water & sanitation

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Water and Sanitation
REPUBLIC OF SOUTH AFRICA

NATIONAL STATE OF WATER REPORT FOR SOUTH AFRICA

HYDROLOGICAL YEAR 2019/20

Department of Water and Sanitation
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APPROVAL

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EXECUTIVE SUMMARY

Water resources management is local in nature, and the Department of Water and Sanitation has as of July 2012 managed water resources based on nine water management areas. The Breede-Olifants and Inkomati-Usuthu are the only two Catchment Management Agencies (CMAs) established so far. There is a proposal for water boards to be converted into regional water utilities to ensure there is extended services of water supply services at a regional level. It is proposed that going forward water resource management will be based on six water management areas; these are: Limpopo-Olifants (1); Inkomati-Pongola (2); Mhlatuze-Mzimkhulu (3); Vaal-Orange (4); Mzimvubu-Tsitsikamma (5); Breede-Olifants (6). CMAs will be established from these six water management areas. As part of the Department's turnaround strategy in establishing CMAs, the boundary and area of operation of the existing Breede-Gouritz CMA has been extended to incorporate the Berg-Olifants water management area as of September 2020. The new CMA is now the Breede-Olifants CMA. This incorporation will enhance revenue generation and sustainability of the CMA, as well as enabling an effective water resources management.

The national water resources monitoring programmes established by DWS provide the necessary water resources data required for analyses and assessment of the status of water resources in South Africa. During the period of reporting (Oct 2019 – Sept 2020) only 26 dam / lake sites were monitored for the National Microbial Monitoring Programme (NMMP), while 24 dams and nine river sites were monitored for the National Eutrophication Monitoring Programme (NEMP). There is no data for the National Chemical Monitoring Programme (NCMP) since September 2018. The Surface Water Monitoring Programme had 28% of active stations with data available nationally on the HYDSTRA database at the time of reporting, while the Groundwater Level Monitoring Programme had 49% of active stations with data available. The National Groundwater Quality Monitoring Programme had 53% of the stations sampled, however, the data were not yet available on the WMS database at the time of reporting.

The Department has recently completed the conceptualization phase of the national project titled "National Digitization of Water and Sanitation Monitoring Systems". The aim of the project is to digitize all monitoring elements, provide dynamic dashboards using real time water quality and quantity data, and / or remote sensing information, integrate various streams of data information and act as an umbrella system for water observation within the water and sanitation sector. The conceptualization will be followed by the design and implementation, which will be done simultaneously with commissioning the digitized and integrated water and sanitation monitoring system across South Africa.

South Africa has generally continued to receive below-normal rainfall, where dry conditions have persisted over large parts of the western parts of the country, while some parts have experienced dry conditions for the past seven years. The western parts of the

Orange WMA and eastern parts of the Mzimbvubu-Tsitsikamma WMA has experienced moderately dry to extremely dry conditions for the past 24 months. Annual average temperatures continue to rise by 0.16°C per decade. The year 2020 was the fifth hottest year on record since 1951, with implications that South Africa will continue to experience severe flooding and drought events more frequently, which will affect the availability and supply of both surface and groundwater.

The Mzimbvubu-Tsitsikamma WMA in the Eastern Cape Province has for the past six years experienced below normal rainfall, resulting in low level storages in major dams and the implementation of water restrictions in the Algoa Water Supply System during the planning year of 2020/21. South Africa loses approximately 35% of its total water supply due to non-revenue water, leakages and illegal connections. Domestic / urban water supply and irrigation remain the largest water use sectors in the country. Water use efficiency data of 2019 for water use within irrigation institutions and schemes has shown that 24% of the water supplied for irrigation is being lost.

The Department as part of protection of water resources, monitors the performance of Water Services Authorities (WSAs) in treatment of wastewater through the Green Drop Programme, while the safety of drinking water performance is monitored through the Blue Drop Programme. During the year 2020, 144 WSAs were monitored for the Green and Blue Drop performances. Approximately 60% of the WSAs achieved good to excellent wastewater physical compliance; 51% achieved good to excellent wastewater chemical compliance, while 45% of the WSAs with available data managed to show a good to excellent wastewater microbial compliance. The wastewater quality compliance by WSAs throughout the country remains poor as most treatment plants have digressed in terms of operational flows to the facilities, effluent monitoring, quality, and technical skills. Most WSAs are to be put under regulatory surveillance.

According to the Blue Drop results of 2020, performance to the South Africa National Standards of drinking water (SANS 241: 2015), 63% of the monitored WSAs achieved the required compliance to chemical quality of drinking water for acute health of more than 95%; while 76% achieved compliance to chemical quality for risk of chronic health. All WSAs are expected to achieve microbiological statistics compliance of 99% on a yearly basis. Results of 2020 show that only 32% of WSAs have managed to achieve the required performance for risk of water quality to cause acute health complications because of microbial contamination in drinking water. This is a growing concern which indicates that 68% of the WSAs monitored, supply portable water that is not safe for drinking due to presence of microbial contaminants in treated water.

In terms of access to improved sanitation, 83% of households had access to improved sanitation in 2018, with about 2.8 million households still without access to improved sanitation. The topography remains a challenge in provision of sanitation in rural areas, while the location of informal settlements near urban areas is still a challenge for providing access to sanitation. To date less than 80% of households in Limpopo, Mpumalanga and the North West Province have access to improved sanitation.

Approximately, 3 out of 4 households with access to improved sanitation are serviced with waterborne toilets. This translates to large quantities of wastewater inflow into the wastewater treatment works and large quantities of effluent back into the environment. Only a third of the population relies on ventilated improved pit latrines and their variants – these are waterless or dry sanitation systems. Because of the deficit in water supply, it is expected that South Africa will see more of an increase in non-sewered sanitation systems.

In terms of sanitation infrastructure, 56% of the municipal wastewater treatment plants are in a poor to critical condition and are discharging poorly treated effluent into watercourses. Approximately 10% of households with onsite sanitation have full pits and are at a risk of defaulting back to open defecation. The Department is currently conceptualizing the framework for the development of a Fecal Sludge Management Strategy to ensure the safe handling of fecal sludge from non-sewered / onsite sanitation in terms of toilet containment, emptying, transportation, and treatment for beneficial use or disposal.

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Acronym	Description
AMCOW	African Ministers' Council on Water
AMD	Acid Mine Drainage
AmWSS	Amatole Bulk Water Supply System
APP	Approved Professional Person
ARC	Agricultural Research Council
AWSS	Algoa Water Supply System
BCMM	Buffalo City Metropolitan Municipality
BDS	Bulk Distribution System
BOQ	Bill of Quantities
BRVAS	Berg River Voelvlei Augmentation Scheme
CMA	Catchment Management Agency
COGTA	Cooperative Governance and Traditional Affairs
CSIR	Council for Scientific and Industrial Research
CWRS	Crocodile (West) Reconciliation Strategy
CWRWSS	Crocodile (West) River Water Supply System
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
EC	Electrical Conductivity
ECO	Environmental Control Officer
FEPA	Freshwater Ecosystem Priority Area
FSC	Full Supply Capacity
FY	Financial Year
GBWSS	Greater Bloemfontein Water Supply System
GGRETA	Governance of Groundwater Resources in Transboundary Aquifers
GHS	General Household Survey
GwLS	Groundwater Level Status
GWS	Government Water Scheme
HGM	Hydrogeomorphic
HY	Hydrological Year
IAP	Invasive Alien Plant
IB	Irrigation Board
IBOM	Infrastructure Built Operations and Maintenance
IHP	International Hydrological Programmes
IRIS	Integrated Regulatory Information System
IVRS	Integrated Vaal River System
IWA	International Water Association
IWRM	Integrated Water Resource Management
KCDM	King Cetshwayo District Municipality
KZN	KwaZulu Natal
KZNCMWSS	KwaZulu-Natal Coastal Metropolitan Water Supply System

LHWP	Lesotho Highlands Water Project
LIMCOM	Limpopo watercourse Commission
LM	Local Municipality
LOR	Lower Orange River
MAP	Mean Annual Precipitation
MH	Magnesium Hazard
MM	Metropolitan Municipality
MMM	Mangaung Metropolitan Municipality
NAEHMP	National Aquatic Ecosystem Health Monitoring Programme
NAT	Total natural runoff
NCMP	National Chemical Monitoring Programme
NDP	National Development Plan
NEMP	National Eutrophication Monitoring Programme
NEPAD	New Partnership for Africa’s Development
NESMP	National Estuaries Monitoring Programme
NIWIS	National Integrated Water Information System
NMBMM	Nelson Mandela Bay Metropolitan Municipality
NMMP	National Microbial Monitoring Programme
NRW	Non-Revenue Water
NSoW	National State of Water
NWA	National Water Act
NWMP	National Wetland Monitoring Programme
NWRS	National Water Resource Strategy
NZQM	National Groundwater Quality Monitoring
OCS	Off-Channel Storage
OFS	Orange Free State
ORASECOM	Orange Senqu River Commission
ORS	Orange River System
ORWRDP	Olifants River Water Resources Development Project
ORWSS	Olifants River Water Supply System
OSRM	Orange-Senqu River Mouth
PD	Present Day
PES	Present Ecological State
PET	Potential Evapotranspiration
PI	Permeability Index
PSP	Professional Service Provider
PWSS	Polokwane Water Supply System
RAL	Roads Agency Limpopo
RBO	River Basin Organisation
RC	Regional Commission
RDM	Resource Direct Measures
REMP	River Ecostatus Monitoring Programme
RQIS	Resource Quality and Information System
RQOs	Resource Quality Objectives

RSC	Residual Sodium Carbonates
RTTS	Real-Time Telemetry Systems
SAFE	Sanitation Appropriate for Education programme
SANRAL	South African National Roads Agency
SANS	South African National Standard
SAR	Sodium Adsorption Ration
SAWS	South African Weather Service
SDC	Swiss Development Cooperation
SDC	Source Directed Controls
SDG	Strategic Development Goal
SDGs	Sustainable Development Goals
SEZ	Special Economic Zone
SIV	System Input Volume
SLA	Service Level Agreement
SPI	Standardized Precipitation Index
TCTA	Trans-Caledon Tunnel Authority
TDS	Total Dissolved Solids
TPTC	Tripartite Permanent Commission
TZN	Tzaneen
UGEP	Utilizable Groundwater Exploitation Potential
UNESCO	United Nations Educational Scientific and Cultural Organization
VIP	Ventilated Improved Pit
VRESP	Vaal River Eastern Sub-system Project
WAAS	Water Availability Assessment Study
WC/WDM	Water Conservation / Water Demand Management
WCWSS	Western Cape Water Supply System
WMA	Water Management Area
WRC	Water Research Commission
WRCs	Water Resource Classes
WRPM	Water Resource Planning Model
WSAs	Water Service Authorities
WSP	Water Service Provider
WSS	Water Supply System
WTW	Water Treatment Works
WUA	Water User Associations
WWTW	Wastewater Treatment Works

1 INTRODUCTION

1.1 Background

The South African National Water Act (NWA, 36 of 1998) requires that the nation's water resources are protected, used, developed, conserved, managed, and controlled in an equitable, efficient, and sustainable manner. The National Government acting through the Minister of the Department of Water and Sanitation (DWS) is the public trustee of the nation's water resources.

Water, its quality, quantity, and availability, underpin all areas of life and the environment in South Africa. Water in South Africa has a powerful link not only to all aspects of the physical environment, but to poverty reduction, sustainability, equity, and economic development (Knight, 2019). Water mediates all aspects of health and sanitation, agriculture and food, ecosystems and biodiversity, and many other aspects of life and the environment (Rockström *et al.,* 2014; Ziervogel *et al.,* 2014).

South Africa is in a predominantly temperate and dry climate (Schulze *et al.,* 2011). Generally, the east of the country lies in a summer rainfall zone with high rainfall totals, which can support dense subtropical vegetation and agriculture; whereas the west of the country in the winter rainfall zone is semiarid to arid and able to support only sparse vegetation and extensive grazing agriculture (Knight, 2019). River systems are the common surface water expression of water availability in South Africa, with others being lakes, ponds, and pans. South African river systems and catchments are characterised by a spatial variation in rainfall, as well as variations in catchment sizes and physical properties. These result in different river patterns and dynamics within catchments and further in Water Management Areas, which have implications for water resource availability (Knight and Grab, 2018).

The total natural streamflow of water flowing in water courses to the seas, predicted largely based on rainfall, was estimated to be 49,251 million m^3 per year in 2012. However, each river system has somewhat different real measured value compared to natural values, depending on water abstractions, land use changes and inter-basin transfers (Knight, 2019). The inter-basin transfers correspond to approximately 3,000 million m^3 per year (DWS, 2017). The real streamflow values are thus 60-90% of naturalised values (Knight, 2019).

The climatic context of South Africa means that seasonal and event-scale variations in rainfall give rise to significant spatial and temporal variations in river discharge unaccounted for by aggregated values of total streamflow (Bugan *et al*., 2012). The result of this seasonal imbalance is hydrological floods and droughts.

The estimated amount of groundwater yield that is accessible for use is 4,500 million m^3 per year, which is less than half of total surface water yield (DWS, 2018). The total volume of groundwater present, yet inaccessible, is unknown (Knight, 2019). Groundwater properties have been substantially affected by mining in South Africa. . The most significant impacts of mining on both groundwater and surface water bodies are due to acid mine drainage (AMD). This is the result of chemical leachates from mine ore reprocessing escaping into surface and groundwater systems (Knight, 2019). The issue of water quality is compounded in urban settings where there may be AMD runoff, sewage/sanitation, and microbial contamination of both surface and subsurface water supplies (Lapworth *et al*., 2017; Sorensen *et al*., 2015).

In terms of water use, irrigation-based agriculture uses 61% of the total annual water volume available from both surface and groundwater sources, and municipal/ domestic use represents 27% of the total. However, urban use (24%) is volumetrically greater than rural water use (3%) (DWS, 2017). It is estimated that around 1,660 million m^3 per year of water is lost from municipal water systems as ‘non-revenue’ water, including from leaking pipes and illegal connections. This represents a loss of around 35% of total supplies which is significantly higher than the global best-practice average of 15%. In terms of water supply, 11% of households still do not have access to water supply infrastructure. Only 64% of households receive a reliable water supply (DWS, 2018).

As a developing country, South Africa requires additional water resources to support the growing economy. With 98% of the country’s available water resources already allocated, opportunities to supplement future water supply are limited. Water security will be further threatened as supply decreases due to the negative impacts on yield arising from climate change, degradation of wetlands and water resources, siltation of dams, whilst water losses and demand escalate due to population and economic growth, urbanization, inefficient use, and changing lifestyles.

The greatest challenge South Africa faces is that of the deteriorating water quality, which is a major constraint to economic and social development, reducing the sustainably of the available resource, and impacting significantly on the cost of treating water. The World Bank Report by Damania *et al*. (2019) has demonstrated that water pollution poses a threat to nearly all agreed Sustainable Development Goals (SDGs) to end environmental destruction, poverty and suffering by 2030. Eutrophication, faecal pollution, salinization, and acid mine drainage are the most prevalent surface water quality challenge facing the country.

Several national monitoring networks/programmes ran by DWS are faced with challenges of lack of spatial representation, problems of data quality, lab contamination and data accuracy (Bailey and Pitman, 2016; Pitman, 2011). This has resulted in limited provision of meaningful data for the compilation of the National State of Water Resources and poses a high risk to decision making and planning. There is an urgent need of repairing and maintaining measuring infrastructure, adopting new monitoring technologies, and improving data management and distribution (DWS, 2018).

1.2 Purpose of the National State of Water Report

This National State of Water (NSoW) Report is an integration of water resource information based on a core set of water resource indicators that provides information on the status and trends of water resources in South Africa. This integration of water resource information provides information relating to the relationship between climatic conditions, and quality and quantity of both surface and ground water.

The main purpose of this report is to give a nationwide overview of the status of water resources in the country, and most importantly disseminate information to the public, decision makers, researchers, water managers and all other water sector stakeholders. Furthermore, because there is uncertainty on the quality and quantity of water resources from year to year, this report aims to enhance the quality, accessibility and relevance of information and/or data related to the goal of Integrated Water Resource Management (IWRM). In implementing a holistic approach in water resource management, it is critical that DWS provides adequate information. This is to ensure that stakeholders have access to the same records and same results from conceptual and physical models. This report also gives an indication of the effectiveness of the National Water Act, 36 of 1998, and its implementation through the National Water Resource Strategy (NWRS).

This NSoW Report gives the status of water resources for the reporting period of a hydrological year October 2019 to September 2020. Data and information used to compile the report were acquired from various monitoring programmes and information systems within DWS. Additional information was obtained from the South African Weather Service (SAWS) and Agricultural Research Council (ARC). Data from various monitoring programmes was analysed, integrated, and interpreted to reflect a synopsis of the water status in the country.

The information contained in this report will ultimately assist in decision making within the water sector value chain. Additionally, it will also be used in evaluating and assessing the effectiveness of the monitoring programmes and information systems within DWS. It is expected that through the interpretation and assessment of data and information provided in this report, the challenges experienced in managing the water resources will be highlighted and understood. Additionally, this report will formulate and distribute recommendations for areas that require action.

1.3 The Policy and Legislation Framework

1.3.1 The Constitution of South Africa

The Vision and the Mission of the DWS is guided, amongst others, by the various constitutional, legislative, policy and strategic mandates. The Constitution of the Republic of South Africa (1996) sets out management of the entire water and sanitation value chain as a national competency. It also states that everyone has a right to an environment that is not harmful to their health or well-being and supports socially justifiable economic development.

Chapter 2 of the Constitution indicates the rights of individuals to have access to basic water and sanitation and sets out the institutional framework for the provision of these services. It gives municipalities the executive authority and the right to administer the provisioning of water and sanitation services within their areas of jurisdiction.

The Constitution also gives national and provincial government authority to regulate local government in terms of water and sanitation services. It further gives them the obligation to support and strengthen the capacity of local government to provide services.

The Constitution became the basis for further policy and legislative development that resulted in the current policy and legislation enabling water resource management in South Africa namely: National Water Policy White Paper of 1997, National Water Act of 1998, Water Services Act of 1997, Water Research Act of 1971 and National Water Resource Strategy (I and II).

1.3.2 National Water Policy

The 1997 White Paper on a National Water Policy for South Africa set out the policy of the Government for the management of both quality and quantity of water resources. It had to reflect the requirements of fairness and equity, values which are cornerstones of South Africa’s Constitution. It also specifies the limits to the water resources available to the country, primarily because water was mostly used by a dominant group which had privileged access to land and economic power.

The National Water Policy Review of 2013 has determined unintended oversight and gaps in the existing water policies to provide amendment to address the following:

a) *Use-it or Lose-it:* Any authorised water use (including existing lawful use) unutilized for a specified period should be reallocated to the public trust. This water will be reallocated to address social and economic equity.
b) *No water trading:* No form of temporary or permanent trading between authorized water users. The obligation for any holder of an entitlement to use water; if it is no longer utilized, is to surrender such use to the public trust.
c) *Prioritizing social and economic equity:* The decision making will have equity as the primary consideration. Priority will be accorded to water use authorisation applications that meet the equity requirement, as provided in the regulatory instruments.
d) *Multiple water use approach in planning:* A multiple water use approach incorporating all water uses in an area including water supply, must be adopted in planning of bulk water infrastructure. This approach will also have equity and transformation as a priority.
e) *Access to basic water supply*: A Water Service Authority (WSA) should work progressively or incrementally towards providing higher levels of a sustainable

water supply to all households and public institutions, including rural areas. When planning, a WSA must consider the basic water supply which addresses current domestic and productive use requirements, as well as future growth in these requirements; and

f) *Free basic water supply to indigent households*: Free basic water supply will be provided to indigent households only.

1.3.3 National Sanitation Policy

The enactment of the Municipal Systems Act (Act 32 of 2000) has made it possible for the local government to assume full responsibility for ensuring water and sanitation services, as provided for in the Constitution and hence a need for revised sanitation legislation to address sanitation gaps and challenges, as well as to address national and international development imperatives.

Access to adequate sanitation services is important to achieve goals of improved health, safety, environmental standards, and dignity for all South Africans. The Constitution of the Republic of South Africa (Act 108 of 1996) provides the right of all people in South Africa to dignity and access to an environment that is not harmful to health and well-being and is sustainable and protected from pollution and degradation through legislative measures. The Water Services Act (Act 108 of 1997) section 3 (1) provides for a basic right of access to basic water supply and basic sanitation to everyone.

The Department of Water and Sanitation (DWS) as a sector leader, has been in the forefront of reviewing the White Paper on Basic Household Sanitation (2001) which resulted in the National Sanitation Policy (2016). The National Sanitation Policy led to a major policy shift that encourages new thinking around sanitation management, innovation, more appropriate ways of treating human waste, and recognizes the economic value of sanitation. The policy addresses the entire sanitation value chain namely, the collection, removal, transportation, treatment, disposal and beneficial use of human excreta.

1.3.4 The National Water Act (Act 36 of 1998) as amended

The National Water Act (NWA) – “The Act” seeks to ensure that the country’s water resources are protected, used, developed, conserved, managed, and controlled in a sustainable and equitable manner for the benefit of all people.

The Act assigns the national government as the public trustee of the water resources. Acting through the Minister, it has the power to regulate the allocation, use, flow, and control of all water in the Republic. The Act also identifies the need to establish suitable institutions to achieve its purpose. In addition, it provides for the development of the National Water Resources Strategy (NWRS) which must be regularly reviewed, and The Act requires each Catchment Management Agency (CMA) to develop a catchment management strategy for the water resources within its jurisdiction.

Chapter 14 of The Act requires the Minister to establish national monitoring systems or programmes to facilitate coordinated monitoring through established procedures and mechanisms; in addition, national information systems need to be established to ensure information is accessible for use by water users and the public.

1.3.5 The Water Services Act, 1997 (Act No 108 of 1997)

The Water Services Act prescribes the legislative duty of municipalities as water service authorities to supply water and sanitation according to national norms and standards. In addition, it regulates Water Boards as important water service providers.

The Act compels the Minister to maintain a National Water Services Information System and to monitor the performance of all water services institutions, as well as providing for the monitoring of water services and intervention by the Minister or the relevant Province when necessitated.

With reference to a “right to basic sanitation”, the Water Services Act is the primary legislation relating to sanitation in South Africa. It further defines basic sanitation as: ‘The prescribed minimum standard of services necessary for the safe, hygienic and adequate collection, removal, disposal or purification of human excreta, domestic wastewater and sewerage from households, including informal households. Further regulations, norms and standards pertaining to sanitation can be found in the Housing Act (No.107 of 1997).

This Act acknowledges that although municipalities have authority to administer water supply services and sanitation services, all government spheres are required to work towards this objective, within the limits of physical and financial feasibility.

1.3.6 The Water Research Act, 1971 (Act No 34 of 1971)

The Water Research Act establishes the Water Research Commission (WRC) and the Water Research Fund, and thus promotes water related research and the use of water for agricultural purposes, industrial purposes, or urban purposes. The Minister appoints members of the WRC, and thus exercises executive oversight over the Commission.

1.3.7 National Water Resource Strategy

The National Water Resource Strategy (NWRS) is developed as a legal instrument to ensure effective implementation of the National Water Act and the NWRS must be reviewed at intervals of not more than five (5) years through a public consultative process. Currently the National Water Resource Strategy (NWRS-2) of 2013 is in a process of being reviewed, and the NWRS-3 is still in the drafting phase. The NWRS-3 provides the framework for the protection, use, development, conservation, management, and control of water resources for the country. It also provides the framework within which water will be managed at regional or catchment level, in defined water management areas. The NWRS is the legal instrument of operationalizing or implementing the National Water Act.

NWRS-3 seeks to address concerns about socio-economic growth and South Africa's potential, which may be restricted if water security, adequate sanitation, resources quality and associated water and sanitation management issues are not resolved in time. NWRS-3 focuses on transformation issues to addressing equitable access to water, or to the benefits derived from using water within the water sector, thus, contributing to eradicating poverty, and promoting equitable sustainable economic growth. The Strategy also puts greater focus on integrated water quality management and setting of stricter minimum requirements for effluent discharges from wastewater treatment works (WWTW), improves regulation by strengthening of the compliance and enforcement unit to properly regulate the sector. NWRS-3 intends to put measures on water conservation and water demand management (WC/WDM) in place to reconcile the available supply with the demand for water to reduce water losses because of leaks and wasteful use. The NWRS-3 aims to ensure that water and sanitation serve as an enabler for inclusive economic and social well-being and development, and not as a hindrance.

1.4 Water Management Areas

Based on the outcome of the Departmental Institutional Reform and Realignment (IRR) study, the NWRS2 established the nine WMAs in South Africa, as from July 2012 (Figure 1.1); these replaced the 19 WMAs identified prior to this date. It was recognised that these WMA boundaries needed to be reviewed periodically to accommodate new realisations and issues. WMAs are largely based on catchment boundaries, except for those catchments that cross international borders. Within these WMAs, catchments are further subdivided into tertiary, secondary, and quaternary catchments. Most of the status and trends of water resources given in this report has been analysed and presented based on these nine WMAs.

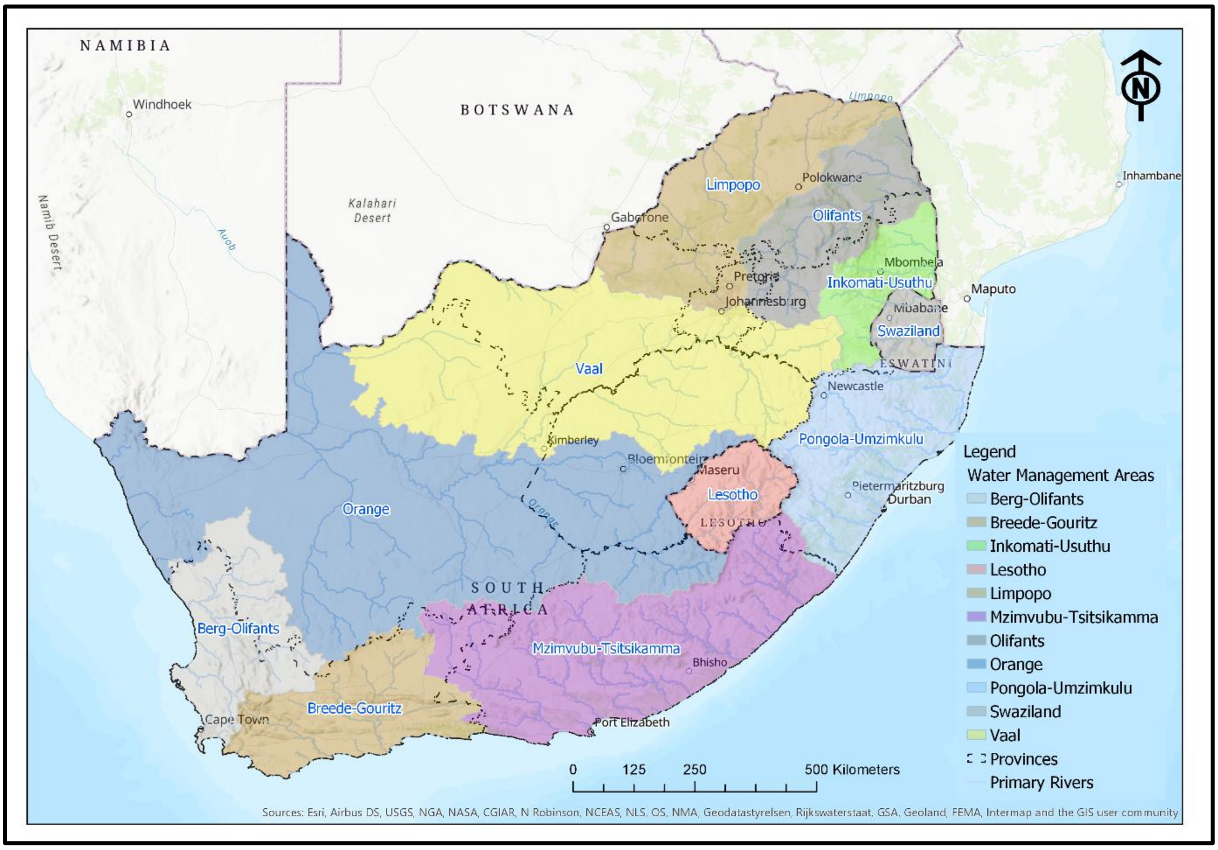


Figure 1.1 South African Nine Water Management Areas as of 2012

The Department has embarked on several institutional re-alignment processes with the aim of transforming the water sector and building stable institutions with clearly defined roles and responsibilities across the sector and promoting effective institutional performance. It is proposed that going forward water resource management will be based on six water management areas for which CMAs will be established, these are: Limpopo-Olifants (1); Inkomati-Pongola (2); Mhlatuze-Mzimkhulu (3); Vaal-Orange (4); Mzimvubu-Tsitsikamma (5); Breede-Olifants (6) – see Figure 1.2.

As part of the Department's turnaround strategy in establishing CMAs, the extension of the boundary of the existing Breede-Gouritz CMA to incorporate the Berg-Olifants water management area has been gazetted for public comments in terms of section 78(1) of the National Water Act, 1998 (Act No. 36 of 1998) to establish the Breede-Olifants CMA in September 2020. While in March 2021, the extension of the Vaal CMA to include the Orange water management area has been gazetted for public consultation in terms of section 78(4) of the National Water Act, 1998 (Act No. 36 of 1998). This incorporation will enhance revenue generation and sustainability of the CMA, as well as enabling an effective water resources management.

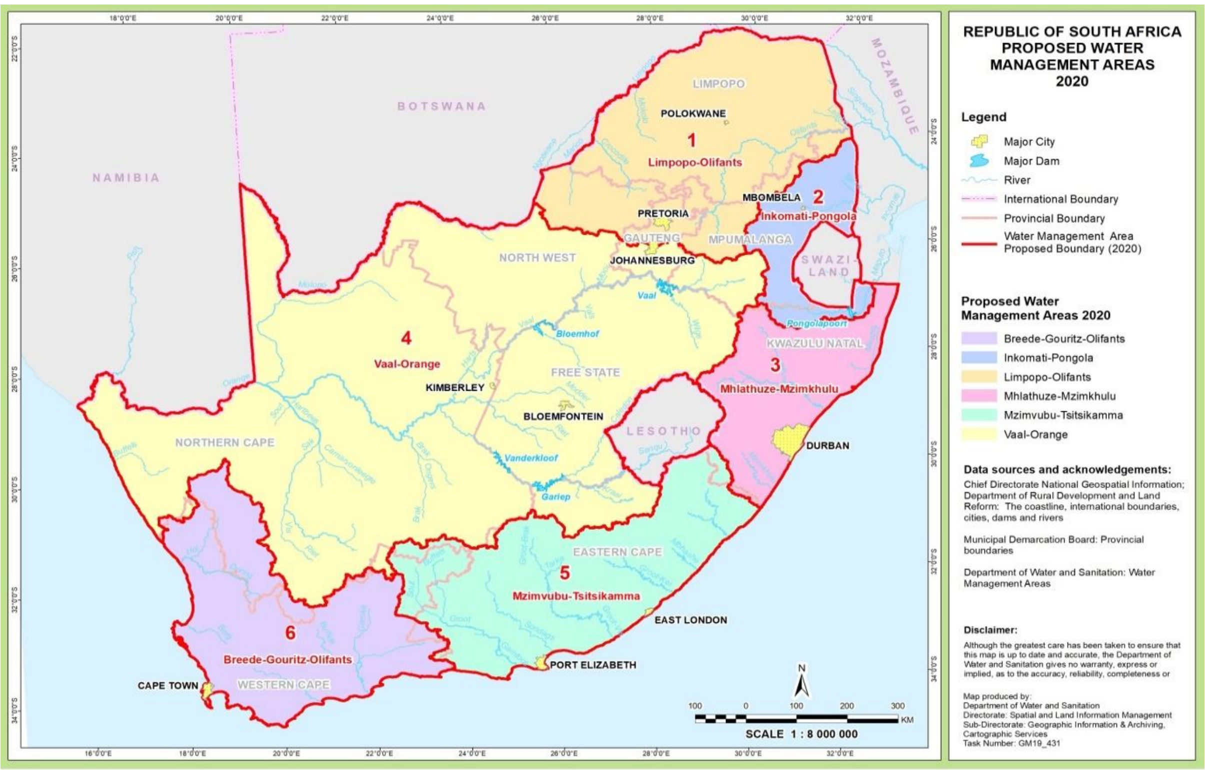


Figure 1.2 Proposed New WMAs and CMA configuration

The CMAs initial function will be to promote community participation in water governance. The CMA will manage and control water resources; develop catchment management strategies and ensure coordination and implementation by municipalities as per section 80 of the National Water Act, 36 of 1998.

1.5 Water Sector Institutional Design

The South African Sector Institutional landscape as of 2020, together with proposed new entities is illustrated in Figure 1.3. The National Department of Water and Sanitation is the custodian of water resources with an obligation of water resource management DWS acting through the Minister is responsible for water sector policy, support, and regulation.

This water resource management obligation or function is to be delegated to an institution at the water management area level such as a Catchment Management Agency (CMA), this is in support of the principles of integrated water resource management. In water management areas where a CMA has not been established the responsible authority (DWS national and regional) continues to act as a CMA to perform all water resource management functions at a catchment level.

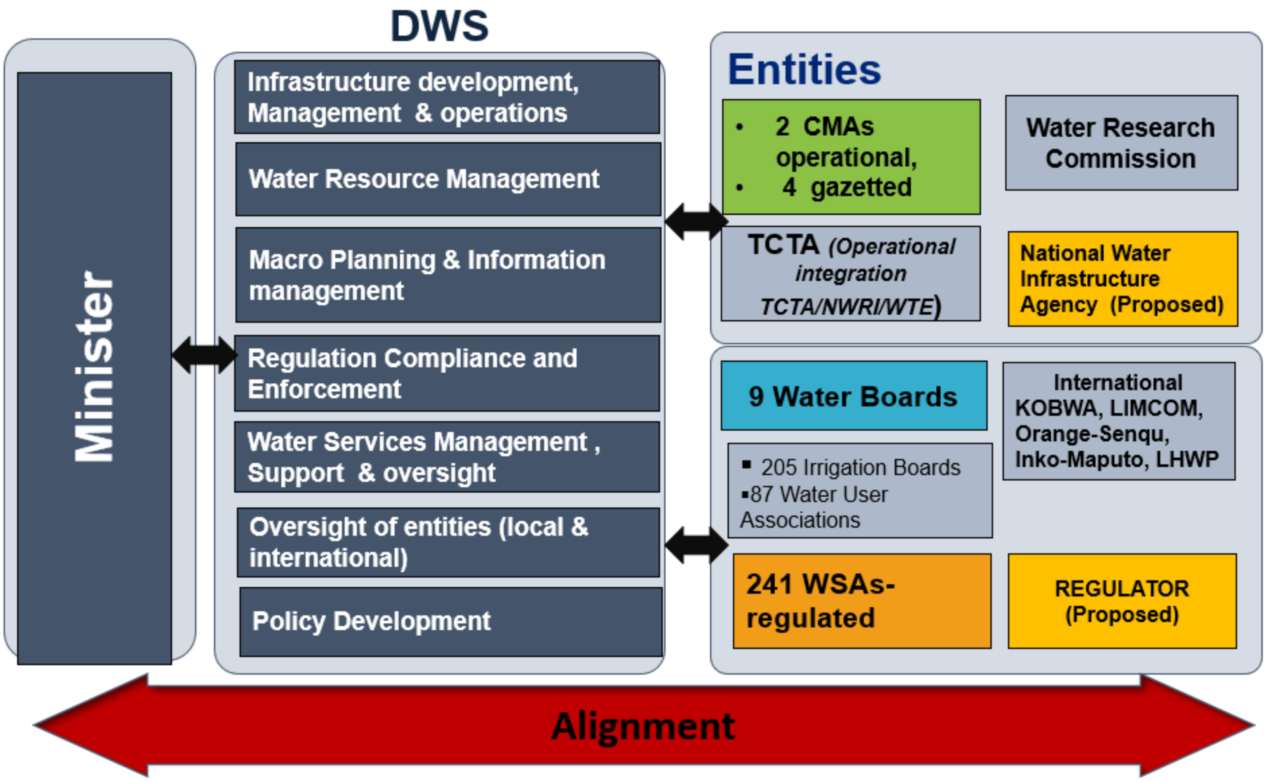


Figure 1.3 Water Sector Institutional Landscape in 2020

At the local level, are Water Services Authorities (WSAs) - municipalities, who provides water services or outsource water services provisions to the private Water Services Providers (WSPs) - water boards. These WSAs and WSPs that provide water and sanitation services are regulated by the Department of Cooperative Governance and Traditional Affairs (CoGTA). A water services authority means any municipality, including district or rural council (as defined in the Local Government Transition Act, 1993), responsible for ensuring access to water services. Water services providers means any person who provides water services to consumers or to another water services institution. Notably, some WSA are WSP, and in other cases the WSA has WSP that provides water services on their behalf.

2 WATER RESOURCE DATA

2.1 Status of the Monitoring Programmes

The national water resources monitoring network programme provides credible, timely and consistent water resource information about changes to status and trends in South Africa's water situations and to ensure the implementation of the NWA.

There is a need to expand the monitoring network due to increasing demand for reliable water resource information. DWS runs several monitoring networks, namely:

- Surface water monitoring - river flows, dam levels rainfall and evaporation:
  Monitoring of water quantity to indicate dam levels, river flows, evaporation using pan-evaporations (Symons-pan & Class A-pan) and rainfall in some places.
- Groundwater monitoring:
  Monitoring of groundwater levels and groundwater chemistry to establish available water and quality for its suitability.
- Surface water quality - microbial, eutrophication, radioactivity, toxicity and chemical:
  Monitoring water quality to assess whether water is impacted and establish the status in achieving the set Resource Quality Objectives (RQOs).
- Biological - aquatic ecosystem health:
  Monitoring of the environmental status or the health of rivers using biological indicators such as SASS, fish, diatoms, etc. The biological indicators show the effect of pollution over a period whereas other methods measure what is in the water at a given time.

The purpose of these monitoring programmes is to ensure water resources are protected, developed, and managed effectively. The existing monitoring programmes have been reviewed with the intention to optimise monitoring. The implementation plan is developed to address the future requirements for water resources monitoring for South Africa.

2.1.1 Groundwater Monitoring Programmes

Groundwater monitoring within the DWS consists of two programmes which are groundwater quality monitoring and groundwater level monitoring, as presented in Figure 2.1 below.

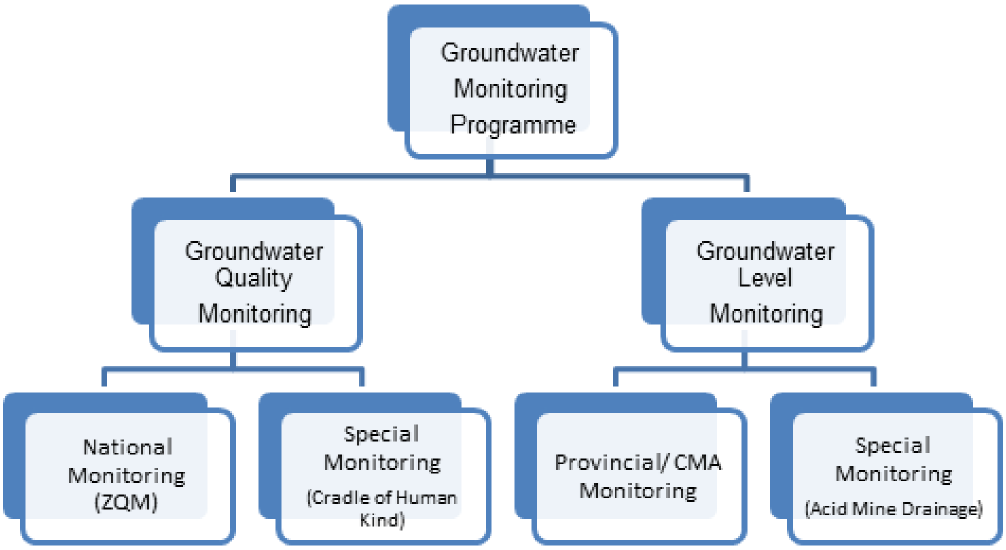


Figure 2.1 Groundwater Monitoring Programmes

a) Groundwater Quality Monitoring Programme

The National Groundwater Quality Monitoring (NGWQM = ZQM)) was established in 1994, with the objective to determine the influence of rainfall on groundwater levels, quality and to establish if groundwater quality reflects the geological characteristics of the aquifers and or ascertain if it is impaired by anthropogenic influences. This programme also determines the groundwater quality on a national scale and evaluates trends and changes. The parameters monitored in the field are pH, EC, and Temperature, while the trace metals, organic and inorganic parameters are analysed in the laboratory.

The activities related to the groundwater monitoring programme resumed in late February to early March 2020 after challenges with the laboratories ability to conduct sample analysis were resolved. DWS had samples collected up to March 2020 in most of the Regional Offices at the end of the reporting period (September 2020). This was due to the nationwide lockdown regulations because of the Covid-19 pandemic.

Groundwater quality data availability on Water Management System (WMS) is presented in Figure 2.2. The data is available for most monitoring stations up to 2017/18, although some results have been received from the February / March 2020 monitoring period. There is, therefore, no recent data in line with the established monitoring frequency.

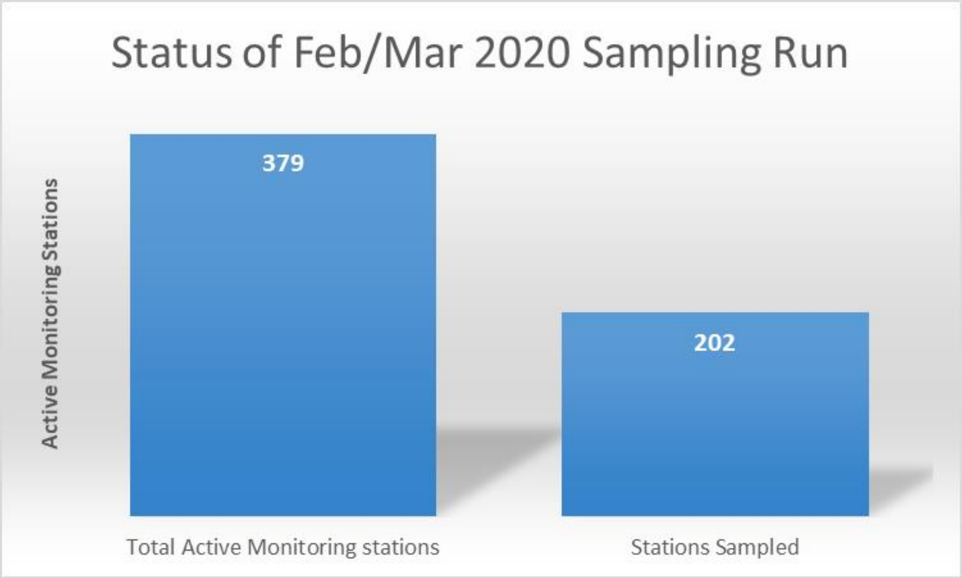


Figure 2.2 Status of latest Sampling Run (February/March 2020)

The sampling run of the national groundwater quality monitoring programme from April 2016 to March 2020 is presented in Figure 2.3.

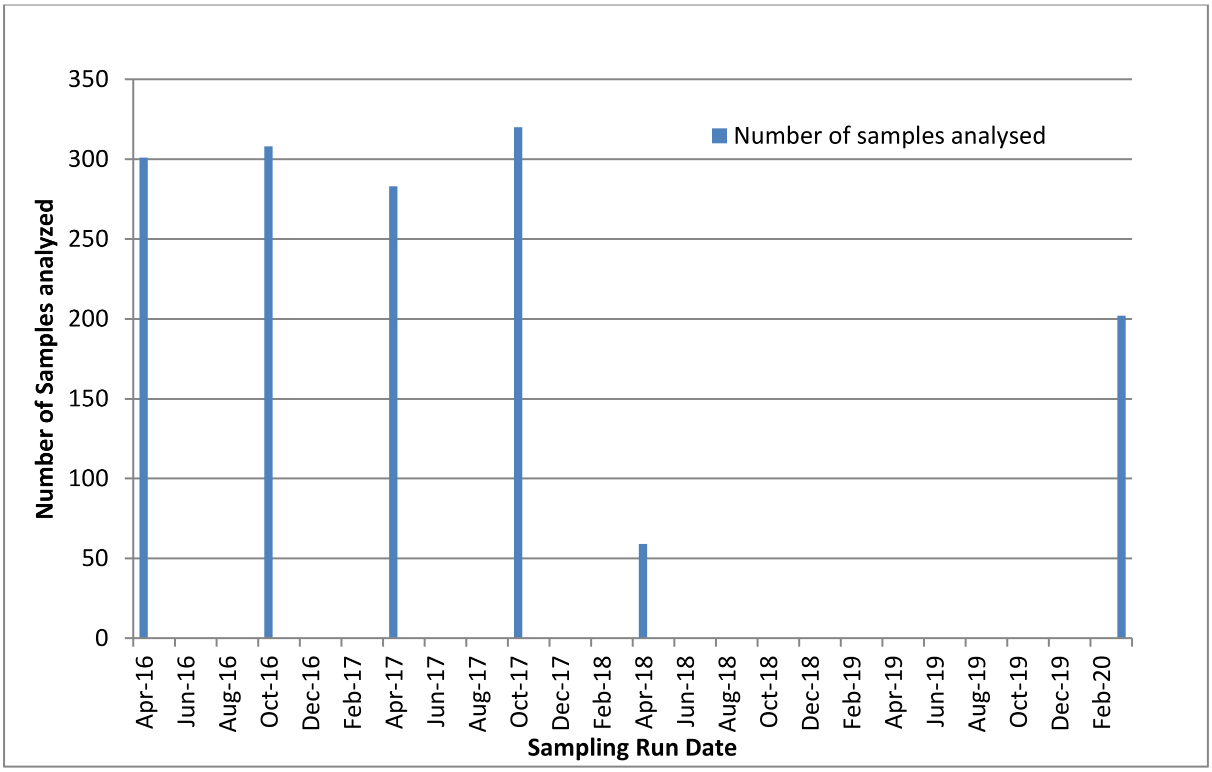


Figure 2.3 Sampling for the national groundwater quality monitoring programme

No monitoring took place for three sampling runs in line with the established frequency (partially in April / May 2018; No Monitoring September / October 2018; and April/ May

2019 monitoring runs) as well as delayed monitoring for September / October 2019, which took place in February / March 2020.

At the end of the reporting period, only 202 samples were taken from the monitoring stations for the hydrological year - October 2019 to September 2020. Approximately 379 monitoring points form part of this monitoring programme. The Western Cape and North West had not collected any samples at all. This was due to a lack of laboratory facilities for sample analysis in the Western Cape and travelling challenges in the North West province.

Generally, the monitoring programme is experiencing challenges of outdated field monitoring equipment and a lack of auditing and or quality control of the sampling process, which threatens the successful continuous implementation of the monitoring programme. The Spatial distribution of the National groundwater quality monitoring network is presented in Figure 2.4.

The groundwater quality monitoring programme, includes samples of Acid Mine Drainage (AMD) from the Tarlton Dolomitic Aquifer, established in 2012. This was to support to the Management Authority of the Cradle of Humankind World Heritage Site who have appointed CSIR to implement the water resources monitoring programme. The objective of this programme is to evaluate the impact of mine water on the receiving karst environment within the heritage site. Activities under this programme are currently undertaken by DWS on a quarterly basis. Approximately 18 monitoring points form part of this monitoring programme. During the reporting period, no monitoring took place in June 2020 as planned, due to the Covid-19 regulations which restricted travel. The groundwater quality status for this programme is contained in a report produced by the CSIR for the Cradle of humankind heritage Site.

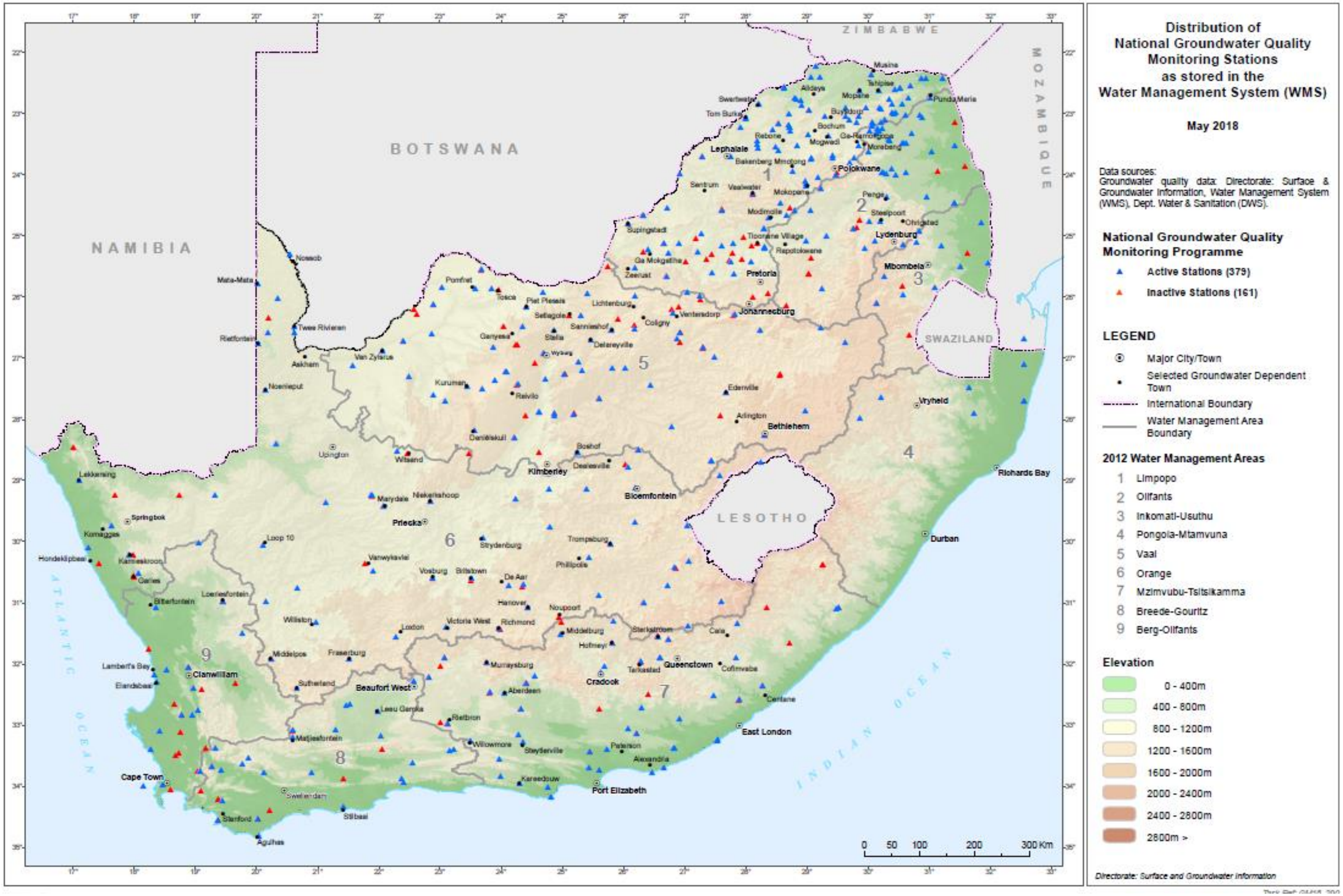


Figure 2.4 Distribution of the National Groundwater Quality Monitoring Stations

b) Groundwater Level Monitoring Programme

The National or Regional groundwater level network is composed of various networks that are managed by the Regional Offices or Catchment Management Agency. The stations used for monitoring water levels include both exploration and hydro census boreholes that were adopted as monitoring boreholes.

This monitoring network is currently active, however, due to Covid-19 regulations, most of the regional offices could not travel to collect data. It must be noted that the availability of water level data is dependent on the captured data on HYDSTRA. The current network challenges result in little to no data available at some stations.

In the Western Cape Region, the groundwater level monitoring network is facing challenges of reduction in the monitoring frequencies due to budget constraints. Most monitoring boreholes which used to be visited monthly are now being visited twice a year. This data gap poses a risk of uncertainty in reaching conclusions based on the interpretation of the data. As a result of the reduced monitoring frequency, the monthly status report on groundwater levels will no longer be feasible for this region.

The status of the availability of groundwater level monitoring data on the national database (HYDSTRA) as of the 26th September 2020 is given in Table 2-1. There was a total of 1 856 active stations, and 49% of these active stations had data for the period of reporting. KwaZulu-Natal, Gauteng, Mpumalanga, and Limpopo recorded the lowest percentage of less than 5 % of total active stations with available data. Lack of groundwater level data for Gauteng was due to cost cutting measures. The nation-wide lock down which was implemented has also affected data availability across all regional offices.

Table 2-1 Status of groundwater level data availability

Total No. Registered Stations	**Total No. Inactive Stations**	**Total No. Active Stations**	**Total No. Active Stations with data between 01 April 2020 - 26 September 2020**	**% Active Stations with available data (01 April 2020 - 26 September 2020)**
6 125	4 269	1 856	911	49%

The spatial distribution of the active national groundwater level monitoring sites as of September 2020 is presented in Figure 2.5.

The AMD Monitoring of the central and eastern basins in Gauteng also forms part of the groundwater level monitoring programme. This network is related to the monitoring of groundwater levels and rainfall for 45 stations (consisting of boreholes, shafts, 1 spring & 4 rainfall recorders). This was established in 2010, with the objective of managing the risk related to AMD wherein flooding of mines could lead to the contamination of shallow groundwater resources, and the decant of AMD could result in significant ecological impacts, which includes regional impacts on major rivers and localized flooding of low-lying areas. Manual dip meters and data loggers are the instruments used for groundwater level monitoring.

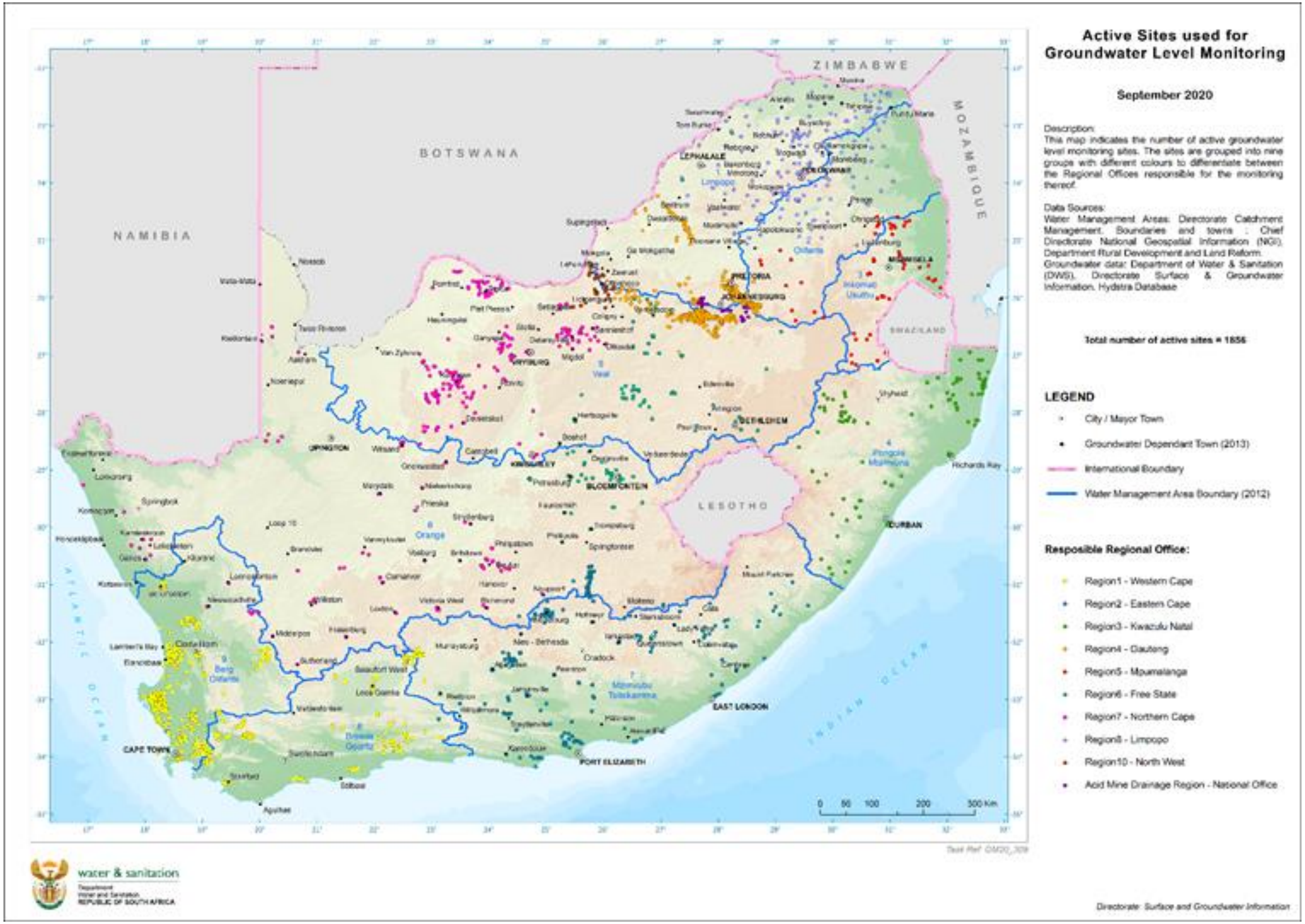
This monitoring network is scheduled to take place monthly. Due to Covid-19 regulations, no field activities were carried out during the period from April through to September 2020. The monitoring data from a few boreholes were obtained by contacting other stakeholders within the area where these boreholes are located.

The groundwater monitoring programme currently faces challenges of vehicles not suited for site access and availability of spares and batteries for data loggers, this poses a threat to the continuous collection of groundwater level data. Vandalism of monitoring stations is also a growing concern, and at some stations, gates have been stolen and some monitoring loggers removed. Safety risks of monitoring officials at the closed mining area are increasing due to the increase of armed illegal miners at monitoring sites around the mine.

Citizen Science (CS) can be introduced in monitoring areas to reduce vandalism that is being experienced at some sites. This will ensure the public's engagement in scientific data collection activities and co-create a new scientific culture where the communities are 'custodians' of the monitoring stations that are in their area. There are successful case studies locally such as the development of the Enviro-Champs model has seen significant parallel growth along with this CS project. Initiated by several local KZN Midlands NGOs including DUCT (https://www.duct.org.za/) and WESSA (http://wessa.org.za).

According to Graham and Taylor (2018) a key strategic policy document around future water resource management for South Africa has been published. This is the DWS – Integrated Water Quality Management (IWQM) Strategy. This key document has identified very specific strategic issues, objectives and actions which include:

a) Governance frameworks for active citizenry.
b) Development of citizen-based monitoring.
c) Expanding capacity building initiatives.
d) Online tools for water quality and water quality management information.



Description:
This map indicates the number of active groundwater level monitoring sites. The sites are grouped into nine groups with different colours to differentiate between the Regional Offices responsible for the monitoring thereof.

Data Sources:
Water Management Areas: Directorate Catchment Management. Boundaries and towns : Chief Directorate National Geospatial Information (NGI), Department Rural Development and Land Reform.
Groundwater data: Department of Water & Sanitation (DWS), Directorate Surface & Groundwater Information, Hydstra Database

Figure 2.5 Active groundwater level monitoring stations

The status of the availability of the AMD groundwater level monitoring data on the national database is given in Table 2-2. There was a total of 37 active stations, and 11% of these active stations had data for the period of reporting.

Table 2-2 Status of data availability for AMD groundwater levels

Total No. Registered Stations	**Total No. Inactive Stations**	**Total No. Active Stations**	**Total No. Active Stations with data between 01 April 2020 - 26 September 2020**	**% Active Stations with available data (01 April 2020 - 26 September 2020)**
49	12	37	4	11%

2.1.2 Surface Water Monitoring Network

DWS has an established and operational national network of gauging stations along rivers, dams, estuaries, dolomitic eyes, canals, and pipelines. The purpose of the national network is to measure hydro-meteorological conditions to enable informed water resource assessment and planning, monitoring of water supply, system operations and drought or flood monitoring and forecasting. From the mid 1980's DWS had equipped some of the gauging stations with automatic wireless communication data relaying systems.

