2

WATER RESOURCES DATA

2 WATER RESOURCES DATA

2.1 Surface Water Monitoring

The Department has established and operates a national surface water monitoring network along rivers, dams, estuaries, eyes, canals, and pipelines. The purpose of the national network is to monitor hydrological and hydro-meteorological conditions to enable water resource assessment, planning, water supply management, system operations, and flood forecasting. The summary structure of the surface water monitoring programme in the Department is shown in Figure 2.1. The programmes are divided into two, the first is hydro-meteorological programme which monitors evaporation and rainfall, and the second programme is hydrological monitoring which entails streamflow and dam levels monitoring.

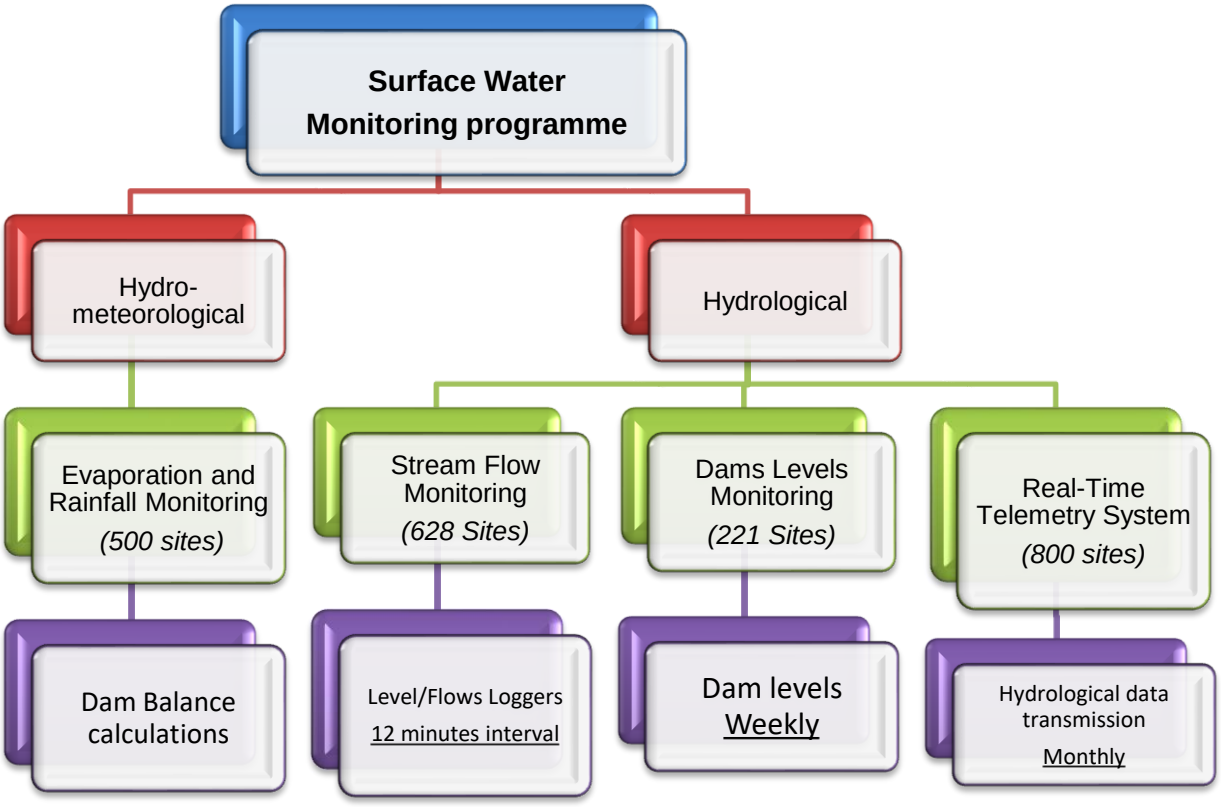


Figure 2.1: Summary structure of the surface water monitoring programmes

The DWS regional offices have selected several monitoring primary stations equipped with real-time telemetry data transmission systems. These include monitoring stations for dams, evaporation, rainfall, and streamflow. Data is transmitted from the monitoring

stations directly to the national office and DWS website in near real-time. It is made available for use by all stakeholders as unverified data.

- *Dam Levels Monitoring*

The national dam monitoring is conducted at a regional level, and the DWS regional officials collect dam gauge plate readings every Monday. Upon capturing collected data, the national office is responsible for processing, verifying, and disseminating data to various stakeholders through a weekly dam levels bulletin and summary synopsis. The locality map of the dam levels stations nationally is presented in Figure 2.2.

- *Evaporation and Rainfall Monitoring*

Evaporation and rainfall monitoring stations are situated at dam sites. The evaporation and rainfall readings are taken daily, except for rain gauges equipped with automatic tipping buckets. Data collected from these monitoring stations are audited monthly and processed in three months at the national office.

- *Streamflow Monitoring*

Streamflow monitoring stations are managed by the regional offices and are responsible for monthly downloading data from the dataloggers. Several streamflow monitoring stations are equipped with real-time telemetry data transmission systems; data transmitted from these systems can be accessed at www.dws.gov.za/hydrology. The national surface water monitoring network for streamflow gauging stations is presented in Figure 2.3.

