April 2024

MONTHLY STATE OF WATER BULLETIN

WATER IS LIFE - SANITATION IS DIGNITY

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

Overview

South Africa is currently in a strong El Niño - Southern Oscillation weather pattern, which was predicted to persist through the 2024 summer season. The El Niño event is associated with drier and warmer conditions during the summer seasons. As a result, in April, below-normal rainfall was received in some isolated parts of the Northern Cape, Limpopo, and Western Cape.

At the end of April 2024, the national dam level was at **87.3**% of full supply capacity (FSC). This is lower than last year during the same reporting period by 5.5% of FSC. Approximately **35%** of the dams nationally were **above 100% of FSC, 56%** were between 50 and 100% of FSC, **8%** were between 10 and 50% of FSC, and at least **1%** were at <10% of FSC (critically low).

The most recent 24-month Standardised Precipitation Index revealed that the Namakwa District, in the Northern Cape province, remains the only district that has been severely affected by drought; parts of this district have experienced extreme drought, while others have experienced severe to moderate drought. The isolated areas of Sarah Baartman District in the Eastern Cape also experienced severe drought, while others were moderately affected.

In April, an intense cut-off low weather system developed along the country's west coast. This resulted in heavy rainfall and strong winds in the Western Cape Province from 6 – 9 April, causing flooding and widespread damage. On 14 April, a severe storm hit the Margate, Uvongo, Shelly Beach, and Port Edward areas of KZN. SAWS reported a total rainfall of 250mm in Margate between 14-15 April, with as much as 225mm rainfall recorded within 4 hours on 14 April. The uGu District was severely affected, with over 110 households destroyed and five fatalities confirmed.

Rainfall

The monthly rainfall distribution during the hydrological year for the summer and winter seasons are presented in Figure 1 and Figure 2, respectively. In April 2024, relatively high rainfall was experienced over the summer rainfall region and some isolated parts of Freee State, North West, Gauteng, and Northern Cape Provinces. The country is currently in a strong El Niño-Southern Oscillation (ENSO) state. This El Niño event was predicted to persist through the 2024 summer season, and thereafter, it is predicted to weaken with ENSO neutral conditions by the 2024 winter season. In April, rainfalls (100-200 mm) were observed over isolated parts of the KwaZulu Natal and Eastern Cape Provinces.

The monthly rainfall anomalies expressed as a percentage of normal rainfall for the summer season and the beginning of the winter season are presented in Figure 3 and Figure 4, respectively. In April, below-normal rainfall was received in some isolated parts of the Western Cape, KwaZulu Natal, Northwest, Mpumalanga, and Limpopo Provinces. Above-normal rainfalls were observed in most parts of the Western Cape, Northwest, Gauteng, and Free State Provinces.

The South African Weather Service (SAWS) multi-model rainfall forecast has indicated mostly below-normal rainfall over most of the country during Jan-Feb-Mar (JFM), Feb-Mar-Apr (FMA), and Mar-Apr-May (MAM) except the central and eastern coastal areas indicating higher likelihood of above-normal rainfall Figure 5. The El Niño-Southern Oscillation (ENSO) is predicted to rapidly decline into a neutral state by early winter**.**The country is currently transitioning from summer to autumn, the cut-off low weather systems (from March to May) climatologically have the highest frequency of occurrence during this period.Minimum and maximum temperatures are expected to be mostly above-normal countrywide for the forecast period.

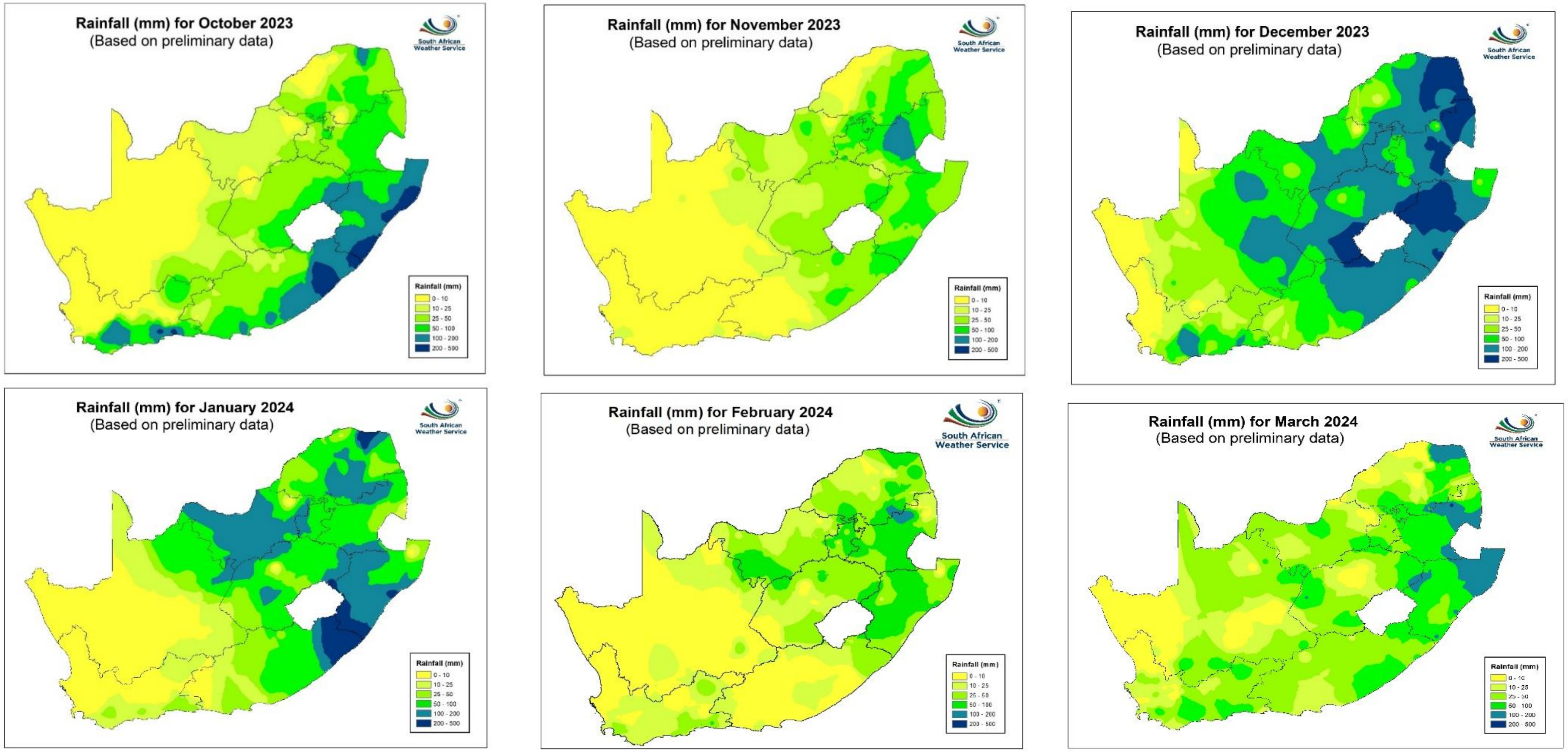


Figure 1: Summer season monthly rainfall distribution for October 2023 to March 2024 (Source: SAWS https://www.weathersa.co.za/home/historicalrain)