Over time gauging stations have been equipped with real-time telemetry systems (RTTS) for other essential water resource management resources assessment operations such as water supply infrastructure operation and the monitoring of water abstraction and environmental water requirements status. Currently 700 hydro-meteorological gauging stations are equipped with RTTS. The number of stations has declined over the years due to vandalism, theft, failure, wear, and tear, under investment and lack of maintenance due to challenges in supply chain processes.

The monitoring of surface water levels, data quality control and data capturing to the HYDSTRA database is done by the Provincial Offices. This database contains surface, groundwater, and rainfall data. The Table 2-3 gives a summary of the availability of surface water monitoring data per type of monitoring station in the national database (HYDSTRA) at the end of the reporting period in September 2020. Only 28% of the total active stations had data available at the end of the reporting period. The surface water monitoring data (dams, floods, flows) captured internally on the HYDSTRA system is available to the public on https://www.dws.gov.za/Hydrology/Default.aspx or alternatively data can be requested at georequests@dws.gov.za.

Table 2-3 Availability of Surface Monitoring Data

STATION TYPE	NO STATIONS WITH DATA
River	186
Canal	89
Pipeline	30
Eye	2
Reservoir	56
Meteorological	33
Estuary	10
Stations with data	406
Total Stations	1450
% with data	28 %

An audit of surface water level data availability as of end September 2020 is given in Table 2-4. The Western Cape and Mpumalanga Region stations had no data recorded, while Limpopo and Gauteng / North West had data available for 6% of the active stations.

Table 2-4 Availability of Surface Monitoring Data on HYDSTRA per Region

REGION	TOTAL ACTIVE SITES	SITES WITH DATA	% WITH DATA
Western Cape	329	0	0
Eastern Cape	256	198	77
KwaZulu Natal	171	50	29
Gauteng & North West	175	10	6
Mpumalanga	176	0	0
Free State	130	79	61
Northern Cape	72	60	83
Limpopo	141	9	6
TOTALS	**1450**	**406**	**28**

The trend of open and closed stations up to September 2020 is presented in Figure 2.6, while the spatial distribution of the active river flow stations as of December 2020 is presented in Figure 2.7.

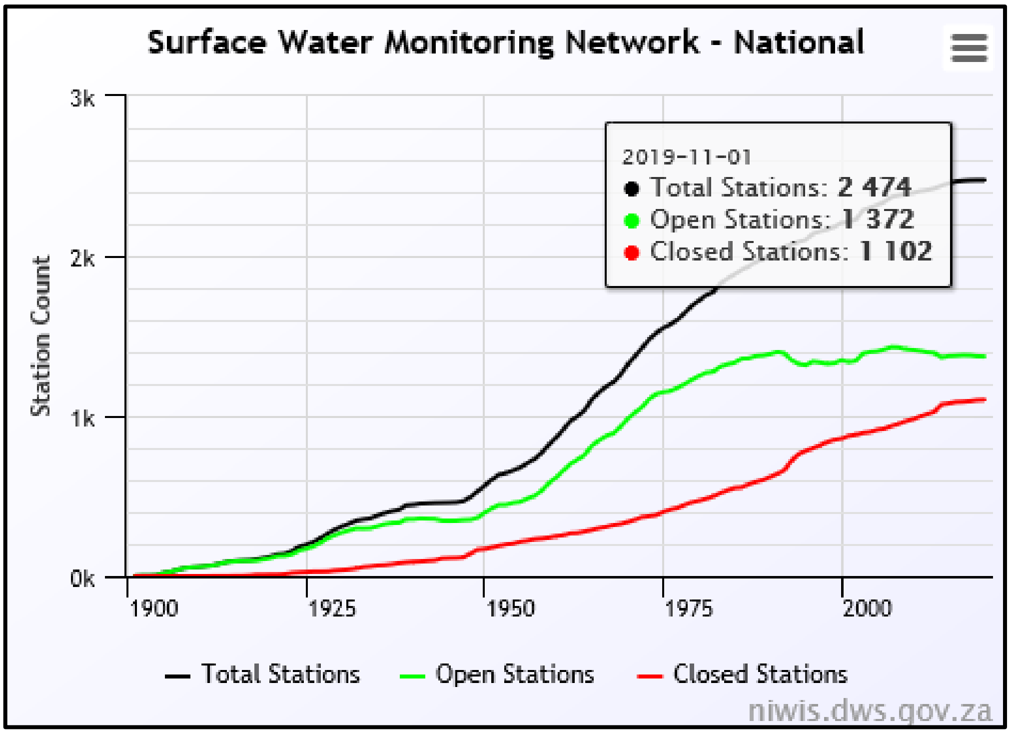
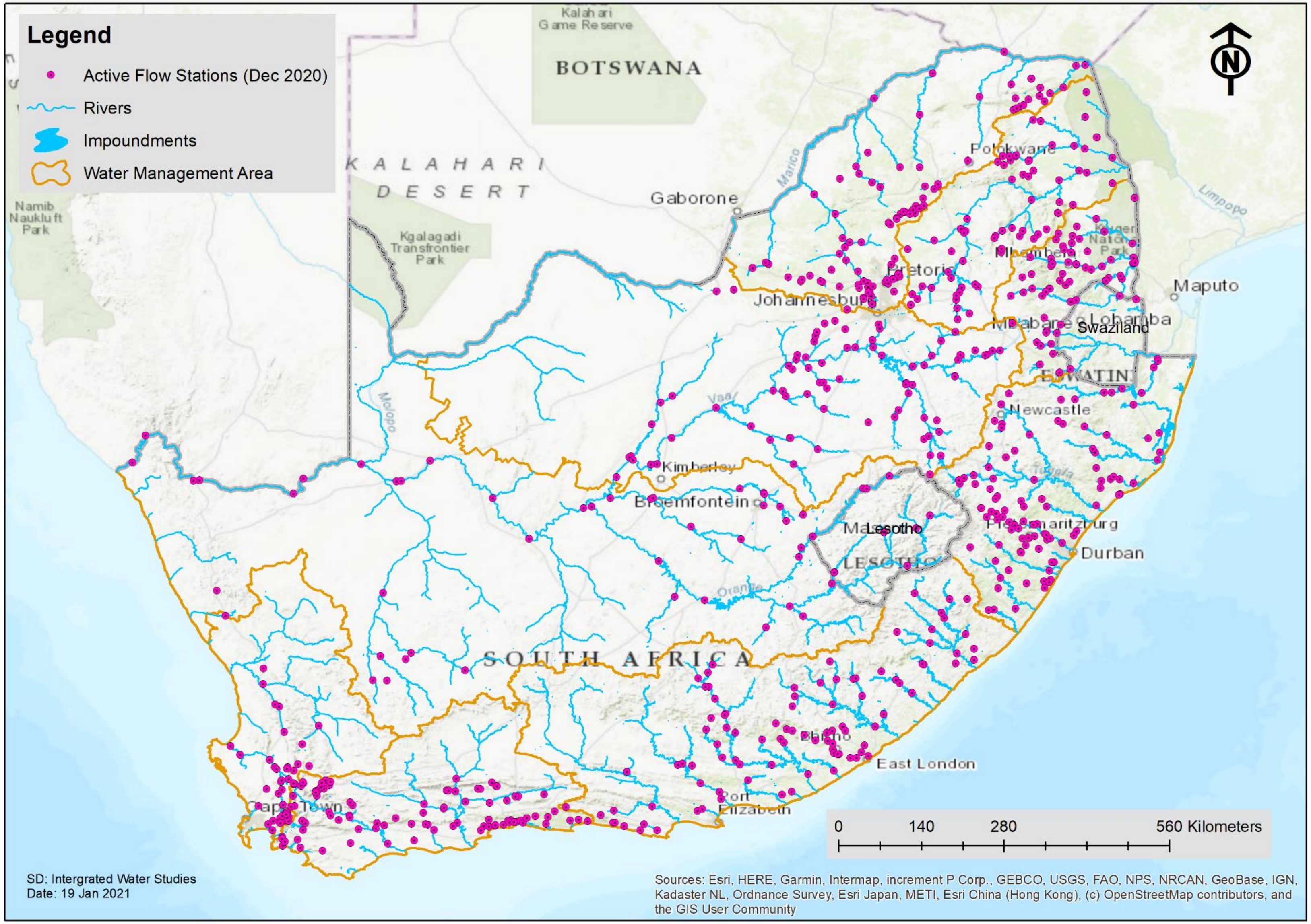


Figure 2.6 Number of Surface Monitoring stations

At the end of the period of reporting only 1 450 stations were active or open, out of the 2 474 total stations that have existed to date. The main reasons for station closure are associated with cost cutting measures, lack of instrumentation and infrastructure maintenance, lack of adequate investment in water monitoring (budget cuts).



SD: Intergrated Water Studies
Date: 19 Jan 2021

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Figure 2.7 Active River Flow Stations.

2.1.3 National Water Resource Quality Monitoring Network

a) National Chemical Monitoring Programme

The National Chemical Monitoring Programme (NCMP) was established in 1970s based on the state of knowledge and national priorities at the time. This is the longest running water quality monitoring programme in the country and has been the source of data and information for the last 48 years for inorganic chemical quality of surface water resources. The programme depends on regional officials for data collection. Samples collected by regional officials are sent to the RQIS laboratory for analysis.

The objectives of the programme include i) to determine at a national scale the inorganic status and trends in South African rivers; ii) to support the National River Ecostatus Monitoring Programme (REMP); iii) to contribute to the integrated overarching database and, dissemination of data and information. The water quality variables measured include salinity level of water resources which is measured as total dissolved solids or electrical conductivity including the concentrations of individual irons such as sodium, chloride, magnesium, potassium, and sulphate. The NCMP also measures nutrients such as ammonium and nitrate-nitrite levels.

In the reporting period the NCMP was not operational due to a range of challenges. For example, the inorganic laboratory at the RQIS was not operation due to shortages of reagents, aging analytical instruments needing replacement, COVID-19 regulations, as well as budgetary constraints. Because of these challenges no data had been collected for all the 346 sites nationwide, since September 2018. Therefore, due to lack of data, the status of inorganic chemical water quality could not be reported on for the period assessed. It is important to note that the RQIS laboratory has lost its accreditation and unless this is addressed, the credibility and reliability of data from the programme may become questionable. As shown in Figure 2.8 Percentage of active NCMP stations for Rivers and Dams, data collected via the NCMP has been declining since 2016, depicted as percentage of active stations.

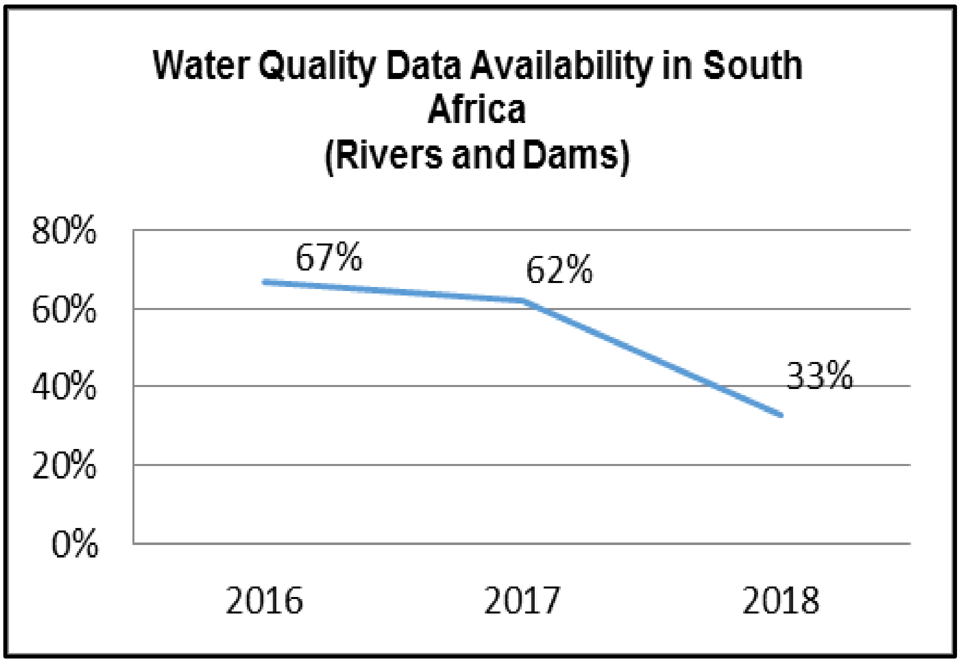


Figure 2.8 Percentage of active NCMP stations for Rivers and Dams

The decline of inorganic chemical data in the Water Management System (WMS) database is of a great concern and need urgent attention. Of equal concern is that even when data were being actively collected, not all desire chemical variables were being analysed. In revamping the programme, attention should be paid to critical water quality variables of concern for inclusion in the NCMP.

b) National Eutrophication Monitoring Programme

The National Eutrophication Monitoring Programme (NEMP) was established and officially implemented in 2002. After the implementation of the NEMP in 2002, the Department also began regularly releasing data indicating the extent of eutrophication in the country.

The objectives of the NEMP are to measure, assess and report regularly on the trophic status of South African water resources. The NEMP is also aimed at identifying problems associated with eutrophication, determining the potential for future changes in trophic status of South African impoundments and Rivers, as well as serving as early warning system for specific eutrophication-related problems, and nutrient balance.

During the reporting period data collection through sampling and analysis for the NEMP has remained suspended for all Provincial Offices due to similar challenges faced by NCMP. The only provinces where data were being collected are Gauteng, North-West and Mpumalanga. Sampling sites in these three provinces are closer to RQIS laboratories and the sampling teams can travel, collect and drop-off samples within a day.

c) River Ecostatus Monitoring Programme

The River EcoStatus Monitoring Programme (REMP) focuses on the monitoring of ecological condition of river ecosystems as reflected by the system drivers and biological responses. Reference conditions derived from best available information are determined for the various indicators used in REMP. The present conditions (Ecological Category) for the different indicators are determined as a percentage change from reference. The REMP is built upon the use of models incorporating existing approved EcoStatus models. The assessment can be done on a sub quaternary reach or site level and includes the use of the Index of Habitat Integrity (IHI), Fish Response Assessment Index (FRAI), Macroinvertebrate Response Assessment Index (MIRAI), Vegetation Response Assessment Index (VEGRAI) and Integrated Ecological condition (Ecostatus). Monitoring is conducted on a quarterly basis and technical reports produced annually.

Challenges relating to COVID-19, lack of sufficient Personal Protective Equipment (PPE), social distancing and challenges with finding accommodation for distant sites, have resulted in the programme shifting to only monitoring macro-invertebrates. This was because macro-invertebrate monitoring is rapid.

d) National Toxicity Monitoring Programme

The National Toxicity Monitoring Program (NTMP) was developed in the latter part of the 1990s to address the issues surrounding new emerging contaminants, which were not originally accommodated in the 1996 South African water quality guidelines. These included some pesticides and a selection of endocrine disrupting compounds. Later, pollutants were included that require reporting under the Stockholm Convention on Persistent Organic Pollutants. This is an international environmental treaty, signed in 2001 and effective from May 2004, that aims to eliminate or restrict the production and use of persistent organic pollutants.

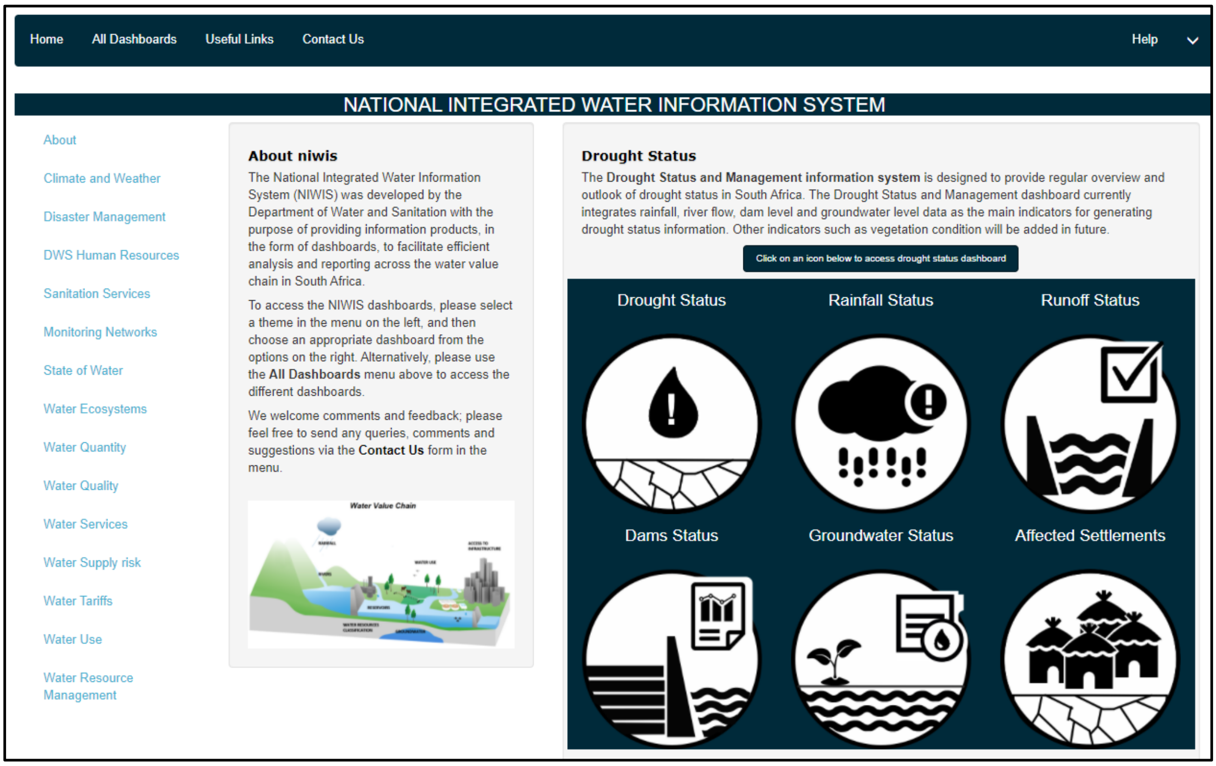
The NTMP is distinguished from the National Chemical Monitoring Program (NCMP) using more advanced analytical technology and the use of direct biotic toxicity assessment. The use of more expensive and time-consuming technology is necessary to address the detection and impact assessment of substances present at low levels but that present a significant hazard to water users.

The challenge associated with the delay in the expansion of the monitoring programme is the logistic on how to get the samples to the RQIS laboratory on time for toxicity analysis. In addition, the financial constraints are hampering the expansion of the NTMP to other identify hotspots in different provinces, hence delays in samples collection.

2.2 National Integrated Water Information System

The National Integrated Water Information System (NIWIS) was conceptualized to meet the objective of serving as a single extensive, integrated, accessible national water information system to fulfil the mandate of both the National Water Act (No. 36 of 1998; Chapter 14, Sections 137 to 145), as well as the National Water Services Act (No 108 of 1997; Chapter 10, Sections 67, 68 & 69). Effective 01 September 2015, NIWIS went live with 43 dashboards that were developed and implemented. Ever since, NIWIS has been experiencing enormous growth through enhancements responding to ever-growing business information requirements. NIWIS is an information system intended to provide information to researchers, water managers and the public at large, this system can be accessed at https://www.dws.gov.za/niwis2.

Currently, NIWIS can provide water related information in the areas of, Climate and Weather, Disaster Management, Enforcement, Water Infrastructure, Water Monitoring Networks, State of Water, Water Ecosystems, Water Quality, Water Quantity, Water Services, Water Supply Risk, Water Tariffs, Water Use and other Water Resource Management areas. The NIWIS dashboards covering various themes are presented in Figure 2.9.



About niwis

The National Integrated Water Information System (NIWIS) was developed by the Department of Water and Sanitation with the purpose of providing information products, in the form of dashboards, to facilitate efficient analysis and reporting across the water value chain in South Africa.

To access the NIWIS dashboards, please select a theme in the menu on the left, and then choose an appropriate dashboard from the options on the right. Alternatively, please use the **All Dashboards** menu above to access the different dashboards.

We welcome comments and feedback; please feel free to send any queries, comments and suggestions via the **Contact Us** form in the menu.

Drought Status

The **Drought Status and Management information system** is designed to provide regular overview and outlook of drought status in South Africa. The Drought Status and Management dashboard currently integrates rainfall, river flow, dam level and groundwater level data as the main indicators for generating drought status information. Other indicators such as vegetation condition will be added in future.

Figure 2.9 NIWIS landing page (https://www.dws.gov.za/niwis2/)

NIWIS continues to grow to allow users personal customisation and convenient. NIWIS has since become one of the Department's strategic investment tools which ensures that information on the sector is readily available and conveniently disseminated. NIWIS is currently experiencing challenges, where the automation has been taking place at a business level not at a Departmental level, which has resulted in many parallel systems that are not complementing each other albeit sharing the same client or water information in some cases.

Further development of NIWIS is in progress amidst several challenges such as unavailability of data (not timely, unreliable, unstructured, inaccessible, inaccurate, irrelevant, and poor quality as well as critical data residing outside DWS); a culture of resisting the use of current technology for data processing and information generation; poor business process management and lack of human and financial resources for monitoring.

During the period of reporting, DWS through the Water Resources Management branch, has just completed the conceptualisation phase of the national project titled "National Digitisation of Water and Sanitation Monitoring Systems" The aim of the project is to digitize all monitoring elements, provide dynamic dashboards using real time water quality and quantity data, and / or remote sensing data, and to integrate various streams of information and act as an umbrella system for water observation within the water and sanitation sector.

3 STATUS OF WATER RESOURCES

3.1 Climatic Environment

Climate is one of the most important drivers of the hydrological response of a catchment. It includes processes such as precipitation or rainfall, evaporation and temperature that are variable, and can have important implications for water supply for drinking, rain-fed agriculture, groundwater, forestry, and biodiversity.

Climate change and variability can be drivers of additional stress on the already stressed water resources of South Africa, placing additional pressure on water availability, accessibility, quality, and demand. Small changes in climate can have an exaggerated effect on runoff, because the impacts can be worsened by the complex responses of the hydrological system.

3.1.1 Rainfall

The South African Weather Services (SAWS) is the custodian of meteorological data in South Africa, and data presented under this section is based on data and information provided by the SAWS. The rainfall regions across the country, together with the ranges of observed Mean Annual Precipitation (MAP) are presented in Figure 3.1. Rainfall in the far south-west falls mainly in winter, while the eastern parts receive summer rain. Rainfall on the south coast can occur at any time of year.

The summer rainfall region is largely dominated by local convective-type thunderstorm activity, while the winter rainfall region is dominated by mid-latitude frontal systems, that can also extend across the whole of the country at different times of the year. Within the coastal areas advection from the Indian Ocean is frequently one of the main drivers of rainfall, while tropical cyclones may affect the Eastern parts of the country bringing extremely heavy rain and causing widespread flooding.

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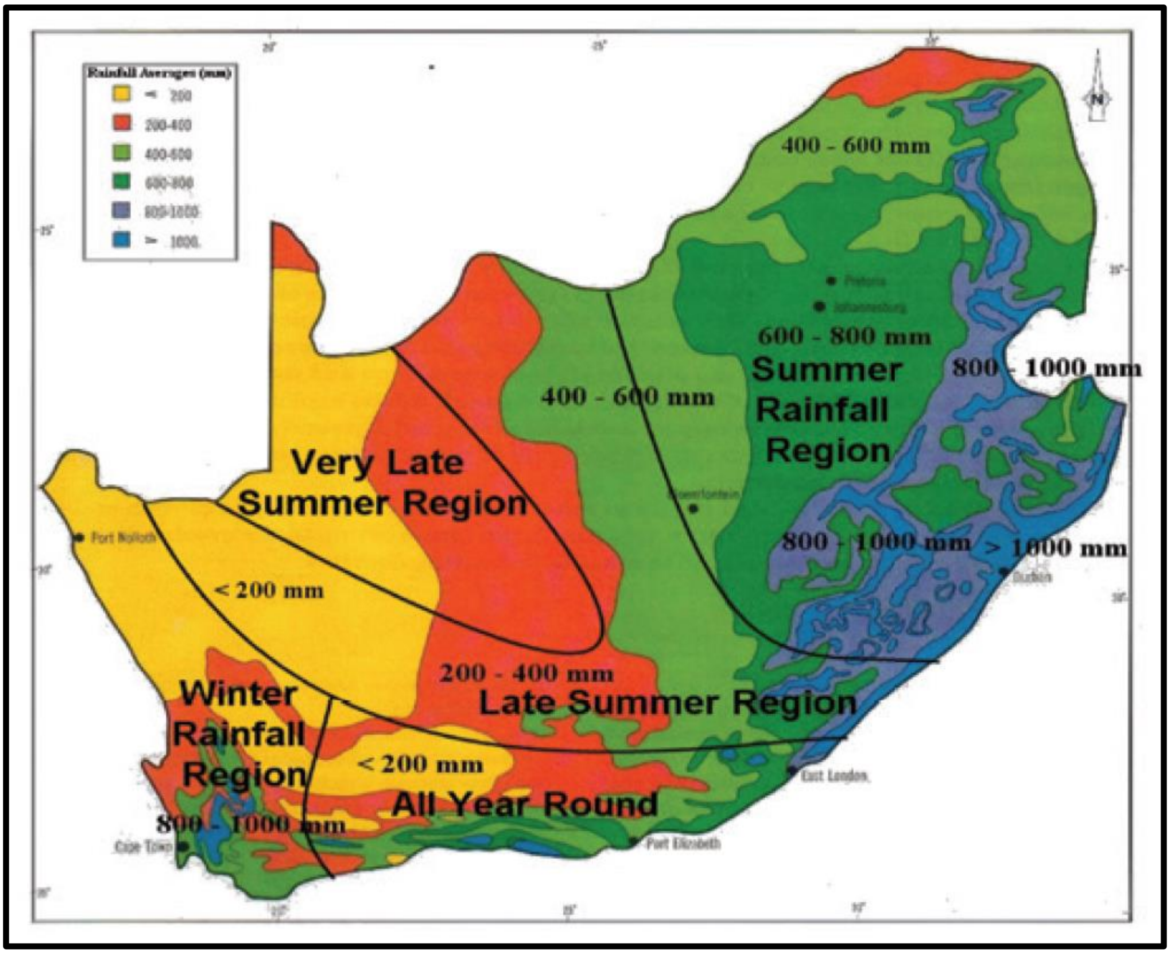

Figure 3.1 Rainfall Regions (Adapted from Botai et.al., 2018)

The rainfall percentage normal for the hydrological year 2019/20 across WMAs is presented in Figure 3.2. The most significant feature of the rainfall during the reporting was less than normal rainfall received in the western and central parts of the country, especially in the Orange and Mzimvubu-Tsitsikamma WMAs. These conditions have affected the availability of water in the Northern Cape and Eastern Cape Provinces. Notably, some isolated parts of the Vaal, Limpopo, Olifants, and the Inkomati-Usuthu WMAs have received above normal rainfall, in some locations up to 200% above normal.

The temporal distribution of rainfall received across the country for typically the wet season and dry season is presented in Figure 3.3 and Figure 3.4, respectively. For the summer rainfall region which covers the north-east, east coast and the central parts of the country, significant rainfall amounts were received between November and February. The winter rainfall region had received significant amounts of rainfall between June and August. It can be noted from Figure 3.4, that the month of April which typically is the beginning of the dry season some isolated rainfall was received in the eastern parts of the country. It can be concluded that these temporal distribution shows the wet season to be from November – April and dry season to be from May-October.

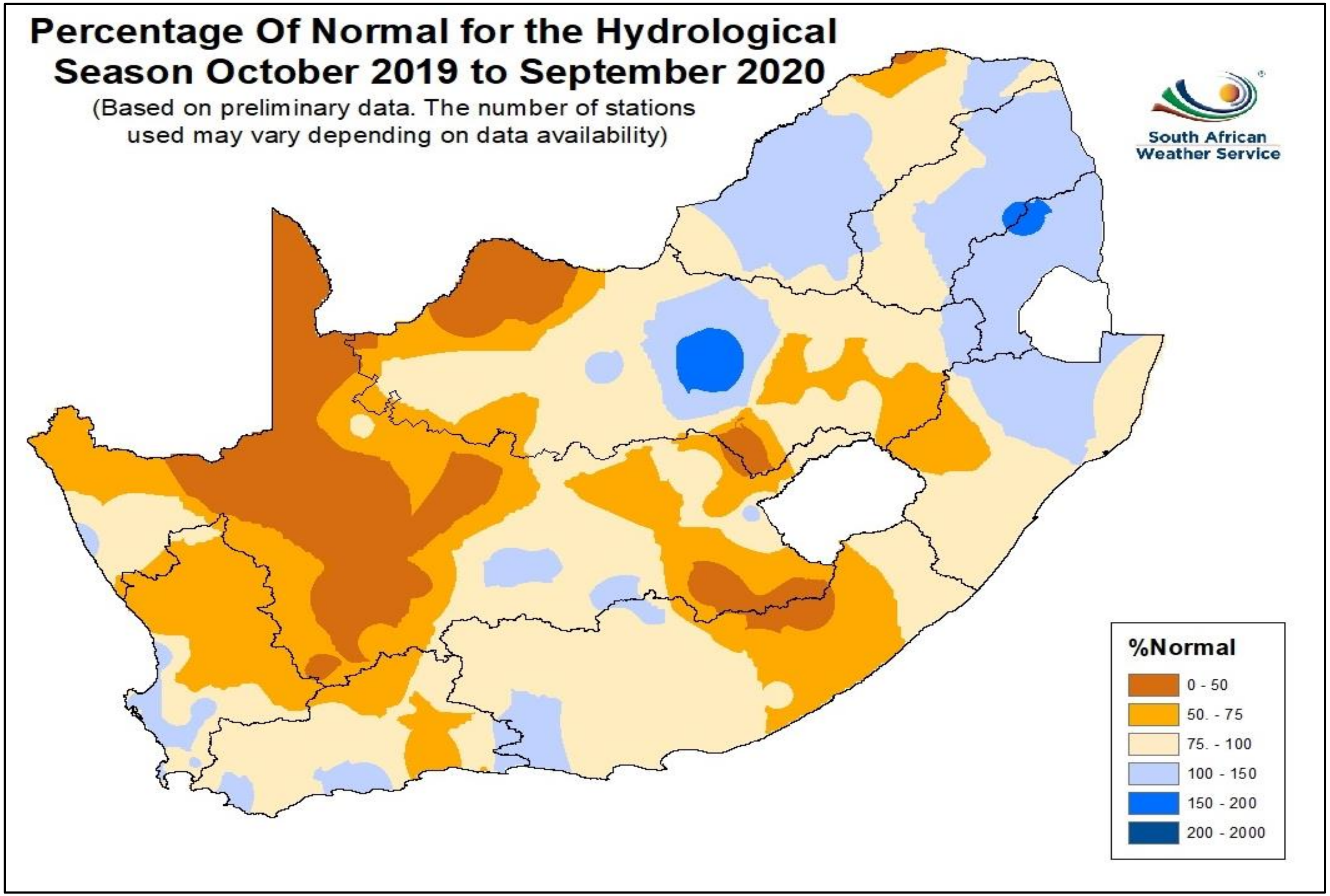

Figure 3.2 Rainfall % anomalies for October 2019 to September 2020 (Source: SAWS)

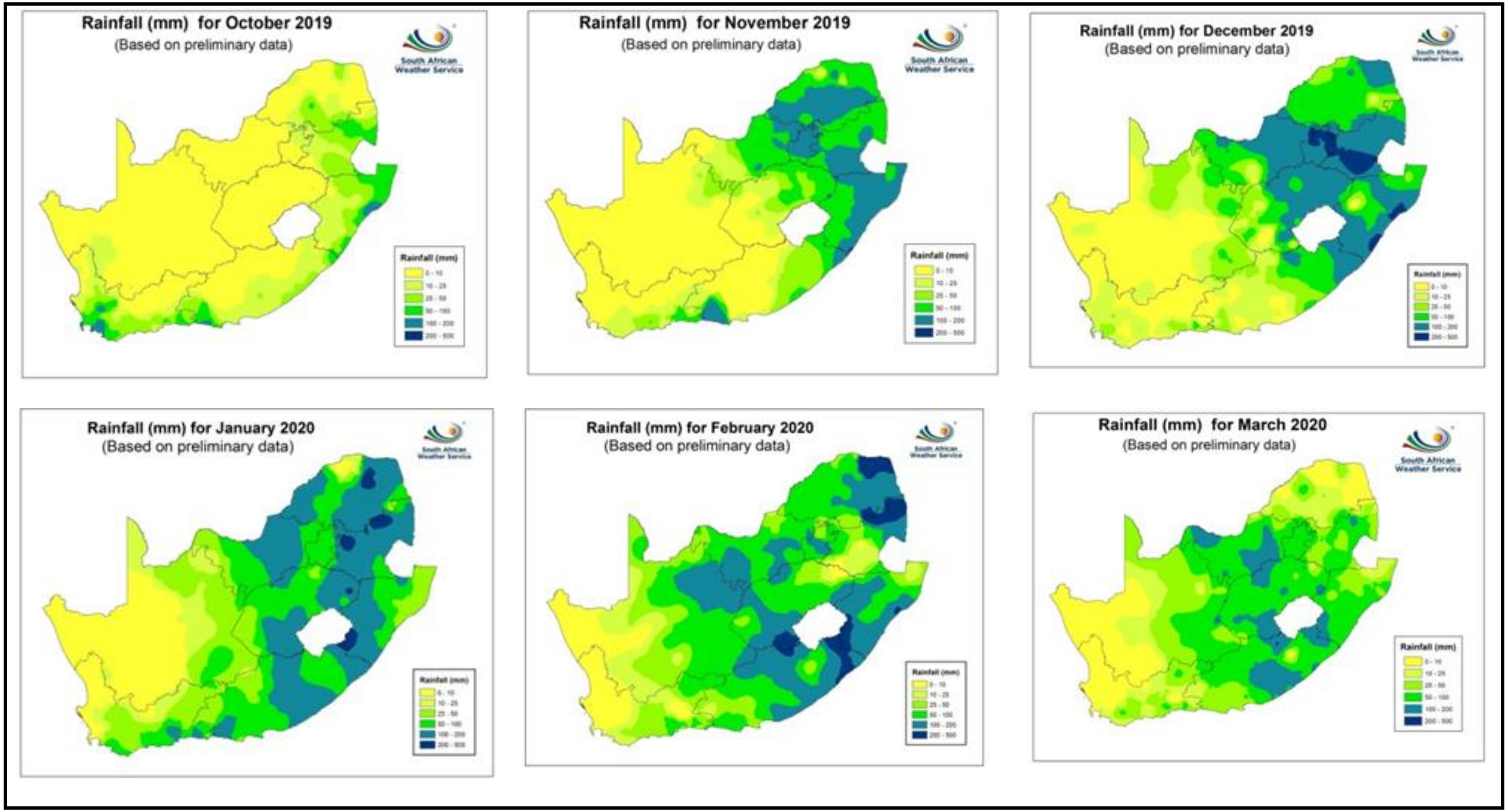

Figure 3.3 Summer Season monthly rainfall distribution from October 2019 to March 2020 (Source: SAWS)

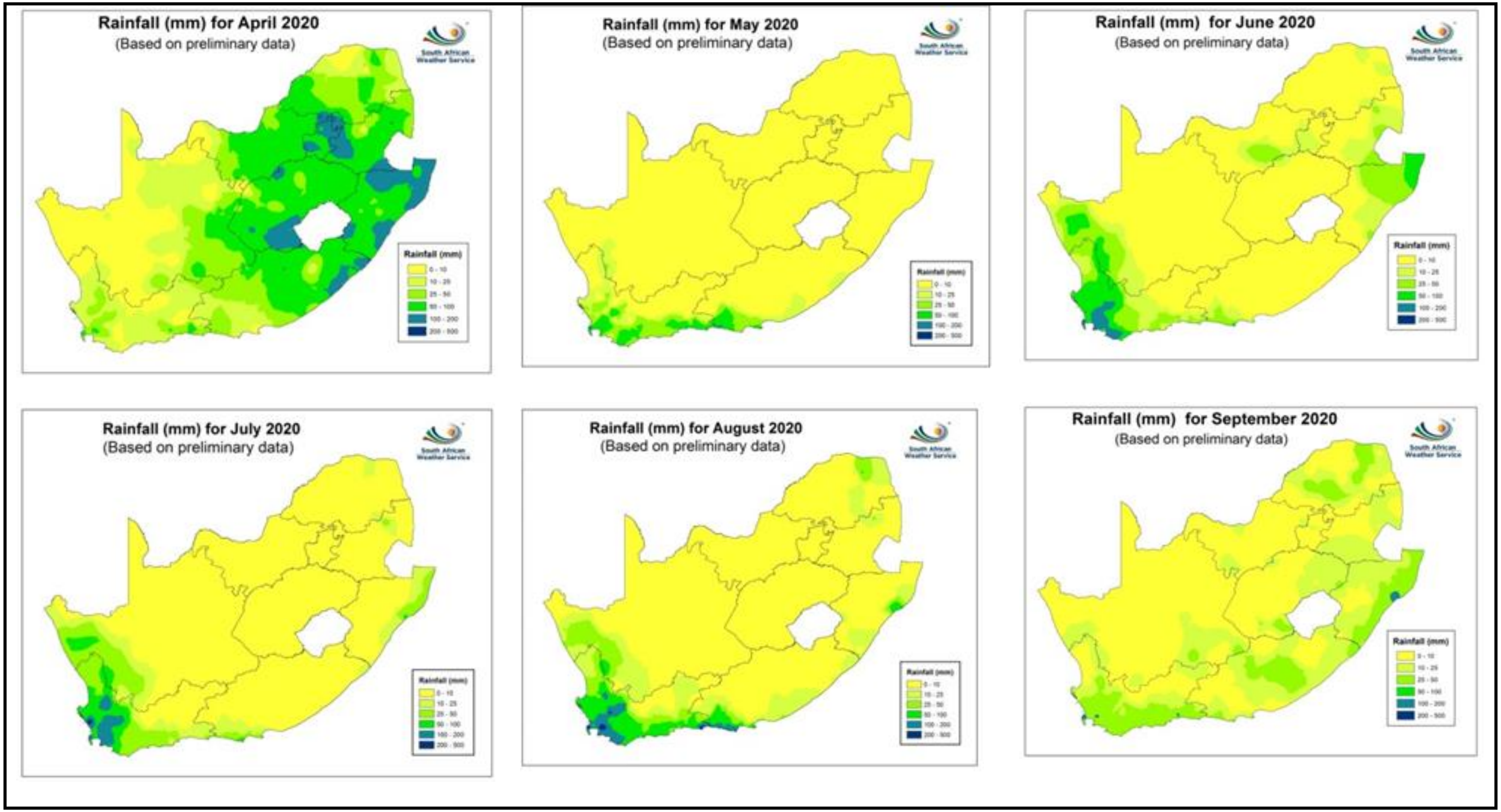

Figure 3.4 Winter season monthly rainfall distribution from April 2020 to September 2020 (Source: SAWS)

The comparison of total rainfall received per WMA from October 2019 to September 2020, against the long-term annual average (Normal – 1921 to 2020) were computed. The WMA rainfall data or statistics are based on the average rainfall within the homogeneous rainfall districts, developed by SAWS, that mostly fall within a particular WMA. This approach ensures a more even weighting of point rainfall in the spatial(areal) rainfall estimations per WMA. The rainfall districts used per WMA are presented in Figure 3.5 below.

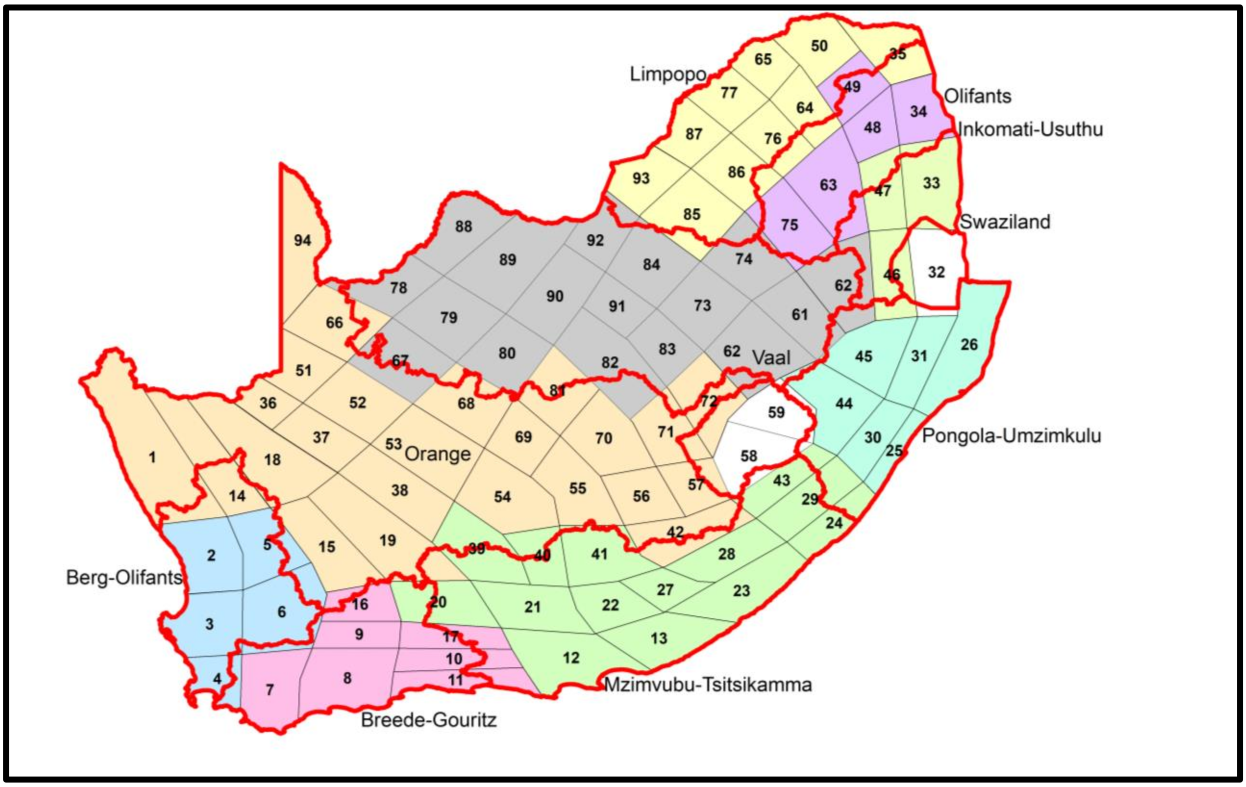

Figure 3.5 Water Management Areas and Rainfall Districts (Source: SAWS)

The resultant computed rainfall amounts per WMA and their comparison with the long-term averages are presented in Figure 3.6.

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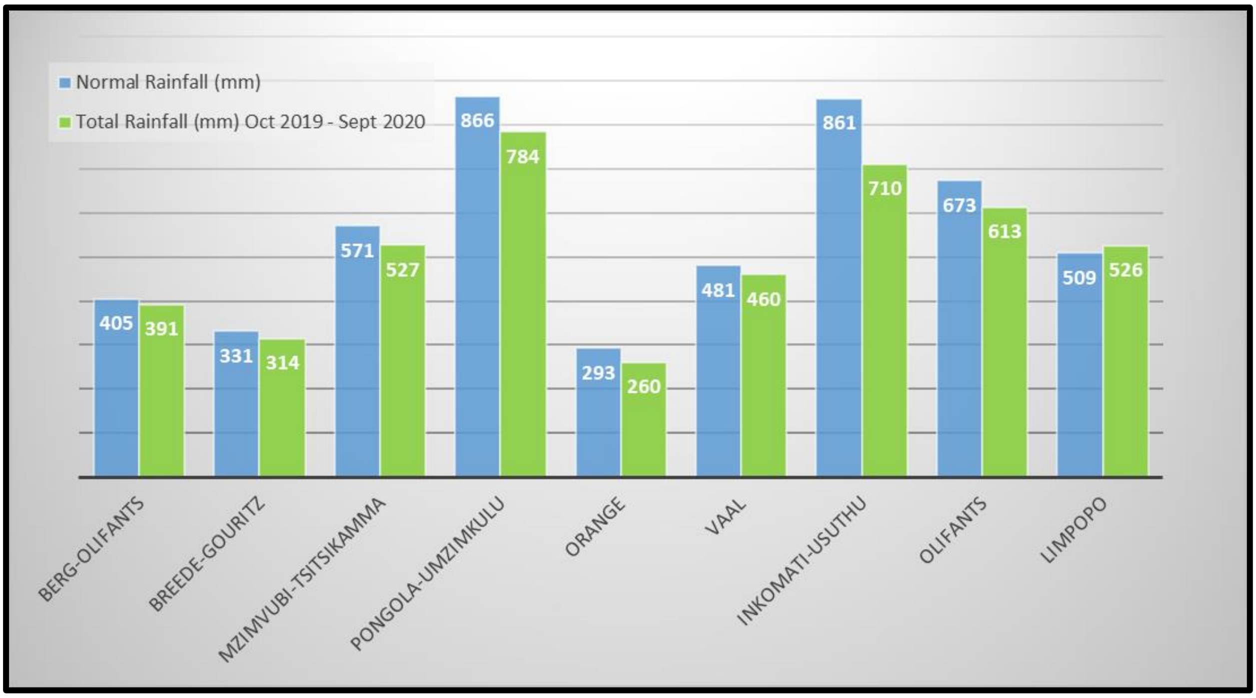
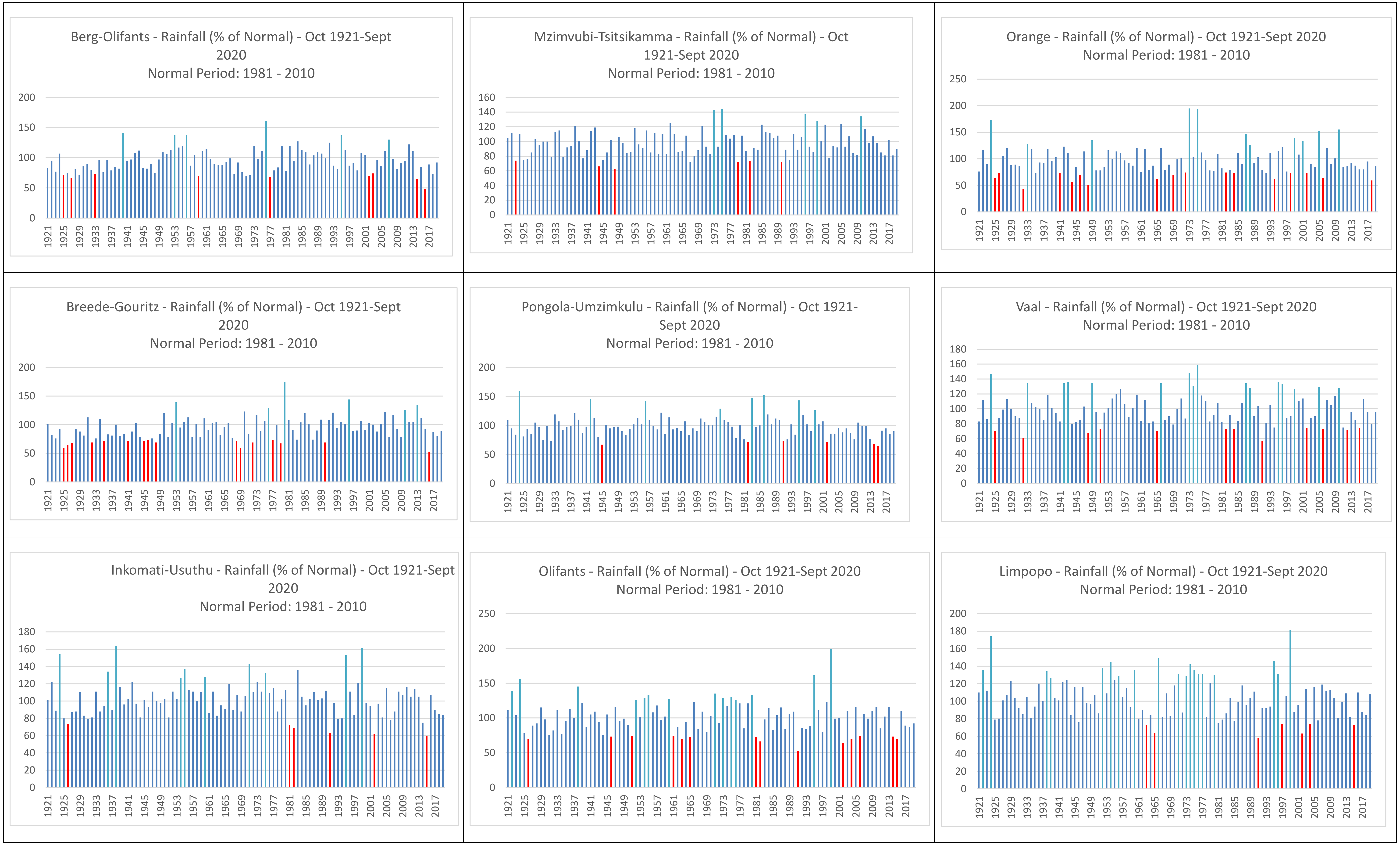


Figure 3.6 Comparison of rainfall(mm) received during the reporting period and the normal rainfall per WMA (Data Source: SAWS)

In general, South Africa received below-normal rainfall at a WMA level except for the Limpopo WMA, which received rainfall that is slightly above the normal. These rainfall trends are expected to be reflected in the status of water storage for water management areas.

Further long-term rainfall trends are presented in Figure 3.7, in the form of graphs for rainfall anomalies for each water management area from long term annual averages (based on the period October 1921 to September 2020 to define ‘Normal’). The anomaly plots indicate that no WMA was classified as experiencing an extreme dry or wet year during the 2019/20 hydrological year, while the highest anomalies were observed for the Orange and Inkomati-Usuthu WMA’s which received 14% and 16% less than normal rainfall, respectively.

The Berg-Olifants and Breede-Gouritz last experienced a dry period during October 2016 to September 2017, and these are events which contributed to the drought conditions within the Western Cape Water Supply System (WSWSS) during January 2018. The Pongola-Mzimkhulu, Vaal, Inkomati-Usuthu, Olifants and Limpopo WMAs experienced a significant dry period during October 2015 to September 2016, while the Orange WMA recently experienced a dry period in the season of October 2018 to September 2019. It is perhaps interesting to note that the ongoing drought and low reservoir storage levels in the Port Elizabeth region (Algoa Water Supply System) is not reflected in the rainfall anomalies for the WMA.



Berg-Olifants - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Mzimvubi-Tsitsikamma - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Orange - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Breede-Gouritz - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Pongola-Umzimkulu - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Vaal - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Inkomati-Usuthu - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Olifants - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Limpopo - Rainfall (% of Normal) - Oct 1921-Sept 2020
Normal Period: 1981 - 2010

Figure 3.7 Rainfall Anomalies per WMA: > 125% (wet) & < 75% (dry) (Data Source: SAWS)

3.1.2 Surface Temperature

South Africa experienced above-normal temperatures for the reporting year. The annual mean temperature anomalies for 2020, based on the data of 26 climate stations, was on average about 0.5ºC above the reference period (1981-2010), making it approximately the sixth warmest year on record since 1951 (see Figure 3.8). A warming trend of 0.16 ºC per decade is indicated for the country, statistically significant at the 5% level.

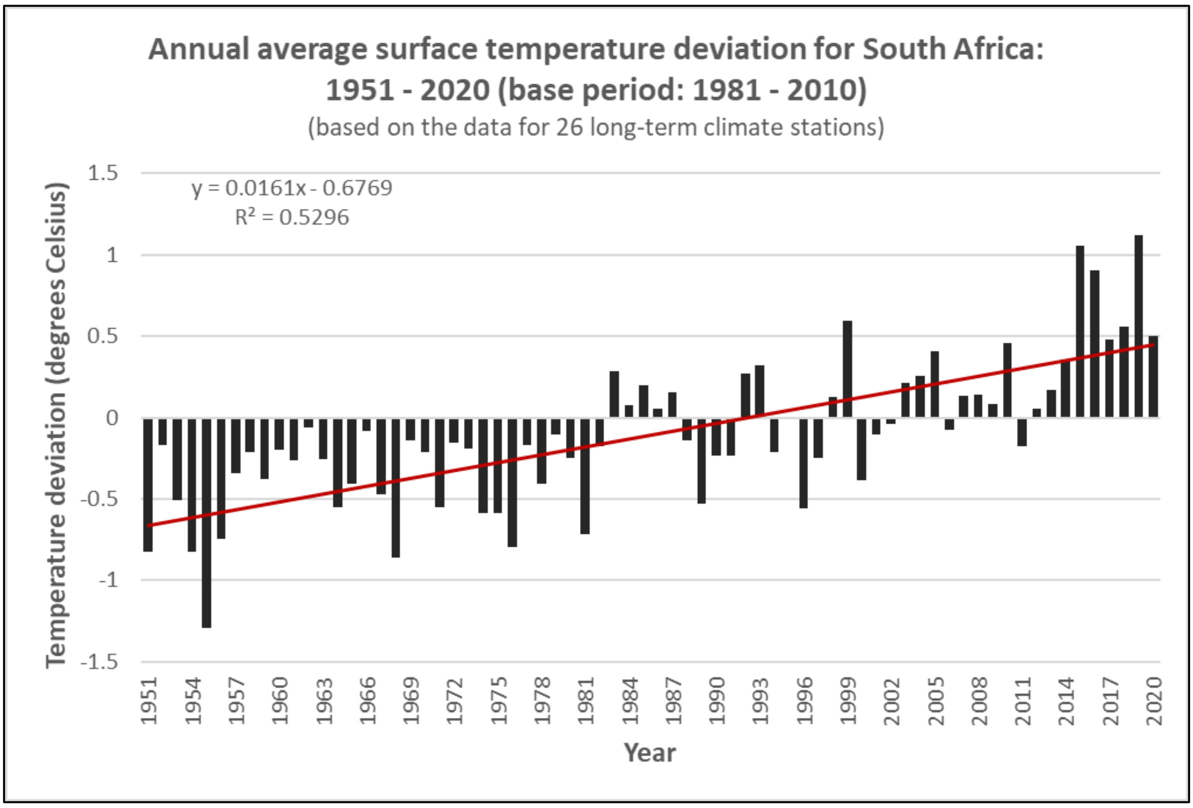


Figure 3.8 Average surface temperature deviation trend over South Africa (Source: SAWS)

3.1.3 Extreme climate and weather events

In South Africa, dry conditions persisted over large parts of the west of the country, and in some parts the dry conditions have continued for approximately seven years (Kruger and Mcbride, 2021).

During the early summer months some noteworthy weather events occurred. In December several large flood events were reported in the east. According to the South African Weather Services (SAWS), the worst for the month was probably on the 9th of December when several parts of northern Gauteng Province were under water following rain that persisted over 5 days. Rivers were overflowing causing devastating floods that lead to damages to road infrastructure and local buildings. Hundreds of people were left homeless and infrastructure severely damaged. Several cars were swept away following the intense flooding in Centurion, Pretoria. At least 700 shacks were destroyed in Eerste Fabriek informal settlement in Mamelodi and consequently thousands of people were displaced.

Dry conditions persisted in most parts of the western interior in January, with warmer than usual conditions in the central parts. The Northern Cape was declared a disaster area after drought that crippled the province for the past couple of years. KwaZulu-Natal Province was also hit hard by a shorter-term drought, accompanied by very high temperatures that affected 256 towns and surrounding communities. The identified hotspot areas include Uthukela, Umzinyathi, Amajuba, Zululand, Uthungulu and Umgungundlovu districts. Good rains were received in the southern and north-eastern parts of the country, with some storms causing extensive damage to infrastructure (Kruger and Mcbride, 2021).

In February, above normal rainfall conditions spread to the central and south-eastern interior, but late-summer rainfall ended abruptly during the month with drier conditions experienced in March. Again, heavy storms were reported with extensive damage, especially in the Gauteng and parts of the Eastern Cape Province. However, April saw very good rains over the eastern half of South Africa, with some places receiving more than twice the normal amounts. Localised flooding was reported in several places. The winter season (July to August) was characterised by colder than normal conditions over most of South Africa and well above-normal rainfall over most of the south-western Cape.

3.2 Potential Evapotranspiration

The amount of rainfall returned into the atmosphere through evapotranspiration (ET) is dependent on land surface conditions including topography, vegetation, and soils. Values of ET can be compared to values of potential evapotranspiration (PET), ET and PET can in combination be used to show the distribution of potential surface water availability. PET is the total amount of water-equivalent that can be evaporated from a pan under prevailing atmospheric conditions and is thus controlled largely by air temperature and relative humidity (Knight, 2019). Actual values of ET, however, are highest in the eastern and coastal areas of the country where there is highest amount of surface moisture availability for evaporation, whereas the lowest ET values are found in areas inland and in the west where there is least surface water available (Tongwane *et al.,* 2017).

Generally, for South Africa, values of PET are high across the country, with highest values in the hottest, driest areas of the Northern Cape and lowest values around the coast where higher humidity, high cloud cover and lower temperatures prevail (Jovanovic *et al*., 2015). The spatial variability of the total PET during the hydrological year October 2019 to September 2020 is presented in Figure 3.9 provided by the ARC.

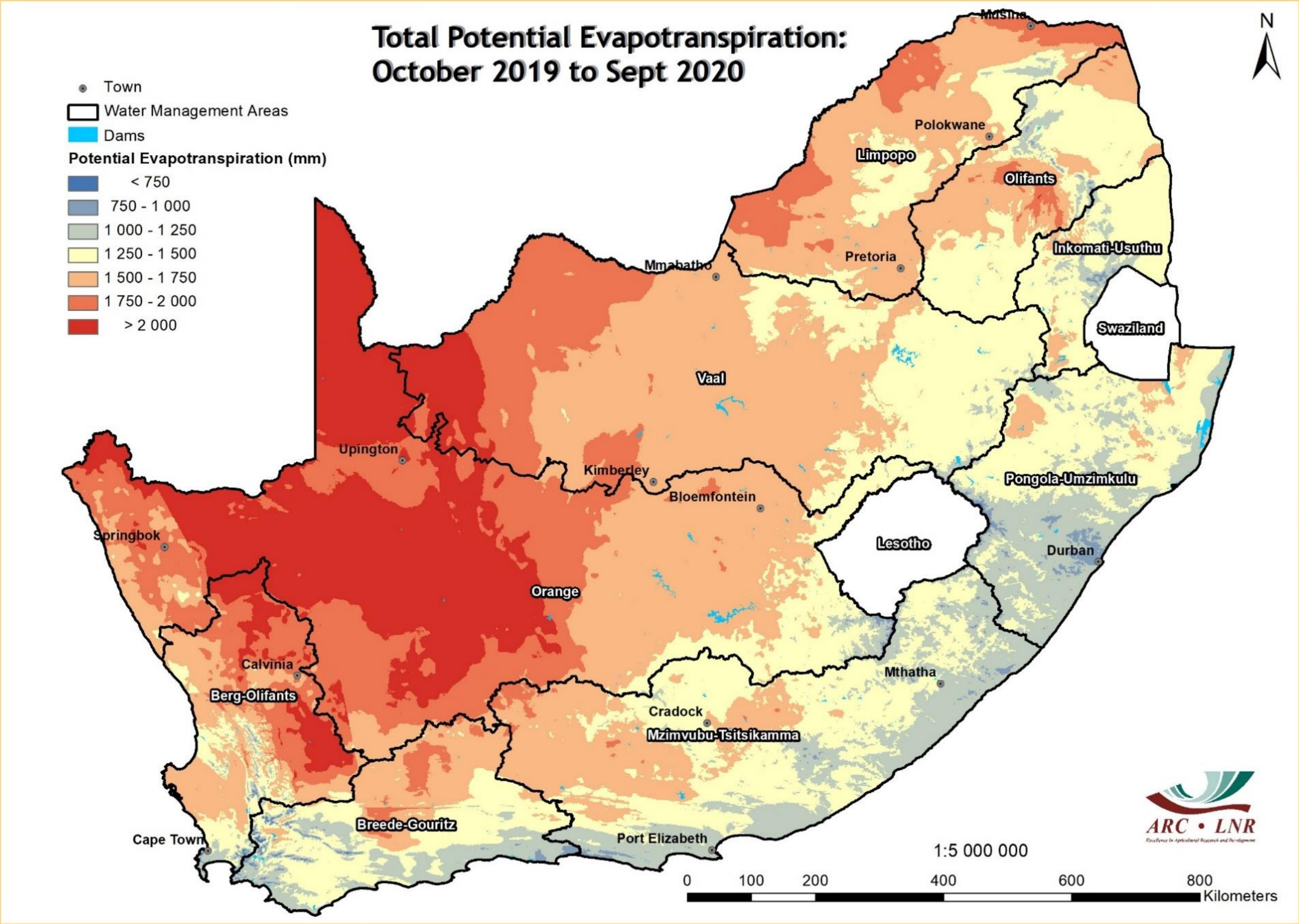


Figure 3.9 Total Potential Evapotranspiration (Source: ARC)

3.3 Indication of Drought

A meteorological drought is defined based on rainfall deficiencies in comparison to “normal” or average amounts of rainfall for a particular area or place and the duration of the dry period.

