water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: Water Information Integration

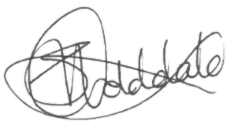
SUB–DIRECTORATE: Information Programmes Management

PPI NO: 3.2.1.3

PORTFOLIO OF EVIDENCE: December 2021

Milestone	Actual
National Water Monitoring Plan (Draft Version 3)	**Achieved**

Signatories

Name & Surname	Designation	Signature	Date
Simphiwe Chabalala	Scientist Manager: Information Programmes Management		15 December 2021
Andy Sambo	Director: Water Information Integration		15 December 2021

DRAFT

water & sanitation

Department:
Water and Sanitation
REPUBLIC OF SOUTH AFRICA

NATIONAL WATER MONITORING PLAN (DRAFT VERSION 3)

DRAFT

EXECUTIVE SUMMARY

The Directorate: Water Information Integration (WII) was established to co-ordinate and integrate information from all technical streams within the Chief Directorate: National Water Resource Information Management (CD: NWRIM) in order to provide a comprehensive picture of water resource information. And as such, Information Programmes Management (IPM) as a sub-directorate of WII was tasked with drafting a National Water Monitoring Plan (NWMP) for the water sector. The draft contains a number of components namely, review of legislation, policy and other reports, priorities and resource allocation for water resource monitoring, and lastly, conclusion and recommendations wherein innovation in the water sector is discussed.

The draft NWMP is based on a number of documents, some of which are desktop studies as well as the series of strategies the Department of Water and Sanitation (DWS) has published to date. For instance, the Gap Analysis Report (2019) revealed numerous gaps in all components of DWS Water Monitoring Programmes and the impact thereof such as decline of data availability in the data bases; HYDSTRA, National Ground Archive (NGA), and Water Management System (WMS). In addition, it was found that water sector stakeholders are disintegrated and there is limited data sharing amongst them that will require formal partnerships to be forged. Furthermore, Chapter 14 of the National Water Resource Strategy (NWRS) (3rd Edition) outlines strategic objectives that includes the development of a plan for data and information management as well as the development of a funding model for effective implementation of Water Monitoring Programmes.

Other work that has contributed to this draft include interactions with the nine (9) regions through the Integrated Regional Water Monitoring Committees (IRWMC) meetings that required all the regions to provide their water monitoring priorities and resource needs for the next five (5) years. In addition, the work carried out in the implementation of the Data Management Strategy (DMS) for the Water Quality, Sanitation, Water Quantity and Wetlands Focus Areas has contributed and further reiterated the importance of all the aspects of data life cycle management. Tapping into the wealth of knowledge developed over the years, the NWMP will provide direction towards achieving the strategic goals of Water Monitoring Programmes as outlined in Chapter 13 of the NWRS 2nd edition as well as provide a guideline for integration of water monitoring programmes through water sector collaborations to maximise limited resource and skills in the water sector.

DRAFT

TABLE OF CONTENTS

DRAFT

DRAFT

LIST OF FIGURES

LIST OF TABLES

DRAFT

LIST OF ABBREVIATION AND ACRONYMS

Abbreviation	Description
ARC	Agricultural Research Council
AWARD	Association for Water and Rural Development
CSIR	Council for Scientific and Industrial Research
DMS	Data Management Strategy
DSI	Department of Science and Innovation
DWS	Department of Water and Sanitation
GIS	Geographic Information Systems
IPM	Information Programmes Management
IRWMC	Integrated Regional Water Monitoring Committee
IUCMA	Inkomati-Usuthu Catchment Management Agency
IWQMS	Integrated Water Quality Management Strategy
IWMGG	Integrated Water Monitoring Governance Guidelines
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NCMP	National Chemical Monitoring Programme
NGA	National Groundwater Archives
NECSA	Nuclear Energy Corporation of South Africa
NEMP	National Eutrophication Monitoring Programme
NEsMP	National Estuaries Monitoring Programme
NIWIS	National Integrated Water Information System
NMMP	National Microbial Monitoring Programme
NRMP	National Radioactivity Monitoring Programmes
NSoWR	National State of Water Report
NTMP	National Toxicity Monitoring Programme
NWA	National Water Act (36 of 1998)
NWetMP	National Wetland Monitoring Programme
NWMC	National Water Monitoring Committee
NWMP	National Water Monitoring Plan
NWMPF	National Water Monitoring Plan Framework
NWRIM	National Water Resource Information Management
NWRS	National Water Resource Strategy
REMP	River Eco-status Monitoring Programme
RQIS	Resources Quality Information System
SAEON	South African Environmental Observation Network
SANBI	South African National Biodiversity Institute
SANParks	South African National Parks
SAWS	South African Weather Services
SDGs	Sustainable Development Goals
SI	Spatial Information
SOPs	Standard Operating Procedures
WARMS	Water Registration Management System
WMS	Water Management System
WRC	Water Research Commission
WSA	Water Services Act (108 of 1997)

DOCUMENT INFORMATION AND VERSION CONTROL

Version	Author (s)	Date
National Water Monitoring Plan Version 2 (2020/21)	Luthando Kiva (Document creator) Mirrander Ndhlovu Simphiwe Chabalala Stranton Narain	2020/09/30
National Water Monitoring Plan Version 3 (2020/21)	Luthando Kiva Simphiwe Chabalala Stranton Narain	2020/12/31
National Water Monitoring Plan Final Draft (2020/21)	Luthando Kiva Simphiwe Chabalala Stranton Narain Mxolisi Mukhawana	2021/03/31
National Water Monitoring Plan Draft Version 1 (2021/22)	Luthando Kiva Simphiwe Chabalala Stranton Narain Mxolisi Mukhawana	2021/06/30
National Water Monitoring Plan Draft Version 2 (2021/22)	Luthando Kiva Simphiwe Chabalala Stranton Narain Mxolisi Mukhawana	2021/09/30
National Water Monitoring Plan Draft Version 3 (2021/22)	Luthando Kiva Simphiwe Chabalala Stranton Narain Mxolisi Mukhawana	2021/12/31

DRAFT

FRAMES OF REFERENCE

1.1 Introduction

Development of the National Water Monitoring Plan (NWMP) required a review of the five-year "National Water Resource Quality Monitoring Plan" of 2004/5 as a basis on which to build. The previous plan had several priorities and strategic interventions to focus on in a five-year period for enhancement and development of the monitoring system. Weaknesses of the components of monitoring programmes were identified and the response was proposed for each area. A need to expand the network of existing monitoring programmes and capacity building for data acquisition process was among the priorities. There is no research done yet to assess the feasibility of integrated data acquisition hence the current NMMP has included this aspect under monitoring governance arrangements and on data management strategic targets.

The previous plan also sought to improve data management through quality control, development of guidelines and standards for all levels of monitoring. Presently, there are standard operating procedures for various monitoring programmes however emphasis should be more on compliance with the existing guidelines through various interventions which include capacity development of personnel and auditing of data and information. The update of five-year "National Water Resource Quality Monitoring Plan" commenced with the drafting of a National Water Monitoring Plan Framework (NWMPF) that sought to identify critical components of water monitoring through consultation with the Department of Water and Sanitation (DWS) officials responsible for implementation of water monitoring programmes. During the development of NWMPF identification of what has been achieved through the implementation of the previous plan was considered. Once the framework was complete, the NWMP began to take shape and allow for prioritization of various components of water monitoring value chain to be addressed in the next five years.

One of the strategic actions of Chapter 13 of NWRS 2nd Edition (2013) is to develop a NWMP. Furthermore, many other strategies and frameworks have informed the NWMP such as; Review, Evaluation and Optimisation of the South African Water Resources Monitoring Network (2017), Integrated Water Quality Management Strategy (2011), Data Management Strategy (2018), Gap Analysis of Monitoring Programmes (2019) and Integrated Water Monitoring Governance Guidelines (2019) among others. These documents revealed a number of gaps and challenges hampering the implementation of an efficient monitoring system and these were in turn used to identify priorities for water monitoring. The following sections speak to the policies and reports that helped shape the NWMP. Table 1.1 provides policy and strategy objectives as well as their objectives and actions relevant for NWMP.

1.2 Review of existing water resource monitoring legislation, policy & reports

1.2.1 National Water Act 36 of 1998 and Water Services Act 108 of 1997

The objective of the National Water Act (NWA) is "to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account amongst other factors" - in a sustainable and equitable manner, for the benefit of all persons. The NWA provides that the National Government, as the custodian of the nation's water resources and acting through the Minister of Water and Sanitation, has the power to regulate the use, flow and control

DRAFT

of all water in the Republic of South Africa (NWA, Act No. 36 of 1998). Under Chapter 14, the National Water Act states that; “Monitoring, recording, assessing and disseminating information on water resources is critically important for achieving the objects of the Act. Part one of this Chapter places a duty on the Minister, as soon as it is practicable to do so, to establish national monitoring systems. The purpose of the systems will be to facilitate the continued and co-ordinated monitoring of various aspects of water resources by collecting relevant information and data, through established procedures and mechanisms, from a variety of sources including organs of state, water management institutions and water users.

The DWS is therefore mandated by the National Water Act (NWA) No. 36 of 1998 and the Water Services Act (WSA) No. 108 of 1997 to provide useful water related information to decision makers and water practitioners. In order to achieve this, the DWS has established various national water information systems which are aimed at assisting decision makers to address the management, use, development, conservation, protection and control of the South African (RSA) water in the most possible sustainable and equitable manner.

1.2.2 National Development Plan 2030

According to the NDP (2030) South Africa should transition to an environmentally sustainable, climate-change resilient, low-carbon economy and just society through coordinated planning and investment in infrastructure and services that take account of climate change and other environmental pressures. Additionally, all South Africans should have access to secure housing, clean water and decent sanitation, and affordable and safe energy, making communities more resilient to the impacts of climate change and less socioeconomically vulnerable. Furthermore, the NDP acknowledges that biodiversity and ecosystems in conservation areas are national assets. Long-term planning to promote biodiversity, conservation and rehabilitation of natural assets is critical and should be complemented by a strategy for assessing the environmental impact of new developments as an important component of overall development and spatial planning for example.

The NDP has a 74% convergence with the Sustainable Development Goals (SDGs), and prioritizes job creation, the elimination of poverty, the reduction of inequality and growing an inclusive economy by 2030. The DWS is committed to report in line with two targets of the SDGs namely, Target 6.3 and Target 6.6. Country progress on these targets depends on the availability of water monitoring data. Target 6.3 is about improving water quality by reducing pollution, eliminating dumping and minimizing release of hazardous chemicals and materials, halving the proportion of untreated wastewater and substantially increasing recycling and safe reuse globally. Target 6.6 is about the protection and restoration of water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes. Without adequate data collection, through various monitoring programmes of DWS and other water sector institutions, it would not be practicable to report on SDGs Target 6.3 and Target 6.6. It is therefore vital to have NWMP addressing sustainability of water resource monitoring programmes and ensure data availability, integrity and security in alignment with the NDP 2030.

1.2.3 National Water and Sanitation Master Plan

The National Water and Sanitation Master Plan (NWSMP) is envisaged to guide the water sector with regard to investment planning for the development of water resources as well as the delivery of water and sanitation services by 2030. The document outlines immediate interventions to respond to, amongst other challenges, infrastructure investment and maintenance, capacity of municipalities, transformation in the sector, licensing of water use, capacity of the DWS and its agencies and most importantly ensuring water security for communities and business. In addition, the purpose of NWSMP is to estimate the investment required to ensure effective water resources and water and sanitation services delivery as well as to facilitate the implementation of actions and evaluate achievements.

1.2.4 National Water Resource Strategy (3rd Edition)

The National Water Resource Strategy (NWRS) 3rd Edition requires implementation of monitoring and information management through a set of objectives that will allow for an integrated, accessible monitoring and information management system that supports sustainable water management among others. The national monitoring and information management plan was envisioned to be a platform for compiling and maintaining accurate data that should support decision-making; reduce and manage risks as well as managing emerging climate change impacts. The NWRS 3rd edition also aims to raise awareness of the importance of investing in data management in terms of data collection, processing and dissemination for supporting water resource management.

The NWRS 3rd edition further highlights the urgent need for a well-designed, coordinated and managed programme for collecting, assessing and disseminating data and information on water recorded by all entities in the water sector, including state departments, provincial governments, municipalities, water management institutions and Water Services Authorities and providers, as well as by other water users. In the same way the NWRS 2nd edition purposes to improve monitoring governance, NWMP details strategic targets for streamlining governance operations and aims to ensure uninterrupted monitoring of all programmes.

The NWRS 3rd edition builds on the National Water Resources Strategy 1st edition and 2nd edition and should articulate approaches to address key current water and sanitation resource and service aspects such as; water resources planning, development and water and sanitation infrastructure management; financing the water and sanitation sector, monitoring and information management, research and innovation; and water and sanitation sector skills and capacity to name a few. Some of these aspects are also discussed and expanded upon in the NWMP focussed particularly on monitoring.

1.2.5 Review, Evaluation and Optimisation of the South African Water Resources Monitoring Network Implementation Strategy

The Review, Evaluation and Optimisation of the National Water Resources Monitoring (NWRM) Project undertaken by the Chief Directorate: National Water Resource Information Management was completed in February 2017. This project was envisioned to provide the design of an optimal national water resources monitoring network for surface, groundwater and water quality. Though most of the recommendations have not been implemented due to lack of funds, the report

provided the basis for NWMP in terms of identifying and prioritization of water monitoring components and thereby narrowing the scope of the NWMP.

The product of this project was a detailed network inventory that includes the 10 DWS national monitoring programmes, as well as the SAWS rainfall and ARC agro-meteorological monitoring networks. The inventory was developed based on information obtained through extensive engagement with the relevant DWS Database Managers, Regional Monitoring Programme Managers and other stakeholders. It includes, among others, the variables/constituents being monitored, the frequency of observations, the storage of data sets, the status of stations, as well as the spatial distribution and coverage (density) of stations across the country. The optimal national water resources monitoring network has been included as part of the National Water and Sanitation Master Plan (NWSMP); in addition, an implementation plan has been developed with timeframes to execute the outcomes of the Review, Evaluation and Optimisation of the National Water Resources monitoring project.

1.2.6 Data Management Strategy

Data acquisition and management plays a fundamental role in DWS and in the water sector at large as the information required for sound decision making solely depends on the data collected from various water resources. At this juncture the question of how we collect and manage data is very critical in the light of all the gaps identified with regard data acquisition and management process. DWS has, in collaboration with key water sector stakeholder, successfully developed the Data Management (DM) Strategy for Water and Sanitation in South Africa. The aim of the DM Strategy is to develop a national data management model that will be used to coordinate and facilitate the sector wide management of data and information required to populate the national information systems. This will be achieved by developing strategic guidelines and framework for data management in water and sanitation in order to improve the credibility, availability, accessibility, timeliness, and the security of water and sanitation data. The key objectives of the DM Strategy is to develop and implement methods and procedures to enhance the four pillars of data acquisition and management; viz. Data Governance, Data Life Cycle Management, Data Management Systems and Stakeholder Collaboration and Partnerships. A DM Strategy implementation framework has been developed and recommended for use as the main guideline for Data Acquisition and Management in the South African Water Sector. Furthermore, the DM Strategy framework has been recommended in the 3rd edition of the NWRS as the main tool for effective and efficient data acquisition and management in South Africa.