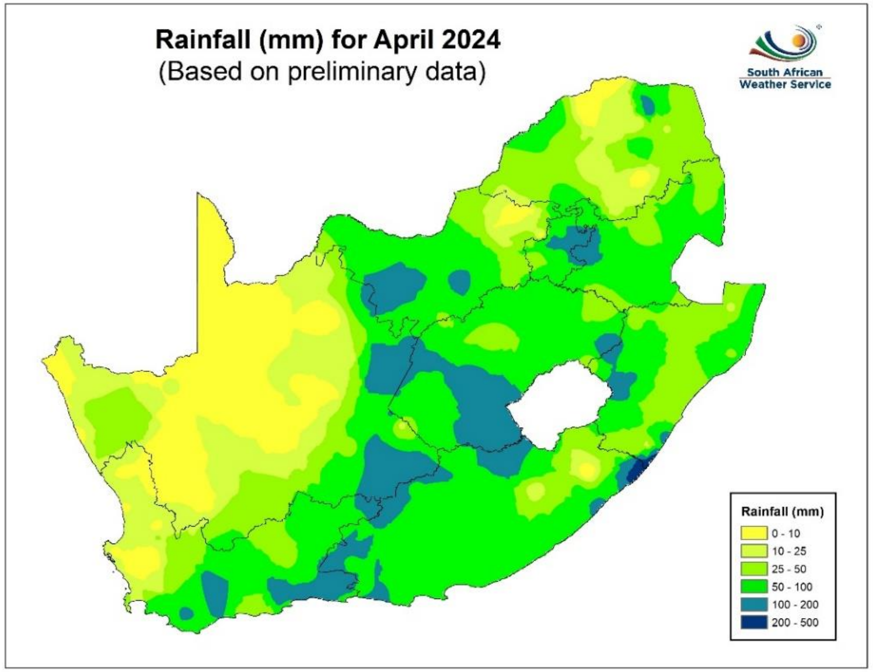


Figure 2: Winter season monthly rainfall distribution for April 2024 (Source: SAWS https://www.weathersa.co.za/home/historicalrain)

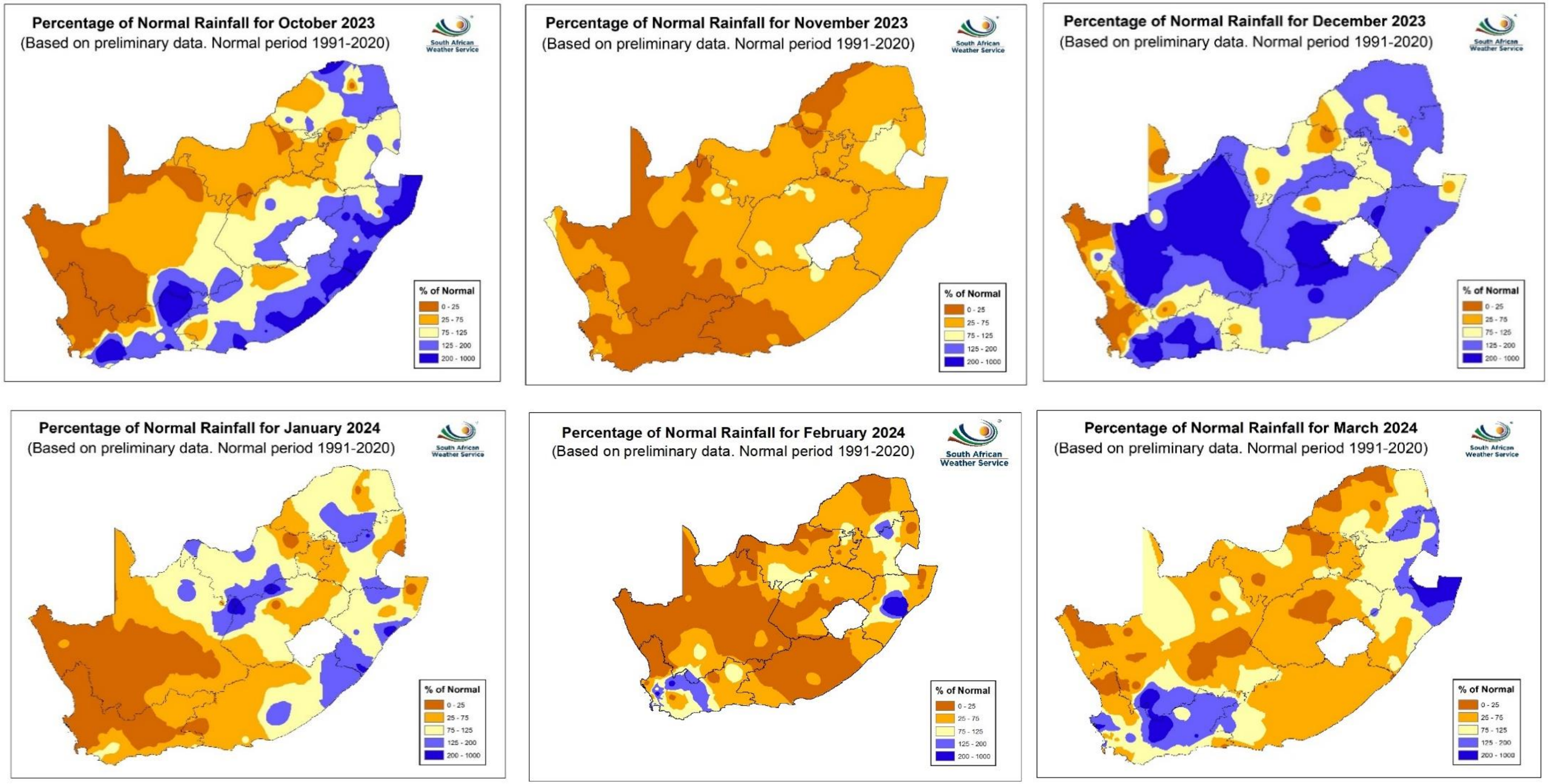


Figure 3: Summer season Percentage of normal rainfall for October 2023 to March 2024. Blue shades are indicative of above-normal rain, and the darker yellow shades of below-normal rainfall (Source: SAWS https://www.weathersa.co.za/home/historicalrain)

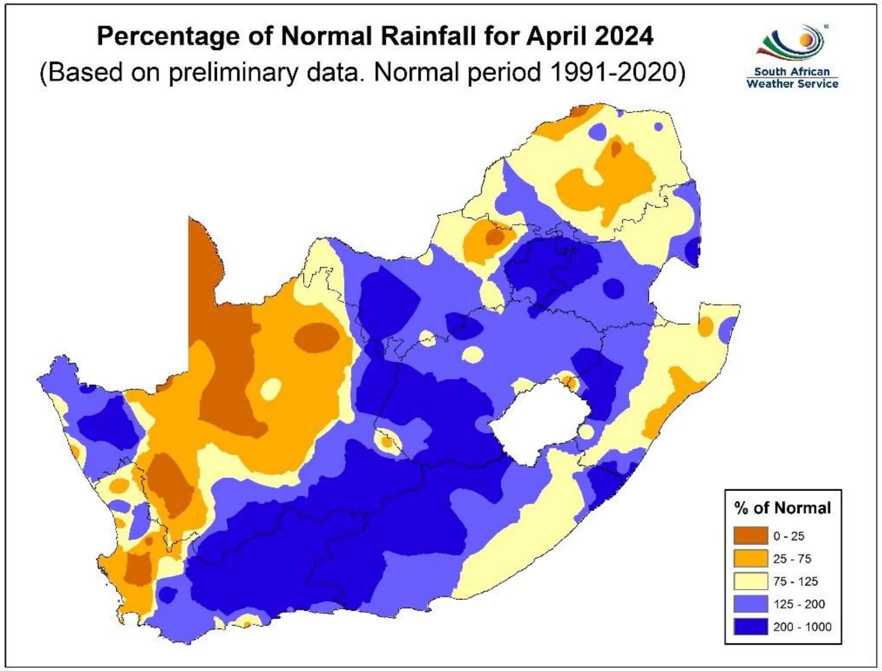


Figure 4: Summer season Percentage of normal rainfall for April 2024. Blue shades are indicative of above-normal rain, and the darker yellow shades of below-normal rainfall (Source: SAWS https://www.weathersa.co.za/home/historicalrain

