OCTOBER 2025

MONTHLY STATE OF WATER BULLETIN

WATER IS LIFE - SANITATION IS DIGNITY

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

Overview

October typically marks the onset of the rainy season in South Africa's summer rainfall regions, with the eastern parts of the country generally receiving significant precipitation during spring and early summer. However, October 2025 was characterized by mixed rainfall patterns. While large portions of the country experienced below-normal rainfall, certain areas recorded above-normal totals. Notably, some stations reported their wettest October in the past 31 years, with rainfall amounts exceeding long-term averages by more than fourfold in isolated cases. Above-normal rainfall was observed in parts of the Northern Cape, North West, Limpopo, Free State, and Mpumalanga provinces. These anomalies highlight considerable spatial variability in rainfall distribution during the current hydrological year.

The SAWS October 2025 report indicates that the El Niño-Southern Oscillation (ENSO) is still in a neutral state. The SAWS predictions indicate a move towards a weak La Niña event during the coming summer season. The La Niña State is more likely and gaining confidence as we near the summer season. The usual effect of La Niña in South Africa is an increased likelihood of receiving above-normal rainfall over the northeastern parts of the country during summer.

At the end of October 2025, the national dam levels were 92.4% of Full Supply Capacity (FSC). This level is 15.7% higher than at the same time last year, when the overall storage level was at 76.7% of FSC. At the end of October 2025, the IVRS was at 97.4% of FSC, down 0.2% from September 2025 but reflecting a substantial annual increase of 24.2% from October 2024. While, the storage level of the Orange System was at 94.9% of FSC end of October 2025, down 1% from September 2025 and up 16% increase from October 2024. These significant improvements in dam levels are largely attributed to the above-average rainfall received earlier this year.

The SPI drought indicator analysed at the end of September 2025 shows that a small part of the Sarah Baartman DM in the Eastern Cape is indicating extreme drought in the last 24 months. While small parts of Ehlanzeni and the City of Cape Town District Municipalities are indicating severe drought status.

In recent years, frequent municipal water supply disruptions and rising municipal water tariffs have prompted many urban communities to shift towards using groundwater. To address and regulate this shift, the Department of Water and Sanitation launched the Groundwater Regulations Project in 2023/2024 under Section 26(1) of the National Water Act to regulate groundwater use. Through these regulations, the Department seeks to develop a comprehensive national inventory of geosites and encourage best practices in borehole drilling and sustainable groundwater abstraction.

Microplastics, tiny plastic particles less than 5 mm in size, have become a growing concern for water quality and aquatic ecosystems. These particles release harmful chemical additives such as phthalates, bisphenol A, and heavy metals into the water, and also attract pollutants like pesticides and persistent organic compounds. Acting as carriers of toxins, microplastics transport these contaminants through aquatic systems, where they can be ingested by organisms and accumulate through the food chain. Over time, environmental ageing makes microplastics even more chemically active, increasing their impact on aquatic life and posing risks to human health and water quality.

Rainfall

During spring and early summer, the eastern parts of the country normally receive significant rainfall. October marks the start of the rainy season for South Africa's summer rainfall regions, and a large part of the country experienced below normal rainfall. However, some areas received above-normal rainfall. Within that area, there were still some stations that had their wettest October over the last 31 years (Figure 1). Several measuring stations recorded rainfall totals that far exceed their long-term averages, with some reporting more than four times their average October rainfall (Table 1). The monthly rainfall anomalies for the current hydrological year, expressed as a percentage of normal rainfall for October 2025 in (Figure 2). Above-normal rainfalls were received in isolated parts of the Northern Cape, North West, Limpopo, Free State, and Mpumalanga provinces.