The Standardized Precipitation Index (SPI) is an index based on the probability of rainfall for any time scale and can assist in assessing the severity of any drought. Long-term drought usually occurs when moisture supply is abnormally below average for periods of up to two years, where-after widespread desiccation occurs. A 12-month and 24-month SPI is a comparison of the precipitation for 12 and 24 consecutive months with the same 12 and 24 consecutive months during all the previous years of available data respectively. SPI’s of these longer timescales are useful in identifying areas of drought, as they are linked to streamflow, reservoir levels and even groundwater levels.

The 12-month SPI map for the period of reporting is presented in Figure 3.10, while the 24 Month SPI is presented in Figure 3.11. The most noteworthy in the 24-month SPI map are the moderately dry to extremely dry western parts of the Orange WMA and, extending to the eastern parts of the Mzimbvubu-Tsitsikamma WMA. The central parts of the Vaal WMA show mildly wet to extremely wet conditions on the 12-month SPI, which remains as mildly to moderately wet for the 24-month period.

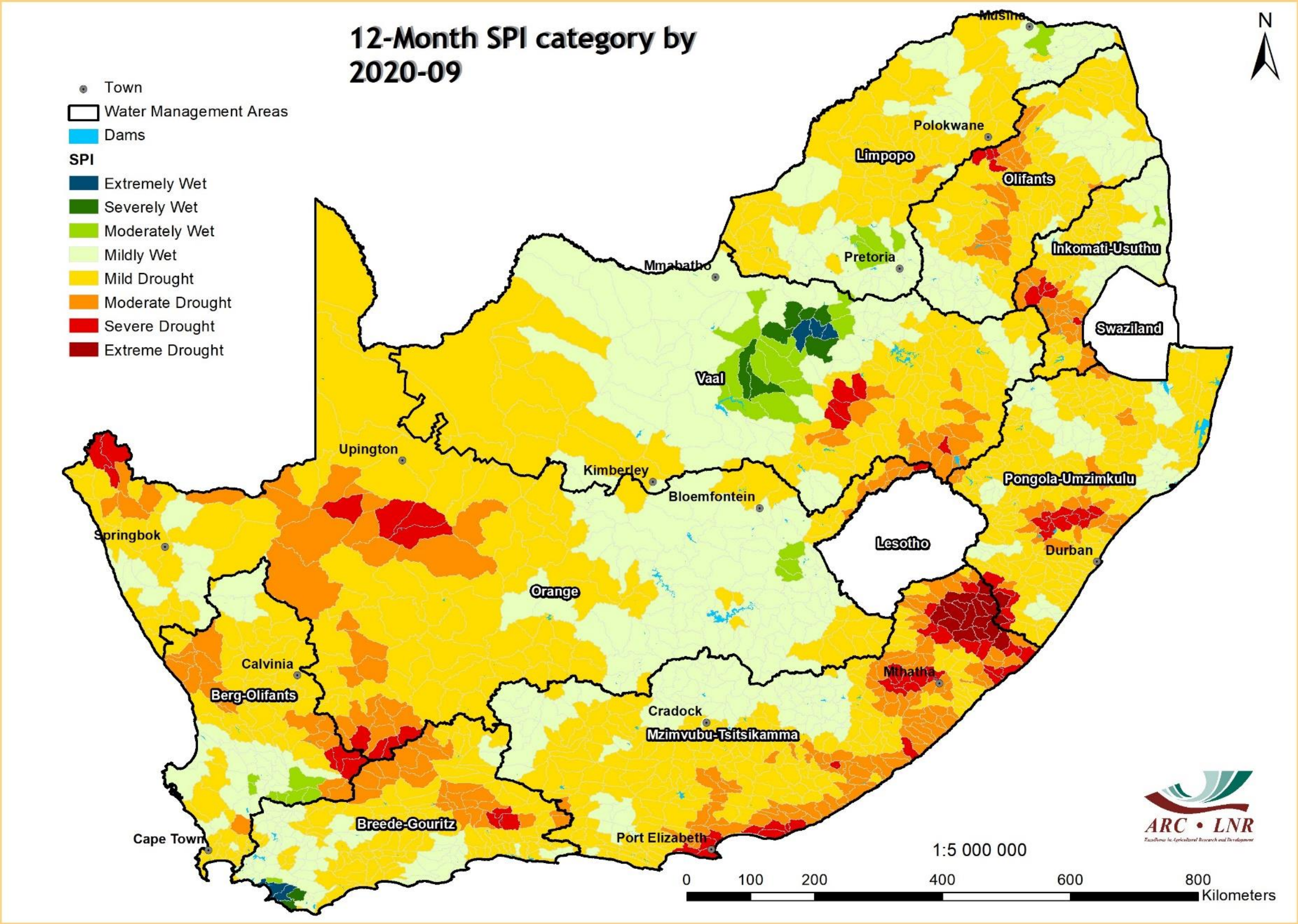


Figure 3.10 12-Month SPI by Category for October 2019 to September 2020 (Source: ARC)

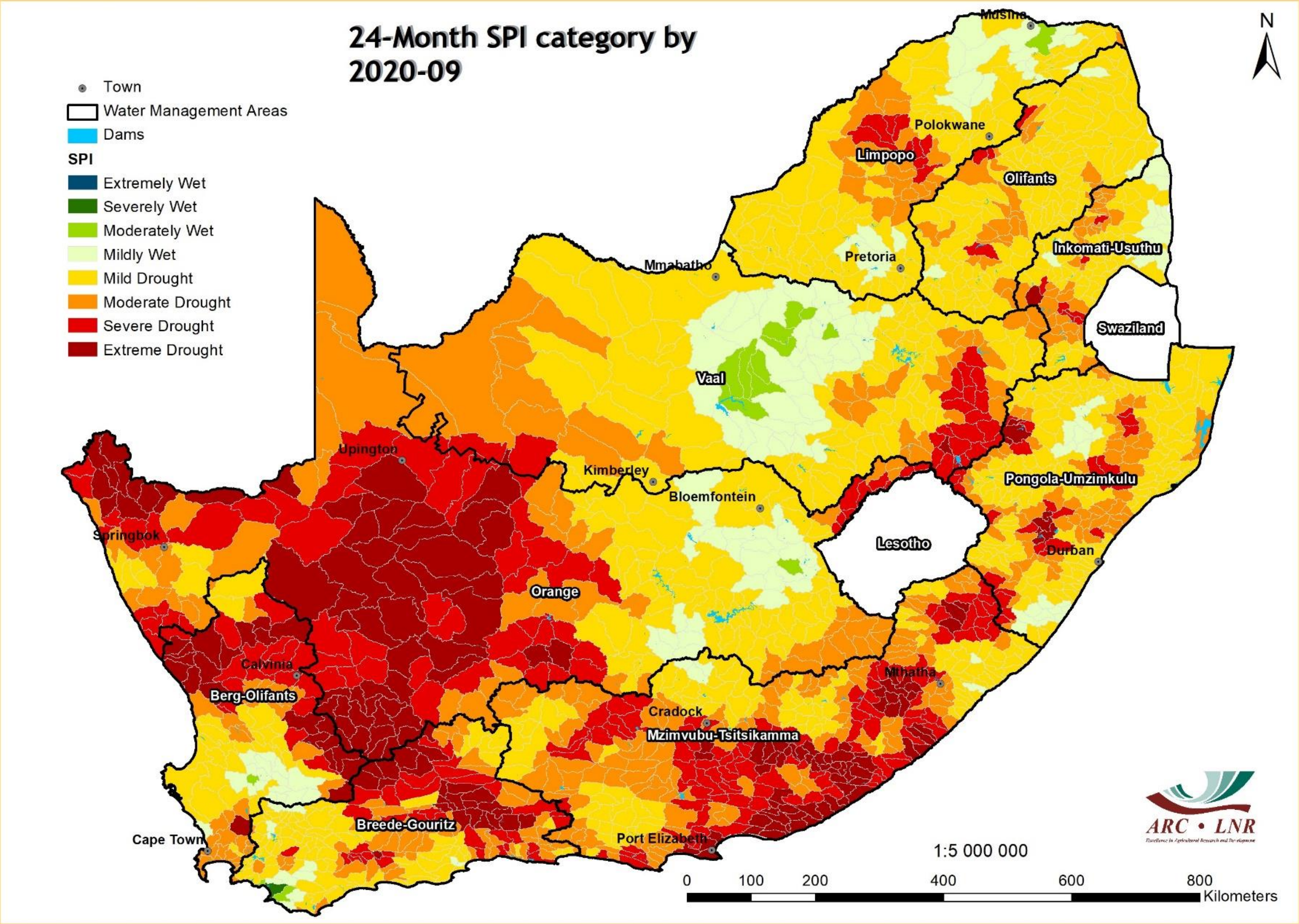


Figure 3.11 24-Month SPI by Category for October 2019 to September 2020 (Source: ARC)

3.4 Status of Rivers

3.4.1 Runoff / Streamflow

Figure 3.12 illustrates the spatial variation of the mean annual runoff for South Africa and demonstrates that the regions with the highest runoff are the eastern regions including the Inkomati-Usuthu, Pongola-Umzimkhulu and the eastern parts of the Mzimvubu-Tsitsikamma WMA's, as well as some parts of the Berg-Olifants and Breede-Gouritz WMAs in the Western Cape.

The total natural runoff (NAT) of water flowing in water courses to the seas, predicted largely based on the Pitman Model (WRSM200) from the Water Resource Study of 2012, was estimated to be 49 251 million m^3 per year. The present-day flows (PD) for simulations up to September 2010 was 36 329 million m^3 per year (74% of NAT) (Bailey and Pitman, 2016). These results are presented schematically for key points in the country per 19 WMAs in Figure 3.13. The natural runoff is streamflow without anthropogenic impacts, while present day streamflow is simulated with the inclusion of afforestation, irrigation, alien vegetation, reservoirs, storages, mining, and transfers.

The Pitman Model (Pitman, 1973) comprises three conceptual storages (interception, soil moisture and groundwater) and simulates infiltration-excess flow, saturation-excess flow, direct overland flow and groundwater flow. It is a conceptual, semi-distributed, monthly rainfall-runoff model that uses monthly rainfall data and monthly estimates of evapotranspiration as input (Kapangaziwiri and Hughes, 2008). It has been successfully used for water resources estimations in the ungauged parts of South Africa for more than 4 decades.

It is important to note that the Present-Day runoff assumes land use is stationary based on data for 2010 (hydrological year - October 2009 to September 2010) throughout the simulation period from 1920 to 2010, i.e., if irrigation started in 1940 at 10 km^2 in a particular catchment and grew to 50 km^2 in 2010, the simulations for the whole period from 1920 to 2010 are based on the fixed value for 2010 (50 km^2).

Each river system, however, shows somewhat different real measured values compared to natural values, depending on the changes over time in water abstractions, land use changes and inter-basin transfers. The total runoff deviation from the natural for the hydrological year 2019/20 is presented in Figure 3.14, for key points which had streamflow data available for the DWS surface flow monitoring stations during the time of reporting.

The most significant modification (decrease) in natural annual flows was observed on the Vaal River downstream of Grootdraai Dam, the Umngeni River downstream of Inanda Dam, and on the Orange River downstream of its confluence with the Vaal River.

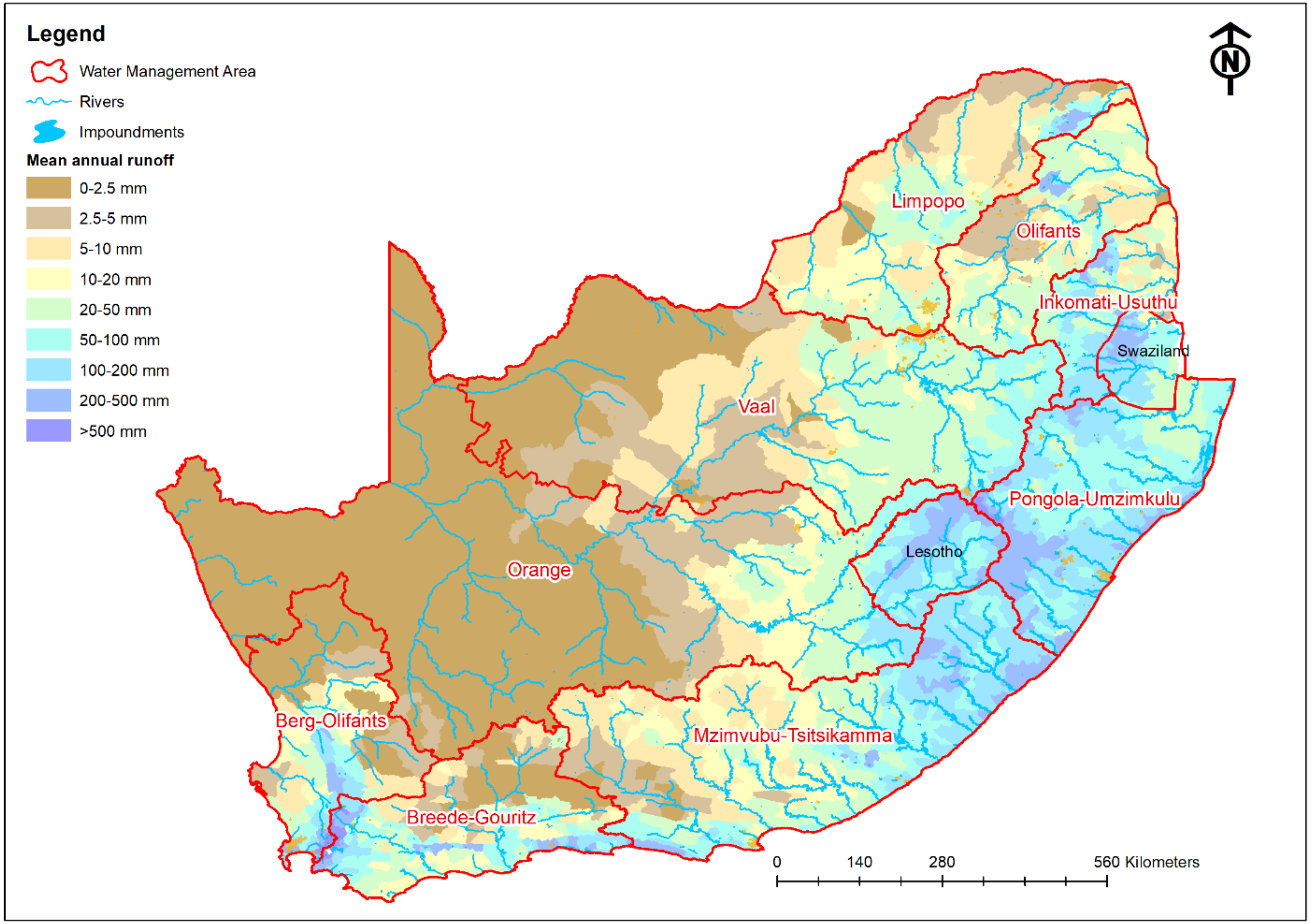


Figure 3.12 Mean annual runoff depth (mm) as of 2009 (WR2012).

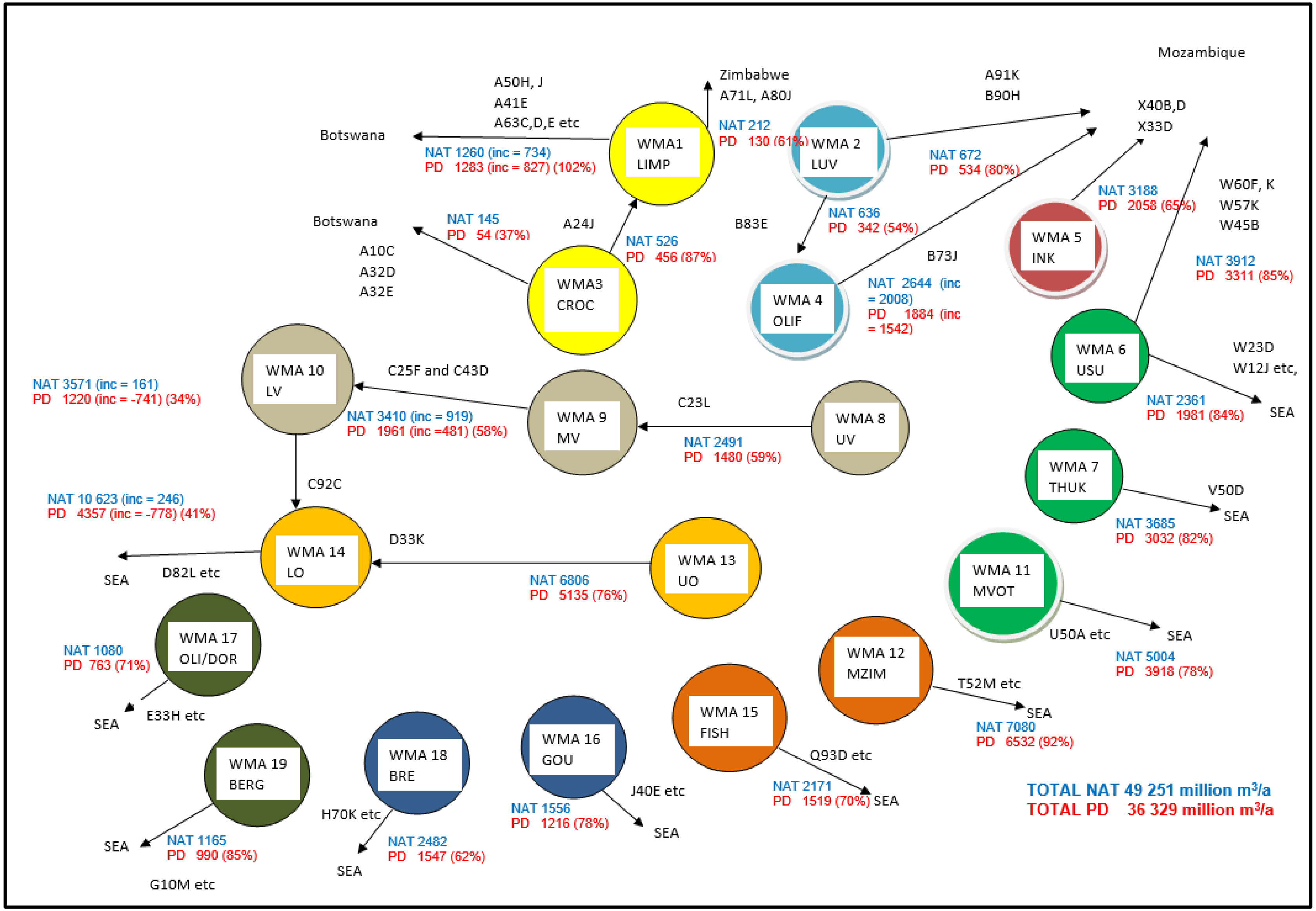


Figure 3.13 WR2012 Natural and Present-day Flows (Bailey and Pitman, 2016)

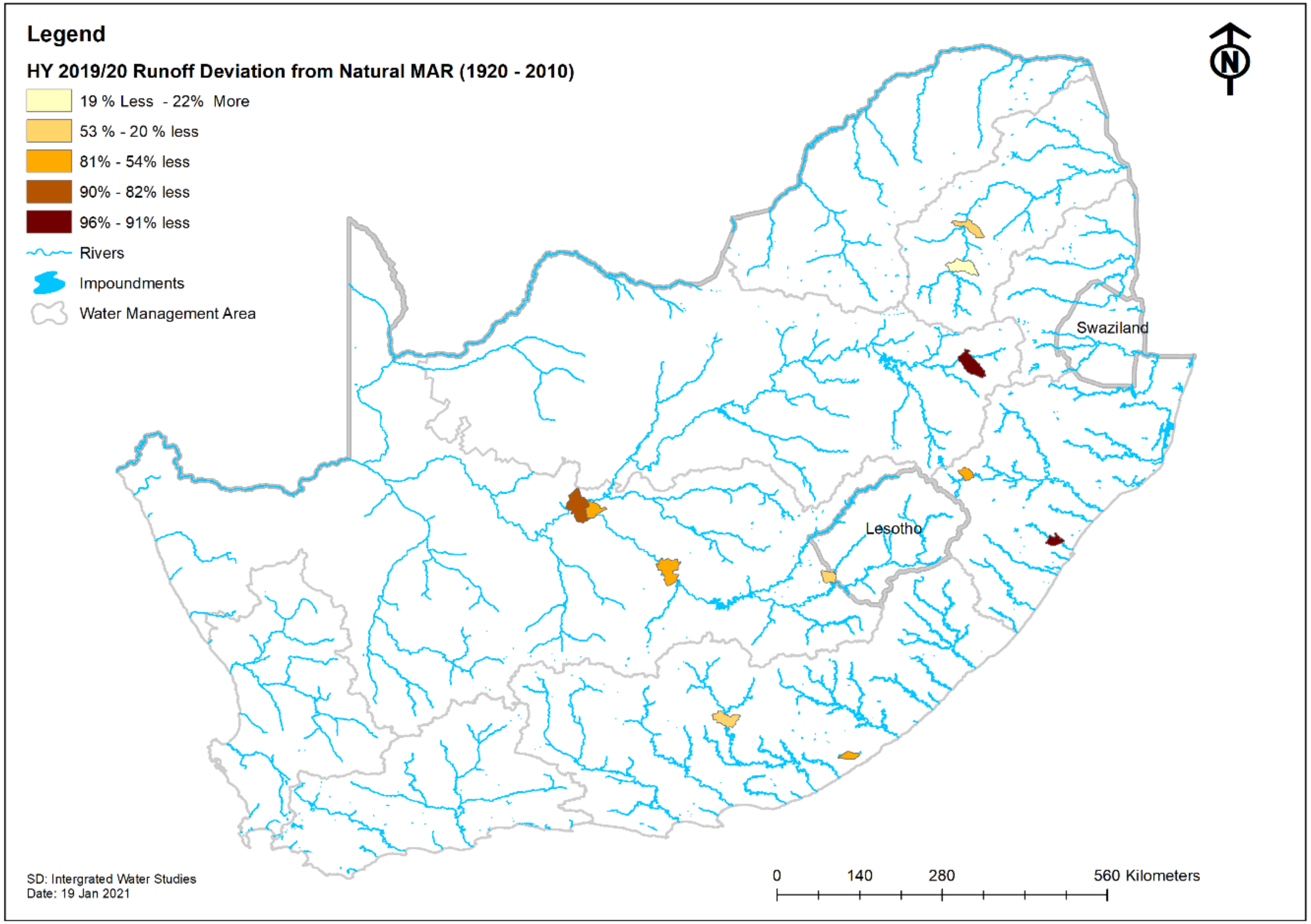


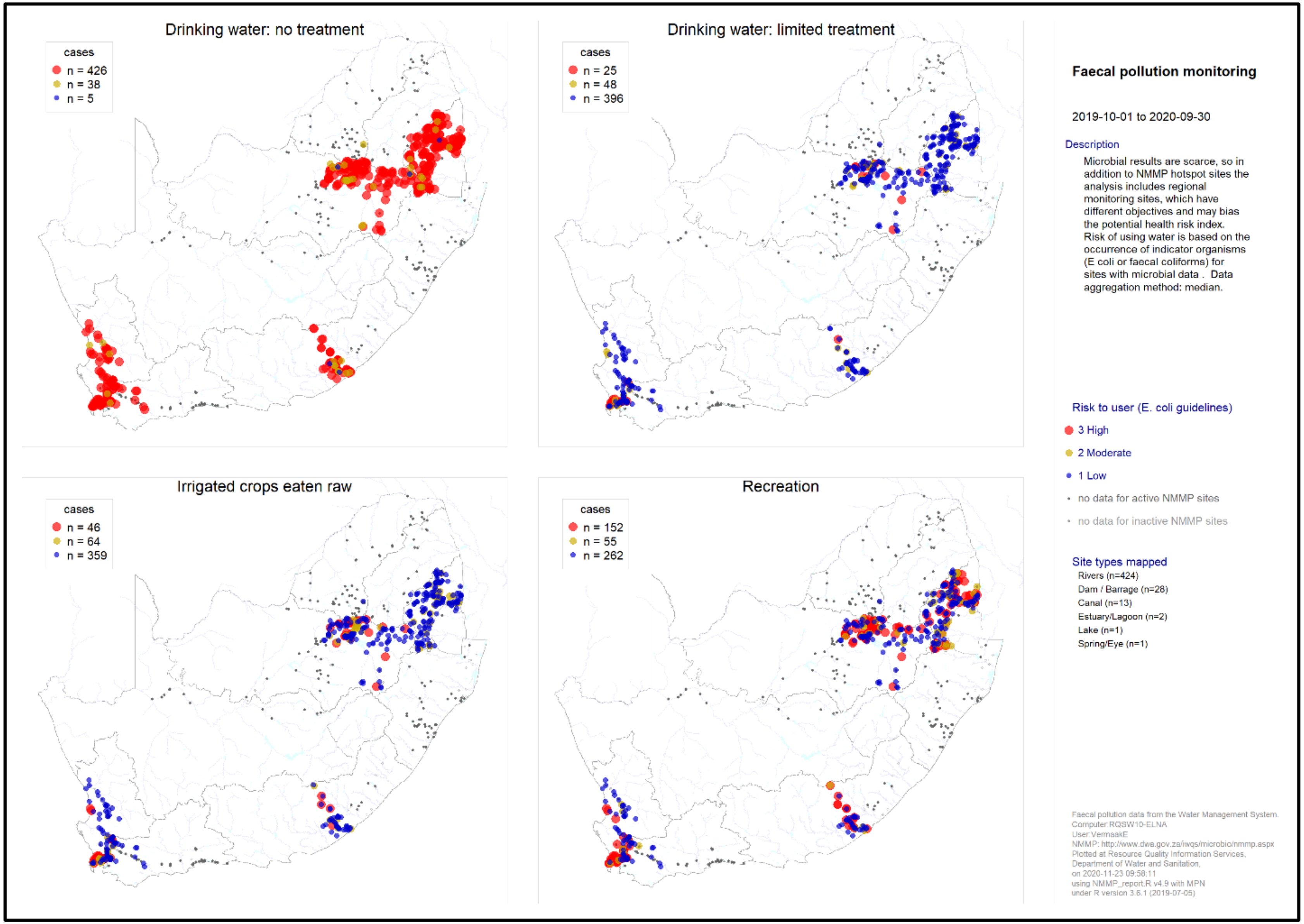
Figure 3.14 Hydrological Year 2019/20 key points streamflow deviation from natural

3.4.2 River Microbial Status

Many South African river waters have been found to be unsuitable for consumption, mainly because of the high levels of faecal contamination. Microbiological data on the map (Figure 3.15) shows that 91% of the tested samples showed high risk of infection to the user if the water was consumed untreated directly from the source. The map is also based on the risk associated with a particular water use. The National Microbial Monitoring Programme guidelines in Table 3-1, were used as a basis for interpreting the potential risk posed by consuming microbiological contaminated waters.

Table 3-1 Guidelines for assessing the potential health risk for four water uses (DWAF, 1998)

	Potential health risk		
	Low	**Medium**	**High**
Water use	***E. coli* counts/ 100ml**		
1. Drinking untreated water	0	1 - 10	> 10
2. Drinking partial treated water	< 2 000	2000 – 20 000	> 20 000
3. Full contact recreational	< 130	130 – 400	> 400
4. Irrigation of crops to be eaten raw	< 1 000	1 000 – 4 000	> 4 000



Microbial results are scarce, so in addition to NMMP hotspot sites the analysis includes regional monitoring sites, which have different objectives and may bias the potential health risk index. Risk of using water is based on the occurrence of indicator organisms (E coli or faecal coliforms) for sites with microbial data . Data aggregation method: median.

Faecal pollution data from the Water Management System.
Computer:RQSW10-ELNA
User:VermaakE
NMMP: http://www.dwa.gov.za/iwqs/microbio/nmmp.aspx
Plotted at Resource Quality Information Services,
Department of Water and Sanitation,
on 2020-11-23 09:58:11
using NMMP_report.R v4.9 with MPN
under R version 3.6.1 (2019-07-05)

Figure 3.15 Spread of human health risk associated with microbiological pollution in priority hotspots.

The risk of infection is reduced significantly if the water to be consumed is partially treated at household level and majority (84%) of tested samples show a low risk of infection to user if water is consumed after limited treatment. Only 10% of the sampled sites were found to be unsuitable for irrigation of fresh produce, which are crops that can be eaten raw and these sites were mainly located in the Gauteng, Eastern Cape, and Western Cape. 32% of the sites showed a high risk of infection to the user for recreation purposes and full or partial contact with the water is highly discouraged in these areas.

It must be noted that data on microbial pollution for the indicated period was very sparse and unevenly distributed spatially and therefore not much can be said about the microbial pollution of the whole country because sampling was only done at selected regions.

3.4.3 River Ecological Status

The number of sites where macro-invertebrate monitoring could be conducted in this reporting period declined from 438 in the 2018/19 hydrological year to 360 for 2019/20 hydrological year. Approximately 61% of sites remained in the same category as the previous reporting period; most of these were sites in the C category. There was an improvement of 21% of the sites and a decline in ecological condition of 18% of the sites. The Guidelines for interpreting River Ecostatus Results are provided in Table 3-2. Based on macroinvertebrate assemblage change, most of the sites in the country, about 63%, were moderately modified (Figure 3.16). When compared with previous hydrological years, most sites continued to remain in the Ecological Category C (moderately modified), and D (largely modified).

Table 3-2 Generic guidelines for interpreting change in ecological categories for REMP (modified from Kleynhans 1996 & Kleynhans 1999). Each category has been colour-coded, indicating the degree of deviation from natural or reference condition (i.e., ecological category A).

ECOLOGICAL CATEGORY	GENERIC DESCRIPTION OF ECOLOGICAL CONDITIONS	GUIDELINE SCORE (% OF MAXIMUM THEORETICAL TOTAL)
A	**Unmodified/natural.** Close to natural or close to predevelopment conditions within the natural variability of the system drivers: hydrology, physico-chemical and geomorphology. The habitat template and biological components can be considered close to natural or to pre-development conditions. The resilience of the system has not been compromised.	>92 - 100
A/B	The system and its components are in a close to natural condition most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a B category.	>88 - ≤92
B	**Largely natural with few modifications**. A small change in the attributes of natural habitats and biota may have taken place in terms of frequencies of occurrence and abundance. Ecosystem functions and resilience are essentially unchanged.	>82 - ≤88
B/C	Close to largely natural most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a C category.	>78 - ≤82
C	**Moderately modified.** Loss and change of natural habitat and biota have occurred in terms of frequencies of occurrence and abundance. Basic ecosystem functions are still predominantly unchanged. The resilience of the system to recover from human impacts has not been lost and it is ability to recover to a moderately modified condition following disturbance has been maintained.	>62 - ≤78

C/D	The system is in a close to moderately modified condition most of the time. Conditions may rarely and temporarily decrease below the upper boundary of a D category.	>58 - ≤62
D	Largely modified. A large change or loss of natural habitat, biota and basic ecosystem functions have occurred. The resilience of the system to sustain this category has not been compromised and the ability to deliver Ecosystem Services has been maintained.	>42 -≤58
D/E	The system is in a close to largely modified condition most of the time. Conditions may rarely and temporarily decrease below the upper boundary of an E category. The resilience of the system is often under severe stress and may be lost permanently if adverse impacts continue.	>38 - ≤42
E	Seriously modified. The change in the natural habitat template, biota and basic ecosystem functions are extensive. Only resilient biota may survive and it is highly likely that invasive and problem (pest) species may dominate. The resilience of the system is severely compromised as is the capacity to provide Ecosystem Services. However, geomorphological conditions are largely intact but extensive restoration may be required to improve the system's hydrology and physico-chemical conditions.	20 - ≤38
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete change of the natural habitat template, biota and basic ecosystem functions. Ecosystem Services have largely been lost This is likely to include severe catchment changes as well as hydrological, physico-chemical and geomorphological changes. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible. Restoration of the system to a synthetic but sustainable condition acceptable for human purposes and to limit downstream impacts is the only option.	<20

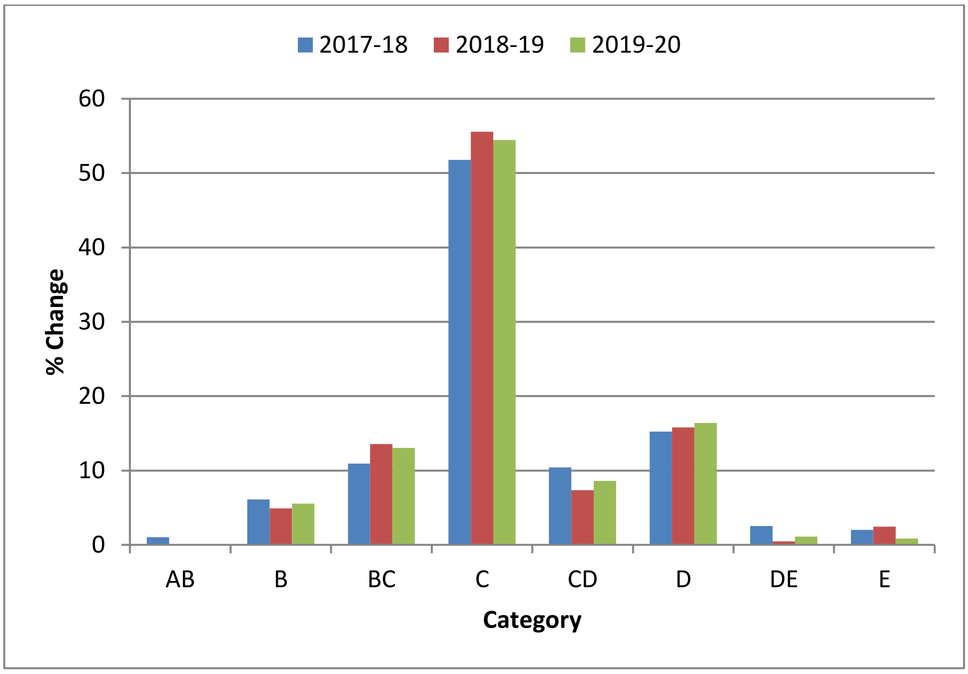
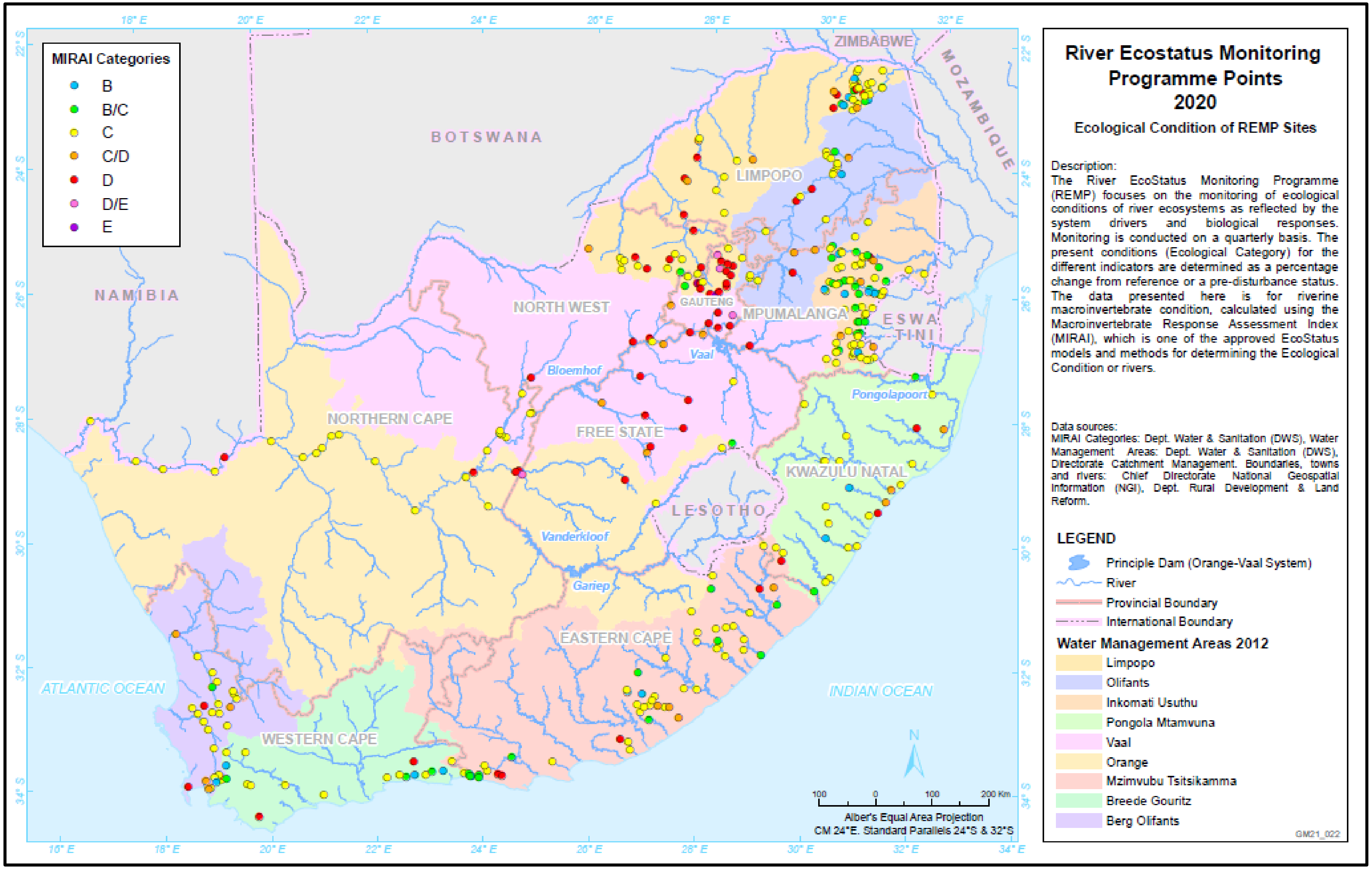


Figure 3.16 Comparison of changes in the ecological categories based on macroinvertebrate assemblages collected and analysed in the period 2017/2018 to the 2019/2020 hydrological year

The spatial distribution of monitoring sites and their ecological conditions are provided in Figure 3.17. As shown in Figure 3-17 sites in ecological category C and E were predominant in highly urbanised catchments such as the Upper Vaal and upper Crocodile systems. Catchments that are less urbanised such as the Komati Usuthu, Luvuvhu, Crocodile East had a few sites in good conditions i.e., Ecological categories B or B/C (Figure 3.18).



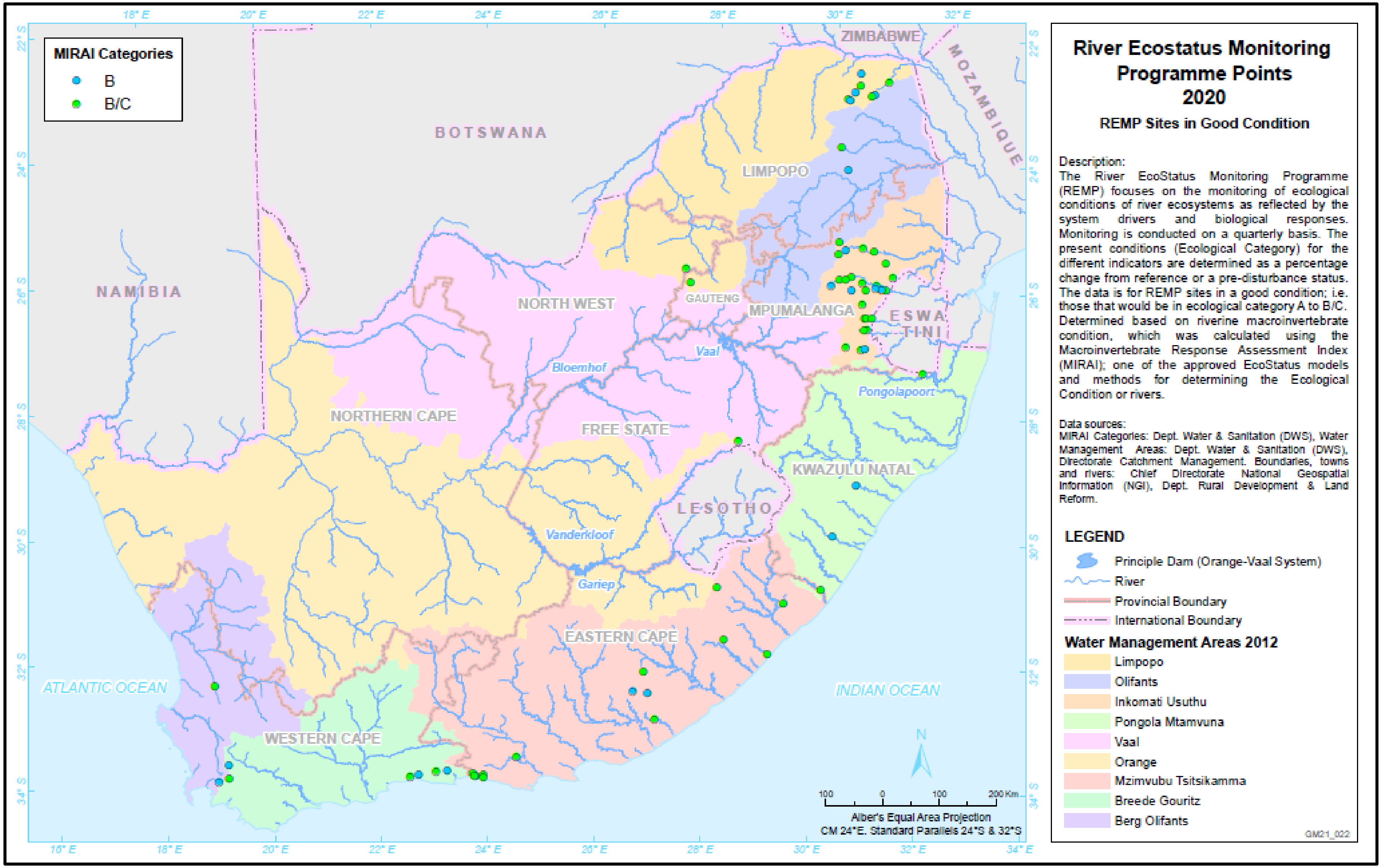
River Ecostatus Monitoring Programme Points 2020

Ecological Condition of REMP Sites

Description:
The River EcoStatus Monitoring Programme (REMP) focuses on the monitoring of ecological conditions of river ecosystems as reflected by the system drivers and biological responses. Monitoring is conducted on a quarterly basis. The present conditions (Ecological Category) for the different indicators are determined as a percentage change from reference or a pre-disturbance status. The data presented here is for riverine macroinvertebrate condition, calculated using the Macroinvertebrate Response Assessment Index (MIRAI), which is one of the approved EcoStatus models and methods for determining the Ecological Condition or rivers.

Data sources:
MIRAI Categories: Dept. Water & Sanitation (DWS), Water Management Areas: Dept. Water & Sanitation (DWS), Directorate Catchment Management. Boundaries, towns and rivers: Chief Directorate National Geospatial Information (NGI), Dept. Rural Development & Land Reform.

Figure 3.17 Macroinvertebrate-based Ecological Categories for 360 sites in selected rivers monitored during the 2019/2020 hydrological year



Description:
The River EcoStatus Monitoring Programme (REMP) focuses on the monitoring of ecological conditions of river ecosystems as reflected by the system drivers and biological responses. Monitoring is conducted on a quarterly basis. The present conditions (Ecological Category) for the different indicators are determined as a percentage change from reference or a pre-disturbance status. The data is for REMP sites in a good condition; i.e. those that would be in ecological category A to B/C. Determined based on riverine macroinvertebrate condition, which was calculated using the Macroinvertebrate Response Assessment Index (MIRAI); one of the approved EcoStatus models and methods for determining the Ecological Condition or rivers.

Data sources:
MIRAI Categories: Dept. Water & Sanitation (DWS), Water Management Areas: Dept. Water & Sanitation (DWS), Directorate Catchment Management. Boundaries, towns and rivers: Chief Directorate National Geospatial Information (NGI), Dept. Rural Development & Land Reform.

Figure 3.18 Macroinvertebrate-based Ecological Categories for sites in good condition in selected rivers monitored during the 2019/2020 hydrological year

3.5 Status of Dams

3.5.1 Surface Water Storage

DWS, through its surface water monitoring networks, monitors water storage levels in approximately 202 state and municipal owned dams. There are also farm dams which play an important role in agriculture as they capture runoff that can be used during dry periods of low or no rainfall. While in most cases the impact of an individual farm dam is relatively small, the cumulative impact of many farm dams and unmonitored small municipality dams on stream-flows and available water storage reporting can be significant.

Accounting for storage in farm dams is important to get a more accurate reflection of the surface water available at any time of reporting, as they can drastically impact on total catchment yield, projected demands, and the availability of water supply to users. It is for these reasons that the surface water storage data given in this report reflects water availability within a water management area, rather than presenting the complete national water storage status, given that it is based on only large dams. The weekly timestep dam storage per water management area for the reporting period is presented in Figure 3.19. Notably the following WMAs have been experiencing below average dam storage levels during the hydrological year:

- Olifants WMA
- IUCMA
- Pongola-Mtamvuna WMA
- Mzimvubu-Tsitsikamma WMA
- BGCMA
- Lesotho and Swaziland Dam Water Storage

The Limpopo WMA reflected a decrease in storage during the reporting period and shows the second lowest levels over a period of 5 years. The storage in the Olifants WMA has been below the for all of the last five years included in the diagram. The same is true for the Pongola-Mtamvuna WMA which has been experiencing below normal dam storages throughout the hydrological years since 2016/17. The situation remains critical for the Mzivumbu- Tsitsikamma, Inkomati-Usuthu and Vaal Major WMA's, which also have the lowest levels of storage at the end of the reporting period than for the last 5 years. The decrease in storage in those WMA's can be mostly attributed to below normal rainfall in the areas. The storage in the Orange WMA was generally above average. The most notable improved storage was observed in the Berg-Oliphants and Breede-Gouritz WMA's, partly because large parts of this region received late summer rainfall in addition to the normal winter rainfall. However, it should also be noted that some of this storage is also dependent on inter-catchment transfers, and changes in storages do not always reflect the rainfall trends.

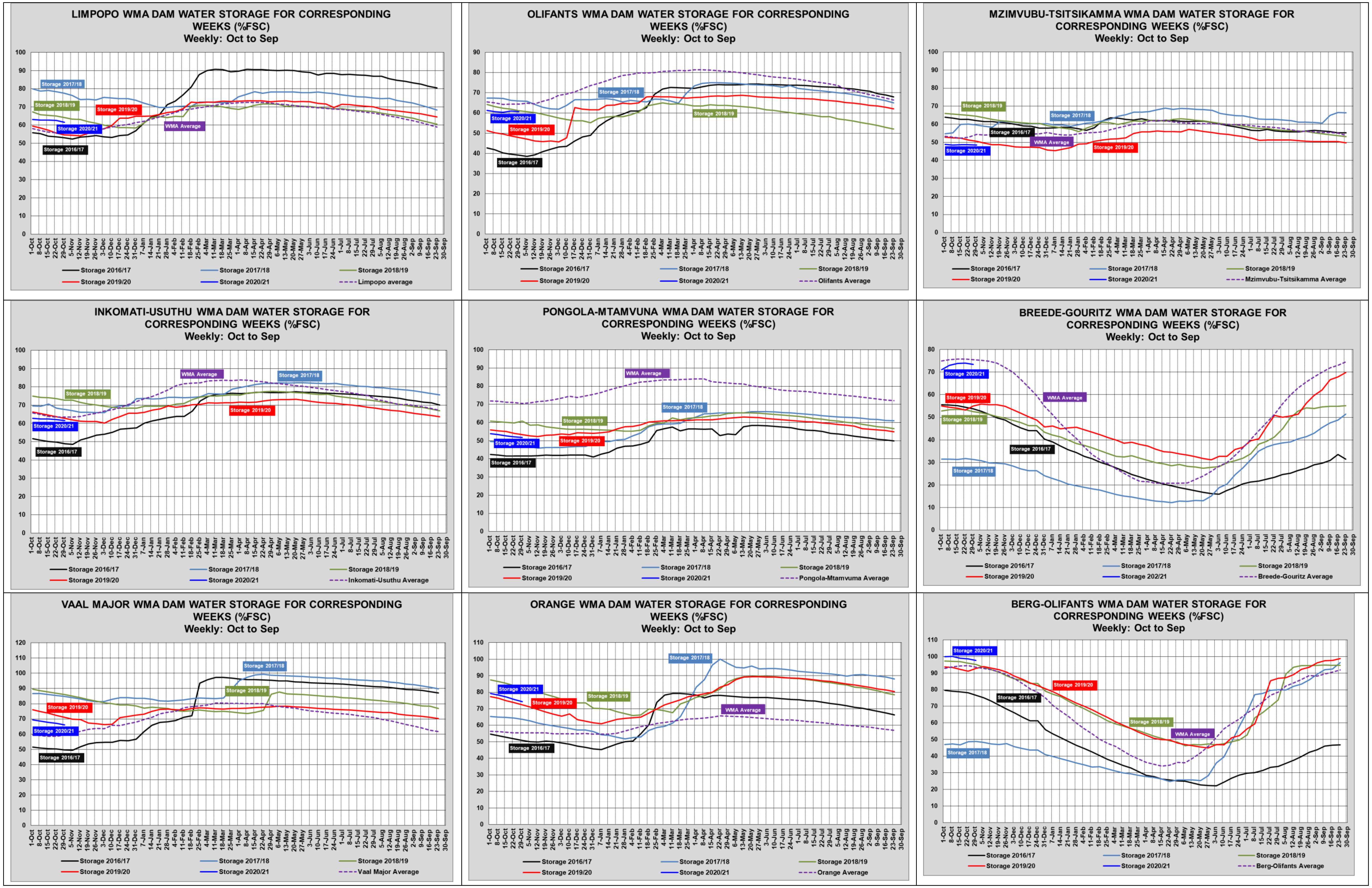
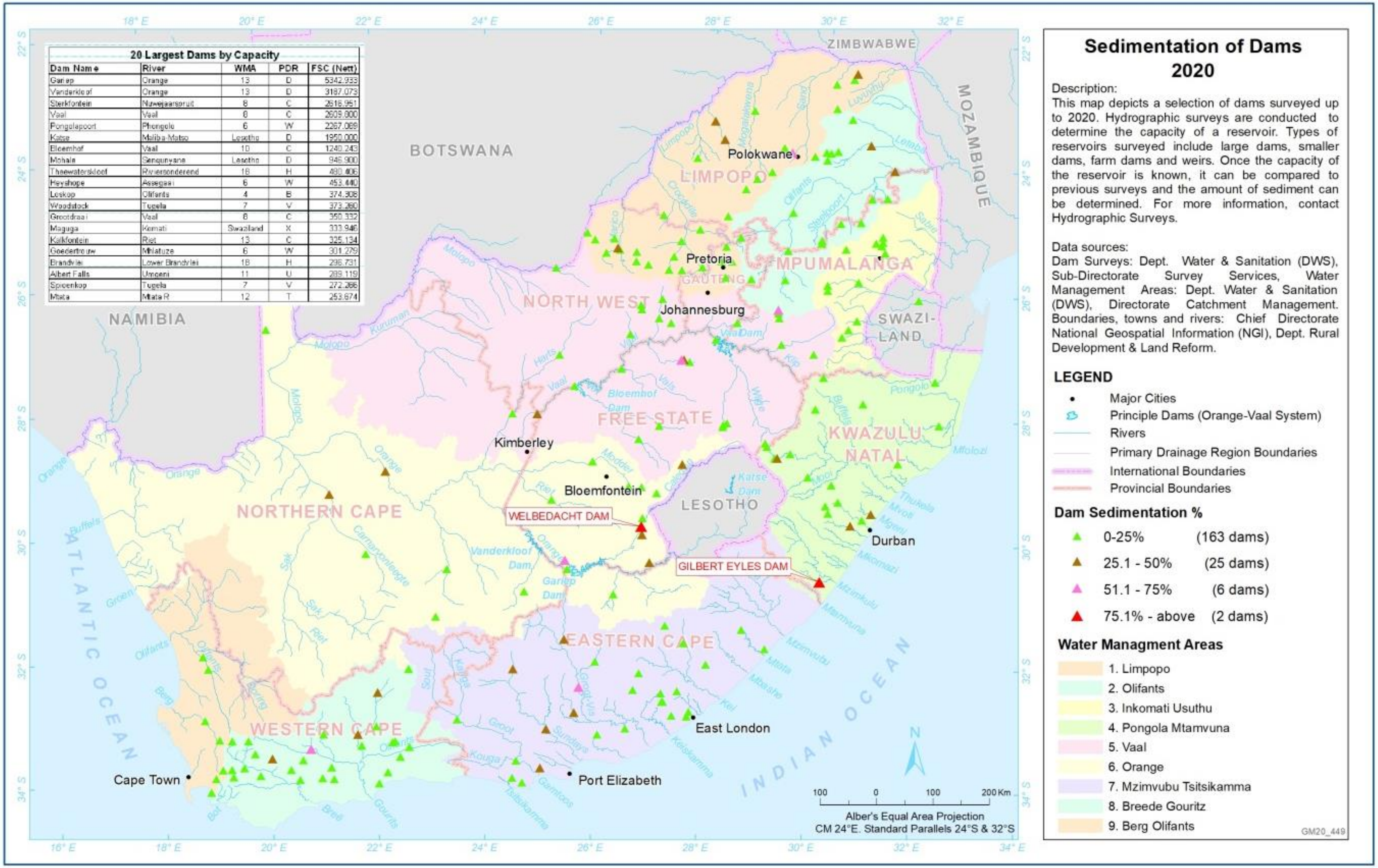


Figure 3.19 Weekly Dam storage from October 2019 to September 2020

3.5.2 Sedimentation of Dams

Eroded soil is transported through water and deposited in a river as sediment. Although naturally occurring, it is exacerbated by human activities i.e., overgrazing, crop tillage practices and others. High sediment loads in rivers reduce the storage capacity of reservoirs as the sediment settles at the bottom of reservoirs. The DWS conducts routine surveys of selected dams and weirs to determine the extent of sedimentation. Based on the outcomes of the survey, a decision will then be taken as to whether to dredge a weir or a dam. The survey status indicates that the Welbedacht Dam in the Caledon River and Gilbert Eyles Dam on the Mzimkhulwana River are the worst affected by sedimentation (Figure 3.20)



Sedimentation of Dams 2020

Description:

This map depicts a selection of dams surveyed up to 2020. Hydrographic surveys are conducted to determine the capacity of a reservoir. Types of reservoirs surveyed include large dams, smaller dams, farm dams and weirs. Once the capacity of the reservoir is known, it can be compared to previous surveys and the amount of sediment can be determined. For more information, contact Hydrographic Surveys.

Data sources:

Dam Surveys: Dept. Water & Sanitation (DWS), Sub-Directorate Survey Services, Water Management Areas: Dept. Water & Sanitation (DWS), Directorate Catchment Management. Boundaries, towns and rivers: Chief Directorate National Geospatial Information (NGI), Dept. Rural Development & Land Reform.

20 Largest Dams by Capacity

Dam Name	River	WMA	PDR	FSC (Nett)
Gariep	Orange	13	D	5342.933
Vanderkloof	Orange	13	D	3187.073
Sterkfontein	Nuwejaarspruit	8	C	2616.951
Vaal	Vaal	8	C	2609.800
Pongolapoort	Phongolo	6	W	2267.069
Katse	Maliba-Matso	Lesotho	D	1950.000
Bloemhof	Vaal	10	C	1240.243
Mohale	Senqunyane	Lesotho	D	946.900
Theewaterskloof	Riviersonderend	18	H	480.406
Heyshope	Assegaai	6	W	453.440
Loskop	Olifants	4	B	374.308
Woodstock	Tugela	7	V	373.260
Grootdraai	Vaal	8	C	350.332
Maguga	Komati	Swaziland	X	333.946
Kalkfontein	Riet	13	C	325.134
Goedertrouw	Mhlatuze	6	W	301.279
Brandvlei	Lower Brandvlei	18	H	296.731
Albert Falls	Umgeni	11	U	289.119
Spioenkop	Tugela	7	V	272.266
Mtata	Mtata R	12	T	253.674

Figure 3.20 State of Dam Sedimentation September 2020

3.5.3 Dams Eutrophication

Eutrophication is a process of progressive enrichment of water bodies with plant nutrients, particularly phosphorous and nitrogen compounds. It commonly occurs in impoundment, but without anthropogenic drivers, it can take thousands of years to reach environmentally detrimental levels. Intensive human activities and associated water pollution impacts can lead to accelerated eutrophication (cultural eutrophication). The trophic status is the extent of nutrient-enrichment in a dam or lake and the classes are given in Table 3-3. The parameters used to assign the trophic status are given in Table Table 3-4.

Table 3-3 Trophic status classes used for assessment of dams in South Africa

1. **Oligotrophic**	low in nutrients and not productive in terms of aquatic and animal plant life;
2. **Mesotrophic**	intermediate levels of nutrients, fairly productive in terms of aquatic animal and plant life and showing emerging signs of water quality problems;
3. **Eutrophic**	rich in nutrients, very productive in terms of aquatic animal and plant life and showing increasing signs of water quality problems; and
4. **Hypertrophic**	Very high nutrient concentrations where plant growth is determined by physical factors. Water quality problems are serious and can be continuous.

Table 3-4 Criterion used to assign trophic status for the dams in South Africa

Statistic	**Unit**	**Current trophic status**			
Median annual Chl *a*	µg/l	0<x<10	10<x<20	20<x<30	>30
		Oligotrophic (low)	Mesotrophic (Moderate)	Eutrophic (significant)	Hypertrophic (serious)
% of time Chl *a* > 30 µg/l	%	0	0<x<8	8<x<50	>50
		Negligible	Moderate	Significant	Serious
Potential for algal and plant productivity					
Mean annual Total Phosphorus (TP)	mg/l	x<0.015	0.015<x<0.047	0.047<x<0.130	>0.130
		Negligible	Moderate	Significant	Serious

The current trophic status for sites monitored during the reporting period is shown in Figure 3.21. For the reporting period, 26 dam/lake sites were monitored. Out of the 26 sites, seven sites had a hypertrophic status, four sites were eutrophic, ten were mesotrophic and five had an oligotrophic status. The sites with hypertrophic status were Leeukraal Dam, Bon Accord Dam, Vaalkop Dam, Klipvoor Dam, Modimola Dam, Lotlamoreng Dam and Cooke's Lake. The eutrophic sites were Roodeplaat Dam, Bospoort Dam, Hartbeespoort Dam and Witbank Dam. The Rietvlei Dam, Centurion Lake and Vaal Dam had a mesotrophic status. The other mesotrophic sites were Roodekoppies Dam, Lindleyspoort Dam, Koster Dam, Marico-Bosveld Dam, Bronkhorstspruit Dam and Rust de Winter Dam.