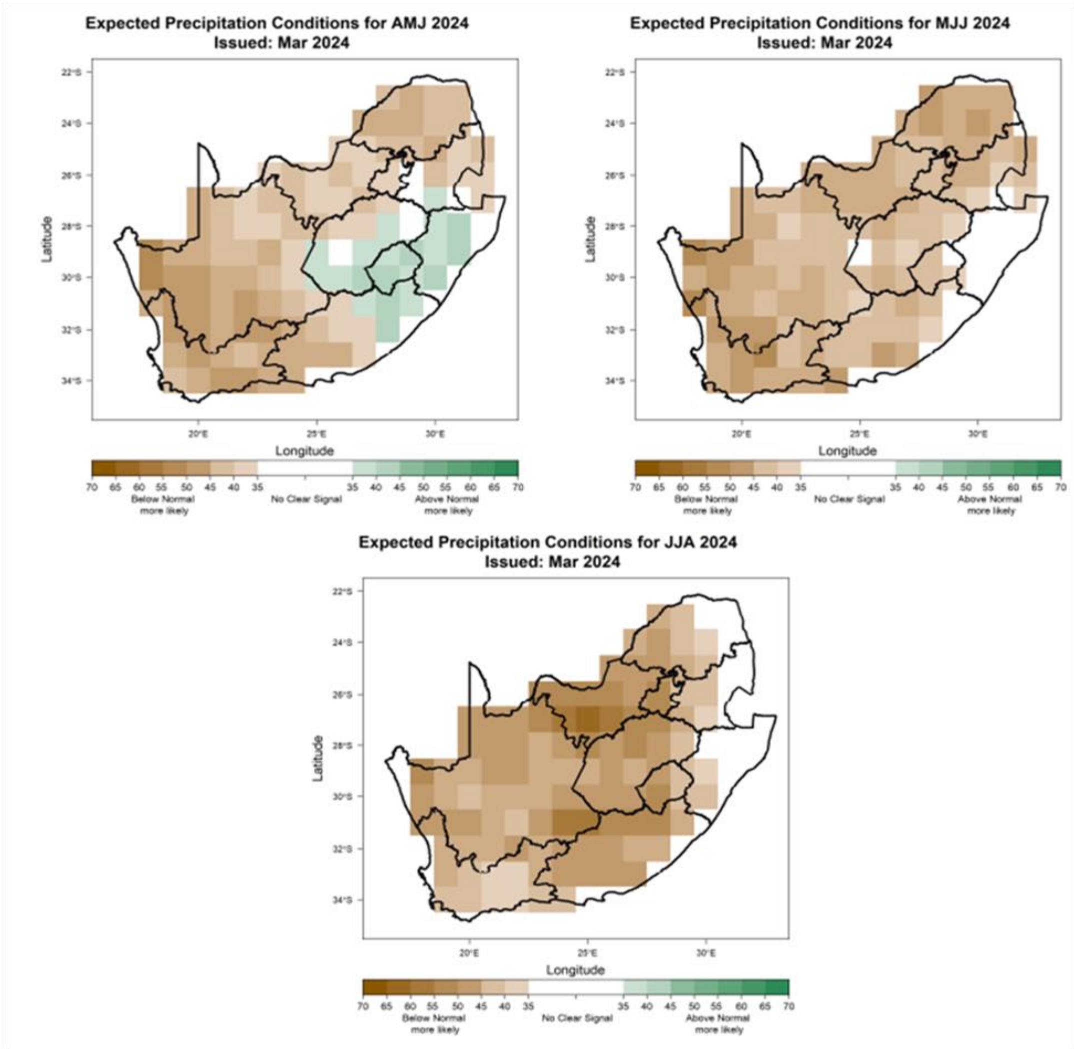


Figure 5 April-May-June 2024 (AMJ; left), May-June-July 2024 (MJJ; right), June-July-August 2024 (JJA; bottom) seasonal precipitation prediction. Maps indicate the highest probability of the above-normal and below-normal categories

National Dam Storage

The national dam's water storage for the previous four years and the trend from October for the hydrological year 2023/24 are presented in Figure 6 below. At the end of April 2024, the national dam levels were at **87.3%** of full supply capacity (FSC). This level is lower than last year, at the same time when national storage was at **92.8%** of FSC. Approximately **35%** of the dams nationally were **above 100% of FSC** (either full or spilling)**, 56%** were between 50 and 100% of FSC, **8%** were between 10 and 50% of FSC, and at least **1%** were at <10% of FSC (critically low).

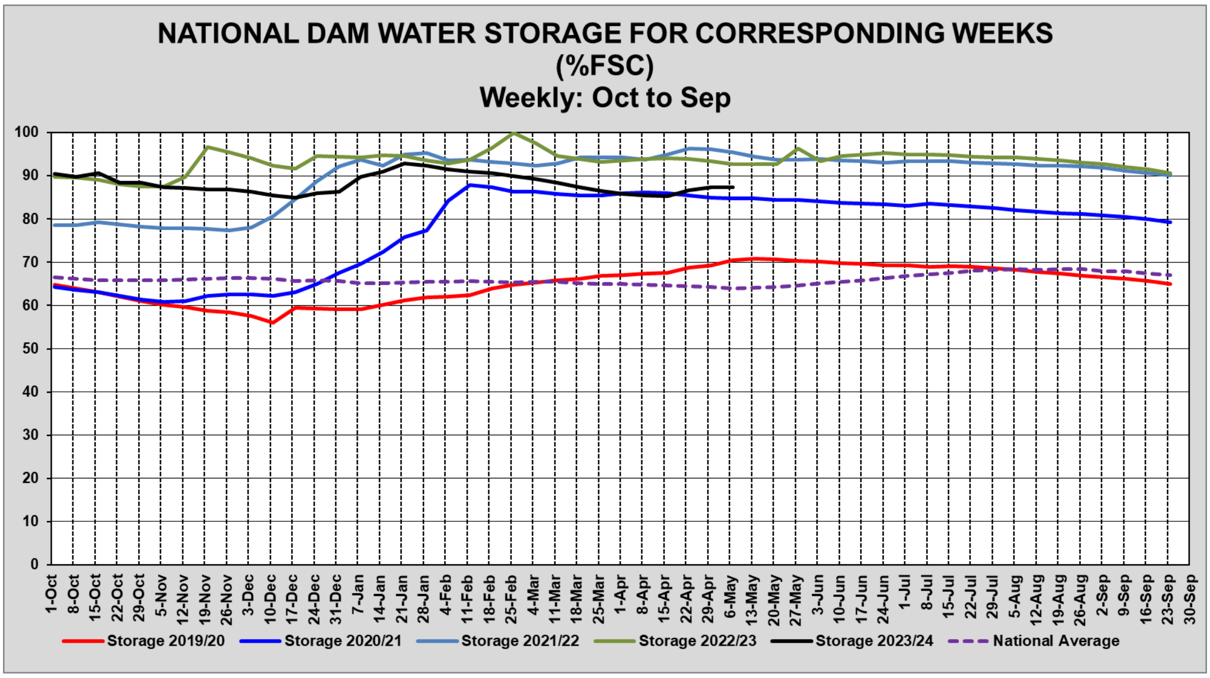


Figure 6 National Dam Storage on 29 April 2024

The comparison of the country's five largest dam storage %FSC for April 2023 and April 2024 is presented in Table 1. Because of the drier and warmer conditions experienced this summer compared to 2023, only Pongolapoort Dam, out of the five largest dams by volume, has positive change at 2.1%, while the Vaal Dam storage levels have declined by 37.8%.