DRAFT

Table 1.1 Policy/Strategy and relevant objectives/actions for NWMP

Policy/Strategy	Relevant Objectives/Actions for NWMP
National Water Act 36 of 1998	NWA places the duty on the Minister to: - Establish national monitoring systems on water resources as soon as reasonably practicable (NWA chapter 14; clause 137(1)). - Establish information systems linked to the national monitoring systems (NWA Chapter 14; clause 137(2)).
Water Services Act 108 of 1997	- Ensure that there is a national information system on water and sanitation services. (WSA Chapter 10; clause 67(1)).
National Development Plan 2030	Provide South Africans with access to secure housing, clean water and decent sanitation, and affordable and safe energy, making communities more resilient to the impacts of climate change and less socioeconomically vulnerable. **Alignment with SDGs** - Prioritizes job creation, the elimination of poverty, the reduction of inequality and growing an inclusive economy by 2030.
National Water and Sanitation Master Plan	One of the key actions for Water Resources is to strengthen and improve water measuring and monitoring network. And the outcome is a wider network of rainfall, runoff and groundwater measurement infrastructure and monitoring to improve knowledge of water availability and climate trends.
National Water Resource Strategy (3rd Edition)	13.4.2 **Develop and implement an integrated national information management plan** for the entire water sector that is easily accessible to government institutions and to other users. This plan must include following: o Planning and implementing water resource development and water services infrastructure o Monitoring for compliance o Monitoring for early warnings to avoid, limit and mitigate risks in water management.
Review, Evaluation and Optimisation of the South African Water Resources Monitoring Network Implementation Strategy	The strategy includes a number of key aspects considered for each of the monitoring programmes: - Finalising the optimal monitoring network design, including the location, the variables/constituents being monitored, the frequency of observations, as well as the implementation priority for each monitoring site. - Identifying opportunities for the integration of processes involved in the implementation process, such as the coordinated development or upgrading of monitoring sites based on physical location and other practical considerations. - Developing preliminary implementation, operation and maintenance cost estimates for each monitoring site. - Developing the sequencing, grouping and programming of the relevant implementation steps for monitoring sites within each monitoring programme. - Developing preliminary implementation timelines and cash flow estimates, both provided per site, monitoring programme, defined implementation area (such as a Water Management Area) and for the National Network. - Identifying Strategy implementation risks and possible mitigation strategies, including the need for Strategy implementation support (DWS, 2017).

DRAFT

Data Management Strategy	Implementation of the DM Strategy will support the objectives of NWMP specifically the aspect of data acquisition and management. There are many gaps identified regarding collection of water samples and management of water data including; - Lack of application of Standard Operating Procedures, - Data gaps within the databases and lack of data integrity. - Fragmentation of water sector stakeholders who are the custodians of different data sets. - Data is disintegrated and is not stored in structured systems.

DRAFT

1.3 Current DWS Monitoring Programmes

The DWS currently runs Surface, Groundwater and Water Quality monitoring programmes that should provide a comprehensive picture of the state of the country's water resources. Each monitoring programme is designed to provide information depending on the specific objectives of the programme. Table 1.2 depicts the different programmes, the elements, frequencies and approximate number of key points monitored. All programmes are marred by similar issues such as financial constraints, lack of access to the monitoring sites and many others. All these challenges have also informed the NWMP in terms of strategic goals and priorities presented in the next section.

Table 1.2 Existing DWS monitoring programmes

Monitoring Classification	Elements	Frequency (NWMP, 2004)	Approx. number of key points
Hydrological	Surface water gauging stations	Flow and Dam records (continuous, daily, monthly, annually and flood peaks)	770
	Reservoirs levels (with water uses at key reservoirs and meta-data on reservoir configuration data)	Total flow regime reports, Evaporation and rainfall records (daily, monthly, annually	
Hydro-meteorological (part of Hydrological programme)	Rainfall (including mountainous rainfall)	Daily, monthly and annually	275
Geo-hydrological	Evaporation	Daily, monthly, annually	185
	Groundwater levels	Hourly readings of groundwater levels, Bi-annual sampling of quality	2 233 (automatic)
	Yields (historic once-off)		Unknown
Water Quality	Surface Water	Monthly	
	Chemical	Monthly and Quarterly	346
	Microbial	Bi-Monthly and Annually	180
	Eutrophication	Annually	112
	Toxicity Radioactivity	Regularly Not confirmed	3
	Groundwater (part of Geohydrological programme)	Bi-annual sampling of quality	412
	Rainfall (part of Geohydrological programme)	Not confirmed	100
Ecosystems	River Eco-status	Annually	639
	Estuaries	Some monthly and quarterly	72
	Wetlands	Not confirmed	28

Source: DWS 2017.

1.4 Rationale

The development of the NWMP is imperative to understand the priorities for monitoring and assist in addressing them in a systematic manner. It brings together; the priorities namely; governance operations, monitoring network infrastructure, data management and information systems and laboratory services. For example; the monitoring governance component provides the platform for reporting on monitoring programme priorities through the Integrated Regional Water Monitoring Committees (IRWMCs) as well as the National Water Monitoring Committee (NWMC). This also brings in the concept of accountability in that regional monitoring plans should reflect the priorities in the national monitoring plan and activities should be allocated accordingly for implementation and perhaps be reflected in individual work plans. And as such, the NWMP provides strategic targets such as facilitating collaboration for monitoring programme integration in the water sector under the component monitoring governance.

In terms of Resource Allocation for Monitoring for example; questionnaires were distributed to all nine regions to determine the finance needs for optimal operations of the monitoring programmes such as maintenance of monitoring sites, data collection costs, procurement of instrumentation, human resources and capacity building. This is an important section as most monitoring programmes present gaps in data as a result of budget cuts and shortages. The NWMP is envisioned to be the document that will inform planning and budgeting process of DWS to cater for the priorities identified. Finally, the NWMP seeks to link the different components namely; governance operations, monitoring network infrastructure, data management and information systems and laboratory services and set targets for each component in response to deficiencies. Moreover, outline how our goals can be achieved and steps required for improving water monitoring programmes. Also, the said components are interdependent and therefore some level of co-ordination is required for example; the availability of data in databases depends on data acquisition process as well as effective data processing and together result in dissemination of accurate information. The next section speaks to the different components and their respective strategic targets.

DRAFT

PRIORITIES FOR WATER RESOURCE MONITORING

2.1 Introduction

This section entails priorities indicated by Free State; Gauteng, KwaZulu-Natal, Mpumalanga, Northern Cape, Western Cape Regional Offices, SGWI and RQIS. This information was gathered through the distribution of a questionnaire to all regions during Integrated Regional Water Monitoring Committees (IRWMC) meeting discussions. The strategic targets, proposed actions, desired outcomes and required resources for various components of water monitoring value chain are presented under the themes; Monitoring Governance Operations, Monitoring Network Infrastructure, Laboratory Services and Data Management.

2.2. Monitoring Governance Operations

2.2.1 Current Status of Monitoring Governance Operations

The sub-directorate Information Programmes Management within the DWS established IRWMCs in all nine (9) regions following the establishment of National Water Monitoring Committee (NWMC). The NWMC was established to enhance coordination and collaboration of national monitoring programmes and plays an integral role overseeing the development and implementation of guidelines, standards, National Water Monitoring Plan and Data Management Strategy for all monitoring levels. While IRWMCs play a significant role to ensure well-designed monitoring programmes and networks with adequate data and/or information and ultimately the integration of water monitoring programmes. All IRWMCs are responsible for developing and implementing their Regional Water Monitoring Plans; implementation of Data Management Strategy, and mapping of monitoring network for integration of monitoring programmes. The IRWMCs are guided by Terms of Reference (ToR) which outline objectives of the committees as well as functions and targets of the members. IRWMCs chairpersons report to the NWMC and in turn, the NWMC chairperson reports to the Deputy Director-General: Water Resource Management. Table 2.1 summarises the status of each of the nine (9) IRWMCs to date. Some of the IRWMCs are far ahead in terms of facilitating collaboration among water sector institutions, while others are not consistent in maintaining the relationship with water sector stakeholders.

DRAFT

Table 2.1 Status of Integrated Regional Water Monitoring Committees

Region	Status
EC-IRWMC	- The EC-IRWMC was established in 2018 and ToR were developed and signed off by the DWS Regional Head for Eastern Cape Operations in September 2019. - According to the signed ToR, EC-IRWMC Meetings are scheduled to take place on a bi-annual basis. - Stakeholders have been identified and invited to participate in the IRWMC, however, they are yet to attend, present and share monitoring inventories. Interventions are currently underway to encourage participation and eventual collaboration. - EC-IRWMC is lagging in terms of developing their Regional Water Monitoring Plan for optimal water resource monitoring operations at regional level as well as implementation of the DMS.
FS-IRWMC	- The FS-IRWMC was established in 2018 and their ToR was signed off by the DWS Regional Head for Free State Operations in February 2021. - According to the signed ToR, FS-IRWMC Meetings are scheduled to take place on a bi-annual basis. - Stakeholders have been identified and currently participating in the FS-IRWMC meetings. - The FS-IRWMC is playing a pivotal role facilitating the collaboration of water resource monitoring programmes implemented by various water institutions in the region. - Water monitoring programmes in the Free State face severe challenges due to a shortage of budget and personnel as well as travel restrictions due to the nationwide lockdown have also impacted water monitoring programmes in the region. - The mapping of integrated monitoring networks is yet to be undertaken while the filling of critical posts in the region remains a priority. - The development of the Regional Water Monitoring Plan also remains a priority.

DRAFT

GP-IRWMC	- The GP-IRWMC was established in 2020 and their ToR was signed off by the DWS Regional Head for Gauteng Operations in October 2020. - According to the signed ToR, GP-IRWMC Meetings are scheduled to take place on a quarterly basis. - The GP-IRWMC is in the process of identifying stakeholders and updating their IRWMC Stakeholder Inventory. - Water monitoring programmes in Gauteng face challenges due to a shortage of budget and personnel. - In addition; travel restrictions due to the nationwide lockdown have also impacted water monitoring programmes in the region. - The mapping of integrated monitoring networks is yet to be undertaken while the filling of critical posts in the region remains a priority. - The development of the Regional Water Monitoring Plan also remains a priority.
KZN-IRWMC	- The KZN-IRWMC was established in 2018 and their ToR was signed off by the DWS Regional Head for KwaZulu-Natal Operations in November 2019. - According to the signed ToR, KZN-IRWMC Meetings are scheduled to take place on a quarterly basis. - Stakeholders have been identified and currently participating in the KZN-IRWMC meetings. - The region is also in the process of mapping of internal monitoring networks while the mapping of external monitoring networks is yet to be undertaken. - The KZN-IRWMC has thus far succeeded in initiating collaboration with the South African Environmental Observation Network (SAEON) for data sharing and exchange. The Directorate: Water Information Integration (WII) is championing this initiative on behalf of the DWS. - Water monitoring programmes in KwaZulu-Natal face challenges due to a shortage of budget and personnel. - Water monitoring programmes in the region have also been impacted by laboratory contract challenges while the filling of critical posts in the region remains a priority. - The development of the Regional Water Monitoring Plan also remains a priority.

DRAFT

LP-IRWMC	- The LP-IRWMC was established in 2016 and their ToR was signed off by the DWS Regional Head for Limpopo Operations in September 2019. - According to the signed ToR, LP-IRWMC Meetings are scheduled to take place on a quarterly basis. - Stakeholders have been identified and currently participating in the LP-IRWMC meetings. - The LP-IRWMC is however lagging far behind in terms of developing their IRWMC Stakeholder Inventory and the mapping of monitoring networks. - The development of the Regional Water Monitoring Plan remains a priority.
MP-IRWMC	- The MP-IRWMC was established in 2016 and their ToR was signed off by the DWS Regional Head for Mpumalanga Operations in October 2019. - According to the signed ToR, MP-IRWMC Meetings are scheduled to take place on a quarterly basis. - The MP-IRWMC has thus far succeeded in initiating collaboration with the Inkomati-Usuthu Catchment Management Agency (IUCMA) for data sharing and exchange in order to strengthen the National Eutrophication Monitoring Programme (NEMP). The Directorate: Resource Quality Information System (RQIS) is championing this initiative on behalf of the DWS. - Through the MP-IRWMC, an agreement has been reached to initiate collaboration with the Association for Water and Rural Development (AWARD) to implement the Data Management Strategy (DMS) for Water and Sanitation in South Africa. AWARD is involved in various monitoring activities in South Africa, contributing to monitoring objectives related to state of water, compliance, planning, etc. AWARD has thus committed to contribute to the implementation of the DM Strategy through their project titled “Bio-Diversity Systems Management and Analytics for the Restoration of Trans-boundary Rivers (BIO-SMART)”. - The development of the Regional Water Monitoring Plan remains a priority.

DRAFT

NC-IRWMC	- The NC-IRWMC was established in the 2018 and their ToR was signed off by the DWS Regional Head for Northern Cape Operations in June 2019. - According to the signed ToR, NC-IRWMC Meetings are scheduled to take place on a bi-annual basis. - The NC-IRWMC is playing a pivotal role facilitating the collaboration of water resource monitoring programmes implemented by various water institutions in the region. - The NC-IRWMC is consistent in stakeholder engagement within the region, the water monitoring institutions are given a platform to present progress of monitoring programmes and challenges are also dealt with in the same platform. - The development of the Regional Water Monitoring Plan and mapping of stakeholder monitoring network is underway. - The maintenance and increasing the monitoring network coverage within the region remains a priority.
NW-IRWMC	- The NW-IRWMC was established in 2019 and their ToR was signed off by the DWS Regional Head for North West Operations in November 2019. - According to the signed ToR, NW-IRWMC Meetings are scheduled to take place on a quarterly basis. - Stakeholders have been identified and currently participating in the KZN-IRWMC meetings. - The NW-IRWMC has contributed to the development of the Wetlands Data Acquisition and Management Strategy (W-DAMS) by means of collecting and submitting inputs from participating external stakeholders. - Furthermore, the NW-IRWMC has supported the implementation of the Data Management Strategy (DMS) for Water and Sanitation in South Africa by successfully facilitating and coordination the Wetlands Mapping Training Workshop that took place during the 2020/21 financial year. The Wetlands Mapping Training Workshop was conducted by both the South African National Biodiversity Institute (SANBI) and the DWS. - The development of the Regional Water Monitoring Plan remains a priority.

DRAFT

WC-IRWMC	- The WC-IRWMC was established in 2018 and their ToR was signed off by the DWS Regional Head for Western Cape Operations in December 2019. - According to the signed ToR, WC-IRWMC Meetings are scheduled to take place on a quarterly basis. - Stakeholders still need to be identified and invited to WC-IRWMC meetings. - The WC-IRWMC is also lagging in terms of the mapping of stakeholder monitoring networks. - The maintenance and increasing the monitoring network coverage remains a priority for the WC-IRWMC. - The development of the Regional Water Monitoring Plan also remains a priority.

DRAFT

2.2.2 Priorities for Water Monitoring Governance Operations

Water Monitoring Governance Operations is a component with several shortcomings to be addressed by all the relevant water and sanitation sector stakeholders during the implementation of NWMP. Water monitoring planning occurs in silos and there is no clear understanding of who is monitoring; what is being monitored, when is it monitored and how is it monitored; and moreover, the use of standards in the process of monitoring is not clear. Data sharing amongst stakeholders is particularly complex due to the absence of memorandum of understanding and/or agreement between stakeholders to drive the water monitoring programme integration agenda. Table 2.2 illustrates the challenges in water monitoring governance operations, the identified priorities and the proposed interventions.

Table 2.2 Priorities for Water Monitoring Governance Operations

Shortcoming/Implications	Priorities	Proposed Interventions	Existing collaborations
- Partnership among Water Monitoring Institutions is not formalised - Data sharing is very complex due to lack of partnership	- Formalise partnership to enable data sharing among Water and Sanitation Sector institutions	- Identify monitoring programmes that can be integrated for mutual benefit and use memorandum of understanding and agreement. - Resuscitation of partnership with some municipalities where there is lack of cooperation on management of boreholes	- The Groundwater Assessment and Monitoring Programme has existing partnership with institutions such SANParks, WRC, Municipalities, Pilanesberg National Park, Cradle of Humankind, Mine and Ithemba Lab.
- It is not clear who is monitoring what, where and how. - This results in duplication of parameters monitored by various water monitoring institutions	- Development of inventory of monitoring networks with geographic location of monitoring sites and monitored parameters - Optimise Monitoring Networks through the integration of respective programmes	- The roles and responsibilities of monitoring institutions should be defined - Facilitate integration of monitoring network through the identification and mapping of monitoring sites with the same parameters and objectives. - Formalise partnership with SAEON, Magalies Water and Rand Water for adequate sharing of data, information and skills.	- The Surface water monitoring programme is currently working in collaboration with SAEON, SAWS, ARC, Municipalities, Water User Association, Umgeni Water Association, Famers Association and Irrigation Boards. These stakeholders are playing a vital role in monitoring of dam levels and evaporation while the association also assist by providing access to monitoring stations located in their property.