Bronkhorstspruit, Rietvlei, Roodekoppies and Belfast dams showed improvements in their trophic statuses (Table 3-5). These improvements should be monitored into the future to determine the trend and possible causes for improvement.

Eutrophication in Roodeplaat and Bospoort Dams is negatively affecting recreational, business and farming activities in and around the dams. This has also impacted negatively on the aquatic ecosystem health. Compared to previous hydrological years, not much data was collected due to lack of fieldworker in many areas (Table 3-5).

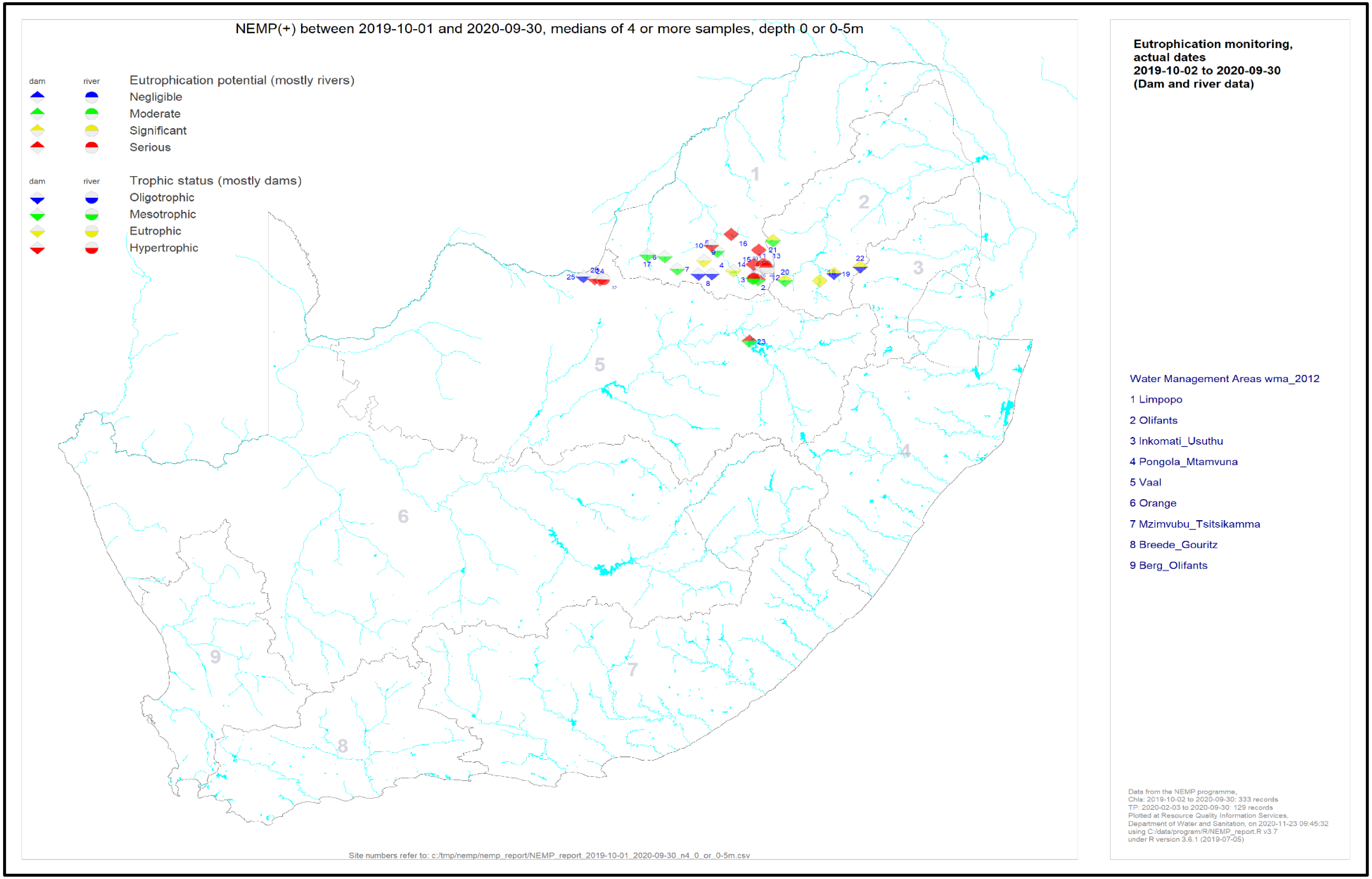


Figure 3.21 Summary of the trophic status and potential eutrophication for the period between October 2019 to September 2020

Table 3-5 Changes in eutrophication from 2017 to 2020 period

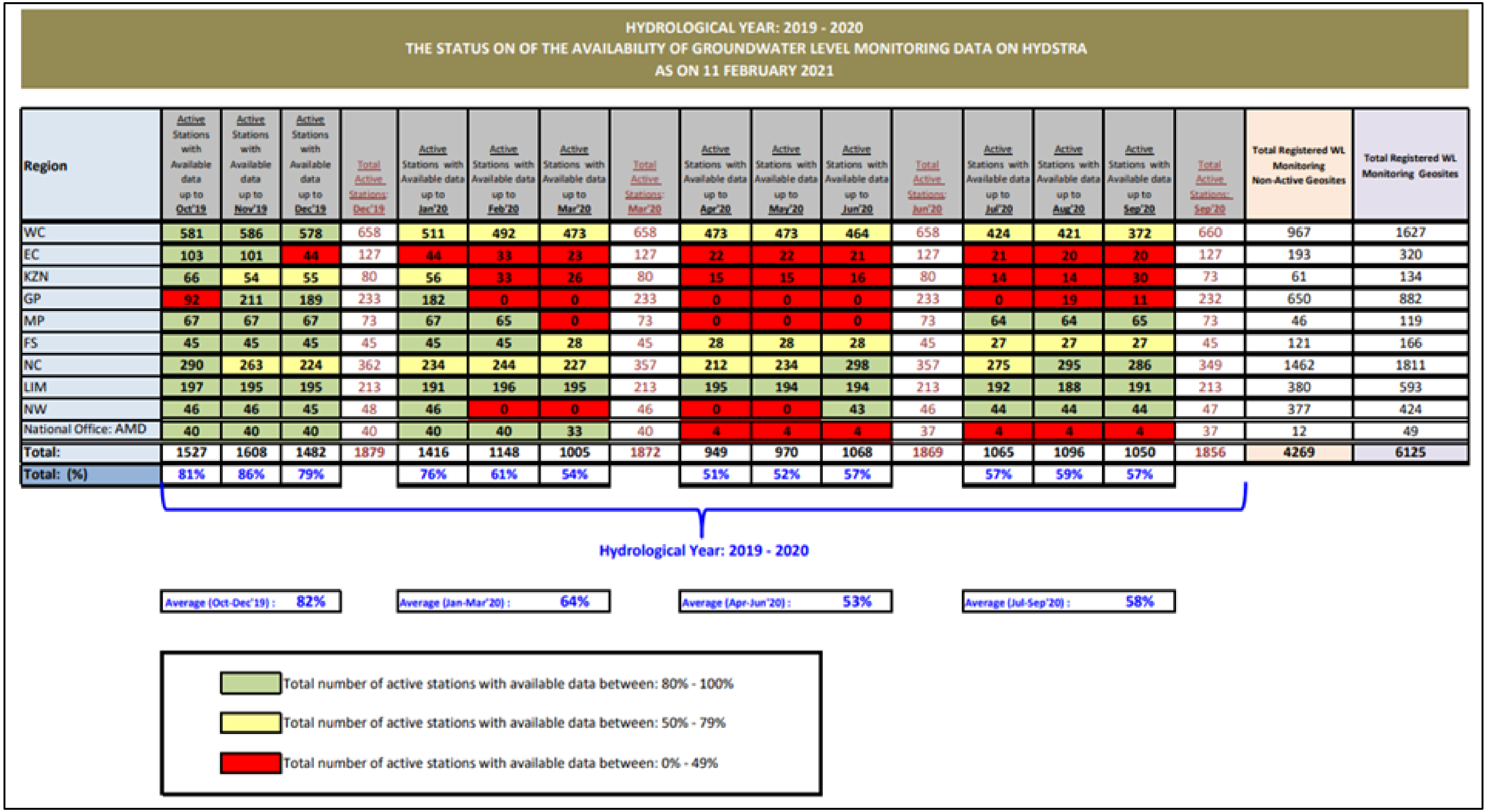
DAM	RIVER	WMA	2020	2019	2018	2017
Belfast	DORPSPRUIT	Olifants	Oligotrophic	Data unavailable	Eutrophic	Hypertrophic
Bon Accord	Apies	Limpopo	Hypertrophic	Data unavailable	Hypertrophic	Hypertrophic
Vaalkop (Bulhoek)	Elands	Limpopo	Hypertrophic	Data unavailable	Hypertrophic	Eutrophic
Bospoort	Hex	Limpopo	Eutrophic	Data unavailable	Eutrophic	Eutrophic
Bronkhorstspruit	Bronkhorstspruit	Olifants	Mesotrophic	Data unavailable	Eutrophic	Hypertrophic
Cooke’s Lake	Molopo	Limpopo	Hypertrophic	Data unavailable	Hypertrophic	Hypertrophic
Hartbeespoort	Crocodile	Limpopo	Eutrophic	Data unavailable	Eutrophic	Hypertrophic
Inlet to Civic Lake	Blesbokspruit	Vaal	No data	Data unavailable	Hypertrophic	Mesotrophic
Kalkfontein	Riet	Vaal	No data	Data unavailable	Eutrophic	
Klipvoor	Pienaars	Limpopo	Hypertrophic	Data unavailable	Hypertrophic	Hypertrophic
Modimola	Molopo	Limpopo	Hypertrophic	Data unavailable	Hypertrophic	Mesotrophic
Outlet Kleinfontein	Blesbokspruit	Vaal	No data	Data unavailable	Eutrophic	Eutrophic
Rietvlei	Hennops	Limpopo	Mesotrophic	Data unavailable	Hypertrophic	Hypertrophic
Roodekoppies	Crocodile	Limpopo	Mesotrophic	Data unavailable	Hypertrophic	Eutrophic
Roodeplaat	Pienaars	Limpopo	Eutrophic	Hypertrophic	Hypertrophic	Hypertrophic

3.6 State of Groundwater

Groundwater is critical water resource that is used to meet domestic, agricultural, industrial, and environmental water needs. It is most often explored as a supplementary option when surface water resources fall short, particularly during drought. Generally, groundwater levels are susceptible to climatic and human impacts in terms of its fluctuation.

3.6.1 Available Groundwater level data

The status of available groundwater level data for the October 2019 to September 2020 hydrological year is presented in Figure 3.22 . Peak groundwater level data availability for the hydrological year is reported for November 2019 with 86% active stations with data and the data availability began to decrease from December 2019 onwards. April 2020 reported the lowest data from active stations at 51%. This was largely attributed to the Covid-19 pandemic National Lock Down travel restrictions that were implemented in March 2020.



HYDROLOGICAL YEAR: 2019 - 2020
THE STATUS ON OF THE AVAILABILITY OF GROUNDWATER LEVEL MONITORING DATA ON HYDSTRA
AS ON 11 FEBRUARY 2021

Region	Active Stations with Available data up to Oct'19	Active Stations with Available data up to Nov'19	Active Stations with Available data up to Dec'19	Total Active Stations: Dec'19	Active Stations with Available data up to Jan'20	Active Stations with Available data up to Feb'20	Active Stations with Available data up to Mar'20	Total Active Stations: Mar'20	Active Stations with Available data up to Apr'20	Active Stations with Available data up to May'20	Active Stations with Available data up to Jun'20	Total Active Stations: Jun'20	Active Stations with Available data up to Jul'20	Active Stations with Available data up to Aug'20	Active Stations with Available data up to Sep'20	Total Active Stations: Sep'20	Total Registered WL Monitoring Non-Active Geosites	Total Registered WL Monitoring Geosites
WC	581	586	578	658	511	492	473	658	473	473	464	658	424	421	372	660	967	1627
EC	103	101	44	127	44	33	23	127	22	22	21	127	21	20	20	127	193	320
KZN	66	54	55	80	56	33	26	80	15	15	16	80	14	14	30	73	61	134
GP	92	211	189	233	182	0	0	233	0	0	0	233	0	19	11	232	650	882
MP	67	67	67	73	67	65	0	73	0	0	0	73	64	64	65	73	46	119
FS	45	45	45	45	45	45	28	45	28	28	28	45	27	27	27	45	121	166
NC	290	263	224	362	234	244	227	357	212	234	298	357	275	295	286	349	1462	1811
LIM	197	195	195	213	191	196	195	213	195	194	194	213	192	188	191	213	380	593
NW	46	46	45	48	46	0	0	46	0	0	43	46	44	44	44	47	377	424
National Office: AMD	40	40	40	40	40	40	33	40	4	4	4	37	4	4	4	37	12	49
Total:	1527	1608	1482	1879	1416	1148	1005	1872	949	970	1068	1869	1065	1096	1050	1856	4269	6125
Total: (%)	81%	86%	79%		76%	61%	54%		51%	52%	57%		57%	59%	57%			

Hydrological Year: 2019 - 2020

Average (Oct-Dec'19) : 82%

Average (Jan-Mar'20) : 64%

Average (Apr-Jun'20) : 53%

Average (Jul-Sep'20) : 58%

🟩 Total number of active stations with available data between: 80% - 100%

🟨 Total number of active stations with available data between: 50% - 79%

🟥 Total number of active stations with available data between: 0% - 49%

Figure 3.22 Status of Available Groundwater Level Monitoring Data on Hydstra (2019 - 2020 Hydrological year)

3.6.2 Groundwater level trends

The water levels over the last two years (the period from March 2018 to March 2020) still show high (>60%) declining trend in Northern Cape (North of Orange River), North West, Limpopo, and KwaZulu-Natal provinces. A good recovery but stable water levels (only 20% declined or in other words a 62% of all the water level stations have shown an increase in water levels) were observed in Free State province over the past year. Table 3-6 presents the percentage of monitoring boreholes with declining water levels

Table 3-6 Percentage of monitoring boreholes with declining water levels

Province	March 2018– 2019	March 2019 – 2020	March 2018 – 2020
Western Cape – ***(Winter rainfall area)***	30.9	*	*
Western Cape – ***(Summer rainfall area)***	63.9	*	*
Eastern Cape	75.3	*	*
Northern Cape – ***(South of Orange River)***	*	*	44.4
Northern Cape – ***(North of Orange River)***	84.6	68.3	75.6
North West	*	*	64.6
Free State	69.0	20.7	51.7
KwaZulu-Natal	*	*	70.4
Mpumalanga	59.3	49.2	39.7
Gauteng	**	**	53.5
Limpopo	71.5	65.4	74.2
National	51.6	55.8	58.1

The table depicts the percentage of monitoring boreholes showing declining groundwater level trends

Decline % text colour: **Blue** < 40% (good); **Black** 40 – 60% and **Red**>60% (bad)

* - No Data – Monitoring done but data collection effected either by monitoring frequency and or monitoring equipment – less than 50% of data available

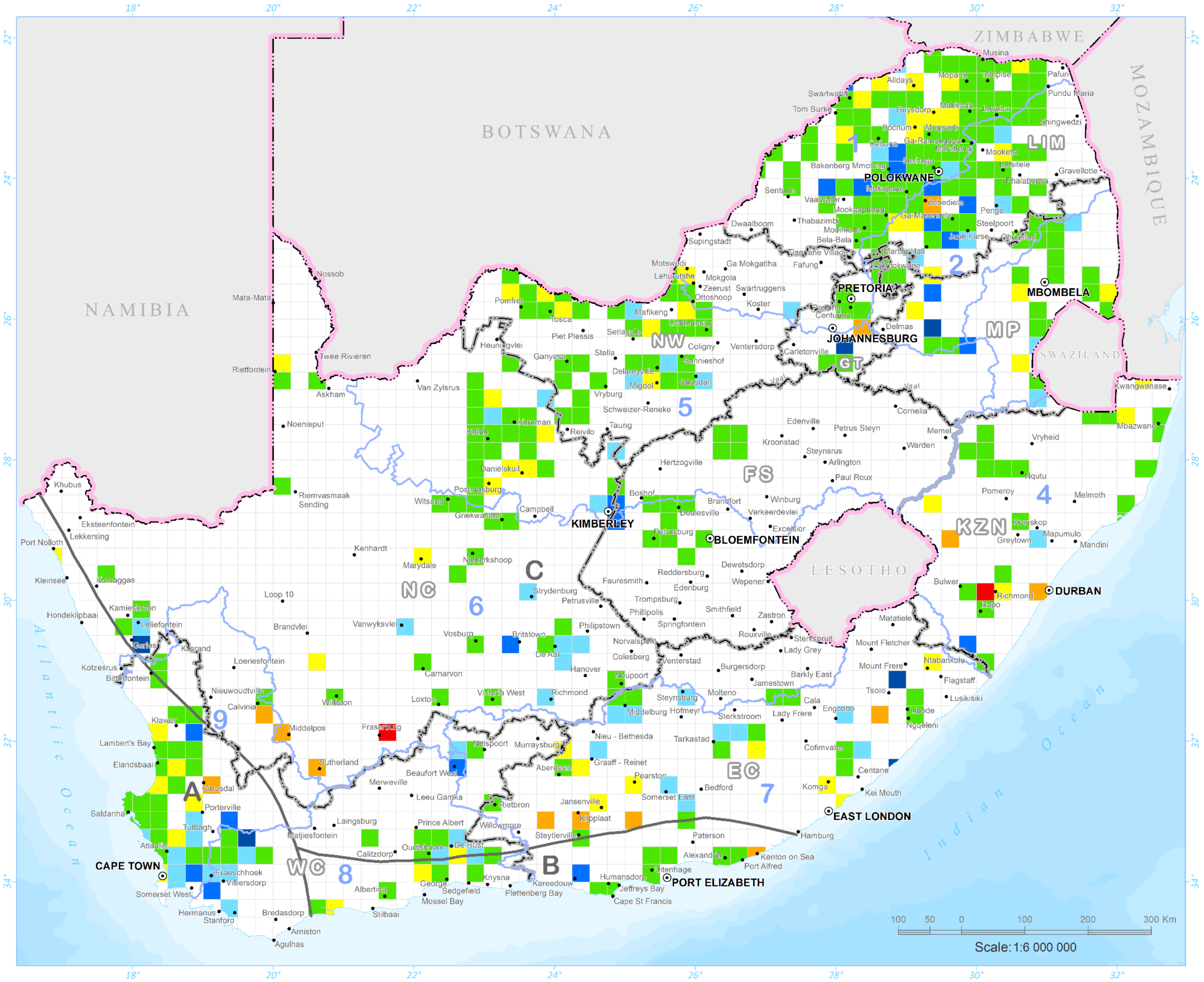
** - No Data – No monitoring conducted

Mpumalanga province showed stable recovery of water levels in last two years whereas, Free State province showed a significant increase after a negative season (2018 – 2019). The Northern Cape (north of the Orange River) and Limpopo are showing a constant significant decline for the last 2 years.

The borehole's full historical monitoring record is analysed, and the current level represents the current status of the groundwater level as a percentage in the borehole and is called the Groundwater Level Status (GwLS) value, provided as a percentage (%). The difference in the maximum and minimum water level measured in metres below ground level (mbgl) within the water level station monitoring history, determine the water level range. The groundwater level status (mbgl) is determined by the difference between the water level range and the last water level measurement.

The groundwater level status of station is averaged within a topo-cadastral grid cell (1:50 000). It is important to note that the groundwater level status is not directly linked to the groundwater availability or the storage volumes within an aquifer, but only gives an indication of water levels in comparison to historical observed groundwater levels.

Figure 3.23 indicates the change in groundwater level status between September 2019 and September 2020. There hasn't between a significant change in groundwater level status between September 2019 and September 2020 as most stations fell within the -10% and +10% range (green grid). However, this is only an indication of a year's difference in groundwater level status and long-term trends for areas experiencing drought would need to be investigated to get context to the groundwater level status patterns of concern that require intervention.



Groundwater Level Status

SEPTEMBER 2019 to SEPTEMBER 2020

Description:

The map indicates the current groundwater levels status as a percentage of monitoring Geosites. The difference of the maximum and minimum water level measured in metres below ground level (mbgl) within the Geosite's monitoring history, which determine the water level range. The groundwater level status (mbgl) determined by the difference between the water level range and the last water level measurement. The groundwater level status is presented as a percentage (%). The groundwater level status of the Geosites is averaged within topo-cadastral 1:50 000 map sheet (grid).

The groundwater level status is not linked to the groundwater availability or the storage levels within an aquifer (volume) but only gives an indication of the water level in comparison to historical monitoring water levels.

Change in Groundwater Level Status

Average % Sep2019 - Sep2020

- ■ > +50%
- ■ > +25% to +50%
- ■ > +10% to +25%
- ■ < -10% to +10%
- ■ < -25% to -10%
- ■ < -50% to -25%
- ■ > - 50%

MAP KEY

- • RSA Groundwater Dependant Towns 2013
- ⊙ Major RSA Cities
- — RSA Rainfall Regions (A = Winter; B = Year Round; C = Summer)
- — Provincial Boundary
- — International Boundary

Water Management Areas

- — 2012 Water Management Areas Boundary

1 Limpopo
2 Olifants
3 Inkomati-Usuthu
4 Pongola-Mtamvuna
5 Vaal
6 Orange
7 Mzimvubu-Tsitsikamma
8 Breede-Gouritz
9 Berg-Olifants

Data sources:
Boundaries, towns and rivers: Chief Directorate National Geospatial Information (NGI), Dept. Rural Development & Land Reform (DRDLR).
Groundwater level data: National Groundwater Archive (NGA) and HYDSTRA Database; Directorate: Surface & Groundwater Information; Dept. of Water & Sanitation (DWS).

water & sanitation
Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

Task No: GM21_409

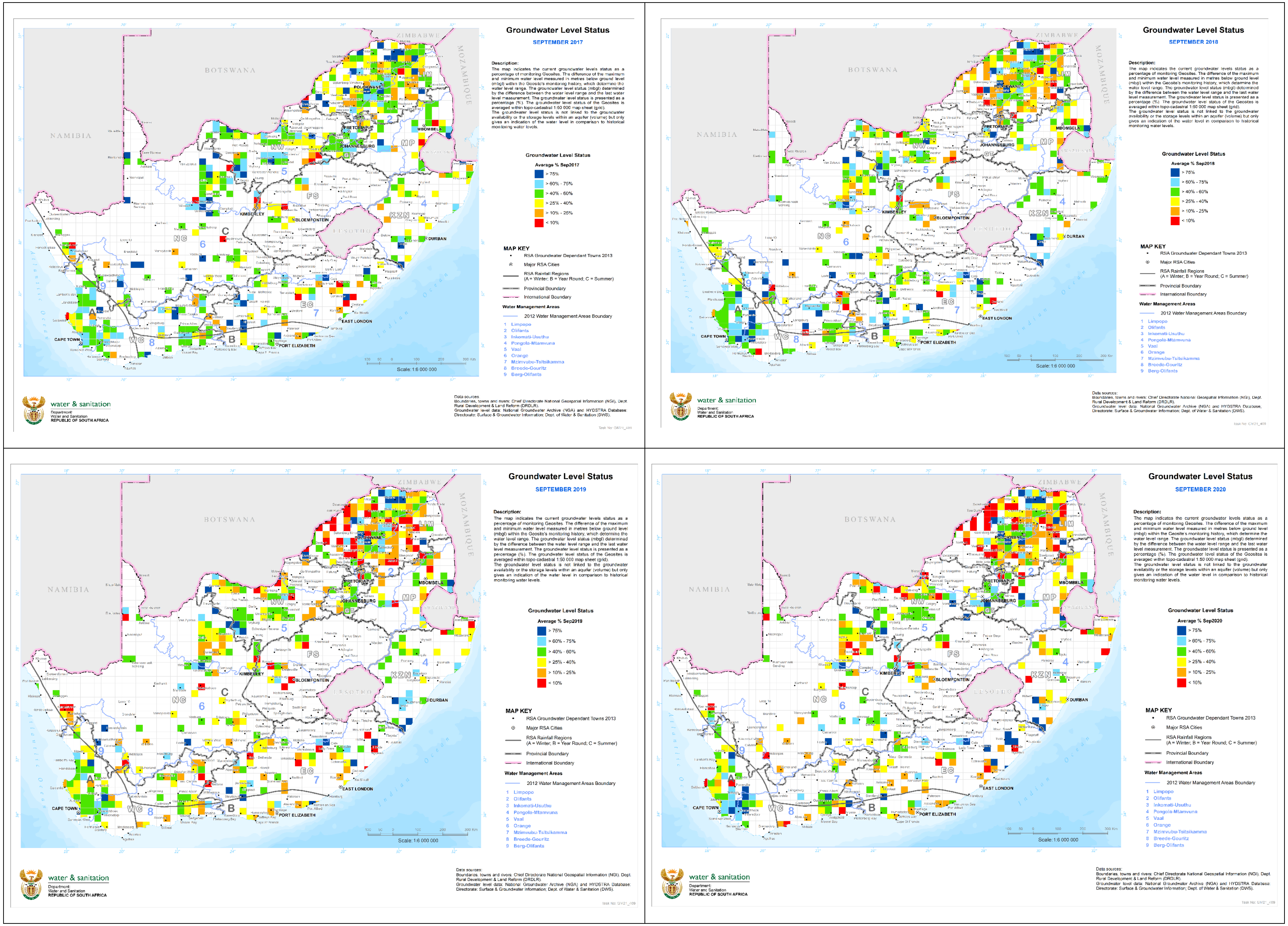
Figure 3.23 Change in Groundwater Level Status September 2019 to September 2020

3.6.3 Groundwater level status:

The severity of the drought can also be shown if the current groundwater level is compared against the range (difference between maximum and minimum) of the groundwater levels ever measured at a groundwater station. The lowest range ever measured of all the current groundwater levels in history were for the Northern Cape north of the Orange River

Figure 3.24 indicates the groundwater level status of September months over the years 2017, 2018, 2019 and 2020. The Western Cape, Eastern Cape, Northern Cape, Free State and Limpopo provinces have shown a downward trend with the average status over the last three years. The Northern Cape south of the Orange River was the only area with a significant rise in the last two months after four years of a decline.

The biggest concerning area is the Namaqualand (Northern Cape) and the Limpopo Province and with a lesser concerned the Karoo (Northern Cape, Western Cape, and Eastern Cape). The groundwater recharge (increasing groundwater levels) has a good relation to precipitation. The SPI (Standardized Precipitation Index - developed to monitor the occurrence of droughts from rainfall data) can provide an indication of the areas experiencing meteorological drought.



Description:
The map indicates the current groundwater levels status as a percentage of monitoring Geosites. The difference of the maximum and minimum water level measured in metres below ground level (mbgl) within the Geosite's monitoring history, which determine the water level range. The groundwater level status (mbgl) determined by the difference between the water level range and the last water level measurement. The groundwater level status is presented as a percentage (%). The groundwater level status of the Geosites is averaged within topo-cadastral 1:50 000 map sheet (grid).
The groundwater level status is not linked to the groundwater availability or the storage levels within an aquifer (volume) but only gives an indication of the water level in comparison to historical monitoring water levels.

Data sources:
Boundaries, towns and rivers: Chief Directorate National Geospatial Information (NGI), Dept. Rural Development & Land Reform (DRDLR).
Groundwater level data: National Groundwater Archive (NGA) and HYDSTRA Database: Directorate: Surface & Groundwater Information: Dept. of Water & Sanitation (DWS).

Figure 3.24 Groundwater Level Status September 2017 through to September 2020

3.6.4 Groundwater Quality

KwaZulu-Natal and the Free State Provinces were the only two provinces with available groundwater quality data at the time of reporting with a combined total of 27 groundwater quality stations with data (see Figure 3.25). Several regions could not conduct their normal monitoring activities due to either financial reasons, data not uploaded to the WMS database due to departmental IT outage or sample analysis that are yet to be conducted at the laboratory.

Water supplies to domestic users can originate from groundwater. Drinking water is often assumed to be the water use with the most stringent quality requirements. Groundwater quality was compared to SANS: 241 (2015) drinking water guideline allowable limits. Table 3-7 gives some water quality parameters compared to the SANS 241 drinking water allowable limit. Total Coliform exceeded the drinking water for acute health risk limit in majority of the stations within the Free State Province. Elevated concentrations of Total Coliform can be attributed to agricultural runoff, effluent from septic tanks or pit latrines coupled with poor borehole maintenance. With agriculture dominating the landscape of the Free State Province; agricultural runoff can be the most likely cause of these elevated concentrations on a high-level overview. Site specific activities would need to be investigated to determine exact nature of the sources of contamination.

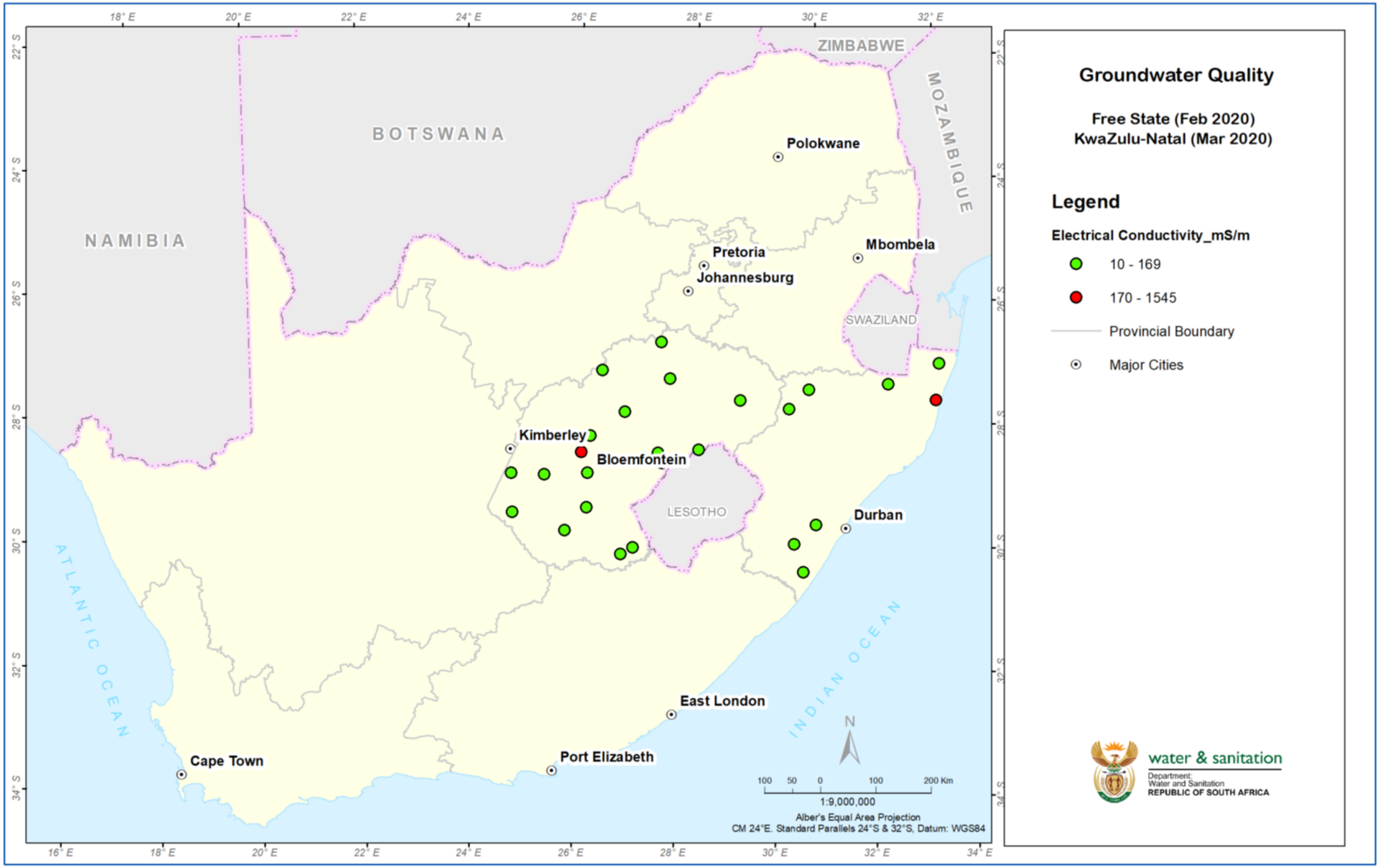


Figure 3.25 Groundwater Quality (Electrical Conductivity

Table 3-7 Groundwater Quality vs SANS 241 Drinking Allowable Drinking Water Limits

Geosite ID	**Latitude**	**Longitude**	**pH**	**Electrical Conductivity**	**Nitrate (NO3)**	**Total Coliform**
Unit			pH Units	mS/m	mg/l	colonies/100ml
SANS 241 Maximum Allowable Limit			≥5 - ≤9.7	≤170	<11	Not Detected
Risk			Operational	Aesthetic	Acute Health	Acute Health
ZQMMLI1	-30.6002	30.2790	8.6	77	6	
ZQMUGU1	-27.4819	31.6476	7.4	13	3	
ZQMETN1	-29.8244	30.4748	7.4	17	1	
ZQMIOO1	-30.1574	30.0830	7	62	2	
ZQMBRK1	-27.9739	29.8627	7.4	16	2	
ZQMHRT1	-27.6451	30.2090	7.1	10	1	
ZQMSFR1	-27.0872	32.5439	6.8	16	1	
ZQMMAI1	-27.6847	32.5439	6.3	61	1	
ZQMOZA1	-27.6847	32.5439	6.5	1545	3	
ZQMPRY1	-26.9658	27.4922	7.4	74	7.5	93
ZQMAGP3	-27.5553	27.6668	8	27	0.3	488
ZQMWAR1	-27.8633	28.9644	7.9	90	0.9	53
ZQMPMF2	-27.4428	26.4367	7.6	45	11	120
ZQMBSF1	-28.5331	25.2431	7.8	150	28	7
ZQMVRA1	-28.1086	26.8606	7.6	157	11.6	61
ZQMMQD2	-28.7625	27.4840	7.9	39	0.5	<1
ZQMCPT2	-28.6928	28.2389	7.7	52	0.7	1203
ZQMCCN1	-28.9206	27.5700	7.1	33	1.6	980
ZQMBFT2	-28.5052	26.2360	7.6	12	0.5	<1
ZQMFBD1	-28.7678	26.0700	7.3	446	0.5	2420
ZQMWRD2	-29.1411	25.3925	7.6	49	4.2	194
ZQMJBL1	-29.1256	24.7786	8	36	0.2	12
ZQMLCF1	-29.7567	24.7964	8.1	53	9.4	<1
ZQMBLM1	-29.1067	26.1894	7.9	63	4.6	<1
ZQMRDG1	-29.6647	26.1844	8.2	64	2.6	<1
ZQMTMG2	-30.0395	25.7818	7.5	78	6.4	26
ZQMRXL1	-30.4158	26.8317	7.5	24	0.2	<1
ZQMZAS1	-30.3050	27.0644	7.7	32	0.9	1733

3.7 Status of Wetlands

As defined in Chapter 9 of the National Water Act (36 of 1998), Wetland ‘means land which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water, and which land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil’. Wetlands are considered as natural water quality filters, floodwater buffers, shelter for a variety of plants and animals’ species, and promote biological productivity and diversity (Environmental Protection Agency, 2001; Woodward and Wui, 2001; Schuyt and Brander; 2004)

Information on mapping and ecological status of wetlands presented in this section is based on the National Biodiversity Assessment 2018 – South African Inventory of Inland Aquatic Ecosystems (SAIIAE) by Van Deventer et al (2019). For more in-depth knowledge and information, the reader is referred to this report which is a collaboration between Council for Scientific and Industrial Report (SANBI) and South African Biodiversity Institute (SANBI) - (http://hdl.handle.net/20.500.12143/5847.)

3.7.1 Wetlands Mapping

The National Biodiversity Assessment (2018) has provided the National Wetland Map Version 5 that is presented in Figure 3.26, which shows the distribution of the estuaries and inland wetlands across South Africa. A total of 2.6 million ha of inland wetlands have been mapped, which makes up 2.2% of the surface area of South Africa.

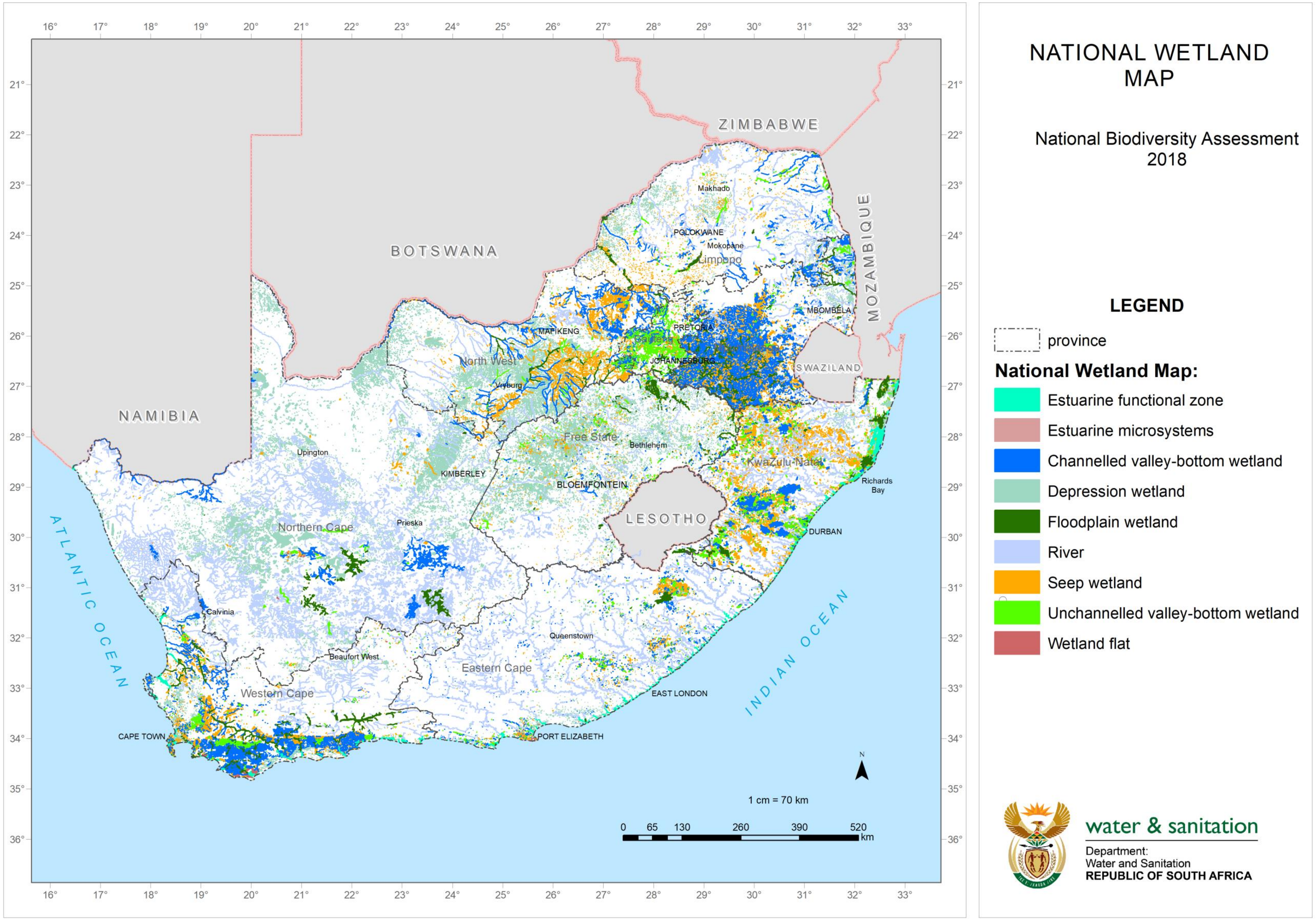


Figure 3.26 Estuaries and inland wetland ecosystem types of National Wetland Map version 5 (Data Source: NBA, 2018)

3.7.2 Ramsar Sites

South Africa as of March 2021 has got 27 wetlands that are classified as Ramsar sites – these are wetlands of international importance. The list of the Ramsar sites sorted by the date of designation is given in Table 3-8, while the locality of these wetland sites is presented in Figure 3.27. The latest site to be designed a Ramsar site is the Ingula Nature Reserve in KwaZulu-Natal, while the largest wetlands site of international importance by area is the St. Lucia System.

Table 3-8 List of South African Ramsar sites

Site name	Designation date	Area (ha)
Turtle Beaches/Coral Reefs of Tongaland	1986-10-02	39 500
Kosi Bay	1991-06-28	10 982
Lake Sibaya	1991-06-28	7 750
Orange River Mouth	1991-06-28	2 000
Verlorenvlei	1991-06-28	1 500
Wilderness Lakes	1991-06-28	1 300
Blesbokspruit	1995-01-01	1 858
Seekoeivlei Nature Reserve	1997-01-21	4 754
Natal Drakensberg Park	1997-01-21	242 813
Ndumo Game Reserve	1997-01-21	10 117
Barberspan	1998-01-01	3 118
De Mond	1998-01-01	918
De Hoop Vlei	1998-01-01	750
St. Lucia System	1998-01-01	155 500
Nylsvley Nature Reserve	1998-07-07	3 970
Langebaan	2001-01-01	6 000
Verloren Valei Nature Reserve	2001-10-16	5 891
Makuleke Wetlands	2007-05-22	7 757
Prince Edward Islands	2007-05-22	37 500
Ntsikeni Nature Reserve	2010-02-02	9 200
uMgeni Vlei Nature Reserve	2013-03-19	958
False Bay Nature Reserve	2015-05-21	1 542
Bot - Kleinmond Estuarine System	2017-03-21	1 349.78
Kgaswane Mountain Reserve	2019-08-26	4 952.4
Dyer Island Provincial Nature Reserve and Geyser Island Provincial Nature Reserve	2019-08-26	288
Dassen Island Nature Reserve	2019-08-26	737
Ingula Nature Reserve	2021-03-22	8 084

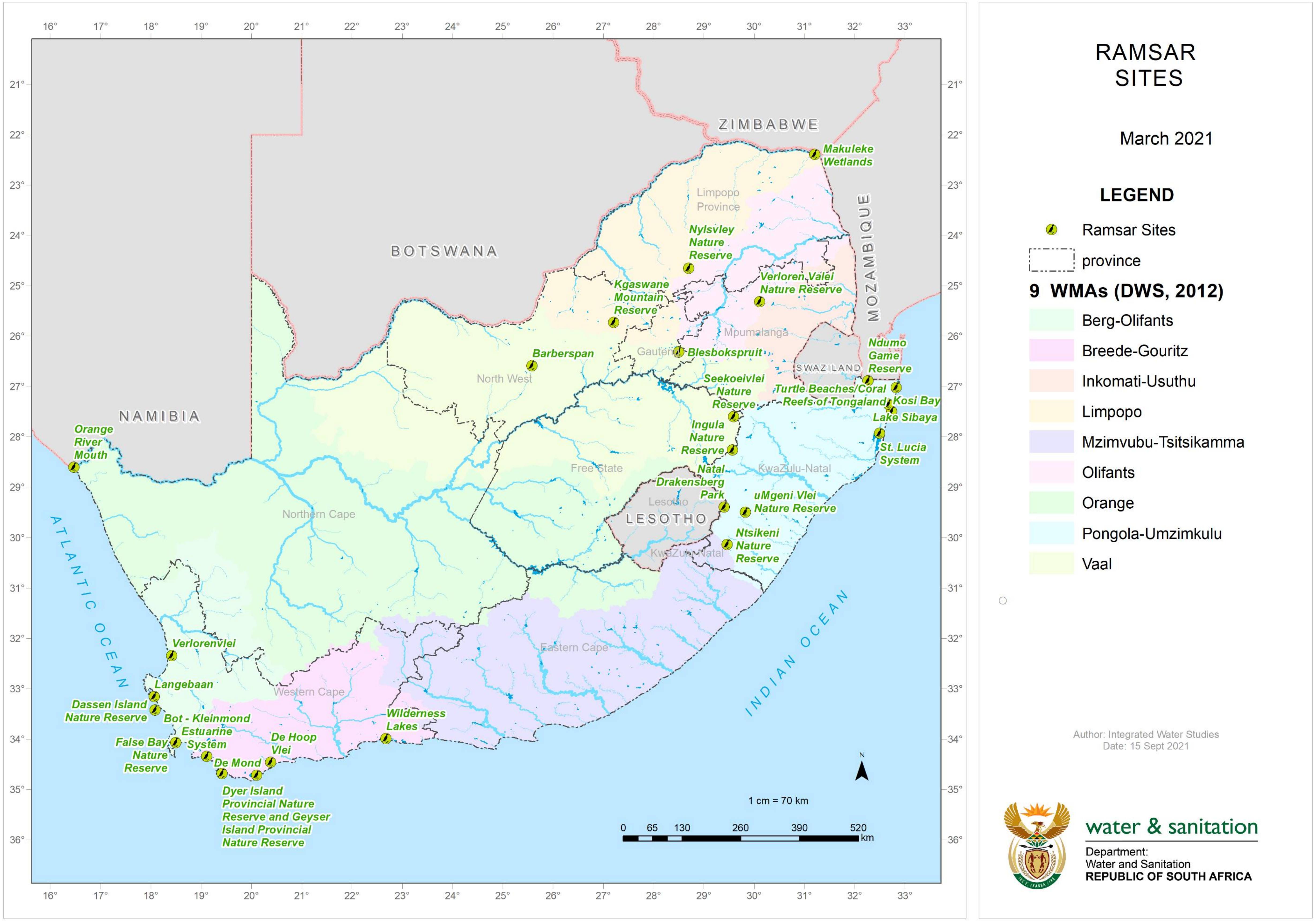


Figure 3.27 Location of 27 Ramsar wetlands sites as of March 2021

3.7.3 Wetlands Ecological Condition

The determination of the ecological condition or status is based on the ecosystem assessment exercise that is dependent on (i) mapping and classifying ecosystem types across the country; and (ii) mapping ecosystem conditions across the country (Nel & Driver, 2012). Given in Table 3-9 is the ecological categories used in the National Biodiversity Assessment (NBA) report, in comparison to the original DWS framework (Present ecological state {PES} categories using letters A to F) applied to rivers, inland wetlands and estuaries.

An ecological condition describes the extent to which a wetland has been modified by human activity. The ecological condition categories reflect the degree of modification from natural (A) to critically Modified (F) (NBA 2018). Ideally freshwater ecosystems or inland wetlands that are currently considered to be of high integrity, in other words in their natural or near natural ecological state should be protected for purposes of conserving biodiversity, while those in the critical condition should be selected for rehabilitation.

Table 3-9 Description of ecological categories by DWS (Kleynhans and Louw 2007)

Ecological Category (EC)	Ecological Description of EC	NBA 2018 Ecological condition category
A	Unmodified, natural.	Natural
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	Near Natural
C	Moderately modified. Loss and change of natural habitat and biota have occurred, but the basic ecosystem functions are still predominantly unchanged.	Moderately modified
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	Heavily modified
E	Seriously modified. The loss of natural habitat, biota and basic ecosystem functions is extensive.	Severely modified
F	Critically / Extremely modified. Modifications have reached a critical level and the system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	Critically modified

The spatial distribution of the ecological condition of inland wetlands based on the NBA 2018, is presented in Figure 3.28. Most inland wetlands are in a poor ecological condition, with 68% of the total spatial extent categorised as an ecological category ‘D/E/F’, meaning heavily to severely/critically modified. Less than 15% of the inland wetlands are in a natural to near-natural ecological condition (‘A/B’), whereas 18% of the inland wetlands fall within the moderately modified (‘C’) category.

Geographically as it can be observed Figure 3.28 the ecological condition of inland wetlands within and around the metropoles are largely transformed (‘D/E/F’), as well as in those regions where crops are cultivated (irrigated and dryland) (Van Deventer et al., 2019). This is particularly true in the Gauteng, KwaZulu-Natal, Mpumalanga, North West, and Western Cape Provinces.

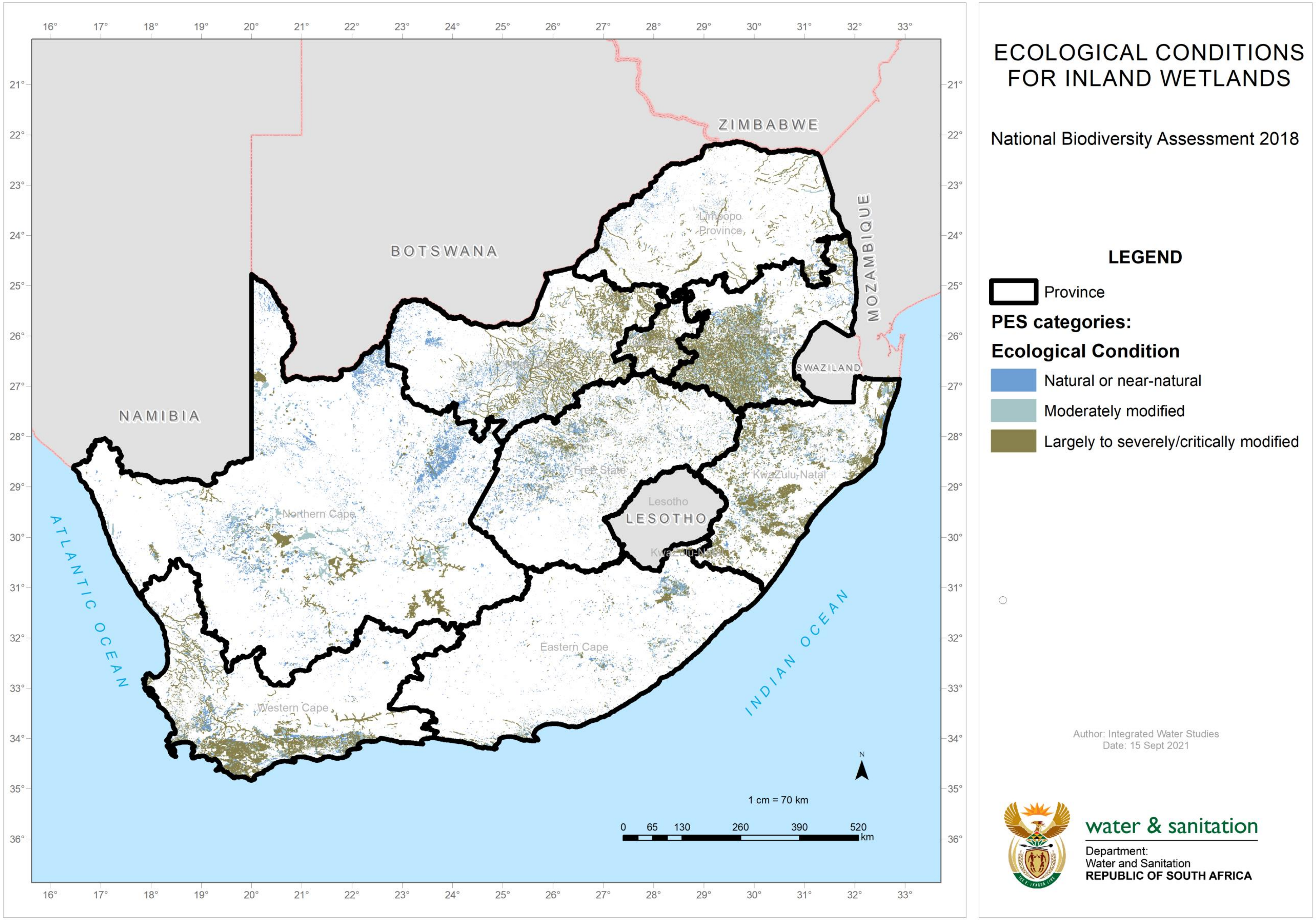


Figure 3.28 Ecological Condition for the inland wetlands of South Africa (NBA, 2018)

3.8 Estuaries Ecological Health

The South African coastline is subdivided into four bio-geographical zones according to the National Biodiversity Assessment (Van Niekerk, 2019) as presented in Figure 3.29 below.

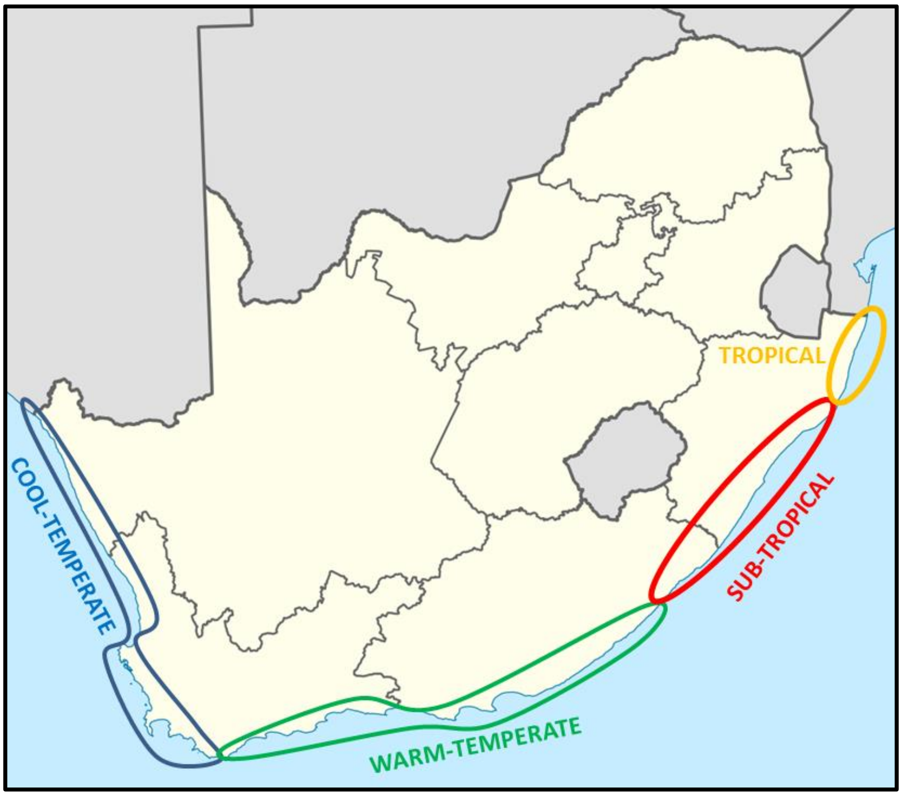


Figure 3.29 The four biogeographical regions (Van Niekerk et al. (2019).

The Tropical sub-region extends from Kosi Bay Estuary to uMgobezeleni Estuary, the Subtropical from St Lucia Estuary to Mbashe Estuary, the Warm Temperate zone is from the Mendwana Estuary to Heuningnes Estuary near Cape Agulhas, and the Cool Temperate zone from Ratel Estuary and ends at the Orange River mouth in the Northern Cape.

South African estuaries were classified into five categories (Whitfield, 1992) and have been refined into nine categories (Van Niekerk, 2019), i.e., estuarine lakes, estuarine bay, estuarine lagoon, predominantly open estuaries, large temporary closed estuaries, small temporary closed estuaries, large fluvial dominated river mouth, small fluvial dominated river mouth, arid predominantly closed. The individual systems may change from one type to another under the influence of natural events or anthropogenic influences.

The National Estuaries Monitoring Programme (NESMP) is responsible for the monitoring of estuaries across the four bio-geographical regions. The main objective of the NESMP is to measure and assess on a regular basis the changes and trends of water quality in South African estuarine system.

In the current reporting period, five estuaries were monitored. As part of the monitoring programme, physico-chemical data are being collected for long term storage in the database. The five estuaries monitored in the reporting period are Breede, Knysna, Ntafufu, Msikaba and Mtentu (Figure 3.30). All estuaries are well oxygenated with dissolved oxygen concentration being greater r than 5 mg/l). The high salinity and electrical conductivity values reported at these estuaries were due to seawater intrusion.

Chlorophyll-a concentrations in the water column remain moderately low throughout the year, indicative of low nutrient loading higher up the river catchments for phytoplankton growth (Figure 3.30). Nutrient results, except ammonium, remained high in all systems. Low ammonium concentrations were detected in Knysna, Ntafufu, Msikaba and Mtentu estuaries. Extremely high values were recorded for nitrates + nitrites in the Knysna Estuary and medium to high values in other systems. Knysna, Ntafufu, Msikaba and Mtentu estuaries exhibited high concentrations of phosphates.

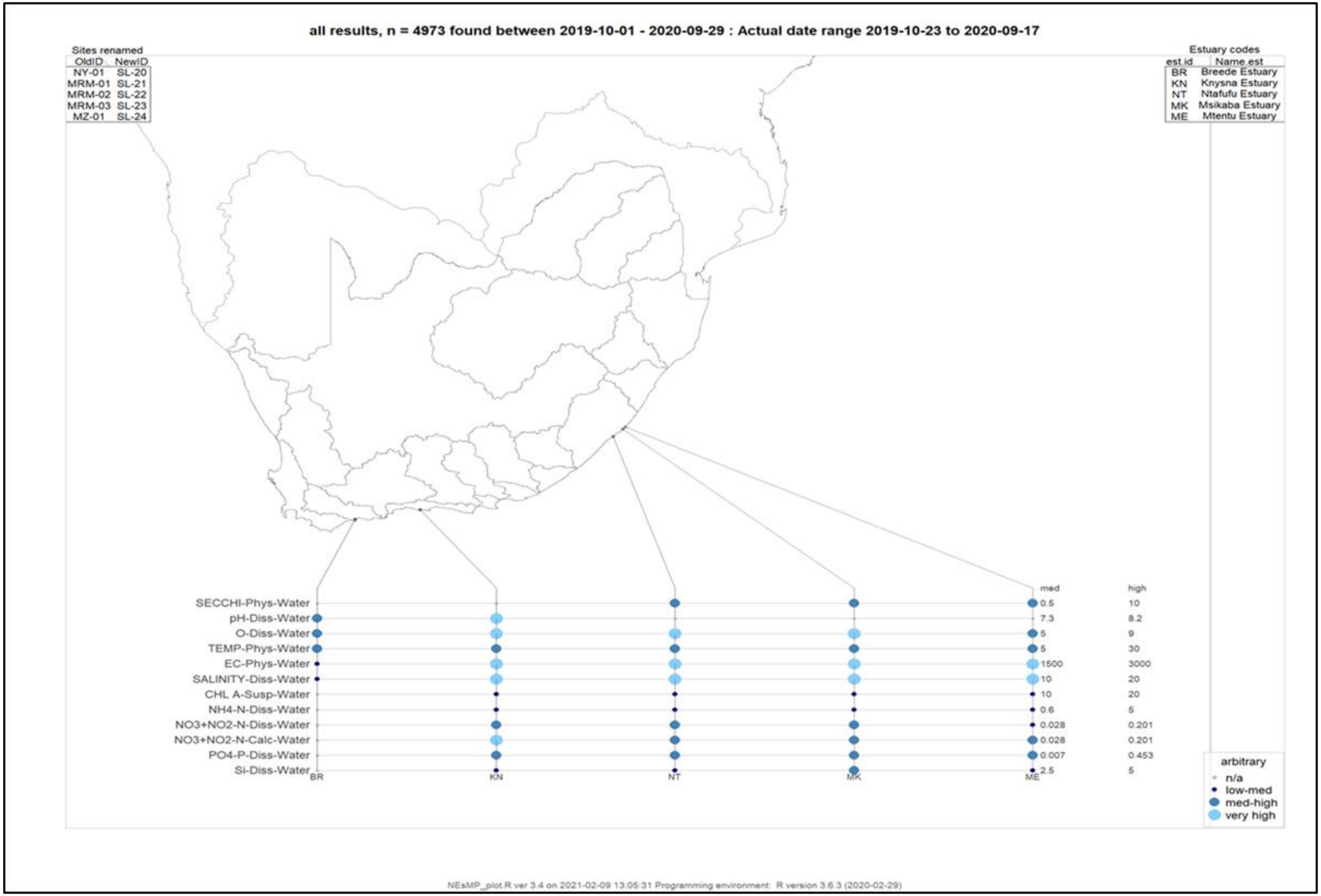


Figure 3.30 Summary findings from 5 estuaries monitored during 2019/2020 hydrological year

4 WATER SECURITY

4.1 Water Use Allocations

The National Water Act allows for regulation and control of water use through registration of water use and the requirement for authorisations of permissible water uses. The different types of authorisations in order of low to high risk of impact on the water resources are: Schedule 1, General Authorisations, Water use licence, and recognised continuation of previously (before the National Water Act of 1998) existing lawful use. Water uses for all sectors are registered and captured in the WARMS database.