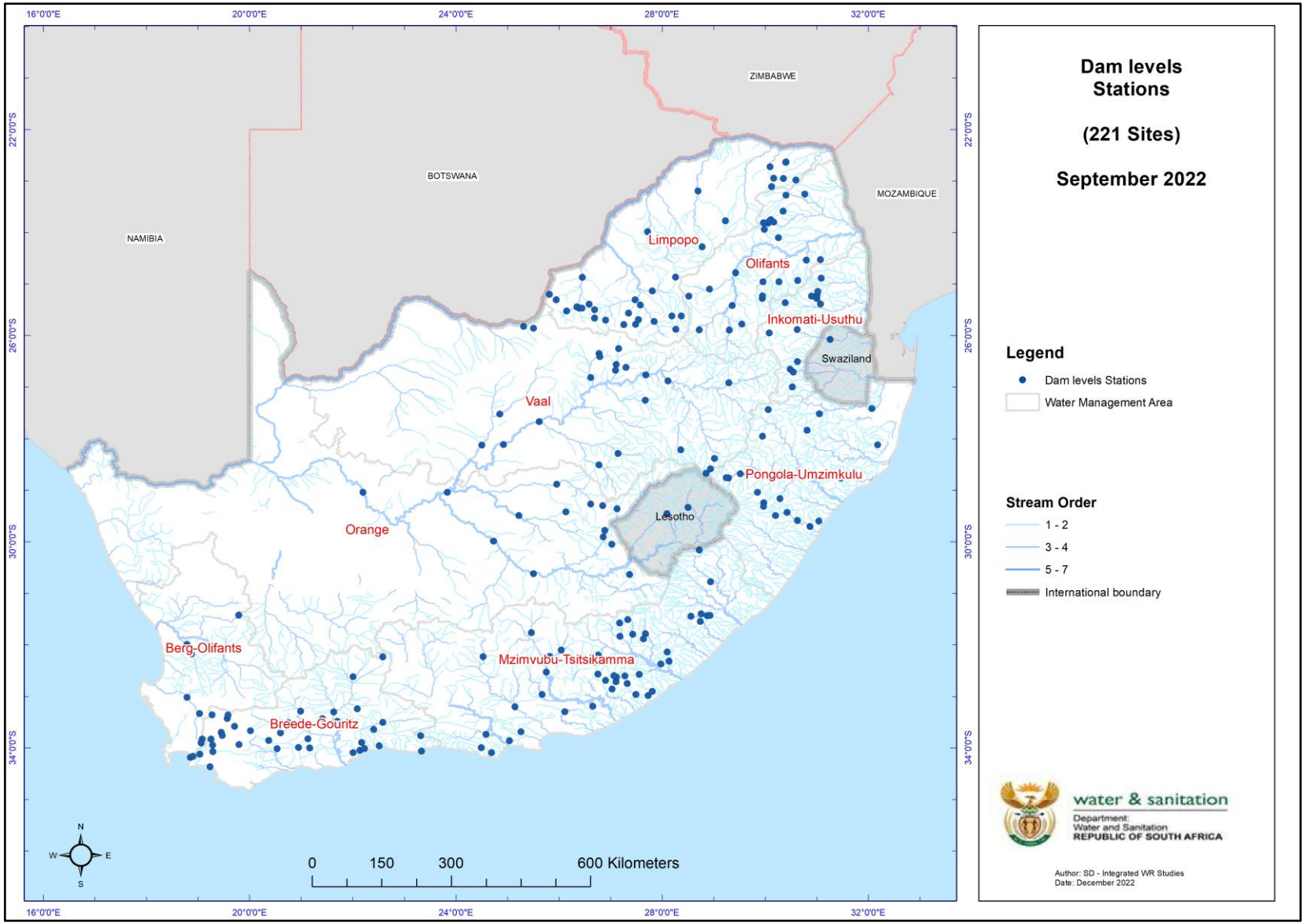


Figure 2.2 Dam levels monitoring stations network

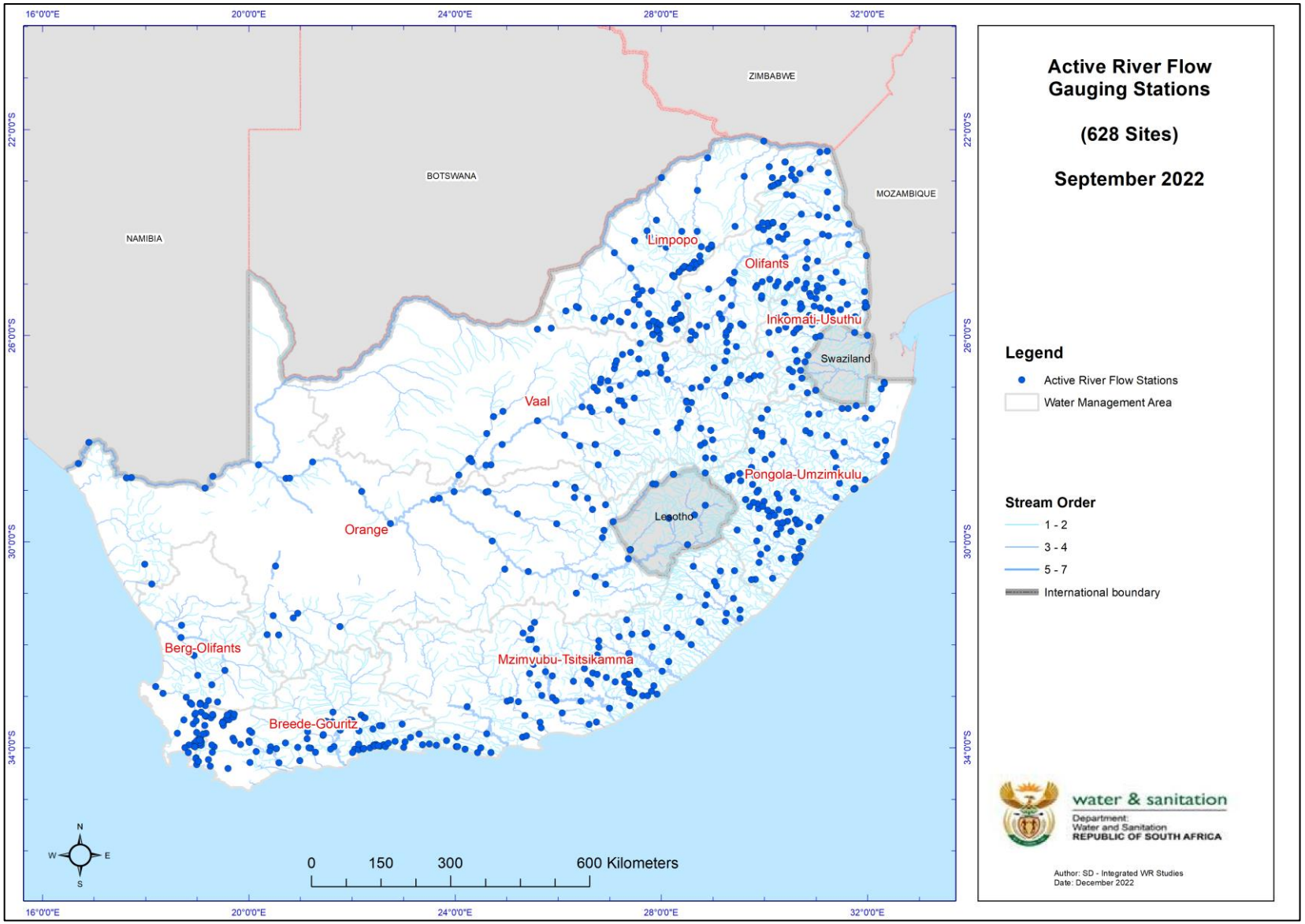
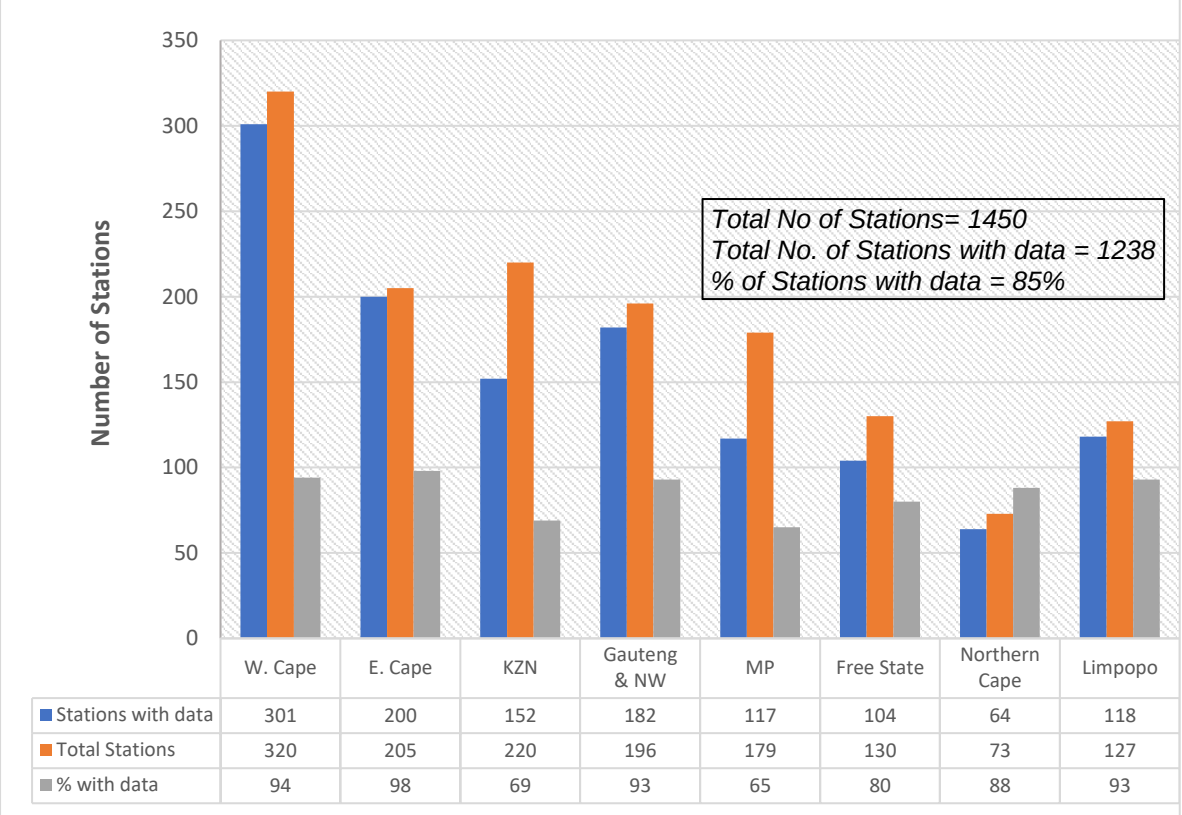