DRAFT

- Lack of standardized guidelines for Water and Sanitation Sector monitoring programmes - Integration is complex due to lack of general standards and protocols for data acquisition, management and dissemination	- General standards for data collection, storing, analysis and dissemination	- Consultation of Water and Sanitation Sector stakeholders to harmonize existing policies, protocols standards and guidelines of respective monitoring programmes for data collection, management and dissemination.	
- Lack of access to monitoring sites within private properties	- Enhance collaboration with property owners to enable access to the monitoring sites	- Agreements between DWS and Private owners must be initiated to ensure smooth operations - Access should be granted with conditions specified such as safety.	

2.2.3 Strategic Targets for Monitoring Governance Operations

Water resource monitoring by water institutions requires high level of coordination and integration for efficiency of monitoring programmes and this can be achieved by setting strategic targets and short term goals. Table 2.3 outlines strategic targets, activities and key role players to drive and ensure success of monitoring governance component.

Strategic Objective: To formalise partnership among water sector institutions responsible for water resource monitoring at regional and national level

Table 2.3 Strategic Targets for Water Monitoring Governance Operations

Strategic Target	Proposed actions	Desired outcome	Required resources	Time Frames	Stakeholders

- Collaborate and partner with as many private and public sector as possible. - Maximise water resource monitoring governance through mutual planning and control of all registered water users. - Exercise authority and protect the needs of all water resource data users - Partnership with water sector stakeholders to provide all information after drilling	- Stakeholder engagement - Amend regulations/policies to enforce data sharing across all stakeholder involved in water resource monitoring - Forming partnership with other public and private institutions which are involved in various monitoring programmes such as groundwater, surface and water quality monitoring programmes: SAWS, SAEON, GroundTruth, Citizen Science - Allocations of funds for managing and maintaining monitoring networks - Allocation of funds to maintain all DWS Hydrological Monitoring Networks	- Central regulated water resource monitoring networks and generating standards/procedures of collection, storing and dissemination of data. - General standards for data collection, storing, analysis and dissemination - Optimised Monitoring Networks through integration of respective programmes - Implementation of Regional Water Monitoring Plans	- Stakeholder task team - MoU and MoA - DWS (National and Regional Offices), other - Government Departments. - SAEON - SAWS - ARC - Universities, - Research Councils, - Catchment Management Agencies, - Water Users Association, - Water Boards, - Consultants and the private sector, affected - Communities, public etc.	- Formalizing partnerships Quarter 4 2022/2023 General standards for data collection, storing, analysis and dissemination Quarter 4 2023/2024 Integration of monitoring networks Quarter 4 2023/2024 - Allocation of funds Quarter 4 2021/2022	- DWS (National and Regional Offices), other - Government Departments, - Universities, - Research Councils, - SAEON - SAWS - ARC - Catchment Management Agencies, - Water Users Association, - Water Boards, - Consultants and the private sector, affected - Communities, public etc.

DRAFT

2.3 Monitoring Network Infrastructure

2.3.1 Current Status of Monitoring Network Infrastructure

Data as the strategic asset of water and sanitation sector is generated from widely distributed hydrological, geo-hydrological and water quality monitoring network infrastructure for sustainable management of water resources. The long term trend analysis of parameters for determination of water situation across the country depends on the functional and reliable monitoring network system. The current financial position of DWS has resulted in closure of a number of monitoring stations which provide data and clear picture of water situation of the country. The number of surface water monitoring points have also been reduced drastically as a result of the financial status of the Department. Decision making process and policy development for sustainable water resource management depends solely on the data that is collected to give status and trends of different parameters, water quality, levels and volumes of various water resources. It is vital to take cognizance of Evaluation and Optimization of South African Water Resource monitoring network project conducted by DWS in 2017 as it addresses expansion of monitoring network coverage in line with information requirements. In addition, the maintenance of existing monitoring network infrastructure is the priority of all monitoring programmes of water and sanitation sector. Table 2.4 presents shortcomings, priorities and with proposed intervention to address the challenges.

DRAFT

Table 2.4 Priorities for Monitoring Network Infrastructure

Shortcomings/Implications	Priorities	Proposed Intervention
- Data gaps in the databases are attributed to lack of instrumentation and lack of backup instrumentation and data capturers in the regions. - Poor maintenance at gauging stations results from inadequate resources available to maintenance such as teams to conduct general maintenance activities at surface water gauging stations, and this also yields to poor quality data being generated and captured.	- Maintenance of monitoring sites which are deteriorating, and provision of backup instrumentation is a priority for all the regions	- Procurement Contracts for purchasing of instrumentation must be initiated and additional funds including personnel must be allocated to improve capacity to maintain existing monitoring stations and minimize closing of stations/ geosites. - Periodic renewal of term contracts of monitoring equipment before expiry date - Creation of data capturers posts
- Monitoring network coverage is not sufficient to provide adequate data and information: The major river and streams are measured but the upper reaches are poorly represented.	- Increasing coverage of monitoring sites to give clear picture of water situation across the country	- Re-designing and revitalization of monitoring network. - Integration of monitoring programmes championed by various water monitoring institutions.
- Lack of personnel dedicated strictly for maintenance of monitoring sites results to inaccessibility of monitoring sites	- Dedicated personnel are needed to continuously maintain the monitoring stations and surroundings as well as access roads where applicable.	- Maintenance of the monitoring network consists of two parts, physical maintenance of the stations, access roads and surrounding areas and maintenance with regard to the instrumentation to keep the network functional.

DRAFT

- Lack of access to monitoring sites results in data gaps and this also affects spatial coverage of monitoring - Access to some sites is an issue as they are fenced off and property owners are untraceable - Some monitoring sites had to be closed because of dangerous working environment, presence of wildlife at Mapungubwe National Park impacting on data availability.	- Maintenance includes, amongst others, cutting of grass and shrubs, trimming of branches, filling of erosion furrows, and painting of the monitoring station.	- To sustain our monitoring programmes, more funds will be needed to procure new and replace defect monitoring instrumentation, heavy duty trucks, new drilling equipment and rigs

2.3.2 Strategic Targets for Monitoring Network Infrastructure

The strategic targets of Monitoring Network Infrastructure component are outlined in Table 2.5 with the list of prosed actions, desired outcomes and required resources. Water sector stakeholders indicated a need to establish a robust monitoring network that will be frequently calibrated and maintained with skilled dedicated personnel for a provision of credible and sufficient data to support business requirements. Increasing of monitoring network coverage is one the strategic targets which also requires additional funds to be allocated for the monitoring network infrastructure in the country.

Strategic objective: To develop and maintain information systems and hydrological monitoring infrastructure networks

DRAFT

Table 2.5 Strategic Targets of Monitoring Network Infrastructure

Strategic Target	Proposed actions	Desired outcome	Required resources	Time Frame	Stakeholders
- Have a robust monitoring network, frequently calibrated devices, skilled people, models and back-up plans - Ensure spatial distribution of water resource monitoring stations, frequently monitored resource - Implement the NWRM network project recommendations	- Maintenance of existing monitoring infrastructure - Identify gaps and establish monitoring network infrastructure - Ensure spatial distribution of water resource monitoring stations, frequently - Monitored resource - Dedicated personnel are needed to continuously maintain the monitoring stations and surroundings as well as access roads where applicable. - Resource and Infrastructure Planning - provide adequate	- Robust technologically advanced water resource monitoring network systems which are well distributed and frequently calibrated, continuously providing good quality and frequently monitored water data to make informed decision on the information pertaining protection, conservation, use and management of water resources	- Financial resources, relevant skilled personnel and technology	- Maintained monitoring network system Quarter 1 2022/2023 Technological advanced monitoring network system 2023/2024 Spatial distribution Quarter 2 2023/2024	- DWS (National and Regional Offices), other - Government Departments, - Universities, - Research Councils, - SAEON - SAWS - ARC - Catchment Management Agencies, - Water Users Association, - Water Boards, - Consultants and the private sector, affected Communities, public etc. - Drillers associations - Public and Private water laboratories

DRAFT

	monitoring data for determining the availability and quality water resource currently and in the future.				
Audited Groundwater Quality Monitoring Programme data and information on information systems	Ensure that Groundwater Quality Monitoring Programme data and information (maps, graphs and analysis) is endorsed by a Hydrogeologist before it is shared or uploaded onto information systems.	Hydrogeologists	DWS (National and Regional Offices), other Government Departments, Universities, Research Councils, Catchment Management Agencies, Water Users Association, Water Boards, Consultants, the private sector, affected communities, public etc.	- Auditing of Groundwater Quality Data: Continuously/Quarterly	
Groundwater Level Monitoring Network aligned with mapped groundwater boundaries	Re-define the groundwater level monitoring network to align with mapped groundwater boundaries.	Hydrogeologists, Production Scientists, Scientific Managers	DWS (National and Regional Offices), other Government Departments, Universities, Research Councils, Catchment Management Agencies, Water Users Association, Water Boards, Consultants, the	- Re-defining the groundwater level monitoring network to align with mapped groundwater boundaries	

DRAFT

			private sector, affected communities, public etc.		
Enhanced Acid Mine Drainage Monitoring Network in the Central and Eastern Basins	a) Relook at spread of monitoring sites within the Acid Mine Drainage Monitoring Network in the Central and Eastern Basins, possibly expand the monitoring network where gaps have been identified. b) Replace old, outdated water level, - quality and - quantity data recorders with stable, updated instrumentation.	Water Monitoring Committees, Skilled monitoring personnel Budget	DWS (National and Regional Offices), other Government Departments, Universities, Research Councils, Catchment Management Agencies, Water Users Association, Water Boards, Consultants, the private sector, affected communities, public etc.	- Expansion of monitoring network where gaps have been identified	
Enhanced Acid Mine Drainage Monitoring Network in the Western Basin	Expand the Acid Mine Drainage Monitoring Network for Gauteng and Regional to obtain more water quality data.	Water Monitoring Committees, Skilled monitoring personnel	DWS (National and Regional Offices), other Government Departments, Universities, Research Councils, Catchment Management		

DRAFT

			Agencies, Water Users Association, Water Boards, Consultants, private sector, affected communities, public etc.		
Improved data availability for all National Water Quality Monitoring programmes.	a) Ensure adequate Human, Financial and travelling resources at DWS Regional Offices for the effective monitoring of all National Water Quality Monitoring programmes. b) Streamline the approval process for travelling. c) Introduce Service Level Agreements between the Directorate: Resource Quality Information Services (RQIS) and DWS Regional Offices to facilitate the	Human, Budget and Travelling resources DWS Management Directorate: RQIS Directorate: RQIS Budget	DWS (National and Regional Offices), other Government Departments, Universities, Research Councils, Catchment Management Agencies, Water Users Association, Water Boards, Consultants and the private sector, affected communities, public etc.	- Introduce Service Level Agreements between the Directorate: Resource Quality Information Services (RQIS) and DWS Regional Offices	

DRAFT

	collection of the samples as well as to stipulate what is required from both parties. d) Ensure there is a fully functional Analytical Services Laboratory and effective courier service in place so that samples can get analysed within the required timeframe.				
Enhanced analytical capacity to convert the data to information to knowledge to intelligence which can be readily accessible for informed decision making.	Strengthen (if not) establish teams to perform analytical functions in order to determine and report on the trends across the various operations in the Department.	Production Scientist, Scientific Managers	DWS (National and Regional Offices), Government Departments, Universities, Research Councils, Catchment Management Agencies, Water Users Association, Water Boards, Consultants, private sector, affected communities, public etc.		

DRAFT

2.3.3 Priorities of Water Quality Monitoring Programmes

This section outlines priorities of water quality monitoring programmes with resources required to achieve the strategic objectives for each programme. A new data base for River Eco-status and Wetlands Monitoring Programme should be established to accommodate all the variables of these two programmes. Expansion of monitoring network coverage for Microbial, Eutrophication, Toxicity and Radioactivity Monitoring Programmes to other Water Management Areas remains the main priority action for the next five years while the National Chemical Monitoring Programme needs to be resuscitated in the regions where the samples are not collected. The enhancement of partnership for Estuarine Monitoring Programme with water institutions in the coastal provinces will contribute in the optimization and sustainability of this programme. Allocation of sufficient resources and formalization of partnership with all the identified stakeholders is recommended to ensure optimal water quality data collection across the country.

Table 2.6 Water Quality Monitoring

Monitoring Programme	Priorities	Proposed Action	Proposed outcome	Significance of the programmes	Stakeholders	Required resources
River Eco-status Monitoring	Development of a new database to fulfill the needs for DWS (River EcoStatus Monitoring Programme, Ecological Reserve studies, Classification Studies and monitoring of RQOs) Enhance synergies among water institutions such as CMAs, SANPARKS, provincial nature conservation bodies The monitoring programme is under resourced hence it is imperative to establish partnerships and enhanced synergies among water institutions (CMAs, SANPARKS, provincial nature conservation bodies)	Identify key features of the database (comparison between features of the Old Rivers Database and FBIS). Identify aspects of each database that works/ed well and did not. Identify the needs. It must make provision for Rivers (Invertebrates, Fish, riparian Vegetation, Habitat etc), Wetlands (different types of biota) and possibly the biological component of estuaries. Feasibility study: Identify possible platforms for database including where it will be housed and who will be responsible for the maintenance of the database. Cost benefit analysis Put out on tender. DWS must receive the source code	Fully capacitated programme allowing the monitoring, reporting and management of South Africa's river systems. This includes the effective monitoring of RQOs.	National State of Water Report Annual State of Rivers Report SDG 6.6	Regional Offices, CMAs, SANParks, Provincial Nature Conservation Bodies, Academic institutions, Transboundary river commisions (ORASECOM, KOBWA, LIMCOM etc.)	Budget for establishment of a new data base is not yet confirmed Efficient SCM processes. Sufficient RQIS staff with diverse knowledge on riverine ecosystems and its indicators. This monitoring programme requires fully capacitated and trained staff in the national and regional offices, this includes PPE, sampling equipment (Nets, fish shockers etc.) identification guides and other resources. Training in the ecostatus indices are required.
Wetlands Monitoring Programme	Recruitment of accredited personnel such as GIS specialist and Technicians in the regions for implementation of Tier 1 Development of Wetland Ecological Data base	The W-DMS will be used as a precursor to implement the National Wetland Monitoring Programme (NWMP, especially Tier 2 & 3).	Full implementation of the programme by 2022-2023	Annual State of Water reporting, SDG 6.6.1 & 6.3.2; information needed for other DWS legislatives processes such as reserves, RQOs and EIAs	DWS Regional Offices; DFFE; DARDLR; SANParks; Provincial Parks Boards; Academic institutions; Conservation Agencies; CMAs; Water boards, Provincial Enviromental	R1.5 million as proposed in the current draft of the Wetland DMS Strategy Implementation Action Report

		Full details are indicated in Wetland DM Implementation Plan			Agencies/Departments; Municipalities, Water User Associations (WUAs), Private Sector organisations, Non-governmental organizations (NGOs) and Industry.	
Estuaries Monitoring Programme	Formalise partnership with local municipalities, local interest groups and governmental institutions such as Cape Nature, Ezemvelo and SAEON. Have external laboratories appointed. Communicate succesfully and provide 100% of the equipment, training and technicall support required to perform field work.	Monthly communication with stakeholders responsible for field work to determine training, equipment and support needs. Also ensure that there are relevant procedures available for training and support purposes. Make use of national laboratories contract. Budget and purchase instrumentation in advance. Develop training material and procedured. Provide training and support as needed.	Capacitated and motivated stakeholders collaborating with the estuaries programme to ensure the sustainable production of data and information.	National State of Water Report SDG Reporting	Regional offices, NGOs performing estuarine research, Ezemvelo KZN, Cape Nature, District Municipalities, SANPARKS, CMAs.	Efficient SCM processes. Sufficient RQIS staff with estuarine knowledge. The estuaries monitoring network requires special instrumentation for both salinity profiles and continuous reading of tidal changes (loggers). Correct operation, maintenance and training relating to instrumentation to maintain quality of the data is a challenge. The programme also requires the use of external specialised laboratories to analyse marine/brackish water samples. Appointment of these laboratories combined with the logistics of getting samples to laboratories within time is also a challenge.
National Chemical Monitoring Programme	Resuscitation of NCMP in the WC, FS, NW, MP and NC WMA and maintenance of planned monitoring Increase compliance with sampling schedule	Contact with DWS Regional Hydrology Offices and other samplers to regain commitment and identify and attempt to help to solve mutual problems. Provision of dedicated data collectors and sampling equipment Improve collaboration with DWS partners to ensure continued collection of samples	Improved collaboration and hence increased compliance with sampling schedules. Data being generated by the RQIS Lab and being available of the WMS database after quality checks.	NCMP is contributing to State of Water Report, Quarterly reports, SDG reporting and ad hoc information requests	RQM, RQI, WII, SDG Secretariat and SANParks	Approximately R12 million per year, including external analyses budget of R1.8 million (to cover for NCMP, NMMP, NEMP and NEsMP) Technical resources (telephone/Cellphone, PC/Laptop, internet connection for communicating with stakeholders) - Financial resources

						(adequate Budget for travel & Accommodation for attending meetings and forums with stakeholders) - Transport - Adequate monitoring budget (analyses, sampling supplies and equipment) -Adequate human resources to administer and perform fieldwork.
National Microbial Monitoring Programme	Resuscitate NMMP and expansion of existing national monitoring network into new WMA's. in regions currently not monitoring.	Recruitment of water quality data collectors in all the DWS regional offices for optimal monitoring operations Liaise with regional offices to assist with monitoring in the regions Enhance existing partnership for data and information sharing	Improved collaboration on monitoring at different government tiers -Good working relationship with established partners. - Coordination and data sharing between partners. - Water Quality improvements. - Water quality data gaps should be improved.	National State of Water Report SDG Reporting	DFFE, Local Government Dept of Health, Local and District Municipality Water Boards, Water User Associations, CMAs and Academic Institutions	Technical resources (telephone/Cellphone, PC/Laptop, internet connection for communicating with stakeholders) - Financial resources (adequate Budget for travel & Accommodation for attending meetings and forums with stakeholders) - Transport - Adequate monitoring budget (analyses, sampling supplies and equipment) -Adequate human resources to administer and perform fieldwork.