The national overview of the registered water use volumes per water use sector as of September 2016 is presented in Figure 4.1 below.

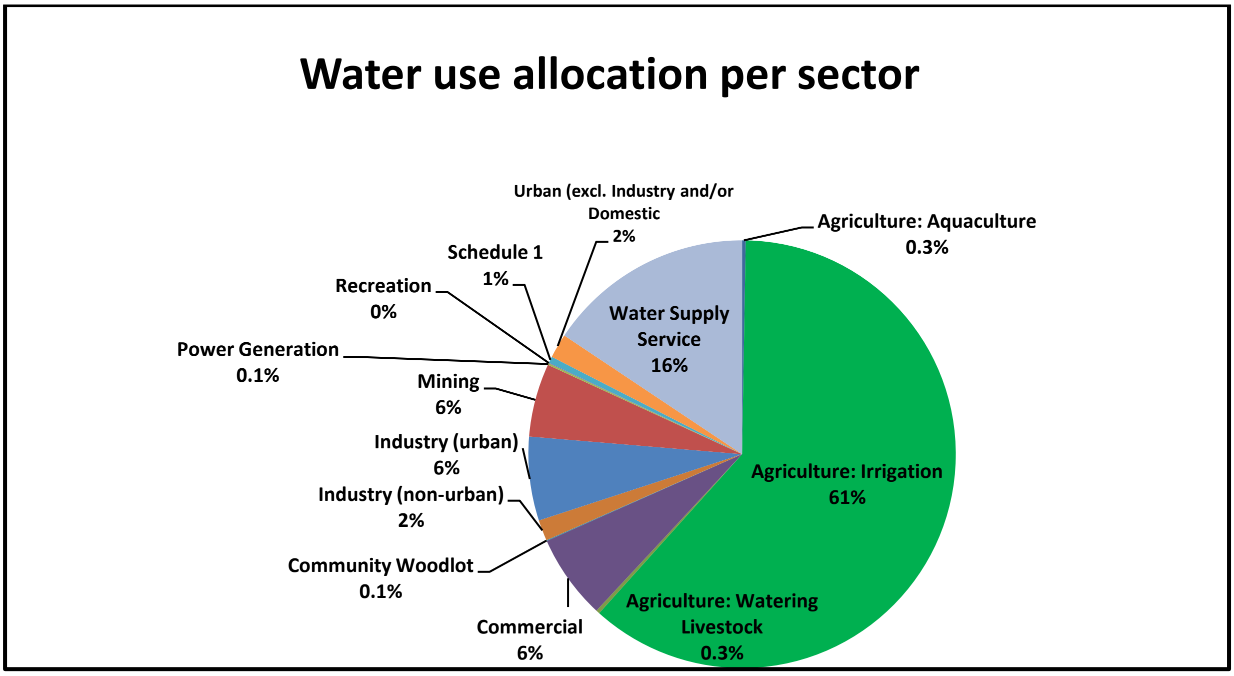


Figure 4.1 Registration of Water Use of taking from a water resource (Source: WARMS, September 2016)

Agricultural irrigation remains the water use sector with more water resource allocation, with more than 60% of the allocation. Water supply services, with an allocation of more than 16%, comes second to irrigation.

In South Africa there is a total of 84 412 ha equipped for irrigation water use. The breakdown of the areas equipped with registered irrigation systems as of September 2020 is presented in Figure 4.2, while Figure 4.3 presents a nationwide picture of the areas which are irrigated by surface water as of 2018.

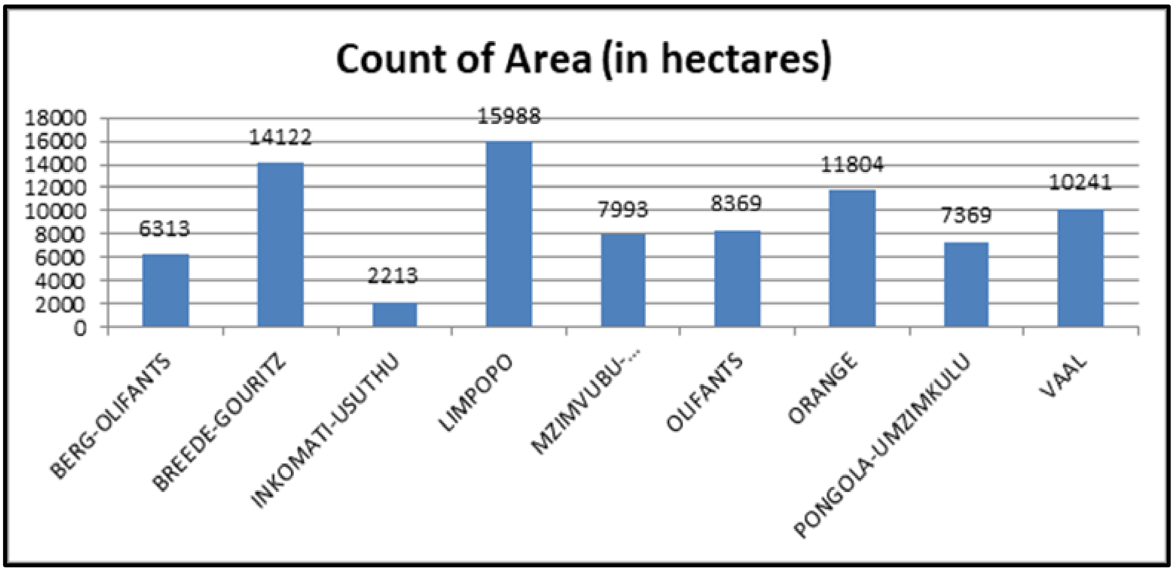


Figure 4.2 Extent of areas equipped with irrigation systems per WMA

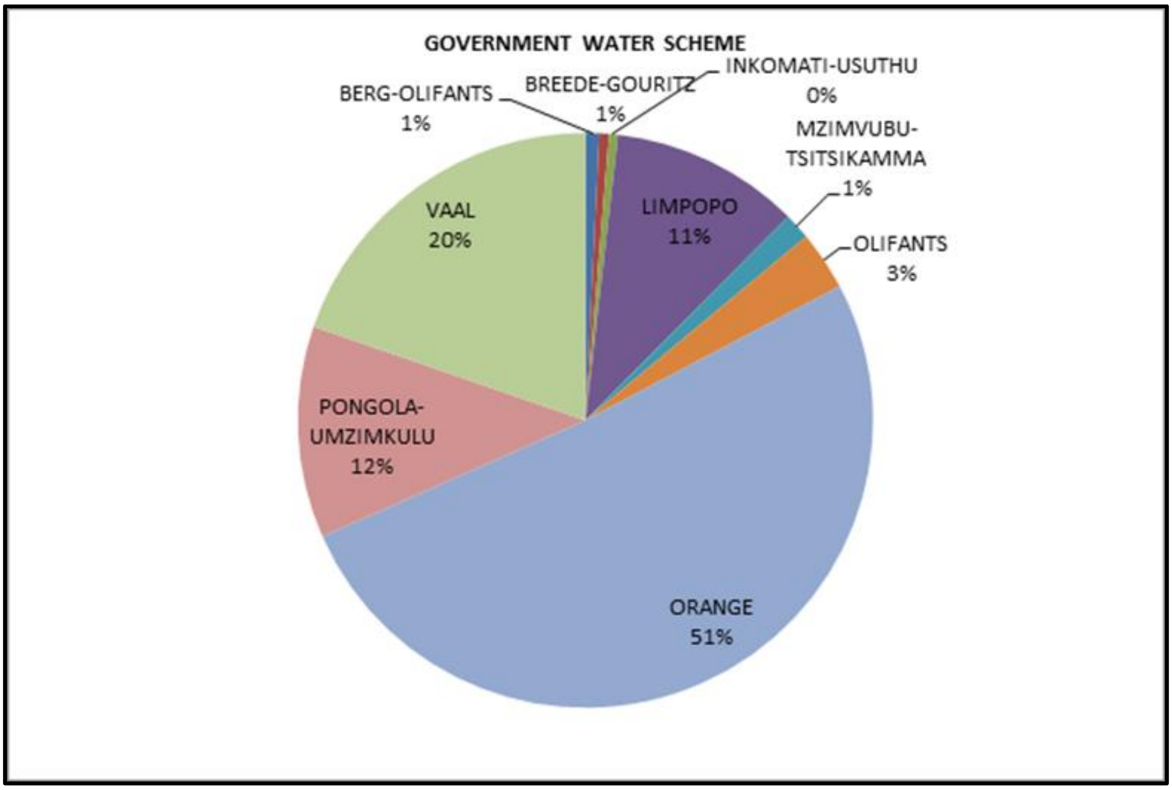


Figure 4.3 Areas irrigated from surface water per WMA

The proportions of registered irrigation systems are in the Orange, Vaal, Pongola-Umzimkulu and Limpopo WMA's. It is expected that this correlates to the largest amount of water use in these water management areas. The irrigations schemes are supplied from a range of different sources, including major reservoirs, direct abstractions from rivers, as well as supplies from smaller farm dams.

4.2 Eight Large Water Supply Systems

The 8 major water supply systems in South Africa are presented in Figure 4.4. DWS identified the need to develop detailed strategies that will ensure adequate future reconciliation of water availability with water requirements for the large water supply systems. In 2004, the DWS Directorate: National Water Resource Planning (NWRP) embarked on a series of reconciliation strategy studies for large water supply systems supplying some of the metropolitan areas and larger cities in the country. A second National Water Resource Strategy (NWRS2) was developed in 2013 which includes summaries of the Reconciliation Strategies and highlighted the need to implement WCWDM (Water Conservation and Water Demand Management) to balance the water supply and demand.

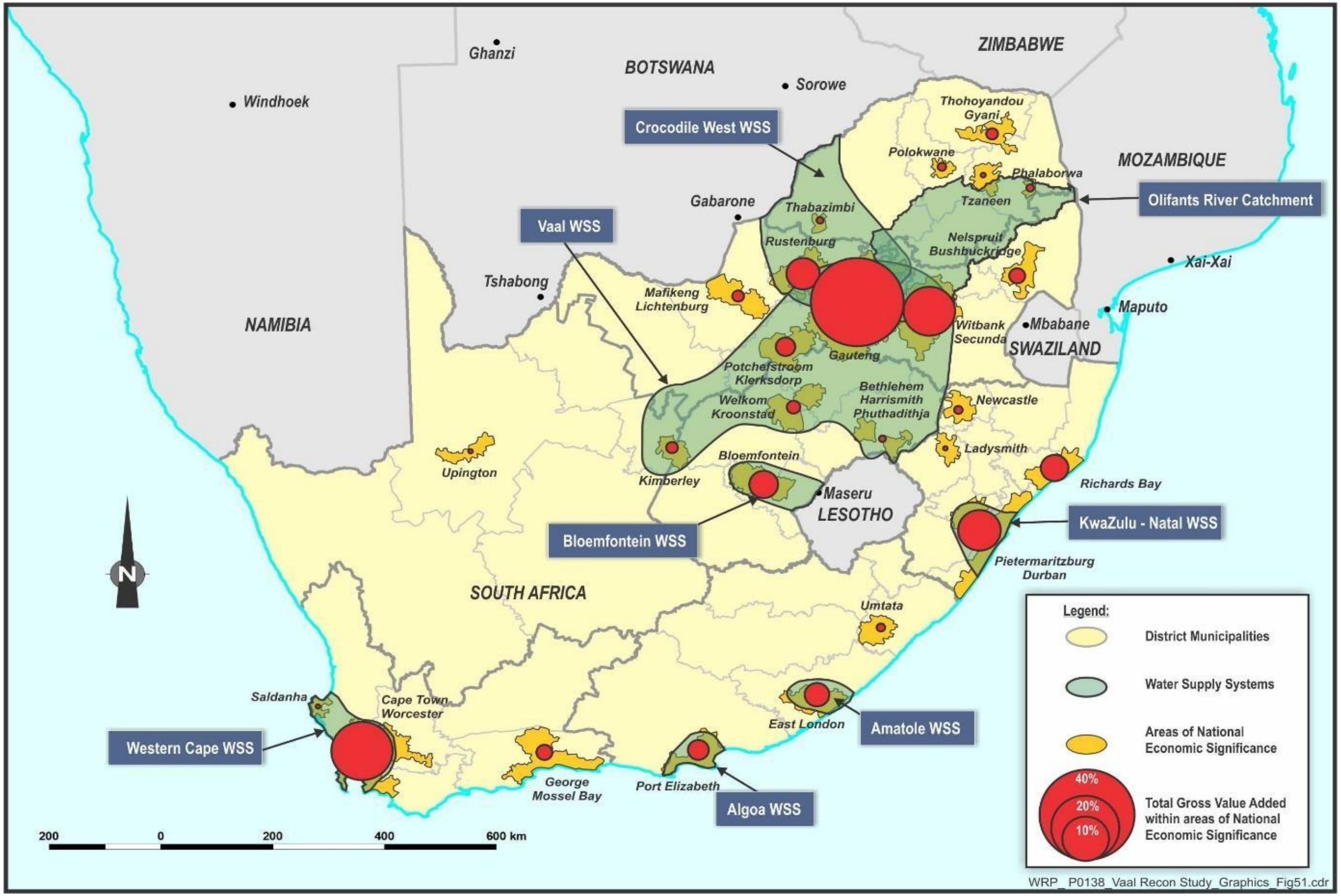


Figure 4.4 Eight Major Water Supply Systems (DWS, 2020).

4.2.1 Integrated Vaal River System (IVRS)

The core of the Vaal River catchment consists of the Upper, Middle and Lower Vaal River WMAs. However, due to the numerous inter-basin transfers that link this core area with other WMAs, the water resource assessments are undertaken in the context of the Integrated Vaal River System (IVRS) which also includes portions of the Komati, Usutu, Thukela, Senqu River (located in Lesotho) and Upper Orange (Riet-Modder River) catchments. Due to the highly developed nature of the IVRS and the various inter-basin transfers that exist in the system, operating rules were developed that regulate when and how much water is transferred.

Figure 4.5 presents the locality of the Integrated Vaal River System. The Integrated Vaal River water resource system provides water to one of the most densely populated and economically important areas in the country as reflected by the magnitude of the developments located in the Vaal, the Olifants and the upper portion of the Crocodile West / Marico Water Management areas. The water requirements in the area are therefore very important to sustain the economy of the country and the well-being of its people.

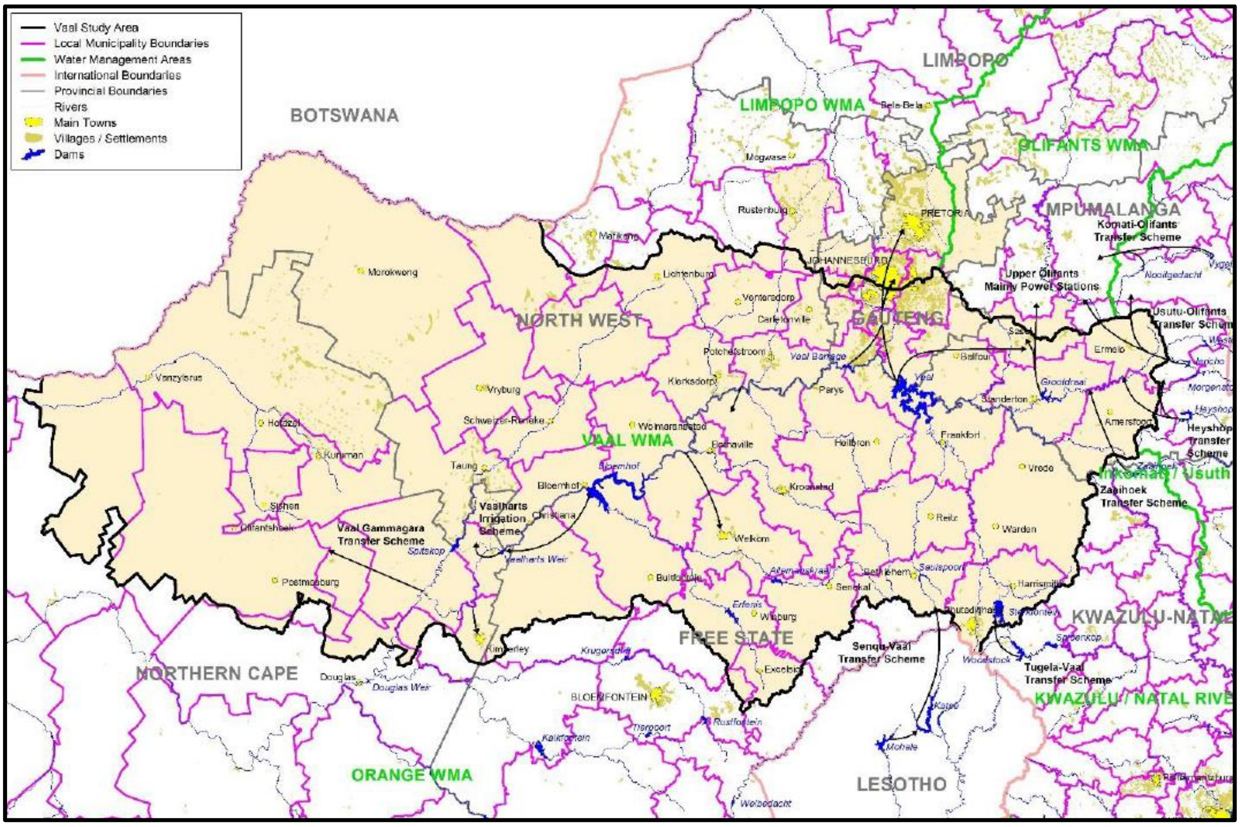


Figure 4.5 Locality map of the Integrated Vaal River System

4.2.2 Crocodile (West) River Water Supply System (CWRWSS)

Municipalities of Rustenburg, Madibeng, Moretele, City of Tshwane and Mogale City are located within the Crocodile (West) River Water Supply System (CWRWSS) but are mainly dependent on the IVRS for water supply. Future augmentation of water supply from the CWRWSS is planned for Lephalale, Modimolle and Mookgopong local municipalities. Figure 4.6 presents the locality map of the CWRWSS.

More than 50% of the urban water use in the CWRWSS returns to the rivers as effluent for possible re-use. Roodeplaat and Klipvoor Dams, on the Pienaars River, are considered as potential sources to meet the growing future domestic water demand of Modimolle and Mookgopong.

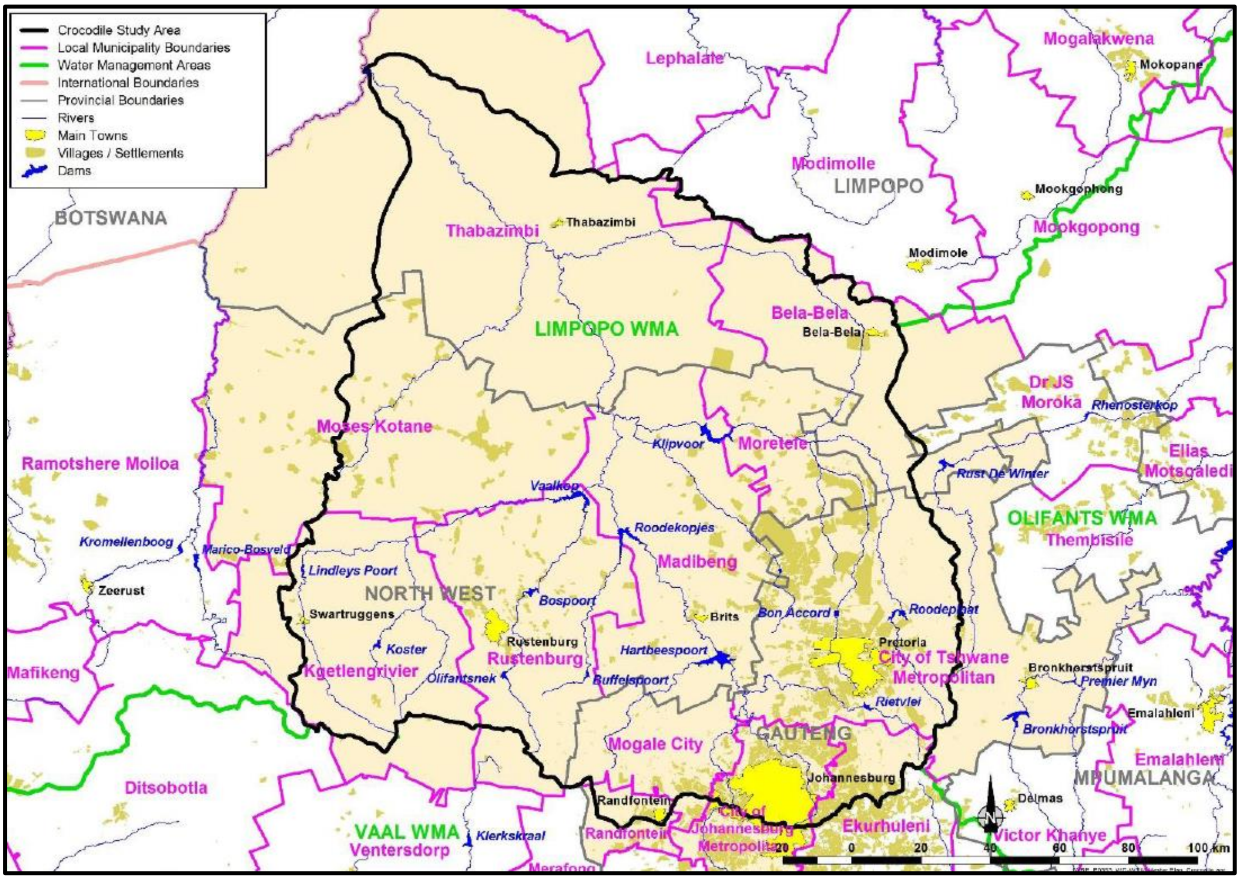


Figure 4.6 Locality map of the CWRWSS

4.2.3 KwaZulu-Natal Coastal Metropolitan Water Supply System (KZNCMWSS)

The key demand centres for water supply within the KZNMWSS are located within eThekwini Metropolitan Municipality (Durban), Msunduzi Municipality (Pietermaritzburg) and Ilembe District Municipality. The locality map of the KZNMWSS is presented in Figure 4.7. Major dams include Albert Falls, Midmar and Inanda dams on the Umgeni River system.

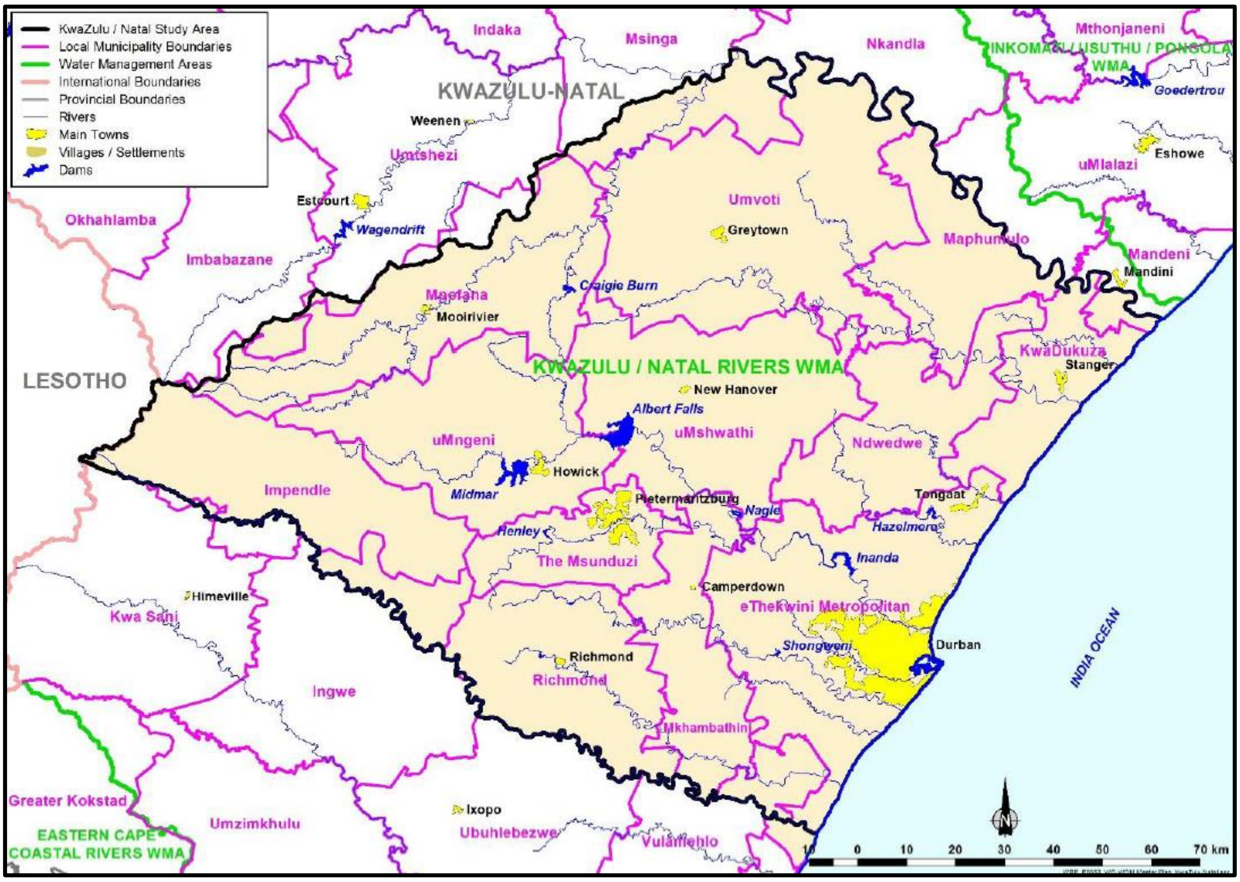


Figure 4.7 Locality map of the KZNCMWSS

4.2.4 Western cape Water Supply System (WCWSS)

The Western Cape Water Supply System (WCWSS) supplies raw water to the City of Cape Town, the West Coast District Municipality for domestic supply to Swartland, Saldanha Bay and Bergrivier local municipalities, augment of the supply to Stellenbosch and Drakenstein local municipalities and the agricultural users downstream of the Berg River, Voelvlei and Theewaterskloof Dams. The system is currently stressed and water usage from the various dams exceeds the sustainable yield from these dams.

The WCWSS consists of the following major dams mostly located in the upper regions of the Berg River and Breede River catchments:

- Theewaterskloof Dam
- Voelvlei Dam

- Berg River Dam and associated supplement pumping station
- Wemmershoek Dam
- Upper and Lower Steenbras Dams supported by transfers from the Palmiet system.

The locality map of the WCWSS is presented in Figure 4.8 below.

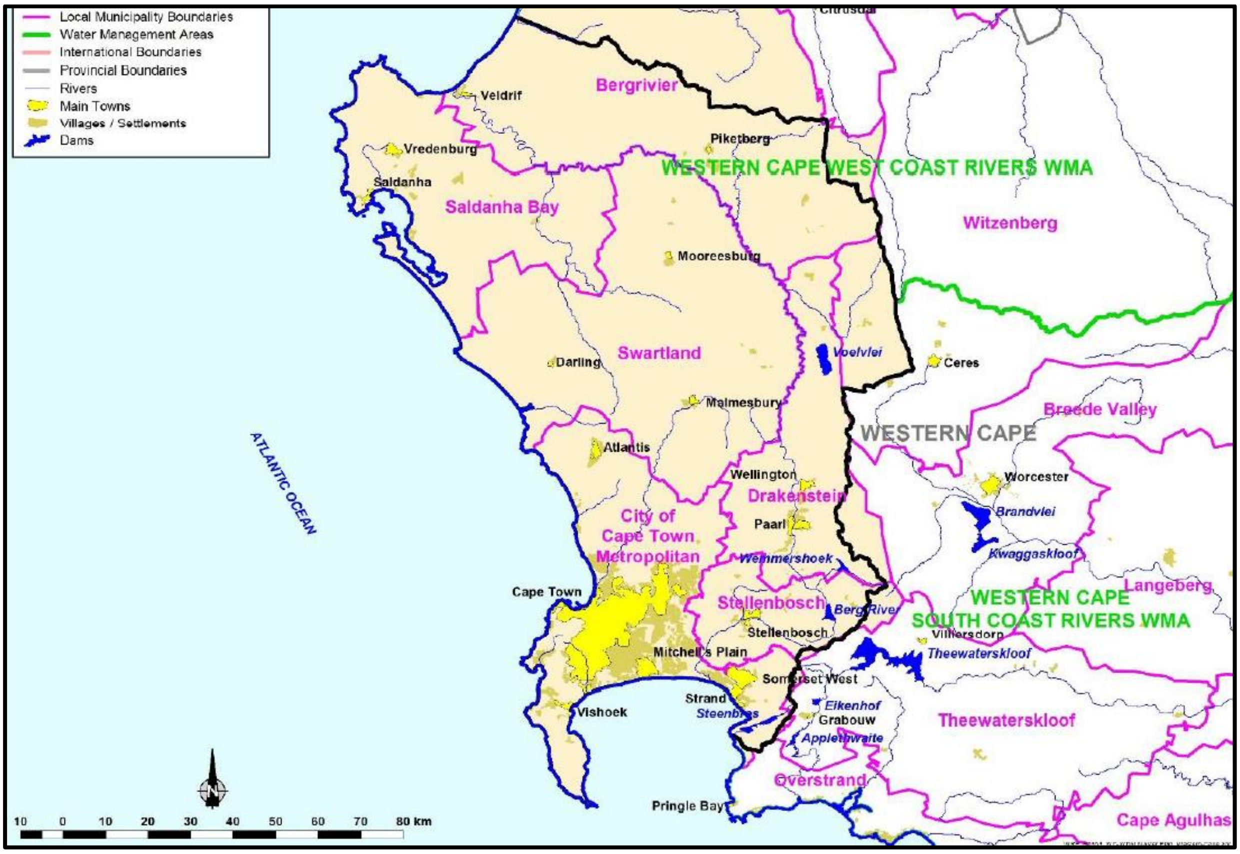


Figure 4.8 Locality map of the WCWSS

4.2.5 Algoa Water Supply System (AWSS**)**

The Algoa Water Supply System consists of the catchments of the Kromme, Kouga and lower reaches of the Gamtoos Rivers, as well as several small rivers which drain the M10A and M10B quaternary catchments. The system supplies water mainly to the Gamtoos Irrigation Board, Nelson Mandela Bay Metropolitan Municipality (NMBMM) and smaller towns within the Kouga District Municipality.

The WSS area is divided into the Western System, Eastern System and Central System. The Western System comprises of the four dams namely Churchill, Impofu, Kouga and Loerie which mainly supply the Gamtoos Irrigation Board, NMBMM and the coastal towns. The Central System comprises of water supply from the Sand, Bulk, Van Staden, Kwa Zuga, Uitenhage springs and Groendal Dam. While the Eastern System is mainly dependent on water transferred from Gariep Dam via the Orange Fish Tunnel, the Fish River, the Fish-Sundays tunnel, the Schoenmakers River and Darlington Dam. The locality map of the AWSS is presented in Figure 4.9.

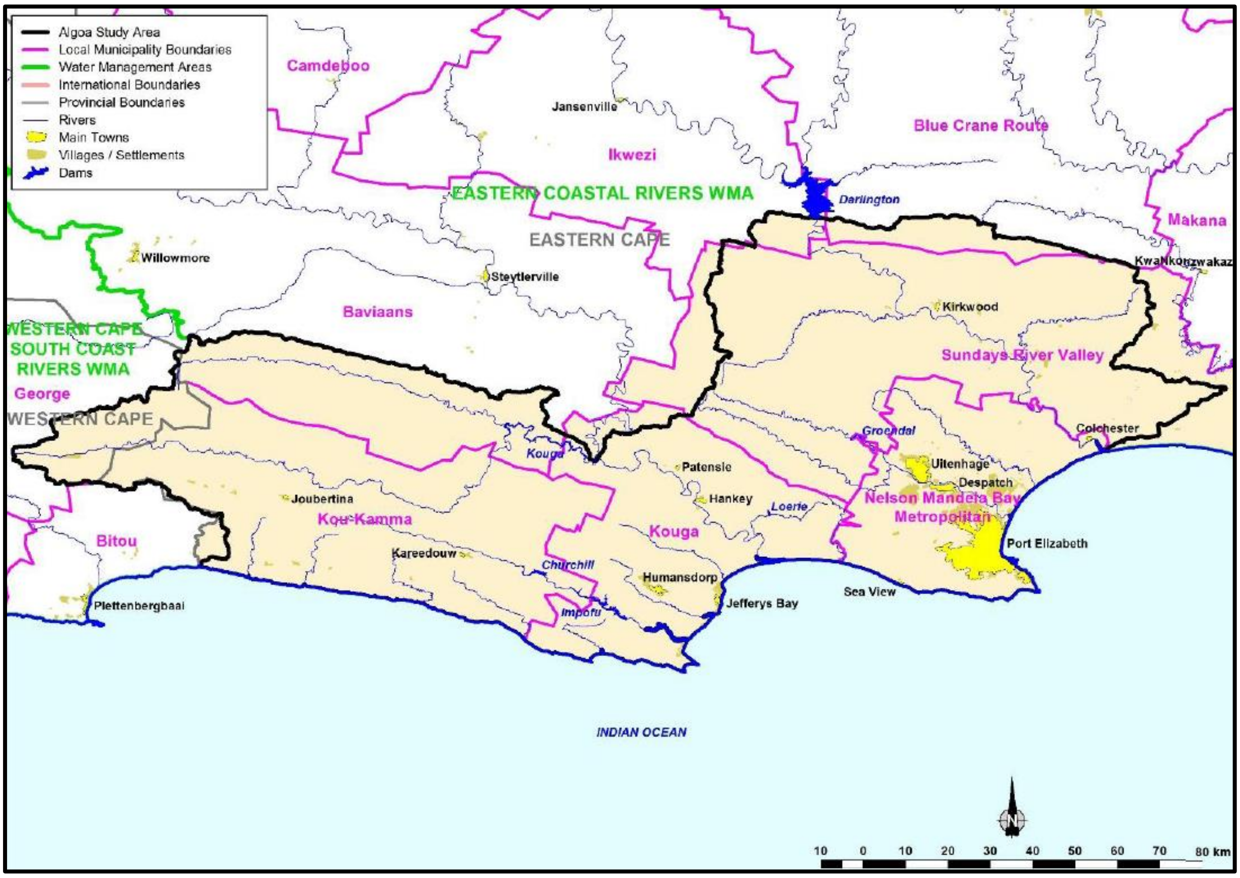


Figure 4.9 Locality map of AWSS

4.2.5 Amatole Bulk Water Supply System (AmWSS)

The Amatole Water Supply System (AmWSS) supplies water to around 1 million people. The water users reside mainly in the catchments of the Buffalo, Nahoon and Upper Kubusi rivers including scheduled irrigation along the upper and middle reaches of the Kubusi River of some 1000 ha. The system primarily supplies the municipal areas of Buffalo City, Amahlati and Ngqushwa including East London, King Williams Town, Bisho and Stutterheim. The locality map of the AmWSS is presented in Figure 4.10.

There has been an increase in water use due to development to the west of East London in the Buffalo City Metropolitan Municipality (BCMM) supply area. The need to supply water from the AmWSS to the Great Kei municipality (east of East London) has also been identified.

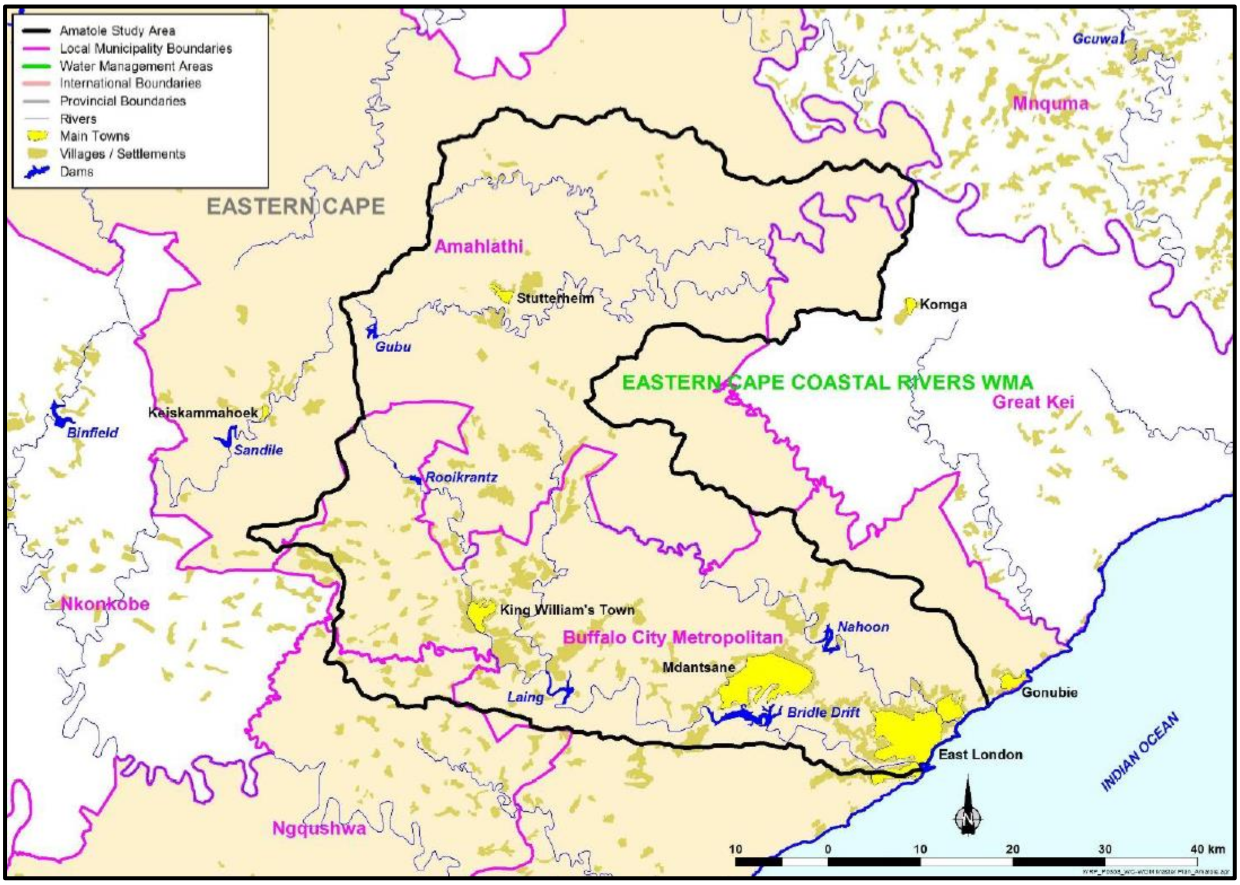


Figure 4.10 Locality map of the AmWSS

4.2.6 Greater Bloemfontein Water Supply System (GBWSS)

The Greater Bloemfontein Water Supply System (GBWSS) is largely dependent on water transferred from the Caledon River basin to the Modder River basin (from Welbedacht Dam) which is to provide for the demands of its supply area. The key demand centres included in this water supply system are Bloemfontein, Thaba Nchu, Botshabelo, together with the smaller towns of Wepener, Dewetsdorp, Reddersburg, Edenburg, and Excelsior. Water is transferred from the Welbedacht Dam to Rustfontein Dam via the Novo Transfer Scheme which comprises the pumping of water through Tienfontein pump station from Welbedacht Dam to Knelpoort Dam from where it is pumped by the Novo pump station to Rustfontein Dam. From Rustfontein Dam water is distributed by Mangaung Metropolitan Municipality (MMM) to Bloemfontein, Thaba Ncu, Botshabelo and Excelcior.

Water is also abstracted and treated by MMM at Maselspoort Weir for supply to Bloemfontein. Furthermore, water is also transferred from Welbedacht WTW through a pipeline serving Bloemfontein and the smaller towns. The locality map of the GBWSS is presented in Figure 4.11.

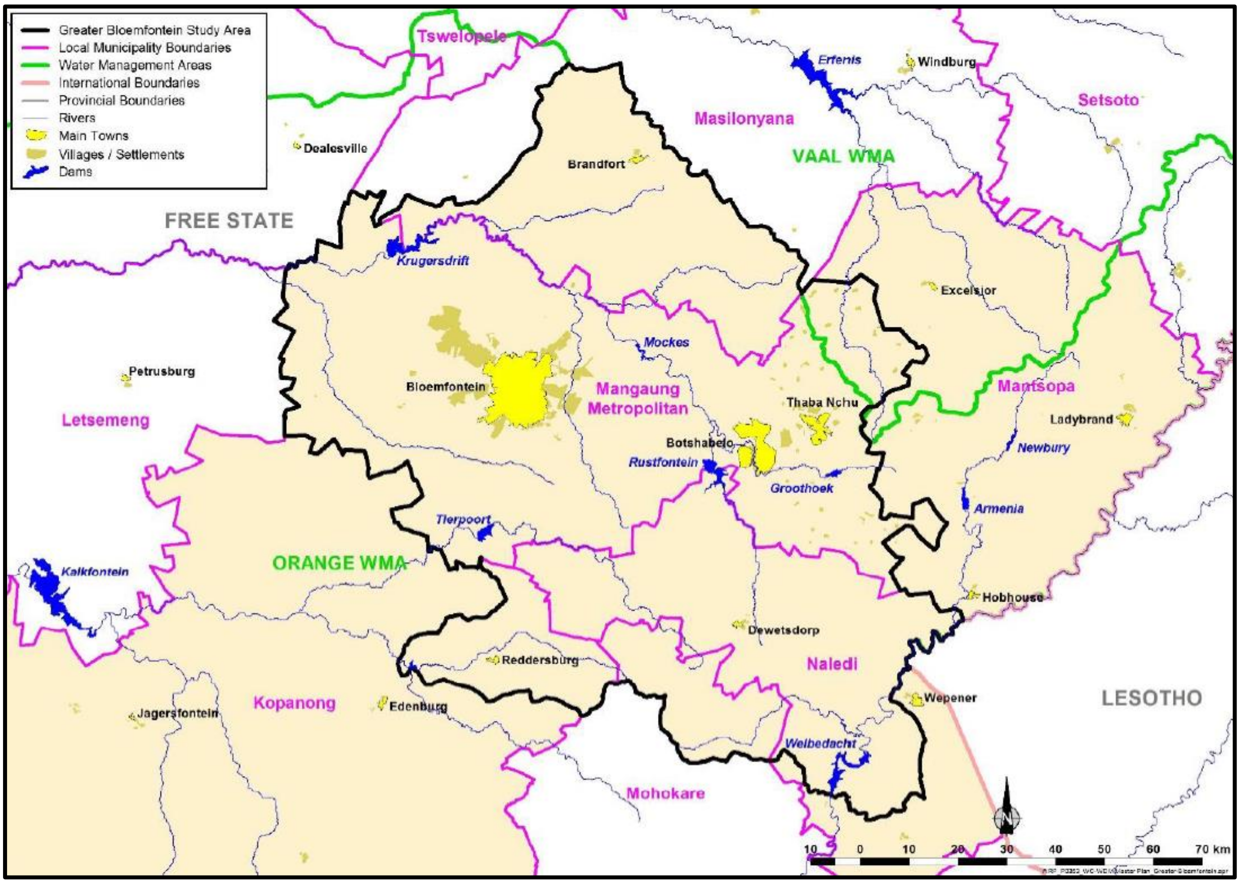


Figure 4.11 Locality map of the GBWSS

4.2.7 Olifants River Water Supply System (ORWSS)

The Olifants River Water Supply System lies within the boundaries of the Olifants WMA. The urban areas of Polokwane and Mokopane have also been included, since they are also dependent of water supplied from the Olifants River even though they are located within the Limpopo WMA. Other towns dependent on supply from the Olifants River include Emalahleni, Middelburg, Groblersdal/Marble Hall, Bronkhorstspruit, Western Highveld, Cullinan, Delmas, Burgersfort, Lebowakgoma, Lydenburg, Belfast, Phalaborwa and Hoedspruit. The Olifants River catchment is considered one of South Africa’s most stressed catchments in terms of water quantity and water quality. The locality map of the ORWSS is presented in Figure 4.12.

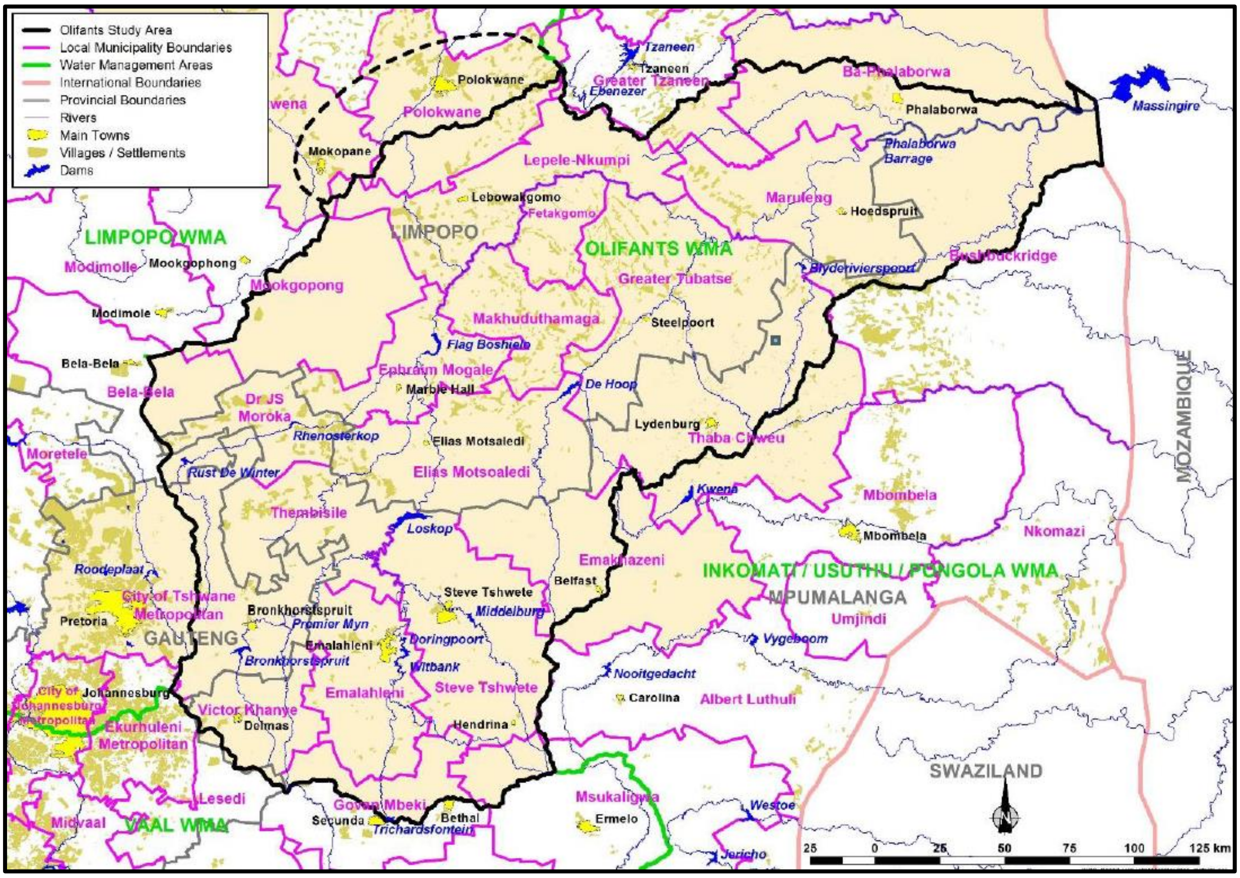


Figure 4.12 Locality of the ORWSS including Polokwane and Mokopane

4.2.8 Other Systems

a) Polokwane Water Supply System

Polokwane Water Supply System (PWSS) supplies water to Polokwane town and surrounding areas. It comprises of 8 Dams namely, Dap Naude, Ebenezer, Mashashane, Molepo, Chuenespoort, Houtrivier, Seshego and Flag Boshielo. Flag Boshielo and Ebenezer are the only two major Dams. The PWSS also gets its water from groundwater and recycling. Local resources make up about 24.92 million m^3/year (or 16%) of the long-term yield for the total resource. The long-term water balance has a negative yield of 24.92 million m^3/year.PWSS relies heavily on transfers.

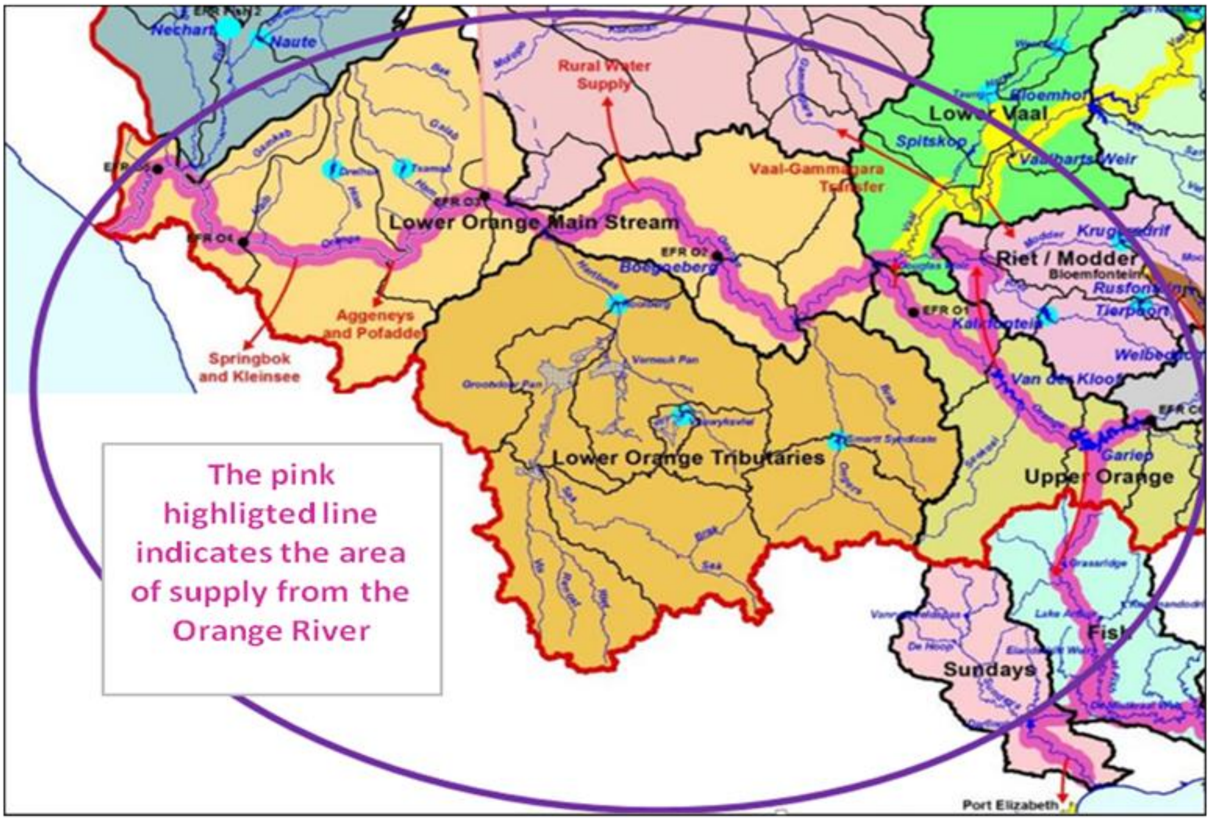
There is significant over allocation of groundwater, Dap Naude Dam and Flag Boshielo Dam. Besides PWSS, Ebenezer Dam also supports downstream irrigation and domestic users while Flag Boshielo Dam supports mining, domestic and irrigation water use. The total water allocation to the PWSS is about 63.93 million m^3/year (178.1 Ml/day). About 34% of the allocations for the system are met from groundwater abstractions and recycling.

The water uses within the system based on the assurances of supply is prioritised for environmental flows, then urban and rural domestic supply, mining and lastly irrigation.

b) Orange River System (ORS)

Orange River System (ORS) includes the catchments of the Upper and Lower Orange WMAs as well as Lesotho and the transfers to the Eastern Cape and Upper Vaal. The Orange River basin is indisputably South Africa's most important river basin. Its catchment covers an area of approximately 1 million km^2. The Vanderkloof Dam is the second largest reservoir in South Africa and currently the most downstream large storage reservoir on the Orange River, it is located approximately 1 400 km upstream of the Orange River mouth.

The Gariep Dam, the largest reservoir in South Africa, is located approximately 125 km upstream of the Vanderkloof Dam. These dams are used to support water demands along the Lower Orange Rover. They also support thousands of hectares of irrigated land via the Orange Fish, Orange-Riet and Orange–Vaal transfer schemes. A locality map of the Orange River System is presented in Figure 4.13.



The pink highligted line indicates the area of supply from the Orange River

Figure 4.13 Orange River System

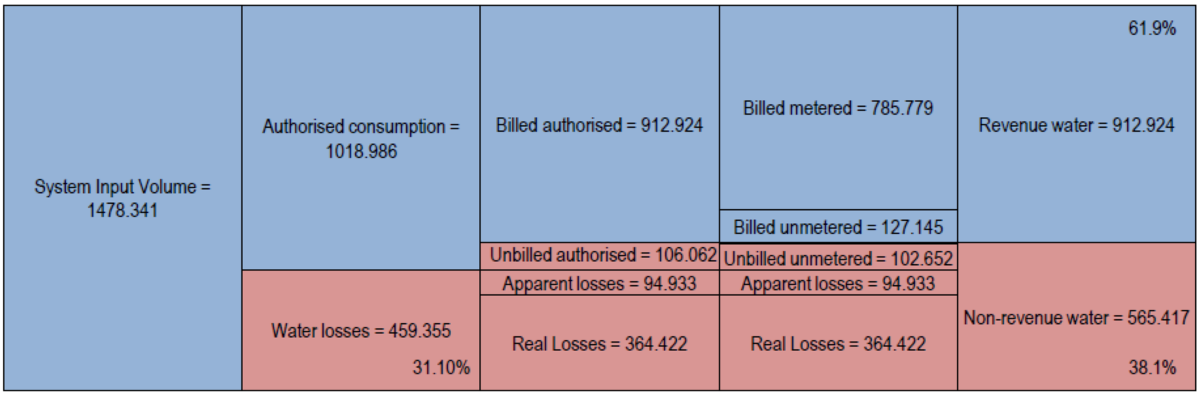
4.3 Water Losses and per Capita Consumption in Water Supply Systems

This section aims to give the status and trends in the improvement, within the eight large water supply systems, to potentially reduce system input volume, water losses, non-revenue water (NRW) and to subsequently improve water use efficiency. The per capita consumption trends are reported until December 2019 and include the June 2022 consumption targets.

4.3.1 Vaal River System (IVRS)

The WCWDM assessment was undertaken for the nine largest urban water users accounting for a demand of 1 186 million m³/a in the year 2004 in the IVRS. The nine main demand centres are the City of Johannesburg, City of Tshwane, Ekurhuleni, Emfuleni, Mogale, Randfontein, Govan Mbeki, Mathjabeng and Rustenburg, which represent 86% of Rand Water's supply area and almost 25% of Sedibeng Water's supply area. The remaining municipalities represent 3.8% of the Rand Water supply with the remaining 10% supplied to mines, individual consumers, and Rand Water.

Error! Reference source not found. shows the 2019 IWA water balance for IVRS (Input volume reported in m^3). A consolidated water balance was prepared for the IVRS based on the individual water balances of the municipalities.



System Input Volume = 1478.341	Authorised consumption = 1018.986	Billed authorised = 912.924	Billed metered = 785.779	61.9% Revenue water = 912.924
			Billed unmetered = 127.145	
		Unbilled authorised = 106.062	Unbilled unmetered = 102.652	Non-revenue water = 565.417 38.1%
	Water losses = 459.355 31.10%	Apparent losses = 94.933	Apparent losses = 94.933	
		Real Losses = 364.422	Real Losses = 364.422	

Figure 4.14 IVRS IWA water balance (December 2019)

The results indicate a weighted average water loss of 31.1% and NRW of 38.1%. The data are highly influenced by the three metros and have a high confidence level. The NRW and System Input Volume (SIV) trends are presented in Figure 4.15 below.

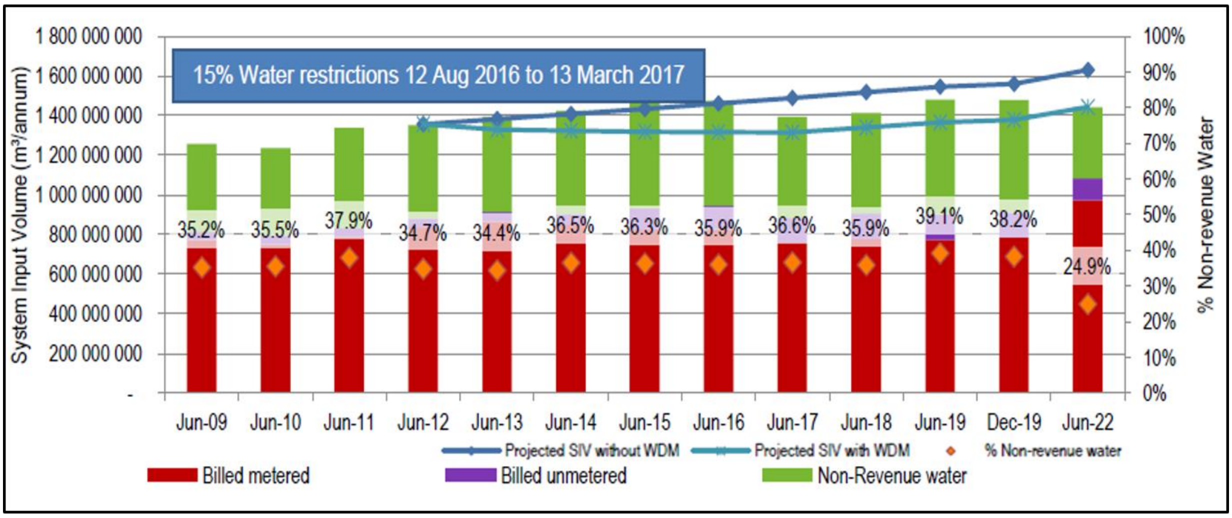


Figure 4.15 IVRS Water Balance Trend for Non-Revenue Water

NRW improved slightly in the past six months from 39.2% to 38.3%. It is concerning to note that NRW is steadily increasing and is at its highest level in 10 years. Municipalities in the IVRS have not achieved their 2017 targets by 87 million m^3/a and need to reduce their current consumption by 41 million m^3/a to achieve their 2022 target.

The per capita consumption is presented in Figure 4.16 which has been reducing from 2015 because of some WCWDM interventions and imposed water restrictions.

