies the municipalities.

September 2018: The City of Cape Town announces it will relax water-use restrictions from Level 6B to Level 5, which allows for per capita consumption of 70 ℓ/d, as water levels in the city's dams rise to nearly 70%.

October 2018: The Department of Water and Sanitation reports that dam levels in Gauteng have improved to 98%, with an average of 85.60%, 81.80% and 73.40% in the Free State, the Northern Cape and the Western Cape respectively.

November 2018: The South African Department of Water and Sanitation (DWS) tells the Portfolio Committee on Water and Sanitation that despite interventions since November 2017 municipalities have run up their water bills to R13.1-billion – an amount just R2-billion short of the entire yearly budget of the DWA.

Picture by Bloomberg

Global overview

An estimated 2.50-billion people – or 36% of the world's population – live in water-scarce regions. The High Level Panel on Water (HLPW), which was launched in 2016 by World Bank president Jim Yong Kim and then United Nations (UN) secretary-general Ban Ki-moon, and is supported by current UN secretary-general Antonio Guterres, forecasts that, by 2050, more than half the world's population will be at risk, owing to water stress.

Water scarcity refers to yearly per capita water availability of 500 m^3 to 1 000 m^3 in a region, country or other geographic unit, while availability below 500 m^3 represents a state of absolute scarcity. Availability between 1 000 m^3 and 1 700 m^3 represents a water-stressed situation, with the latter figure deemed to be the threshold for meeting water requirements for agricultural, industrial and energy production, and the environment.

The HLPW, which comprises 11 sitting heads of State or government, has been mandated to identify ways of accelerating progress towards attaining the UN's Sustainable Development Goal (SDG) 6 – ensuring the availability and sustainable management of water and sanitation for all – and to contribute to the attainment of various other SDGs, which require progress on the development and management of water resources. The panel warns in a report released in March 2018 that, should there be no change in water consumption patterns, as well as the way this important resource is managed, as many as 700-million people will be displaced in the next 12 years as water scarcity intensifies.

The HLPW report, titled 'An Agenda for Water Action', states that water scarcity will be exacerbated by a growing population and increasing demand for food and energy – both of which are water intensive – poor decisions on water allocation and management, and the effects of climate change. The UN estimates current water demand at 4 600 km^3/y. However, owing to increasing household and industrial use and the need to produce more food and energy, the figure is expected to have risen to between 5 500 km^3/y and 6 000 km^3/y by 2050.

To avert a water shortage disaster, the HLPW makes several recommendations in its report. These include better management of water resources, transboundary cooperation on the management of rivers and aquifers that straddle sovereign borders, as well as the efficient use of and investment in water and related infrastructure. According to the report, the financing needs of the global water sector are estimated at $6.70-trillion by 2030 and $22.60-trillion by 2050. These amounts will be required to not only build new facilities but also maintain and operate existing ones.

Other suggested measures to avoid a potential water crisis include treating wastewater to potable and nonpotable quality and harnessing the natural processes that regulate the various elements of the water cycle. The latter response, more commonly known as nature-based solutions, can be deployed at micro level – when dry toilets are installed, for example – or at macro level, such as the establishment of more ecosystem-friendly forms of water storage, with natural wetlands being a case in point.

Potential water crises have been highlighted as one of the top five risks confronting the world in terms of impact in each edition of the World Economic Forum's (WEF's) yearly 'Global Risks Report' since 2012. The WEF notes in the 2018 iteration of the report that the declining quantity and quality of available fresh water could impact on human health and economic activity. The economic impacts it anticipates include constrained business growth and a higher risk profile for businesses, which could ultimately lead to a higher cost of capital.

Meanwhile, citing a 2017 study, the World Business Council for Sustainable Development (WBSCD) states in its 2018 'CEO Guide to Water' report that, if the full costs of water availability and water quality had to be absorbed by businesses, this would equate to an average decline in profits of 44% for utilities and 116% for food and beverage companies. It illustrates this by citing a major drought in Brazil during 2015 that resulted in water costs increasing by more than $2-million and electricity costs by close to $6-million, owing to reduced availability of hydropower.

SUPPLY AND DEMAND

The world boasts an estimated 1.40-billion cubic kilometres of water, but only about 0.003% is fresh water suitable for potable use and for hygiene, agriculture and industrial use. However, not all this water is accessible, as some of it flows into remote rivers during seasonal flooding.

Water demand has increased sixfold in the past 100 years and a further increase at the rate of 1% is expected as the world's population increases from 7.70-billion in 2017 to between 9.40-billion and 10.20-billion by 2050. About two-thirds of the increase will occur in Africa and Asia, the world's poorest continents, according to the UN. Estimates by the UN and other multilateral organisations suggest that, if current consumption trends continue and there is no significant change to the current approach to water management, water demand will exceed supply by 40% by 2050, putting at risk about 45% of global gross domestic product (GDP), 52% of the world's population and 40% of grain production.

Of the estimated 4 600 km^3 of water that is currently consumed worldwide, 70% is used in agriculture – most of it for irrigation – with the industrial and domestic sectors accounting for 20% and 10% respectively. Taking into account the projected increase in the world's population, the UN's Food and Agriculture Organisation predicts that water use for irrigation will increase by 5.50% from 2008 to 2050. Conversely, the Organisation for Economic Cooperation and Development (OECD) believes that water use for irrigation will decrease slightly during the period 2000 to 2050, basing its optimistic forecast on technology-driven improvements in irrigation efficiency.

Industrial water use – comprising 20% of total water demand – is dominated by energy production, which is responsible for 75% of the industrial sector's total abstractions, with the balance used in manufacturing processes. According to the UN's 'Water Development Report 2018', industrial water demand is set to increase in all regions of the world, except North America and Western and Southern Europe, with the increase to be as high as eight times the current levels in regions such as West, Middle, East and Southern Africa, where the industrial sector's share of water use currently comprises a very small percentage.

The OECD estimates that demand for water used in manufacturing will increase by 400% by 2050. Meanwhile, according to the International Energy Agency, water withdrawals for energy production is forecast to increase by 20% from 2000 to 2050, while water consumption for energy production will increase by 85%, driven by the increasing adoption of more efficient power generation plants using advanced cooling systems that reduce water withdrawals, while increasing consumption.

Cognisant of their impact on available water resources, businesses involved in manufacturing and related activities have been playing their part in ensuring water security. In 2017, for example, companies that signed up to the Carbon Disclosure Project (CDP) committed to investing $23.40-million in 1 000 projects to address water risks in 91 countries. These included US mining group Alcoa, which invested $115-million in its Australian operations for a filtration system that reduces freshwater consumption by about 1.20-billion litres a year, and French foods product multinational Danone, which is spending $59-million on projects to secure sustainable access to raw materials. For its part, Taiwanese technology company AU Optronics has invested $49.70-million in improving water-use efficiency at its operations by increasing water recycling to 90%. The company is aiming for zero discharge of processing water.

Meanwhile, a significant increase in water used in homes – which is distributed by municipalities and accounts for about 10% of total demand – is expected from 2010 to 2050 in nearly all regions of the world, except Western Europe. According to the 'Water Development Report 2018', consumption could triple in Africa and Asia during this period, while doubling in Central and South America, owing to an increase in water supply services in urban areas.

WATER STRESS AND INSECURITY

According to the UN's water agency, UN-Water, more than two-billion people worldwide live in countries experiencing high water stress. While the global average water stress is only 11%, the agency states in its 'Synthesis Report on Water and Sanitation 2018' that 31 countries experience water stress of 25% to 70%, with 22 experiencing water stress above 70%, which means they are seriously stressed. Countries experiencing the highest stress levels are located in North Africa, as well as Western, Central and Southern Asia. UN-Water expects levels of water stress to increase as populations and the demand for water increase and the effects of climate change intensify.

Meanwhile, the HLPW states in its latest report that, in 2015, an estimated 2.10-billion people – equivalent to about 30% of the world's population – lacked access to water services that comply with the new SDG standards. Further, 844-million did not have access to basic water supply that year, while 263-million lived more than 30 minutes away from the nearest water point and 159-million

relied on untreated water drawn from rivers, streams or lakes for potable use.

UN-Water states that achieving universal access to safe and affordable drinking water by 2030 poses a major challenge for developed and developing countries. The agency notes that, while the proportion of the world's population using at least a basic drinking water service increased from 81% in 2000 to 89% in 2015, only one in five countries that have yet to achieve 95% coverage in terms of affordable clean water availability is on track to achieve universal basic water services by 2030.

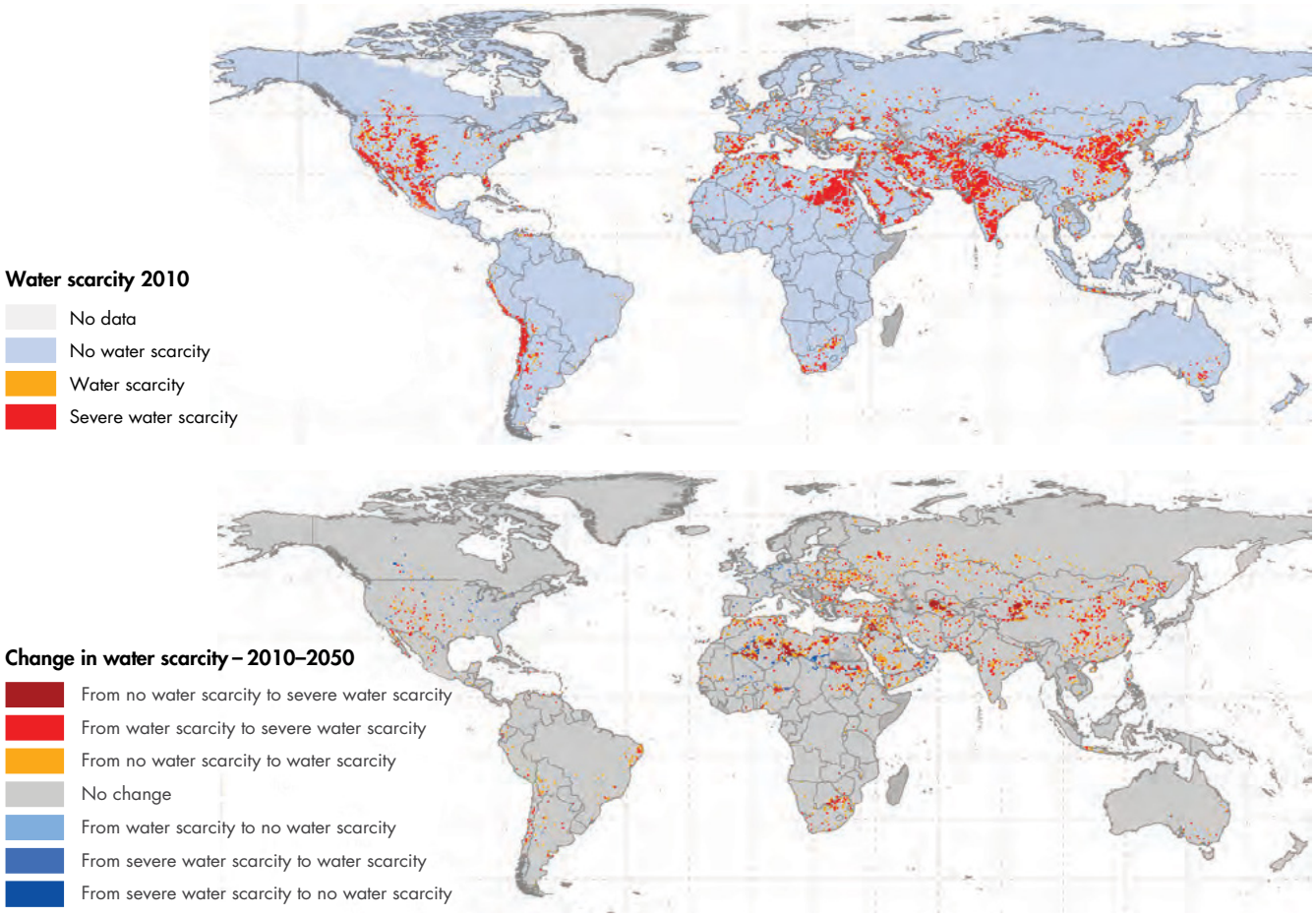
Water scarcity and stress do not only have a societal impact – they have an economic one as well. According to the World Bank, GDP could decline by 6% by 2050 in some regions, owing to water-related impacts on agriculture, health and incomes. Water scarcity could also cause migration and even conflict, besides an increase in food prices.