National Eutrophication Monitoring Programme **National Eutrophication Monitoring Programme**	Increase monitoring network coverage of NEMP to all 9 WMA Improve compliance of sampling requirements on 112 dams and 82 rivers. Increase monitoring network coverage of NEMP to all 9 WMA Improve compliance of sampling requirements on 112 dams and 82 rivers.	Forge partnerships with DWS regional offices, CMAs and external stakeholders (municipalities, water boards etc) to assist with NEMP sampling. Acquire laboratory contracts for analyses. Forge partnerships with DWS regional offices, CMAs and external stakeholders (municipalities, water boards etc) to assist with NEMP sampling. Acquire laboratory contracts for analyses.	NEMP status and trend monitoring and reporting in the 9 WMA. NEMP status and trend monitoring and reporting in the 9 WMA.	NEMP is contributing to State of Water Report, Quartely reports and SDG reporting. NEMP is contributing to State of Water Report, Quartely reports and SDG reporting.	Resource Quality Management, Resource Quality Information, WII, SGD Secretariat	Technical resources (telephone/Cellphone, PC/Laptop, internet connection for communicating with stakeholders) - Financial resources (adequate Budget for travel & Accommodation for attending meetings and forums with stakeholders) - Transport - Adequate monitoring budget (analyses, sampling supplies and equipment) -Adequate human resources to administer and perform fieldwork.
Radioactivity Monitoring Programme	Under current circumstance the priority is to maintain the planned monitoring and where the funds are available or information need highest to increase montoring. Pertmit data export from external laboratory Activating the function on WMS for external laboratories to export analysis results to WMS	Maintain the collaboration and relations between RQIS, regional offices and the National Nuclear Regulator (NNR) on monitoring of radiological sites in SA. Liaising with regional offices to assist with monitoring of sites within their proximity and sharing data for sites they are monitoring for the similar variables to curb financial implications.	NRMP monitoring coordination and data sharing within stakeholders to improve radiological water quality monitoring Expansion of radioactivity monitoring, Improved water quality monitoring representation	National State of Water Report SDG Reporting	RQIS_RQM, Regional offices, NNR, CMAs	Human Resources: Additional samplers at RQIS, regional office assistance with sampling Budget support SCM support Scientific manager/ Field Expert

Toxicity Monitoring Programme	Maintenance of existing monitoring sites and expansion of the programme to other WMAs Have reliable connectivity at RQIS and access to the different databases. Databases must be Windows 7 and higer compatable	Resuscitation of the labs for effective analysis of samples. Establishment of labs in the regions is the key step which is also cost effective and will contribute to good quality of data Recruit data collectors for implementation of the programme in the regions Liaising with regional offices to assist with monitoring of sites within their proximity and sharing data for sites they are monitoring for the similar variables to curb financial implications. Investigate the connectivity challenges through interaction with CIO and Sita.	NTMP will become a national programme to give a full picture of the trends and status of toxicity of country's water resources. Quality and quantity of data generated by the programme will be sufficient for planning purposes Jobs within the sector will be created as well as human resource capacity development	National State of Water Report SDG Reporting	Local and Regional municipalities; Water Boards/Providers; Catchment Management Agencies; Academic institutions; the Water Research Commission; other institutions and private individuals including farmers. SITA CIO	Budget for analysis and Sampling Sampling personnel / lab analysis contract Functional Database Technical expertise / Production scientist (radiophysicist) Functional DWS server and network connection Support from all necessary role players.

DRAFT

2.4 Laboratory Services

2.4.1 Current Status of Laboratory Services

The water quality samples for National Chemical Monitoring Programme (NCMP); National Eutrophication Monitoring Programme (NEMP), National Toxicity Monitoring Programme (NTMP), National Estuaries Monitoring Programme (NEsMP) collected from various monitoring sites across the country are analysed by Resource Quality Information Services (RQIS) Laboratory Services and results are uploaded in WMS. National Microbial Monitoring Programme (NMMP) and National Radioactivity Monitoring Programmes (NRMP) sample analysis is conducted by Nuclear Energy Corporation of South Africa (NECSA) due to the nature of parameters, instrumentation and expertise required for the analysis.

Budget restrictions for contracted laboratories remain a challenge which affects analysis of samples for NMMP and NRMP. RIQIS laboratories are faced with many challenges which include inability to procure reagents and maintain instrumentation. Among the shortcomings reported, RQIS laboratory accreditation remains a critical issue which affects the “perceived” reliability of data and accuracy of any water quality results coming from samples analysed by the RQIS laboratory. Laboratory accreditation needs to be prioritised and finalised as soon as possible to ensure that the information produced from the laboratory is scientifically validated and reliable for decision makers and for effective water resource management.

Currently there is a blanket laboratory service approval for surface water quality monitoring which is utilised by both National office and the regions. A lot of challenges are experienced with those laboratories which were appointed by the Department. They are unable to conduct analysis for some of the critical parameters and they end up subcontracting other laboratories to provide services for them. The subcontractors only accept samples on certain days of the week and the regions are sometimes unable to submit samples on those preferred days.

2.4.2 Strategic Targets for Laboratory Services

The strategic targets of laboratory services as indicated in Table 2.6 include revitalizing and ensuring well-functioning and accredited laboratories at RQIS. Functioning of the laboratory depends on the availability of reagents and the maintenance of instruments which have not been able to be procured in the past financial year (2019/2020) due to financial constraints. It is imperative to resuscitate Hydrobiology, Trace Metal, Microbiology and Inorganic Laboratories at RQIS which have been reported as non-functional.

Table 2.7 Strategic Targets for Laboratory Services

Strategic targets	Proposed action	Proposed outcome	Required resources	Timeframes	Stakeholders
Plan of action for the application for method accreditation with SANAS signed off by Minister on 21 August 2019. New target dates proposed during feedback reporting as follows: Trace metal and Hydrobiology lab in Q4 2020/21 Microbiology lab in 2021/22 Inorganic Chemistry lab 2022/23 Development of funding model that will support RQIS laboratory and contracted laboratories for adequate analysis	- Procure supplies and services - Prepare methods, SOPs and policy manual - Train personnel - Perform method validation - Analyse routine samples - Take part in proficiency testing - Perform quality control actions	- Sufficient and high quality supplies available - Well maintained equipment - Controlled documents such as methods, SOPs and policy manual - Competent personnel - Approved method validation reports - Routine samples' results available on WMS - Evaluated proficiency testing results within criteria limits - Quality control results within criteria limit	Analytical service and RQIS support personnel Accredited contract laboratory and adequate analyses budget. Funding for instrumentation and invest in our RQIS laboratory	New target dates proposed during feedback reporting as follows: Hydrobiology lab in Q4 2020/21 Trace metal lab in Q4 2020/21 Microbiology lab in 2021/22 Inorganic Chemistry lab 2022/23	RQIS Personnel, SANAS, DWS support personnel e.g. SCM section Suppliers

DRAFT

2.5 Data Management

In the water sector, water-related data is used for decision making in all aspects of water resources management, in a wide range of operational applications, as well as in research (WMO, 2015). Water-related data is commonly used to provide information on the state of the water resources, water related hazards such as floods and droughts, water related public health issues, planning water resources development, planning infrastructure development, effects of water use, effects of economic activities, effects of regulation measures, the state of the climate system, etc. Thus, poor management of water-related data may lead to negative economic effects and disastrous situations such as; unpreparedness for extreme water related events (floods, droughts, contamination, etc.), lack of account for water use, non-compliance on international agreements for water sharing, etc. (Wenninger and Venneker, 2015).

Water data is a strategic asset of the DWS and the water sector at large. Data is normally translated into information after it has been loaded into the databases. The information generated from water data is very useful for decision makers within the DWS. A number of stakeholders from Planning, Compliance and Enforcement, Regulation, Policy Development, Infrastructure Support, Reserves and Ecosystems directorates depend on this water information for their operations. The well-being of the general public (communities using raw water either from the rivers or groundwater) depends on water information and academic institutions also require the same information for research purposes. The National State of Water Report (NSoWR) is also dependant on water information stored within the various databases and without this information it would be impossible to disseminate information about the water situation of the country.

Currently the DWS has developed the National Integrated Water Information System (NIWIS) which serves as an information dissemination system for various monitoring programmes. The NIWIS comprises of various dashboards created to display water information. The DWS also has other databases where water data on quality and water levels is stored; some of the databases have some kind of information which is useful for understanding of water situation. Water data on stream flows, rain evaporation and reservoirs are archived in HYDSTRA; Groundwater data is archived in various databases including the NGA, WARMS, GRIP and HYDSTRA; Fitness for use data in the WMS, NGA/REGIS and GIS, and water-use data is captured in WARMS. The Directorate: Water Information Integration within the DWS is responsible for analysing different data sets from HYDSTRA, NGA, WARMS and WMS.

However, all these various databases can only be useful if they have accurate and reliable data that is uploaded on a regular basis. Currently, DWS officials are continuously faced with network challenges which appear to be hampering the capturing of data on these databases. For example, during a recent review of Water Monitoring Programmes at DWS, not all groundwater monitoring stations were found to be registered on HYDSTRA.

2.5.1 Current Status of Data Management

Through water sector stakeholder consultation, the following data management related challenges have been recorded on Table 2.7 (refer to 1st edition Data Management Strategy for Water and Sanitation in South Africa).

DRAFT

Table 2.8 Water Quality & Quantity Data Management Challenges

Shortcomings	Recommendation/s	Proposed Mitigation
Insufficient Human Capacity / Shortage of Staff ⇒ The processes required to collect data used to generate information that is used to manage surface and groundwater resources are summarised as follows; Continuous maintenance of monitoring networks and monitoring points, Field Data Collection in line with approved monitoring methodologies, Data editing, validation and storage into data management systems such as WMS and HYDSTRA. ⇒ As reported during the DAM Strategy regional workshops and the IWQM Strategy, there is inadequate numbers of suitably skilled staff at the regional offices to perform and manage these processes. This is caused by lack of advertisement for vacant positions resulting from resignations and retirements, lack of transfer of skills from senior officials and contractors and lack of continuous training of officials on the scientific aspects behind the collection, validation and processing of data.	⇒ Plan an awareness campaign to the DWS Top Management Committee to highlight the consequences of vacant positions and lack of skills transfer.	⇒ The DWS regional offices should prepare lists of all vacant water quality related positions and positions where officials require training. Report on the data backlogs that are directly or indirectly caused by the vacant positions or lack of skills, and present to the DWS Top Management Committee. ⇒ A training program should be developed for the DWS regional offices where staff will be equipped with the required skills to acquire and manage different types of data.
Delays in Procurement of Instrumentation and Renewal of Laboratory Contracts ⇒ The DWS is currently experiencing very long procurement processes for purchasing new and replacement instrumentation as well as renewal of laboratory contracts, resulting in the lack of hydrological instrumentation used to collect data as well as laboratories for sample analysis. As reported in the IWQM	⇒ As proposed in the IWQM Strategy, the DWS must support the monitoring network expansion with an initiative to ensure that accessible accredited laboratories are available to ensure efficient and effective analyses ⇒ Procurement procedures must be reviewed and improved in order to improve the turnaround time for renewal of	⇒ The DWS regional offices and head office should prepare lists of all instrumentation and laboratory contracts that have not been renewed and report on the consequent data backlogs, and present to the DWS Top Management Committee.

DRAFT

Strategy, there exists an uneven availability of access to accredited laboratories for testing of samples across the RSA.	laboratory contracts. Current procurement procedures prevent laboratories from analysing water quality samples on time or at all. ⇒ Expired contracts should be extended until new contracts are finalised.	
Some Water Quality Data Stored into DMSs with Errors ⇒ Surface and Groundwater quality data used for decision making is stored without validation, leading to errors and ultimately negatively affecting its credibility.	⇒ Standard Operating Procedures (SOPs) should be established for data collection, processing, validation and dissemination of water quality data.	⇒ Establish or revive data acquisition and management committees for the entire DWS where SOPs for water quality data are developed, agreed upon, endorsed and regularly reviewed and revised
Vandalism of instrumentation and lack of Access to Private Land ⇒ A number of instrumentation across the RSA are vandalised by members of the community. Some private land where monitoring points such as boreholes are situated is inaccessible due to locked gates or access refusal by the private land owners.	⇒ Create awareness to communities and private landowners about the importance of water resources monitoring in RSA.	⇒ Organise awareness campaigns to communities and private landowners to create awareness about the implications of vandalism and lack of access to private land on the quality and availability of water resources in RSA. ⇒Establish a memorandum of understanding between the DWS and private land owners for access to private land. Establish a standard procedure for gaining access to private land. ⇒ Establish memorandum of understanding between the DWS and community leaders to prevent vandalism of monitoring instrumentation.
Lack of adequate data collection skills in Municipalities ⇒ In order to monitor aquifer responses to activities such as abstraction, data such as groundwater levels and abstraction volumes is required. Some of this data used for local groundwater monitoring is collected monthly by operators at municipalities. Municipal technical managers are expected to edit and	⇒ Establish a memorandum of agreement with municipalities for skills transfer and data sharing.	⇒Organise workshops or meetings with municipalities to establish memorandum of understanding for skills transfer and data sharing.