Table 1: Storage Levels comparison for the Five Largest storage Dams (by volume) to last year

Reservoir	River	Province/Country	29 April 2023 (%FSC)	29 April 2024 (%FSC)	% Change (-/+)
Gariep Dam	Orange River	Free State	96.4	87.2	-9.2
Vanderkloof Dam	Orange River	Free State	99	95.7	-3.3
Sterkfontein Dam	Nuwejaarspruit River	Free State	101.6	99.5	-1.7
Vaal Dam	Vaal River	Free State	98.7	60.9	-37.8
Pongolapoort Dam	Phongolo River	Kwazulu-Natal	84.5	86.6	+2.1

The spatial distribution of the dams and a classified range of their storage levels on 29 April 2024 is presented in Figure 7. An observation can be made that most of the dams across the country are at storage levels of between 50 – 100% of FSC. The Middle-Letaba Dam in Limpopo Province remains the only dam at critical levels, as given in Table 2 below.

Table 2: Dams below 10% of Full Supply Capacity compared to last year

Reservoir	River	Province/Country	13 May 2023 (%FSC)	13 May 2024 (%FSC)	% Change (-/+)
Middel-Letaba Dam	Middel-Letaba River	Limpopo	6.1	1.8	-4.3

Figure 8 presents the 24-month Standardised Precipitation Index (SPI) for March 2024, indicating that several District Municipalities have experienced droughts in the previous 24 months. The Namakwa District in the Northern Cape Province, remains the only district that has been severely affected by drought; parts of this district have experienced extreme drought, while others have experienced severe to moderate drought. The isolated areas of Sarah Baartman District in the Eastern Cape also experienced severe drought, while others were moderately affected. Several other districts have experienced moderate drought in the last 24 months, including the Thabo Mafutsanyane District in Free State, the Mopani and Capricon Districts in Limpopo, the City of Cape Town and Garden Route in the Western Cape, and the Ngaka Modiri Molema District in the North West. Drought conditions in these areas result from continuous below-normal rainfalls.

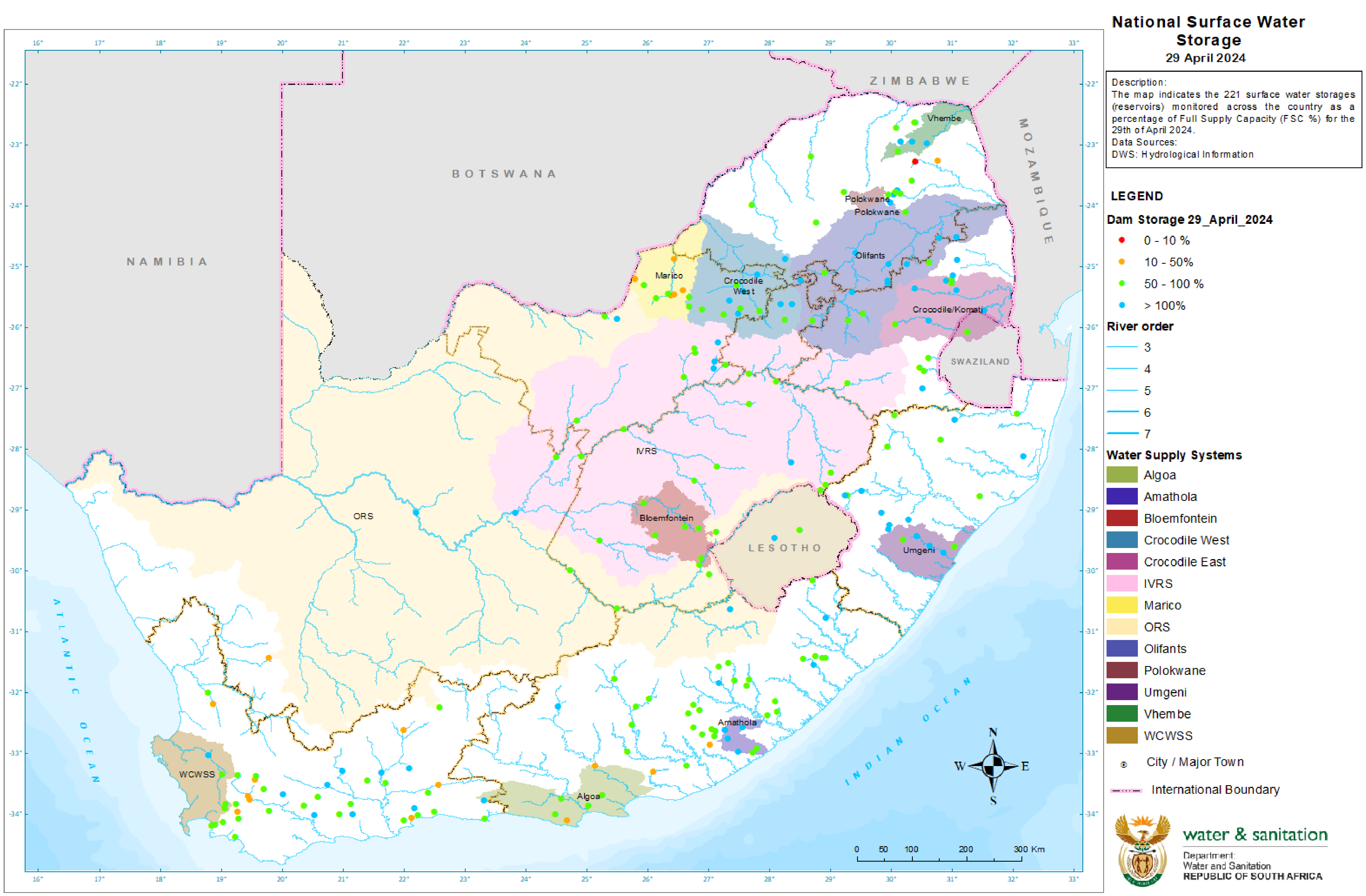


Figure 7: Surface Water Storage Levels - April 2024.