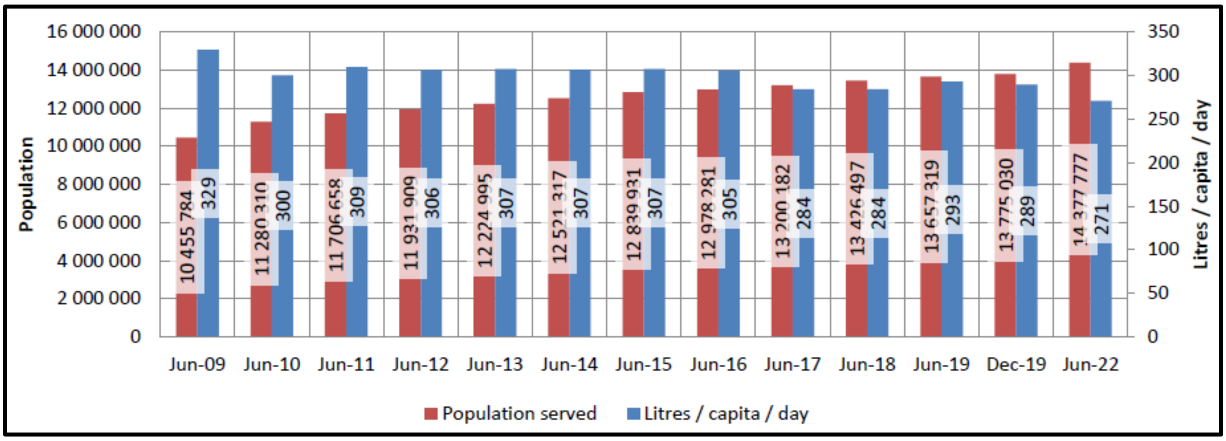


Figure 4.16 IVRS per capita consumption trend

The current consumption is still high compared to the national benchmark of 236 ℓ/c/d but the study area includes the highest number of wet industries in the country. The ℓ/c/d is expected to reduce to 275 ℓ/c/d if the 2022 target is achieved.

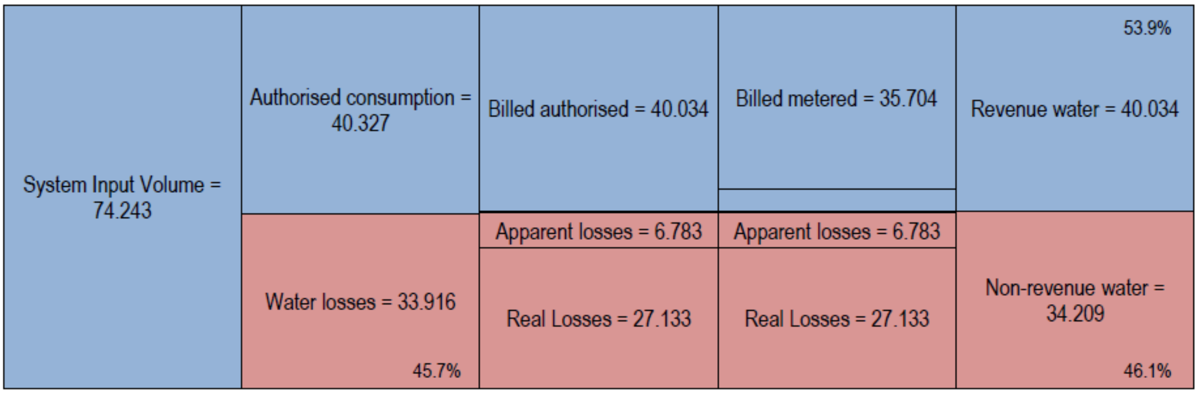
4.3.2 Crocodile West River Water Supply (CWRWSS)

A large portion of the Crocodile (West) River catchment is dependent on water from the IVRS. The progressive implementation of WCWDM can reduce the required transfer from the IVRS. Furthermore, more than 50% of the urban water use returns to the rivers as effluent for possible re-use, which can also be decreased if WCWDM measures are successfully implemented.

Madibeng and Moretele have been included in the water balance calculations (SIV and billed metered consumption) for the City of Tshwane since 2010. The plan is for these municipalities to become independent of the City of Tshwane in terms of water supply by 2020. According to the Crocodile (West) Reconciliation Strategy (CWRS)(DWS, 2012), the City of Tshwane has requested Magalies Water to take over the water supply to Moretele. Roodeplaat or Klipvoor Dams, on the Pienaars River, are considered as potential sources to meet the growing future domestic water demand of Modimolle and Mookgopong.

A consolidated water balance was prepared for the CWRWSS based on the individual water balances of the municipalities. In cases where a water balance could not be obtained from the municipality, the last acceptable water balance was used to estimate the December 2019 figures. The information has a low confidence level.

Figure 4.17 presents the 2019 IWA water balance for the CWRWSS (Input volume reported in m^3). These data are highly influenced by Moretele, Madibeng and the City of Tshwane.



System Input Volume = 74.243	Authorised consumption = 40.327	Billed authorised = 40.034	Billed metered = 35.704	53.9% Revenue water = 40.034
	Water losses = 33.916 45.7%	Apparent losses = 6.783	Apparent losses = 6.783	Non-revenue water = 34.209 46.1%
		Real Losses = 27.133	Real Losses = 27.133	

Figure 4.17 CWRWSS IWA water balance (December 2019)

No accurate assessment could be made of the NRW trend as presented in Figure 4.18 but indications are that municipalities are achieving the 2019 target. NRW is steadily increasing and reaching levels that could jeopardise the sustainability of the municipalities.

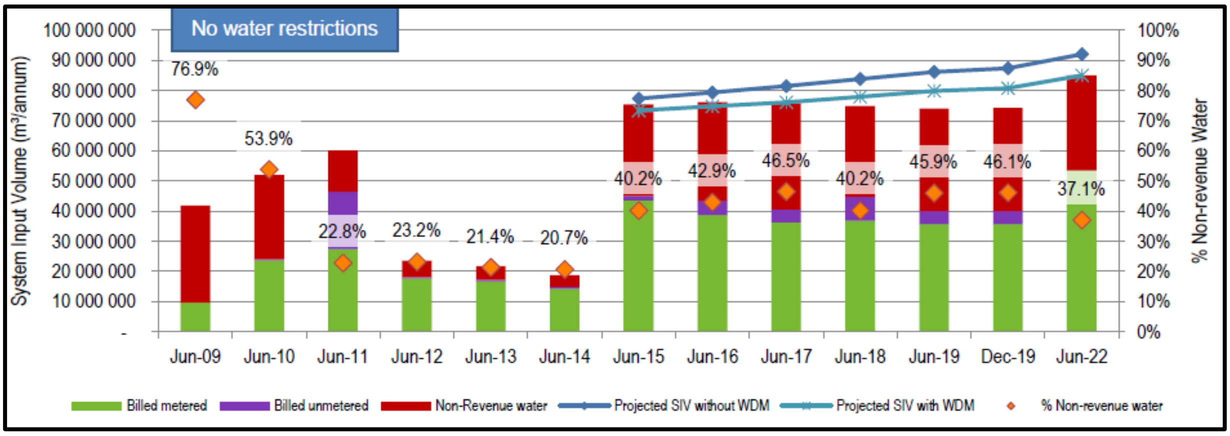


Figure 4.18 CWRWSS Water Balance Trends for Non-Revenue Water

The per capita consumption is presented in Figure 4.19. In December 2019, the consumption was estimated at 170 ℓ/c/d which is in line with the level of service. The results indicate that progress has been made with the reduction of water losses within these municipalities although the data had a very low confidence level.

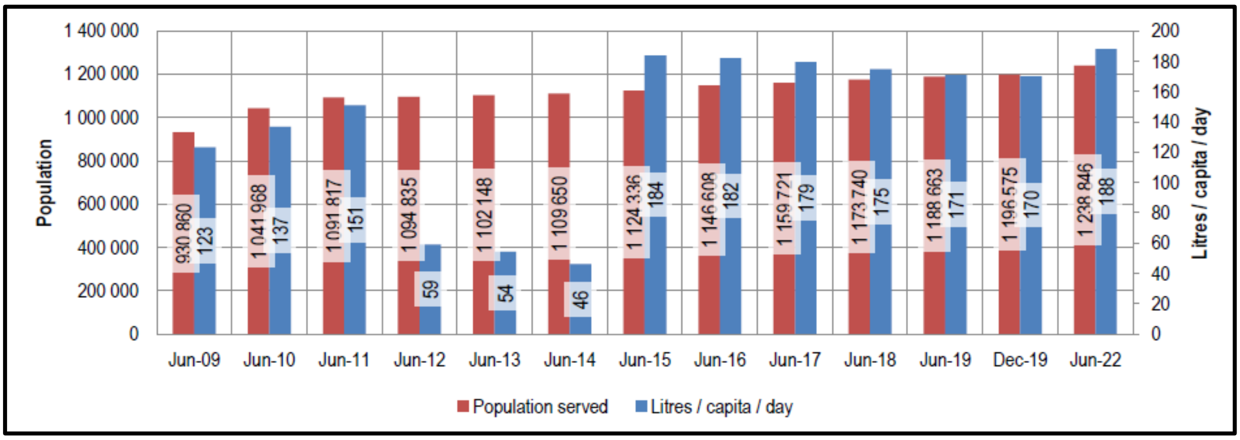
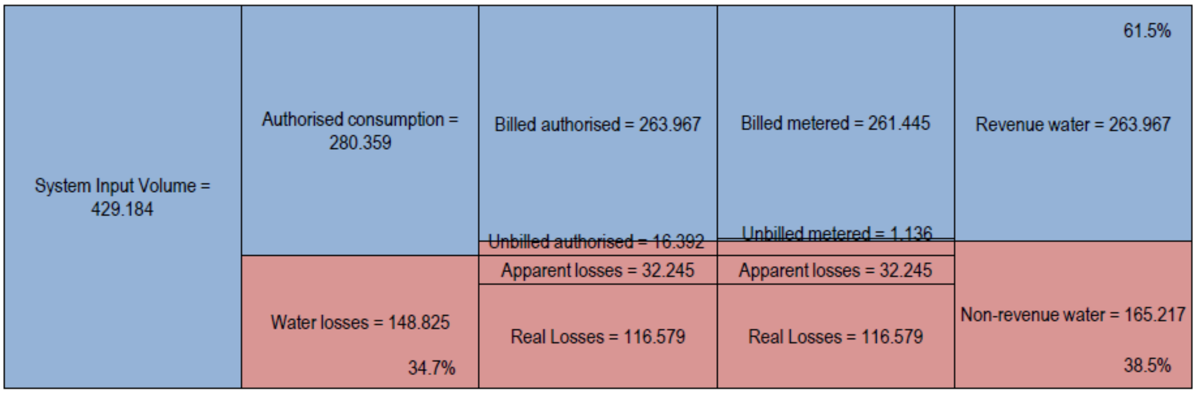


Figure 4.19 CWRWSS per capita consumption trend

4.3.3 KwaZulu-Natal Coastal Metropolitan Water Supply System (KZNCMWSS)

A consolidated water balance was prepared for the KZNCMWSS and includes the water balance data for eThekwini, Msunduzi and iLembe for the 2019. Although iLembe is only partially located within the strategy area, data for the whole district municipality were included in the water balance.

Figure 4.20 presents the 2019 IWA water balance for the KZNCMWSS (Input volume reported in m^3), indicating a weighted average water loss of 34.7% and NRW of 38.5%. The data are highly influenced by eThekwini and have a high confidence level.


System Input Volume = 429.184

Authorised consumption = 280.359

Billed authorised = 263.967

Billed metered = 261.445

61.5%

Revenue water = 263.967

Unbilled authorised = 16.392

Unbilled metered = 1.136

Apparent losses = 32.245

Apparent losses = 32.245

Water losses = 148.825

34.7%

Real Losses = 116.579

Real Losses = 116.579

Non-revenue water = 165.217

38.5%

Figure 4.20 KZN Coastal Metropolitan WSS water balance (December 2019)

The NRW and SIV trends for KZNCMWSS are presented in Figure 4.21. The results indicate that NRW is increasing, and municipalities are following the high population with WCWDM projected demand mainly because of water restrictions.

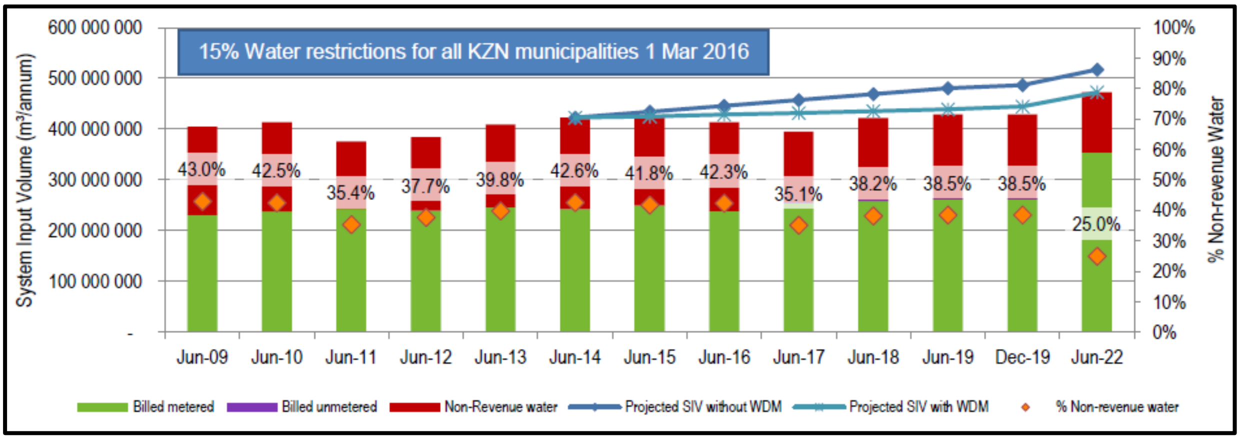


Figure 4.21 KZN Coastal Metropolitan WSS Water Balance Trend for Non-Revenue Water

The per capita consumption is presented in Figure 4.22 which has been consistently increasing since 2017 when water restrictions were lifted.

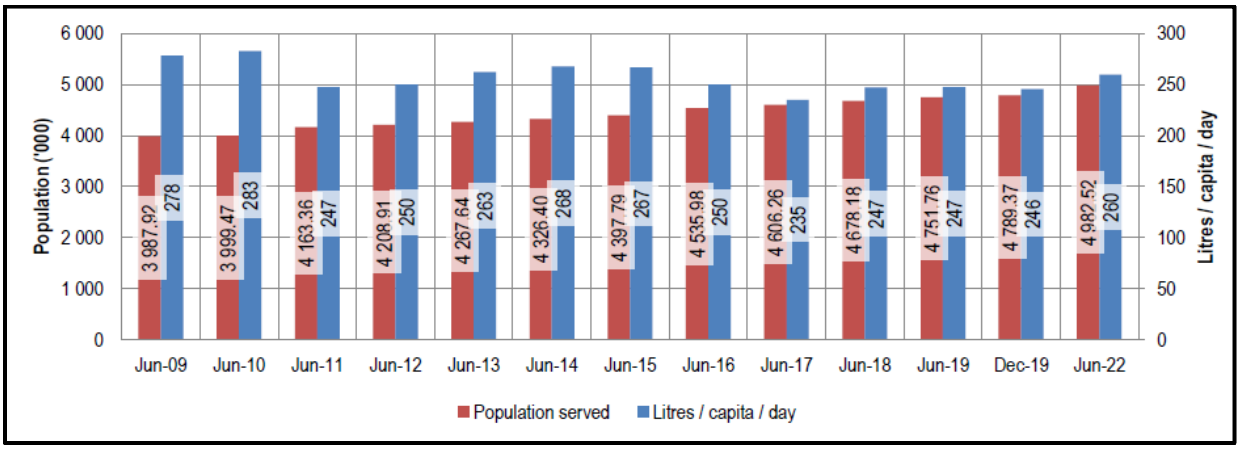


Figure 4.22 KZN Coastal Metro WSS per capita consumption trend

4.3.4 Western Cape Water Supply System (WCWSS)

The WCWSS supplies raw water to the City of Cape Town, the West Coast District Municipality for domestic supply to Swartland, Saldanha Bay and Bergrivier local municipalities, augment the supply to Stellenbosch and Drakenstein local municipalities and to the agricultural users downstream of the Berg River, Voelvlei and Theewaterskloof Dams.

A consolidated 2019 water balance was prepared for the WCWSS as shown in Figure 4.23 (Input volume reported in m^3). The water balance includes data from all municipalities in the WCWSS and has a high confidence level.

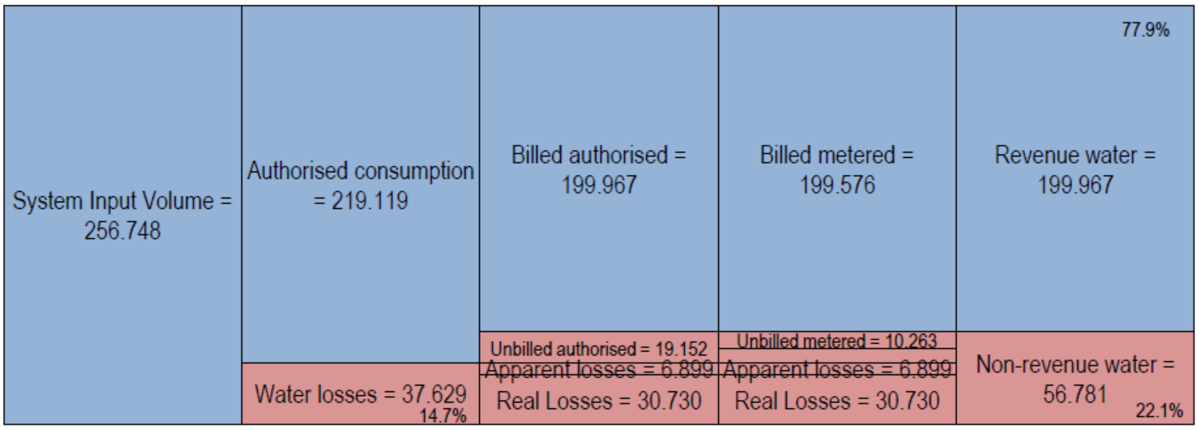


Figure 4.23 Western Cape WSS water balance (December 2019)

The NRW and SIV trends are shown in Figure 4.24. Severe droughts have been experienced in this system since the end of 2014, which is a reason for the lower SIV.

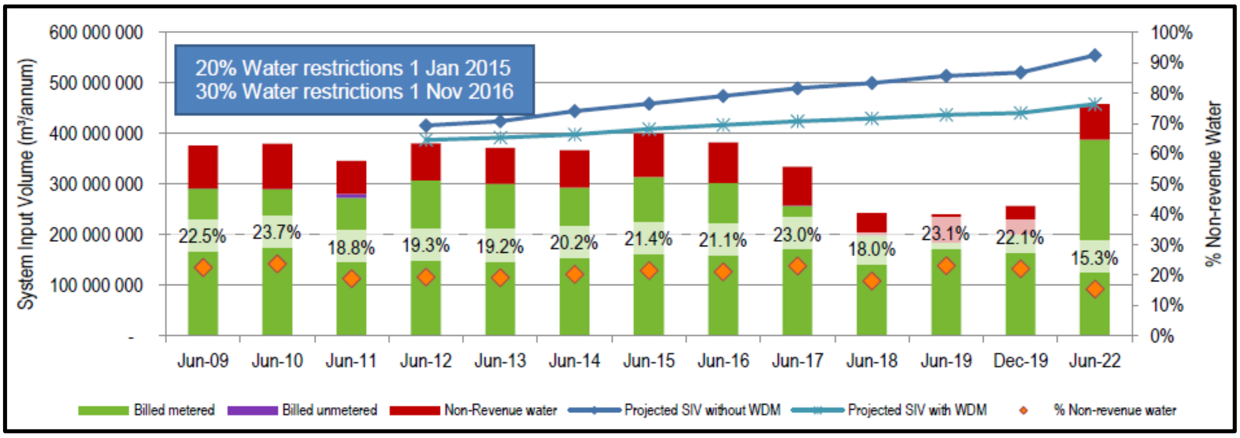


Figure 4.24 Western Cape WSS Water Balance Trend for Non-Revenue Water.

The per capita consumption is presented in Figure 4.25 which has been consistently decreasing over the past 10 years. The average consumption of 127 ℓ/c/d is well below the national benchmark of 236 ℓ/c/d.

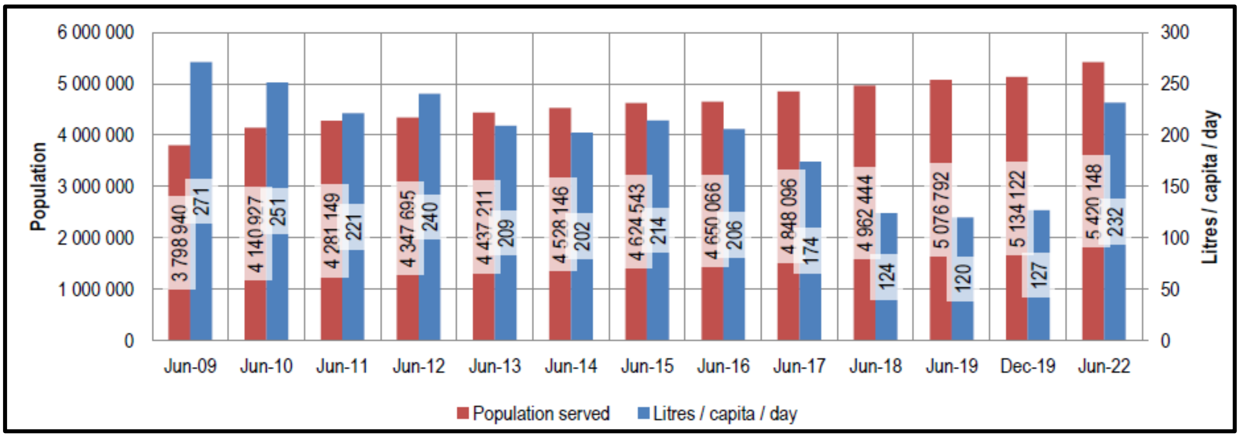


Figure 4.25 Western cape WSS per capita consumption trend

Municipalities included in the WCWSS have been forced to implement WDM strategies and water restrictions due to the severe drought in the region. Swartland, Drakenstein and Stellenbosch should endeavour to sustain their water losses to below 15%. Water losses below 15% compares well with international best practice but further improvement will be a significant challenge since they are now operating at or close to their economic levels of leakage (systematic way for a water utility to estimate the optimum leakage level below which the costs of reducing leakage further exceed the benefits of saving water).

4.3.5 Algoa WSS

The AWSS includes Nelson Mandela Bay, Koukama, Kouga and Sundays River Valley municipalities. The data for Koukama, Kouga and Sundays River Valley municipalities have very low confidence level. A consolidated 2019 water balance was prepared for the AWSS as presented in Figure 4.26 (Input volume reported in m^3), indicating a weighted average water loss of 42.2% and NRW of 44.9%.

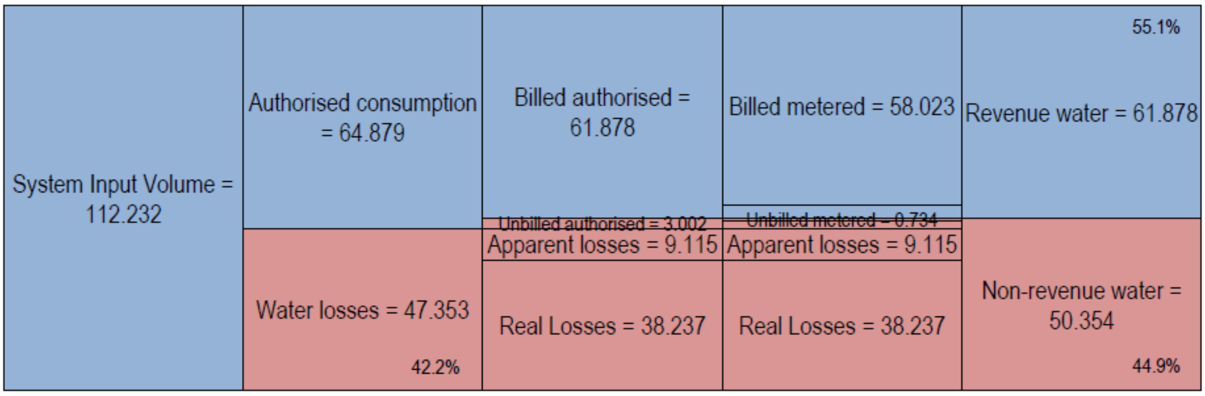


Figure 4.26 AWSS water balance (December 2019)

The data are highly influenced by NMBMM and have a medium confidence level. The average NRW is in line with poorly managed systems. The NRW and SIV trends for AWSS are presented in Figure 4.27.

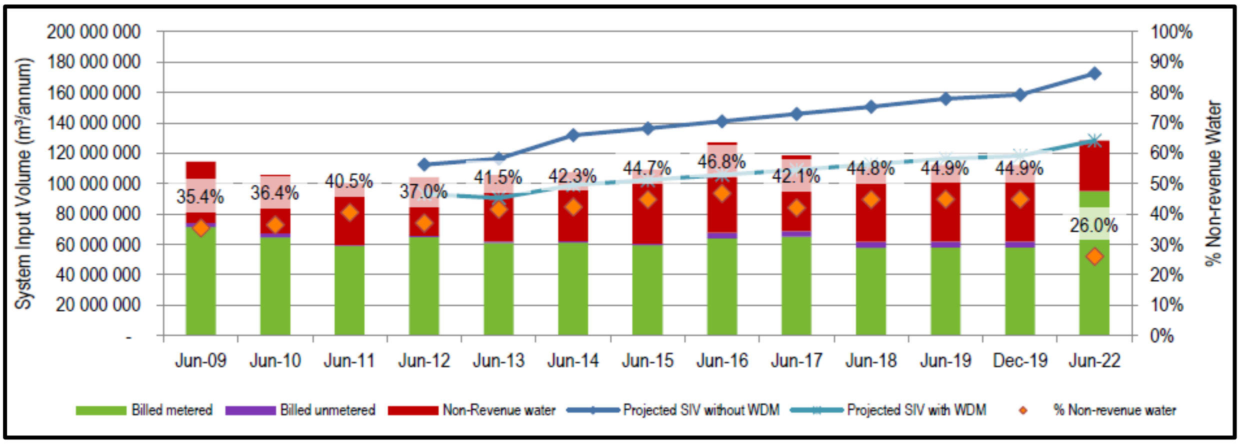


Figure 4.27 Algoa WSS Water Balance Trend for Non-Revenue Water

The results indicate that NRW has been relatively constant over the last 6 years, at approximately 45%. The AWSS per capita consumption is shown in Figure 4.28 which has been between 199 and 277 ℓ/c/d over the past 10 years. The average consumption is expected to reach 226 ℓ/c/d if the 2022 target could be achieved.

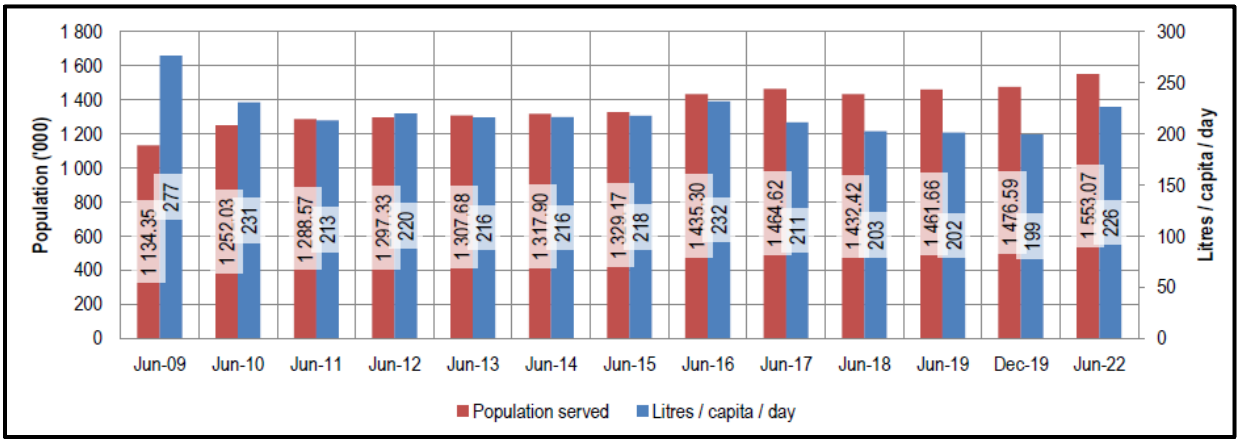


Figure 4.28 Algoa WSS per capita consumption trend

4.3.6 Amatole WSS

A consolidated water balance was prepared for the AmWSS based on the individual water balances of the municipalities. Figure 4.29 presents the 2019 IWA water balance for the AmWSS (Input volume reported in m^3). The data have a medium confidence level.

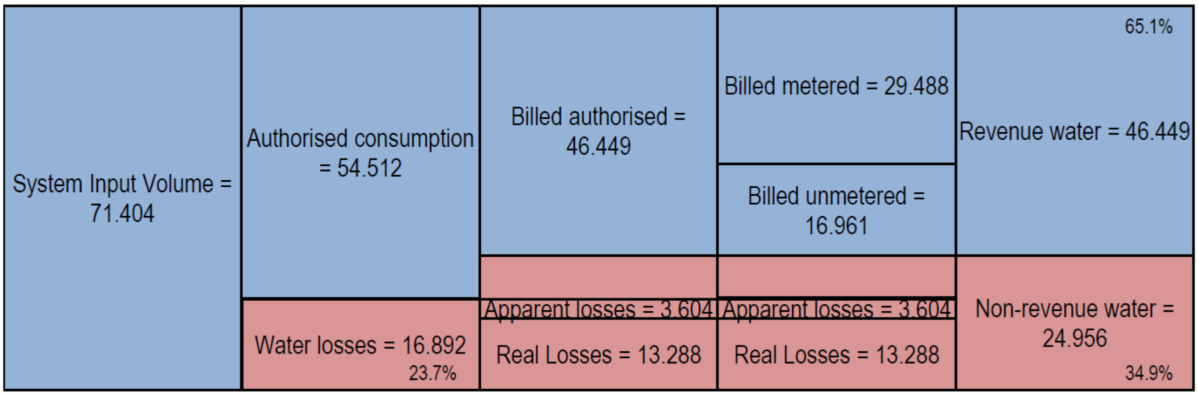


Figure 4.29 AmWSS water balance (December 2019)

The NRW and SIV trends for AmWSS are shown in Figure 4.30. The results indicate that NRW is between 35% and 40%.

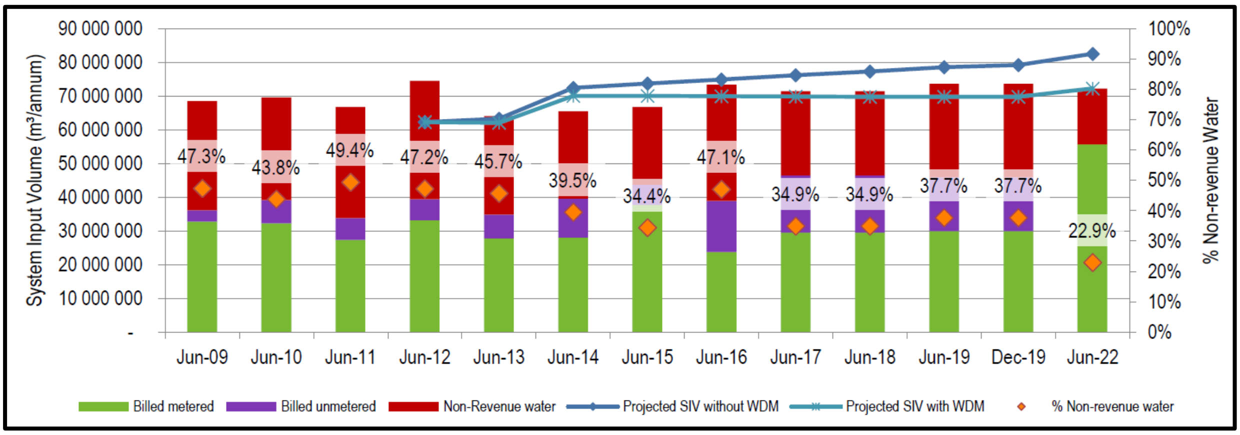


Figure 4.30 AmWSS Water Balance Trends for Non-Revenue Water

The per capita consumption for AmWSS is presented in Figure 4.31. The average per capita consumption has been stable over the past few years.

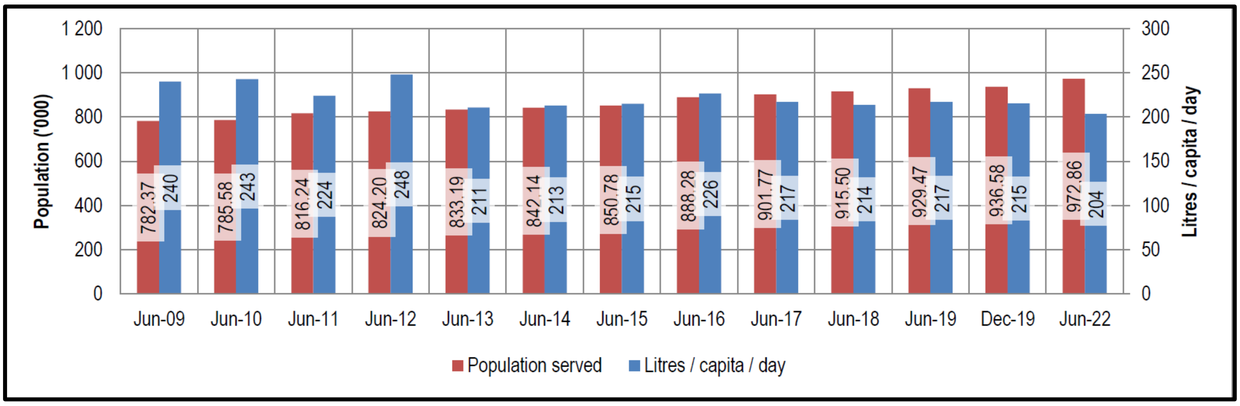
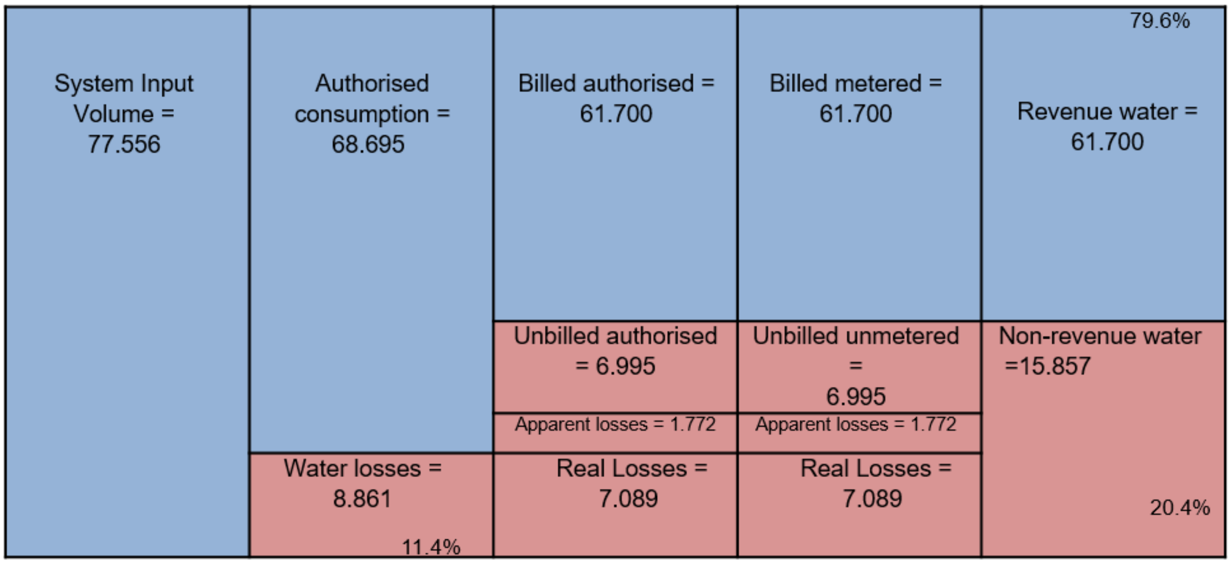


Figure 4.31 AmWSS per capita consumption trend

4.3.7 Greater Bloemfontein WSS (GBWSS)

The GBWSS supplies water to the Mangaung Metro Municipality (MMM) and smaller towns in Naledi, Kopanong and Mantsopa municipalities. Only around 4% of the water supplied by Bloem Water to the Greater Bloemfontein Area is distributed to the smaller towns and poor or no data were received from the other municipalities, the status of water losses and the progress made in terms of WCWDM within the GBWSS was based only on data received from Mangaung Metro Municipality.

Figure 4.32 summarises the 2019 water balance for MMM.(Input volume reported in m^3). The results indicate NRW of 20.4% and water losses of 11.4%.



System Input Volume = 77.556	Authorised consumption = 68.695	Billed authorised = 61.700	Billed metered = 61.700	79.6% Revenue water = 61.700
		Unbilled authorised = 6.995	Unbilled unmetered = 6.995	Non-revenue water =15.857 20.4%
		Apparent losses = 1.772	Apparent losses = 1.772	
	Water losses = 8.861 11.4%	Real Losses = 7.089	Real Losses = 7.089	

Figure 4.32 Mangaung Metro Municipality water balance (December 2019)

Figure 4.33 shows the NRW and SIV trends for MMM. The NRW of MMM reduced by almost 20% in the past year and needs further investigation. The MMM should strive to improve its water balance data. MMM has managed to achieve its water restrictions target.

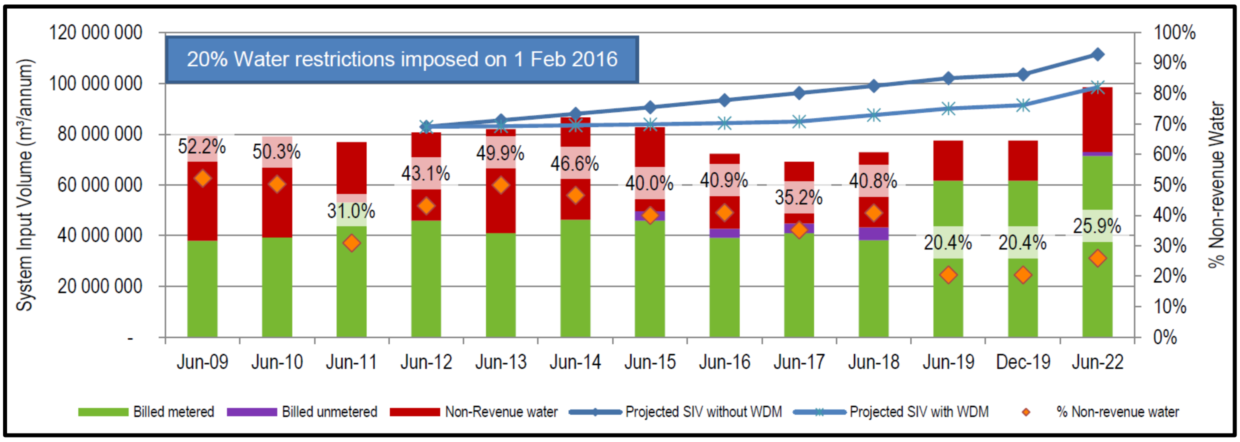


Figure 4.33 MMM Water Balance Trends for Non-Revenue Water

The per capita consumption for MMM is shown in Figure 4.34. The average per capita consumption has been improving over the past few years, however, can improve considering the level of service. Restrictions of 15% have been implemented in MMM during July 2015, which was increased to 20% in July 2016, due to resources being under stress.

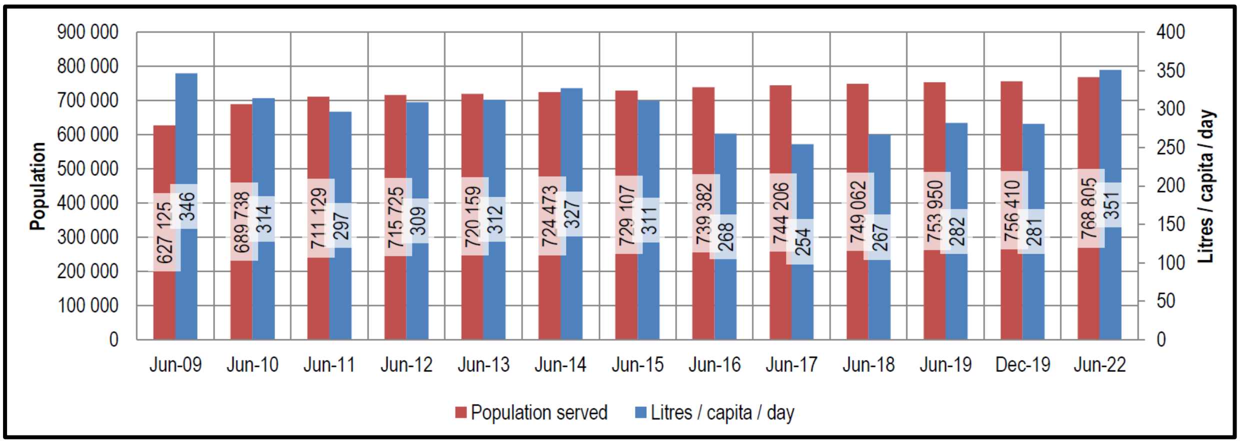


Figure 4.34 MMM per capita consumption trend

4.3.8 Olifants River WSS

Information regarding the total consumptive water use and losses in the towns within the Olifants WSS was based on the limited WCWDM investigation carried out as part of the Olifants WCWDM Study (DWS, 2007). There is rarely significant scope to reduce the water use in the rural sector since the level of service at which water is supplied is already low.

A 2019 consolidated water balance was prepared for the ORWSS based on the individual water balances of the municipalities. Estimated water balance was used where no other information was available.

Figure 4.35 shows the 2019 IWA water balance for the ORWSS indicating a weighted average water loss and NRW of 46.7% and 52.4% respectively. The data is highly influenced by Madibeng, Moretele and City of Tshwane (eastern regions) and has a very low confidence level.

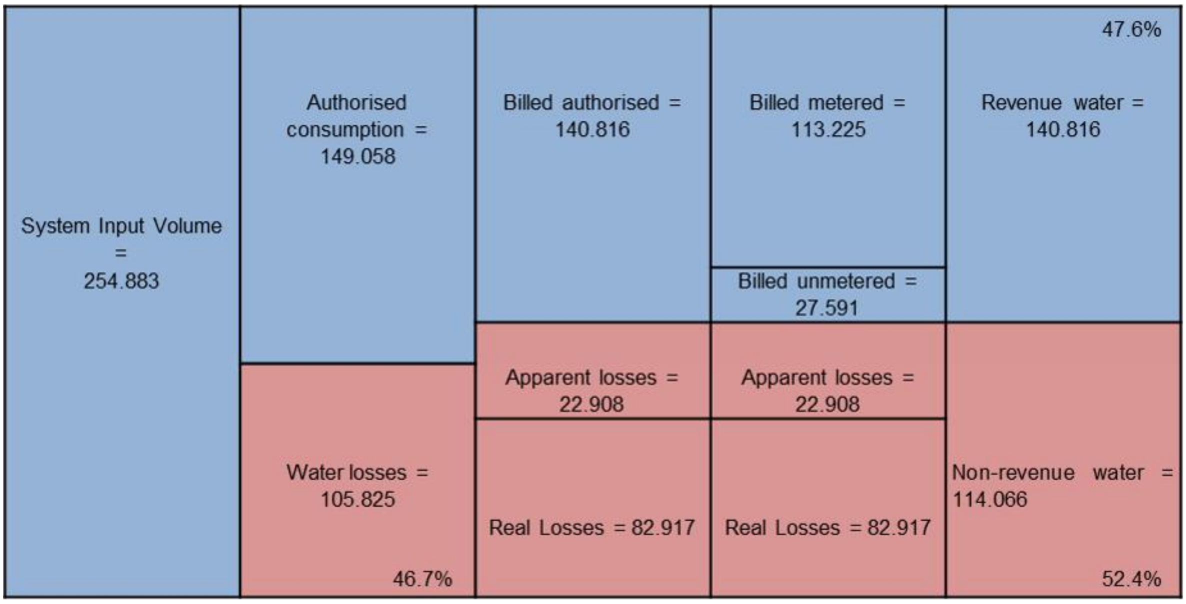


Figure 4.35 ORWSS water balance (December 2019)

NRW is stable between 40% and 45% as presented in Figure 4.36.

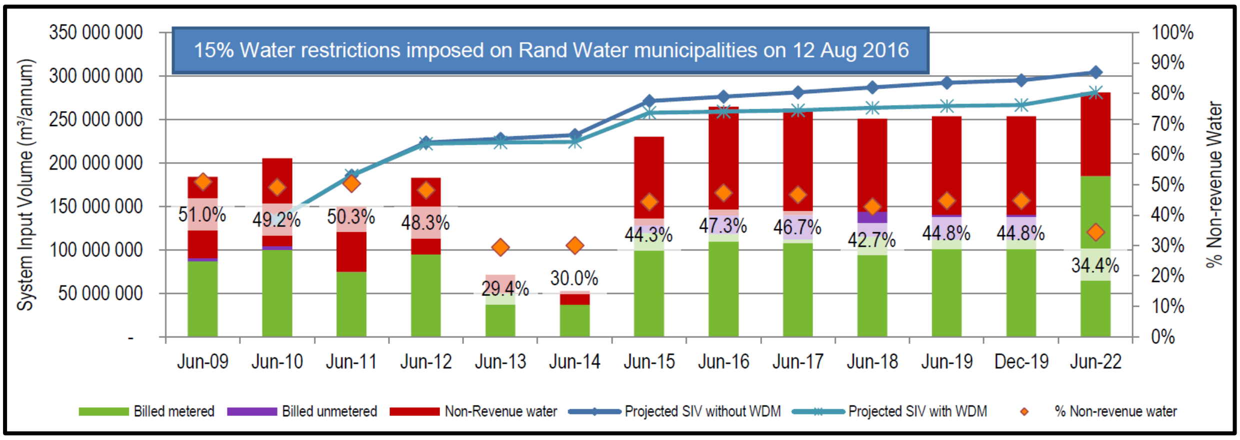


Figure 4.36 ORWSS Water Balance Trends for Non-Revenue Water

The per capita consumption is shown in Figure 4.37.The unit consumption decreased over the past 5 years, however, has a very low confidence level. The current estimated average consumption is 184 ℓ/c/d.

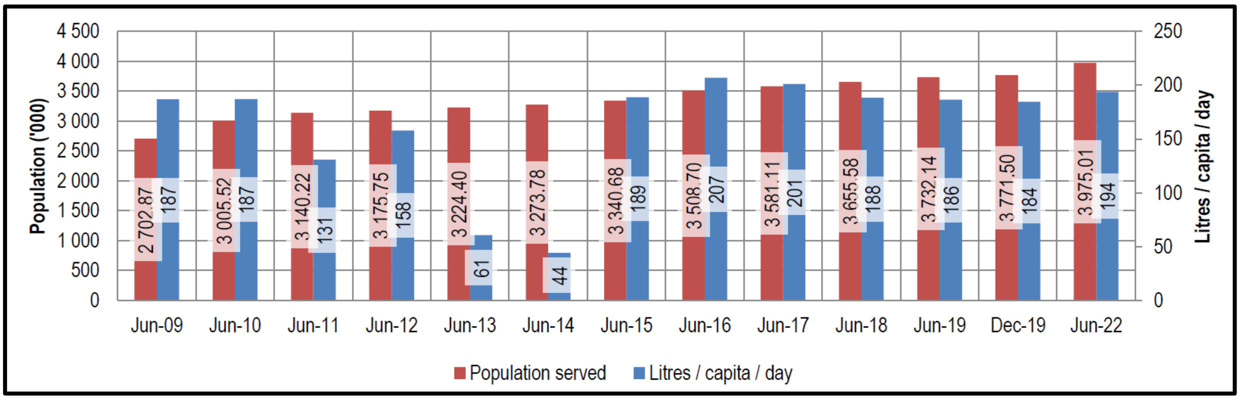


Figure 4.37 ORWSS per capita consumption trend

4.3.9 WCWDM Progress in Water Supply Systems

Since South Africa is a semi-arid country which experiences high variability and uncertainty in available water resources from year to year, Water Conservation / Water Demand Management (WCWDM) is a key strategic intervention to reconcile the water requirements with water availability. Progress of the recommended WCWDM interventions and targets set during the Reconciliation Strategies for major water supply systems is to be monitored and reported on biannually as defined by the International Water Association (IWA) and in the standard IWA water balance.

The targeted versus actual savings for the eight systems combined are summarised in Figure 4.38 and the results indicate that an actual combined total of 12.0% saving has been achieved by June 2017 compared to the projected 11.8% for all the WSS combined. The savings are encouraging as water restrictions have now been imposed in most of the water supply systems. Sufficient resources and budgets should be allocated to ensure savings are sustained.

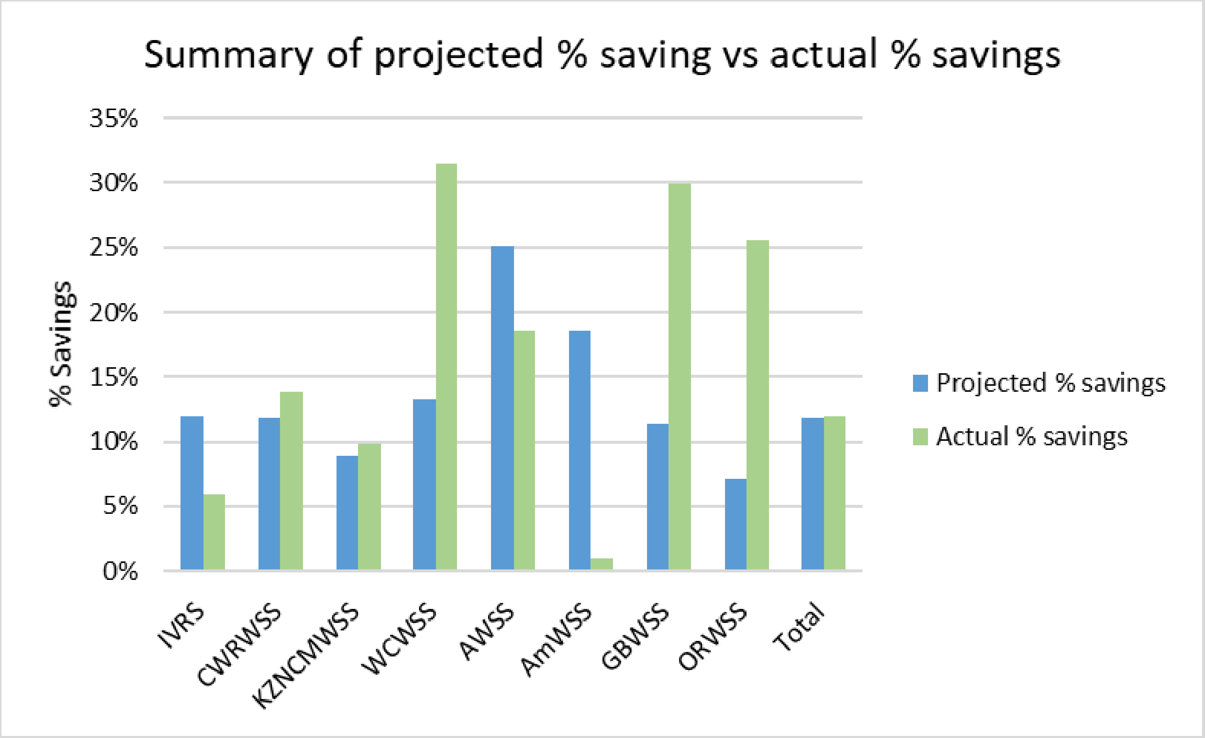


Figure 4.38 Summary of projected percentage savings vs actual percentage savings, up to June 2017.

The Integrated Vaal River System (IVRS) failed to achieve the actual water saving target of 11.6%in December 2019, and only achieved 5.2%. At a municipality level Ekurhuleni and Midvaal surpassed their 2019 targets, while the City of Johannesburg, City of Tshwane and Emfuleni, the major contributors to water loss in the IVRS, have not achieved their targets.

It is important to note that during the period of analysis (DWS, 2020), water restrictions in the IVRS and Algoa WSS could have been avoided if the targets with WCWDM were achieved. Additional restrictions in the GBWSS, KZNCMWSS and WCWSS were unavoidable due to the severity of the drought in these systems.

4.3.10 Recommendations

The following recommendations are made to address the progress made with the implementation of WCWDM in the eight large water distribution systems.

a) Maintenance of the reconciliation strategies must continue and used to monitor the progress made with the implementation of WCWDM.
b) Too many local municipalities are not aware of the reconciliation strategies or expect DWS to provide the necessary funding to implement these strategies. Municipalities must be reminded of their responsibilities in terms of the Water Services Act and actively participate, budget through the IDP process and implement the results from the reconciliation strategies.

c) Budgets are allocated towards new infrastructure projects through ACIP, MWIG, RBIG, MIG, etc. funding programmes but the management of these funds are fragmented with emphasis on new infrastructure and insufficient focus on WCWDM.

d) Ongoing monitoring and reporting of municipal NRW and water loss performance by DWS against determined targets and baselines are critical.

e) Monitoring and reporting on water balances by municipalities could become more self-regulatory if a policy is implemented that no new infrastructure projects will be funded unless the municipality can provide actual consumption figures and proof that their water losses are under control

f) Municipalities should increase payment levels, encourage consumer fixing of leaks, and prosecution of illegal water connections and reduce theft of water.

g) Municipal asset management needs to be improved to ensure greater sustainability of water supply services.

h) DWS Regional Offices / CMAs must upscale their skills and capacity to provide WCWDM support to municipalities, monitoring and reporting.

i) Some Regional Offices appointed a PSP to provide support with the development of reporting templates, meeting with municipalities to confirm targets, analyse the water balance information and provide feedback. The reporting structures in these regions are well established and all municipalities are reporting on a quarterly basis. The initiative was supported by Regulations sending directives to municipalities who did not respond. A similar approach could be followed for all the other provinces to improve communications and water balance reporting.

j) The results from the No Drop audit must be used to motivate for funding in the next financial year. The No Drop incentive-based regulation programme should be rolled-out as planned to with the other Drop programmes to elevate WCWDM in the municipal environment. DWS should also enforce its regulatory mandate to penalise municipalities that do not comply.

k) Closer involvement and collaboration with CoGTA and SALGA is critical to ensure issues related to human resources skills and capacity in municipalities, payment for services and unauthorised water use are resolved.

4.4 Agriculture - Irrigation Water Use Efficiency

Irrigated agriculture is the biggest water user based on WARMS registration data in the South Africa, with more than 60% of registered water use nationally. With the increasing competition between existing user sectors, the available water cannot meet the demand under current water use practices and operating conditions in all water use sectors. It is therefore imperative to ensure that available water supplies are used efficiently and effectively to avoid supply shortages and intermittent water supplies, which would have a major impact on the socio-economic growth and development of the country.

The Department of Water and Sanitation has identified that, based on preliminary assessment of water losses in the agricultural sector, there was potential to implement measures to improve water use efficiency in the sector. The overall aim in reducing water losses and improving irrigation water use efficiency levels in the Water User Associations (WUAs)/Irrigation Boards (IBs)/Government Water Schemes (GWS) is that the limited available water can be optimally utilised to ensure a high economic return for the scheme area.

Table 4-1 presents the water use efficiency for the 2018/2019 (April 2018 – March 2019). The dams, schemes or WUA that had no data available for the reporting period reported zero towards the total of the WMA total water released and lost.

Table 4-1 Agriculture- Irrigation Water Use Efficiency, DWS (2018/2019)

WMA	Total Released m^3	Total Loss m^3	% Water Loss
Breede-Gouritz	31,634,800	6,594,200	19%
Inkomati-Usuthu	90,868,300	19,860,300	20%
Berg-Olifants	109,685,000	26,428,000	24%
Mzimvubu-Tsitsikamma	400,823,264	114,270,951	30%
Olifants	513,866,465	132,210,953	23%
Vaal	606,579,800	134,060,300	20%
Limpopo	699,155,172	196,345,800	33%
Pongola-Mtamvuna	807,567,020	195,526,300	25%
Orange	5,489,031,600	925,889,600	20%
Total	**8,749,211,421**	**1,751,186,404**	**20%**

It is important to note that the water use efficiency accounting data is based on estimates for most schemes and that there are gaps in the data due to various reasons including but not limited to water management issues - lack of measurement recording at some of the critical points in the scheme for a comprehensive water balance assessment. The greatest percentage water loss in the WMA schemes for agricultural water use is reported in Limpopo.

5 RESOURCE PROTECTION

5.1 Resource Directed Measures

Chapter 3 of the National Water Act, 1998 (No. 36 of 1998) prescribes Resource Directed Measures which aim to achieve a balance between protecting the water resources and utilising the water resources for social and economic development. The Act makes use of two Integrated Water Resource Management (IWRM) approaches or tools i.e., Resource Directed Measures (RDM) and Source Directed Controls (SDC).

The RDMs determines the required level of protection of the water resource through a Water Resource Classification (WRC) process. This WRC process states the kind of impacts that are acceptable to achieve a desired class based on stakeholder consultations. RDMs also allows for water to be set aside as Reserve for basic human need and the ecosystem (Ecological Reserve), and lastly, they allow for the setting of the Resource Quality Objectives (RQOs). RQOs are clear numerical goals and /or descriptive goals for the resource, and these are required for both water quality and quantity as well as the assurance of supply (Odume *et al.*, 2018).

5.1.1 Classification of significant water resources

Water Resource Classification System (WRCS) was formally prescribed through Regulation 810 which was published in Government Gazette (GG 33541 of 17 September 2010). This system prescribes processes to be followed for determining RDM. Through this system water resources are categorised according to specific water resource classes that represent a management vision of a particular catchment.

Water Resource Classification defines three water resource classes based on the extent of use and the alteration of ecological condition of water resources from pre-development condition as given in Table 5-1.

Table 5-1 Water Resource Classification Classes

Classes	**Description of use**	**Ecological Category**	**Description of water resource**
Class I	Minimally used	A-B	Minimally altered
Class II	Moderately used	C	Moderately altered
Class III	Heavily used	D	Heavily altered

**Ecological Category (EC) - the assigned ecological condition of a water resource in terms of the deviation of its biophysical components from a pre-development condition*

The classification of water resources represents the first stage in the protection of water resources and determines the quantity and quality of water required for ecosystem functioning as well as maintaining economic activity that relies on a particular water resource.

5.1.2 Resource Quality Objectives

RQOs are numerical and/or narrative descriptors of conditions that need to be met to achieve the required management scenario as provided during the water resource classification. Such descriptors relate to the:

(a) Water quantity, pattern, timing, water level and assurance of instream flow.
(b) Water quality including the physical, chemical, and biological characteristics.
(c) Character and condition of the instream and riparian habitat; and
(d) Characteristics, condition, and distribution of the aquatic biota.

In 2011 the Department developed a procedure for the determination of RQOs. The RQO determination procedure involves amongst other things, the delineation and prioritisation of Resource Units (RUs) for the different water resource components (e.g., rivers, dams, wetlands, and groundwater). RQOs are determined at RU level.

A Resource Unit (RU) is a stretch of river that is sufficiently ecologically distinct to warrant its own specification of Ecological Water Requirements (EWR). Resource Units are nested within IUAs and in the RQO process, are aligned to IUA boundaries. There are normally several RUs within a single IUA. Once determined, the RQOs will give effect to water resource classes set for each Integrated Unit of Analysis (IUA) during classification process.

The integrated framework of the Gazetted steps for classification, reserve and RQO determination are presented in Figure 5.1. Figure 5.2 shows the status of WRCs and the finalisation of RQOs in South Africa as of September 2020.

It should be noted that after the completion of the technical processes for the determination of water resource classes and the associated RQOs in a particular river system, a legal notice for the proposed water resource classes and the associated proposed RQOs is published in the Government Gazette for a 60-day public commenting period. The public comments received are considered to finalise the water resource classes and the associated resource quality objectives. Once the Minister of Water and Sanitation approves the final water resource classes and the associated RQOs for the respective river systems, then these are published in the Government Gazette and they become legally binding on all institutions and authorities.