DRAFT

validate the data and DWS regions provide final recommendations and store the data in HYDSTRA. It has been reported that there is lack of skills at municipalities to collect the required data as well as lack of cooperation from municipalities for DWS to train data collectors.		
Inaccessibility of Water Quality and Quantity Data Collected by Consultants ⇒ There exist data collected by consultants and other external institutions that are not easily accessible as the data stored in the DWS owned systems. For instance, the RAMSAR and NFEPA data used in generating information for the national state of wetlands is reported to be collected mainly by the DEA/SANBI and the CSIR. Wetlands research data is collected mainly by the WRC, wetlands health and protection data is collected mainly by SANBI and GIS data is collected mainly by the DWS in partnership with SANBI.	⇒ Enable access to water quality data collected by external institutions and consultants.	⇒ Identify the different types of missing data as well as the external institutions and consultants that are collecting the missing data. ⇒ Participate in workshops and meetings with the external institutions and consultants to discuss the sharing of water quality data. ⇒When appointing consultants, the Terms of Reference (ToR) should include the handover of project raw data to DWS. The ToR should also include an obligation for technicians and Graduate Trainees (GT's) to receive field training while the consultants are collecting the raw data.
Fragmented DMSs used to Manage Water Quality and Quantity Data ⇒ In the assessment of business objectives and information needs for water quality, the following objectives for managing water quality data have been identified; *i.e.* to provide information on the state of water resources in RSA, surface and groundwater reserves, point and non-point pollution sources, drinking water quality, water quality regulation, wetlands information, water quality monitoring programmes and trend analysis information. These business	⇒ Develop an integrated approach or method to efficiently and effectively manage water quality data management systems in the DWS.	⇒ Investigate the types of data stored in the ± 10 data management systems and identify any possible risk of duplication of datasets among the data management systems. Where duplication may exist, it must be established which data management systems are the most capable for handling the different types of data in order to eliminate duplication. ⇒ Investigate the types of data (formats) stored in the water quality data management systems to establish which systems are most capable of providing the best accessibility,

DRAFT

objectives combined require information generated from a number water quality data management systems and supporting systems; with WMS being the main water quality system. The other systems used in water quality management are; GIS data management systems, BDS, GDS, GRIP, HYDSTRA, EWULAAS, NGA, Rivers DB, ECMS, NCIMS, WARMS. Currently, the data in these DMSs are fragmented and stored in multiple formats.		security as well as the best timeliness in disseminating data. ⇒ Review the WMS technical specifications and the technical specifications of the other Water Quality data management systems in order to develop an integrated approach for managing the data stored in the all the Water Quality data management systems. ⇒ Develop a central database for River health data to improve data accessibility.
Some Water Quality and Quantity Data not stored in structured Data Management Systems ⇒ There exist data stored into personal computers, hard drives and as hard copies within the DWS, making it not easily accessible, compromising the security of critical and sensitive data. For instance, some of the data required for generating information on river health and Eco-status in rivers, point and non-point water pollution sources and state of water information is stored in personal computers across the different business units and regional offices in the DWS, and on computers in other departments and independent research organisations.	⇒ Identify and retrieve data stored in personal computers, hard drives and as hard copies; and transfer into relevant DMSs for water quality.	⇒ Investigate the types of data stored in personal computers and identify water quality data management systems where the data should be stored. Make recommendations on how to transfer the data depending on the type of data and the design of the data management systems. The following types of data have been prioritized during the 2nd DAM Strategy National workshop; viz, Groundwater Hard copy data storage and arching system required; no structured system currently exists, groundwater quality data currently in personal computers, regional spread sheet data currently in personal computers that should be stored into the WMS, etc. ⇒ Task teams should be established at all the DWS regions and head office facilitate the collection of all the data that is currently in network drives and personal computers that should be stored in the WMS and other relevant systems.
No Structured DMS for Wetlands Water Quality and Quantity Data	⇒ Develop a structured data management system for wetlands data.	⇒ A workshop between key DWS Directorates should take place to achieve the following;

DRAFT

⇒ There currently exists no structured DMS in the DWS for wetlands data. Wetland data acquisition, storage and management are a relatively new mandate of the DWS and as a result it is the least well developed field. No previous assessments of the data and information produced and required by the DWS for wetlands has been undertaken. Although DWS has yet to implement the wetland health monitoring programme and wetlands still need to be integrated into catchment management plans, the DWS determination of management objectives and authorisation of water uses that impact on wetlands has been undertaken since its mandate for managing wetlands first arose in 1998 (i.e. for the past 20 years). . In order to contribute to information on the state of wetlands in RSA and to improve decision making by DWS and its institutions with regards to wetland management GIS data, research data, data on resource directed measures that have been put in place, ecosystem services data, compliance monitoring and enforcement data, data for wetlands health monitoring wetlands use authorisation and offsets data, hydrological data and water quality data, amongst others, is required. In addition, given the inter-governmental nature of wetland management, where both DEA and DAFF also have mandates to sustainably manage and protect wetlands, numerous data from other government departments (in particular data from the ARC, DEA , SANBI and		→ Investigate the current wetlands data governance structure. The following questions should be answered; what is the role of DWS in wetlands monitoring and data management and how does this differ or compare /align with the role of DEA and SANBI. → Develop information needs and data requirement specification by identifying the following; information users, required information, data requirements and identify where the required data is stored. → Perform a gap analysis and determine whether there is a need to develop standalone data management systems for wetlands data or whether other currently existing water quality data management systems such as the WMS may be used. ⇒ An inter-departmental workshop should be held with the ARC, DEA, WRC, Working for Wetlands, DAFF and SANBI (who are the current champions for wetland data acquisition and management in South Africa). The aim will be to understand the data they require from DWS, and to understand the availability of wetlands data that they are responsible for, their existing systems, their governance arrangements and opportunities for linkages and alignment. The outcomes from this engagement should further inform the requirement for a DWS based DMS for wetlands. ⇒ The following external stakeholders should be consulted; →External Stakeholders viz. SA Wetland Society; CSIR; KNP/SANParks; STATSSA;

DRAFT

Working for Wetlands) are required to ensure aligned and integrated decision making.		International research institutions such as IWMI NGOs (such as WWF) and the Private sector (businesses and public enterprises, including SANRAL, Eskom, Sappi, Mondi, Sasol, *etc*.). → The following platforms may be used to communicate the wetlands DAM Strategy; the Freshwater Ecosystem Network (FEN),the DWS Wetland Task Group, the Wetland Prioritisation Imbizo and the National Wetland Indaba. ⇒ A task team should be established at all the DWS regional offices to perform a review of wetlands data in collaboration with the DWS head office. The outcome and recommendations from this review should contribute to the overall review of wetlands data.
Underutilisation and none utilisation of the WMS ⇒ It was reported that the WMS is not fully utilised at some regions and not utilised at all at other regions due to perceived lack of user friendliness; hence, not all the officials from the various DWS regions are able to capture water quality data. It has been reported that some water quality data collected in the DWS regions has not been stored into the WMS for years due to the lack of user friendliness of the WMS.	⇒ Improve the ease of use of the WMS.	⇒ A DWS regional audit of the WMS usage must be conducted where the following must be performed; → An analysis of regions that are fully utilising the WMS versus those not fully utilising it. → Where WMS is not fully utilised, investigate gaps and propose mitigation activities. → Escalate the gaps and proposed mitigation activities to the Top Management committee, for approval to implement. ⇒ Evaluate the current procedures for entering and retrieving data using the WMS in order to identify possible new tools, methods or technologies for improving the user friendliness of the WMS. ⇒ The Directorate: RQIS must provide training at the DWS regional offices and develop

DRAFT

		standard operating procedures (SOPs) and business process for capturing and retrieving data using the WMS. ⇒ The Directorate: RQIS should investigate and make recommendations on how to improve the WMS user interface. Monitor the progress of the current update of the WMS. ⇒ Create an internet connection to WMS in order to integrate WMS with Laboratory management systems. This must be accompanied by training for Labs and stakeholders to enable them to transfer data.
Most Water Quality and Quantity Data Management Systems are not Current ⇒ As reported in the IWQM Strategy, most of the DMSs currently used in the DWS are not current and accessible to support adoptive and latest methods and techniques for WQM such as citizen based monitoring.	⇒ As reported in the IWQM Strategy, the DWS and other water sector stakeholders must develop data and information systems that are current and accessible to support adoptive WQM and accommodate latest methods and techniques such as citizen based monitoring.	⇒ A task team from the DWS, the WRC and CMAs must be established to lead the development of a programme for developing DMSs that are compatible to citizen-based monitoring programmes.
Lack of Documented Data Architecture for Water Quality and Quantity Data Management Systems ⇒ It appears that not all data management systems used in water quality and quantity have documented data architecture.	⇒ Document a Data Architecture for the data management systems used in water quality and quantity.	⇒ Investigate methods for documenting data architecture for water quality and quantity data management systems.

2.5.2 Data Management Strategic Targets

Strategic Objective: Development and Implementation of Data Management Strategy for Water and Sanitation in South Africa
Desired Outcome: Have a National Data Management Model for coordinating and facilitating the Sector-Wide management of Water and Sanitation data required to populate the national data and information systems.

DRAFT

Table 2.9 Strategic Targets for Data Management

Targets	Proposed actions	Required resources	Stakeholders	Time Frames	Progress
Establish Strategic Guidelines and Framework for Data Acquisition and Management in order to improve the 4 Pillars: o Data Governance o Data Life Cycle Management o Data Management Systems o Stakeholder Collaboration and Partnerships - Develop a Data Management Strategy Implementation framework.	- Development of Data Management Implementation (Action) Plans for the following Focus areas: o Wetlands Data Management o Water Quality and Sanitation data Management o Water Quantity Data Management o Water Accounting Data Management - Establishment of Data Management Steering and Technical Committees for the following Focus areas: o Wetlands Data Management o Water Quality and Sanitation	- Technical Expertise from the DWS regions – Production Scientists, Scientific Managers, Graduate Scientists. - Technical Expertise from the DWS National Office – Production Scientists, Scientific Managers, Graduate Scientists. - Budget for Workshops, Meetings with external Stakeholders, Field Work, Training	- DWS (National and Regional Offices), other Government Departments, Universities, Research Councils, Catchment Management Agencies, Water Users Association, Water Boards, Consultants, the private sector, affected communities, public etc.	- Establishment of strategic guidelines and framework for 4 pillars: March 2021 (Overall processes to follow for implementation) • Action Plans for Wetlands Data Management- End of March 2022 • Water Quality and Sanitation Data Management- March 2023 • Water Quantity Data Management- March 2023 • Water Accounting Data	Guidelines Completed Action 2 Partially completed Wetlands-In progress

DRAFT

	data Management ○ Water Quantity Data Management ○ Water Accounting Data Management			Management- March 2023 - Establishment of steering and technical committees for - Wetlands Data Management March 2022 under progress Water Quality and Sanitation Water Quantity DM Identification of committee members in progress -Water Accounting MoU between DWS and Stats SA is underway in order to effect action plans	Water Quality and Sanitation- in progress Steering committee has been nominated

DRAFT

RESOURCE ALLOCATION FOR WATER MONITORING

3.1 Introduction

Water resource monitoring programme operations require adequate human and financial resource in order to ensure a robust monitoring network system that generates sufficient and credible data for effective water resource management. It has been indicated by champions of various monitoring programmes that deteriorating of monitoring network infrastructure is mainly attributed to insufficiency of funds and lack of dedicated personnel for maintenance of existing monitoring sites. This section details the additional human and financial resources needed for optimal monitoring operations.

3.2 Human Resource Requirements

3.2.1 Human Resources Challenges

Table 3.1 highlights the key priorities of monitoring programmes in relation to human resource. The shortage of personnel for data collection, technicians for maintenance of geosites and dedicated personnel for data management is indicated as the main challenge that requires urgent strategic intervention. Establishment of fully functional components of respective monitoring programmes with data collectors, technicians and scientists requires all the identified critical posts to be filled. Moreover, capacity building and clear succession plan should be prioritized for sufficient data collection, management and information dissemination.

Table 3.1 Human Resource Challenges

Shortcomings	Key Priorities	Proposed Interventions
Shortage of personnel: Data collectors, dedicated personnel for maintenance of geosites Implications include deteriorating monitoring stations due to lack of personnel for maintenance Restrictions put on the appointment of Data collectors and qualified Technicians Deficit and misalignment of necessary skills Lack of clear succession plan and transfer of skills from highly experienced personnel with long service	Filling of critical and vacant posts More personnel is required for data auditing and quality assurance, calibration of monitoring stations, to specialise on other indices for efficient and effective monitoring, for example fish Capacity building of officials responsible for collection of water samples and management	Recruitment of Data collectors and Technicians Establishment of a functional unit responsible for maintenance of monitoring infrastructure Capacitate and develop Data collectors, Scientists, Technicians and Engineers for effective data collection and information management. Continuous training programme must be developed and implemented with the primary focus on WMS, HYDSTRA, NGA, Calibration, logger data upload or format data extractions. Formalise development and transfer of skills from highly experienced personnel in all levels of monitoring.

DRAFT

		Funds should be available for external training sessions aiming to capacitate Data collectors, Scientists, Technicians and Engineers and this include accredited courses contributing with Continuous Personal Development credits as required by SACNASP. Develop and implement a clear succession plan for personnel nearing retirement.

3.2.2 Regional Human Resource Requirements

The enhancement of monitoring programmes also depends on filling of vacant and critical posts of data collectors, technician, scientists, and deputy directors to ensure that the directorates responsible for monitoring operations are fully functional. The Regional Offices within the FS**,** KZN, WC, GP, MP, NW, EC, LP and NC have indicated additional personnel required for each monitoring programme as shown in Table 3.2. The regions have not provided data on personnel required where the programme does not exist in the Region; another reason is the fact that water quality monitoring programmes such as National Chemical Monitoring Programmes, Surface Water Quality and Estuary Monitoring Programmes are managed by RQIS and the information has been provided by various Regions.

DRAFT

Table 3.2 Regional Human Resource Requirements

Monitoring Classification	Free State		KwaZulu-Natal		Western Cape		Gauteng		Mpumalanga		North West		Eastern Cape		Limpopo		Northern Cape	
	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel	Current personnel	Required personnel
Hydrological	**26**	**46**	**14**	**23**	**64**	**73**	**55**	**70**	**91**	**96**	no data	no data	**41**	**25**	no data	no data	**2**	**1**
Surface Water Quality	no data	no data	no data	no data	no data	no data	no data	no data	**53**	**53**	**10**	**5**	**17**	**7**	no data	no data	no data	no data
Geo-hydrological	no data	no data	no data	no data	**17**	**23**	no data	no data	no data	no data	6	no data	no data	no data	**14**	**6**	**10**	**1**
Chemical	**26**	**46**	no data	no data	no data	no data	no data	no data	no data	no data	0	no data	no data	no data	no data	no data	no data	no data
Eutrophication	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Toxicity	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Microbial	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
Radioactivity	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data	no data
River Eco-status *** CEO: Control Environmental Officer** **EO: Environmental Officer** **EOS: Environmental Officer Specialised** **ST: Scientific Technician** **CS: Candidate Scientist** **GT: Graduate Trainee** **SC: Scientist Manager)**	**1 (ST)**	**7 (5 EO, 2 ST)** Fish, invertebrates, Riparian Vegetation, Geomorph	1 (SM) (Invertebrates, Fish, Riparian Vegetation, IHI)	7 1SM 4 Scientists 2ST (Invertebrates, Fish, Riparian Vegetation. IHI)	8 (4 Scientists 1 ST 1 CS 2 GT)	10 Scientists (2 per index)	no data	no data	5 (1 CEOl 1 Scientist 3 EO) Fish, invertebrates, Riparian Vegetation, Geomorph	6 (1 CEO, 1 Scientist,4 EO) Fish, invertebrates, Riparian Vegetation, Geomorph	**11** **2 CEO** **9 EO** **(invertebrates, IHI, Riparian Vegetation)**	**22** **3 scientists 3 ST** **1admin** **15 EO** **(invertebrates, IHI, Riparian Vegetation, Fish)**	11	12 4 CEO (Invertebrates, Fish, RHAM, IHI),4 Scientist (Riparian Vegetation, Geomorphology),4 EOS (invertebrates)	**7** **1scientist** **4EO (invertebrates, Riparian Vegetation, IHI)**	**8** **(Fish, invertebrates, Riparian Vegetation, IHI)**	4 1CEO 3Scientists)	8 1CEO, 3 EOs (Invertebrates, Fish, RHAM, IHI),4 Scientists (Riparian Vegetation, Geomorphology),
Estuaries	no data	no data	**2**	**3**	no data	no data	no data	no data	no data	no data	0	0	no data	no data	no data	no data	no data	no data

DRAFT

3.2.3 RQIS Human Resource Requirements

Water Quality Monitoring Programmes need a dedicated team of qualified data collectors, laboratory personnel for sample analysis, data and information management. The Directorate RQIS has indicated that for NCMP, the current personnel is enough except for regional offices where samples are collected by regional data collectors. The Microbial, Eutrophication, Radioactivity, Toxicity, Estuaries and Ecosystems need two additional data monitors as outline in Table 3.3.

