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CONCLUSIONS

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Key features that characterise water resources availability in South Africa are the following:

- South Africa is characterised by spatial variability in rainfall, with the east of the country lying in the summer rainfall zone with high rainfalls. In contrast, the country's west lies in an all-year-round or winter rainfall region that is semi-arid to arid.
- The seasonal variability in the country's climate influences water availability and storage dynamics.
- River systems (mostly through the surface water storage in large dams) are the common surface water expression of water availability in South Africa, with others being lakes, ponds, and pans.
- Aquifer (groundwater) storage is another expression of water availability in the country where an increased groundwater utilisation in the country's water mix has been observed due to the significant potential of the groundwater resources in adaptation to climatic-related stresses and augmenting conventional surface water supply systems.
- South Africa's water supply is dependent on Strategic Water Source Areas (SWSAs). SWSAs are defined as areas of land of national importance that either (a) supply relatively large quantities of mean annual surface water runoff compared to their size (b) have high groundwater recharge and high dependence, or (c) areas that meet both criteria (a) and (b). They include transboundary Water Source Areas that extend into Lesotho and Swaziland.
- South Africa is a water-scarce country. Water insecurity has become severe as almost 98% of the available freshwater resources are already allocated, and over 60% is used for crop production. Water availability is highly variable, determined by rainfall variability in the national territory.

The following features characterise water resource management in South Africa:

- The water sector institutional reform is ongoing; for the current outlook, the National Department of Water and Sanitation is the custodian of water resources with an obligation to perform water resource management functions. The water resource management functions are to be delegated to the six Catchment Management Agencies (CMAs), where two are existing and four are being established; this supports the principles of good governance, where water will be managed locally.
- At a local level, there are Water Services Institutions (WSI), which comprise Water Services Authorities (WSAs) that provide water services or outsource water services provisions to the private Water Services Providers (WSPs).

- The four new CMAs, namely Breede-Olifants CMA, Vaal-Orange CMA, Pongola-Mzimkulu CMA, Mzimvubu-Tsitsikamma CMA have been established, with three of the four CMAs already having interim CEO appointed.
- South Africa shares four international river basins, namely the Limpopo, Orange/Senqu, Inkomati, and Maputo, with six neighbouring countries, Botswana, Lesotho, Mozambique, Namibia, eSwatini, and Zimbabwe. These water resources are managed through shared watercourse institutions, commissions, and international agreements to promote international transboundary cooperation.
- The Department of Water and Sanitation has established various monitoring networks (along rivers, dams, estuaries, eyes, canals, pipelines, groundwater aquifers, wetlands, and abandoned mines), monitoring programs, and information systems to ensure water resource data is freely available and accessible.
- South Africa faces water, energy, and food insecurity; while the country is food secure at a national level, over 50% of households still face food insecurity, 98% of the country's water resources are already allocated, and the country currently faces instability in the energy sector (StatsSA, 2019).

Rainfall and Temperatures

A warming trend of approximately 0.17 ºC per decade is indicated for the country over the period 1951-2023, statistically significant at the 5% level (SAWS, 2024). The summer periods for the hydrological years 2020/21, 2021/22, and 2022/23 have fallen within the protracted 2020-2023 La Niña event. Wetter and cooler conditions occurred for extended periods of the summer, as is typical during La Niña events.

Over South Africa from October 2022 to September 2023, there were several notable periods of extremely hot or cold conditions, two of which include the anomalously hot period of 9-23 January 2023 and the anomalously cold period of 9-12 July 2023. With extreme hot events, there is typically increased water demand not only for domestic consumption but also for agricultural and industrial uses. These heightened water demands, coupled with increased evaporation, can easily strain water resources. On the other hand, extremely cold temperatures can also impact water resources, but to a lesser extent. In the context of cold waves (and the 9-12 July 2023 cold wave) and other extremely cold temperature events (e.g., cold snaps), the impact on water availability can be felt through freezing over of water bodies, limiting available water that can be used for drinking and household, irrigation, and industrial use.