However, some of the impacts could be mitigated through several measures, including improved water governance, treating wastewater for reuse and increasing water-use efficiency.

CLIMATE CHANGE

Should there be no adequate mitigation measures, climate change will have a major impact on water availability. A key element of climate change is its impact on the earth's water cycle, which continually distributes water from seas and oceans to the atmosphere and then to land and rivers and lakes before it returns to the seas and oceans. Climate change increases the levels of water vapour in

Physical water scarcity in 2010 (upper figure) and projected change in water scarcity by 2050 (lower figure) based on the middle-of-the-road scenario



Source: UN-Water

Should there be no adequate mitigation measures, climate change will have a major impact on water availability

Picture by Bloomberg

the atmosphere, which can lead to intense rainstorms in some regions, while others may experience severe drought conditions, especially during summer months. This makes the provision of water, sanitation and hygiene services more challenging. Further, food shortages, as a result of longer and more frequent droughts, could lead to famine and widespread hunger.

The 2015 Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC), which was adopted by 195 governments, committed countries to lowering their climate-change-inducing carbon emissions, but it suffered a setback when US President Donald Trump announced in July 2017 that the US would withdraw from the agreement in November 2020. Nevertheless, according to a new study by the New Climate Institute, which was published in August 2018, 76% of global greenhouse-gas (GHG) emissions – excluding those emitted in the US – are now covered by pledged national GHG reduction targets. Moreover, more than two-thirds of global emissions are covered by national climate legislation or strategy. Although national climate actions are deemed by some to be insufficiently stringent, the New Climate Institute insists that the current coverage represents an important step forward.

As the effects of climate change will impact on companies' bottom lines, business is also taking steps to move away from climate-changing practices. One of the global-level initiatives is the Low Carbon Technology Partnership Initiative (LCTPi), which is led by the WBCSD. A total of 160 companies and partner organisations participate in the LCTPi, which comprises nine subinitiatives. These focus on carbon capture and storage, low-carbon freight, low-carbon transport fuels, chemicals, renewable energy, climate-smart agriculture, energy efficiency in buildings, forests and sustainable cement.

Meanwhile, in a statement released in June 2018, the African Development Bank (AfDB) said climate financing from the world's six largest multilateral development banks increased to a seven-year high of $35.20-billion in 2017, up 28% on the previous year. Of that amount, $27.90-billion was devoted to climate mitigation projects that aim to reduce harmful emissions and slow down global warming, with the balance of $7.40-billion channelled to developing countries. The banks that contributed to the climate financing are the AfDB, the Asian Development Bank for Reconstruction and Development, the European Investment Bank, the Inter-American Development Bank Group and the World Bank Group. The Islamic Development Bank joined the multilateral development bank climate finance packaging groups in October 2017 and its climate finance contributions will be included in joint reports from 2018.

ACCESS TO WATER AND SANITATION

Governments are struggling to not only provide clean, affordable water for their citizens – with about 500-million people worldwide experiencing severe water shortages all year round – but also adequate sanitation services. According to nonprofit organisation Solidarites International, 4.50-billion people – or about 60% of the world's population – do not have access to a sanitation facility that safely disposes of excreta. Further, 2.30-billion lack decent toilets, 600-million share toilets or latrines with other families, while 892-million, mostly in rural areas, relieve themselves in the open. The majority of those who practise open defecation live in Central and Southern Asia, with 558-million people, and sub-Saharan Africa, with 220-million. Solidarites International states in its '2018 Water, Hygiene and Sanitation Barometer' report, published in March 2018, that the number of people practising open defecation is increasing in sub-Saharan Africa and Oceania, owing to population growth. The prospects for dealing with this challenge are bleak, with UN-Water stating that only one in ten countries below 95% coverage in terms of sanitation provision is likely to have achieved universal coverage by 2030.

Meanwhile, research group Global Water Intelligence (GWI) calculates that global investments of $449-billion will be needed each year between 2018 and 2030 to meet SDG6's water and sanitation access objectives. It

states in its 'Financing Water to 2030' report, published in June 2018, that water tariffs will have to be increased by 6% each year if the SGD for water is to be met, while lessening utilities' dependence on grant finance. This, GWI states, will more than double the global average water tariff from the current rate of $2.08/m^3 to $4.38/m^3 by 2030.

GWI's report further states that the amount of private finance used to fund water infrastructure worldwide will total more than $35-billion over the next 12 years, providing about 7.70% of the required investment. This will be a sizable increase from the $3-billion invested from 2013 to 2015. During the 12 years to 2030, GWI expects government funding of water infrastructure development to decline from 31% of yearly investment requirements currently to 18%.

The research group also says that the consolidation of utilities, coupled with government reforms to improve the bankability of water infrastructure projects, will be key to attracting the financing that water utilities will require to achieve the UN's clean-water and sanitation goals.

Meanwhile, like countries in many other regions of the world, many African countries face serious water- and sanitation-access challenges. The continent is the second driest, containing about four-billion cubic metres of fresh water, which equates to only 9% of the world's available resources. This water is not evenly distributed, with North Africa, the Sahel region and parts of Southern and East Africa having a limited endowment, while the tropical and equatorial regions have abundant resources. The six most water-rich countries, located in Central and West Africa, account for 54% of the continent's freshwater resources, while the 20 driest countries have only 7%.

Further, while sub-Saharan Africa has a plentiful supply of rainwater, the water supply is seasonal and unevenly distributed. Many countries in the region are characterised by a lack of economic development, rapid population growth and rural-urban migration. These factors constrain towns and cities from adequately providing clean water and sanitation services and preventing the further deterioration of water quality. Additionally, rapid population growth has led to an increased number of settlements on flood-prone, high-risk land in the region.

An estimated 330-million people, or about one-third of the continent's population, lack access to safe drinking water, while almost half of Africans suffer from health problems related to a lack of safe drinking water.

Africa's water-access challenge is exacerbated by insufficient water storage infrastructure. Illustrating how dire the situation is, AfDB water development and sanitation divisional manager Osward Mulenga Chanda told an interviewer in March 2018 that yearly investment of $13-billion in water and sanitation infrastructure would be required if the continent is to meet the SDG for water supply and sanitation. This excludes investments to address the operation and maintenance of existing infrastructure. Further, to meet the AfBD's Africa Water Vision 2025, Chanda said African countries needed to invest at least 0.50% of their GDP in water and sanitation projects each year, a benchmark that only very few governments were meeting. He added that this level of investment had to be supplemented by international financial institutions and the private sector.

At continental level, the African Water Facility (AWF), an initiative of the African Ministers Council on Water (AMCOW) that is hosted and managed by the AfDB, is one of the major initiatives that assist African countries in mobilising resources for water and sanitation projects. The AfDB states on its website that every €1 contributed by the AWF attracts an average of €4 in additional follow-up investments. Since 2006, the facility has mobilised €2.10-billion, which has been used to fund 117 national and regional projects in 52 countries, including Africa's most vulnerable States.

Meanwhile, in November 2017, AMCOW endorsed the Moroccan-developed Water for Africa (WfA) Initiative, which aims to mobilise the international water and climate community for the implementation of a priority action plan to improve access to water on the continent.

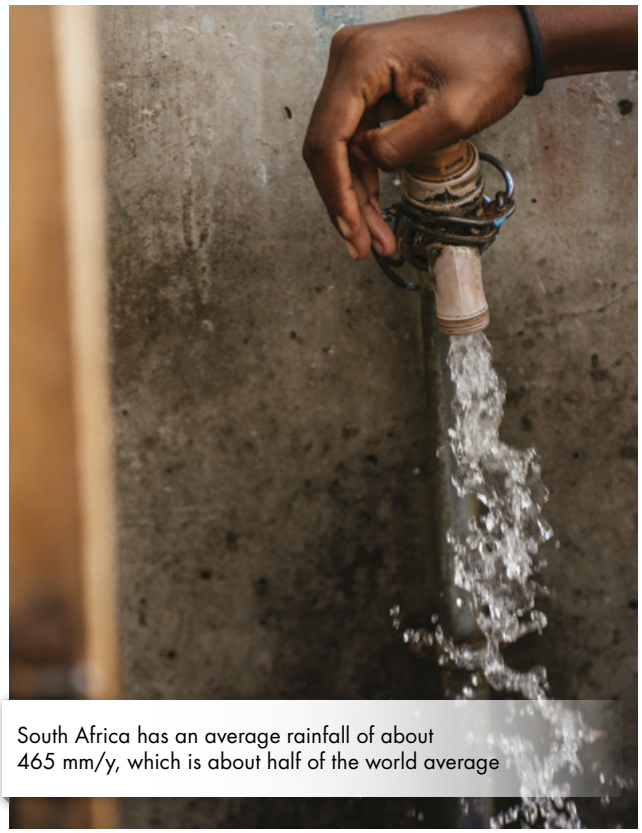
The WfA Initiative stems from a Ministerial declaration known as the Rabat Call to Action, which was launched during the International Conference on Water and Climate, held in the Moroccan city of Rabat in July 2016. To implement the so-called Rabat Call, Morocco launched the WfA Initiative in partnership with the World Water Council, the AfDB and the World Bank at the UNFCCC's twenty-second Conference of the Parties, which was held in Marrakech, Morocco, in November 2016.

The main objective of the WfA Initiative is to highlight the impact of climate change on water resources in Africa and promote climate justice through initiatives and programmes to improve access to water and sanitation, and ensure food and energy security on the continent.

Water in South Africa

South Africa, which has an arid to semi-arid climate, is the world's thirtieth-driest country and has been classified as highly water stressed. Its average yearly rainfall is about 465 mm, which is equivalent to half the world average and produces total runoff of about 49-billion cubic metres a year. According to nonprofit organisation GreenCape's '2018 Market Intelligence Report', the country's reliable yield (the supply available from current infrastructure) is about 15-billion cubic metres a year, 10.20-billion cubic metres of which is surface water, with 70% of this volume stored in the country's large dams.

South Africa is prone to droughts, with the worst since 1904, which occurred in 2015, resulting in the country receiving only 403 mm of rainfall that year, the lowest on record. The 2015 drought came on the back of three consecutive years of below-average rainfall and caused dam levels in the country to decline from 93% in 2014 to 48% in November 2016. Although a recovery was recorded in early 2017, dam levels stood at an average of only 59% in February 2018. The drought was declared a national disaster in March 2018, but this was lifted in June 2018 as water availability improved.