Figure 2.3 Streamflow monitoring network

2.1.1 Surface Water Monitoring Network Data Availability

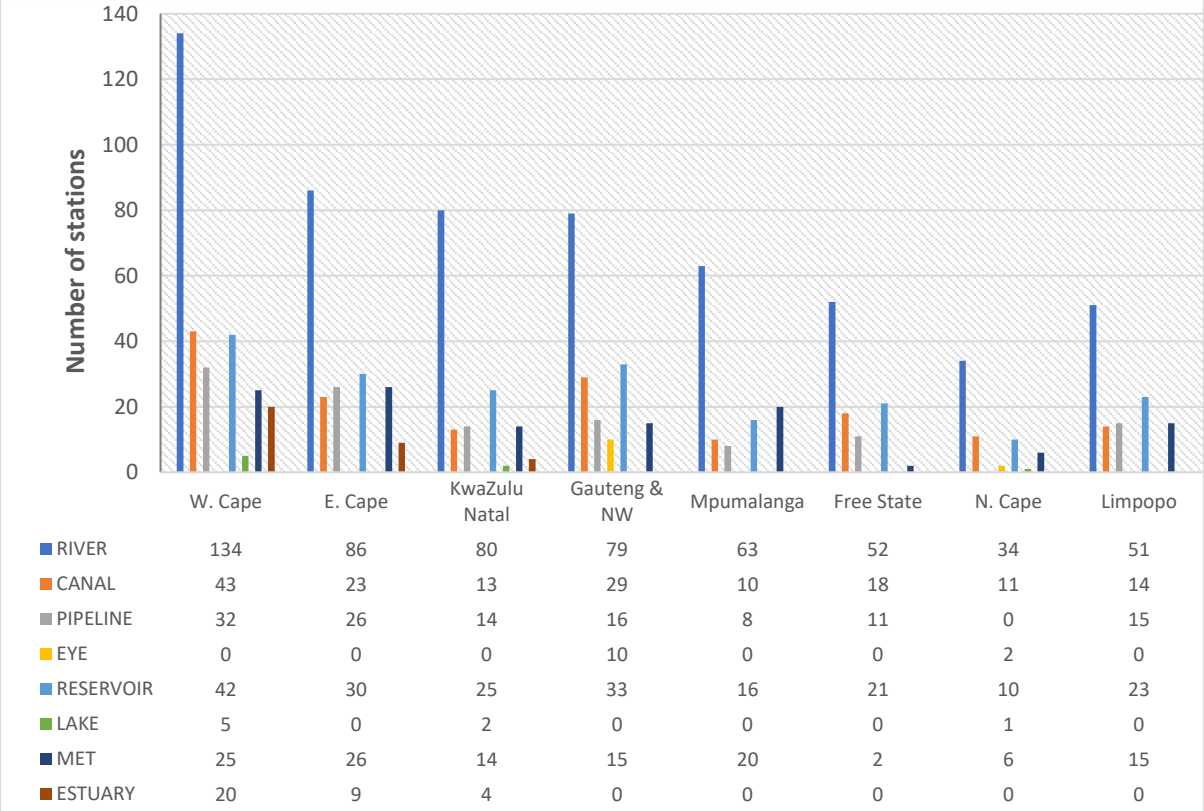
There are currently 1450 stations for the surface water monitoring network distributed across the provinces, as demonstrated in Figure 2.4. At the end of the current reporting period, 1238 stations were active and had data. All station types across provinces had commendable data availability, led by Eastern Cape, Western Cape, Limpopo, and Gauteng (includes NW) Provinces, with over 90% data availability at the end of the reporting period, achieving a national percentage of 85%.



	W. Cape	E. Cape	KZN	Gauteng & NW	MP	Free State	Northern Cape	Limpopo
Stations with data	301	200	152	182	117	104	64	118
Total Stations	320	205	220	196	179	130	73	127
% with data	94	98	69	93	65	80	88	93

Figure 2.4: Summary of monitoring networks across South Africa as of November 2022.

The station types per province presented in Figure 2.5 demonstrate a dominant number of stations for river flow monitoring, with Western Cape, Eastern Cape, KwaZulu-Natal, and Gauteng having the most stations, respectively. The estuaries are monitored in the coastal areas, and the active stations in the Western Cape Province have doubled from 10 stations in the 2020/21 hydrological year to 20 stations in the current reporting period. All provinces demonstrated a reasonable number of active stations in the reservoir monitoring led by the Western Cape Province. DWS has positively reported a significant improvement in the inflow of data into HYDSTRA captured by regional offices, which indicates that regions have caught up with monitoring and adjusted to the working conditions after the 2020 national lockdown.



	W. Cape	E. Cape	KwaZulu Natal	Gauteng & NW	Mpumalanga	Free State	N. Cape	Limpopo
RIVER	134	86	80	79	63	52	34	51
CANAL	43	23	13	29	10	18	11	14
PIPELINE	32	26	14	16	8	11	0	15
EYE	0	0	0	10	0	0	2	0
RESERVOIR	42	30	25	33	16	21	10	23
LAKE	5	0	2	0	0	0	1	0
MET	25	26	14	15	20	2	6	15
ESTUARY	20	9	4	0	0	0	0	0

Figure 2.5: Station types with available data per province as of November 2022.

2.2 Groundwater Monitoring

Groundwater monitoring within the DWS consists of two programmes which are groundwater quality monitoring and groundwater level monitoring, as presented in Figure 2.6 below.

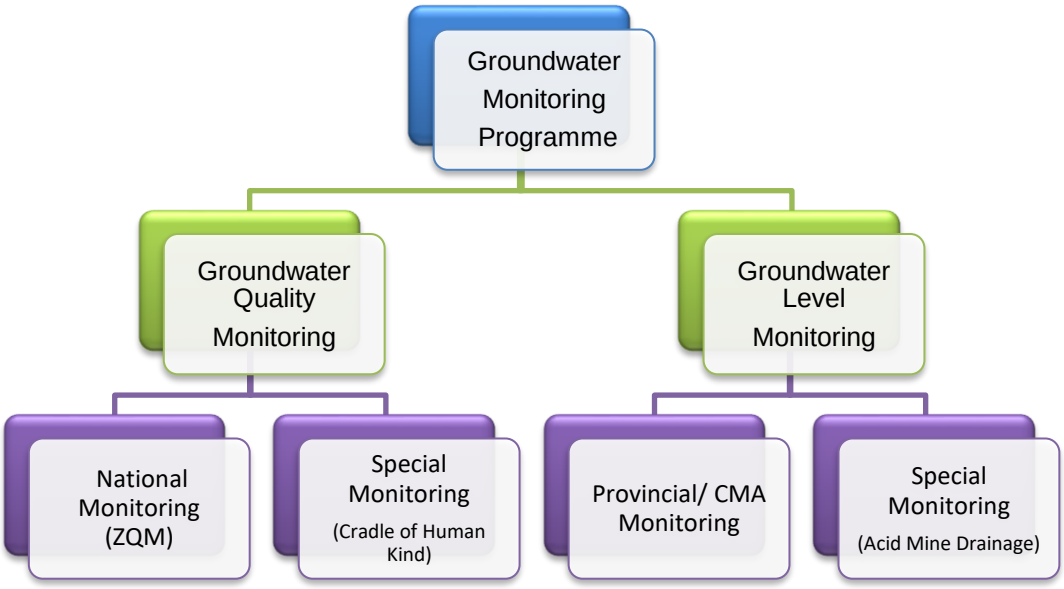


Figure 2.6 Groundwater Monitoring Programmes

2.2.1 Groundwater Level Monitoring

Over 1 800 groundwater-level sites (geosites) are monitored throughout the country. Figure 2.7 indicates the locations of 1 787 active sites and responsible regional offices as of September 2022. The monitoring data is archived on HYDSTRA, whereas additional station data is stored on the National Groundwater Archive (NGA) (https://www.dws.gov.za/groundwater/NGA.aspx). Data requests for groundwater level data monitored by DWS can be sent to the geo-request service at georequests@dws.gov.za .