Drought

Based on the long-term SPI time series, over most parts of the country (north-eastern central to western, eastern to south-eastern) parts, wetter periods occurred around 2017 and then again during the 2021-2023 period. Drier periods, with widespread drought, occurred during the 2015-2016 period as well as 2018 – 2020.

Surface Dam Storage

The national dam storage levels for the 2021/22 and 2022/23 hydrological years were the highest for most of the months in the past five hydrological years, especially after the beginning of summer rainfalls received between November and February 2023 for the eastern parts of the country. The two dams that were in critical storage condition at the end of the reporting period were each from Eastern Cape and Limpopo.

Water Restrictions

Some parts of the country were still experiencing dry conditions, for example, the southern parts of the Eastern Cape, parts of the Northern Cape, and the southwestern parts of the Western Cape Province. The Department implements water use restrictions in these areas that are experiencing dry conditions, which affect dam storage levels in standalone dams or dams within a WSS or cluster to avoid the risk of failure of water supply or non-supply to the various water use sectors, including users with a high assurance of water supply such as strategic users in the power generation industries.

The Algoa WSS remains with water restrictions in response to the low water storage levels. Notably, restrictions have been lifted for the Amathole WSS as the system recovered. Due to infrastructure limitations, permanent restrictions are still applicable for the Polokwane WSS in Limpopo and Bloemfontein WSS in the Free State Province.

Eutrophication

In the current reporting period, forty-five of the sixty-one monitored sites were analysed for trophic status and eutrophication potential. The trophic status assessment found nine (9) dams to be hypertrophic, two (2) eutrophic, three (3) mesotrophic, and twenty-four (24) oligotrophic. The nine hypertrophic dams included Rietvlei Dam, Hartbeespoort Dam, Bon Accord Dam, Klipvoor Dam, Vaalkop Dam, Roodeplaat Dam, Modimola Dam, Bronkhorstspruit Dam and Witbank Dam, while the eutrophic dams included Loskop Dam and Disaneng Dam.

Microbial Quality

The microbial quality of water for the current reporting period is determined based on the sampling of 43 hotspot sites in the country. Microbiological data collected from October 2022 to September 2023 suggests that water at all 43 newly selected sites is unsuitable for drinking without treatment, as they all exhibit a high risk if consumed directly from the source. Treating water at the household level through methods such as boiling, filtration, or chlorination can help mitigate the potential health risks. However, 35% of the sampled sites still demonstrated a high risk associated with using the water even after undergoing limited treatment. Furthermore, the findings indicated that 41% of the sites were unsuitable for irrigating crops intended for raw consumption,

and 67% of the sampled sites were deemed unsuitable for recreational activities, posing a high risk of infection for individuals engaging in such activities. These recreational activities include full-contact activities such as swimming, washing laundry, and events like baptisms.

Ecological State

Based on the assessment of riverine macroinvertebrates at 455 sites during the 2021/22 hydrological year, approximately 60% of the rivers were found to be moderately modified (C). The upper portions of the Crocodile West catchment are located in Gauteng's industrial and urban areas and, thus, are heavily impacted. The Jukskei River, Modderfonteinspruit River, and Crocodile Rivers upstream of Hartbeespoort Dam, Hartbeesspruit just upstream of Roodeplaat Dam, the Apies and Hennops Rivers were all in very poor condition (D/E and E). The Sabie, Komati, and Usuthu catchments had a high proportion of sites in largely or nearly largely natural conditions (B and B/C categories). The remaining largely natural sites were either in the upper reaches closer to the source for Magalies, Debengeni, Berg, and Breede-Gouritz sites, protected areas (Eerste, Klerkspruit, Perskeboomspruit, Glen Reenenspruit, Ribbokspruit), or rural areas (the former Transkei, Mkomazi, uMhlatuze, and Pongola catchments).

Groundwater

The national average groundwater level status indicates a recovery trend from below normal in 2019 to above normal at the end of September 2023. This can be attributed to the above-normal rainfall received in the current and previous two hydrological years, which has significantly recharged aquifers, now showing above-normal percentile levels.