South Africa has an average rainfall of about 465 mm/y, which is about half of the world average

Picture by Bloomberg

The Western Cape was the most affected of South Africa's nine provinces by the persistent droughts. This prompted the province's municipalities, including the City of Cape Town, to impose stringent water-use restrictions. In Cape Town, for example, Level 6B restrictions, which limit per capita water use to 50 ℓ/d, were introduced in February 2018 amid concerns that the city would reach the so-called Day Zero – when most taps would be turned off – in April 2018. The estimated timing of Day Zero was postponed several times as water levels in the city's dams increased and consumption decreased. The metro now believes that, in light of the rising dam levels and provided adequate water restrictions are maintained, there is no prospect of reaching Day Zero in 2018 or 2019.

Meanwhile, as Cape Town's dams neared 70% of storage capacity, the city announced in September 2018 that per capita water-use restrictions would be relaxed from Level 6B to Level 5 from October 1, 2018. This would result in allowable per capita consumption increasing from 50 ℓ/d to 70 ℓ/d and commercial and industrial customers being required to reduce consumption by 40% instead of 45%. When Level 6B restrictions were in force, the City of Cape Town had a daily consumption target of 450-million litres. However, this was never achieved, with consumption during that period averaging 500-million litres a day, which is the target under Level 5 restrictions.

Residents in many other parts of the country have not been spared water-use restrictions, with the City of Johannesburg imposing Level 1 restrictions in March 2017. Level 1 restrictions prohibit the watering of gardens between 06:00 and 18:00 during summer months and also disallow the washing of paved areas and driveways. The City of Tshwane introduced similar measures two months later, but lifted the restrictions in June 2018, citing above-average rainfall in the Integrated Vaal River System (IVRS) catchment area. The City of Johannesburg, however, announced in September 2018 that restrictions would remain in force.

In August 2018, restrictions were also lifted in areas supplied by Umgeni Water, in KwaZulu-Natal, following significant increases in water levels in the five dams in the province. Umgeni Water supplies water in bulk to the eThekwini, uMgungundlovu and Msunduzi municipalities. Industries, commercial enterprises and households in these areas had been required to reduce consumption by 15% for the previous two years, while a 50%

Two Eastern Cape towns to start 'water-shedding' as dam empties

The Kouga municipality, in the Eastern Cape, announced at the beginning of August 2018 that it planned to cut off water supplies to the towns of Hankey and Patensie for extended periods as it sought to stretch the little water still available in the Kouga dam, which supplies the municipalities.

The municipality explained that water would be available from 04:30 to 11:00 and from 16:00 to 20:00 on Wednesdays and Saturdays and from 04:30 to 08:00 and 16:00 to 20:00 on the other five days of the week. It added that, should there be no sufficient rainfall in the dam's catchment area, the two towns would have no water supply in three months' time.

Source: News24

South Africa: Water and sanitation statistics

8.20-million people still do not have access to safe drinking water.

14.10-million people do not have access to safe sanitation.

Only 63% of households have access to a reliable service.

41% of municipal water does not generate revenue.

35% of municipal water is lost through leakage.

233 ℓ of water per capita per day is consumed in the country.

56% of wastewater treatment works and 44% of water treatment works are in a poor or critical condition.

48% of the remaining wetlands are critically endangered.

R33-billion more is needed each year to achieve water security.

Source: National Water and Sanitation Master Plan

reduction had been imposed on agricultural consumers. Umgeni Water spokesperson Shami Harichunder said that the immediate lifting of all the restrictions would be implemented in 80% of the eThekwini metro and in all of uMgungundlovu and Msunduzi, including Pietermaritzburg. However, Umgeni Water is concerned that the storage level of Albert Falls, the largest dam in the province, remains consistently below 60%.

The Eastern Cape, however, has not been as fortunate, with the Department of Water and Sanitation (DWS) announcing in August 2018 that it intended implementing an 80% water restriction in the province to avoid what it described as a natural disaster. According to the department, the situation was most severe in the western part of the province, in areas such as Nelson Mandela Bay, the Sarah Baartman district municipality and the Kouga local municipality. At the beginning of September 2018, the average water level of the dams comprising the Algoa water supply system, which serves these municipalities, was 17.82%, compared with 31.70% a year earlier. The most affected was the Kouga dam, with a water level of only 6.70%, followed by the Churchill dam, at 16.40%. The least affected was the Impofu dam, which was 27.60% full.

Water availability countrywide, however, had improved considerably by the end of October 2018, with Gauteng dams being 98% full and the Free State and the Northern Cape dams 85.60% and 81.80% full respectively, while those in the Western Cape were 73.40% full. Dam levels in the Eastern Cape averaged 72.20% and those in KwaZulu-Natal 59.70%.

The droughts that have affected South Africa over the past few years have had a major economic impact on the country. In the Western Cape, for example, 30 000 jobs had been lost as a result of the drought, the World Wide Fund for Nature announced in July 2018, explaining that this equated to an economic loss of R5.90-billion and a 20% decline in exports. As a result of the drought, farmers in the province have been forced to reduce water use by 60% since 2017.

Besides frequent droughts, which are driven by climatic variation, South Africa's water challenges are also attributable to inadequate water infrastructure maintenance and investment, deteriorating water quality, a shortage of water engineers in the country and increasing demand that is attributable to population growth and urbanisation.

The DWS forecasts that the situation is approaching crisis proportions, warning that, if demand continues to grow at current rates, the deficit between supply and demand could range from 2.70-billion cubic metres a year to 3.80-billion cubic metres a year by 2030.

Despite this dire prediction, South Africa's water conservation record continues to be poor. For example,

at 237 ℓ/d per person, household consumption is 64 ℓ/d per person more than the global average of 173 ℓ/d per person. However, as highlighted by DWS deputy director-general Trevor Balzer when he addressed the National Assembly's Water and Sanitation Portfolio Committee in August 2018, it is possible to reduce consumption levels in South Africa. He cited the City of Cape Town, where daily per capita consumption declined to 80 ℓ as a result of water conservation measures introduced by the metro.

The high water consumption in South Africa is also due to nonrevenue water (NRW) of as high as 41% of total supplies – for which consumers do not pay. The major cause of NRW is physical loss in municipal systems, which accounts for 35% of the total.

SUPPLY AND DEMAND

The bulk of South Africa's water supply comprises surface water, which accounts for 68% of the total, and return flows that supports the surface water, at 13%. About two-billion to three-billion cubic metres of groundwater is also accessible nationally.

To improve water supply, government plans several interventions, including the implementation of the second phase of the Lesotho Highlands Water Project (LHWP), which will increase water transfer from Lesotho to the IVRS from 780-million cubic metres a year currently to 1.26-billion cubic metres when it is completed in 2023. The R24-billion project will comprise a water delivery system that will augment supplies to the IVRS and a hydropower scheme that will increase electricity generation capacity in Lesotho. The water supply component will comprise the Polihali dam, to be constructed as a concrete-faced rockfill embankment, and a 38-km-long tunnel that will transfer water from the Polihali reservoir to the Katse reservoir.

During a tour of the LHWP sites in Lesotho in July 2018, South African Water and Sanitation Minister Gugile Nkwinti and his Lesotho counterpart, Samonyane Ntsekele, reaffirmed that the governments of their countries were committed to implementing the project.

The DWS believes that South Africa's water supply could also be improved by, besides other measures, increasing groundwater withdrawals from two-billion cubic metres to three-billion cubic metres a year currently to as much as 4.50-billion cubic metres a year by exploiting the estimated 85% of the country's groundwater aquifers that have not yet been allocated. In its 'Water:

LHWP Phase 2 contracts awarded

The Lesotho Highlands Development Authority (LHDA) awarded the first construction contract on the Lesotho Highlands Water Project (LHWP) – the R235-million contract for the Polihali north–east access road – to the Sinohydro-Nthane Brothers joint venture (JV) in October 2018. The JV comprises South African-registered Sinohydro and Lesotho-registered, Maseru-based Nthane Brothers.

The Polihali north–east access road is one of the critical advance infrastructure components of LHWP Phase 2, most of which should be completed prior to the completion of the project's main works.

Media reports published at the time stated that the contractor was expected to be on site in November 2018 and that construction of the access road would be completed in 20 months.

In November, the LHDA announced that advance infrastructure construction at Polihali and Katse would begin in early January, following the award of a contract, valued at about M394-million, to the WBHO and LSP Construction joint venture (JV).

At Polihali, where the Phase 2 Polihali dam is to be built, the scope of work includes earthworks and the creation of platforms for buildings, water and wastewater systems, landfill, roads, drainage, electrical and telecommunications networks.

At Katse village, the village built in Phase 1 to accommodate consultants and contractors working on the project, the works cover the upgrade of existing water and wastewater systems, a landfill site, as well as roads and utilities.

Advance infrastructure comprises temporary and permanent housing and offices, labour camps, main access roads, bulk power supply and telecommunications transmission lines, to be completed before the start of construction of the main works, the Polihali dam and tunnel, in 2020.

The LHDA has also appointed Gauteng-based GA Environment as safety, health, environment and quality auditors for the advance infrastructure of Phase 2.

The Lesotho Highlands Water Project

Picture by Trans-Caledon Tunnel Authority

Source: *Engineering News and LHDA*

2018 Market Intelligence Report', published in March 2018, nonprofit organisation GreenCape identifies Cape Town as one of the urban centres in South Africa where recent efforts to harness the country's groundwater resources are proving successful. The city has developed a sandy aquifer groundwater scheme, with recharge, in Atlantis and Silverstroom. The scheme yields 12-million litres a day. Drilling for groundwater is also under way in the city – at the Cape Flows and Table Mountain Group aquifers.

Drilling for groundwater, however, has not been universally supported, with several commentators suggesting that cheaper and more environment-friendly alternatives should be considered. These include the clearing of alien vegetation in water catchment areas, which the South African Environmental Observation Network calculates could result in as much as 100-million litres of additional water running into the country's dams.