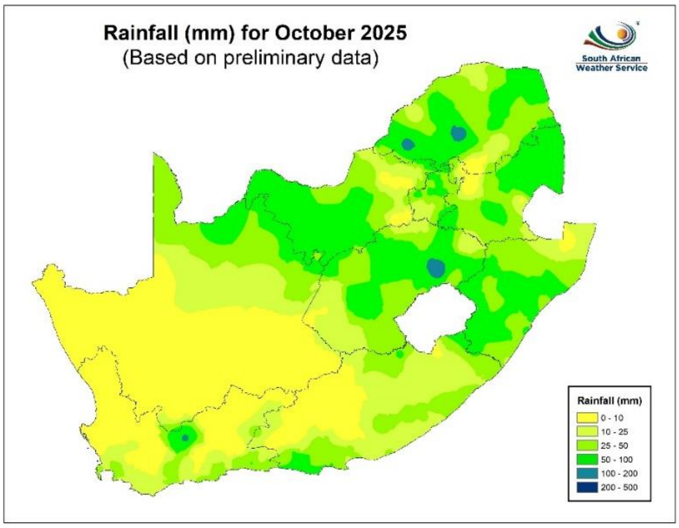

Figure 1: Summer season monthly rainfall distribution for October 2025

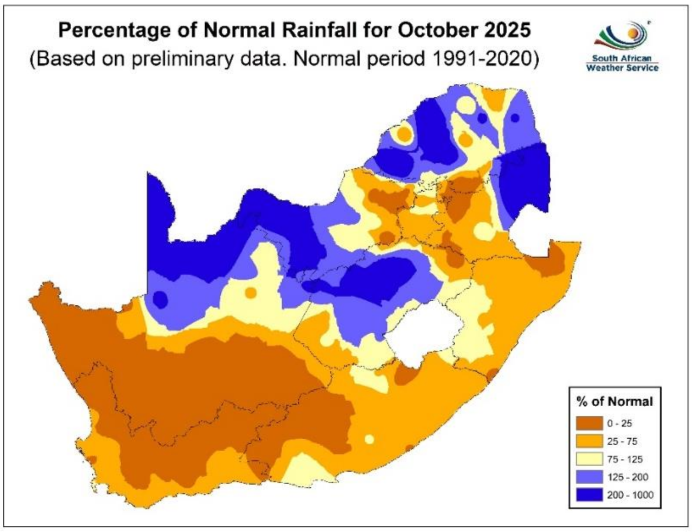

Figure 2: Summer season Percentage of normal rainfall for October 2025. Blue shades are indicative of above-normal rain, and the darker yellow shades of below-normal rainfall

Table 1: Selected stations that recorded the wettest October 2025 rainfall totals compared to 1995-2025 climatological averages, representing the wettest locations across South Africa during the month over the last 31 years (SAWS, 2025).

Station	Province	October 2025 rainfall (mm)	Previous Wettest October Year (Data in mm)
EXCELSIOR ARS	Free State	121,4	117,0 (2021)
ELIM – HOSP	Limpopo	99,0	86,5 (2003)
MODJADJI WATER PLANT	Limpopo	106,2	91,4 (2020)
MOKOPANE	Limpopo	116,4	84,0 (2020)
MUKUMBANI TEA ESTATE - VENDA	Limpopo	144,8	137,2 (2017)
VUVHA CLINIC ARS	Limpopo	103,4	94,6 (2021)
LICHTENBURG	North West	243,2	114,6 (2007)
VRYBURG - MOOILAAGTE ARS	North West	72,6	53,0 (2021)
VAALHARTS AWS	Northern Cape	65,0	60,6 (2021)

Weather Forecast and Early Warning

The weather has a significant impact on water resources. Rising temperatures increase evaporation and reduce water availability, while extreme weather events, such as droughts and floods, exacerbate water scarcity and pollution, respectively. Changes in precipitation patterns also affect water availability.

The South African Weather Services (SAWS) October 2025 report indicates that the El Niño-Southern Oscillation (ENSO) is still in a neutral state (SAWS, 2025). The SAWS predictions indicate a move towards a weak La Niña event during the coming summer season. The La Niña State is more likely and gaining confidence as we near the summer season. The usual effect of La Niña on South Africa is an increased likelihood of receiving above-normal rainfall over the northeastern parts of the country during summer.

Most of the areas that receive significant rainfall in the coming summer are situated in the North-East of the country. Most of these areas are expected to receive above-normal rainfall during the forecast period up until late-summer (Figure 3).