Relatively high groundwater nitrate concentrations are found in some parts of South Africa, particularly the Limpopo and Vaal WMAs. Fluoride concentrations higher than 1.5 mg/L are found in the Limpopo WMA, mainly associated with geothermal springs. The spatial Electrical Conductivity (EC) data shows higher salinity dominating the following WMAs: Limpopo, Vaal, Mzimvubu-Tsitsikamma, and Berg-Olifants. Evidently, the Limpopo WMA has nitrate, Fluoride, and EC water quality concerns. Groundwater in Limpopo and North West plays a significant role in the water supply regime, and together, the two provinces have the most groundwater strategic water source areas.

Groundwater use

Over 3 232 Mm^3 groundwater is abstracted per annum, with three sectors dominating the groundwater use by volumes, with over 55% (1 788 Mm^3/a) of the abstracted groundwater going to irrigation, while 21% (677 Mm^3/a) goes to mining and 11% (340 Mm^3/a) goes to water supply. The balance 13% (424 Mm^3/a) goes to other minor users

such as aquaculture, livestock, schedule 1, industry, urban, power generation, and recreation.

Water use Efficiency

Non-revenue water (NRW) in South Africa is a big problem. Approximately 41% of municipal water does not generate revenue. While figures vary between service providers, average physical losses in municipal systems are estimated to be around 35%, against a global best practice of about 15%. As a result, municipalities are losing around R 9.9 billion each year.

The National Water Balance of June 2023 indicates a SIV of 4.39 billion m^3/a, water losses of 1.79 billion m^3/a (40.8%), and NRW of 2.08 billion m^3/a (47.4%). NRW and water losses have increased by a notable 5.9% and 4.3%, respectively, since June 2016. The volume NRW in Categories A (metropolitan), B1, and B2 (secondary cities and large municipalities) municipalities account for almost 75% of the national NRW and should be a focus area of the national WC/WDM programme.

There is significant scope for improvement of NRW, and all municipalities would benefit from targeted demand management programmes, including community education and awareness, leak repair, infrastructure refurbishment, pressure management, and installation of bulk meters, amongst other measures.

Water Consumption

National trends as of June 2023 indicate that the per capita water consumption has remained constant (218-220 l/c/d) over the past 7 years, which is commendable. However, WC/WDM efforts must be elevated considering the level and reliability of service and inefficiencies, and South Africa is one of the 30 driest countries in the world. The per capita consumption has significantly declined after peaking at 237 l/c/d national average in June 2016 because of the prevailing droughts in parts of South Africa, deteriorating infrastructure, and service delivery.

Water Leakage

The Infrastructure Leakage Index (ILI) deteriorated drastically from 2016 to date, showing signs of improvement in 2017 and 2018. The COVID-19 pandemic escalated the deterioration from 2020. The ILI of 6.9 and 7.0 for 2022 and 2023, respectively indicates poorly managed physical losses; this trend is expected to improve once municipalities have returned to normal, eliminated the leak repair backlogs, and improved revenue collection.

Cost of water supply

Based on the functional expenditure and SIV of 127 WSAs, the average cost of supplying water is R 13.07/kl. This ranges from R 17.32/kl for metropolitan municipalities to R 12.06/kl for Category B3 municipalities. The cost of supplying rural

municipalities (Categories B4 and C2) is the highest, ranging from R 14.26/kl to R 17.64/kl. This is a meaningful change from previous assessments that suggested that the cost of supplying water in rural schemes is less than in large municipalities. The higher cost is justified, considering that these schemes often consist of many small systems with boreholes, which are expensive to operate. Using the national average and category average tariffs, the estimated cost to supply water in South Africa is between R 60 and R 70 billion per annum, and revenue of between R 42 and R 44 billion is generated from water sales. The value of NRW is between R 28 and R 33 billion at R 13.07/kl, which is higher than previous estimates. The increase is due to the above inflation in water tariff increases from water boards and the underestimation of water supply costs to rural municipalities.

Approximately R 1 billion per annum could be saved if the SIV is reduced by 2%, and municipalities would generate nearly R 1 billion per annum for every 2% increase in revenue. The net benefit could be R 10 billion per annum if revenue is increased by 10% and the SIV is reduced by 10%. Reducing the SIV by 10% and increasing the revenue by 10% would reduce the national NRW figure to 35.7%, and the per capita consumption to 195 l/c/d.