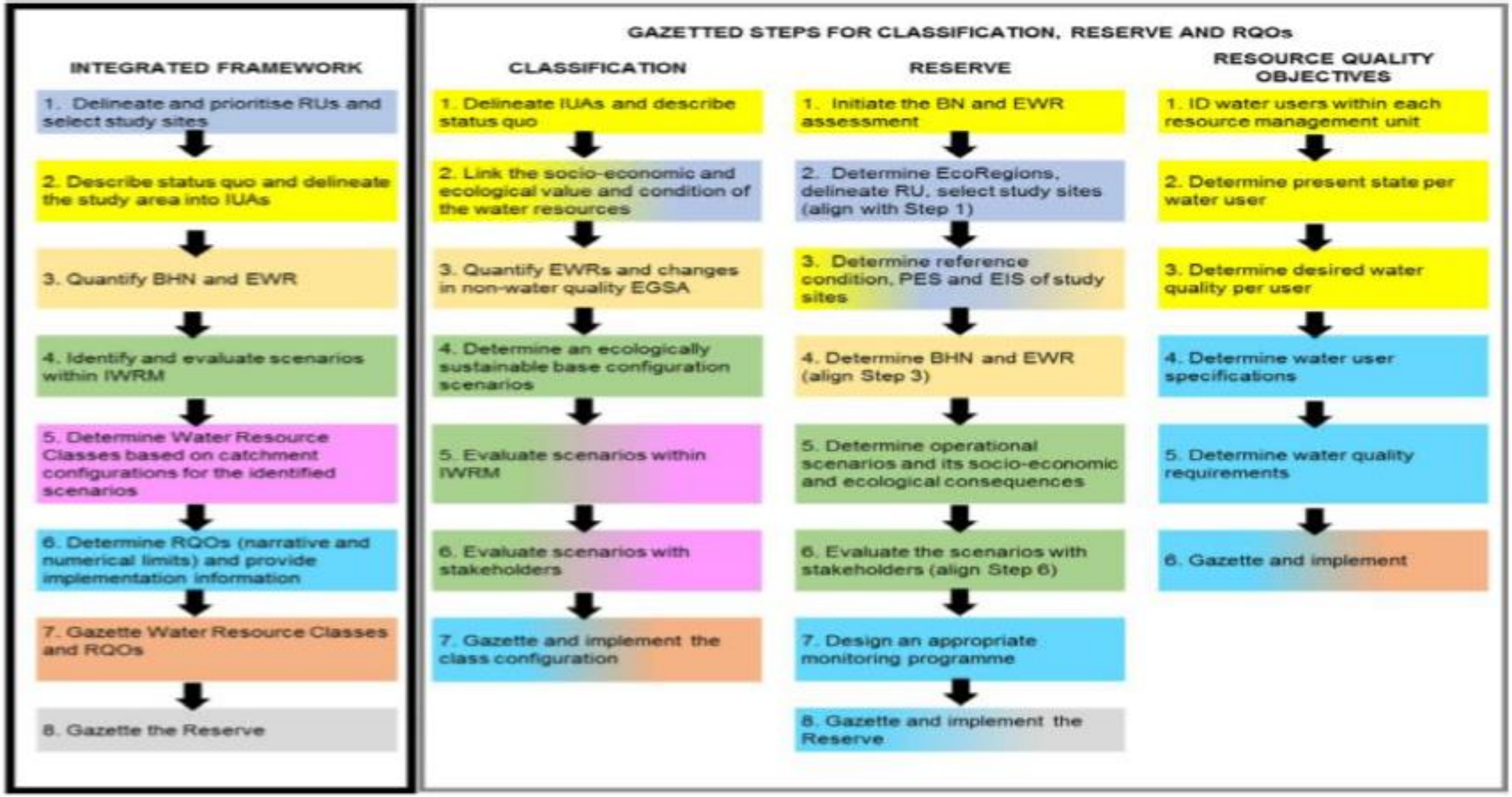


Figure 5.1 integrated framework for Gazetted steps for classification, Reserve and RQO determination

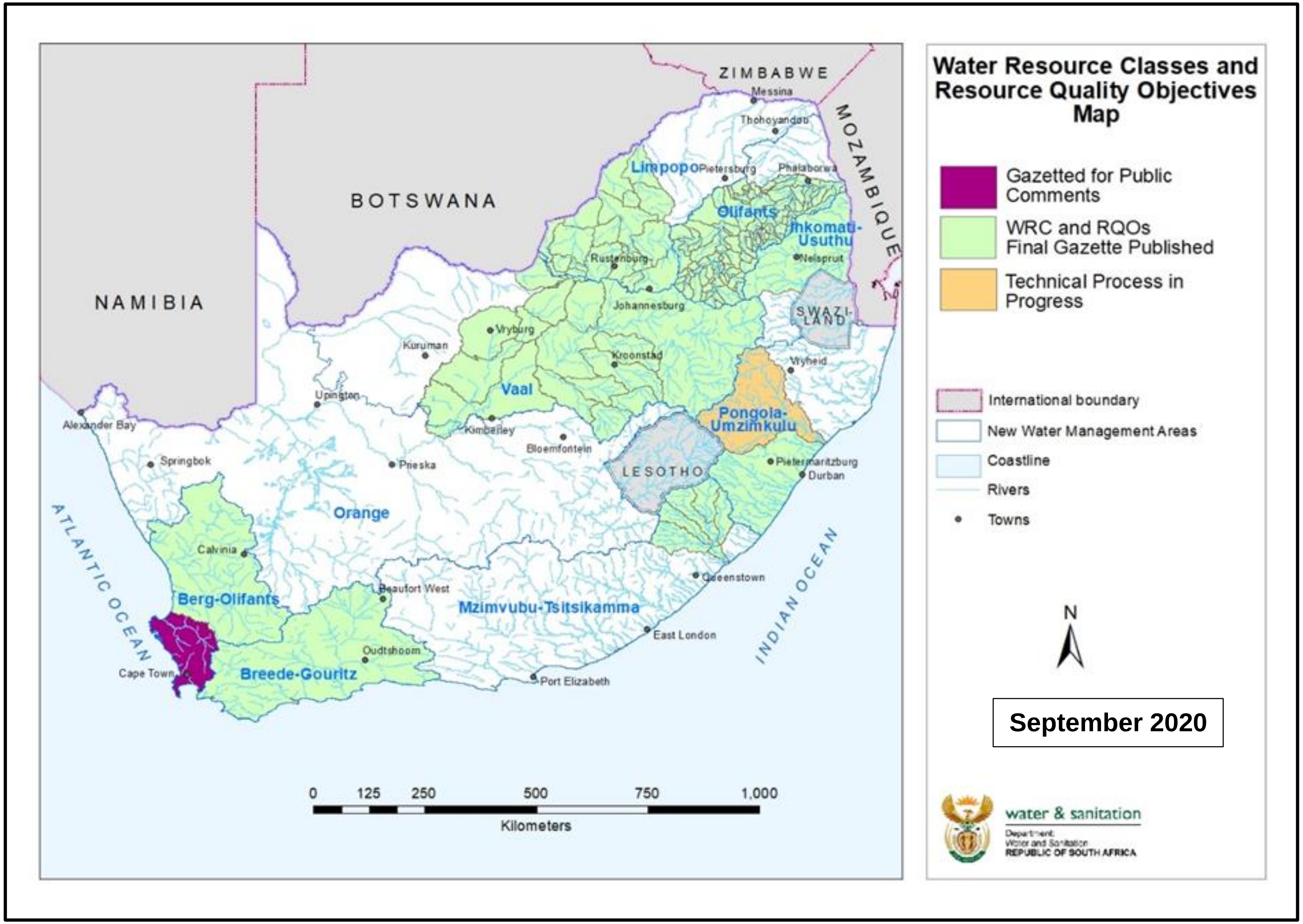


Figure 5.2 Status of WRC and RQOs determination Post 2010 to by September 2020

It is desirable to report on the status of achieving the set resource quality objectives for areas where they have been set, but to date the monitoring of the RQOs at regional or local scale has not been implemented. It is for this reason that the Chief Directorate: Water Ecosystems Management has developed an implementation plan to provide guidance to the implementation of RDM tools in a practical and efficient ways by DWS Provincial Offices and CMAs. The main objective is to monitor compliance to RQOs and Ecological Reserve.

The Department of Water and Sanitation has finalised and gazetted the water resource classes (WRC) together with the associated resource quality objectives (RQOs) for several catchment areas this hydrological year. The overview status of WRC and RQOs from post 2010 to September 2020 is given in Table 5-2. Catchments covered during the reporting period are the Crocodile (West) Marico, Mokolo and Matlabas, Breede-Gouritz and Mzimvubu-Tsitsikamma. This is in addition to those that were completed in the previous hydrological year, which include the Olifants-Doorn, Olifants, Upper Vaal, Middle Vaal, Lower Vaal, Letaba, Inkomati and Mvoti to Mzimkhulu..

Table 5-2 Overview status of WRC and RQO determination post 2010 to September 2020

Study Area	**Status**	**Government Gazette No.**
Olifants-Doorn	The Department finalised and gazetted the water resource classes together with the associated resource quality objectives.	GG 39943 of 22 April 2016
Olifants		
Upper Vaal		
Middle Vaal		
Lower Vaal		
Letaba	The Department finalised and gazetted the water resource classes together with the associated resource quality objectives.	GG 40531 of 30 December 2016
Inkomati		
Mvoti to Mzimkhulu	The Department finalised and gazetted the water resource classes together with the associated resource quality objectives.	GG 41306 of 08 December 2017
Crocodile (West) Marico, Mokolo, and Matlabas	The Department finalised and gazetted the water resource classes together with the associated resource quality objectives.	GG 42775 of 18 October 2019

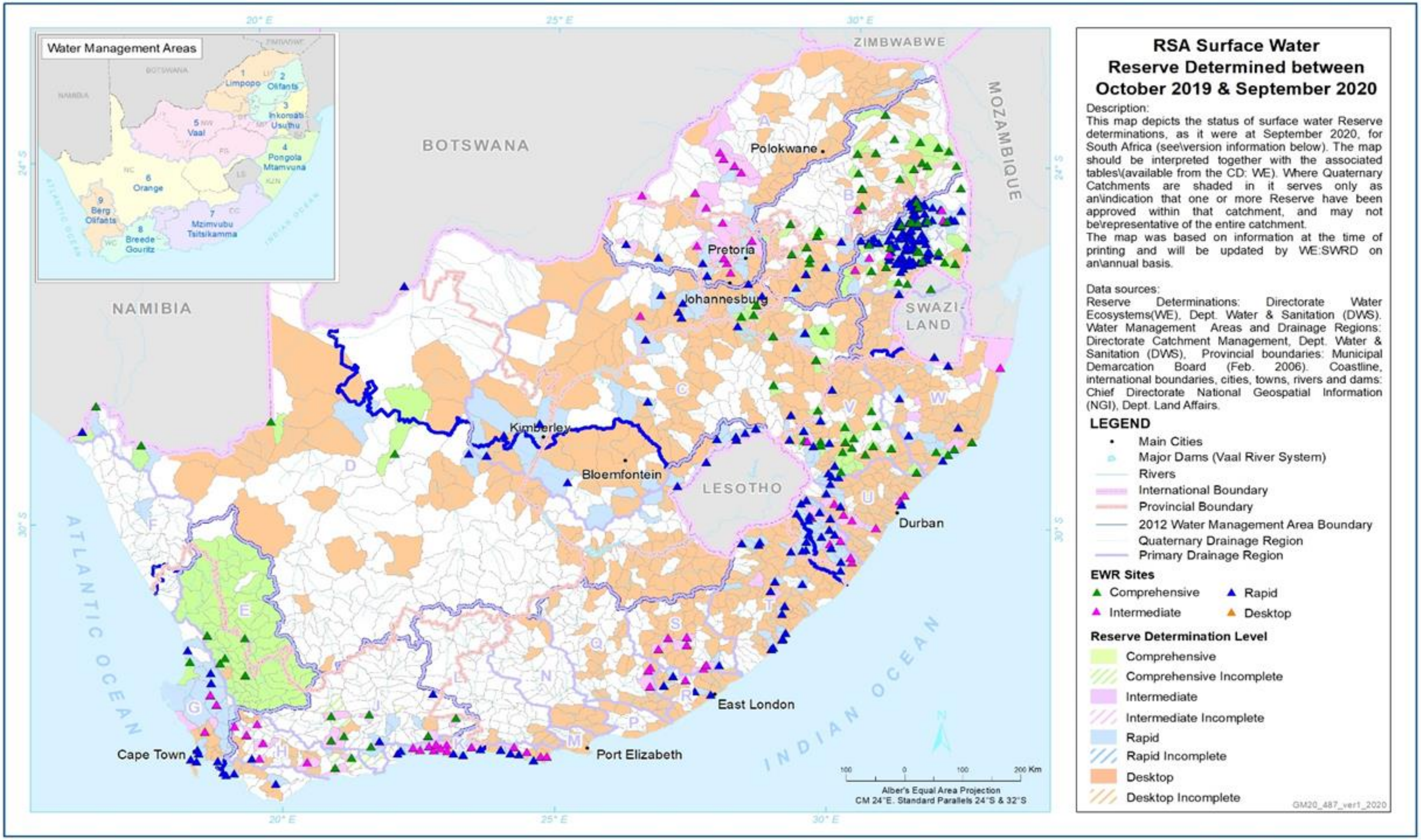
Study Area	Status	Government Gazette No.
Breede-Gouritz	The Department finalised and gazetted the water resource classes together with the associated resource quality objectives.	GG 43726 of 18 September 2020
Mzimvubu	The Department finalised and gazetted the water resource classes together with the associated resource quality objectives.	GG 43015 of 14 February 2020.
Berg	The Department published the notice containing the proposed water resource classes together with the associated proposed resource quality objectives for public comments on 10 May 2019. The closing date for receiving comments was 08 July 2019. Preparations for publishing the final gazette is currently underway and the final gazette is scheduled to be published by November 2020.	GG 42457 of 10 May 2019
Thukela	The technical process for the determination of water resource classes and the associated resource quality objectives in the study area is underway. The study is currently at a stage of analysing the relationships that link the change in the configuration of scenarios to a resulting change in economic value and social wellbeing – developing an Integrated Economic Model that will be used in the valuation step to inform the evaluation of scenarios at a later stage in the classification process. The study is scheduled to complete in the 2021/22 financial year.	None

5.1.3 Determination of the Reserve

The Department has been making progress in the determination of the Reserve for significant water resources at various levels of confidence ranging from desktop to comprehensive, depending on the type of impact, magnitude of the impact on water resources, and the quantity and quality of data available to run the models.

Reserves for surface water resources (i.e., rivers, wetlands, and estuaries) have been determined at a desktop, rapid, intermediate, and comprehensive level. Similarly, the Reserve for groundwater resources (aquifers) have also been determined at a desktop, rapid, intermediate, and comprehensive level. The spatial distribution of the surface water Reserves, and groundwater Reserves determined to date by September 2020 are presented in Figure 5.3 and Figure 5.4, respectively.

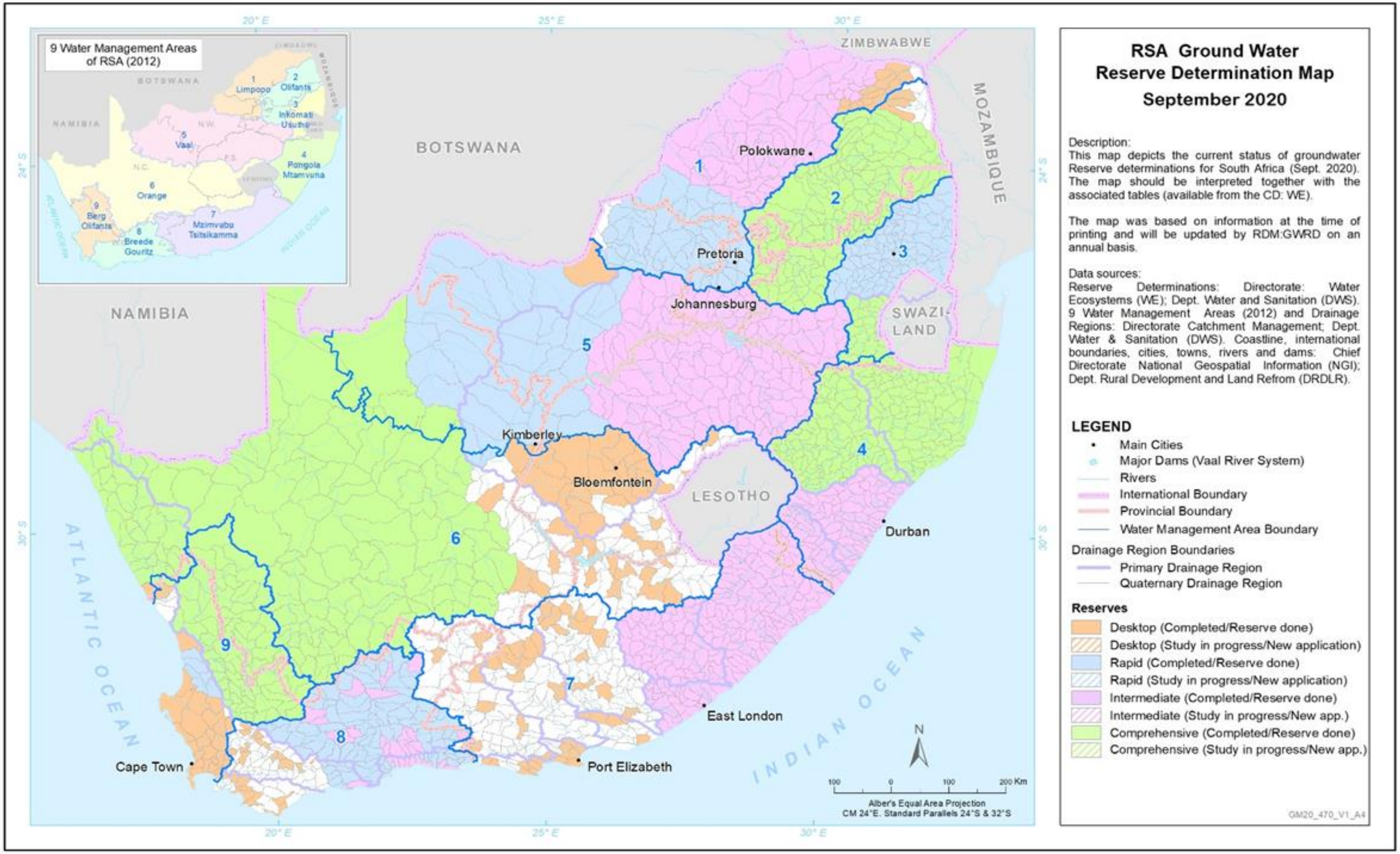
A total of four desktop Surface Water Reserves have been determined and completed during the reporting period of October 2019 to September 2020. These four desktop Reserves were one in Limpopo, two in Orange and one in Breede-Gouritz WMAs. For groundwater, four desktop groundwater Reserves were completed, which two were in Limpopo, while another two were in Mzimvubu-Tsitsikamma WMA.



Description:
This map depicts the status of surface water Reserve determinations, as it were at September 2020, for South Africa (see\version information below). The map should be interpreted together with the associated tables\(available from the CD: WE). Where Quaternary Catchments are shaded in it serves only as an\indication that one or more Reserve have been approved within that catchment, and may not be\representative of the entire catchment.
The map was based on information at the time of printing and will be updated by WE:SWRD on an\annual basis.

Data sources:
Reserve Determinations: Directorate Water Ecosystems(WE), Dept. Water & Sanitation (DWS). Water Management Areas and Drainage Regions: Directorate Catchment Management, Dept. Water & Sanitation (DWS), Provincial boundaries: Municipal Demarcation Board (Feb. 2006). Coastline, international boundaries, cities, towns, rivers and dams: Chief Directorate National Geospatial Information (NGI), Dept. Land Affairs.

Figure 5.3 Surface water Reserve determined as of September 2020



Description:
This map depicts the current status of groundwater Reserve determinations for South Africa (Sept. 2020). The map should be interpreted together with the associated tables (available from the CD: WE).

The map was based on information at the time of printing and will be updated by RDM:GWRD on an annual basis.

Data sources:
Reserve Determinations: Directorate: Water Ecosystems (WE); Dept. Water and Sanitation (DWS). 9 Water Management Areas (2012) and Drainage Regions: Directorate Catchment Management; Dept. Water & Sanitation (DWS). Coastline, international boundaries, cities, towns, rivers and dams: Chief Directorate National Geospatial Information (NGI); Dept. Rural Development and Land Refrom (DRDLR).

Figure 5.4 Groundwater reserve determined as of September 2020

5.2 Regulatory measures (Source directed controls)

The implementation of RDM has linkages to a number strategies and activities such as water allocation, water regulation, water use authorisations, compliance monitoring and enforcement, and importantly to the second complementary approach to sustainable water resource management which is the SDCs (DWS, 2021).

The SDCs, are aimed at the control of impacts into the water resource using regulatory measures (Odume *et al.*, 2018). The regulatory measures include general authorisations (GA), compulsory water use licencing (WUL), waste discharge charge system (WDCS), economic incentive programme and penalties (e.g., Green, and blue drop programme, levies and fees), and compliance and enforcement actions such as directives and prosecution to ensure that the RQOs are met.

The mandate of reporting on the compliance to the reserve and RQOs and the achievement of Water Resource Classes resides with Chief Directorate: Water use and Compliance Monitoring. The compliance to RQOs results will start to be made available for reporting from the hydrological year 2021/22 based on the currently piloting of monitoring compliance to RQOs with a specific focus on surface water quality. Although RQOs have four drivers (quality, quantity, habitat and biota), in future all four drivers for both surface and groundwater will be reported. The successful implementation and monitoring of RQOS and Reserve will not only allow effective protection and management of water resources but will also assist in decision making for resource allocation.

The Department is undertaking monitoring of compliance to the RQOs to assess if the standard and quality of the resource is improving or declining based on the set RQOs for the specific resource, the aim is to see the resource improving and the RQOs being implemented. These will allow water resource managers to manage demands on water resources and it will also make decision making easier.

5.3 Regulating wastewater discharge through the Green Drop Programme

DWS issues WWTW licences and regulates WWTWs and effluent releases, through Section 21 of the National Water Act, No 36 of 1998. In 2008, Department of Water and Sanitation introduced an incentive based, risk management approach, to address design and operating capacity of WWTWs, compliance of the effluent to agreed standards, local regulation (by-laws implementation) and infrastructure management and condition, (i.e., asset management practices).

This process is known as the Green Drop certification process, measures and compares the results of the performance of water services institutions, and subsequently rewards (or penalises) the institution upon evidence of their excellence (or failures) according to the minimum standards or requirements that has been defined.

The first green drop report was issued in 2009, while the latest green drop report was issued in 2013. The green drop and certification take place every 2nd year, using a full set of green water services assessment criteria to assess performance of the wastewater system. The comparative analysis of the green drop results since inception are given in Table 5-3. Generally, as the number of wastewater system assessed are increasing, an increasing trend in average green drop score and percentage of green drop scores greater than 50% is observed. However, it is also observed that a percentage of low scores (less than 50%) have been showing a decreasing trend.

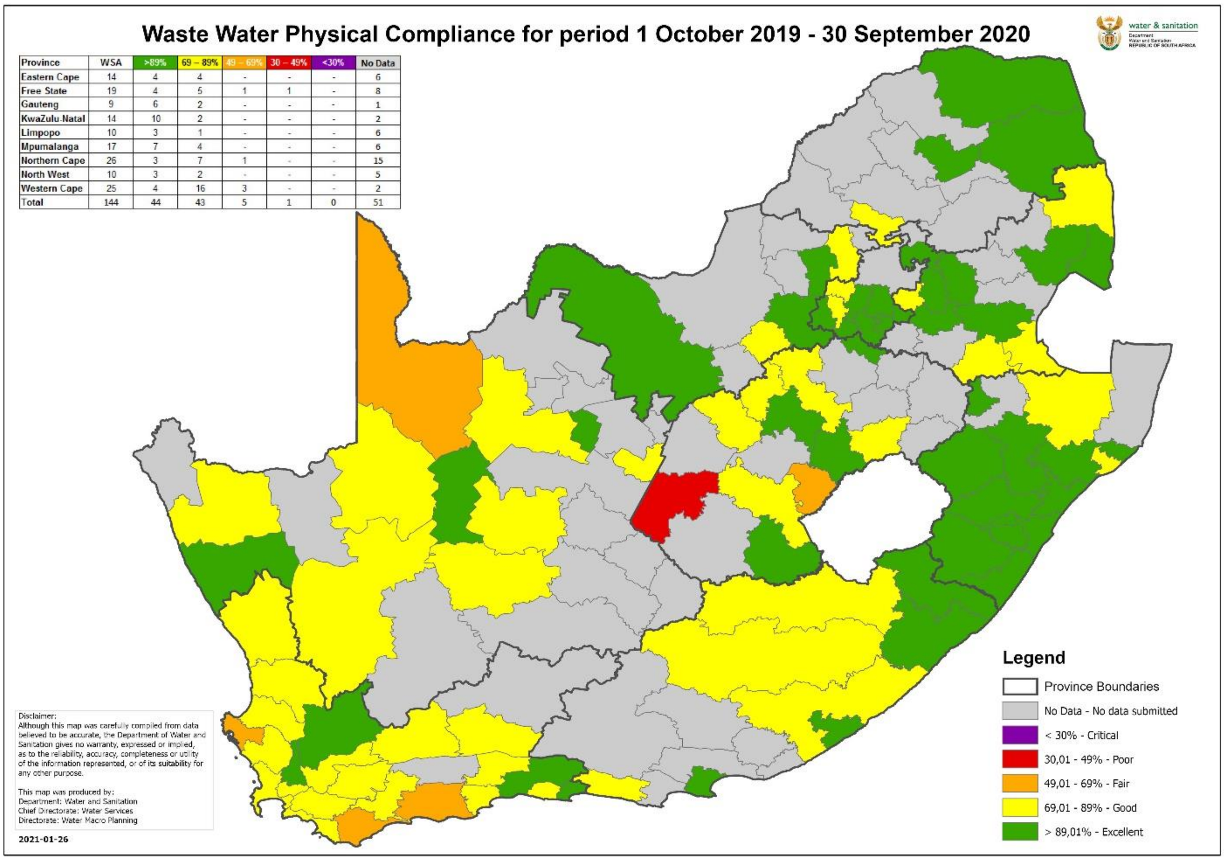
Table 5-3 Green Drop comparative analysis

Performance category	**2009**	**2010/11**	**2012/13**	**Trend**
No. of municipalities assessed	98	156 (100%)	152 (100%)	Increase
No. of wastewater system assessed	444	821	824	Increase
Average Green Drop Score	37%	45%	46.4%	Increase
No. of Green Drop Scores ≥50%	216 (49%)	361 (44%)	415(50.4%)	Increase
No. of Green Drop Scores ≤50%	228 (51%)	460 (56%)	409 (49.6%)	Decrease
No. of Green Drop awards	33	40	60	Increase
Average Site Inspection Score	N/A	51.4%	57.0%	increase
National Green Drop Score	**N/A**	**71%**	**73.8%**	**Increase**

The green drop programme is currently being revitalised with plans to conduct an audit for period: 01 July 2020 – 30 Jun 2021. 966 wastewater systems will be assessed. There were no latest results of the green drop programme during the period of reporting. Based on monthly compliance monitoring results for municipal WWTWs to licence conditions as submitted by water services authorities into the Integrated Regulatory Information System (IRIS) - (http://ws.dwa.gov.za/IRIS/documents.aspx), a compliance report was derived from assessed against discharge standards in water use licences and the results are presented in the proceeding sections.

5.3.1 Wastewater discharge physical compliance

Wastewater physical compliance measures compliance against physical variables of wastewater such as temperature (risk to aquatic life), suspended solids and pH levels of wastewater. The wastewater physical compliance of WSA within each Province from 1 October 2019 – 30 September 2020 is presented in Figure 5.5. A total of 144 WSAs were monitored. More than 60 percent of the WSAs achieved good to excellent compliance performance. Only five WSAs, two in the Free State Province, one in the Northern Cape and three in the Western Cape achieved a poor to fair wastewater physical compliance performance.



Waste Water Physical Compliance for period 1 October 2019 - 30 September 2020

Province	WSA	>89%	69 – 89%	49 – 69%	30 – 49%	<30%	No Data
Eastern Cape	14	4	4	-	-	-	6
Free State	19	4	5	1	1	-	8
Gauteng	9	6	2	-	-	-	1
KwaZulu-Natal	14	10	2	-	-	-	2
Limpopo	10	3	1	-	-	-	6
Mpumalanga	17	7	4	-	-	-	6
Northern Cape	26	3	7	1	-	-	15
North West	10	3	2	-	-	-	5
Western Cape	25	4	16	3	-	-	2
Total	144	44	43	5	1	0	51

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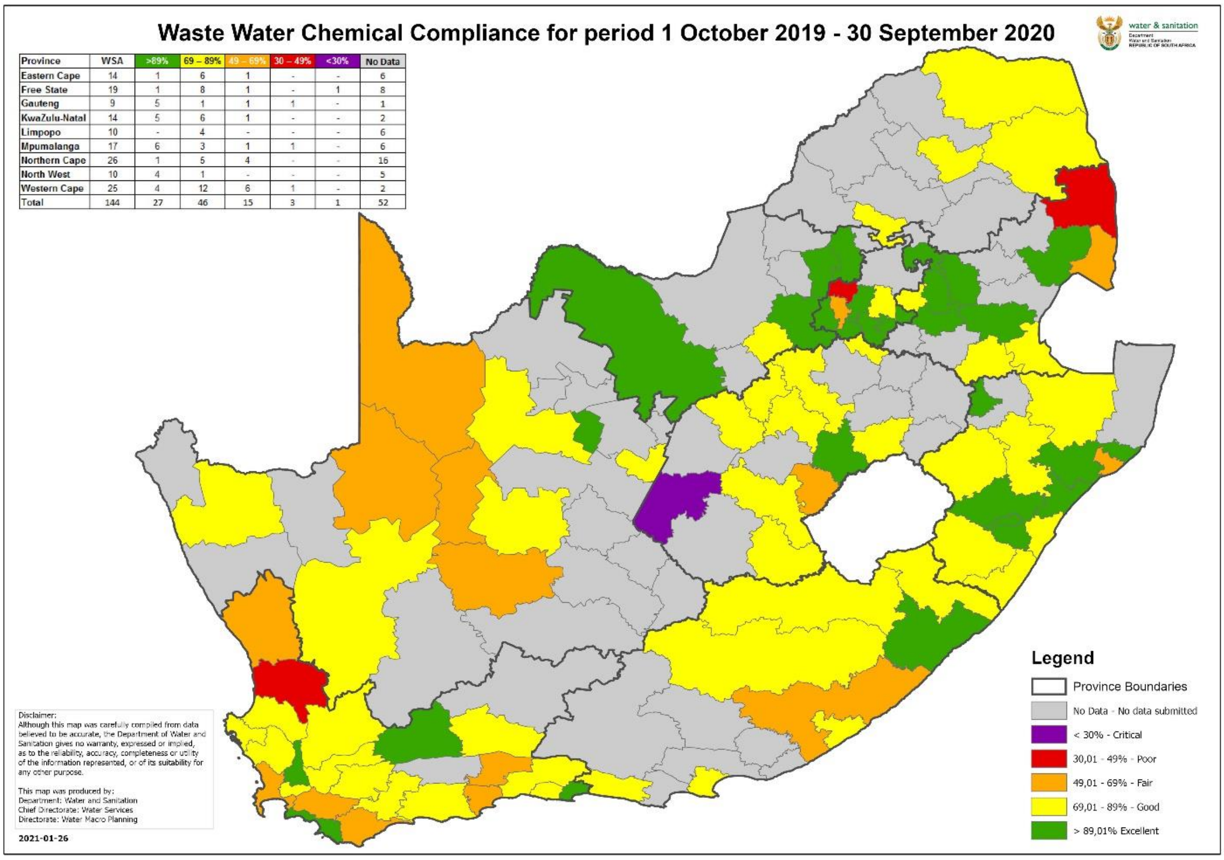
Figure 5.5 Wastewater physical compliance

5.3.2 Wastewater discharge chemical Compliance

Wastewater chemical compliance monitoring is undertaken for wastewater treatment works in terms of soluble organic and inorganic pollutants that may be present in wastewater. Compliance is assessed against the licence standards or GA issued to the Water Services Authority as per the WWTW being assessed. Figure 5.6 presents the chemical compliance by WSAs per Province for the period of reporting. The percentages categorise chemical determinants as prescribed in the water use licence or GA. The typical chemical determinants in wastewater effluent are chemical oxygen demand; ortho-phosphate; Nitrates and Nitrites; and Ammonia.



Province	WSA	>89%	69 – 89%	49 – 69%	30 – 49%	<30%	No Data
Eastern Cape	14	1	6	1	-	-	6
Free State	19	1	8	1	-	1	8
Gauteng	9	5	1	1	1	-	1
KwaZulu-Natal	14	5	6	1	-	-	2
Limpopo	10	-	4	-	-	-	6
Mpumalanga	17	6	3	1	1	-	6
Northern Cape	26	1	5	4	-	-	16
North West	10	4	1	-	-	-	5
Western Cape	25	4	12	6	1	-	2
Total	144	27	46	15	3	1	52

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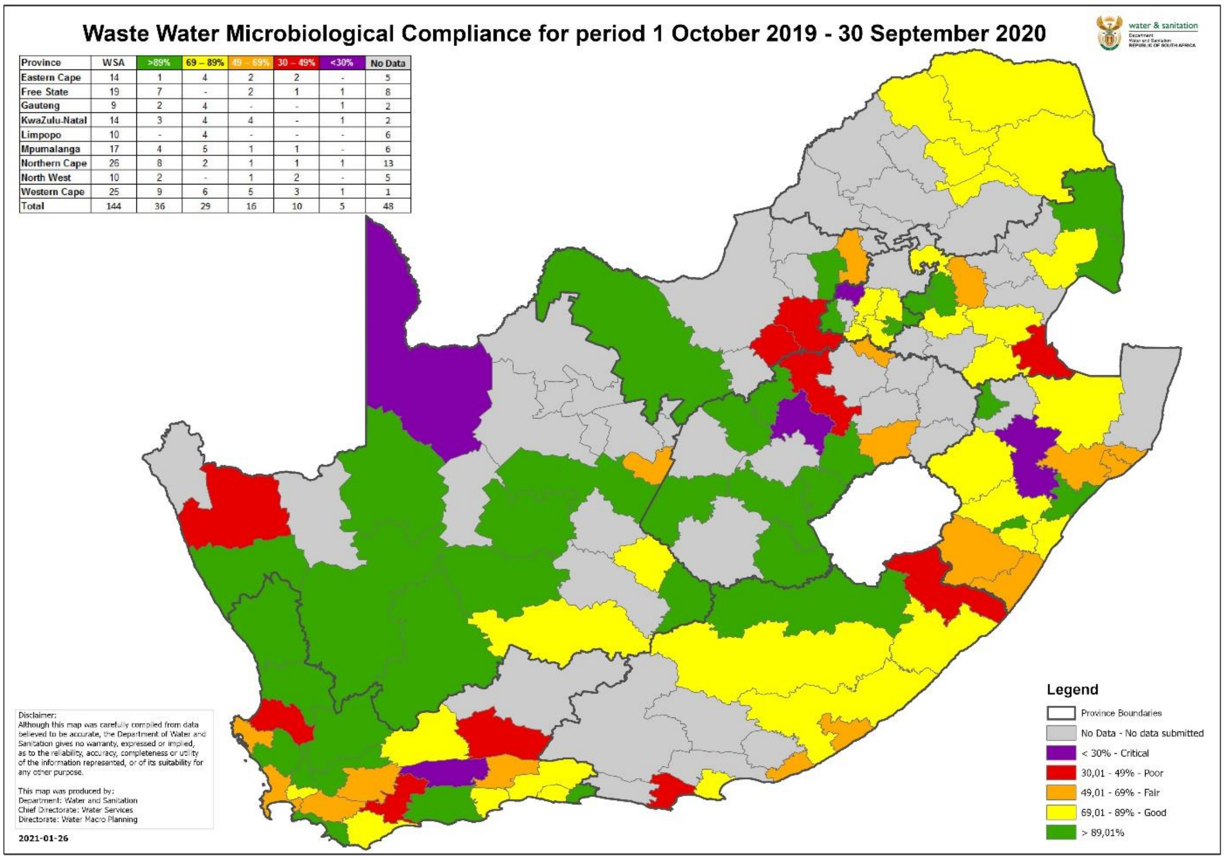
Figure 5.6 Wastewater chemical compliance

One WSA in the Free State Province was found to be in a critical stage of wastewater chemical compliance. This WSA's is at a higher risk of non-compliance and should be placed under regulatory surveillance. Three of the WSAs were found to be in a poor state, each in Gauteng, Mpumalanga, and Western Cape.

5.3.3 Wastewater discharge microbial compliance

Wastewater microbiological compliance monitoring is undertaken for wastewater treatment works in terms of microbial variables as *E.coli* or Faecal Coliforms. These microbial variables indicate the level of faecal pollution but also treatment efficiency of the assessed WWTWs. The microbial compliance performance for effluent in WSAs per Province is presented in Figure 5.7.



Province	WSA	>89%	69 – 89%	49 – 69%	30 – 49%	<30%	No Data
Eastern Cape	14	1	4	2	2	-	5
Free State	19	7	-	2	1	1	8
Gauteng	9	2	4	-	-	1	2
KwaZulu-Natal	14	3	4	4	-	1	2
Limpopo	10	-	4	-	-	-	6
Mpumalanga	17	4	5	1	1	-	6
Northern Cape	26	8	2	1	1	1	13
North West	10	2	-	1	2	-	5
Western Cape	25	9	6	5	3	1	1
Total	144	36	29	16	10	5	48

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Figure 5.7 Wastewater microbial compliance

In terms of the microbiological compliance, five WSAs were found to be in a critical state, achieving less than 30% compliance during the reporting period. About 25% of the WSAs monitored in the country achieved more than 89% (excellent compliance). On average, the overall national picture leans towards a negative trend as most treatment plants have digressed in terms of effluent compliance performances. More than 30% of the WSAs across the country had no data and therefore their statuses could not be assessed.

5.4 Drinking water Quality – Blue Drop

The Water Services Act, 1997 (Act No. 108 of 1997) prescribes the legislative duty of water service providers (WSPs) to provide water and sanitation services according to national norms and standards. The Water Services Authorities (WSAs) regulates the services provided by the WSPs. Some WSA are also WSP, and in other cases the WSA has WSP that provides water on their behalf.

The Act compels the Minister to establish and maintain a national information system and to monitor the performance of all water services institutions. Based on this, the Department established the Integrated Regulatory Information System (IRIS) to monitor quality of drinking water. This is a system available to the public at http://ws.dwa.gov.za/IRIS/documents.aspx.

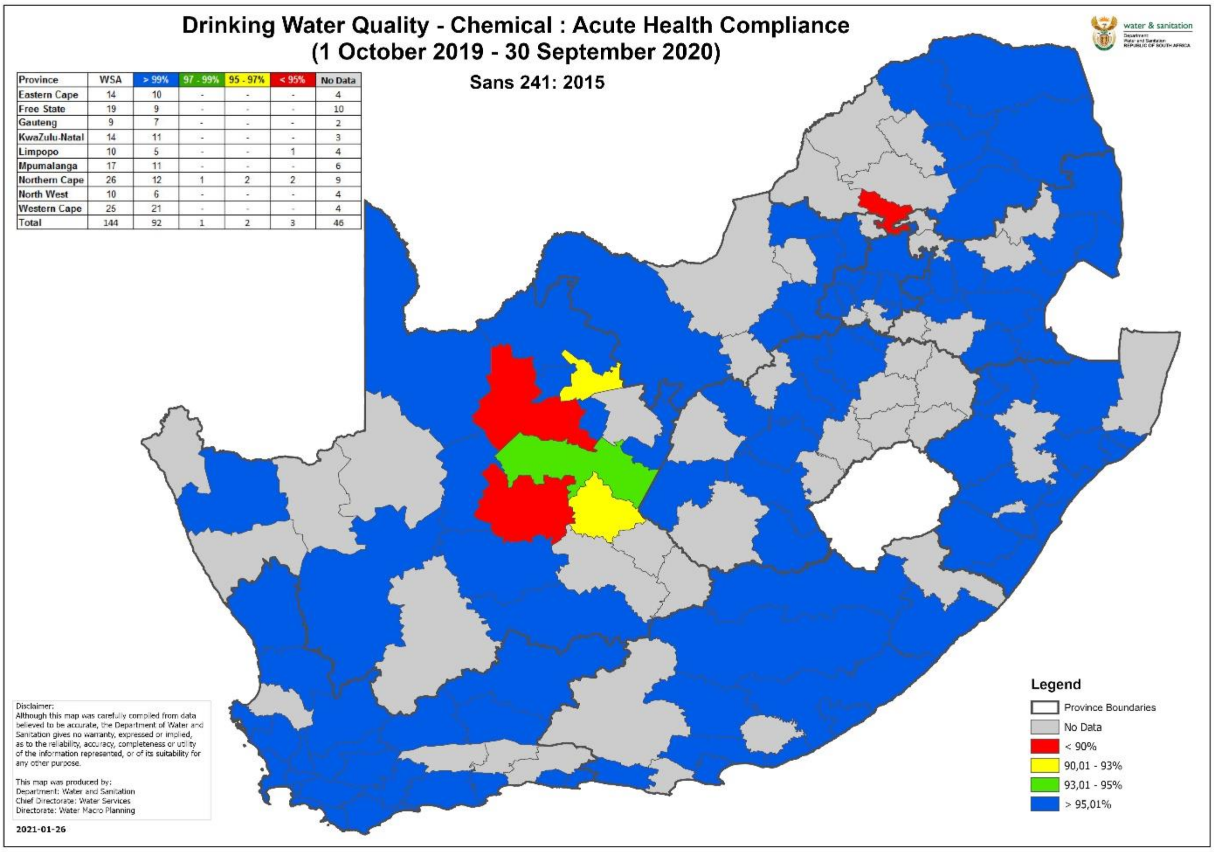
The South African National Standard for drinking water (SANS:241) prescribes the minimum numerical limits that must be met for drinking water quality to be deemed safe for human consumption. Most raw water require treatment to comply with the drinking water standards. In South Africa there are over 1 300 drinking water treatment works (WTWs), mostly owned by municipalities, but also by water boards or privately owned. There are several determinants that are taken into consideration in determining compliance which are mainly grouped into microbiological (acute), chemical (acute) and chemical (chronic). In addition, physical and aesthetic determinants are also investigated.

Compliance to drinking water standards must address the entire value chain in the water supply system including sampling and testing of water at the treatment works intake and outflow points, in the distribution pipelines, reservoirs and at the point of use as prescribed by the South African National Standard (SANS 241).

5.4.1 Chemical drinking water compliance

Chemical determinants contrary to microbiological determinants may be monitored at least once per annum for drinking water provided a risk to consumers has not been prior identified. In compliance monitoring all WSAs are required to perform a full SANS 241 as prescribed by the standard. At a minimum, for the supply system to be consider safe, drinking water must achieve a 95% chemical compliance status.

The results of the water supply systems compliance in terms of chemical drinking water quality: acute health determinants and chemical: chronic health for 12 months from October 2019 to September 2020 are presented in Figure 5.8 and Figure 5.9, respectively.



Drinking Water Quality - Chemical : Acute Health Compliance
(1 October 2019 - 30 September 2020)
Sans 241: 2015

Province	WSA	> 99%	97 - 99%	95 - 97%	< 95%	No Data
Eastern Cape	14	10	-	-	-	4
Free State	19	9	-	-	-	10
Gauteng	9	7	-	-	-	2
KwaZulu-Natal	14	11	-	-	-	3
Limpopo	10	5	-	-	1	4
Mpumalanga	17	11	-	-	-	6
Northern Cape	26	12	1	2	2	9
North West	10	6	-	-	-	4
Western Cape	25	21	-	-	-	4
Total	144	92	1	2	3	46

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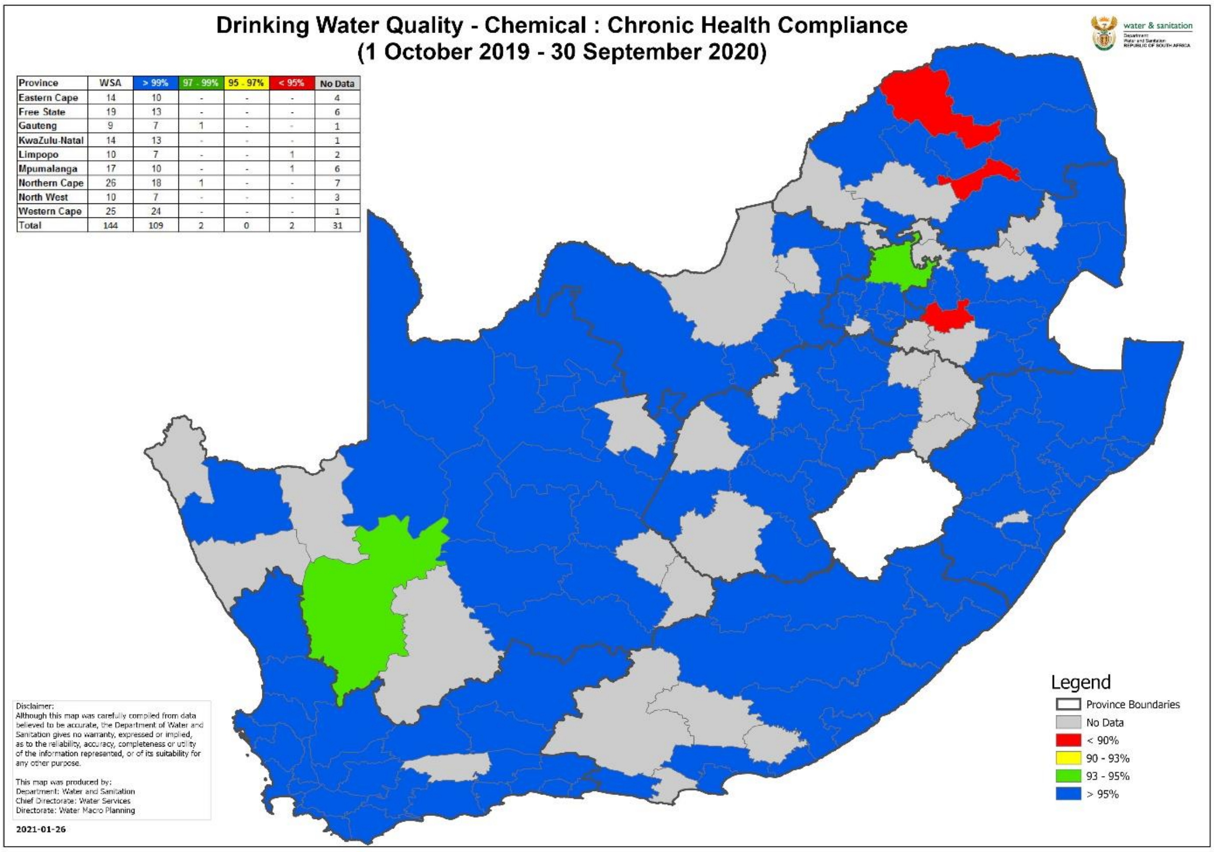
Figure 5.8 Status of drinking water chemical quality compliance: acute health



Province	WSA	> 99%	97 - 99%	95 - 97%	< 95%	No Data
Eastern Cape	14	10	-	-	-	4
Free State	19	13	-	-	-	6
Gauteng	9	7	1	-	-	1
KwaZulu-Natal	14	13	-	-	-	1
Limpopo	10	7	-	-	1	2
Mpumalanga	17	10	-	-	1	6
Northern Cape	26	18	1	-	-	7
North West	10	7	-	-	-	3
Western Cape	25	24	-	-	-	1
Total	144	109	2	0	2	31

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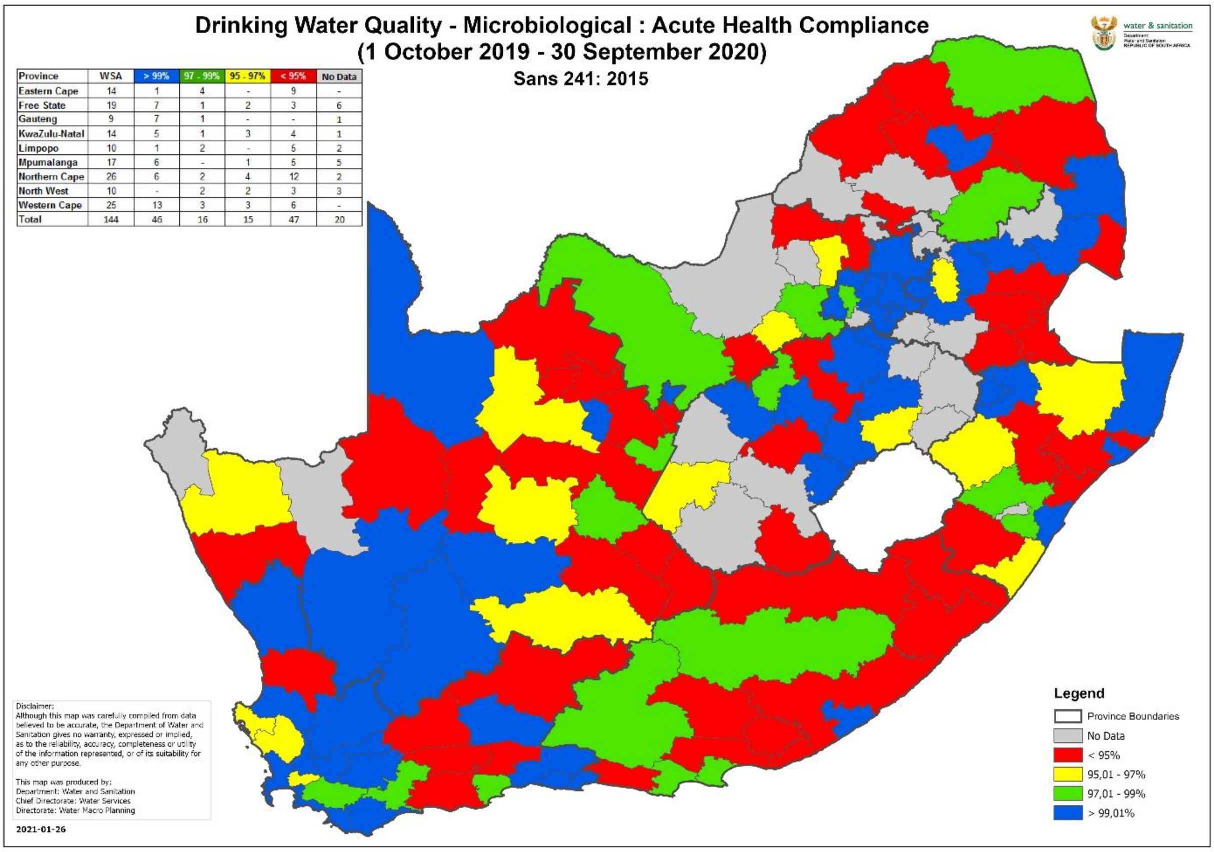
Figure 5.9 Status of drinking water chemical quality compliance: l chronic health

Most WSAs achieved acceptable compliance level (> 95%), but in cases where non-compliance was observed (< 90%), the reasons should be further investigated. A few WSA could not be assessed because they had not submitted data as required by SANS 241. The Department will continue to monitor WSA that are not reporting data as well as those that are not achieving the acceptable level of compliance.

5.4.2 Microbial drinking water Compliance

Pathogenic microbes pose serious health risk to final consumers and thus WSA/WSPs are expected to be compliant 99% of the time for all microbial indicators assessed. The results for the drinking water microbial compliance for the reporting period is presented in Figure 5.10. For the reporting period (October 2019 – September 2020), very few WSAs achieved a 99% compliance level. Most of the WSPs assessed had a compliance level below the acceptable 99% threshold. It was also noted that a few of the WSPs were not submitting their data, thus impacting on the national outlook as these WSAs could not be assessed in the absence of data.



Province	WSA	> 99%	97 - 99%	95 - 97%	< 95%	No Data
Eastern Cape	14	1	4	-	9	-
Free State	19	7	1	2	3	6
Gauteng	9	7	1	-	-	1
KwaZulu-Natal	14	5	1	3	4	1
Limpopo	10	1	2	-	5	2
Mpumalanga	17	6	-	1	5	5
Northern Cape	26	6	2	4	12	2
North West	10	-	2	2	3	3
Western Cape	25	13	3	3	6	-
Total	144	46	16	15	47	20

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Figure 5.10 Status of drinking water microbial quality compliance: l acute health

The overall results suggest a need to engage with the WSA to improve microbial drinking water quality across the country as well as the submission of results to the Department. The Department through its provincial offices, is continuously monitoring and engaging those WSAs whose microbiological compliance is below 95% including those not submitting results to the Department.

6 STATUS OF SANITATION SERVICES

The United Nations General Assembly recognized water and sanitation as a human right and acknowledged that water and sanitation are essential to the realization of all other human rights. In 2015 the South African Government, along with other members of the United Nations, endorsed the UN Sustainable Development Goals (SDGs), Agenda 2030. Sustainable Development Goal 6 (SDG 6) is dedicated to water and sanitation, with the objective to ensure availability of, and sustainable management of water and sanitation for all.

Target 6.2 of Goal 6 states that "By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations". The SDG target 6.2 has a global indicator 6.2.1 which is measured by a proportion of population using safely managed sanitation services including hand washing facility with soap and water. The global indicator 6.2.1 is defined as a population using an improved sanitation facility at the household level that is not shared with other households and where excreta is safely disposed of onsite or treated off site, including a hand washing facility with soap and water in the household.

This SDG target coincided with the South African National Development Plan (NDP) which also sets a sanitation target for provision of improved sanitation for all by 2030. With only 10 years left until 2030, the rate of sanitation service delivery will need to be accelerated if South Africa is to achieve the NDP Plan and SDG sanitation targets.

Safe and hygienic sanitation, together with potable water supply and good hygiene practices, play a significant role in preventing waterborne diseases and protecting the environment. The National Sanitation Policy of 2016 by DWS (2016) defines sanitation services as: "the collection, removal, treatment and or disposal of human excreta, and domestic public institution wastewater, and the collection, treatment and/ or disposal of municipal, agricultural, mining, and industrial wastewater"

6.1 Access to Sanitation

The South African government has over the years been involved in a massive infrastructure drive through various sanitation programmes, to address sanitation delivery backlogs in the country and to ensure that no one is left behind. The country has made a significant progress in addressing access to sanitation. The households with access to improved sanitation increased from 49% in 1996 to 83% in 2018 (STATS SA, 2019). However, there are still approximately 2.8 million households in South Africa without access to improved sanitation services.

The eradication of open defecation remains a challenge, although the country has recognized the right to basic sanitation services for all since 1997, with the promulgation of the Water Services Act. In 2018, approximately 2% of the national population practiced open defecation. A rural and urban disaggregation reveals that 4% of the population in rural areas practiced open defecation compared to 1% of the urban population (STATS SA, 2019).

There are distinct reasons as to why open defecation continues in rural and urban areas. In rural areas, open defecation likely persists because there are no sanitation facilities provided; or existing sanitation facilities are beyond their functional capacity; and the possibility that rural populations are uninformed about the dangers of open defecation (DWS, 2018). The terrain and topography in most rural areas present another challenge to sanitation services delivery. To address the sanitation backlogs, Government would need to direct focused investment in addressing some of the identified challenges. A key challenge impacting on the delivery of safe sanitation services to urban areas, especially informal settlements, is the location of settlements. Most informal settlements are usually situated on the outskirts of urban areas, and as a result cannot be connected to existing bulk and sewer services, while the cost of building new connections and sewer systems to service informal settlements most probably makes that not feasible (STATS SA, 2019). Government would need to prioritise focused investments to address the sanitation challenges in both rural and urban areas across the country.

The Figure 6.1 below indicates percentage of households with access to improved sanitation per province in 2018.

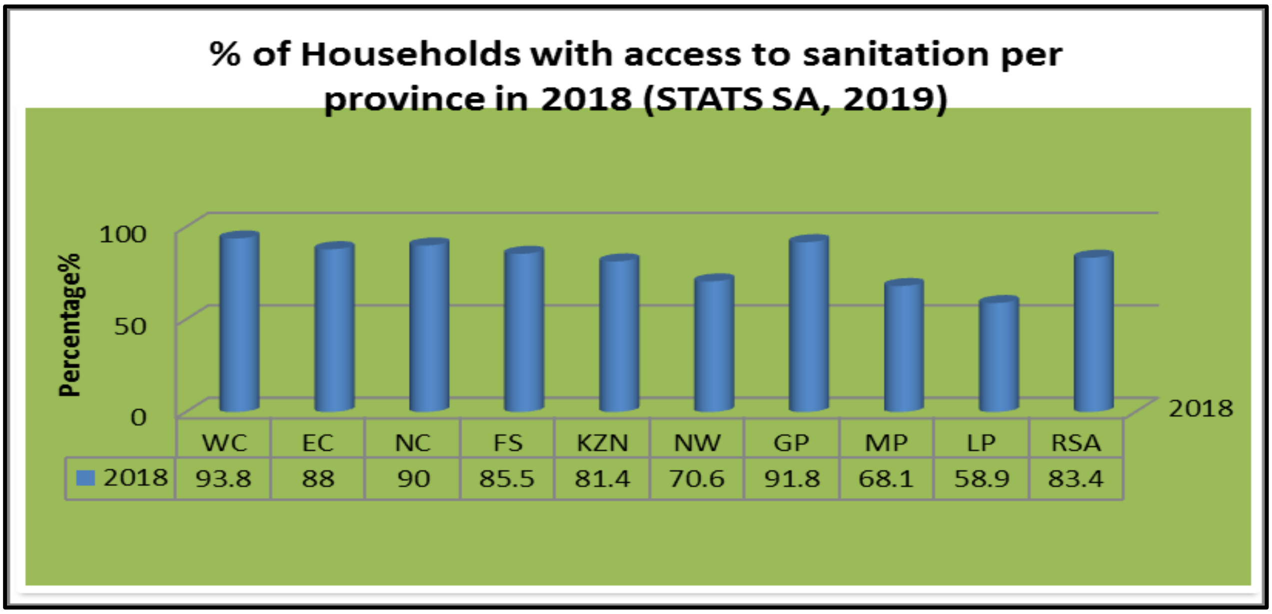


Figure 6.1 Households with access to improved sanitation per province (STATS SA, 2019)

Western Cape and Gauteng provinces had the highest coverage of sanitation services amongst all provinces. The provinces of Limpopo, North West and Mpumalanga had the least coverage. Coverage In these three provinces was less than 80%. Efforts need to be made to improve access to sanitation services in these three provinces.

Over the past 16 years, South Africa has witnessed a steady increase in access to sanitation services. Figure 6.2 shows the trend in access to improved sanitation services at the households' level per province based on latest data available for the period 2002 to 2018.