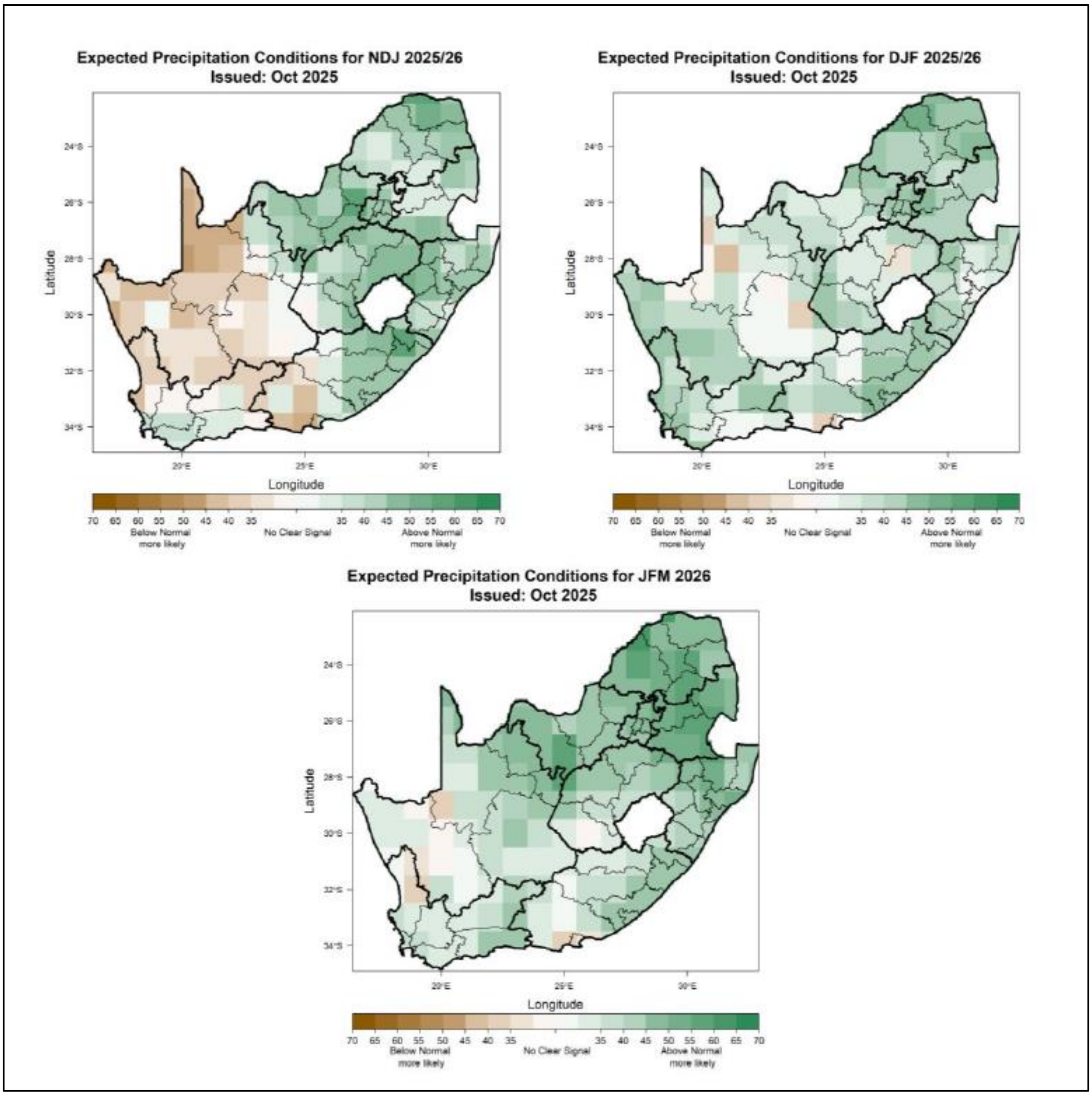

Figure 3: November-December-January 2025/26 (NDJ; left), December-January-February 2025/26 (DJF; right), January-February-March 20226 (JFM; bottom) seasonal precipitation prediction. (Source: SAWS, 2025).