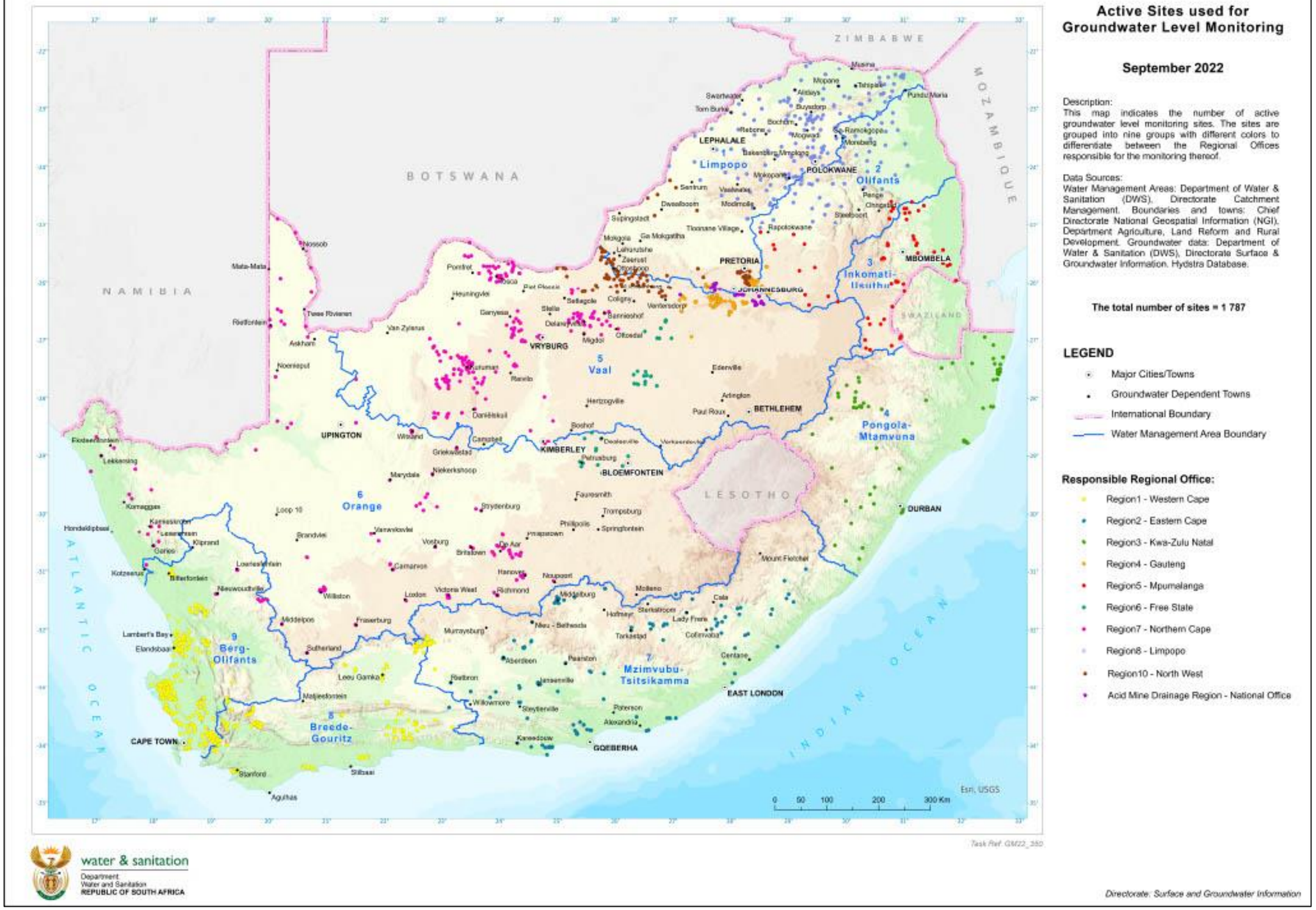


Figure 2.7 Active Groundwater Level Monitoring sites (geosites), September 2022

From the Special Water Level monitoring – Acid Mine Drainage (AMD) monitoring of the Eastern, Central, and Western Basins is conducted on a monthly basis. The data from this network is analysed on a regular basis, and results are shared with the Chief Directorate of Mine Water Management to manage the risks related to AMD, where flooding of mines may lead to contamination of shallow groundwater and decant into the environment. Figure 2.8 provides an example of the analysis for the AMD special water level monitoring within the Witwatersrand Basin.

2.2.2 Available Groundwater Level Monitoring Data

The number of total active sites with data as of 30 September 2022 was 1 674. 94% of the total number of active sites had available data by the end of September 2022. Mpumalanga and the Free State regions have 100% of their active sites with data available on the central database. Gauteng region reported 77% of the total sites with available data by September 2022. Figure 2.9 presents the graph depicting the available groundwater level data given the surface area of South Africa versus the current active national groundwater level monitoring geosites. There is a need to expand the existing monitoring network and pull together public, private, and other groundwater level monitoring databases within the country to get a clear picture of groundwater level trends. The Department has thus initiated a National Digitised Integrated Water and Sanitation Monitoring Systems Project in the Chief Directorate: National Water Resource Information Management within the Branch: Water Resource Management to apply digital innovations in the water monitoring space.