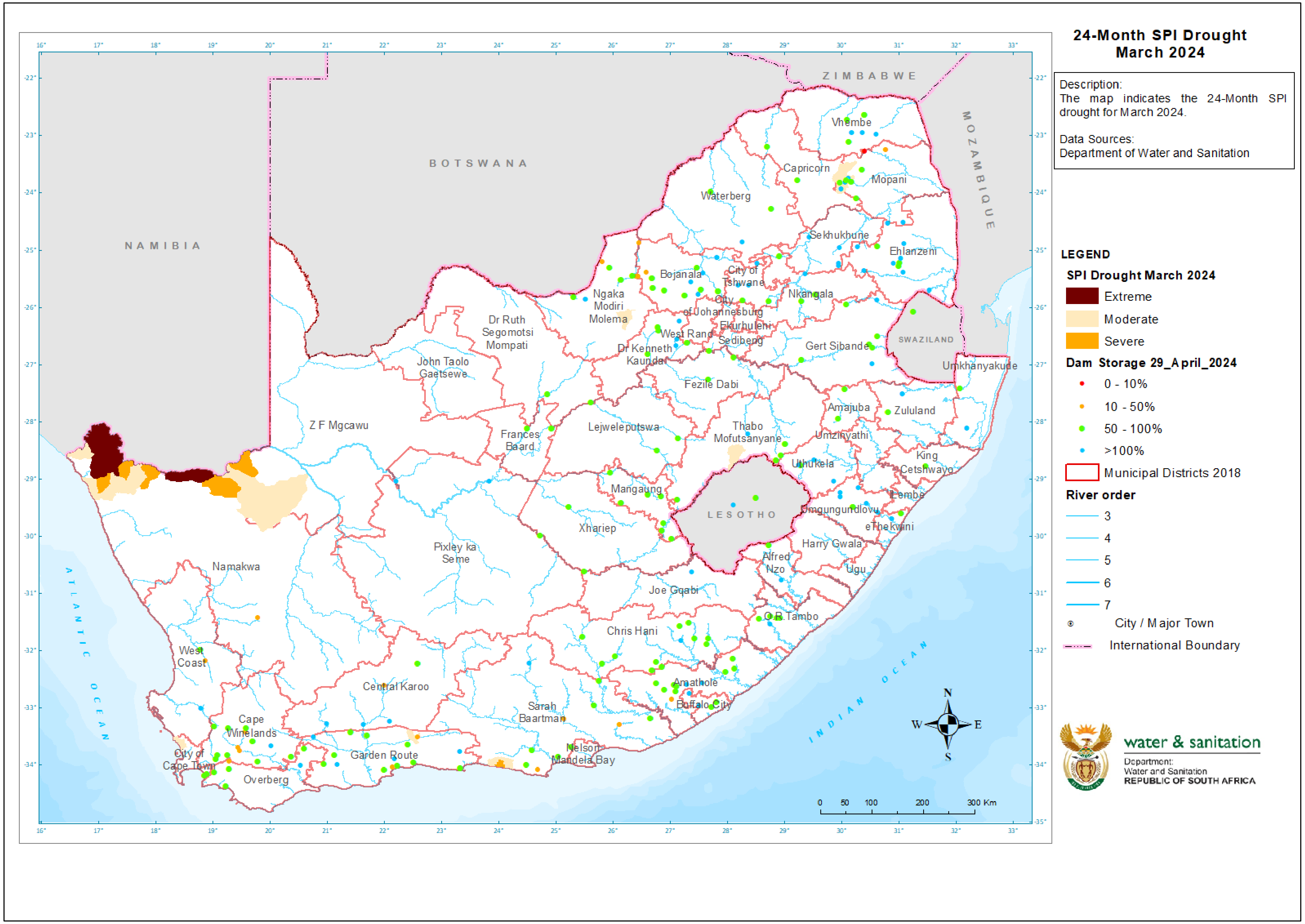
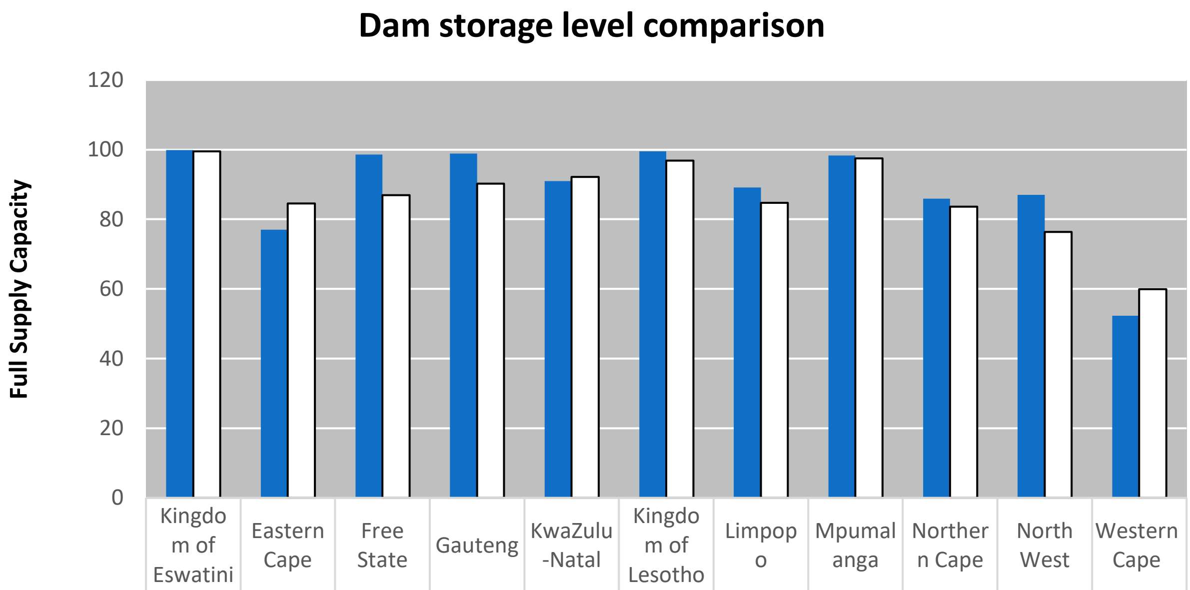


Figure 8: 24-month Spatial Precipitation Index and dam levels

Figure 9 compares the storage levels per province and international areas for April 2024 to the same time last year. Seven of the nine provinces presented a decline in dam storage levels compared to the previous year. The two Provinces with increased dam storage levels were the Eastern Cape (+7.5% of FSC) and Western Cape (+7.6% of FSC), while the highest decline was in the Free State Cape (-11.3%) of FSC.



	Kingdom of Eswatini	Eastern Cape	Free State	Gauteng	KwaZulu-Natal	Kingdom of Lesotho	Limpopo	Mpumalanga	Northern Cape	North West	Western Cape
29-Apr-23	99.9	77	98.6	98.9	91	99.5	89.1	98.3	85.9	87	52.3
29-Apr-24	99.5	84.5	86.9	90.2	92.2	96.8	84.7	97.5	83.6	76.4	59.9

Figure 9: Water Storage Levels April 2023 vs. April 2024.

District Municipalities

The year-on-year comparison of water storage levels per District Municipality (DM) is presented in Figure 10. Sarah Baartman DM, Garden Route DM, Central Karoo DM, and Namakwa DM experienced a significant increase (>20%) in dam storage levels compared to last year. In contrast, Ngaka Modiri DM and Sedibeng DM experienced significant declines (>-20%) in dam levels compared to last year.

The dam storage levels in water supply systems (WSSs) and applicable restrictions are presented in Table 3. The Algoa WSS decision date was changed from 1 June to 1 November, and a new annual operating analysis for the decision date was performed, resulting in an update of water restrictions which were effected from 1 November 2023 to 31 October 2024. However, these restrictions are yet to be gazetted.

Due to infrastructure limitations, permanent restrictions are applicable for the Polokwane and Bloemfontein WSSs.

