An overview of challenges in the South African Water Sector

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Overview

- Water security as a lens to identify the range of challenges in the South African water sector

Source: ARQ Consulting Engineers
Defining water security

- UN Water defines water security as:
  - ‘the capacity of a population to safeguard sustainable access to adequate quantities of acceptable quality water for sustaining livelihoods, human well-being, and socioeconomic development, for ensuring protection against water-borne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability’.

- Common strands in other water security definitions include:
  - Water quantity
  - Water quality
  - Environment/sustainability
  - Risks/hazards

- Developing capacities to ensure water security
- Continuum of water security: insecure to secure
South Africa is a dry country
- Ranked 29th driest country out of 193 countries

Annual rainfall is about 50% of the world’s average
- 463mm mean annual precipitation
- Water scarcity is a norm

Uneven spatial distribution of rainfall across the country
Mega-trends in African cities

1 – Climate change
- Rising surface temperatures
- Reinforcing water scarcity and drought risks
- Pressure on already limited water supplies
- Increased demand for water; negatively affects crop production
  - Impacts food security
  - Heightened vulnerability
  - Weak adaptive capacity, high dependence on ecosystem goods for livelihoods and less developed agricultural production systems
- Rural-to-urban migration

2 – Urbanisation
- Growing levels of urbanisation
- Transformation of landscapes
- Sprawl of cities
- Informal settlements – unplanned, poor infrastructure, practices

3 – Demographic change
- Growing populations
- Interlinked with urbanisation: concentrated in cities; inter-regional migration

These mega-trends adversely impact water security

Adapted from OECD 2020
Drivers of water insecurity

According to ASSAF (2023), the major drivers of water insecurity in South Africa include:
- Poor water and sanitation infrastructure maintenance and investment
- Inequitable access to water
- Poor water quality
- Unsustainable water demand

Insecurities are amplified by
- Floods
- Droughts
- Poor infrastructure planning and maintenance

Source: Comins 2021
Programme is focused on the current condition of drinking water infrastructure and treatment processes from a technical perspective:

- 141 water supply systems were inspected
- Technical site assessment scores of 69%
  - Status is *partially functional with average performance*
  - 85% had average, good and excellent
  - 15% - poor and critical conditions
    - The cost to restore is R1.5bn

Drinking water quality analysis:

- Microbiological water quality status
  - Excellent – 38%
  - Good – 11%
  - Poor to bad – 51%

- Chemical compliance status
  - Excellent - 16%
  - Good – 14%
  - Failure to comply – 71%

- 13 water supply systems have no water quality data
  - Indicates a lack of monitoring
Green Drop Watch Report

- Purpose is to improve wastewater management in South Africa
  - Revitalised in 2021
- Statistics from 2022
  - 850 wastewater treatment works
  - 334 wastewater treatment works were in a critical state in 90 municipalities – 34%
  - Issued with non-compliance notices
    - Required to submit Corrective Action Plans
- 2023 update
  - 168 Corrective Action Plans were submitted to DWS
  - March 2023: 34 out of 168 Corrective Action Plans were being implemented
  - DWS has issued directives; and criminal charges in some cases
- The majority of wastewater treatment works do not comply with national minimum standards.
  - Collectively, this results in chronic pollution of water resources
  - Impacts on the health of communities
Infrastructural Challenges

- Maintenance of ageing infrastructure
  - Results in extensive water losses
- Lack of investment in infrastructure
  - Outcomes: Cholera outbreak in Hammanskraal in Tshwane
    - 15 deaths, 40 people hospitalised
- Pollution from wastewater works
  - Linked to load shedding
  - Results in biodiversity loss; threat to human health
  - But wastewater has the potential to become a resource when it is treated correctly
    - Through resource recovery and reuse

Source: African News Agency
Water-energy nexus challenges

- Water supply and wastewater treatment are driven by the supply of electrical energy
  - Creates a water-energy nexus
  - Electricity is produced from 15 water-cooled power plants, each operating at more than 3l of water per unit sent out and consuming more than 100Ml/day.
  - Chronic energy shortage
- Combination of poor electricity supply and ageing investment in water infrastructure – key constraints to water for growth and development
  - Vast quantities of wastewater are produced for water uses
    - There is frequently insufficient treatment when wastewater is disposed
Water pollution