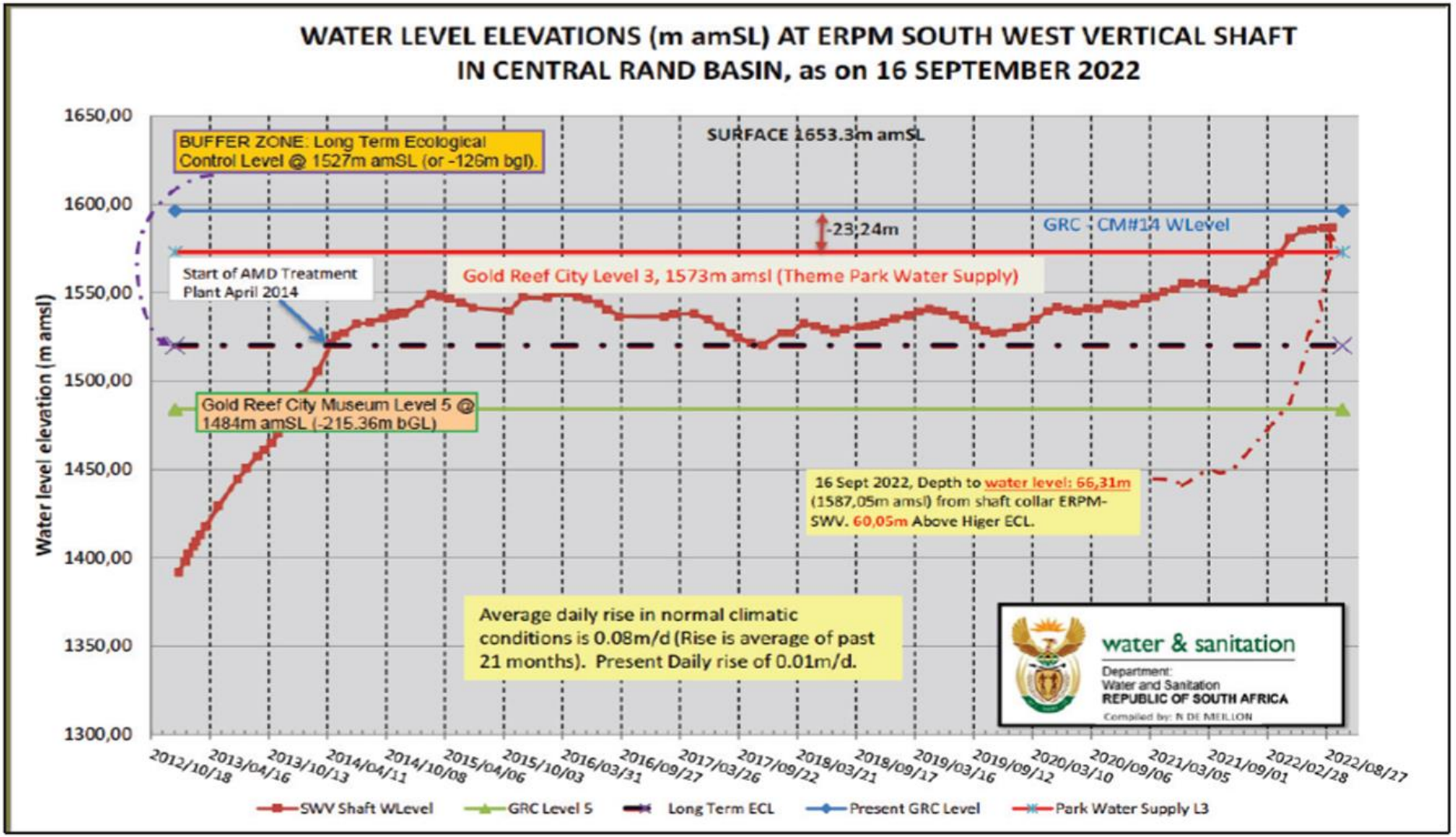


Figure 2.8 Water Level Special Monitoring for AMD data analysis

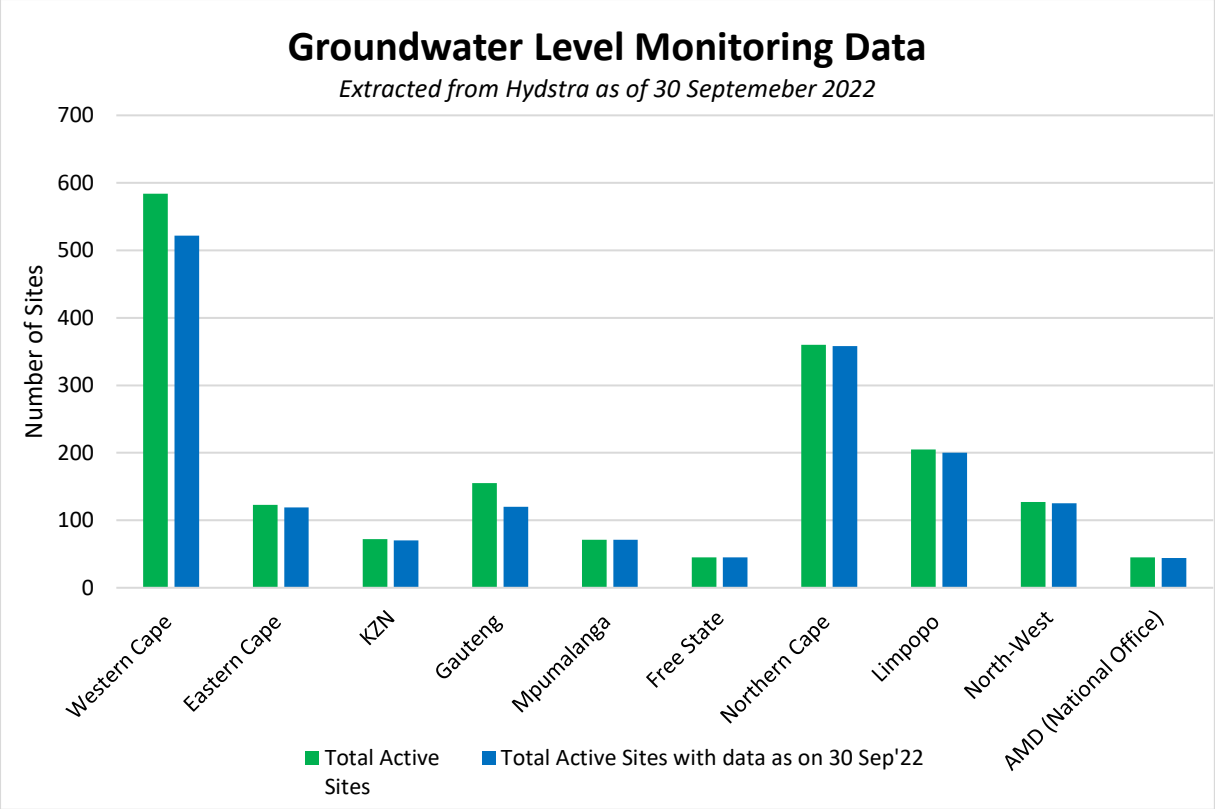


Figure 2.9 Groundwater Level Available Data September 2022

Most groundwater level monitoring equipment is still predominately manually utilizing a dip meter. KwaZulu-Natal, Gauteng, Free state, and the North West regions are 100% monitored by electronic data loggers. Electronic data loggers improve the timeliness of data which can be helpful to the water sector in helping with sustainable management of groundwater resources in the wake of climate change.

The promise of the data revolution has not been oversold, and researchers have highlighted the need for investment to build robust, validated models and infrastructure. Figure 2.10 indicates the percentage of sites using either manual or electronic data loggers to monitor groundwater levels in the different regions.

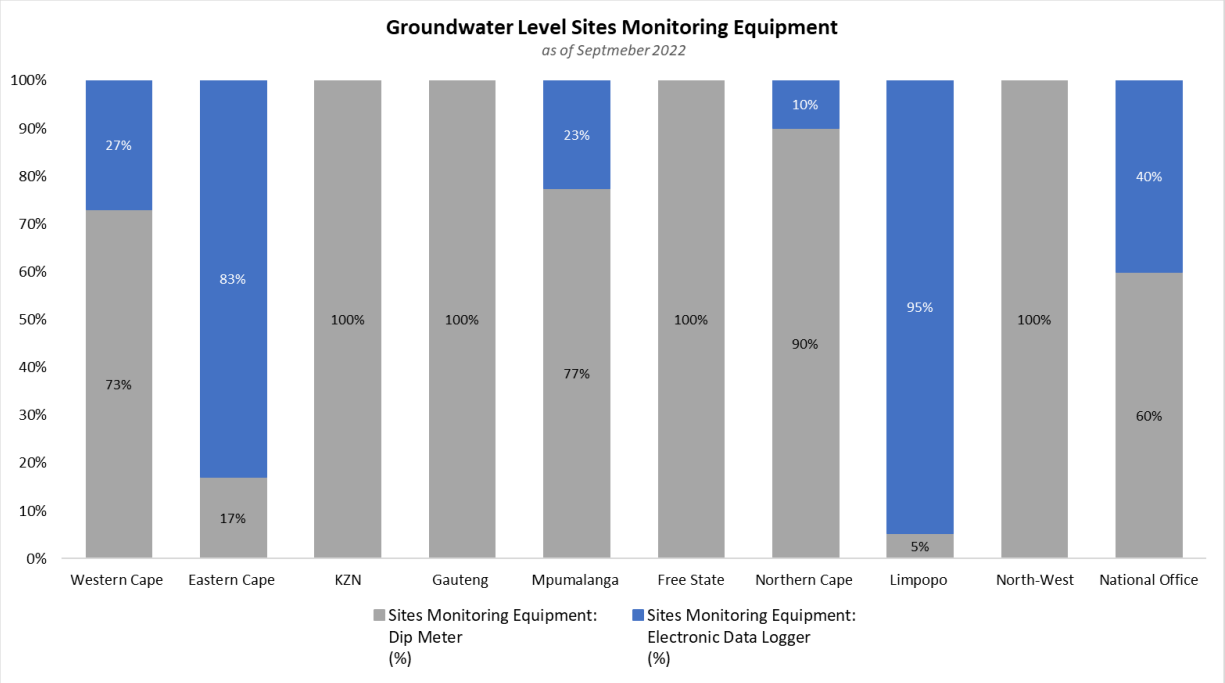


Figure 2.10 Geosites monitored by manual vs. electronic data loggers

2.2.3 Available Groundwater Quality Monitoring Data

Groundwater quality data declined significantly in 2022 back to the pre-2019 levels. Compared to the 308 samples collected and analysed in the previous year, no samples were analysed in 2022 at the reporting time. Data from the 2022/2023 sampling run have not been received from the regional offices, and monitoring is still underway. Regional offices are expected to complete groundwater sampling by the end of November 2022. Figure 2.11 presents the groundwater quality samples from 2016, including 2022.