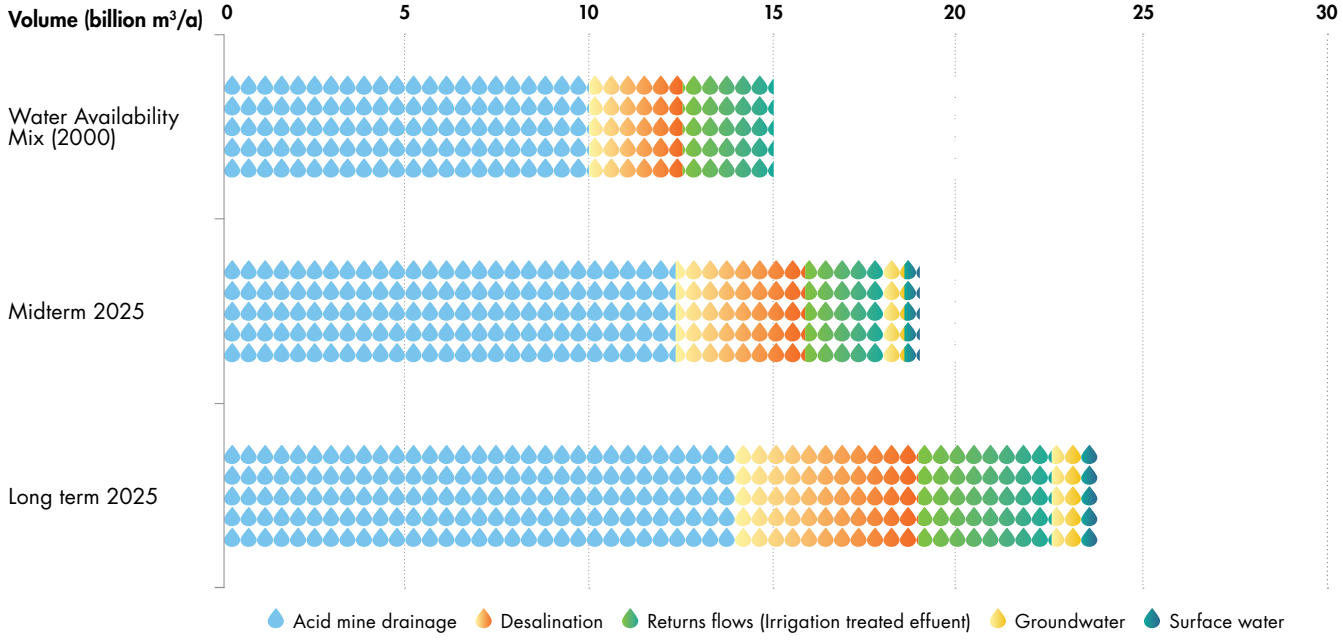
Desalination – which produces potable water by removing salt and other impurities from saline water such as seawater – is increasingly being considered as one of the main solutions to South Africa's water challenge. In recent years, the technology has been successfully deployed on a small scale in coastal towns in the Western Cape, such as Mossel Bay, Saldanha, Knysna, Plettenberg Bay, Bushman's River Mouth and Lambert's Bay. In Cape Town, a temporary desalination plant at Strandfontein produced its first water in May 2018, while similar facilities are being constructed in the city at Monwabisi and the V&A Waterfront. The temporary facilities form part of the first phase of the Western Cape augmentation programme, which aims to deliver a 16-million-litre yield over the next two years.

Permanent desalination plants are being considered in South Africa, as only desalination is totally independent of rainfall. Two to three large-scale projects are expected to be launched in the next five years in the major coastal hubs. Feasibility studies for large-scale plants producing 150-million litres to 450-million litres have been completed for Cape Town and eThekwini, with Nelson Mandela Bay investigating large-scale desalination for future implementation. Inland, the DWS plans to build a desalination plant to treat acid mine drainage (AMD) in the Witwatersrand mining basins.

The department is considering a long-term strategy in which 300-million cubic metres of yearly water supply of 16.39-billion cubic metres by 2040 will be desalinated water, including desalinated AMD.

Questions have, however, been raised about the cost of desalination as a water augmentation option. According to Council for Scientific and Industrial Research calculations,

Projected shifts in South Africa's water supply mix to 2040



Source: Draft National Water and Sanitation Master Plan

in South Africa, the cost of a medium-sized desalination plant is R12 to R18 for 1 000 ℓ of water production capacity, compared with the average cost of surface water schemes of R5 for 1 000 ℓ, which includes bulk infrastructure and treatment.

The cost of desalination plants is influenced by economies of scale, however, with the cost being higher for smaller plants and lower for bigger ones. The degree of salinity and temperature of the water that is desalinated, marine works requirements, network integration costs and the selected procurement method also contribute to the high cost of such plants. In its 'Water Outlook 2018' report, published in May 2018, the City of Cape Town states that, where procurement is properly managed, reputable international companies are convinced to invest and contracting is undertaken through the build-operate-transfer model, the cost of the desalinated water can be less than the international benchmark cost of $1 for 1 000 ℓ. In contrast, it says, projects implemented using the owner-engineer design-build model are prone to cost escalation and have proven to be more expensive, with costs ranging from $2 to $3 for 1 000 ℓ of desalinated water delivered. Therefore, achieving economical outcomes for the development of desalination capacity is especially important. Desalination's other disadvantage is that they take longer to implement than alternative solutions.

Another technology that is showing promise is a technology that produces water from air. The new technology, developed by Israel-based tech company Watergen, was showcased in Cape Town in April 2018, and was selected among hundreds of candidates as one of the World Economic Forum's "technology pioneers" in 2018.

The World Economic Forum's Technology Pioneers community are early-stage companies from around the world that are involved in the design, development and deployment of new technologies and innovations, and are poised to have a significant impact on business and society.

Watergen's atmospheric water generator takes in ambient air through a filter, and cools it to its dew point, extracting water through condensation. The water is then purified, mineralised – ready and safe to drink.

A large-scale unit can extract up to 5 000 ℓ/d, depending on the amount of humidity in the air, and can provide water to about 2 500 people a day. The generator can be installed on a rooftop and connected directly to a building's water grid. While the technology is still more expensive than desalinated water, it provides the cheapest alternative for when desalinated water cannot be used because of bad infrastructure – a problem, which many African countries face.

Yet another option for augmenting available water supply is the treatment of municipal wastewater for reuse. Currently, South Africa treats only about 50% of its municipal wastewater, compared with 90% in Israel, which is well known for its water conservation efforts. Wastewater treatment for reuse is a less costly alternative to desalination, owing to lower capital costs and energy costs of about 2 kWh for 1 000 ℓ of water, compared with 3.50 kWh to 4 kWh for a similar volume of water for desalination, according to the 'Water Outlook 2018' report. A 450-million-litre-a-day plant in Cape Town, for example, could potentially account for only about 7% of the city's electricity consumption.

The report further states that the latest engineering estimate for treating wastewater to potable standards in Cape Town is about R7.50 for 1 000 ℓ, which is slightly more than half the cost of efficient desalination. It adds that the cost of wastewater treatment is correlated to scale, with a 50-million-litre-a-day wastewater treatment plant being about 15% cheaper than a 20-million-litre-a-day facility. A few potable water reuse projects are under way in Cape Town, including an investigation into the upgrading of the Zandvliet wastewater treatment plant into a permanent 75-million-litre-a-day facility.

The DWS's target is for the reuse of treated municipal wastewater to comprise 2.10-billion cubic metres of South Africa's envisaged water supply of 16.39-billion cubic metres in 2040. According to the department's statistics, water reuse accounts for about 14% of currently available resources. Indirect reuse on a large scale takes place inland, in areas such as the Vaal catchment, in Gauteng, where return flows from wastewater plants form part of the downstream raw water abstraction from the same river.

Meanwhile, rainwater harvesting (RWH) – the collection and storage of rainwater for immediate use or for use before the next rainy season – is increasingly being practised in South Africa, especially in rural areas and where municipal systems are failing. A significant advantage of RWH is that it is convenient, as water is stored at the point of consumption, with the owner having full control over how and when the water is used, thus

reducing operating and maintenance costs. Further, the practice has a lower environmental impact than traditional water collection methods such as dams and reservoirs.

Meanwile, a proposal has been made specifically for Cape Town to tow icebergs that break off the Antarctic ice shelf to the city during droughts. Speaking at a seminar at the University of Cape Town, in August 2018, Dr Chris von Holdt, an engineer at Aurecon Asset Management, said using Antarctic iceberg water to boost Cape Town's water supply would be a cheaper alternative to building a big desalination plant. Von Holdt, who has undertaken a technical assessment and economic evaluation of the iceberg proposal, stated that producing 100-million litres of iceberg-derived water a day for any three years over the next 20 years would cost about R3.80-billion. In comparison, a large desalination plant producing the same amount of water would cost about R10.20-billion.

Von Holdt said that, besides the low capital expenditure, towing icebergs from the Antarctic had the added advantage of the short lead times involved. Further, the water would be ordered only when it was needed and the quantity could be increased or reduced in tandem with demand trends, while this solution did not pose the economic risks associated with building large-scale desalination plants. He said that, in Australia, for example, several cities had built large-scale plants at great expense during protracted droughts, but only Perth was still using its plant, while Adelaide had used its plant for only two years.

The iceberg proponents contend that Cape Town is an ideal location for capturing icebergs, as ocean currents carry some of the 140 000 icebergs that break off the shelf each year north towards Gough Island, about 2 700 km from the city. Once an iceberg has been captured, they highlight, the trip back will take two tankers, travelling at 1.50 knots, only about 42 days.

The City of Cape Town has said it needs a detailed costing before deciding whether it will implement this proposal. However, the Water Research Commission (WRC) believes the proposal has merit, with Dr Shafick Adams, an executive manager at the commission, saying at a seminar in September 2018 that it was expected that, in 20 years, countries would be towing icebergs from the Antarctic to supplement their water supplies. He suggested that South Africa would lose out to other countries, if it did not become one of the first countries to be involved in this initiative.

Early efforts to evaluate the proposal are already under way, with Cape Town maritime expert Nick Sloane having established the Southern Ice Forum, which consists of experts from several countries who are specifically investigating the feasibility of the proposal. It is envisaged that the icebergs, wrapped in textile insulation skirts to prevent melting, will be dragged towards Cape Town by a supertanker and tugboats using prevailing ocean currents. The icebergs, carefully selected by drones and radiography scans, would be about 800 m long, about 450 m across and up to 230 m deep, with a flat, tabletop surface. Melted water could be gathered each day using collection channels and a milling machine.

Farmers challenge policy on water rights transfer

West Coast launched an urgent application in the Western Cape High Court in October 2018 concerning water rights, which may have far-reaching consequences for agriculture.

The court action was prompted by a January 2018 Department of Water and Sanitation circular barring irrigation boards from approving the transfer of water rights from one farm to another in a board's area of jurisdiction, which the boards had been doing for years, reportedly with the knowledge of the department.

Farmers are concerned that if the system might fail if decisions about water rights transfers were to be taken by a few officials in Pretoria instead of irrigations boards with intimate knowledge of the situation in their areas of jurisdiction.

The court proceedings were launched by Wittewater Boedery and Groot Winterhoek Koelkamers, which have farming operations near Piketberg, about 8 km east of Saldanha Bay, in the Western Cape.

Picture by Bloomberg

Source: News24Wire

The forum believes that it can supply an iceberg that will yield 100-million litres of water a day to Cape Town for a year. This equates to 15% to 20% of the city's requirements. According to Sloane, all that is required for the project to get under way is for the South African authorities to sign an agreement committing them to buying the water. Swiss funders have agreed to pay for the project. He estimates that it would cost $100-million to haul an iceberg on a journey that could take up to three months and another $50-million to $60-million to harvest the water for one year as it melts.

In a new development, the City of Cape Town has announced that stormwater is set to become a new water resource. Instead being lost down gutters and into the sea, stormwater will be kept and used. How much of it will be incorporated into the water system, or how much of it will be captured is still in the planning stage.

The first step in being able to use stormwater as a water resource is to move stormwater and river management out of the city's transport department and into the water department, which has already been done. The next step comprises the management of all water within the urban water cycle.

However, the initiative is a complex one, as City of Cape Town Deputy Mayor Ian Neilson has noted. "Stormwater and rain harvesting on a large scale is an incredibly intricate and complicated process with many legal, practical, budgetary, infrastructure and other considerations."

Nonetheless, if Cape Town can retain 20% of winter rainfall through stormwater capture and rainwater tanks this will add between 10% and 15% more water for use in the summer months.

In terms of demand, as is the case elsewhere in the world, agriculture is the biggest water-consuming sector in South Africa, accounting for 66% of total withdrawals, according to the DWS. In volume terms, this amounted to nine-billion cubic metres in 2015. The second-biggest user is the municipal sector, which supplies industrial, commercial and domestic customers and accounts for 27% of withdrawals, or 4.45-billion cubic metres in 2015. The mining and bulk industrial sectors, which, together, are the third-biggest user, consumed 876-million cubic metres in 2015, while forestry and power generation consumed 431-million cubic metres and 362-million cubic metres respectively.