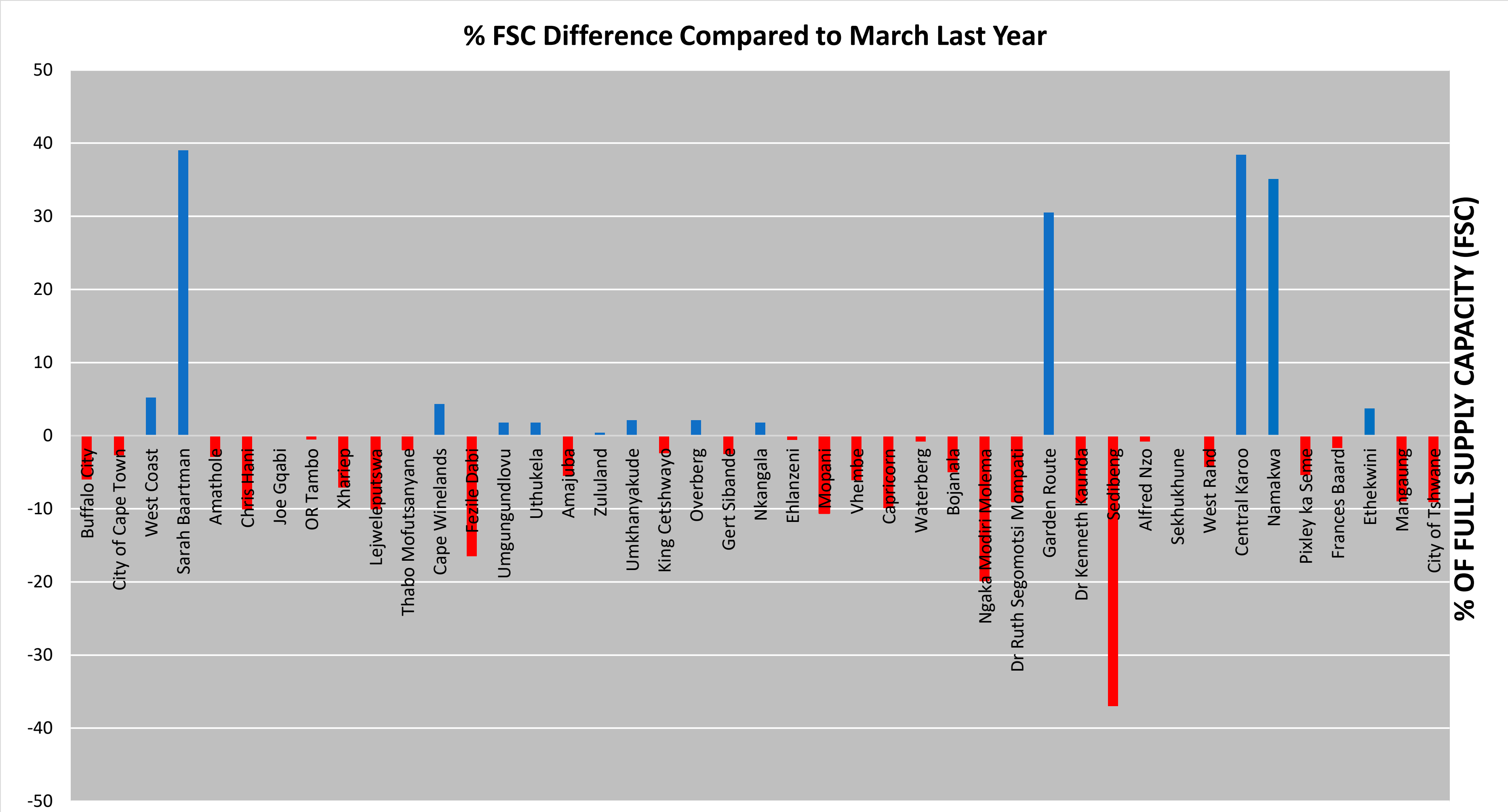


Figure 10: Difference in Water Storage Levels per District Municipality April 2023 vs April 2024

Table 3: Water Supply Systems storage levels

Water Supply Systems/clusters	Capacity in 10^6m^3	29 April 2023 (% FSC)	22 April 2024 (%FSC)	29 April 2024 (% FSC)	System Description
Algoa System	282	13.4	72	72.1	The following 5 dams serve the Nelson Mandela Bay Metro, Sarah Baartman (SB) DM, Kouga LM and Gamtoos Irrigation: Kromrivier Dam, Impofu Dam, Kouga Dam, Loerie Dam, Groendal Dam
Amathole System	241	98.7	95.5	95.2	The following 6 dams serve Bisho & Buffalo City, East London: Laing Dam, Rooikrans Dam, Bridle Drift Dam, Nahoon Dam, Gubu Dam, Wriggleswade Dam
Klipplaat System	57	100.1	95.6	95.3	The following 3 dams serve Queenstown (Chris Hani DM, Enoch Ngijima LM): Boesmanskrantz Dam, Waterdown Dam, Oxkraal Dam
Luvuvhu	225	101.5	100.5	100.2	The following 3 dams serve Thohoyandou etc: Albasini Dam, Vondo Dam, Nandoni Dam
Bloemfontein	219	98.3	91.8	90.6	The following 4 dams serve Bloemfontein, Botshabelo and Thaba Nchu: Rustfontein Dam, Groothoek Dam, Welbedacht Dam, Knellpoort Dam
Butterworth System	14	99.2	94.6	94.1	Xilinxa Dam and Gcuwa weirs serve Butterworth
Integrated Vaal River System	10 546	99.5	87.8	87.8	The following 14 dams serve Gauteng, Sasol, and ESKOM: Vaal Dam, Grootdraai Dam, Sterkfontein Dam, Bloemhof Dam, Katse Dam, Mohale Dam, Woodstock Dam, Zaaihoek Dam, Jericho Dam, Westoe Dam, Morgenstond Dam, Heyshope Dam, Nooitgedacht Dam, Vygeboom Dam
Polokwane	254.27	100.7	101	100.2	The following 2 dams serve Polokwane: Flag Boshielo Dam, Ebenezer Dam
Crocodile West	444	98.7	96.8	96.8	The Following 7 dams serve Tshwane up to Rustenburg: Hartbeespoort Dam, Rietvlei Dam, Bospoort Dam, Roodeplaat Dam, Klipvoor Dam, Vaalkop Dam, Roodekopjes Dam
uMgeni System	923	99.2	101.1	100.7	The following 5 dams serve Ethekwini, iLembe & Msunduzi: Midmar Dam, Nagle Dam, Albert Falls Dam, Inanda Dam, Spring Grove Dam
Cape Town System	889	60.7	63.6	62.7	The following 6 dams serve the City of Cape Town: Voelvlei Dam, Wemmershoek Dam, Berg River Dam, Steenbras-Lower Dam, Steenbras-Upper Dam, Theewaterskloof Dam
Crocodile East	159	100.4	100.4	100.3	Kwena Dam supplies Nelspruit, KaNyamazane, Matsulu, Malelane and Komatipoort areas and Surroundings

Water Supply Systems/clusters	Capacity in $10^6 m^3$	29 April 2023 (% FSC)	22 April 2024 (%FSC)	29 April 2024 (% FSC)	System Description
Orange	7 996	97.4	90.4	90.5	The Following two dams service parts of the Free State, Northern and Eastern Cape Provinces: Gariep Dam, Vanderkloof Dam
uMhlathuze	301	100.1	98.1	97.7	Goedertrouw Dam supplies Richards Bay, Empangeni Towns, small towns, surrounding rural areas, industries and irrigators, supported by lakes and transfer from Thukela River

Table 4: Water Supply Systems with Restrictions

Water Supply Systems/clusters	Restrictions
Algoa	The decision date was changed from 1 June to 1 November, therefore new AOA were conducted, and water restrictions imposed as from 1 November 2023, Urban (Domestic and Industrial) = 5%, Irrigation = 15% for Kouga Subsystem and Urban (Domestic and Industrial) = 40%, Irrigation = 50% for the Kromme Subsystem, these are yet to be gazetted.
Bloemfontein	A 15% restriction has been recommended on Domestic and Industrial water supply when the system drops below 95%, notice yet to be gazetted.
Polokwane	20% restrictions on Domestic and Industries

Extreme Weather Events – April 2024

Most provinces received heavy rainfall in April; in some provinces, the heavy rainfall caused floods, leaving a trail of destruction and fatalities. The rainfall was caused by a cut-off low weather system, which occurs most frequently during this period. Cut-off lows are large weather systems that are known to cause widespread flooding, such as the KwaZulu-Natal flooding in 2022 and the Laingsburg flooding in 1981 (SAWS, 2024*a*). In the first week of April, the cut-off low-pressure system was positioned over the country's western interior. Figure 11 shows widespread showers and thundershowers predicted by the Global Forecast System across most parts of the country, with heavy rainfall and severe thunderstorms predicted in some areas for 07 and 08 April 2024.