The key challenge in getting the groundwater quality data analysed in time is the expired laboratory contracts for water quality analysis across the country and the gap in the implementation of new contracts. This breaks the momentum of water quality collection efforts and, in turn, the availability of timely water quality data to inform water managers. To mitigate this, innovative supply chain management processes would need to be deployed to avoid a gap between the start and end of one contract from another and capacitate the RQIS laboratory, weighing out the need to establish DWS laboratories at crucial locations at other parts of the country.

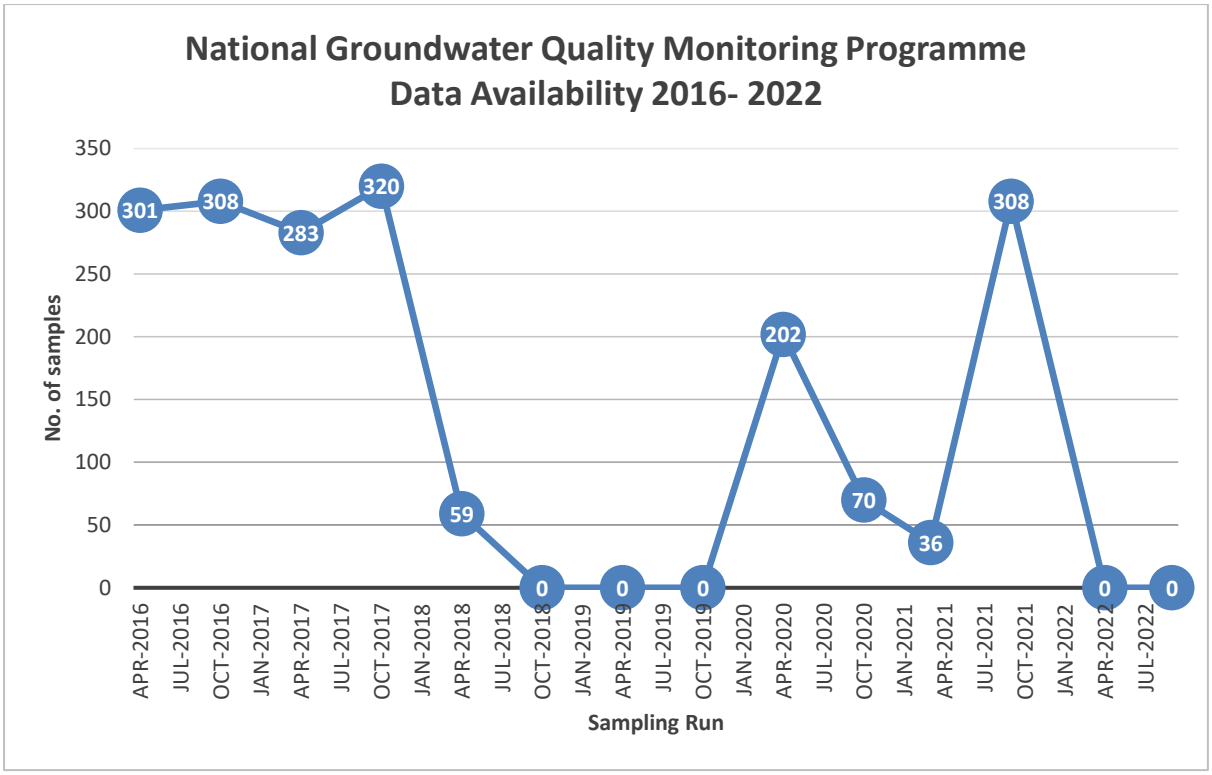


Figure 2.11 Groundwater Quality Samples Analysed - end September 2022

2.3 Surface Water Quality Monitoring Programmes

2.3.1 National Chemical Monitoring Programme (NCMP)

The NCMP was established in the 1970s based on the information requirements and national priorities at the time. It has been amended over the years to remain relevant. This is the longest-running South African water quality monitoring programme which has provided data and information for more than 48 years for the inorganic chemical quality of surface water resources at various sites. The programme has been highly dependent on Regional Office officials for sample collection and the Resources Quality Information System (RQIS) laboratory for sample analysis, quality assurance and data capturing onto the WMS database. These data and other resources are available to the public through the link: https://www.dws.gov.za/iwqs/wms/default.aspx.

The main objectives of this national scale programme include:

- Determining the inorganic status and trends in South African rivers.
- Supporting the National River Ecostatus Monitoring Programme (REMP); the United Nations Environmental Programme – Global Environmental Monitoring System (UNEP GEMS), and Sustainable Development Goals (especially SDG 6.3) initiatives.
- Contributing to the integrated overarching historical database; and
- The dissemination of data and information.

The parameters monitored include the salinity, which is measured as Total Dissolved Solids (TDS) or Electrical Conductivity (EC), the concentrations of Iron (Fe), Sodium (Na), Chloride (Cl), Magnesium (Mg), Potassium(K), Sulphates (SO_4), Ammonium (NH_4) and Nitrates-nitrites (NO_3 + NO_2). The NCMP also measures the ammonium and nitrate-nitrite levels, indicating nutrient loading from discharges and return flows into water resources.

The priority NCMP sites had a sampling compliance of 1.1% for the 2020/21 hydrological year, while the sampling compliance for 2021/22 increased to 7.0%. Site visits also increased from 15.9% for the 2020/21 period to 42.2% for the 2021/22 hydrological year, as shown in Figure 2.12. This figure is anticipated to increase to at least 70% in 2022/23.

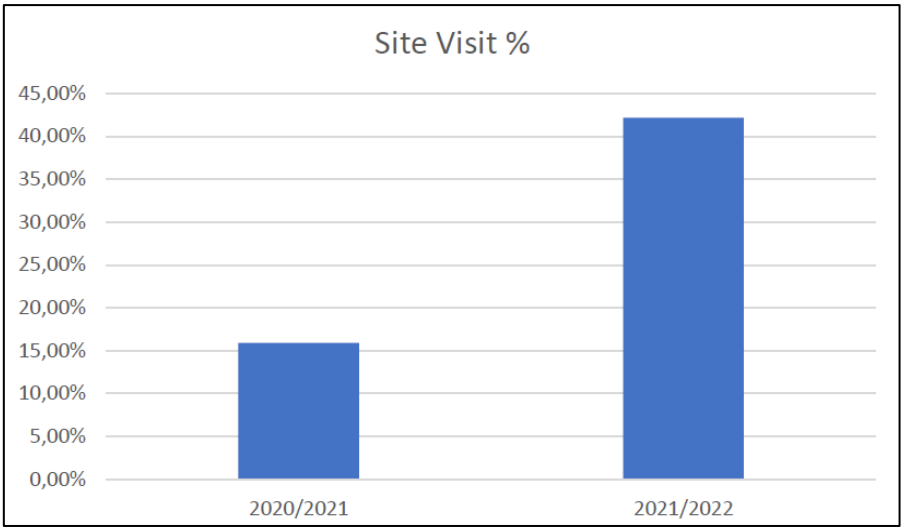


Figure 2.12: Percentage of Priority NCMP sites sampled over the past two hydrological years.

The Department is currently reviewing all sampling sites in line with the optimised network to consider possible additional sampling sites and to refine the current sample site list of the priority NCMP. Additionally, the formalisation of the working relationship with DWS Regional Offices through Service Level Agreements (SLAs) is at an initial stage to ensure better understanding and cooperation between sampling and coordination.

2.3.2 National Eutrophication Monitoring Programme (NEMP)

The NEMP was established and officially implemented in 2002. The objective of the NEMP is to measure, assess and report regularly on the current trophic status and the nature of the current eutrophication problems for South African water resources. It also reports on the potential for future changes in the trophic status of dams/lakes and rivers in a manner to support strategic decisions in respect of their national management, being mindful of financial and capacity constraints yet being soundly

scientific. The NEMP provides frameworks for addressing the following six (6) objectives for impoundments (dams/lakes) and rivers:

- Establishing trophic status in dams/lakes
- Early warning system – water treatment
- Early warning system – blooms
- Early warning system – invasive macrophytes
- Early warning system – long-term impacts
- Nutrient balance

The NEMP has over 289 registered sites, including dams, lakes, and rivers. The dam sites are selected based on their strategic importance for the region, country, and international commitments. Sampling is done at the dam wall or near the abstraction or discharge point. River sites are mostly selected at points that represent the inflow to the dams monitored.