In their 'A Delicate Balance: Water scarcity in South Africa' report, published in March 2018, the Institute for Security Studies (ISS) and the WRC forecast that agriculture will remain the sector responsible for most of South Africa's water withdrawals. However, they forecast that, should current trends continue, the sector's demand would increase by only about 0.5 km^3 from 2017 levels by 2035. By then, agriculture's proportion of total withdrawals would be 58%. The biggest increase in demand – of 1.30 km^3 from 2017 levels – is expected to be posted by the municipal sector, driven by South Africa's growing and rapidly urbanising population, rising incomes and an increase in the percentage of the population with access to piped water. By 2035, municipal demand will account for 32% of total withdrawals, compared with the bulk industrial sector's 10%.

NONREVENUE WATER

One of the major challenges facing the South African water sector is NRW, which is defined as the difference between the amount of water in the distribution system and the amount billed to consumers. Senior official at Gauteng water board Rand Water Samuel Molekoa said in May 2018 that the proportion of NRW in the country had increased from 36.80% in 2012 – which was in line with the world average – to 41% in 2017. In volume terms, this equates to 1.66-billion cubic metres. At a unit cost of R6/m^3, this amounts to a revenue loss of about R9.90-billion a year.

South Africa's NRW is much higher than in other water-stressed countries, such as Australia, where the figure is about 10%. The ISS and the WRC calculate that, to reduce NRW to the same level as that of Australia, South Africa needs to reduce its water withdrawals by about 1.10 km^3/y.

NRW is attributable to physical losses caused by leakage owing to poor operation and maintenance, commercial losses caused by meter tampering and other forms of water theft, as well as unbilled authorised consumption, which includes water used for emergency purposes such as firefighting. Physical losses are the largest contributor to NRW, accounting for 35% of all the water that is distributed by South Africa's 257 municipalities, according to the DWS's draft National Water and Sanitation Master Plan (NW&SMP). The percentage of water lost through leaks in South Africa compares with global best practice at 15%.

The high proportion of water lost through leaks is attributable to the state of the country's water infrastructure. In its '2017 Infrastructure Report Card', the South African Institution of Civil Engineering (Saice) ranks the water supply infrastructure in major urban centres at C+ and in small towns and rural areas at D–. A 'C' symbol indicates that the infrastructure is in satisfactory condition, although it becomes stressed at peak periods, while a 'D' symbol indicates that it is not coping with demand and is poorly maintained.

To address the challenge of water leaks, the DWS launched its five-year War on Leaks (WoL) programme in 2015 to train 15 000 South Africans under the age of 35 as plumbers, instrument technicians, fitters and turners, electricians and water agents in three phases, with the third phase concluding in the 2017/18 financial year.

However, online publication TimesLive reported in July 2018 that only 10 000 trainees had been enrolled and that technical colleges that were owed money by the DWS were barring trainees from entry. *Engineering News* cited Water and Sanitation Minister Gugile Nkwinti during the same month as saying that the programme had been affected by a shortage of funds, as it did not have a specific budget. The Minister said he had transferred the programme to the department's Infrastructure Build, Operate and Maintenance branch, formerly the National Water Resources Infrastructure branch. Under this arrangement, the branch would finance the programme as part of its mandate to maintain infrastructure. Nkwinti added that payment had been made available to colleges, ensuring that first-phase-intake trainees would register for trade tests and complete their training.

Nkwinti added that a shortage of qualified mentors in some of the targeted municipalities was affecting the capacity of those municipalities to absorb the trainees for workplace training. Consequently, 106 trainees – or 7% of the Phase 1 enrolment – had still to be placed at the beginning of July 2018.

WATER AND SANITATION INFRASTRUCTURE

South Africa's water and sanitation infrastructure, comprising dams, bulk abstraction and conveyance facilities, as well as treatment plants and distribution networks, has a book value of R584-billion and a capital replacement value of R1.36-trillion, according to calculations by the DWS, which owns much of the

infrastructure. The department's asset register features 1 070 km of pipe network and 8 100 km of canal systems, as well as 320 dams, which, while representing only 6% of the dams in South Africa, account for 86.40% of the country's retained water.

The major water and sanitation infrastructure is ageing and its condition has been exacerbated by inadequate maintenance and a lack of ongoing capital renewal. According to the draft NW&SMP, South Africa currently invests R42-billion in bulk water infrastructure each year, with R1.50-billion and R13-billion invested in ecological infrastructure and sanitation infrastructure respectively. This total investment of about R56.50-billion a year falls far short of the required R89.90-billion. In the next decade, according to the document, South Africa must invest R899-billion in its water and sanitation infrastructure. This funding requirement includes a critical refurbishment of more than R53-billion for water supply alone, caused by a lack of maintenance.

The South African government's long-term planning involves significant investments to increase dam capacity and distribute water to cities, towns, farms and mines. In the next three years, former Finance Minister Malusi Gigaba said when he presented the National Budget in the National Assembly in February 2018, R91.60-billion would be invested in extending, upgrading and maintaining water infrastructure, while an additional R34-billion would be invested in water services, mostly through municipal grants.

Major water projects under construction include the R2.10-billion first phase of the Mokolo River and Crocodile River Water Augmentation Project, which is being implemented by the Trans-Caledon Tunnel Authority (TCTA), an agency of the DWS, and involves the construction of

a pumpstation and a 43-km-long pipeline, in Limpopo, to augment water supply to coal-fired power stations, mining operations and a growing population. Also in Limpopo, the TCTA is implementing the R3.40-billion Phase 2C of the Olifants River Water Resources Development Project, which entails the construction of bulk distribution works from the Flag Boshielo dam to Mokopane, Steelpoort to Mooihoek, Mooihoek to Olifantspoort, and Nebo Plateau to Roossenekal.

The DWS itself is implementing several bulk water infrastructure projects, the biggest of which is the multiphase Vaal Gamagara scheme, in the Northern Cape, for which R18-billion has been budgeted. Launched in 2016, it involves the upgrading of a raw water pumpstation, purification works, six booster pumpstations, several reservoir facilities and a pipeline network of about 470 km. The scheme aims to ensure purified bulk water supply for mining, industrial and domestic use to 2040. Also under construction is the R1.70-billion Mogalakwena project, in Limpopo, which involves the upgrade of boreholes and the construction of a new bulk water scheme.

Among the major planned projects are phases 2B and 2G of the Olifants River Water Resources Development Project, which are at the feasibility study phase. The project will cost an estimated of R13.10-billion to implement.

Another major DWS project at the feasibility study stage is the R5-billion Lusikisiki Regional Water Supply Scheme, in the Eastern Cape, which will involve the construction of the Zalu dam, on the Xura river.

WATER INFRASTRUCTURE FUNDING

According to the DWS's National Investment Framework for the Water Sector, South Africa needs to invest R70.40-billion a year in water services infrastructure and an additional R19.50-billion a year in sanitation infrastructure, bringing the total requirement to R89.90-billion a year – which is just under the R91.60-billion allocated for water infrastructure over the medium term when former Finance Minister Malusi Gigaba presented the National Budget in February 2018. Actual expenditure patterns, however, will be influenced by specific development targets, such as eradicating basic services backlogs by 2019, improving the reliability of supply to 90% by the same year and implementing the second phase of the LHWP. Investment needs will also be influenced by climate change and whether water resource management, as well as water conservation and demand management, improve.

Municipalities, which received only R24.70-billion from water sales in the 2017/18 financial year, are unable to fund the water and sanitation infrastructure investment deficit. As a result, government provides several water service capital grants. However, grant funding has been inadequate and calls have been made for private-sector involvement. In January 2018, former Water and Sanitation Minister Nomvula Mokonyane conceded that government, on its own, could not afford the investment required in the water and sanitation sector, where much of the infrastructure has been operational for five or more decades. She called for partnerships between government and the private sector.

Infrastructure investment company Gaia Infrastructure Partners chief investment officer Mich Nieuwouldt supports Mokonyane's proposal, suggesting that government could provide private companies with exclusive rights to supply water, treat sewage and maintain the pipe network in a specific area for agreed periods of up to 30 years. There are numerous examples of such arrangements in developed and developing countries, one of which is Chile. The South American country had very few wastewater plants and treated only about 15% of its sewage in the late 1990s. When the country decided to treat at least 90% of sewage by 2010 – which required an estimated investment of $4-billion – it offered predominantly European investors strategic stakes in 13 public water companies. As a result, it currently treats almost 100% of its sewage and is recognised as a world leader in wastewater treatment.

Private-sector funding of water and sanitation infrastructure is, however, not new in South Africa, with Singaporean company Sembcorp having bought out the owners of two projects – one in Mbombela, in Mpumalanga, and the other in iLembe, in KwaZulu-Natal – in 1999. According to Nieuwouldt, despite initial setbacks, the two projects have been successful and have been awarded the DWS's Blue Drop and Blue Green certification for excellence in water supply and sewage treatment respectively.

Nieuwouldt believes that the South African government will succeed in attracting private investment in water and sanitation infrastructure if it introduces a transparent framework that is similar to the Department of Energy's internationally acclaimed Renewable Energy Independent Power Producer Procurement Programme (REIPPPP), in

terms of which the power purchase agreements that power producers sign with State-owned utility Eskom are guaranteed by the National Treasury. This means that the independent power producers' investments have the same low level of default risk as government bonds. Investor confidence in the REIPPPP, which was launched in 2011, combined with the reduced levels of perceived risk, has resulted in lower renewable-energy prices, with the cost of solar and wind having fallen by 68% and 42% respectively since the first round of the programme.

Estimated water-sector capital investment needs

Ten-year infrastructure cost (R-billion) as at January 2017	New	Upgrade	Rehabilitation	Total
Internal	39	22	58	119
Connector: potable	22	13	56	91
Local bulk	25	14	29	68
Regional bulk	47	13	41	101
Connector: nonpotable	14	3	53	70
Water resources	145	26	84	255
Total: Water	**292**	**91**	**321**	**704**
Sanitation	89	42	64	195
Total: Water Sector	**381**	**133**	**385**	**899**

Source: Department of Water and Sanitation

WATER QUALITY

The DWS has not compiled its Blue Drop and Green Drop reports – which monitor the quality of drinking water supplied by the South Africa's municipalities and the state of wastewater treatment plants respectively – since 2013 and 2014. The results of those surveys were released in January 2017 and showed that drinking water quality had declined from 87.60% to 79.60%, while only 60 of the country's 824 wastewater treatment plants were in an 'excellent' condition, with the condition of 248 facilities described as 'critical' and that of 161 as 'poor'.

Speaking to a journalist in November 2017, DWS spokesperson Mlimandlela Ndamase insisted that the water consumed by South Africans was of a high quality, although, in some municipalities, quality had been compromised by a shortage of the requisite skills. However, he conceded that the deteriorating management of wastewater treatment plants in various municipalities was a concern. Consequently, he said, as part of the Back to Basics programme of the Department of Cooperative Governance and Traditional Affairs, support was being provided for 27 municipalities.

While the DWS has not published Blue Drop and Green Drop reports since January 2017 (for studies conducted in 2013 and 2014), rights organisation Afriforum has been conducting its own surveys and publishing its own reports. The latest reports, covering municipalities in Limpopo and the northern part of Gauteng, were published in May 2018 and were based on tests conducted the previous month. The tests showed that most of the water supplied in Limpopo towns was clean, while the sewage water in seven towns in that province did not comply with the stipulated microbiological standards. Meanwhile, water in northern Gauteng, supplied by the Tshwane metropolitan municipality, was found to be clean, while six sewage treatment plants in the region did not comply with the stipulated standards.