Ecological Infrastructure Rehabilitation

Several wetlands in South Africa have been rehabilitated and restored by different institutions, such as the Water Research Commission (WRC), South African National Biodiversity Institute (SANBI), and the Working for Wetlands programme. DWS, in collaboration with the City of Ekurhuleni, the Gauteng Department of Agriculture, Rural Development, and Environment (GDARDE), is currently working to rehabilitate a wetland along the Blesbokspruit River, which, once completed, will contribute to cleaner and better-managed water for the Vaal Water Management Area (VWMA).

Water-Energy-Food NEXUS

The connectedness of current challenges (climate change, environmental degradation, population growth, migration, and the emergence of novel infectious diseases) requires circular and transformative approaches that holistically address these cross-cutting challenges. Managing the intricate relationships between distinct but interconnected sectors through nexus planning has provided decision-support tools to formulate coherent strategies that drive resilience and sustainability. As a result, the Water-Energy-Food (WEF) nexus has gained increasing attention in the research and decision-making communities in recent years as a prominent approach for integrated resources management. The systematic thinking embedded in the WEF nexus is priceless as it considers the synergies and trade-offs in resource planning, utilisation, and management. The developments in one of the three WEF sectors should always consider the impacts on the other two to avoid transferring problems from one sector to the other.

A working group of the country's WEF Community of Practice (WEF-COP) was formed to support the development and implementation of a 5-year country WEF programme. The working group is meant to harmonise policy documents and reduce sector-based management of resources that are still fragmented, sitting in distinct departments. Through its WEF nexus Lighthouse, the Water Research Commission (WRC) has been leading work and discussions as well as pilot projects that highlight the benefits of the WEF nexus approach. However, despite these efforts, South Africa still lacks a guiding WEF policy document to guide the implementation, monitoring, and evaluation of the nexus (WRC, 2018).

There is a need for a framework that facilitates proper coordination and identifies synergies and trade-offs across sectors to avoid duplication of activities, create opportunities for harmonising government priorities, and allocate resources effectively and efficiently.

Resource Protection

The Department has completed and gazetted the Water Resources Classes (WRCs) and the determination of associated RQOs in several WMAs, with Uthukela, recently finalised in March 2023. The final WRCs and RQOs have been implemented in some catchments, including Inkomati and Olifants-Doorn, and are currently being monitored through surface water resource monitoring programs. The Department is, as of September 2023, only left with the Orange River System (Upper and Lower Orange), which has outstanding WRCs and RQO determination studies.

Source Directed Controls

The Eutrophication Management Strategy for South Africa (EMSSA) was developed to provide direction concerning the management of eutrophication, particularly the control of anthropogenic sources of excessive nutrient enrichment, from a strategic country perspective. The Eutrophication Management Policy contains fourteen technical policy statements and five supporting policy statements, which are general and cross-cutting in nature, all of which are regarded as the most pertinent to eutrophication management in South Africa.

Protection of water resources is critical for ensuring healthy ecosystems and water availability for current and future use. To this end, sustainable development of water resources requires that water quality degradation be avoided, minimised, and remedied where applicable. There is an ongoing project that aims to develop rehabilitation management guidelines that address the following characteristics of watercourses: hydrology, geomorphology, water quality, habitat, and biota.

Compliance Monitoring

The Department of Water and Sanitation (DWS) constantly strives to enhance the Compliance Monitoring and Enforcement (CME) procedures, protocols, and instruments for effective functioning within the Environmental Management Network.

The development of the DWS CME or Environmental Management Inspector (EMI) Standard Operating Procedure (SOP) Manual has been finalised to harmonise and standardise operating procedures within the water sector that will allow the CME officials and EMIs to perform their duties in an administrative just and legal defensive manner and conform to the chain of custody process and actions at national, regional and Catchment Management Agency (CMA) levels to result in successful court cases.