Table 3.3 RQIS Human Resource Requirements

Monitoring classification	Approximate number of key points	Required Personnel
Chemical	346	Current RQIS personnel adequate, regional offices short on personnel.
Microbial	117	RQM sampling team will need 2 additional monitors. One vacant post and one occupied by an employee that will be going on early retirement soon.
Eutrophication (Dams and River sites)	112 Dams and 81 River sites	2 additional monitors
Radioactivity	18	2 additional monitors
Toxicity	18	2 additional monitors
Estuaries	159	2 additional monitors
Ecosystems:	453	98

DRAFT

3.3 Funding Requirements

The Hydrological, Geo-hydrological and Water Quality Monitoring programmes depend on regional officials for sample collection, calibration and control checks of real time devices in the monitoring stations distributed across the country. The travelling for sample collection and lab analysis requires adequate funding including accommodation for officials collecting samples away from the Regional office. Currently, funding for accommodation, Phakisa contract and subsidy vehicles is not sufficient and this has negative implications on the smooth running of water resource monitoring operations at National and Regional level. The lack of long term contract for labs and procurement of instrumentation is one of the factors resulting from insufficiency of funds. The lack of adequate funding for maintenance of monitoring network infrastructure resulted in deteriorating and closing of a number of monitoring stations over a long term. DWS Regional Offices in the FS, GP, KZN, MP, WC, NW, EC, LP, NC and the Directorate: RQIS have indicated that additional funding is required for water resource monitoring programmes.

DRAFT

3.3.1 Free State Funding Requirements

The Free State Region is currently running Hydrological, Geo-hydrological, Surface Water Quality, NCMP and Aquatic health monitoring programmes. All the mentioned monitoring programmes are faced with a total of **–R 17 514 550** budget shortfall as indicated in Figure 3.1 and a total of **R36 932 550** budget is required to ensure optimal monitoring operations of these monitoring programmes in the Free State Region.

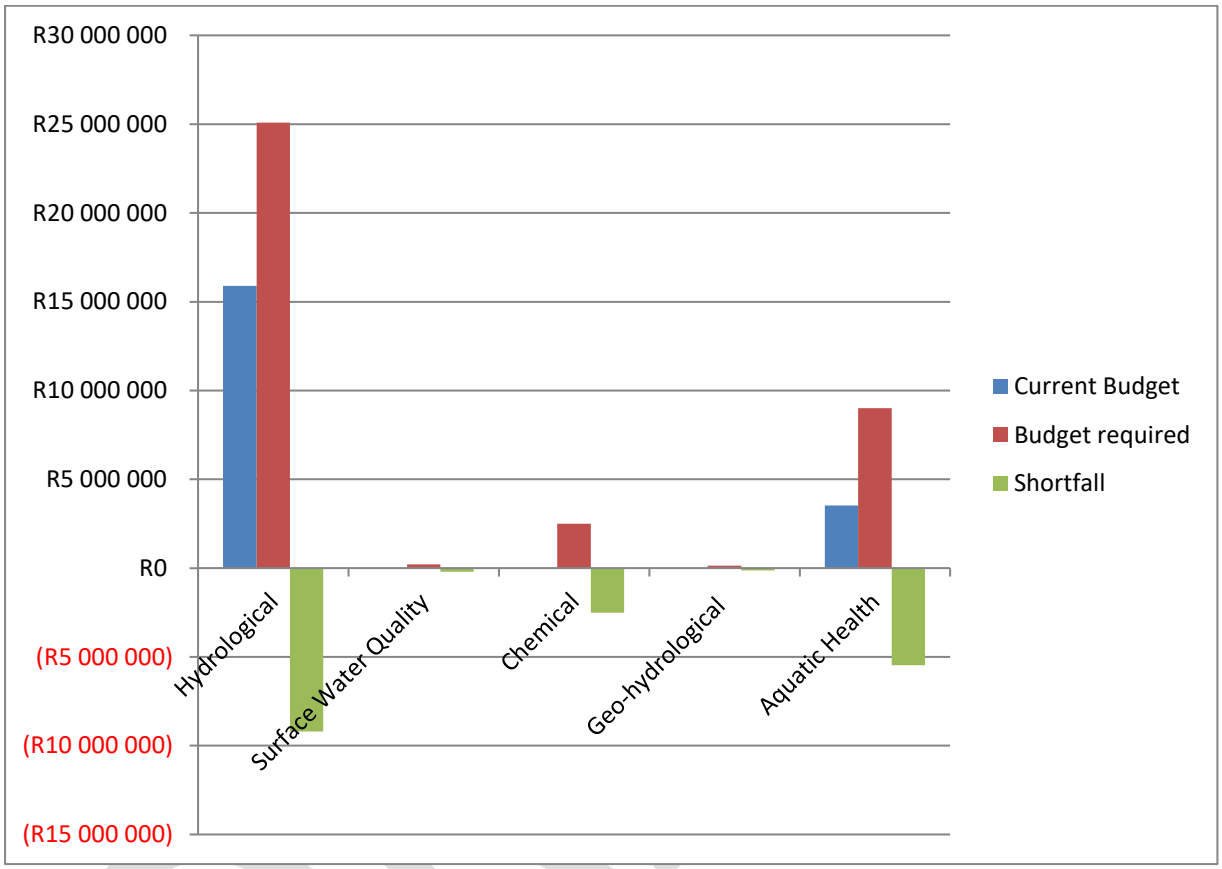


Figure 3.1 Free State Funding Requirements

3.3.2 Gauteng Funding Requirements

The Gauteng Region is currently responsible for Surface Water Gauging, measurement of Reservoirs, collection of Rainfall and Evaporation Data. Gauteng reported a shortfall of **-R6 554 000** required for effective implementation of its Hydrological Monitoring Programmes. A total of **R13 200 000** budget is required to ensure effective and sufficient implementation of Hydrological monitoring programmes within Gauteng Region. Other monitoring programmes such as Geo-hydrological are no longer operational due to insufficiency of funds. Allocation of required budget for Gauteng Region is imperative for restoration of monitoring network that has collapsed previously due to lack of financial resources.

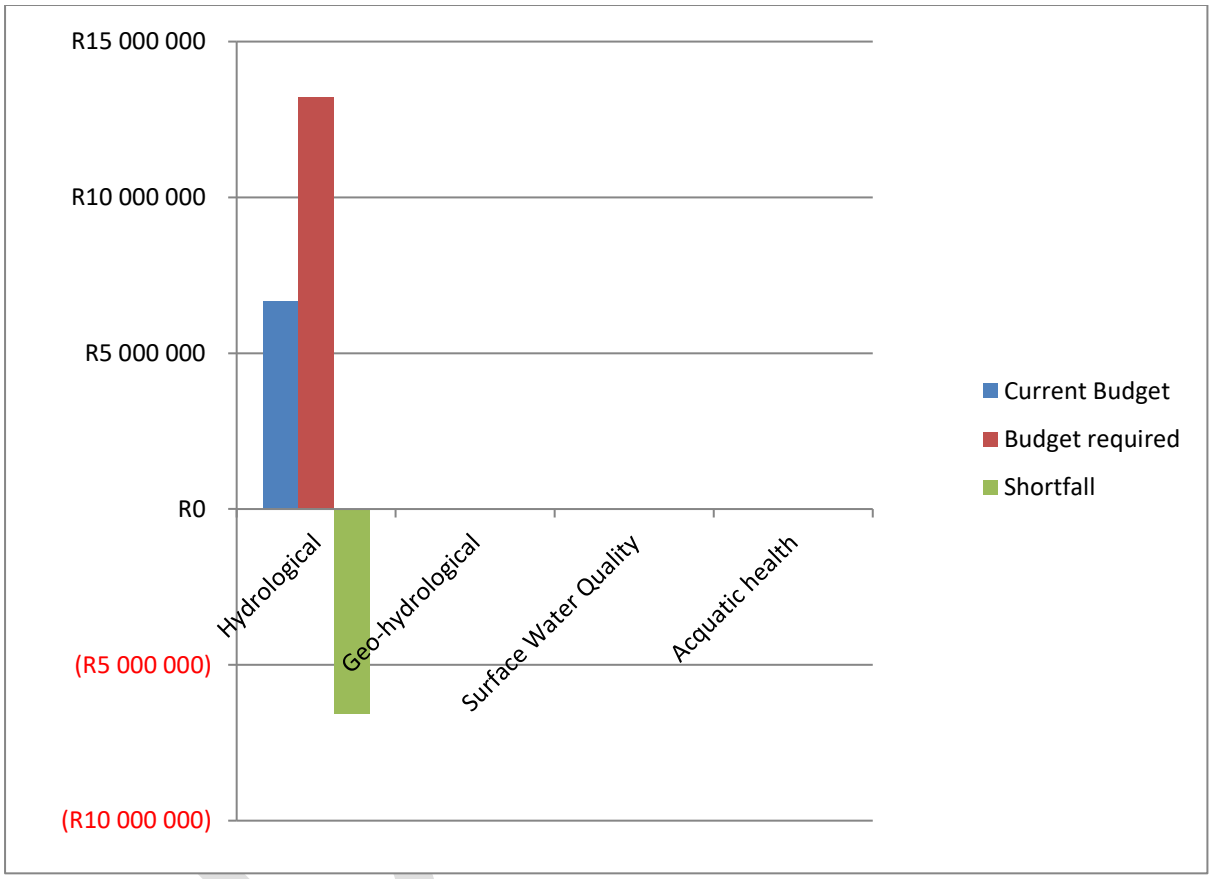


Figure 3.2 Gauteng Funding Requirements

3.3.3 KwaZulu-Natal Funding Requirements

The KZN Region is currently managing Hydrological, Geo-hydrological, Surface Water Quality, Aquatic health, Estuaries Monitoring programmes. The monitoring programmes are faced with a **-R20 286 638** shortfall of budget hence a need was indicated of adding funds for sustainability of water resource monitoring programmes in KZN Region. A total of **R39 786 282** budget is required to ensure fully functional monitoring network systems that will generate sufficient data and information about water resource situation in KZN Region.

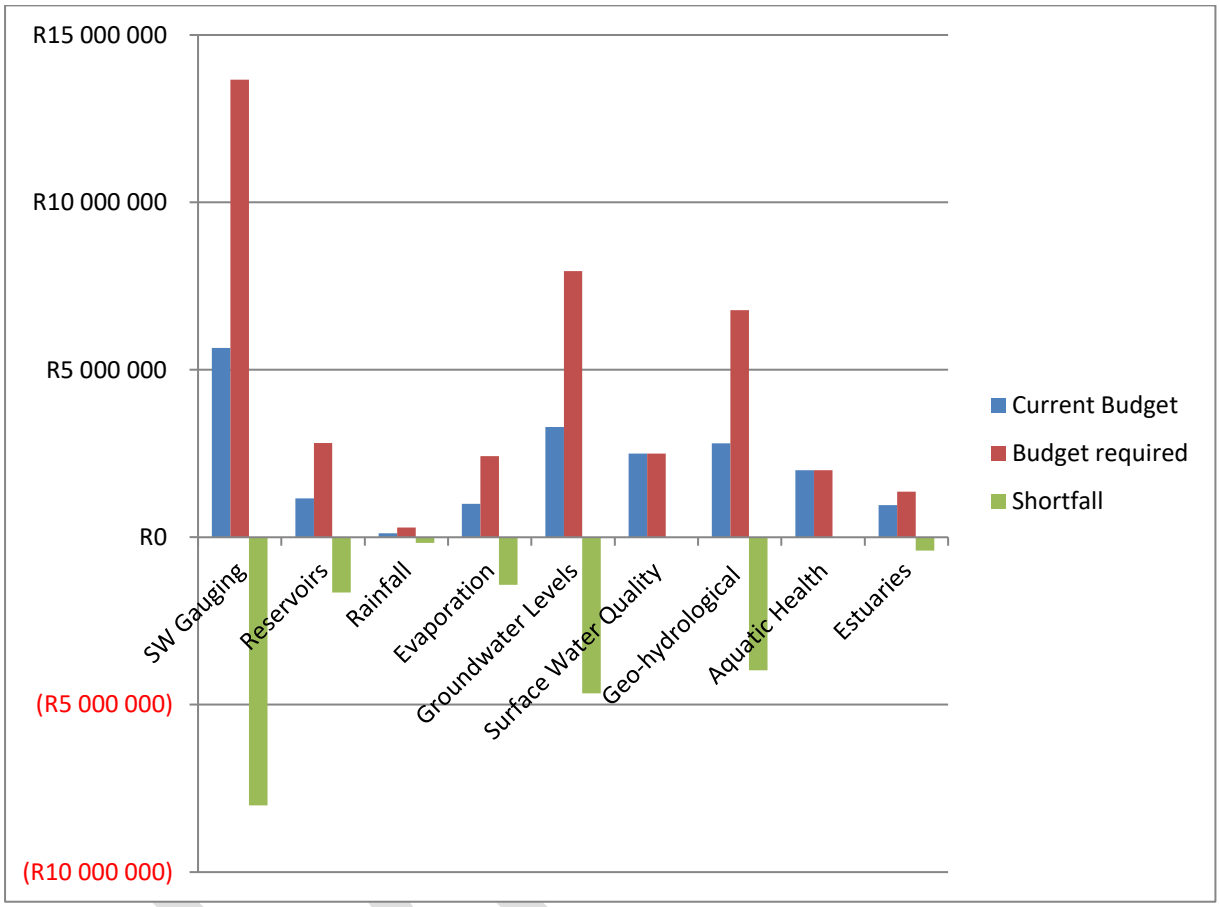


Figure 3.3 KwaZulu-Natal Funding Requirements

3.3.4 Mpumalanga Funding Requirements

The Mpumalanga Region has reported a total of **R 32 500 075** budget required for successful running of Hydrological, Geo-hydrological, Surface Water Quality and Aquatic health Monitoring programmes. The monitoring programmes including water services are faced with a total of **–R16 516 075** budget shortfall. The current budget allocated is not enough for effective and sufficient implementation of Mpumalanga water resource monitoring programmes. Failure to allocate the required budget will compromise the health and sustainability of the monitoring network systems and result in many gaps in the data bases and information systems.