The organisation conducted tests on drinking water supplied by 156 municipalities countrywide and found that the drinking water in three towns did not meet the national standards, with 59 of the tested 88 sewage water systems not meeting set standards.

Meanwhile, members of the National Assembly's Portfolio Committee on Water and Sanitation said in August 2018 that they were concerned about the level of pollution in the 14-dam IVRS, which supplies water to Gauteng and parts of Mpumalanga, the Free State and the North West. Their statement was made following a visit to the IVRS, and committee chairperson Mlungisi Johnson blamed the pollution on a lack of maintenance of infrastructure by municipalities in the Vaal Triangle region. He singled out the Sedibeng district and Emfuleni local municipalities – both of which are facing the challenge of crumbling water and sanitation infrastructure – as the main polluters.

The pollution in the IVRS is so serious that the DWS announced in August 2018 that it was working with the Gauteng provincial government and Rand Water to help the Sedibeng and Emfuleni municipalities stop the pollution by ensuring that the water and sewerage systems in the region were functioning properly.

Meanwhile, a study whose results were released in July 2018 found that drinking water in the Gauteng metros of Johannesburg and Tshwane was contaminated with microplastics – bits of plastics less than 5 mm in size.

Microplastics were also found in rivers and boreholes in the province, as well as in the North West. It has yet to be established if microplastics have any deleterious effects on human health, but there is concern that toxic chemicals might be ingested with the microplastics, as one of the characteristics of plastic is that pollutants are trapped on the outside and are absorbed by it. It is mostly pollutants that do not have an affinity for water, such as the insecticide DDT, which are trapped on the outside of plastic.

According to the study, which was commissioned by the WRC and undertaken by researchers at North West University, the primary sources of microplastics are plastic pellets used as a raw material by the plastics industry and microbeads used in the cosmetics industry and in some toothpastes.

The Department of Environmental Affairs announced in August 2018 that it had established a task team comprising its own officials and those from the departments of Trade and Industry, Health, and Science and Technology to study the possibility of gradually banning the manufacture or importation of microbeads, which were among the microplastics found in rivers, boreholes and tap water in Gauteng and the North West. Canada, France, New Zealand, Sweden, Taiwan, the UK and the US have already introduced legislation banning microbeads, which are added to a variety of toiletries, including shower gel, toothpaste, facial scrubs and exfoliants. India, Ireland and Italy are considering a similar course of action.

SKILLS

A skills gap analysis conducted by the WRC in 2015 identified a significant shortage of skilled professionals in all major institutions in the water sector. According to the analysis, there was a 30% shortage at the DWS and a 36% shortage at catchment management areas. Shortages were also identified at water boards and municipalities.

The study, however, showed that the number of people graduating with civil engineering degrees had doubled from 1 000 to 2 000 a year from 2010 to 2015; however, it did not indicate how many of the new graduates sought employment in the water sector. The number of people graduating with other qualifications relevant to the water sector also increased between 2010 and 2015, and there was no longer a shortage of science graduates in the water sector. However, the study noted that municipalities, especially those in rural areas, still faced a shortage of qualified and experienced professionals in not only technical disciplines but also the legal and financial fields.

Meanwhile, in its nonfinancial census of municipalities for the year ended June 30, 2017, which was published in June 2018, Statistics South Africa (Stats SA) noted that, for the period under review, there was a vacancy rate of 15% in South African municipal water and wastewater management departments. However, many commentators believe that the DWS's WoL programme, which aims to train technicians and other water-sector workers, will go a long way towards reducing the vacancy rate.

The South African government has, in recent years, resorted to recruiting foreign professionals to help address the country's shortage of water-sector professionals. Through the DWS, it hired 35 Cuban water engineers, geohydrologists, hydrologists and water supply specialists in 2015 to work in all the country's nine provinces on two- to three-year contracts. In September 2017, Deputy Water and Sanitation Minister Pamela Tshwete announced that she had signed an agreement with Cuba's Institute of National Hydraulic Resources (INHR) to extend the South Africa-Cuba cooperation agreement to 2023. Speaking at the signing ceremony, INHR first VP Bladimir Matos Moya said the Cuban professionals working in the South African water sector had requested the DWS to identify its training needs so that these could be addressed.

The agreement with Cuba, as well as another one with Italy, which former Water and Sanitation Minister Nomvula Mokonyane signed with Italian Deputy Environmental Minister Barbara Degani in 2016, aims to enhance capacity building in the South African water sector, has been criticised by various stakeholders. One of the main detractors is former South African Institution of Civil Engineering (Saice) CEO Manglin Pillay, who was cited by the website Civilsonline in an article published in January 2018 as claiming that South Africa was better equipped than Cuba to deal with this country's water supply challenges. He said more than 50% of the available water in Cuba was lost through leaks in its dilapidated water infrastructure, compared with about 41% in South Africa. Stating that he had obtained this information from a news report from Qatar-headquartered television channel Aljazeera, he added that Cuban State officials had to manually change the flow of water in pipes daily to ensure an equal divide between homes and neighbourhoods.

Pillay stated in the same article that South Africa had suitably qualified civil engineers who were more familiar with the situation in this country than the Cubans. He added that the cultural and linguistic differences between the Cubans and South Africans were a major hindrance to the Cubans' training role.

Consulting Engineers South Africa CEO Chris Campbell agreed with Pillay's view, stating that South African engineers were only 83% used, indicating that there was more than enough local capability. He added that South Africa had more experience than Cuba in the water sector, with this country's WRC having been in existence for 20 years longer than the INHR. Further, whereas South Africa had more than 500 dams, about 1 000 treatment plants and many thousand kilometres of water pipeline, Cuba had only 241 dams, 59 water treatment plants and about 19 km of water pipeline network.

WATER TARIFFS

South African municipalities either buy untreated, which they then treat themselves, or treated bulk water which they distribute to final consumers and charge a retail tariff. In general, municipalities have separate tariffs for residential, commercial, industrial and agricultural customers.

According to the DWS, the water and sanitation tariffs charged by the municipalities are generally inadequate to cover the costs of rendering these services, and this necessitates implicit subsidies from the fiscus. The agriculture sector, according to the department, pays particularly low tariffs, which places increased responsibility on not only the fiscus but also other water consumers.

Against this background, the DWS states in its draft NW&SMP that the current pricing strategies for water and sanitation services should be reviewed so that the tariffs are cost reflective based on life-cycle costs. It further proposes that, as the South African water sector is not sustainable, tariff increases exceeding the country's inflation targets should be introduced to address the historical undervaluation of water and sanitation services in the country. The draft master plan, however, states that the new tariff structure resulting from the review should take into account the socioeconomic situation of users to ensure that water and sanitation remain affordable to all South Africans. Where subsidised consumers exceed their free basic allocation, it recommends that they pay for the excess amount.

While water and sanitation tariffs remain below the cost of rendering these services, the tariff increases have been more than double consumer price inflation for the past seven years, according to the DWS. This is owing to rising costs, especially the cost of electricity, and a long-overdue adjustment to the historical underevaluation of water and sanitation services. Most municipalities, however, have been reluctant to significantly increase water tariffs for equity and political reasons.

Drought situations have had implications for municipalities' water and sanitation tariffs in that, during a drought, water consumption decreases, which may lead to a reduction in revenue.

Big water debt is another issue facing municipalities. The DWS told the Portfolio Committee on Water

DWS to establish licensing body, advisory council

The Department of Water and Sanitation (DWS) plans to establish a Schedule 3 institution to accelerate the issuing of water-use licences.

Water and Sanitation Minister Gugile Nkwinti expressed his intention to establish the licensing body, during a Ministerial Innovators Interactive Session that was hosted in Gauteng, in November 2018.

"The delay [in] the issuing of the licences to businesses, especially emerging farmers, can no longer be tolerated. Government should not be seen as a stumbling block to enthusiastic entrepreneurs who wish to contribute towards the country's economic development," he said in an address to about 400 delegates at the event.

Nkwinti also announced his intention to appoint a Ministerial Advisory Council before the end of December.

The proposed council will comprise water experts, water scientists and civil engineers, and will advise the Minister on matters pertaining to the work of the Ministry and the DWS.

"This matter of the department working in solo mode must come to an end. I want to remove all bureaucratic processes so that the department can deliver its mandate without any further delay," he said

Source: *Engineering News*

and Sanitation in November 2018, that, despite interventions since November 2017, municipalities had run up their water bills to R13.10-billion – an amount just R2-billion short of the entire yearly budget of the DWS. Of this, municipalities owe water boards R8.60-billion and the water boards, in turn, owe the DWS R4.50-billion.

Government and provincial departments also owe a portion of the R13.10-billion debt.

Moreover, the problem is getting worse. Between March and September 2018, municipal water debt increased by R1.70-billion.

Over the past year the DWS issued 63 summonses to municipalities, and had taken seven to court, where the department won the cases. Forty-seven started paying their accounts.

The consequences of big water debt are serious, as the DWS and South Africa's water boards do not have enough money for the necessary refurbishment of water infrastructure and to deal with important issues such as water pollution.

An interministerial task team, established in December 2017, to deal with municipalities' nonpayment for electricity, was extended to include nonpayment of water bills. "Because of deep-rooted problems in municipalities it is no surprise that those that owe Eskom are the same municipalities that owe water boards," the DWS's Paul Nel said.

It was decided that an advisory panel of water experts be established. The task team is currently identifying experts and establishing terms of reference for the advisory panel.

WATER AND ENERGY

Water and electricity are entwined, as the use of one depends on the availability of the other.

In coal-fired power stations, which account for more than 90% of South Africa's electricity generation capacity, water is boiled to produce steam, which turns turbines to generate power. The cooling process, which converts the steam back into water, is the dominant water user. Water is also used to wash the coal.

The raw fresh water used in State-owned electricity utility Eskom's baseload coal-fired power stations in the inland provinces of Mpumalanga, Limpopo and the Free State is drawn from the Vaal River Eastern Subsystem (VRESS), which is supported by a pipeline from the Vaal dam, the Vaal River Eastern Subsystem Augmentation Project (Vresap), and several smaller schemes. The Vresap pipeline delivers a maximum of 160-million cubic metres of water a year.

Eskom's water-use licence on the VRESS, entitling the utility to draw 360.30-million cubic metres a year, expires on October 31, 2025, but can be renewed on a five-year interval basis. The licence includes 11 power stations and possible water use at the proposed Majuba underground coal gasification plant, in Mpumalanga.

Over the past ten years, Eskom has used an average of 320 000 Mℓ/y of water – equivalent to about 2% of available resources – at its coal-fired power stations, as well as at the Koeberg nuclear power station, in the Western Cape. Consumption, however, is forecast to decrease in the future as new dry-cooled power station units come on line. Studies have demonstrated that water use in dry-cooled coal-fired power stations can be as little as 100 ℓ/MWh of electricity produced, compared with the 183 ℓ to 226 ℓ required to produce the same amount of electricity in wet-cooled power stations. It is expected that, when all the units at the Medupi and Kusile power stations, being built in Limpopo and Mpumalanga respectively, have been completed, the contribution of dry-cooled net generation capacity will increase to about 18 000 MW of Eskom's nominal coal-based generation capacity of about 41 900 MW.