- Impacts health: related to improper hygiene, poor sanitation or contaminated water
- Disease transmission: cholera, diarrhoea, typhoid etc.
- Access to safely managed sanitation
- Impacts of farming on water quality
  - Farming practices: nitrates and phosphates -> leads to eutrophication
  - Soil erosion
- Lack of monitoring data: need monitoring data to address pollution issues effectively
- Solid waste runoffs
- Pollution increases the costs of wastewater management

Source: Luhanga 2021
Water scarcity and droughts

- Water-scarce environment; water stress
  - High levels of evapotranspiration
- Water stress in SA – medium to high (20 to 40%)
  - Water stress is the ratio of withdrawals to supply
- Drought consequences include:
  - Increased food prices
  - Impacts on agriculture
  - Day Zero situations, e.g. Cape Town
  - Water restrictions; risk of turning off all taps
  - Impacts on agriculture and tourism

Source: Resilience Shift
Water abundance and floods

- Floods and landslides: loss of lives, damage to infrastructure
  - Exacerbated by rapid urbanisation, uncontrolled urban growth and unregulated informal settlements in floodplain areas
- Landcover change
  - Impermeable surfaces
- Impacts urban poor – often living on marginal land
- Loss of lives, disruption to traffic and economic activities, exposure to health risks (sewage, industrial waste and waterborne diseases)

Source: Stewart 2022
Climate change

- Climate change is influencing the biosphere
  - More frequent and intense hydro-climatic extremes – SA being a hotspot for floods, droughts and heatwave events
  - Becomes a socio-economic threat
    - COP27 – over 80% of climate adaptation strategies were water-related
- Biodiversity and water are linked
  - Ecosystem services
  - Ecological infrastructure: nature-based equivalent of engineered infrastructure
    - EI is viewed as a critical resource for tackling water security challenges
    - Water purification, flow regulation
  - Biological degradation adversely impacts water security

Sources: Dlamini 2017; Bennie 2019
Insufficient access to water and sanitation

- Urban access to safely managed piped water – SA 99%
- Challenging in the context of urban population growth and unplanned urbanisation
- Disparities related to urban water access within cities
  - Linked to where services are concentrated
    - Urban versus rural versus peri-urban
- Growing demand for water – growing middle-class
  - Overwhelms existing urban infrastructure and challenges the capacity of institutions
- Informal settlements: Free Basic Water Programme
  - Tension between payment for water services and free basic water (universal)

Source: Bratton 2017
Some solutions

- Demand management
  - Reducing water demands
  - Recycling wastewater
  - Promoting land use management alternatives
  - Education

- Supply management
  - Supplementing water supplies locally
  - Increasing the water supply mix
    - Less reliance on surface water
    - Focus on groundwater abstraction, water reuse
    - Desalination in water-scarce coastal areas
    - Centralised versus decentralised systems
  - Interbasin transfers

Source: Mistry 2022.
Some solutions

- Nature-based solutions
  - Ecological infrastructure, ecosystem services
  - Requires source-to-sea management approach of catchments

- Collaboration
  - Partnerships between state and non-state actors
    - Growing number of networks
  - Growing calls for cross-sectoral collaboration
Some solutions: Digitalisation in the water sector

- Smart water meters
- Sensor networks
- Leak detection systems
- GIS
- Remote sensing for drought analysis
- Data analysis
- Remote monitoring
- Automation in treatment plants
- Customer engagement platforms
- Blockchain for water management
- Predictive modelling
- Mobile apps for water reporting
- Desalination Technology

- Drones for infrastructure inspection
- Water conservation gamification
- Real-time monitoring of water supply and demand
- Smart irrigation systems
- Digital twin technology
- Cloud-based data storage
- AI for water treatment
- Smart wastewater management
- Augmented reality for training
Concluding statements

- With challenges, comes opportunities for innovation
  - Harness ingenuity
- Holistic overview of challenges in the water sector
  - Call focuses on digitizing and improving wastewater management
Q&A
Contact

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