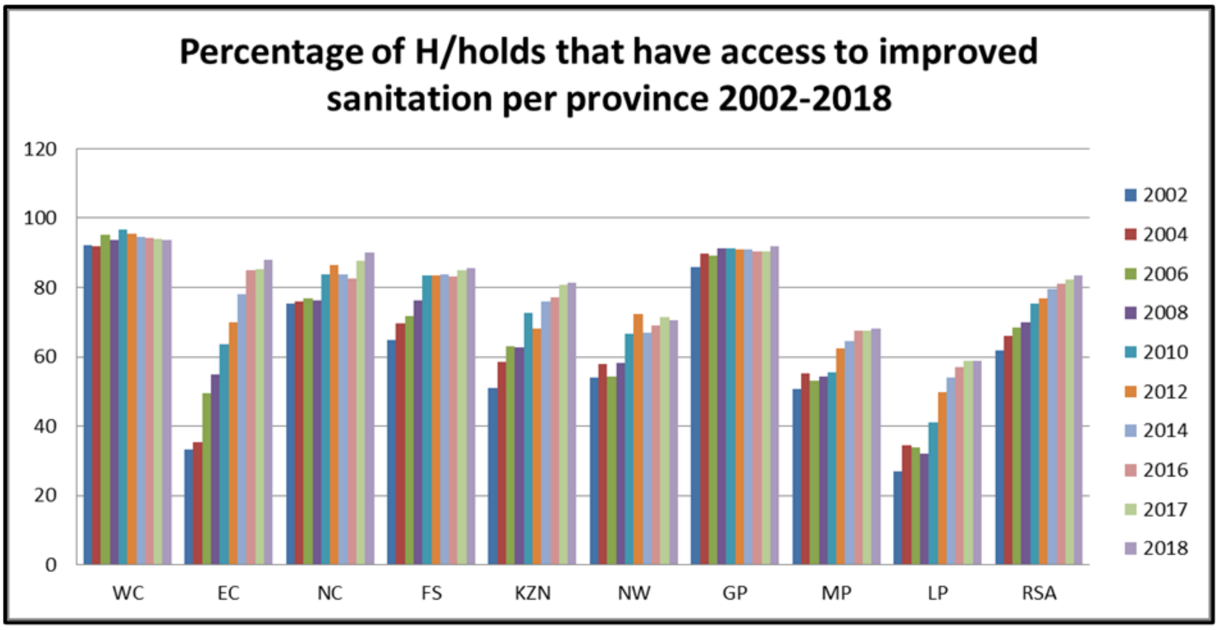


Figure 6.2 Sanitation delivery trends and Percentage of households that have access to improved sanitation per Province from 2002 – 2018

Over the past 16 years, Eastern Cape has demonstrated an accelerated delivery rate, and this may possibly be due to budget prioritisation to sanitation projects in this Province.

6.2 Sanitation Technologies used in South Africa

Sanitation technologies that can hygienically separate human excreta from human contact are referred to as *improved sanitation* technologies and include the following technologies (WHO and UNICEF, 2012):

- Flush toilet
- Connection to a piped sewer system
- Connection to a septic system
- Flush / pour-flush to a pit latrine
- Pit latrine with slab
- *Ventilated Improved Pit (VIP)* latrine
- Composting toilet.

According to the General Household Survey of 2018, in terms of technological options used in South Africa, 61% out of 83 % of all households with access to improved sanitation are served with waterborne toilets which are connected to Wastewater Treatment Works (WWTW) (Figure 6.3). Waterborne or full flush toilets depend on the availability of water to flush human excreta and transport it to a WWTW where it is treated and discharge or disposed into the environment. Typically, urbanised areas make use of flush toilets connected to a WWTW via a network of sewers.

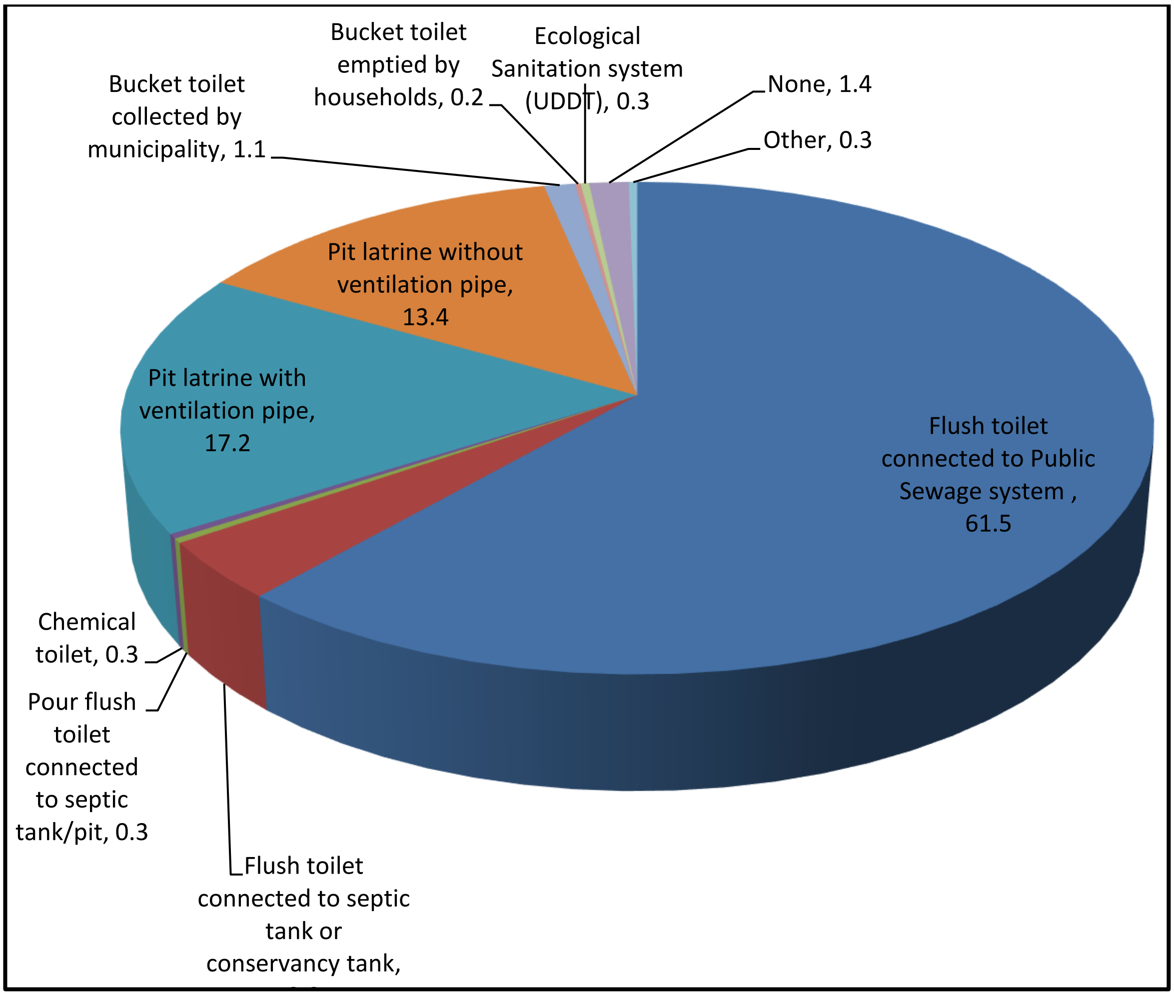


Figure 6.3 National breakdown of households using various sanitation systems

A third of the South African population relies on Ventilated Improved Pit (VIP) latrines and their variants. These dry onsite technologies offer the technical advantage of not requiring water for effective functioning. Almost 2% of households has no access to sanitation facilities, as a result they practice open defaecation.

South Africa is a water scarce country, and it is projected to have a 17% deficit between water demand and supply by 2030. Some parts of the country have already started experiencing severe drought conditions. There is an urgent need to reduce water demand by reducing reliance of sanitation services on water. To this end, the predominant flush toilets connected to Wastewater Treatment Works (WWTWs) via sewer networks is not sustainable due to their reliance on water. As an alternative, waterless (dry) sanitation systems are being promoted in unserved rural areas, resulting in a binary approach, one for the urban areas and the other for the unserved rural areas (Figure 6.4).

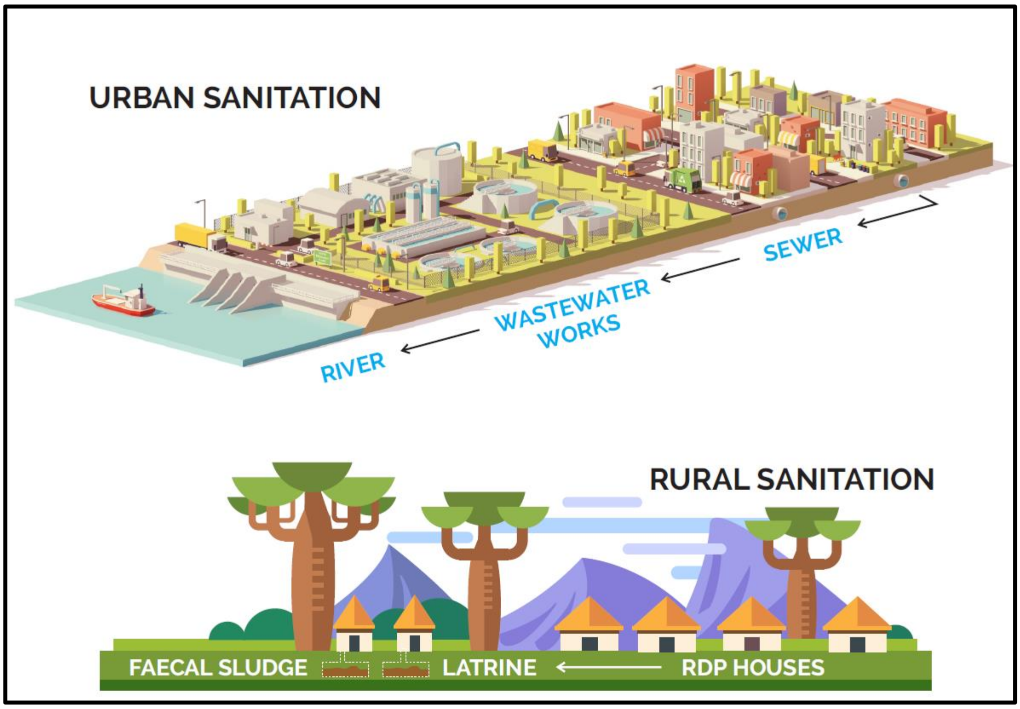
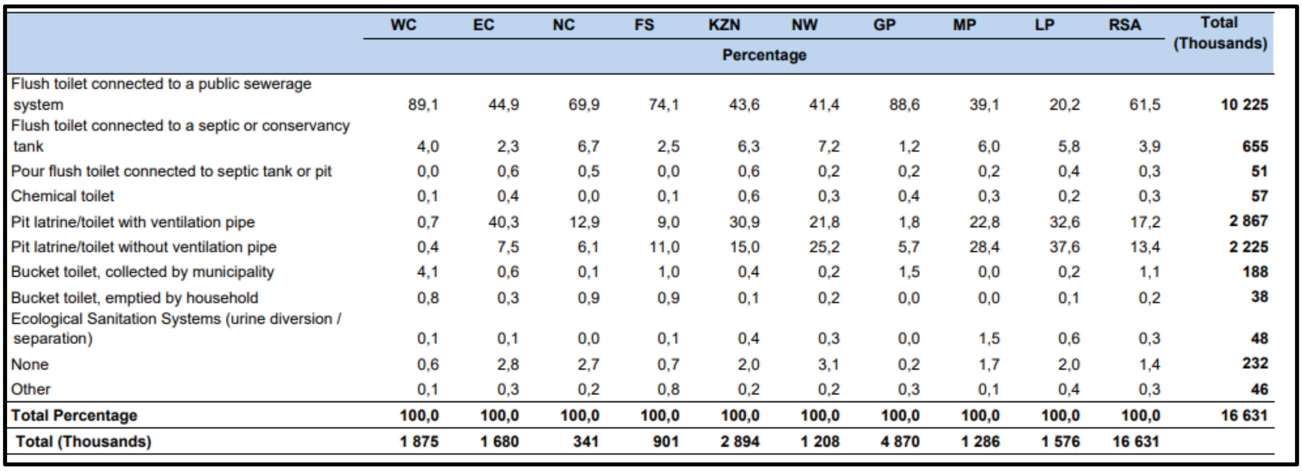


Figure 6.4 A binary engineering approach is used to deliver sanitation services, full flush systems connected by a network of sewers that leads to a WWTW, which are common in urban areas or latrine which acts as a storage vessel that subsequently requires safe emptying and disposal of faecal sludge, which are common in rural areas.

The provincial breakdown of households using the different types of sanitation system is provided in Figure 6.5.



	WC	**EC**	**NC**	**FS**	**KZN**	**NW**	**GP**	**MP**	**LP**	**RSA**	**Total (Thousands)**
	Percentage										
Flush toilet connected to a public sewerage system	89,1	44,9	69,9	74,1	43,6	41,4	88,6	39,1	20,2	61,5	**10 225**
Flush toilet connected to a septic or conservancy tank	4,0	2,3	6,7	2,5	6,3	7,2	1,2	6,0	5,8	3,9	**655**
Pour flush toilet connected to septic tank or pit	0,0	0,6	0,5	0,0	0,6	0,2	0,2	0,2	0,4	0,3	**51**
Chemical toilet	0,1	0,4	0,0	0,1	0,6	0,3	0,4	0,3	0,2	0,3	**57**
Pit latrine/toilet with ventilation pipe	0,7	40,3	12,9	9,0	30,9	21,8	1,8	22,8	32,6	17,2	**2 867**
Pit latrine/toilet without ventilation pipe	0,4	7,5	6,1	11,0	15,0	25,2	5,7	28,4	37,6	13,4	**2 225**
Bucket toilet, collected by municipality	4,1	0,6	0,1	1,0	0,4	0,2	1,5	0,0	0,2	1,1	**188**
Bucket toilet, emptied by household	0,8	0,3	0,9	0,9	0,1	0,2	0,0	0,0	0,1	0,2	**38**
Ecological Sanitation Systems (urine diversion / separation)	0,1	0,1	0,0	0,1	0,4	0,3	0,0	1,5	0,6	0,3	**48**
None	0,6	2,8	2,7	0,7	2,0	3,1	0,2	1,7	2,0	1,4	**232**
Other	0,1	0,3	0,2	0,8	0,2	0,2	0,3	0,1	0,4	0,3	**46**
Total Percentage	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**16 631**
Total (Thousands)	**1 875**	**1 680**	**341**	**901**	**2 894**	**1 208**	**4 870**	**1 286**	**1 576**	**16 631**	

Figure 6.5 Type of sanitation systems per province, (STATS SA, 2019)

As can be seen in Figure 6.5, connection of flush toilets to the public sewerage systems is most common in the urbanised provinces, namely Western Cape (89,1%) and Gauteng (88,6%). Only 26,5% of households in Limpopo had access to any type of flush toilet, the lowest of any province. In the absence of flush toilets, 70,2% of households in Limpopo used pit latrines, most (37,6%) without ventilation pipes. In the Eastern Cape, 40,3% of households used pit toilets with ventilation pipes. Only 0,3% or 48 000 households primarily used ecological toilets, also known as urine diversion/separation or composting toilets. Given the scarcity of water in South Africa, the non-sewered sanitation systems are expected to become much more common in the future.

It is evident that alternative sanitation technologies are being implemented in rural areas in provinces which have the highest number of Ventilated Improved Pit (VIPs), namely, Eastern Cape, Limpopo, and KwaZulu-Natal provinces.

6.3 Appropriate Sanitation Technologies

Given the fact that South Africa is a water scarce country, coupled with the fact that water demand has been projected to outstrip supply by the year 2030, appropriate sanitation technologies for South Africa are those that rely less on water. In this regard, the country has adopted the international standards (ISO 30500) for non-sewered sanitation systems which led to the development of SABS 30500 with support from the Gates Foundation and South African Bureau of Standards. These standards provide criteria for the safety, functionality, usability, reliability, and maintainability of non-sewered sanitation systems. It is thus expected that more non-sewered sanitation technologies would be implemented across the country in the years to come.

6.4 Operation and Maintenance of Sanitation Infrastructure

Despite significant strides made in increasing sanitation coverage, there is still a challenge in maintaining existing infrastructure which has impacted on their lifespan.

6.4.1 Households Sanitation

According to STATS SA (2019), 10% of households served with onsite sanitation technologies have their pit latrines. When pit latrines are full there is a high possibility of reverting back to open defaecation. This is a challenge that needs to be urgently addressed because full pit latrines can pose public health risk to communities. To avoid a situation where full pit latrines are left, there is a need to pay attention to the maintenance and operation needs of onsite sanitation technologies. In the past the operation and maintenance of onsite sanitation technologies have not been given much attention when compared to offsite sanitation systems such as Wastewater Treatment Works (WWTW). The first generation of Ventilated Improved Pit toilets are now getting full, and most WSAs have challenges with emptying, transporting, treating, and disposing faecal sludge from full pits.

The Department of Water and Sanitation in collaboration with USAID Resilient Water Programme has commenced the development of the National Faecal Sludge Management Strategy for on-site sanitation. The Strategy will guide the sector on the safe management of faecal sludge to prevent ground water contamination, to safeguard public health and protects the environment from pollution throughout the sanitation service chain.

It needs to be noted that South Africa has embraced the reality that sanitation has an economic value and is currently exploring approaches of expanding sanitation economic opportunities throughout the entire sanitation service value chain. Faecal sludge management presents an opportunity to recover resources from human waste to produce by-products such organic compost, biochar, and biogas.

To promote the safe management of onsite, non-sewered sanitation service, The World Health Organisation (WHO) has introduced the Sanitation Services Value Chain (SSVC). The SSVC is aligned to the SDG 6, which seeks to promote safety and hygiene practices regarding sanitation services delivery. Figure 6.6 shows the Sanitation Service Value Chain for non-sewered sanitation.

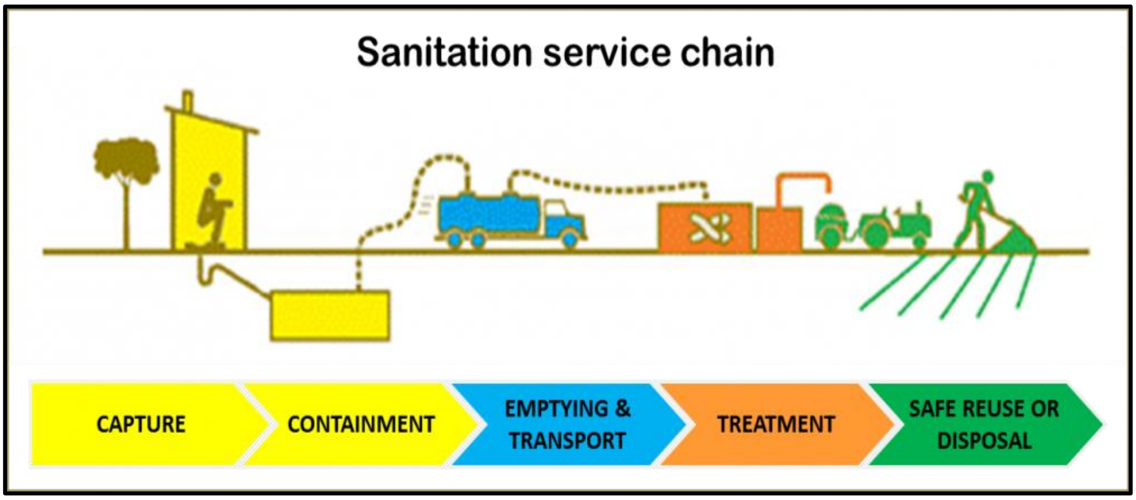


Figure 6.6 Sanitation Value Chain for non-sewered Sanitation (source: Reserchgate.net)

Each stage of the sanitation service value chain presents economic and job creation opportunities over the short to long term. The sanitation values chain stages are explained in detail below:

a) Capture and Containment Stage

The capture and containment stage is made of technologies design the retain, and store sanitation related waste such as human faeces. Examples of such facilities/technologies are Ventilated Improved Pit (VIP) toilets, Double VIPs, Septic Tanks and Urine Diversion systems.

b) Emptying and Transportation Stage

This stage involves the safe emptying of full pits /tanks and safe transportation of faecal sludge for offsite treatment, and/or beneficial use or disposal. The commonly used methods of pit emptying are manual or motorised (vacuum trucks) emptying.

c) Treatment and Safe Reuse of Faecal Sludge stages

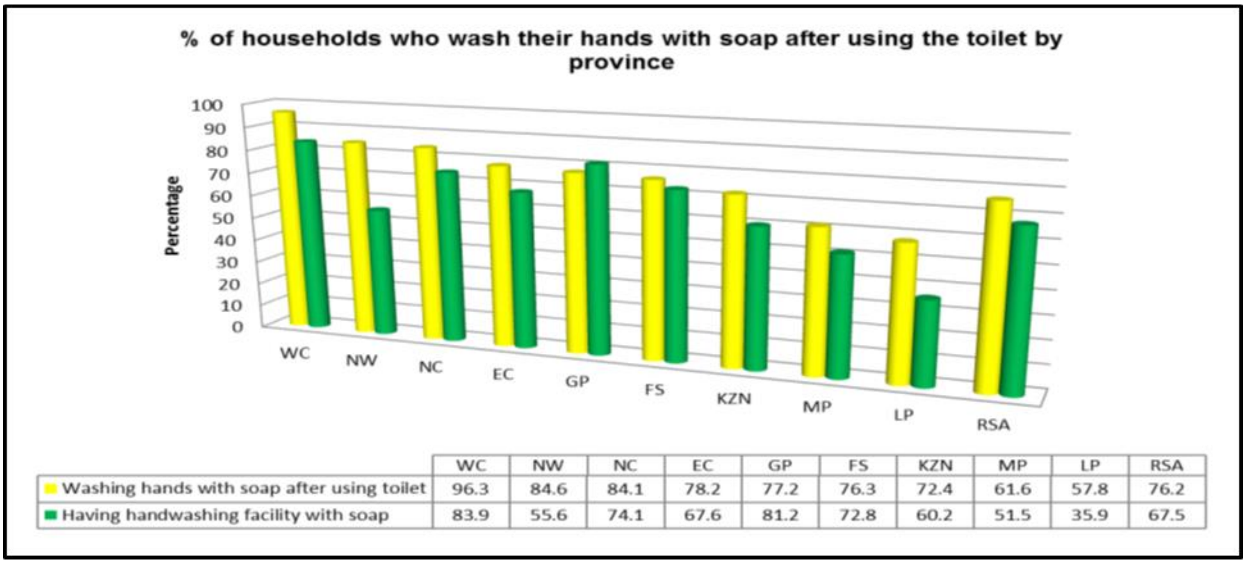
This stage involves the treatment of faecal sludge so that it is of good quality and fit for purpose for the intended beneficial use or disposal.

Over the years the focus on sanitation has been to ensure access to the un-served communities and minimum focus was given to operation and maintenance especially of on-site sanitation such as Ventilated Improved Pit toilets.

6.5 Hygiene and User Education

Hand washing with soap and water is widely recognized as a top priority for reducing disease transmission, and South Africa has started tracking the level of hygiene as of 2018. The SDG target 6.2 also highlights the importance of hygiene and calls for special attention to the needs of women and girls. Indicator 6.2.1 measures the percentage of the population using safely managed sanitation services, including a hand-washing facility with soap and water. This is being measured by the proportion of the population using an improved basic sanitation facility at the household level, which is not shared with other households and where excreta are safely disposed in situ or treated off-site.

The National Sanitation Policy (2016) requires that the provision of sanitation services includes hygiene and end user education to ensure behavioural change that would break the cycle of sanitation-related diseases and to ensure the sustainability of sanitation facility. Figure 6.7 indicates the state of hygiene in the country as of 2018



	WC	NW	NC	EC	GP	FS	KZN	MP	LP	RSA
🟨 Washing hands with soap after using toilet	96.3	84.6	84.1	78.2	77.2	76.3	72.4	61.6	57.8	76.2
🟩 Having handwashing facility with soap	83.9	55.6	74.1	67.6	81.2	72.8	60.2	51.5	35.9	67.5

Figure 6.7 Percentage of households with handwashing facility with soap as well as those who wash their hands with soap after using the toilet.

It is concerning that 5 out of 9 provinces, have less than 70% of households with hand washing facilities and soap. In Mpumalanga and Limpopo provinces the households that wash hands with water and soap after using a toilet were below 65%. The situation in which much of the population do not wash hands with water and soap after using a toilet calls for strengthening of hygiene promotion, awareness, and education programmes in the country.

6.6 School Sanitation

In August 2018, President Cyril Ramaphosa launched the Sanitation Appropriate for Education (SAFE) programme and called upon the private sector to partner with Government to find innovative solutions to accelerate safe sanitation in schools. The primary objective of the SAFE initiative is to replace basic pit toilets with appropriate sanitation in accordance with the Norms and Standards for school infrastructure. The sanitation needs of schools in the country are diverse but can be summarised as i) providing sanitation services to school where these are absent, ii) maintaining onsite sanitation infrastructure where these are available, iii) removing onsite sanitation facilities where offsite sanitation services are being provided, iv) replacing sanitation facilities that are not fit for purpose, and v) expanding sanitation facilities where these are inadequate.

Table 6-1 shows the status of sanitation services in schools across the country. Out of 10 661 schools in the country, 3 898 (36.6%) of schools have pit latrines and unacceptable sanitation facilities. The poor sanitation services coverage in schools in the Republic is a cause for concern, particularly regarding the health of learners. The implication is that urgent intervention measures need to be taken to address and eradicate the sanitation backlogs in schools, particularly those in rural areas (DBE, 2018).

Table 6-1 Sanitation services status in schools in South Africa (source: DBE, 2018).

Province	**Number of Schools**	**Pit Latrines Girls Basin**		**Grade R**	**Insufficient Sanitation**
		Schools with Pit latrines only and Unacceptable sanitation	**Schools with proper sanitation but pits not demolished**	**School that needs safe sanitation for Grade R**	**Schools requiring additional seats**
Eastern Cape	3157	1598	323	2810	216
Free State	223	156	42	209	40
Gauteng	747	0	5	325	435
Kwa Zulu Natal	2842	1365	1477	2001	59
Limpopo	1360	507	853	400	614

Mpumalanga	1111	127	278	740	206
North West	192	145	47	189	119
Northern Cape	373	0	15	118	240
Western Cape	656	0	0	482	174
Totals	**10 661**	**3898**	**3040**	**7274**	**2103**

6.7 Recommended interventions for Sanitation Services

To accelerate the coverage of sanitation services in response of the provisions of the NDP and to meet the SDG 6.2 targets the following are recommended:

- Develop and implement a National Sanitation Integrated Plan to fast-track coverage of sanitation services in the country.
- Invest in research and innovation aimed at accelerating uptake of alternative, water efficient sanitation technologies. This should be done as a collaborative endeavor between the Department of Science and Technology, Water Research Commission, and other sector partners.
- Develop and implement a National Faecal Sludge Management Strategy for non sewered systems to ensure the safe management of sanitation services along the entire value chain.
- Explore an approach of expanding sanitation economic opportunities for the entire sanitation service value chain.
- Strengthen hygiene promotion, awareness and education across the country. Integrate hygiene education and menstrual health in sanitation programmes to maximize health benefits for learners.
- Strengthen f monitoring and evaluation of sanitation projects and adopt an open learning approach.

7 INTERVENTION PLANS AND INITIATIVES

7.1 Algoa Water Supply System

More than sixty potential interventions, which could contribute to meeting the future water requirements of the Algoa Water Supply System (WSS), were initially identified. Preliminary screening of potential interventions was then done based on set criteria. Table 7-1 gives interventions that are currently being considered.

Table 7-1 Algoa Water Supply System Intervention plans considered

Scheme	Description
Municipal Water Conservation/Water Demand Management (WC/WDM)	Continued roll-out of a WC/WDM programme, preferably being controlled by a full-time WC/WDM manager, being the implementation of a well-formulated and funded WC/WDM strategy and programme. Besides WC/WDM in the Nelson Mandela Bay Metropolitan Municipality (NMBMM), this is also required for especially the Kouga Local Municipality.
Rainwater harvesting	Collection of rainwater from roofs, primarily for toilet flushing, or to supplement garden watering. This normally entails promotion by a municipality or enforcement through the promulgation of a bylaw.
Removal of Invasive Alien Plants (IAPs)	Programmes to remove IAPs in the catchments of the Kromme, Kouga and Baviaanskloof rivers, which is already being done on a large scale.
Re-use of water treated to industrial standards – Fish Water Flats WWTW	Re-use of treated water from the Fish Water Flats Wastewater Treatment Works (WWTW), to meet requirements for industrial quality water within the Coega SEZ.
Re-use of water treated to industrial standards – Coega WWTW	Re-use of treated water from the future Coega WWTW, to meet requirements for industrial (non-potable) quality water within the Coega SEZ.

Re-use of water treated to potable standards	Potable re-use of treated water from the Fish Water Flats (and possibly Uitenhage and Despatch WWTWs) through reverse osmosis treatment, storage in Loerie Dam, or in a proposed new dam at Echodale on the Elands River, and treatment at a new Water Treatment Works (WTW).
Lower Sundays River Irrigation return flow	Abstraction of irrigation return flows in the Sundays River downstream of the Sundays River Water User Associations (WUA) irrigation development, low-pressure desalination, and blending at Olifantskop reservoirs with treated Orange River water supplied from the Nooitgedagt WTW.
Desalination of seawater	Supply via a bulk seawater intake system and pumping of seawater via pipeline to a proposed reverse osmosis plant site. Such a scheme can easily be phased. Potential schemes for NMBM, Coega SEZ and sea salt producers have been identified. A seawater desalination plant that can be sited at the old Swartkops Power Station and will discharge brine via the existing sea outfall of the Fishwater Flats WWTW is a drought mitigation backup option.
Groundwater schemes	Implementation of the South-Eastern Coega Fault groundwater scheme is underway. In addition, groundwater schemes can be implemented at Churchill Dam, Moregrove Fault, Bushy Park, Jeffreys Arch, Van Stadens River Mouth, Gamtoos Valley, Kruisrivier and other new groundwater schemes. Some of these schemes could either supply NMBM or alternatively supply small coastal towns, freeing up water for NMBM. Groundwater interventions are in various stages of implementation, as emergency drought measures. As fracking is a new technology, no fracking interventions have been identified.
Orange River Project/ Nooitgedagt Low-Level Scheme	This entails increased supply from the Orange River to NMBM, supplied from the Nooitgedagt WTW, via a new pipeline to the Olifantskop Reservoir. This scheme also offers significant energy savings on account of the reduced pumping heads needed. DWS issued a licence to NMBM to abstract a total of 58.3 million m3/a of water from the Orange River, with the proviso that the licence could be reduced back to 22 million m3/a after 20 years (by 2031). However, NMBM has requested that the licence be made permanent on

	account of the high capital investment. Implementation of the third phase of the scheme is underway. The potential for further allocation of transferred Orange River water, in line with potential efficiency savings, to be obtained along the Orange Free State (OFS) transfer route has been considered, and can be considered further, depending on the success of efficiency measures introduced. An additional allocation of 18.25 million m3/a has been recommended, to be made available from water saved through efficiency measures introduced, which could potentially be developed as a Phase 4 of the Nooitgedagt Low Level Scheme.
Guernakop Dam on the Kouga River	Construction of a new 83 m high rollcrete dam at Guernakop, approximately 15 km upstream of the upper end of Kouga Dam on the Kouga River and doubling of the capacities of the Loerie WTW and the pipelines to NMBM.
Raising Kouga Dam on the Kouga River (replacement and raising)	Construction of a mass gravity rollcrete dam immediately downstream of the existing Kouga Dam and doubling of the capacities of the Loerie WTW and the pipelines to NMBM.

7.2 Recommendations

The recommendations following from the assessment of the current water requirements and updated scenario planning are:

7.2.1 Studies

- DWS should complete the Eastern Cape Verification and Validation Study, to be followed by a Water Availability Assessment Study (WAAS), including irrigation and urban uses, to address uncertainty regarding the hydrology and assurance of supply of the Baviaans, Kouga and Kromme rivers, which feed into the different supply dams.
- When the Algoa WSS analysis is updated with the updated hydrological information, the priority classes for different category water users (drought planning rules) should be revisited.
- While the NMBM has made good progress with the implementation of their WC/WDM strategy during the past year, there is room for improvement. WC/WDM should receive more prominence but the current funding model for WC/WDM is a constraint.

- To ensure that there are no bottlenecks regarding the transfer of additional Orange River water to NMBM, DWS should complete the investigation into the balancing requirements and conveyance infrastructure in the transfer between the abstraction point in the Sundays River and the Nooitgedagt treatment works as soon as possible.
- DWS should initiate a study to develop a strategy for the implementation of the Reserve for existing Algoa WSS dams.
- DWS should initiate an impact assessment study to determine the expected regional impact of climate change on the Algoa WSS water balance, once improved hydrological information is available.

7.2.2 Licensing

- NMBM should submit a water use licence application to DWS for the additional water use from Loerie Dam.
- NMBM should submit a water use licence application to DWS for additional Orange River water use of 18.25 million m^3/a (50Mℓ/d).
- DWS should make recommendations on any additional allocation of Orange River water that can be made to NMBM or to other water users in the Eastern Cape Province, in lieu of achieved water efficiency savings of transferred Orange River water, and the conditions under which this would be allocated.
- DWS should evaluate implications if the NMBM's total 22.81 million m^3/a unrestricted allocation at 98% from Kouga Dam is reduced to 12 million m^3/a (or an alternative volume), which will allow the GIB to supply its last user on the main canal, offset by an allocation of similar yield to NMBM, out of efficiency savings in the Orange Fish Sundays system. Cost, operational and other implications and options should be assessed, such as to reduce allocation from the sub-system to reduce stress on the sub-system.

7.2.3 Augmentation

- DWS (and their implementing agent Amatola Water) should complete the implementation of the Nooitgedagt Low-level Scheme Phase 3.
- NMBM and Kouga LM should continue with groundwater evaluations and implementation of groundwater schemes, particularly those schemes that are close to and easily integrated into the existing WSS infrastructure. Groundwater initiatives the Kouga LM will further aim to make the various small towns less reliant on surface water supply. Potential groundwater yields should be updated when additional information becomes available.
- NMBM should continue with the implementation of re-use schemes for supplying the potable and industrial requirements of the Coega SEZ. They should ensure implementation-readiness for water re-use and implementation from the Fish Water Flats WWTW and the planned Coega WWTW, within the constraints of available development funds, and the emergence of a major water user in the

Coega SEZ. At some point though, if the Coega SEZ does not realise its potential, it may need to be considered whether the re-use schemes should be used to supply NMBM, although the danger is that the viability of the SEZ can be jeopardised if the effluent is used elsewhere.

- DWS should keep the comparative costs and potential impacts of the 'raised' Kouga Dam and the Guernakop Dam updated, especially for comparison with seawater desalination as a long-term augmentation option, considering that an EIA application for a 60 Mℓ/d desalination plant has already been granted to CDC by DEA.
- NMBM should continue with the feasibility study on seawater desalination and keep abreast of development plans at the Coega SEZ and a potential associated desalination plant, and the Marina Sea Salt Desalination scheme.
- DWS should evaluate the Lower Sundays River Return Flows scheme at a more detailed reconnaissance or pre-feasibility level. This should be followed by a Feasibility-level Study by NMBM, as this could be one of the next interventions to be considered for implementation. It should timeously be established whether this scheme is worth pursuing further.

7.2.4 Efficiency

- The DWS should monitor achieved water efficiency savings of transferred Orange River water to the Eastern Cape, to follow from more efficient conveyance and operational releases of transferred water, as well as more efficient water use by irrigation.
- NMBM and small towns should continue monitoring the success of implementation of their WC/WDM interventions.

7.2.5 Operations and Monitoring

- Clearing of invasive alien plants in the catchments of the Algoa WSS dams by the Gamtoos Irrigation Board should and will continue.
- DWS is responsible for monitoring of water availability and will continue to monitor the quantity and quality of the Sundays River WUA return flows.

7.2.6 Scenario Planning

- The high-growth water requirement scenario will be used as basis for future scenario planning. Water requirements must be monitored, and the projected water requirement curves should be updated if the current assumptions used are deemed to be no longer valid. Future water requirement curves will be projected from the latest annual water use available, but this approach must be carefully considered and potentially adjusted during drought years. It is further important that the planning forecasts of NMBM and DWS respectively is regularly aligned.
- Monitor progress with the decision of where the next nuclear power plant will be located, and its implementation planning, if it will be located at Thyspunt.

7.3 Western Cape WSS

With the easing of the severe water restrictions from the 2018/19 hydrological, the average per capita consumption started to recover to the pre-drought levels. In some municipalities such as Swartland and Bergrivier Municipalities, the average per capita consumption is now at pre-drought levels, while other municipalities have seen a significant recovery as evaluated by the average per capita consumption. The average per capita consumption of the WCWSS in the 2019/20 hydrological has recovered to 67% of the average per capita consumption at pre-drought levels. The recovery could have been much higher but for the fact that the City of Cape Town maintained a 30% restriction on its consumers in the last hydrological year. This included their bulk consumers in the Stellenbosch and Drakenstein Municipalities.

The water uses by irrigated agriculture in the current 2019/20 hydrological year showed that it had significantly recovered. The releases for irrigation water use in the WCWSS in the current hydrological year increased to approximately 96% of the total allocation for irrigation when the environmental releases of 16 million m^3/a are excluded. During drought, agriculture started replacing the mature trees with young trees which required less water but more critical in water placement particularly in the first year. With the post-drought, the developing trees account for an expanding canopy and enlarging root zone. The increasing leaf area demands more water because of the water loss through stomata increases

The WCWSS will be in deficit soon because the available water supplies cannot meet the growing water requirements from the system at the required level of assurance of supply of 97% for domestic and industries and 91% for the agriculture sector. At this stage the estimated future impact of climate change on the yield of the WCWSS is small but nevertheless requires that the WCWSS identify and develop water augmentation options that reflect the need to be climate resilient and climate change adaptable to mitigate against more substantial effects of climate change. To ensure the ongoing reconciliation between supply and requirement, it is imperative that the municipalities and in particular the City of Cape Town (CoCT) implement their committed augmentation programmes. The implementation of City of Cape Town's Water Strategy is crucial as the future water requirement forecasts illustrate that 84% of the additional water requirements is in the area of jurisdiction of the City of Cape Town.

Several water augmentations options that the various institutional stakeholders have identified and committed to implement. These include but are not limited to the following:

(i) Development of groundwater by the City of Cape Town and the other municipalities in the WCWSS. Groundwater development was initially intended only to mitigate against the most recent drought. However, this will become part of the climate resilient and adaptation programme for the WCWSS, although groundwater is also weather and climate change dependent.

(ii) Development of water re-use and desalination of seawater. The CoCT is currently implementing a 70 Mℓ/d water reclamation plant at Zandvliet WWTW. The treated water will be pumped to the Faure WTW where it will be blended and further treated. Because wastewater at coastal towns does not have downstream demands and is mainly discharged to the sea, there is a strong argument to be made that wastewater reuse should be a component of the coastal towns' future source of water supply. The hydrological risk of utilising this resource is low compared to surface water resources. On the other hand, desalination of seawater is independent of rainfall, i.e., it has no hydrological risk. This is the other source of supply for coastal towns in the WCWSS. Although the cost of seawater desalination is higher, it partly reflects the absence of hydrological risk.

(iii) Development of surface water resources. The BRVAS Phase 1 is currently in the implementation phase. The Lower Berg River is under water stress and the scheme is urgently required to address the reliability of water supply in the lower catchment. The current deficit is estimated at 10.1 million m^3/a at a mixed assurance of supply. This however depends on whether all the users including agriculture agree to an uptake of the scheme.

7.4 Richards Bay WSS

The Department of Water and Sanitation (DWS) commissioned a study on the Water Reconciliation Strategy for Richards Bay and Surrounding Towns (2013-2015) to inform the planning and implementation of water resource management interventions necessary to reconcile future water requirements and water use patterns up to a period of thirty years until 2044. These interventions are given in Table 7-2.

Table 7-2 Richards Bay intervention plans

Intervention	Target Date (priority)
WCWDM	High priority, implementation to continue/start immediately City of Mhlatuze (CoM): 10% savings, reduction in growth by 2025 King Cetshwayo District Municipality (KCDM): 15% savings, reduction in growth by 2025
Maintain existing Thukela Transfer scheme	Immediate and ongoing
Complete Thukela Transfer upgrade from Middeldrift	High priority (December 2023)
Water Reuse	Medium priority level (2032)
Interim Restriction Rule to Benefit Priority (Primary) Users	Immediate and ongoing

Intervention	Target Date (priority)
Efficient system operation	Immediate and ongoing
Existing Dam Raising	Low priority (2035)
New Dam Construction	Low priority (dam construction) (2038) Medium priority (feasibility study)
Lower Thukela Transfer to KCDM	High priority
Remove alien vegetation	Immediate and ongoing

7.5 Mbombela WSS

The Mbombela WSS is covered by the Crocodile (East) and Sabie Sub-catchments. There are two major dams for the system, which are the Inyaka in the Bushbuckridge and Kwena Dam in the Thaba Chweu Local Municiplaity, as well as smaller dams in the City of Mbombela (CoM) local municipality such as Witklip Dam, Longmere Dam, Klipkopje Dam, Primkop Dam and Da Gama Dam. The Sappi Ngodwana Mill is a major industrial water user in the Crocodile (East) sub-catchment, which abstracts water from the Ngodwana Dam, on the Ngodwana River, and obtains additional water supply from former irrigation licenses. Other major industrial water users are the TSB Malelane sugar mill in Nkomazi local municipality in the Lower Crocodile (East) Tertiary Catchment and smaller mining operations in the former Umjindi local municipality.

The largest water user in the Crocodile (East) sub-catchment is the irrigation sector (467 million m^3/a), followed by commercial afforestation (158 million m^3/a). The shared watercourses with Mozambique are regulated by an international water sharing agreement. There are water transfers from the neighbouring Komati catchment to support the towns of Barberton and Shiyalongubo. There is also a transfer from the Sabie Sub- Catchment to the Crocodile (East) sub-catchment to support the Nsikazi North demand centre.

7.5.1 Water Requirements:

Irrigation is a significant user of water that uses about 54% of water, 22% for afforestation, 13% for Urban-Industrial, 6% for IAPs and 5% for the environment. The international Obligations exist for the Crocodile and Sabie Rivers. The requirements are stipulated in the Interim Inko-Maputo Water Use Agreement (TPTC 2002). A minimum requirement of 37 million m^3/annum (1.17 m^3/s) is to cross the border into Mozambique. 0.6 m^3/s is the required minimum flow from the Sabie River to cross the border.

7.5.2 Water Resources Availability:

Groundwater

While some localized use of groundwater exists within the catchments, it is generally accepted that groundwater abstraction on a large scale is not a viable option in the Middle Crocodile, City of Mbombela (Nelspruit) and White River, due to high river flow reductions and drawdown during drought conditions (Mussá et al., 2015). Some potential exists in the Kaap and Lower Crocodile, however this is not where the large domestic demands are located. Groundwater is used in the Bushbuckridge local municipality, however, there are many boreholes which are unused, destroyed, not working and blocked.

Hydrology

Surface water runoff is the main source of water for users within the Crocodile and Sabie catchments. The Crocodile system contains one major dam which is in the upper reaches of the catchment. It provided water to users distributed along a lengthy stretch of downstream of the Kwena Dam. The yield is influenced by size of abstraction and location of the users in the system. In the Sabie River, major dam used is Inyaka and it supplies user in Sabie and Sand catchments through the Bushbuckridge Transfer Pipeline.

7.5.3 Water Conservation and Water Demand Management:

A strategy was developed for WCWDM in the Mbombela WSS, and this strategy looked at infrastructure options that remain listed for further consideration such as the small dams within the Crocodile and Sabie catchment.

7.5.4 Action Plan:

Intervention to be taken are WCWDM, reduce canal loses, remove alien vegetation, water use entitlement exchange from irrigation to urban, eliminating unlawful uses and compulsory licensing. Interventions are not limited to water re-use as also taken into consideration, interim restriction rule to benefit priority (primary) users, efficient system operation, groundwater development and new dam construction and existing dam raising such as raising of the Promkop Dam and the water releases from Ngodwana Dam.

7.6 Integrated Vaal River System

The water balance projection confirms the following interventions are to be implemented to ensure sufficient water is made available to users receiving water from the Integrated Vaal River System (IVRS):

- Implement the LHWP Phase 2.
- Mine water effluent treatment first step is the recalibration of the decisions support model.
- Water re-use project of up to 50 million m^3/a is implemented in the next 3 years (Tshwane reuse project or another equivalent scheme).

- WC/WDM measures to achieve the Project 15% target savings.
- Optimal operation of Thukela-Vaal transfer scheme.
- Remove unlawful water use, focusing on the irrigation sector.
- Implement yield replacement scheme in ORS.
- Timeously implementation of water use restrictions during drought.
- WCWDM strategic programs such as bulk metering, active leakage detection, pressure management, pipe replacement, retrofitting and removal of wasteful devices, and consumer education and awareness programmes.

8 INFRASTRUCTURE DEVELOPMENT

In most instances, infrastructure is increasingly ageing and becoming dis-functional. Aged infrastructure results in huge water losses and problematic water backlogs. Responsibility for infrastructure renewal lies with the IBOM unit of the Department, which is also responsible for the management of Government Water Schemes (GWSs). Several strategic water resource infrastructure projects were implemented during the period of reporting.

8.1 Augmentation Projects Progress

This section aims to give progress on the augmentation projects that are being implemented by the infrastructure development unit of DWS at the end of the reporting period - September 2020.

The following projects are at construction phase:

Table 8-1 Augmentation Projects

PROJECTS AT CLOSE-OUT PHASE			
No.	Project Name	Project Start Date	Completion Date
1.1	De Hoop Dam	2004	October 2018
PROJECTS AT CONSTRUCTION PHASE			
No.	Project Name	Project Start Date	Estimated Completion Date
2.1	Raising of Hazelmere Dam	April 2014	August 2021
2.2	Raising of Tzaneen Dam	February 2016	August 2022
2.3	Raising of Clanwilliam Dam	2014	April 2025
PROJECTS AT DESIGN PHASE			
No.	Project Name	Project Start Date	Estimated Completion Date
3.1	Nwamitwa Dam	October 2015	*tbc*
3.2	ORWRDP 2D	March 2015	October 2023

3.3	ORWRDP 2E & 2F	April 2015	March 2025
3.4	Cwabeni OCS Dam	June 2017	*tbc*
3.5	Zalu Dam	April 2018	*tbc*
PROJECTS AT PREPARATION PHASE			
No.	Project Name	Project Start Date	Estimated Completion Date
4.1	Stephen Dlamini Dam	2013	*tbc*
4.2	Foxwood Dam	*tbc*	*tbc*
OPERATIONAL PROJECTS			
No	Project Name	Project Start Date	Completion Date
5.1	De Hoop Dam	April 2020	March 2021
EXTERNAL PROJECTS			
No	Project Name		
6.1	TCTA Projects		

8.1.1 Projects at close-out phase

De Hoop Dam

Project Description:

Phase 2 of the Olifants River Water Resources Development Project (ORWRDP – 2) involves the development of additional water resource infrastructure consisting of the De Hoop Dam on the Steelpoort River.

Progress:

The taking over certificate was signed off in October 2018 and the installations have been handed over to DWS. Work by Construction Unit to address outstanding snags is continuing. The tender for the passenger lift was awarded in January 2020. A service level Agreement has been prepared for signing between DWS and the contractor. No budget has been allocated for the project in the current financial year.

8.1.2 Projects at construction phase

Raising of Hazelmere Dam

Project Description:

The project for the raising of Hazelmere Dam is aimed to augment the water supply to the KZN North Coast by raising the dam wall by 7 metres to increase the yield of the dam for medium term supply. The scope of the work includes the construction of a Piano Key Weir on the spillway, the installation of rock anchors, founding grouting and other minor works.

Progress:

The grouting curtain is 100% complete. Phased impoundment was achieved in January 2017 and the water level is maintained below the 88 masl level. To date (2020), 73 anchors have been installed and stressed. The 10 remaining anchors cannot be stressed until the load cell installations are complete.

The Piano Key Weir construction is complete. The SLAs for the Professional Service Provider (PSP) and the ECO for the completion of the works have been signed. The SLA for the contractor is being finalised.

Raising of Tzaneen Dam

The project for the raising of Tzaneen Dam is aimed at augmenting the water supply in the region by raising the dam wall by 3 metres to increase the yield of the dam to address water shortages. The scope of the work includes the demolition of the top of the existing spillway, construction of a labyrinth spillway and other minor works.

Progress:

The demolition works are complete. The establishment of a project management Office for the Raising of Tzaneen Dam has been initiated. The appointment of the Approved Professional Person (APP) is still under consideration by DWS.

Raising of Clanwilliam Dam

Project Description:

The project for the raising of this dam is aimed to provide additional water to improve the assurance of supply for agriculture, provide for water allocations to resource-poor farmers and to address dam safety aspects. The scope of the work includes the raising of the existing dam wall by 13 metres, the relocation of a section of the N7 directly affected by the raised dam wall and the raising of the secondary provincial roads affected by the full supply level in the dam.

Progress:

The civil design is complete. Most of the construction drawings are complete and have been formally issued to the Contractor. Construction progress is at 21% completion. Construction work on site is being hindered by the delay in the procurement of construction materials and specialist services.

Tenders for the procurement of outsourced services and goods are still being processed. The appointment of a new APP has been finalised.

8.1.3 Projects at design phase

Nwamitwa Dam

Project Description:

The project involves the construction of a large storage dam with a gross storage capacity of approximately 187 million m^3 on the Great Letaba River downstream of the confluence of the Nwanedzi River in order to provide for the ecological water Reserve, domestic and irrigation water requirements. The scope of work includes the construction of the Nwamitwa Dam and the realignment of affected national and provincial roads.

Progress:

The design reports and tender documents have been completed. The specifications for the development of borrow pits have been developed. The terms of reference have been developed and submitted to DWS.

Olifants River Water Resources Development Project (ORWRDP – 2)

Project Description:

The project involves the development of additional water resource infrastructure consisting of the De Hoop Dam on the Steelpoort River. Phase 2D comprises a 21.5 km of 1200 mm nominal diameter welded steel pipeline of raw water from Steelpoort pump station to GaMathipa Reservoir, a balancing dam, pump station and approximately 2.2 km of 800 mm nominak diameter welded steel pipeline from GaMathipa pump station to the existing Mooihoek Water Treatment Works.

Progress:

The design work to take the design to tender stage is complete and the work packages have been prepared. The tender documents have been finalised and have been delivered to DWS for review. The Design Criteria Memorandum and the design report were finalised and submitted to DWS. A decision is still awaited on the way forward for the funding and implementation of the project.

Olifants River Water Resources Development Project (ORWRDP-2E and 2F)

Project Description:

Phase 2 of the Olifants River Water Resources Development Project (ORWRDP-2) involves the development of additional water resource infrastructure consisting of the De Hoop Dam on the Steelpoort River. Phase 2E comprises a 13 km long gravity pipeline from the Ga-Mathipa Reservoir to Havercroft Junction and it runs parallel to the existing Lebalelo rising main. Phase 2F comprises a 44 km gravity pipeline from Havercroft junction to the existing Olifantspoort Water Treatment Works.

Progress:

Design work is substantially complete; however, options are still being considered for the Olifantspoort River crossing, subject to the results of the geotechnical investigations. The work packages will be reviewed and updated by the PSP following DWS feedback on the ORWRDP 2D tender documentation.

A high-level resettlement scope and cost estimate has been prepared. A decision is still awaited on the way forward for the funding and implementation of the project.

Cwabeni off-channel storage (OCS) Dam

Project Description:

The project involves the construction of a new concrete faced zoned rockfill dam on the Ncwabeni River, with a multi-level intake tower, an abstraction weir on the Umzimkhulu River and a pump station and pipeline to pump water into the off-channel storage dam.

Progress:

Civil and mechanical designs that are independent of the geotechnical investigations and surveys are continuing. Preliminary design is 85% complete, detailed design is 22% complete and tender documentation is 8% complete. The procurement of environmental engineering, geotechnical engineering and surveying services required to advance the design work is being hindered by the lack of funding for the project. The Minister issued a Directive to Umgeni Water on July 2020 to fund and implement the Cwabeni OCS Dam project.

Zalu Dam

Project description:

The project involves the construction of a storage dam with a yield of 6.85 million m^3/a on the Xura River at the Zalu site approximately 10 km northwest of the town of

Lusikisiki, and water distribution infrastructure to supply water for domestic use and irrigation to the town of Lusikisiki and surrounding villages.

Progress:

The civil engineering design is 29% complete. The investigation on the pipeline route selection for the abstraction works is complete. The dam layout drawings are 50% complete, the spillway civil drawings are 20% complete, and the outlet works civil drawings are 10% complete.

8.1.4 Projects at preparation phase

Stephen Dlamini Dam

Project Description:

The project involves the construction of a large storage dam on the Luhane River, pump station and water treatment work for bulk domestic and irrigation water supply to town of Bulwer and surrounding areas.

Progress:

The decision on the dam and associated infrastructure is complete and a license to construct has been issued by DWS. The Minister issued a directive to Umgeni Water in June 2020 to fund and implement the Stephen Dlamini Dam project.

Foxwood Dam

The project involves the construction of a new composite concrete gravity and earth embankment dam on the Koonap River upstream of Adelaide and associated infrastructure to augment the water supply to Adelaide and to provide reliable bulk water supply for new irrigation development for resource poor farmers. The proposed dam will have a gross capacity of approximately 55 million m^3, with a dam wall of a maximum height above foundation level of 48 m.

Progress:

Progress is being hampered by the lack of funding for project implementation.

8.1.5 Operational Projects

De Hoop Dam

This project involves repairs to 38 houses and to the water reticulation and sewage network at the Buffelskloof community, as well as the rehabilitation of the furrow on Tsehla Trust land.

Progress:

A Bill of Quantities for repairs to the Buffelskloof houses, water supply and sewage network and Tsehla Trust furrow has been compiled and is being finalised.

8.2 TCTA Projects Progress

The Trans-Caledon Tunnel Authority (TCTA) is directed by the Minister of Human Settlements, Water and Sanitation to fund and implement a portfolio of projects which are categorised as projects at preparation phase, implementation phase, projects on hold, and potential projects. This report updates the status and key issues pertaining to TCTA projects that are at the implementation phase for the period ending September 2019.

TCTA further oversees the operation and maintenance of the AMD treatment plants in the Western, Central and Eastern basins and on Delivery Tunnel North of the Lesotho Highlands Water Project.

The following is the project that is at the Implementation Phase:

Mokolo and Crocodile River Water Augmentation Project – Phase 2A (MCWAP-2A)

Project Description:

Additional water from MCWAP-2A is required to provide Eskom with a second water source to run their two power stations in the Waterberg area. The water is to further provide Medupi Power Station and Matimba Power station with enough water. It will also provide Lephalale Municipality with water and provide Exxaro with the required additional water. It will also unlock industrial development the region.

Progress:

MCWAP – A is at Procurement level. The PSP has submitted all required wayleave application to Eskom, SANRAL, RAL and Transnet. Approval has been received from SANRAL, Eskom Transmission and RAL. Feedback from Eskom Generation and Transnet are outstanding.

Project at Close-Out

Olifants River Water Resources Development Project – Phase 2C (ORWRDP -2C)

Project Description:

ORWRDP -2C bulk distribution system (BDS) – to transfer water from the De Hoop and Flag Boshielo dams for municipal and mining needs in the middle Olifants River catchment area, unlocking significant social and economic development. Phase 2C will improve water supply to Jane Furse/Nebo Plateau and for mining activities in the Steelpoort-Burgersfort area. Phase 2C has been implemented by TCTA as per revised Ministerial Directive.

Progress:

Construction of the 40 km pipeline including a pump station has been completed. The project has been handed over to DWS for operations and maintenance. DWS have appointed Lepelle Northern Water to operate and maintain the project on their behalf.

9 CONCLUSION

Water plays an important role in sustainable development and is crucial for socio-economic development, ecosystem health and human needs. As a developing country, South Africa has experienced increasing demand for water to support the growing economy. This has been further exacerbated by increasing population growth coupled with the semi-arid climatic location of the country in the wake of climate variability.

The National Water Act seeks to ensure that the country’s water resources are protected, used, developed, conserved, managed, and controlled in a sustainable and equitable manner for the benefit of all people. The National Status of Water Report is an integration of water resource information that provides valuable information on the status of water resources in South Africa.

Water Resource Data

There is a considerable need to expand the current water resource data monitoring network because of the increasing demand for reliable data that has greater spatial representation. The percentage of data availability from the four monitoring networks (surface water, groundwater, surface water quality and biological monitoring) has generally for the 2019/2020 reporting period. This was due to several factors including cost cutting measures, vandalism at monitoring sites, RQIS laboratory’s inability to conduct analysis and the Covid-19 restrictions amongst others.

Only 28% of the total active surface water monitoring stations had data available on HYDSTRA database at the end of the reporting period. Provincial offices responsible for capturing the data on HYDSTRA need encouraging and awareness of capturing data on the platform in a timely manner. Water quality data for South African rivers and dams has had a sharp decline in available data from 62% in 2017 to 33% in 2018. This decline is attributed to among others financial constraints in data collection and analysis.

Status of Water Resources

The status of water resources in the 2019/2020 hydrological year found majority of the rivers to be unsuitable for consumption at select sampled regions due to the high levels of faecal contamination. WMAs that experienced below average dam storage levels for the most part of the hydrological year are namely: Olifants, IUCMA, Pongola-Mtamvuna, Mzimvubu-Tsitsikamma, BGCMA, Lesotho and Swaziland. Groundwater quality assessment for the country has been reported for the Free State and KwaZulu-Natal Provinces only, as data for these two provinces were available for the reporting period. The implementation of National Wetland Monitoring Programme of the DWS aims to assess and monitor the extent of wetlands, threats and changes in their present ecological state and ecosystem services provided by wetlands; however, monitoring results from this newly established monitoring programme are not yet available for reporting.

Status of Water Supply Services

Water use allocations reported on the national register of water use volumes per water use sector lists the top four top users are: Agriculture, including irrigation (61%), Water Supply Service (16%), Commercial (6%) and Industry urban (6%). The integrated Vaal River System in December 2019 achieved 5.2% of the 11.6% water savings target. Municipalities in KwaZulu-Natal Coastal Metropolitan water supply system exceeded their December 2019 targets through WCWDM interventions. Municipalities in the Western Cape achieved a savings of 51% by December 2019 and the Amatole water supply system did not achieve its target.

Resource Directed Measures and Regulations

The DWS has finalised and gazetted the water resource classes (WRC) together with the associated resource quality objectives for several catchments areas such as the Crocodile (West) Marico, Mokolo and Matlabas, Breede-Gouritz and Mzimvubu. More than 60% of the total 144 Water Supply Authorities monitored achieved good to excellent wastewater physical compliance performance. On average, the overall national picture of wastewater compliance of the country leans towards the negative. This is because most treatment plants have digressed in terms of operational flows to the facilities, effluent monitoring, quality and technical skills. Three WSAs were found to be non-compliant on chemical acute health. The non-reporting and non-compliance of WSAs, particularly for drinking water quality, will be continuously monitored by the DWS.

Status of Sanitation Services

Approximately 2.8 million households are without access to improved sanitation services. Open defecation remains a challenge in both rural and urban areas as result of sanitation facilities not being provided and or existing facilities being beyond their functional capacity. Three out of four households with access to improved sanitation are served with waterborne toilets connected to wastewater treatment works. A third of the South African population relies on Ventilated Improved Pit Latrines. Approximately 56% of municipal wastewater treatment works are in poor to critical condition, thereby discharging poorly treated effluent into water sources. Development of National Sanitation Integration Plan is recommended to guide the sector in the implementation and monitoring of sanitation in line with the National Development Plan and Sustainable Development Plan.

Intervention Plans, Initiatives, and Infrastructure Development

Several interventions plans and initiatives with the potential to contribute to meeting the growing water requirements in future have been identified for several WSS. Some of the plans and interventions include, although not limited to: Municipal WC/WDM, rainwater harvesting, re-use of water treatment to portable standards, groundwater schemes, development of surface water sources, mine water effluent treatment and removal of unlawful water use.

Several strategic water resource infrastructure projects were implemented during the reporting period to address the ageing, dis-functional infrastructure, and to increase the availability of water resources. Some notable augmentation projects include: The De Hoop Dam (close out phase); Raising of the Hazelmere, Tzaneen and Clanwilliam Dams (construction phase); Nwamitwa dam, ORWRDP 2D, ORWRDP ZE and 2F, Cwabeni OCS Dam, Zalu Dam (design phase).

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