While greater use of dry-cooling technology will reduce the amount of water used for cooling purposes, proposed air quality standards, which are significantly stricter than current ones, will require Eskom to install water-intensive plants. The proposals, which have been gazetted by the Department of Environmental Affairs and are due to take effect in April 2020, state that industrial facilities will be permitted to postpone compliance only once, and after a five-year period, as opposed to the rolling postponements they are currently allowed. This means Eskom will have to be compliant with the stricter air quality standards by 2025. Johannesburg-based daily Business Day cited Eskom in July 2018 as saying that it would require an additional 67-million cubic metres a year by 2025 for it to comply with the new standards.

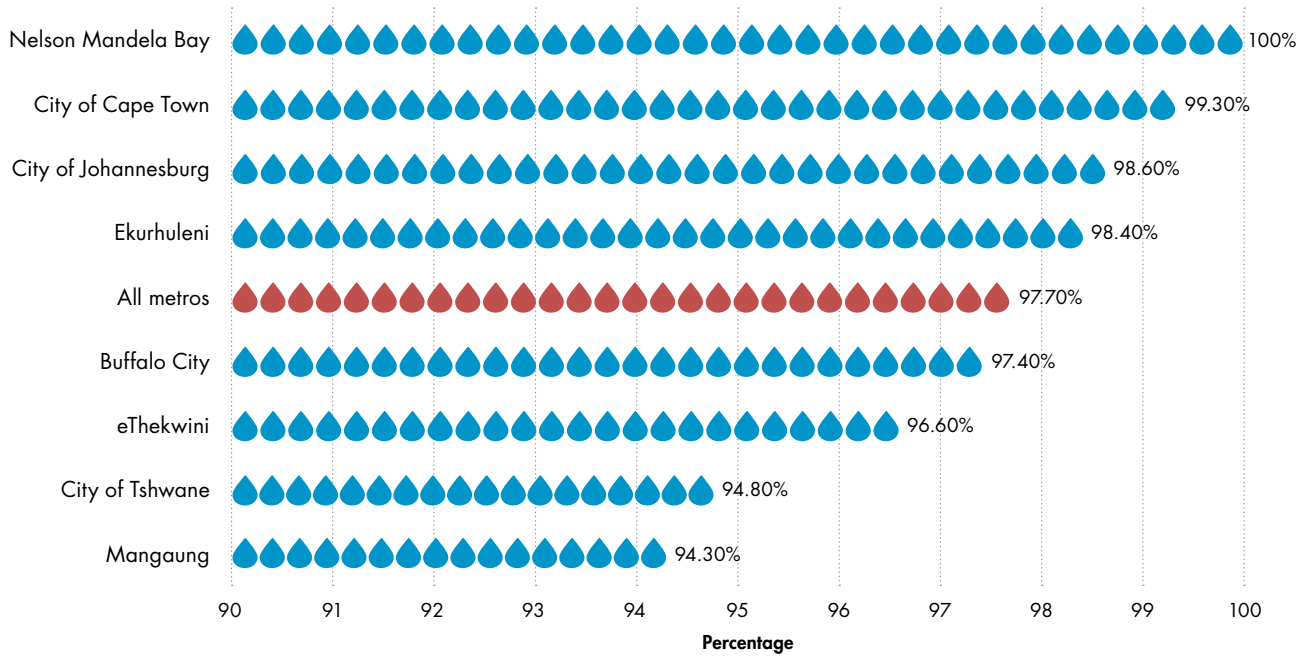
While water use in South Africa's power stations comprises only 2% of total consumption at national level, consumption varies by region, with electricity generation accounting for 37% of water use in the Upper Olifants, in Limpopo, for example, according to a report compiled by environmental lobby organisation Life After Coal, which was released in July 2018.

Besides the water used in power stations, significant volumes are also used in the coal mining sector, where, according to Life After Coal's calculations, on average, 0.47 m^3 is needed for every ton produced. This comprises 0.16 m^3 for extraction, 0.04 m^3 for dust control and 0.04 m^3 for coal washing, with about 0.20 m^3 lost through evaporation.

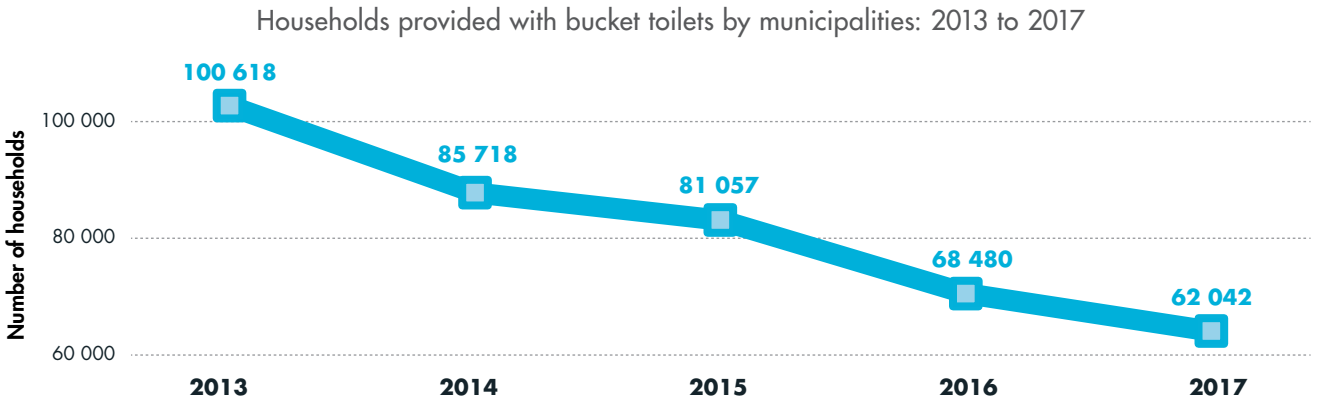
The entire coal value chain impacts on the quality of water resources. In underground and surface mining, groundwater is pumped out to dry the mined area, which not only impacts on the groundwater but also lowers the water table and damages ecosystems. In addition, as coal mining is associated with sulphide strata, these sulphide minerals oxidise when they come into contact with water and oxygen during mining, resulting in decreased pH values and increased salt concentrations. This further increases the solubility and mobility of metals, often increasing concentrations to toxic levels. This acidic water, commonly known as acid mine drainage, together with the metals it contains, leaches into groundwater and eventually discharges into streams and rivers. The South African government is implementing initiatives to treat AMD in Gauteng and, in 2016, proposed a new levy on mining companies that would partly finance AMD treatment.

Meanwhile, the global move towards renewable energy has created an environment where hydropower projects are environmentally and financially attractive, owing to the existence of suitable infrastructure. South Africa has several hydropower projects. These include pumped-storage schemes, namely the Ingula (1 332 MW), Drakensberg (1 000 MW), Palmiet (400 MW) and Steenbras (180 MW) schemes. The country also has conventional schemes at the Gariep, Vanderkloof and Mbashe dams, as well as several small-scale schemes. Conventional schemes do not consume any water, other than what is released to meet downstream environmental and other requirements. Pumped-storage schemes require only some augmentation to compensate for evaporation losses, after the initial storage of water for the system.

Percentage of households with access to piped or tap water in their dwellings, off-site or on-site by metropolitan during 2017



Source: Statistics South Africa



Source: Statistics South Africa

WATER REGULATION AND PLANNING

South Africa's Constitution grants every citizen the right to have access to water. Key pieces of legislation governing water resources in the country are the Water Services Act (WSA) of 1997 and the National Water Act (NWA) of 1998. The former regulates the water and sanitation services provided by municipalities, while the later, whose promulgation effectively transferred water ownership in the country to the State – with the DWS as the primary responsible authority – regulates various activities in the sector. These include the protection, use, development, conservation, management and control of water resources.

The policies governing the water sector include the National Development Plan, which was launched in 2012 and provides a detailed blueprint on how South Africa can eliminate poverty and reduce inequality by 2030. The plan contains an aspiration for all South Africans to have affordable, reliable access to safe water and sanitation 12 years from now. Other water-sector policy provisions are articulated in the five-yearly National Water Resource Strategy (NWRS), which includes estimates of water requirements, the quantity available and the resulting water balance in each of the country's catchment management areas. The latest NWRS was, however, last updated in 2013, and commentators say this may lead to flawed analysis and an underestimation of the severity of the water challenges confronting the country.

The DWS is reviewing the WSA and the NWA to consolidate them into a National Water Act that clarifies roles across the water and sanitation value chain, with common targets for water delivery and sanitation. The new Act will also be more aligned with the Municipal Systems Act of 2000 and the Municipal Finance Management Act of 2003.

Another major legislative change under way involves the consolidation of South Africa's 12 water boards into nine regional utilities, each serving one of the country's provinces. It is envisaged that the process will take several years. However, work is already under way to establish the first provincial water board, the KwaZulu-Natal Water Board, with former Water and Sanitation Minister Nomvula Mokonyane having published in the Government Gazette in November 2017 government's intention to merge Umgeni Water and Mhlatuze Water into the new entity.

Mokonyane said in the Government Gazette notice that the rationale behind creating fewer, stronger water boards with larger geographic footprints was that the new entities would be more effective in financing, managing and delivering regional water infrastructure and supporting municipalities in providing water services. This, she explained, would result in more effective service delivery and cross-subsidisation, especially in rural areas.

Mokonyane added that the realignment of water boards in KwaZulu-Natal was also intended to address the water service challenges attributable to the limited capacity of the uThukela Water Partnership, a regional municipal utility that was established to serve the uThukela, Amajuba and uMzinyathi district municipalities. It would also align the roles and responsibilities of water user associations and irrigation boards to minimise the duplication of functions among

the various entities that report to the Minister of Water and Sanitation.

Meanwhile, the DWS is leading efforts to develop the NW&SMP, the main purpose of which is to give an overall perspective on the water and sanitation business to provide a comprehensive schedule of the actions needed to address current challenges, estimate the investments required to ensure that there are adequate water resources and sanitation services, and facilitate integrated investment planning. During a presentation to Parliament's Portfolio Committee on Water and Sanitation, in August 2018, DWS officials said the NW&SMP, which has received Cabinet support, would be refined in consultation with stakeholders during a proposed

South African women wait in line to fill buckets from a communal clean water source

Picture by Reuters

mini-Phakisa, which they said would be held at the end of February 2019 at the latest.

ACCESS TO WATER AND SANITATION

Notable success has been achieved in providing all South Africans with access to water and sanitation since the advent of the democratic dispensation in 1994.

According to Stats SA's latest yearly General Household Survey (GHS), 88.60% of the country's 16.20-million households were served with piped or tap water in their homes or on or off their premises in 2017. Although a marginal decline from 89% in 2016, this represented a sizeable improvement from 84.40% in 2002. The Western Cape had the highest access rate of 98.70%, followed by Gauteng (97.10%), the Northern Cape (96%), the Free State (92.80%), the North West (85.80%), Mpumalanga (85.50%), KwaZulu-Natal (84.50%), Limpopo (74.70%) and the Eastern Cape (74.20%).

Stats SA's 2017 GHS also shows that much progress has been made in sanitation provision. Nationally, 82.20% of households had access to improved sanitation facilities, defined as flush toilets connected to a public sewerage system or a sceptic tank with a ventilation pipe. This represented an improvement from 61.70% in 2002 and 81% in 2016.