A total of 119 sites were sampled during the 2021/22 hydrological year, and this was a significant improvement from 52 sites reported during the 2020/21 period (Figure 2.13). The improvement can be attributed to the improvement of RQIS laboratory capacity after method development, recruitment of additional sampling personnel, and committed monitoring in the RQIS, IUCMA, Limpopo Regional Office, Eastern Cape Regional Office, and various Water User Associations. Plans are underway to reactivate monitoring in Northern Cape, Western Cape, and KwaZulu-Natal Provinces.

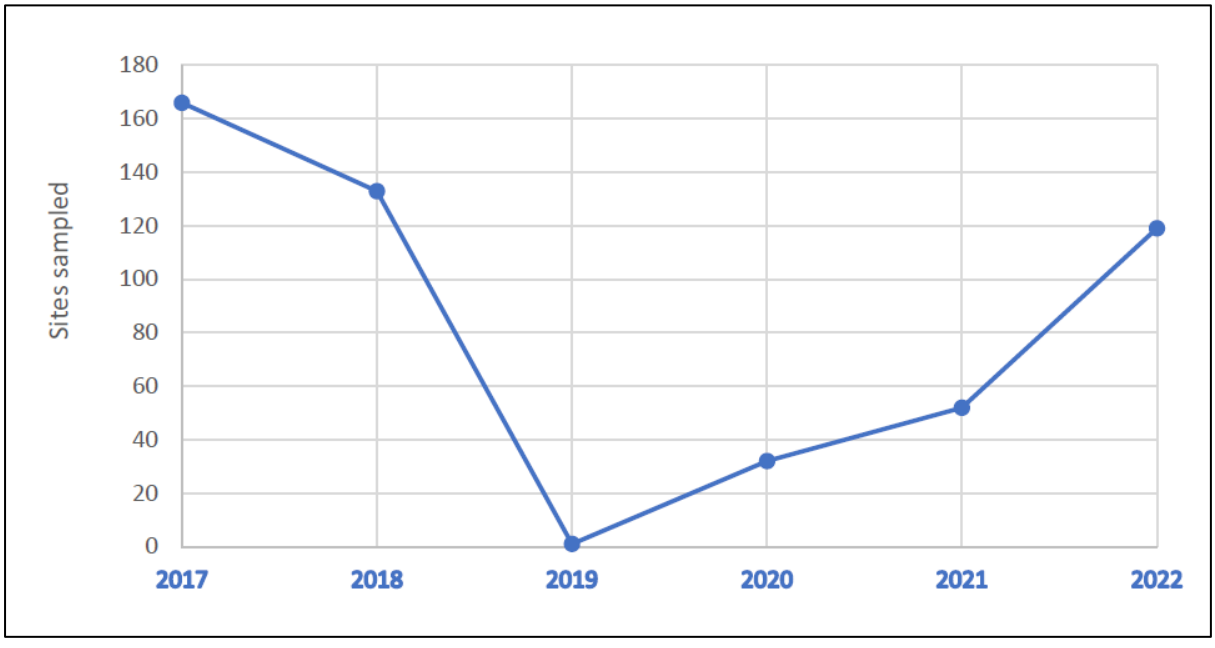


Figure 2.13: NEMP data availability from the year 2017 to 2022.

A map showing the dam and river sites monitored during the 2021/22 hydrological year is provided in Figure 2.15. Samples were received from 53% of the sites that were scheduled for monitoring. A significant improvement in the number of sites was

noted during the hydrological year due to the availability of laboratory capacity, recruitment of additional samplers, and return of the entire staff complement after Covid19 disruptions.

2.3.2.1 NEMP Optimisation

The NEMP is currently under review, and optimisation is to focus on monitoring strategic sites representative of the country's ambient water quality. This approach focuses on monitoring key strategic catchments while meeting international obligations, including SDG reporting. An Optimised NEMP programme consisting of sixty-one dams has been recommended for initial implementation in the 2022/23 financial year. The map depicting the spread and location of Optimised NEMP sites is provided in Figure 2.14 below. Thirty-five sites in the optimised NEMP were monitored during the 2021/22 period.

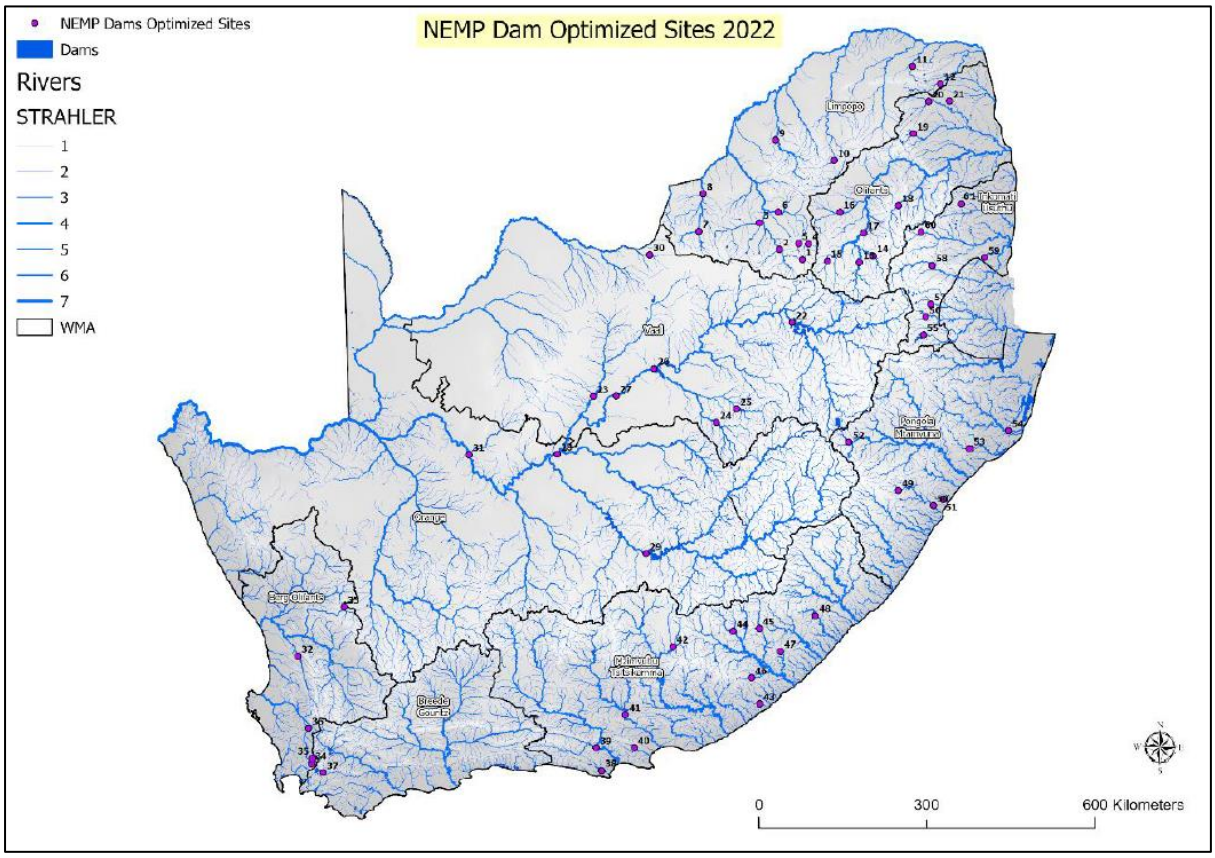


Figure 2.14: Distribution of Optimised NEMP dam sites across the country.

The reporting of sampling compliance in the next reporting cycle will be based on the sixty-one sites identified for the optimised NEMP.