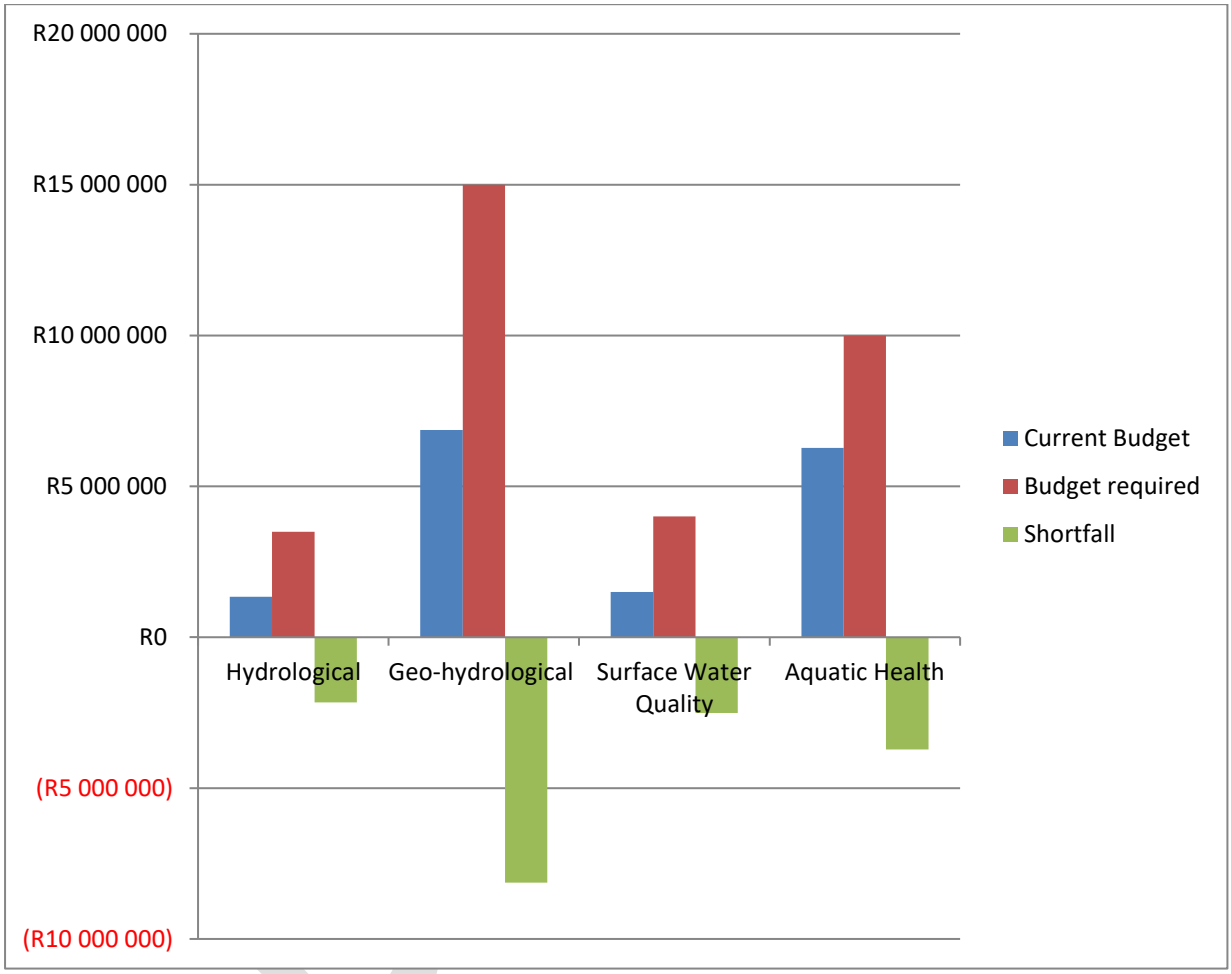


Figure 3.4 Mpumalanga Funding Requirements

3.3.5 Western Cape Funding Requirements

The Western Cape Region is responsible for Hydrological, Geo-Hydrological and Surface Water Quality Monitoring Programmes. The DWS Regional Office in the Western Cape reported that a total of **R 38 517 412** is required for effective implementation of water resource monitoring programmes. The monitoring programmes within the Western Cape Region are experiencing a total of **–R 7 500 000** budget shortfall. The current budget of **R 48 412 000** is not sufficient to ensure that the monitoring network generates sufficient data required to support business requirements.

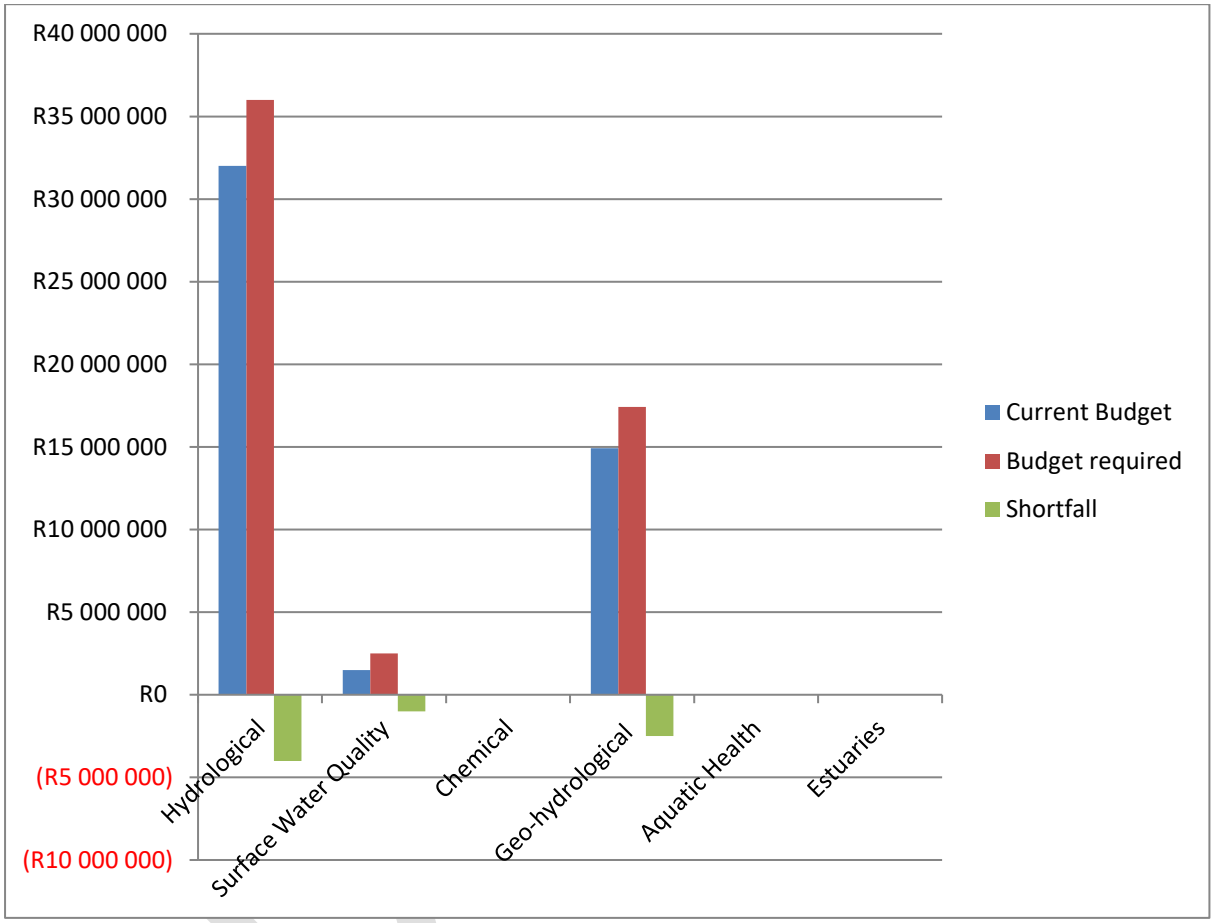


Figure 3.5 Western Cape Funding Requirements

3.3.6 North West Funding Requirements

The North West Region is currently running Geo-hydrological (levels and quality) and Surface Water Quality monitoring programmes. As indicated in Figure 3.6 the North West Region requires an additional budget of **R 900 000** for Geo-hydrological monitoring, with **R 900 000** for Surface Water Quality and **R 100 000** for Geo-hydrological quality monitoring programmes. It is vital to ensure that the required additional budget is allocated for these monitoring programmes to be implemented effectively in the North West Region.

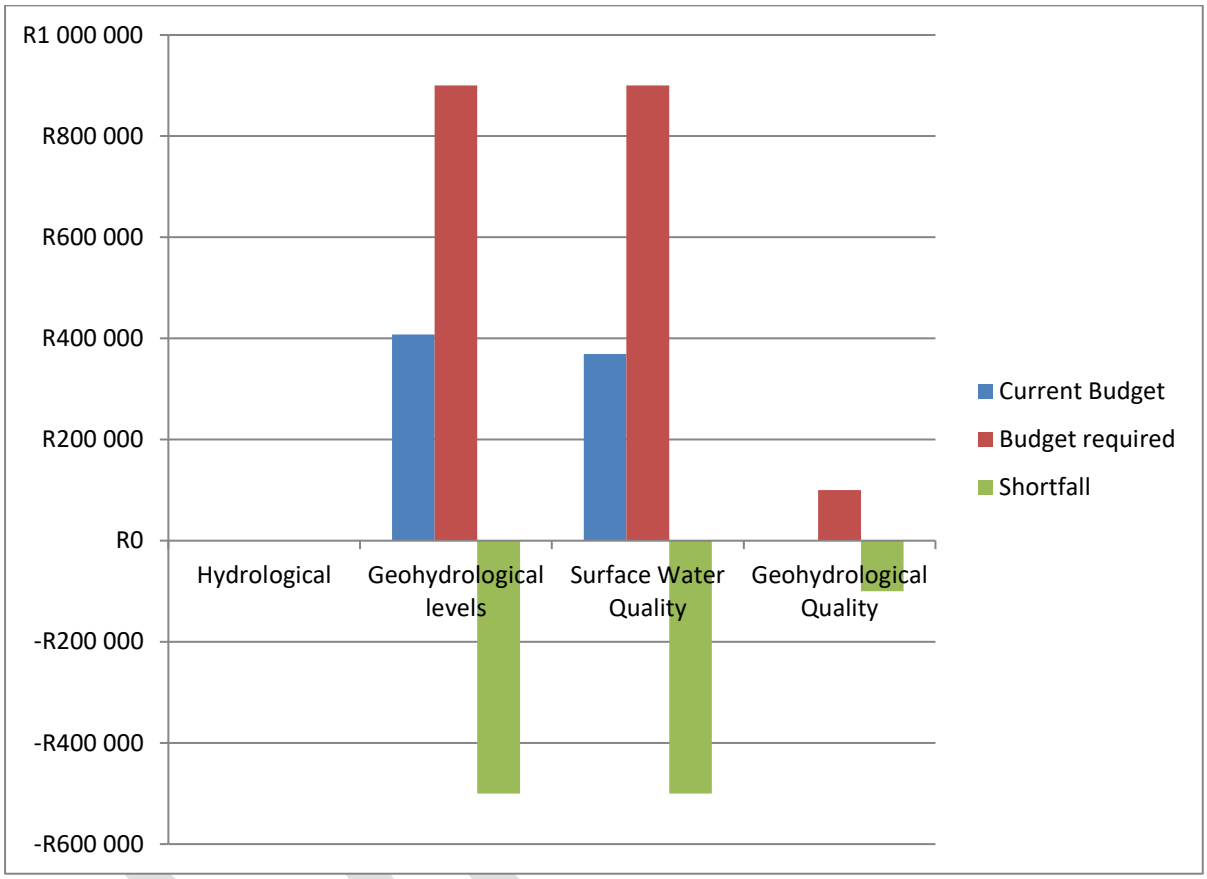


Figure 3.6 North West Funding Requirements

3.3.7 Eastern Cape Funding Requirement

The Eastern Cape Regional Office is responsible for Hydrological, Geohydrological, Surface Water Quality and Aquatic Health Monitoring programmes which require **R 48 000 000** for effective and efficient monitoring operations. The EC Regional office is faced with a shortfall **-R15 890 000**, the current budget allocated of **R 40 010 000** is not sufficient for an optimal data acquisition and management process.

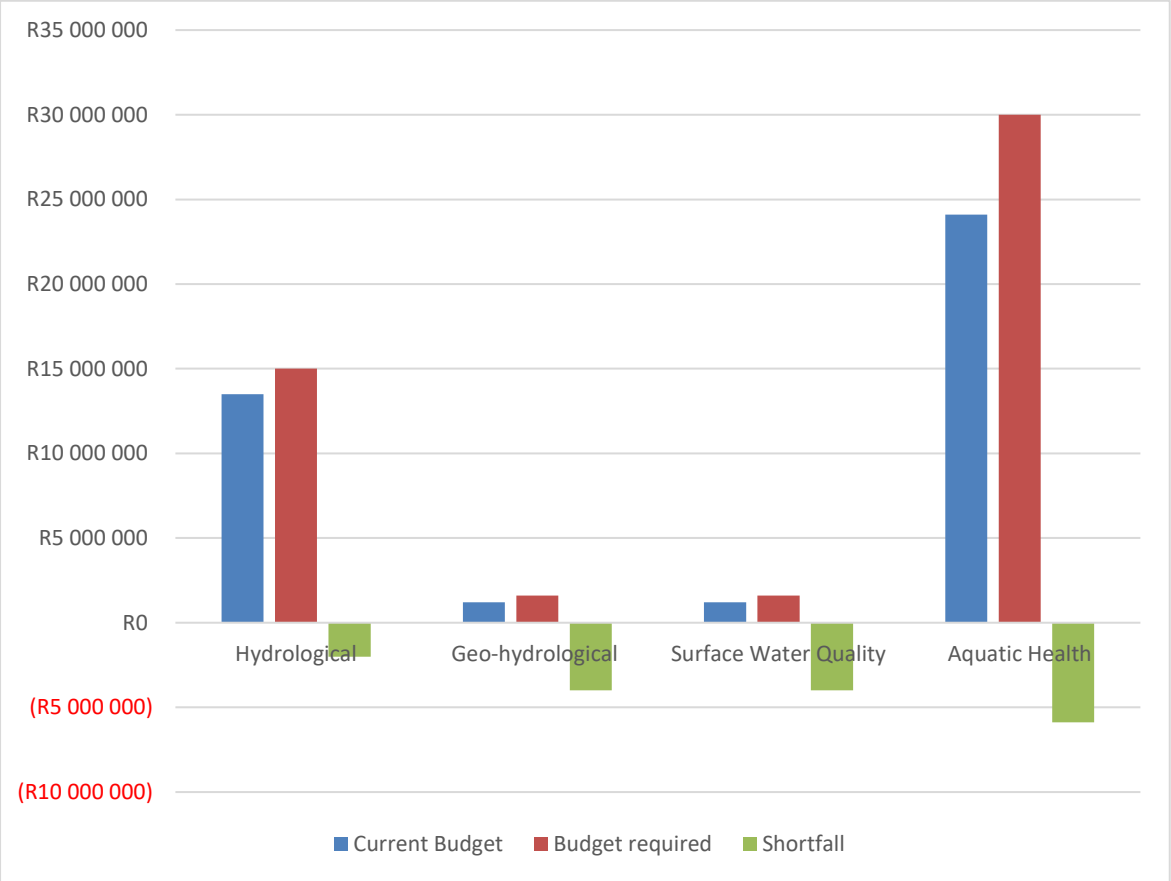


Figure 3.7 Eastern Cape Funding Requirements

3.3.8 Limpopo Funding Requirements

The Hydrological, Geohydrological, Surface Water Quality and Aquatic Heath monitoring programmes implemented by Limpopo Regional Office require a budget of **R17 500 075** for provision of adequate data and information that will give comprehensive picture of water situation. The Geohydrological Monitoring Programme needs to be allocated a budget of **R8 130 00** for the programme to be fully functional while an amount of **-R8 386 075** is indicated as the total shortfall for all the monitoring programmes.