The Western Cape and Gauteng had the highest number of people with access to improved sanitation facilities, at 94.10% and 90.50% respectively, followed by the Northern Cape (87.70%), the Eastern Cape (85.30%), the Free State (85.10%), KwaZulu-Natal (80.80%) and the North West (71.30%). Access was lowest in Mpumalanga and Limpopo, at 67.60% and 58.90% respectively. In terms of metropolitan areas, access was highest in Johannesburg, at 95.10%, followed by Buffalo City (93.60%), Nelson Mandela Bay (93.50%), Cape Town (92%), Mangaung (90.90%), Ekurhuleni (90%), eThekwini (83.40%) and Tshwane (82.30%).

Despite the improvement in the provision of sanitation facilities, many households continue to lack access, with 62 042 families countrywide relying on bucket toilets during 2017. Although the number is still high, there has been a progressive decline over the years – from 100 618 in 2013 to 85 718 in 2014, 81 057 in 2015 and 68 480 in 2016 – according to Stats SA's 'Nonfinancial Census of Municipalities 2017', which was published in June 2018. However, according to the DWS, most of the families that still use this form of sanitation live in informal settlements, with only 11 001 being formal settlement dwellers.

Speaking in the National Assembly in November 2017, Mokonyane said only municipalities in the Free State and the Northern Cape still provided this form of sanitation, adding that government was struggling to eradicate the system, owing to budgetary constraints. She said the department needed R741-million to eradicate the system in the two provinces, but had received no allocation for this from the National Treasury for the 2017/18 financial year. The lack of funding had resulted in the department's redirecting R409-million from the Water Sector Infrastructure Grant and the Accelerated Community Infrastructure Programme towards the bucket system eradication programme.

While Mokonyane stated in her November 2017 presentation that bucket toilets were still in use in formal settlements only in the Free State and the Northern Cape, Stats SA deputy director-general Joe de Beer reported in June 2018 that only municipalities in Gauteng, KwaZulu-Natal and Limpopo had eradicated bucket toilets. The Western Cape and the North West, he added, had reported increases of 11.40% and 4% respectively in the use of bucket toilets during 2017. Decreases of 15%, 12.70% and 6.90% had been reported in the Eastern Cape, the Northern Cape and the Free State respectively.

Meanwhile, the Nelson Mandela Bay municipality, in the Eastern Cape, reported in May 2018 that it had managed to reduce the number of bucket toilets in the metro from 30 000 in April 2015 to only 8 562. After missing an initial target of eradicating the system by December 2017, the metro set a new deadline of June 2018. However, resistance to the provision of temporary communal toilets in place of bucket toilets by community members who believed this meant they would live in informal housing for the foreseeable future threatened the attainment of this deadline.

Government initially set a 2006 deadline to replace bucket toilets but missed it. A subsequent deadline of 2015 was also missed.

Outlook

Climate change impacts in South Africa will likely be felt primarily through impacts on water resources. According to the Council for Scientific and Industrial Research (CSIR), these will include longer droughts in the western parts of the country and the arid interior and rainfall becoming more intense in the north and the eastern interior, resulting in flooding.

In the Western Cape, which bore the brunt of the droughts that affected South Africa in the past three years, drier conditions could be experienced until the 2040s, according to climate experts from the CSIR, the Alliance for Collaboration on Climate and Earth Systems Science, the South African Weather Service, the South African Environmental Observation Network, the Agricultural Research Council and the universities of Cape Town and Pretoria.

However, the Western Cape is not the only province that faces an uncertain future from a water security point of view. As Institute of Security Studies senior researcher Zachary Donnenfeld highlighted in an article published in the Daily Maverick in February 2018, it is not clear how much rainfall the country will receive over the coming decade. What is clear, he said, was that the country was living beyond its water resources.

Many observers have forecast that the country will run out of water by 2030. Such a prediction with not eventuate, however, if there is a change in consumers' mindsets about the true value of water and R899-billion is invested over the next decade to build new infrastructure and rehabilitate and upgrade existing facilities. This level of investment – which works out to about R89.90-billion a year – is about R33-billion more than what is currently invested each year, which leaves a 37% funding gap.

The draft National Water and Sanitation Master Plan (NW&SMP) states that the mindset shift that must accompany an increase in water and sanitation infrastructure investment should occur not only among consumers but also at all levels of government and in the business sector and civil society.

According to the NW&SMP, which was the culmination of extensive input from several stakeholder groups, water is severely underpriced in South Africa, as a result of which cost recovery is not achieved. It singles out agriculture as one of the sectors benefiting from this underpricing, which places an increased responsibility on other sectors and the national fiscus to balance the cost:revenue equation.

Many observers gave forecast that South Africa will run out of water by 2030

Picture by Reuters

The NW&SMP states that "the new reality [is that] water will become more expensive [and] everyone, except the indigent, must pay for water and sanitation".

Main sources

African Development Bank. World Water Day interview: Osward Mulenga Chanda, division manager, Water Development and Sanitation Department (March 22, 2018).

Afriforum. Afriforum announces its national blue and green drop results (August 1, 2017).
Afriforum. Afriforum announces Gauteng North's blue and green drop results (May 9, 2018).
Afriforum. Afriforum announces Limpopo's blue and green drop results (May 15, 2018).

Business Day. Water infrastructure investment an opportunity for private sector (January 31, 2018).
Business Day. SA makes progress in eradicating bucket toilets – but not enough (June 4, 2018).
Business Day. MPs warned about slide to Day Zero countrywide (August 30, 2018).
Business Day. Western Cape agriculture adds up the cost of the continuing drought (July 19, 2018).

Carbon Disclosure Project. A Turning Tide: Tracking corporate action on water security (November 2017).

CBS News. Could a 100-million-ton iceberg alleviate S Africa's water woes? (July 5, 2018).

CivilOnline. The Cuban crisis (January 21, 2018).

City of Cape Town. Water Outlook 2018 Report (May 20, 2018).

Council for Scientific and Industrial Research. SA climate experts warn of drier future in Western Cape (May 16, 2017).

Department of Water and Sanitation. National Water Investment Framework (September 2017).
Department of Water and Sanitation. South Africa and Cuba extend working relations in water sector to 2023 (September 25, 2017).
Department of Water and Sanitation. Draft National Water and Sanitation Master Plan (March 31, 2018).
Department of Water and Sanitation. Pamela Tshwete: Address by Deputy Minister of Water and Sanitation on the occasion of the Budget Vote debate in the National Assembly (May 22, 2018).
Department of Water and Sanitation. Stringent water restrictions needed to avoid water shortages in drought-stricken areas of Eastern Cape (September 5, 2018).

Engineering News. Drought-stricken South Africa faces water infrastructure funding shortfall (April 4, 2018).
Engineering News. Should desalination play a bigger role in South Africa's water future? (May 25, 2018).
Engineering News. DWS notes concerns about War on Leaks programme (July 10, 2018).
Engineering News. Ministers reiterate commitment to implementation of LHWP Phase 2 (July 27, 2018).
Engineering News. Water dept, stakeholders continue to seek solutions to Vaal river pollution (September 4, 2018).
Engineering News. First LHWP Phase 2 construction contracts awarded (October 12, 2018)
Engineering News. Farmers head to court to challenge policy on transfer of water rights (October 15, 2018).
Engineering News. DWS to establish licensing body, advisory council (November 12, 2018).
Engineering News. City of Cape Town to harness stormwater to boost water resources (November 13, 2018).

Forbes. EPA, Israeli company partner on 'water from air' tech (April 13, 2018).

Fox Business. Watergen to open at least 3 more US plants, president says (November 9, 2018).

Government Gazette. Intention to disestablish Mhlatuze Water and transferring of staff, assets and liabilities into Umgeni Water and changing the name of Umgeni Water into KwaZulu-Natal Water Board (November 10, 2017).

GreenCape. Water: 2018 Market Intelligence Report (June 2018).

Herald. Demand for houses delays plan to end bucket toilets (April 27, 2018).
Herald. Water project fails to flow (May 8, 2018).
Herald. Bucket toilet eradication deadline draws closer (May 28, 2018).
High-Level Panel on Water. Making Every Drop Count: An agenda for water action (March 14, 2018).

Institute for Security Studies. A delicate balance: Water scarcity in South Africa (March 2018).

Insurance Gateway. The private sector's role in alleviating SA's water crisis (November 16, 2017).

Independent Online. Day Zero cancelled for 2018 and 2019 (June 28, 2018).

Lesotho Highlands Development Authority. LHWP Phase II advance infrastructure construction works starting (November 9, 2018).

National Treasury. Budget Overview (February 21, 2018).

New Climate. National action on climate change now covers 89% of GHG emissions, spurred by international climate agreements (August 6, 2018).

News24. Government is 11 years past deadline to end bucket system (November 10, 2017).
News24. South Africa could run out of water by 2030 – govt draft plan (March 29, 2018).
News24. Drinking water contaminated with microplastic pollution in Gauteng (July 25, 2018).
News24. Water Research Commission to investigate tow-an-iceberg proposal (August 1, 2018).
News24. Two Eastern Cape towns to start 'water shedding' as dams empty (August 6, 2018).
News24. Iceberg water could be cheaper than desalination (August 16, 2018).
News24. Water Research Commission urges SA to 'get in first' and develop iceberg project (September 11, 2018).
News24. Drilling for water makes no economic sense (October 1, 2018).
News24. Gauteng dams almost 100%, Western Cape levels stable (October 23, 2018).
News24. Municipalities' unpaid water bills increase to a whopping R13.1bn (November 15, 2018).

Rand Water. Nonrevenue Water and Water Loss Management: A critical review (May 9, 2018).

Research Channel Africa. Lesotho Highlands Water Project – Phase II, Lesotho and South Africa (July 20, 2018).

Reuters. South Africa plans levy on mines to tackle acid mine water pollution (May 19, 2016).

Solidarites International. 2018 Water and Hygiene and Sanitation Barometer (March 4, 2018).

South African Institution of Civil Engineering. 2017 Infrastructure Report Card for South Africa.

Sowetan. Bucket toilets still reality for thousands (June 6, 2018).

Statistics South Africa. Nonfinancial census of municipalities for the year ended June 30, 2017 (June 4, 2018).
Statistics South Africa. Presentation by Stats SA deputy director-general: economic statistics Joe de Beer on the Nonfinancial census of municipalities 2017 for the year ended June 30, 2017 (June 4, 2018).
Statistics South Africa. General Household Survey 2017 (21 June, 2018).

TimesLive. Cape Town's first desalination plant comes on line (May 21, 2018).
TimesLive. Water restrictions in KwaZulu-Natal lifted (August 31, 2018).

UN-Water. United Nations World Water Development Report 2018 (March 19, 2018).

UN-Water. Sustainable Development Goal 6: Synthesis Report 2018 on Water and Sanitation (July 6, 2018).

University of the Witwatersrand. South Africa needs good water management – not new water laws (February 7, 2018).

US Environmental Protection Agency. Administrator Pruitt Announces Cooperative Research and Development Agreement (March 3, 2018).

Water for Africa Initiative. Basic document: Water for Africa Initiative Consultancy Assignment (November 2017).

Watergen. Watergen in Cape Town (April 10, 2018).
Watergen. Watergen awarded as technology pioneer by World Economic Forum (June 21, 2018).

World Business Council for Sustainable Development. CEO Guide to Water: Building resilient business.

World Economic Forum. Global Risks Report 2018 (January 17, 2018).
World Economic Forum. Why the answer to water insecurity is working together (January 25, 2018).
World Economic Forum. Companies can help solve water scarcity (March 15, 2018).

https://africanwaterfacility.org
http://widgets.weforum.org/techpioneers-2018/

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