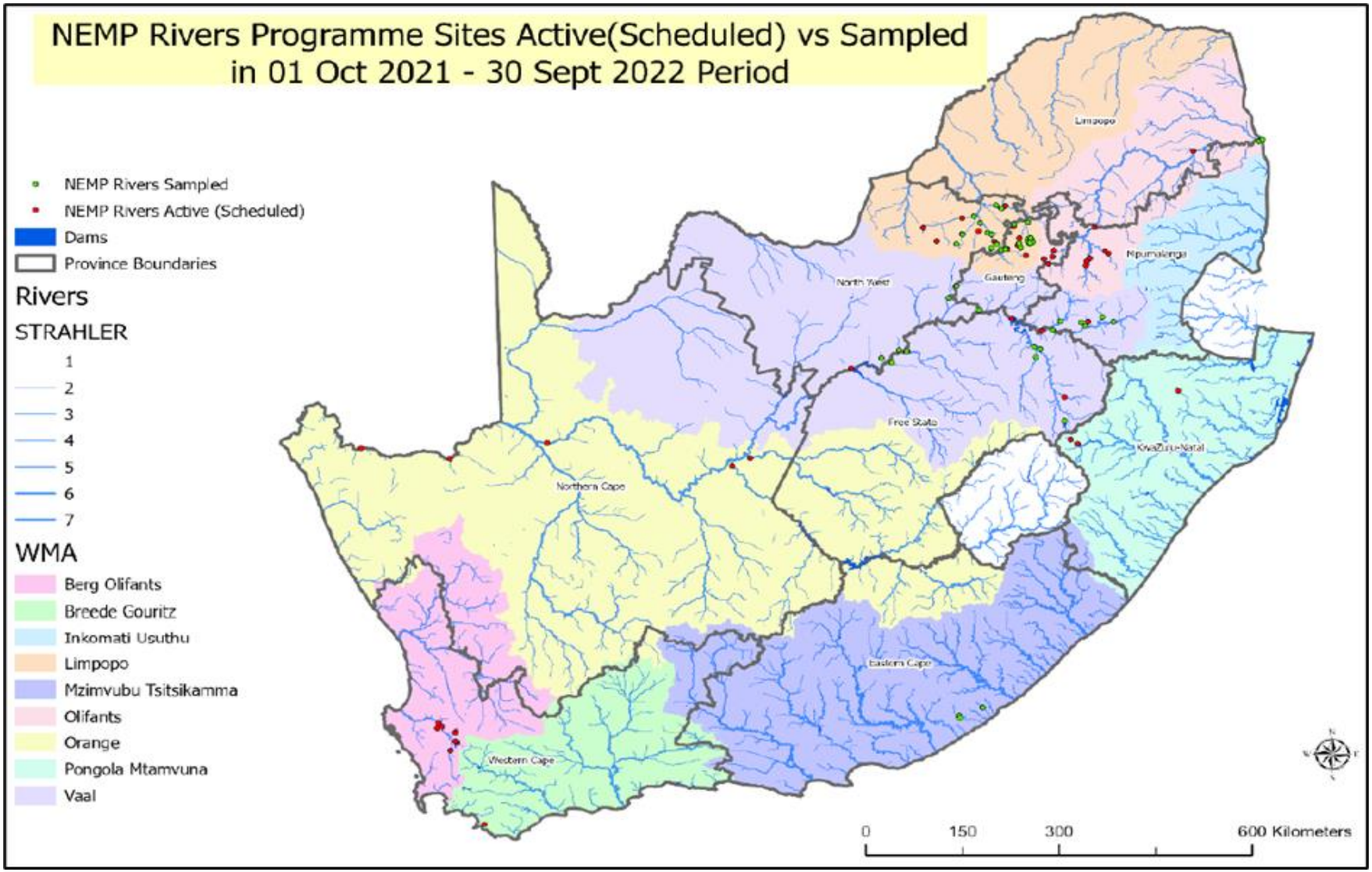


Figure 2.15 Map showing scheduled NEMP rivers versus sampled sites

2.3.3 National Microbial Monitoring

The National Microbial Monitoring Programme (NMMP) has been implemented in phases nationwide since the year 2000. The programme uses the presence of faecal coliform bacteria in the water to indicate contamination. The main objectives of the NMMP are to provide information on the status and trends of the extent of faecal pollution in terms of the microbial quality of surface water resources in priority areas. Furthermore, is to provide information to help assess the potential health risk to humans associated with the possible use of faecal polluted water resources. The parameters measured are faecal coliform, *E. coli*, pH, turbidity, and temperature.

2.4 National Integrated Water Information System

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

Currently, NIWIS can provide water-related information in the areas of, Climate and Weather, Disaster Management, Enforcement, Water Infrastructure, Water Monitoring Networks, State of Water, Water Ecosystems, Water Quality, Water Quantity, Water Services, Water Supply Risk, Water Tariffs, Water Use, and other Water Resource Management areas. The NIWIS dashboards covering various themes are presented in Figure 2.16.

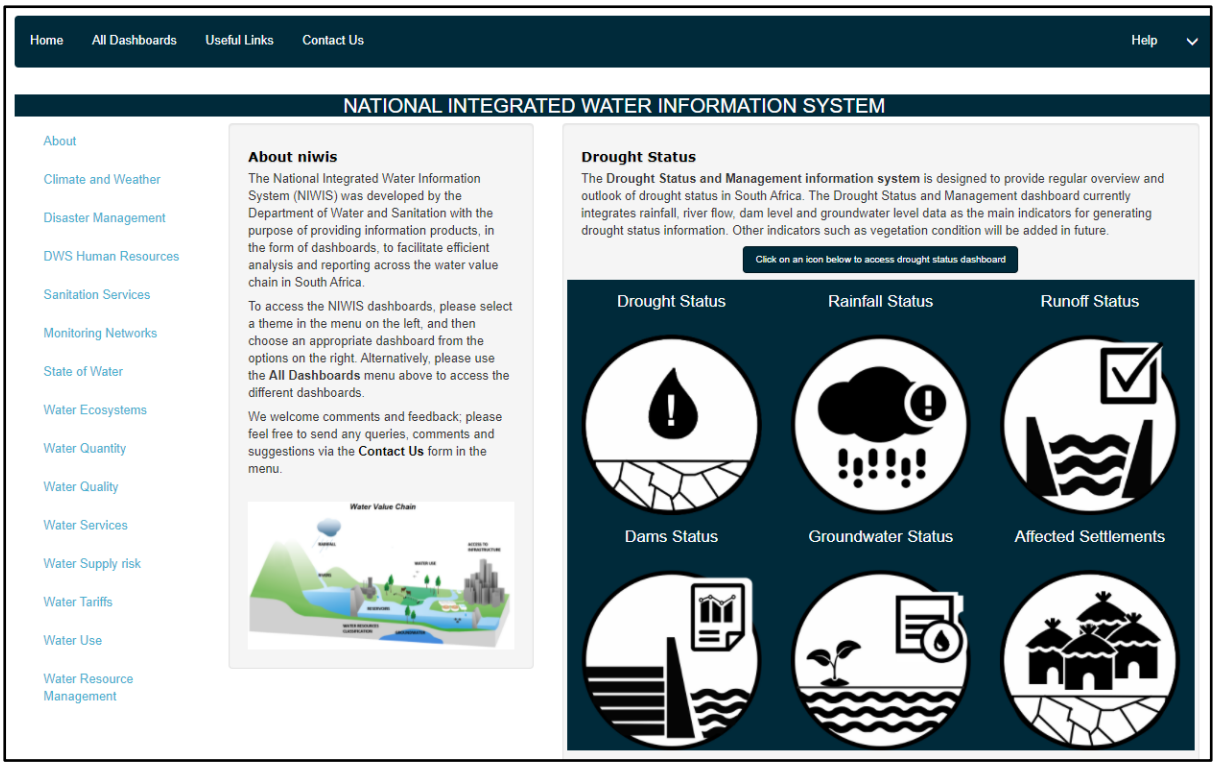


Figure 2.16 NIWIS landing page (https://www.dws.gov.za/niwis2/)

NIWIS allows for user customisation and is convenient. It has since become one of the Department's strategic investment tools, which ensures that information on the sector is readily available and conveniently disseminated. However, the system is currently experiencing challenges, where the automation has been taking place at a business level, not at a Departmental level, which has resulted in many parallel systems that are not complementing each other, albeit sharing the same client or water information in some cases. However, there are further developments of NIWIS in progress despite several challenges.