The latest climate report (SAWS,2025) also stated that the minimum temperatures are largely expected to be above-normal for most parts of South Africa during summer, with maximum temperatures likely to be a mixture of above and below-normal throughout the country. The spurious below-normal expectation of maximum temperatures is indicative of prolonged cloud cover over most parts of the summer rainfall areas and gives extra confidence in an above-normal summer rainfall season (Figure 4).

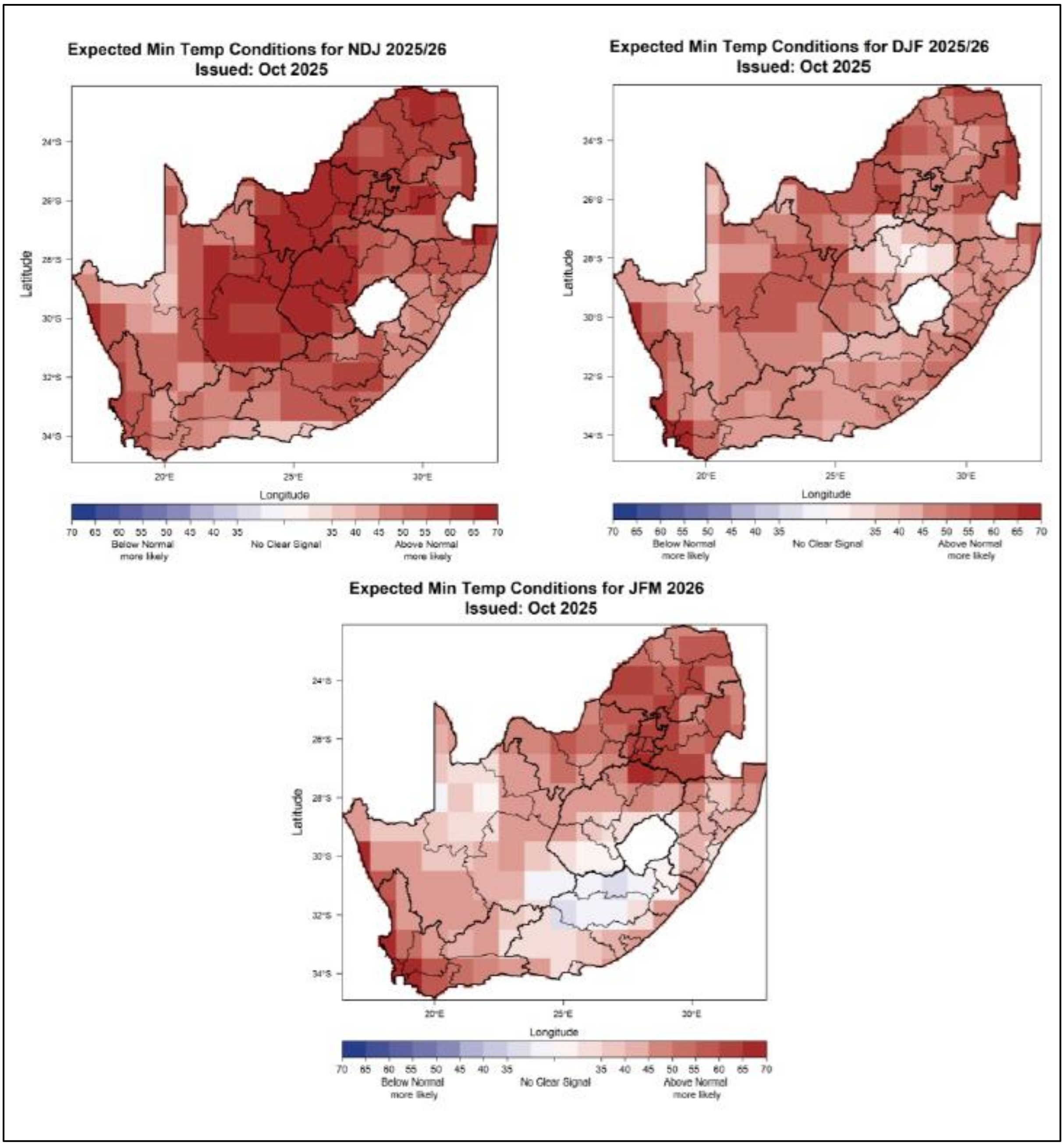

Figure 4: October-November-December 2025 (OND; left), November-December-January 2025/26 (NDJ; right), December-January-February 2025/26 (DJF; bottom) seasonal minimum temperature prediction (Source: SAWS, 2025).