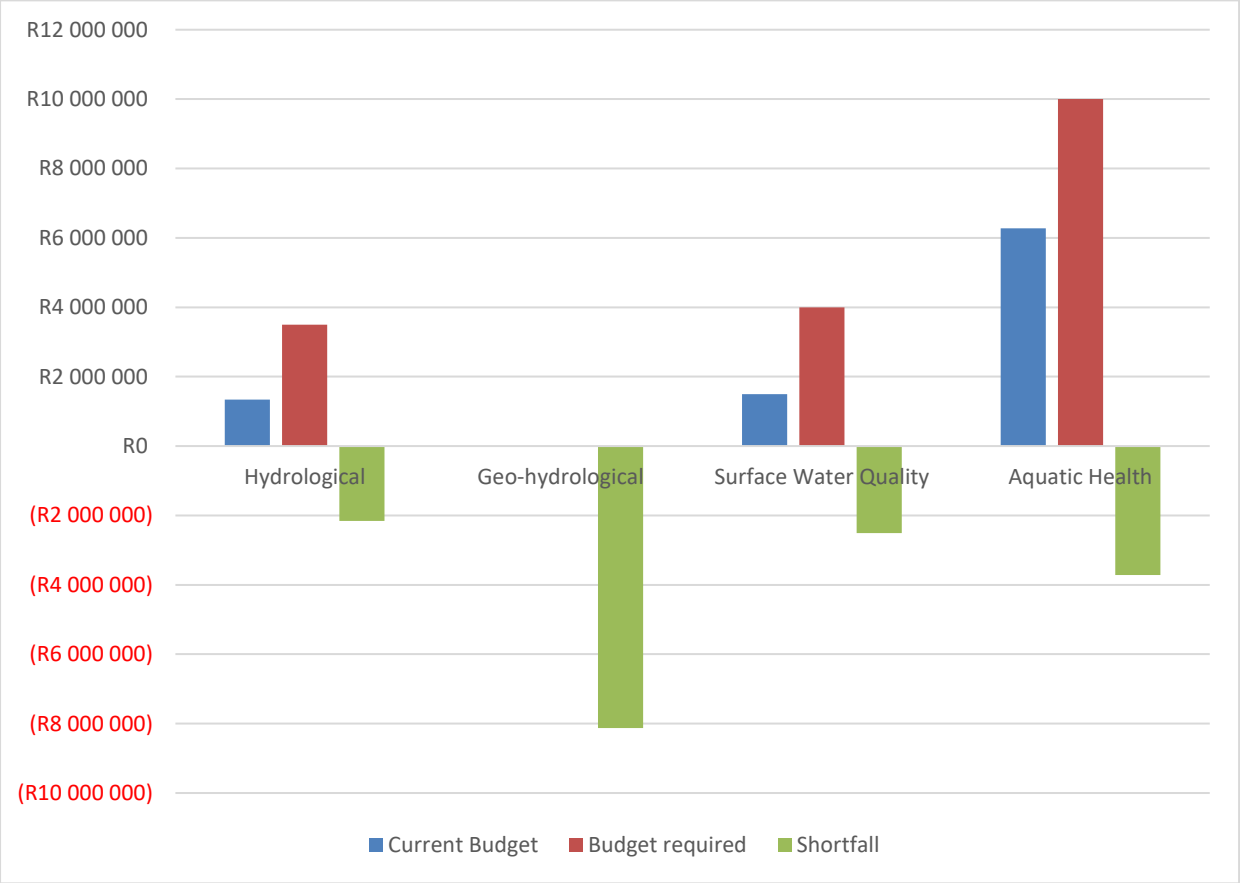


Figure 3.8 Limpopo Funding Requirements

3.3.9 Northern Cape Funding Requirements

The Regional office within the Northern Cape is currently generating data and information through Hydrological and Geohydrological monitoring programmes. It is evident that the current budget of **R10 150 000** is not sufficient for smooth monitoring operations. It is vital to allocate **R13 730 000** for optimization of Hydrological and Geohydrological monitoring programmes of the Northern Cape Region. There is no indication of the amount required for Surface Water Quality and Aquatic Health monitoring programmes.

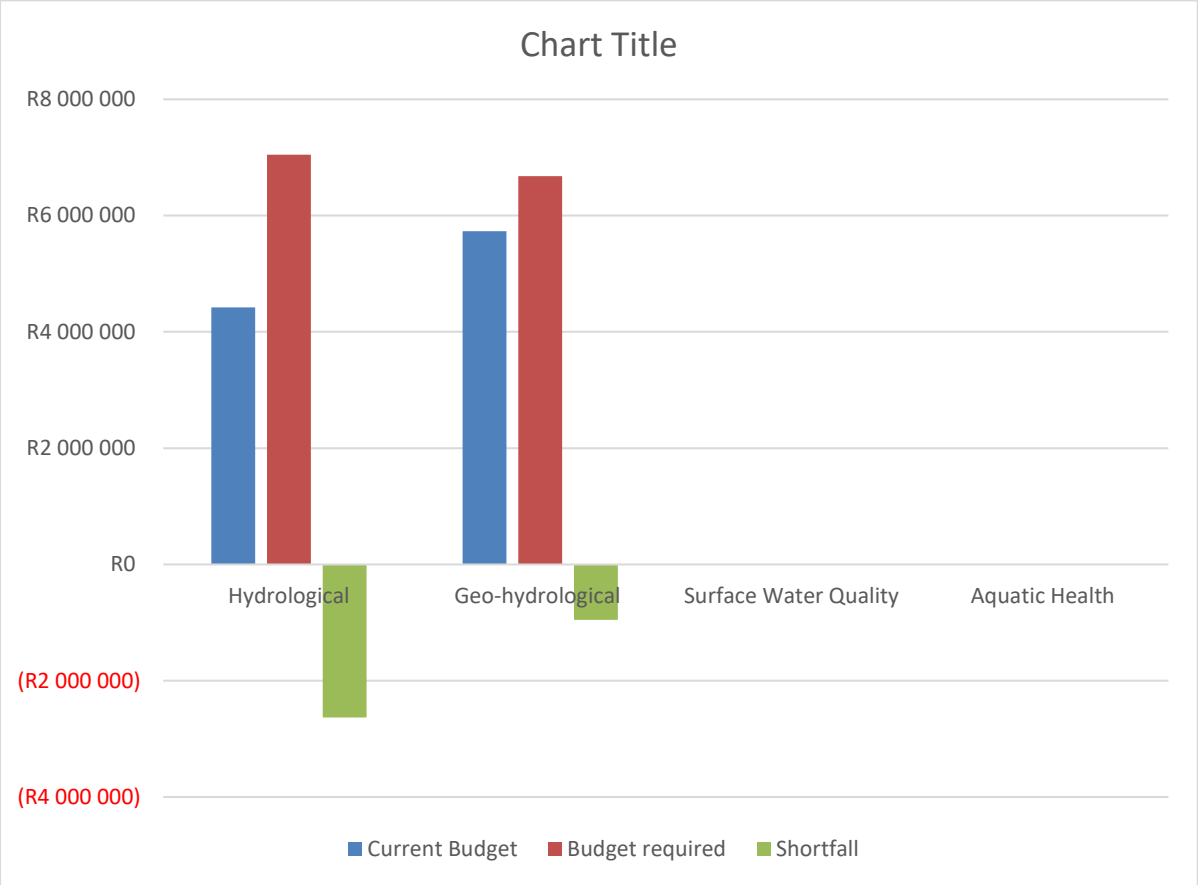


Figure 3.9 Northern Cape Funding Requirements

3.4 RQIS Funding Requirements

The Directorate RQIS is responsible for management and implementation of water quality monitoring programmes namely; NCMP, NMMP, NEMP, NRMP, NEsMP, NREMP, NTMP and NWMP. The analysis of samples for various water quality monitoring programmes depends on the functioning of RQIS Laboratories which are currently faced with a number of shortcomings such as lack of accreditation, defunct labs, inability to procure reagents and maintenance of instrumentation. Resuscitation of RQIS laboratories and adequate collection of samples from various monitoring points requires an allocation of R 12 million per annum as illustrated on Table 3.4. The Regional offices are currently using contracted laboratories and it has been indicated that a budget of R 1.8 million is required to ensure that continuous analysis of samples from the external laboratories. The failure to allocate the required budget will have negative implications on the sustainability and trend analysis of water quality monitoring programmes.

Table 3.4 RQIS Funding Requirements

Monitoring classification	Approximate number of key points	Expected budget per annum	Shortfall
Chemical	346	The analysis and sampling cost is part of the RQIS Goods and Services budget which approximately R12 million per year, including external analyses budget of R1.8 million	The allocated budget is for 2020/2021 sufficient for the samples that will be collected. Shortfall on the Hydrology regional offices Additional budget required for external analyses performed. (Additional R1.8 million for 2021/2022 required)
Microbial	117		
Eutrophication (Dams and River sites)	112 Dams and 81 River sites		
Radioactivity	18		
Toxicity	18		
Estuaries	159		
Ecosystems:	453	R 9 979 190	**- R 15 291 900**

DRAFT

CONCLUSION AND RECOMMENDATIONS

4.1 Introduction

This section aims to bring together the key findings and the key lessons learnt while drafting the National Water Monitoring Plan. The NWMP has proposed strategic targets for the identified priority areas; monitoring governance operations, monitoring network infrastructure, data management strategy and laboratory services that could be used as a tool for optimizing monitoring programme operations in the country. Finally, the section outlines recommendations that would see the strategic targets of the NWMP implemented.

4.2 Innovation in the Water Sector

4.2.1 Digitisation of Water and Sanitation Monitoring Systems

As the world moves into an era of “Big data” analytics and climate change necessitates the need for accurate, reliable, real-time data for planning and decision making; so to must water monitoring evolve and take advantage of advancements brought about by the Fourth Industrial Revolution. To this extent, the DWS has recently embarked on a National Digitised Integrated Water & Sanitation Monitoring System project which is envisaged to bring about this much needed transformation by ensuring that current monitoring practices are in line and up to date with the latest approaches and technologies. The premise for the National Digitised Integrated Water & Sanitation Monitoring System project is that its architecture shall take into account the collection of data from end-to-end across the entire water monitoring value chain.

The aim of the project is to digitise all elements of water monitoring value chain in line with the Fourth Industrial Revolution and further enhance the current National Integrated Water Information System (NIWIS) to display dynamic dashboards by using real-time data on water quality and quantity, remote-sensed data, etc. The project also aims to integrate various streams of data and information thereby serving as an umbrella system for water observation across the water and sanitation sector. Similar initiatives within and outside of the DWS that have the same objectives will also be incorporated into the National Digitised Integrated Water & Sanitation Monitoring System project in order to minimise duplication. The objective of the study is to assess current Water & Sanitation Monitoring Systems (from data collection, data processing and dissemination) with a view to design, develop or acquire and implement a digitised integrated Water & Sanitation Monitoring System across the country.

Monitoring systems outside of the DWS are in the short term excluded from the National Digitised Integrated Water & Sanitation Monitoring System project specifically for implementation purposes, except for initiatives that are already being undertaken by other stakeholders which the envisaged project can leverage from. However, a high-level plan is to include all components of water and sanitation monitoring including those outside of the DWS to ensure alignment and phased retro-fitting when required. The project focuses on digitising monitoring components within the water monitoring value chain. The approach will involve an integrated design for the entire water monitoring value chain however; the implementation will be done in phases based on priority areas within the water monitoring value chain. Specific focus areas include: Water Resources Management, Water Resources Infrastructure Assets, Water Regulation, Revenue Management, Sanitation Services and Water Services.

DRAFT

Due to the complexity of the water monitoring value chain and the fact that some of these components are monitored by stakeholders outside of the DWS, the project will garner support from multi-stakeholder committees. To this extent, the project intends to leverage on two existing committees namely: first at a strategic level, the Water & Sanitation Leadership Group to which the Director-General will report on progress as well as solicit high-level support and secondly at a more operational level, through the National Water Monitoring Committee which aims to bring together stakeholders from the DWS as well as other entities that are involved in aspects of the water monitoring value chain outside of the DWS. Potential stakeholders include the South African Weather Service (SAWS), the Agricultural Research Council (ARC), Water Boards, Municipalities, Water User Associations, Catchment Management Agencies, Industry and Mines. The project is expected to be completed in March 2026.

Other considerations would be to strengthen collaboration with water and research institutions that are ahead in terms of technology for monitoring water resources to take advantage of the knowledge base and build on it. In addition, working closely with other national and local government departments will give DWS access to data and/or information it wouldn't otherwise obtain. For example; some department s are exploring the use of drones to assess sites that are not easily accessible. Also, there is a need for research agendas to be aligned particularly that of DWS and Water Research Commission and other research and tertiary institutions to build the body of knowledge on water resources and achieve targets set out by the NWMP. Lastly, it is imperative to understand who the customer is i.e. data user, at every point of the monitoring value chain as it helps produce reliable and accurate information products that assist managers in decision making.

4.2.2 Drought Monitoring using Remote Sensing Techniques

The DWS in collaboration with the South African National Space Agency (SANSA) have initiated the project on the use of Vegetation Condition Index (VCI) to generate and disseminate drought information. The information is now available in the National Integrated Water Information System (NIWIS). The DWS Sub-Directorates: Integrated Water Information System (IWIS), Information Programmes Management (IPM) and Spatial Information (SI) facilitated and coordinated the inclusion of Vegetation Condition Index (VCI) to report drought in South Africa. The SANSA plays a vital role in this project by supplying vegetation related data for the country to the department.
This project seeks to firstly assess the suitability of using the satellite based Vegetation Condition Index approach in order to design, develop and implement an integrated drought risk management system to aid in the decision making process. Secondly, to test the feasibility of using satellite-based vegetation condition data for monitoring drought to supplement and complement the current information provided in the NIWIS that rely solely on the conventional hydrological data and lastly, to ensure implementation of the findings in order to enhance the NIWIS drought status dashboard. The project started in September 2019 and is currently at the phase where VCI information is being incorporated and tested into the NIWIS. The project can be concluded at any time from now, as soon as the testing is done and no faults are identified.

4.3 Recommendations

Based on the findings above, it is recommended that:

1. DWS investigates ways to leverage on technologies brought about by the 4th Industrial Revolution, Citizen Science and Remote Sensing Applications.

2. Make funds available for attending stakeholder collaboration meetings, presentations at conferences and workshops as well as training to enable scientists and engineers to pursue investigations on ways to leverage on technologies brought about by the 4th industrial revolution, Citizen Science Monitoring and Remote Sensing Applications.

3. Forge and formalize relationships among stakeholders of the water sector to align research agendas:
   I. The MP-IRWMC must formalise partnerships with the IUCMA, SANParks and AWARD around data and information sharing.
   II. The DWS is currently working in collaboration with SANBI to develop and implement the Wetlands Data Management Strategy for South Africa and eventually these partnerships need to be formalised.
   III. Formalise partnership with GroundTruth for data Citizen Science Data and Information sharing in South Africa.
   IV. Initiate and formalise partnerships between the DWS and NECSA for water quality data and information sharing and exchange.
   V. Formalise partnerships with academic institutions for collaboration on Digitisation 4IR and Big Data Analytics research to improve water resources monitoring and management in South Africa.

4. Funds should be made available for the plan to be distributed to the entire water sector through workshops, focus group discussions and interviews to further improve and streamline the strategic targets for the identified priorities, as the plan is not complete without the contributions of water sector experts and institutions.

5. A comprehensive cost benefit analysis should be done in terms of running state laboratories in some of the regions and increase the capacity and scope of RQIS laboratories instead of outsourcing Microbial, Chemical and Radioactivity sample analysis to private labs. The longer-term scenario for monitoring must be taken into account and not the continual renewal of contracts where services are outsourced.

DRAFT

REFERENCES

Department of Water Affairs and Forestry (DWAF) (1997) *National Water Services Act*, Act No. 108 of 1997. Republic of South Africa Government Notice.

Department of Water Affairs and Forestry (DWAF) (1998) *National Water Act*, Act No. 36 of 1998. Republic of South Africa Government Gazette, Volume 398, Number 19182.

Department of Water Affairs and Forestry (DWAF) (2004) *A 5-year Water Resource Quality Monitoring Plan.* Directorate: Information Programmes, Department of Water Affairs and Forestry, Pretoria, South Africa.

Department of Water Affairs and Forestry (DWAF) (2004b) *National Water Resource Strategy (1st Edition)* September 2004, Republic of South Africa.

Department of Water Affairs (DWA) (2013) *National Water Resource Strategy (2nd Edition)* Water for an Equitable and Sustainable Future June 2013, Republic of South Africa.

Department of Water and Sanitation (DWS) (2017) *Review, Evaluation and Optimisation of the South African Water Resources Monitoring Network. Report No 1*, Department of Water and Sanitation, Pretoria, Republic of South Africa.

Department of Water and Sanitation (DWS) (2019) *Gap Analysis Report on guidelines, procedure, standards and methods for integrated monitoring*. Department of Water and Sanitation, Pretoria, Republic of South Africa.

Department of Water and Sanitation (DWS) (2020) *Project Proposal: Digitization of Water Monitoring Systems. Version Draft V0.1*. Directorate: Information Programmes, Department of Water and Sanitation, Pretoria, South Africa.

Department of Water and Sanitation (DWS) (2020) *Terms of Reference: The Design of a National Digitized Integrated Water & Sanitation System. Version 2.2*. Directorate: Information Programmes, Department of Water and Sanitation, Pretoria, South Africa.

National Development Plan (NDP) (2012) Our Future – Make it work, National Planning Commission, Department of the Presidency, Pretoria, Republic of South Africa.

Sustainable Development Goals (SDGs) (2015) United Nations, General Assembly, Transforming our world: the 2030 Agenda for Sustainable Development, Resolution adopted by the General Assembly on 25 September 2015.

Wenninger, J., and Venneker, R. (2015) Hydrological data monitoring, data processing, data analysis and data dissemination." Short Course, 8-12 June 2015, Stellenbosch, Republic of South Africa.

World Meteorological Organization (WMO) (2015) Hydrological Monitoring and Data Management. http://www.wmo.int/ (accessed June 25, 2015).

DRAFT