The Compliance Monitoring team achieved 422 (including dam safety) and exceeded the target by 43 for the financial year 2022/23. The target set for the level of compliance with water user authorizations obligations per sector is 65%. The 422 users monitored achieved a combined average performance level of 58%, with the mining sector (49%) and landfills (45%) having the worst scores. To improve this, more emphasis needs to be placed on follow-up inspections to ensure findings are implemented and to follow through with enforcement actions and consequences where required.

Enforcement

During FY2022/23, a total of 460 cases were reported for non-compliance. Out of these reported cases, 385 were investigated, demonstrating a commendable achievement of 84% compared to the committed target of 80%. The DWS duly issued a total of 205 notices indicating its intention to subsequently issue directives. A total of 72 directives were issued. Moreover, the DWS recorded 17 criminal cases against offenders. Six cases, which had been initiated in the preceding financial years, were subsequently referred to the National Prosecuting Authority (NPA) for a decision.

Several complaints have been reported regarding unlawful water uses and pollution-related cases, highlighting non-compliance in various sectors. The agriculture sector and local government municipalities account for the highest proportion of reported cases, at 28% for each, followed by mining at 21%.

Drinking water compliance

A total of 144 water service authorities were assessed for the 2022/23 hydrological year. However,14.6% of the water services authorities did not upload data on the Integrated Regulatory Information System (IRIS). The results of the Water Supply Systems (WSS) compliance in terms of chemical drinking water quality from October 2022 to September 2023 show that 79% of the systems had excellent compliance in terms of chemical quality compliance, 2.8% had good compliance, while 3.5% demonstrated poor chemical quality compliance. In cases where non-compliance was observed (< 90%), the reasons should be further investigated.

In terms of microbiological compliance, 72% of the WSSs in the country did not meet SANS:241 requirements for the reporting period (1 Oct 2022- 30 Sept 2023), and only 18% of the WSSs achieved an excellent status (>99.9%). It was also noted that 13 WSAs did not submit their drinking water quality data as prescribed by the norms and

standards, thus impacting the national outlook as these WSAs could not be assessed in the absence of drinking water quality data submission to the Department. The Department, through its provincial offices, is continuously monitoring and engaging with the relevant WSAs, which achieved microbiological compliance below 99.9%, including those that are not submitting water quality data to the Department.

Sanitation Services

The DWS has recognised that due to a) the impact of climate change, b) water resources constraints, and c) energy supply challenges, the historical approach of providing waterborne sanitation is no longer sustainable and realistic to achieve universal access to safely managed sanitation. Hence, there is a need to embrace a combination of on-site, off-grid; sewered or non-sewered sanitation systems, including centralized or decentralized wastewater treatment solutions. In addition, South Africa must accept the reality that the country no longer has the luxury of flushing 9 to 12 litres of potable water while some parts of the country do not have access to drinking water.

In response to the National Sanitation Policy (2016), DWS developed the National Sanitation Framework (NSF). It is an implementation framework that will assist the government in providing equitable and safe sanitation in all settlement types. It guides towards ensuring appropriate support to Water Services Authorities (WSAs) in cases of service delivery lapses, and non-compliance to regulator prescripts leading to a deterioration in the provision of sanitation services. Furthermore, the National Sanitation Integrated Plan (NSIP) has been developed and provides a 10-year roadmap for ensuring access to adequate sanitation services, eradicating open defecation, providing innovative solutions, and creating a pathway to generate new sanitation opportunities. The main goal of the NSIP is to assist the sanitation sector in providing adequate and innovative sanitation services and solutions to enable long-term sustainable management of sanitation services in South Africa.

The National Faecal Sludge Management Strategy has also been developed and encourages sustainable sanitation management along the sanitation service chain to prevent health hazards and protect the environment. It also enhances the operation and maintenance of on-site sanitation systems and prevents groundwater contamination. The strategy introduces a paradigm shift of safely managing sanitation along the sanitation services chain. Of importance is the need to recover, re-use and recycle resources from faecal sludge and wastewater sludge for beneficial use. The Department is working with various Research Institutions and Universities to fast-track resource recovery initiatives from sludge. The private sector is also encouraged to take advantage of the faecal sludge reuse and resource recovery business opportunities.