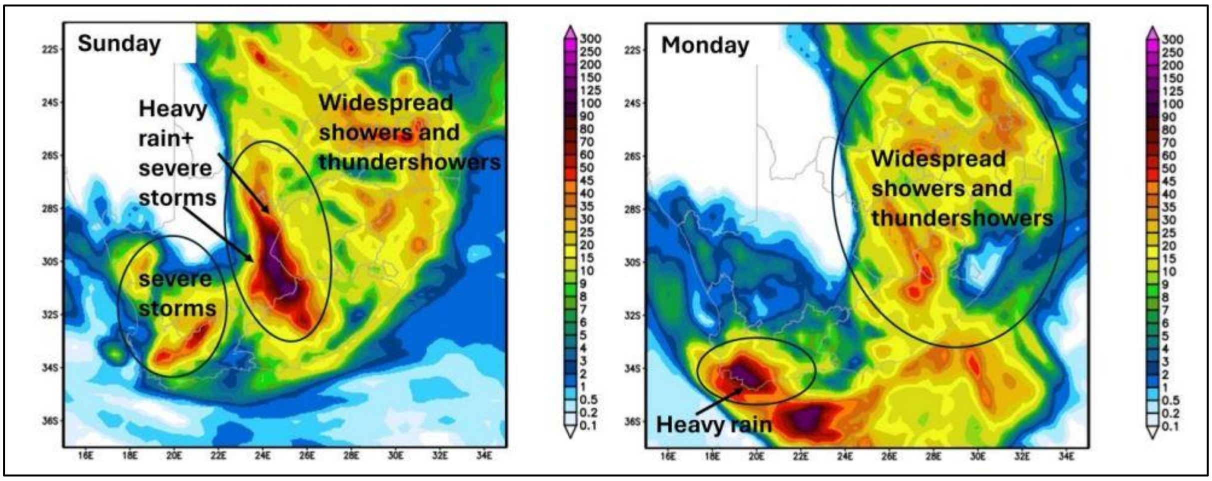


Figure 11: *24-hour rainfall accumulation for Sunday, 7 April (left) and Monday, 8 April (right) according to the Global Forecast System (GFS) (Source: SAWS).*

Western Cape: Strong Winds and Floods

On 4 April 2024, SAWS issued an early warning for the Western Cape for disruptive rain and strong winds from 7 April to 9 April (Figure 12). The statement described an intense cut-off low that was expected to develop along the country's west coast from 4 April 2024. The statement also predicted heavy rainfall over parts of the Overberg and the south-west coast of the Western Cape on the 8th and 9th as the cut-off low exited along the southern coast of the Western Cape, as well as a strong to gale-force south-easterly wind, which could disrupt coastal marine routines and operations (SAWS, 2024*a*).

On 9 April, the Western Cape Government reported that George had accumulated more than 100mm of rain within 24 hours. Furthermore, dam levels in the Karoo and Garden Route districts rose rapidly, with some dams reportedly overflowing, particularly those along coastal areas.

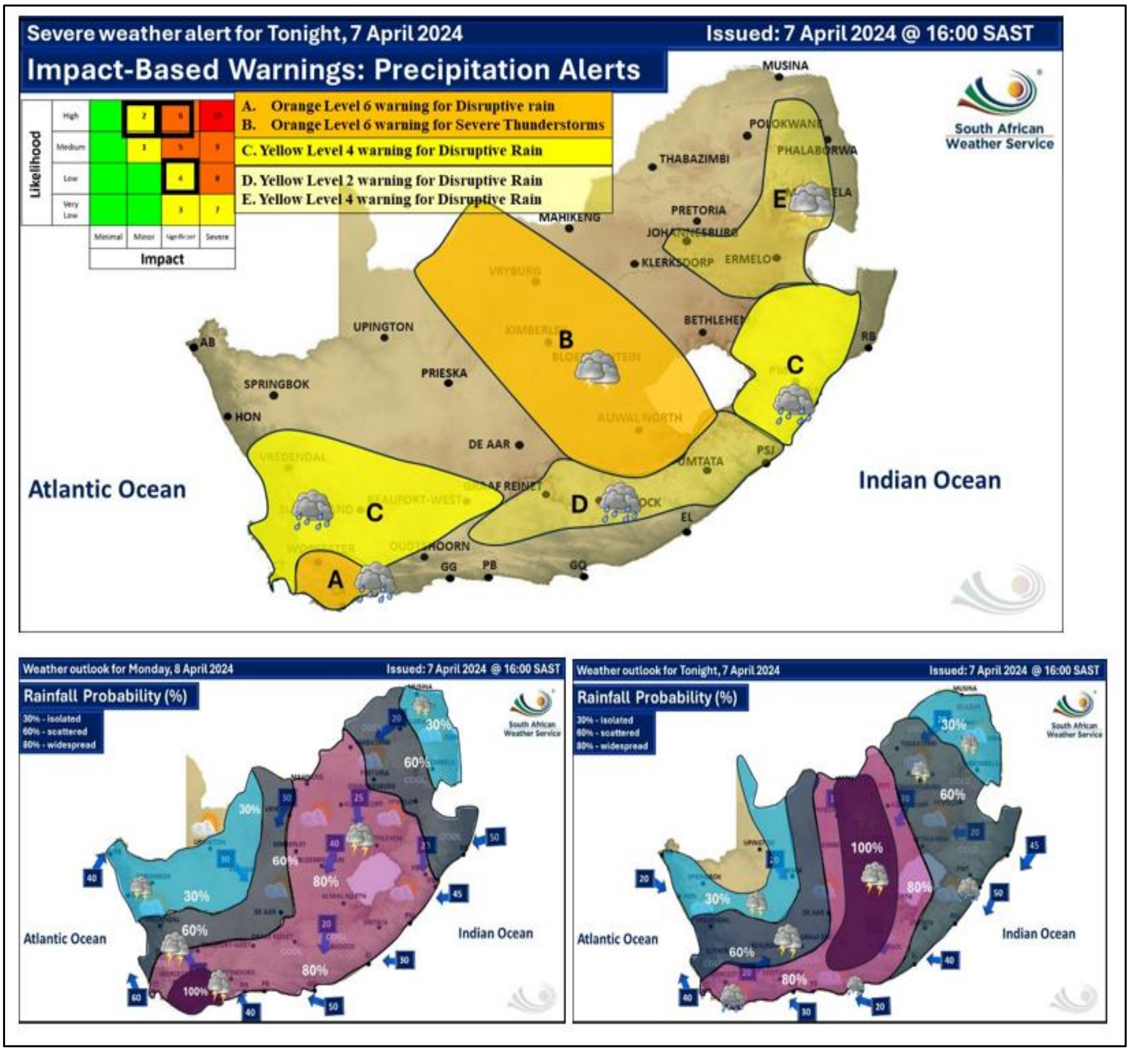


Figure 12: Extreme weather warning indicating heavy rainfall for the Western Cape Province

By 10 April, one fatality had been reported, with 2,779 buildings affected, at least 26 schools damaged, and several highways closed across the Cape Winelands, Overberg, and West Coast regions, as well as several power outages.

KwaZulu Natal: Floods

On 14 April, SAWS issued an orange level 5 warning for KwaZulu Natal's south coast, predicting heavy rainfall and thunderstorms. A severe storm hit the Margate- Uvongo -Shelly Beach - Port Edward areas of KZN from the 14 to 15 April, as per rainfall probability, and a warning was issued, as displayed in Figure 12. A total rainfall of 250mm was recorded in Margate, with 225mm recorded between 16h00 and 22h00 on 14 April (SAWS, 2024*b*).

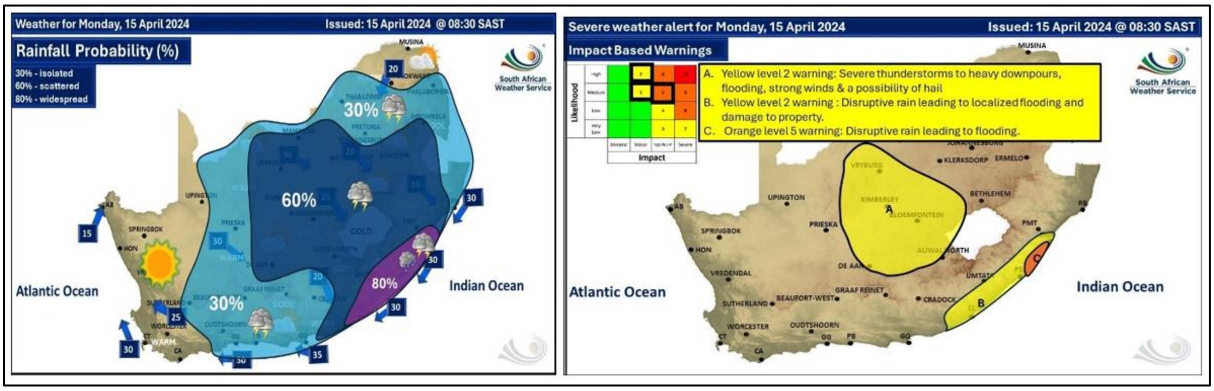


Figure 13: Rainfall probability and severe weather warning for 15 April 2024, affecting KZN's south coast.

The two most severely affected districts were uGu District (Margate area) and eThekwini District. Floods caused damage to infrastructure such as shelters, roads, schools, clinics, water, businesses, and electricity supply. Over 249 people were estimated to have been affected, more than 110 households were destroyed, and five fatalities were confirmed. Figure 14 depicts the trail of destruction left by floods in Margate.

Figure 14: Images showing the destruction caused by floods in KZN's South Coast (Margate 15 April 2024). (Source: Social media).

Water Quality Parameters Explained

Water quality refers to the condition and characteristics of water that determine its fitness for various uses and the health of aquatic ecosystems. It encompasses water's chemical, physical, and biological properties and the presence of contaminants and pollutants. Water quality in natural water bodies such as lakes, rivers, and oceans can be affected by several factors. These factors include natural processes like weathering, erosion, and biological interactions, as well as human activities such as industrial discharges, agricultural runoff, and improper waste disposal. Contaminants commonly found in water include organic and inorganic substances, pathogens, heavy metals, pesticides, and nutrients like nitrogen and phosphorus. Assessing water quality is essential for understanding aquatic ecosystems' health, identifying pollution sources, and developing effective management strategies.

PART A: PHYSICAL WATER QUALITY PARAMETERS

Physical parameters commonly investigated to establish water quality include color, temperature, turbidity, suspended solids, and electrical conductivity.

Color

Drinking water should ideally have no visible color. Color in water can be caused by dissolved and suspended materials, typically organic matter (primarily humic and fulvic acids) associated with the humus fraction of soil. Color is also strongly influenced by the presence of iron and other metals, either as natural impurities or as corrosion products. It may also result from the contamination of the water source with industrial effluents and may be the first indication of a hazardous situation.

In the laboratory, with methods to measure the color of a water sample, there is a distinction between apparent color and true color. Apparent color is the color of the sample *as received* and includes color due to both the dissolved and suspended materials in the water. The true color is the color in the sample after it has been filtered to remove suspended materials, such as algae and particulates, which cause turbidity. True color results from only dissolved species in water, which can be natural organic matter, minerals, or chemicals. Color measurements are conducted using a spectrophotometric technique that measures how much light is absorbed or transmitted through a sample at a certain wavelength. Measurements are obtained using a Platinum-Cobalt standard. A unit of color is the color produced by one mg/L of platinum in the form of the chloroplatinum ion and is expressed as Pt-Co (Thermo Fisher Scientific, 2020).

Temperature

Temperature is an important factor to consider when assessing water quality. Temperature influences several other parameters and can alter the physical and chemical properties of water. In this regard, water temperature should be accounted for when determining:

- pH
- Electrical conductivity and Salinity
- Dissolved oxygen and other dissolved gas concentrations
- Water density
- Compound toxicity
- Metabolic rates and photosynthesis production
- Oxidation-reduction potential

Turbidity

Turbidity refers to how cloudy or opaque the water is and is a measure of suspended minerals, bacteria, plankton, and dissolved organic and inorganic substances. High turbidity can cause an increase in water temperatures because suspended particles absorb more heat and can also reduce the amount of light penetrating the water. Turbidity can act as a shield for harmful microorganisms, which makes it more difficult to get rid of these contaminants. Suspended materials may damage fish gills, reduce growth rates, and decrease resistance to diseases.

The laboratory method to determine turbidity is based on the scattering of light by the suspended particles in water. Turbidity is often expressed as NTU - Nephelometric Turbidity Units. The name Nephelometry is derived from the Greek word "nephelo" which refers to "cloud," hence the cloudiness of a solution.

Purification of turbid water includes mixing with a substance such as alum - a hydrated double sulphate salt of aluminium with the general formula $XAl(SO_4)_2 \cdot 12H_2O$, where X is a monovalent cation such as potassium or ammonium that causes coagulation of the suspended materials, which then can be removed by sand filter filtration.

Total Suspended Solids (TSS)

Solids in water can be in suspension (Total Suspended Solids) or dissolved in solution (Total Dissolved Solids). TSS measures the turbidity of the water, while TDS measures the minerals, metals, salts, and ions dissolved in the water. TSS are particles larger than 2 microns found in water, such as sand, silt, clay, or other material produced by erosion. It also includes organic matter such as animals, plants, and algae, which, when decayed, become suspended solids that may contain high levels of pollutants like phosphorus, pesticides, and heavy metals.

The laboratory technique used to measure TSS is based on a gravimetric method. A volume of water sample is filtered through a glass-fiber filter, and the filter is then dried to a constant weight. The increase in weight of the filter is a measure of the TSS.

Electrical Conductivity

The electrical conductivity (EC) of water is a measure of the ability of an aqueous solution to carry or conduct an electrical current. Since the electrical current is carried by ions in solution, the conductivity increases as the concentration of ions increases. Other factors that influence the ability of the solution to conduct an electrical current are the composition of dissolved salts (mainly sodium, chloride, magnesium, calcium, and sulphate), mobility of the ions, valence, and the temperature of the measured solution. Temperature directly affects conductivity by increasing the solubility and ionic mobility of salts and minerals. The SI (International System of Units) unit of an EC measurement is milliSiemens/m (mS/m) or microSiemens/cm (µS/cm) at a standard reference temperature of 25 °C.

EC and Total Dissolved Solids (TDS) are water quality parameters used to describe salinity levels. Since a true TDS analysis is time-consuming (determined by gravimetry), it is often estimated from electrical conductivity assuming that the dissolved solids are predominantly ionic species of low enough concentration to yield a linear TDS-EC relationship: TDS (mg/L) = k × EC (µS/cm) where k is a constant of proportionality and is dependent on the type of water being analysed. Conductivity meters and other measurement options either use a constant of 0.65 or an adjustable EC to TDS factor from 0.50 to 0.75 for increasingly saline waters (Walton, 1989). Since salts increase the ability of a solution to conduct an electrical current, a high EC value indicates a high salinity level.

The laboratory measurement for determining EC is based on a potentiometric method where 2 electrodes in a probe are placed in the water sample, a potential (voltage) is applied across the electrodes, and the current that passes through the solution is measured. Common desalination processes are reverse osmosis and distillation.

Table 5: Guidelines for Drinking Water Quality according to SANS 241: 2015: 2

Physical Parameter	Standard Limit
Colour (mg/L as Pt-Co)	≤15
Turbidity (NTU)	≤1
Electrical conductivity (mS/m at 25 °C)	≤170
Total Dissolved Solids (TDS, mg/L)	≤1200

Next month's bulletin will feature Chemical Water Quality Parameters.

Compiled by: Hulisani Mafenya, Nokulunga Biyase, Judy Reddy, Mirrander Ndhlovu, and Joshua Rasifudi

For technical inputs and enquiries:
Sub-Directorate: Integrated Water Resource Studies:
Tel: 012 336 6856
Email: IntegratedWaterStudies@dws.gov.za

National State of Water Reporting Web page:
https://www.dws.gov.za/Projects/National%20State%20of%20Water%20Report/default.aspx

Department of Water and Sanitation
Private Bag X313
Pretoria
0001

Glossary

Term	Definition
EC	Electrical Conductivity
FSC	Full Storage Capacity
SPI	Standardized Precipitation Index (SPI) is a widely used index to characterise meteorological drought on a range of timescales. On short timescales, the SPI is closely related to soil moisture, while at longer timescales, the SPI can be related to groundwater and reservoir storage
TSS	Total Suspended Solids
TDS	Total Dissolved Solids
Water Supply System	A typical town/city water supply system consists of a gravity or pumping-based transmission and distribution system from a local or distant water source with needed water treatment system

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