"Minimum temperatures are largely expected to be above-normal for most parts of South Africa during summer, with maximum temperatures likely to be a mixture of above and below-normal throughout the country. " (SAWS, 2025)

National Dam Storage

The national surface water storage trends for the current hydrological year (2025/26) against the past four hydrological years are graphically presented in Figure 5. The graph shows that at the end of October 2025, the national dam levels were 92.4% of Full Supply Capacity (FSC). This level is 15.7% higher than at the same time last year, when the overall storage level was at 76.7% of FSC (Table 2).

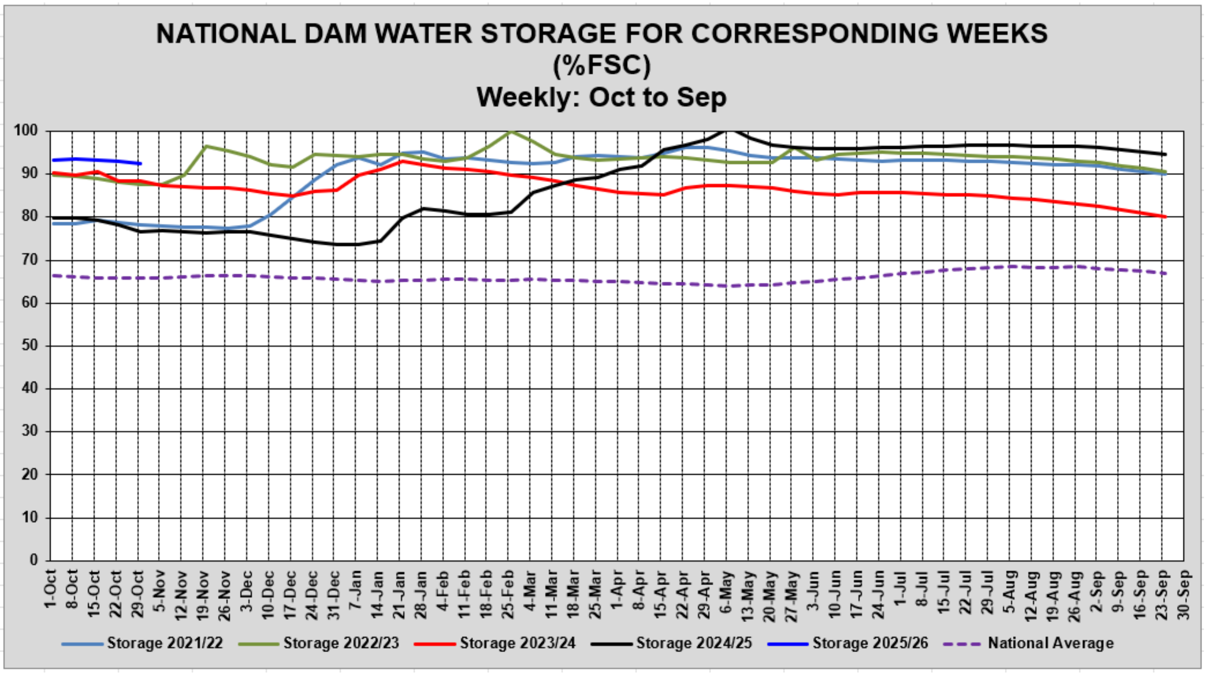

Figure 5: Weekly National Dam Storage at the end of October 2025, for five hydrological years.

Table 2 and Figure 6 show a summary of the status of 219 South African dams plus three dams from the Kingdoms of Eswatini and Lesotho. Based on 27 October 2025 dam data, at least 36 of 222 national dams were above 100% of FSC, only one (<1%) dam was below 10% of FSC (critically low). Gauteng dam levels remain above 100%, which is 15% higher than same time last year.

Table 2: National Surface Water Storage – 27 October 2025.

Provinces/Countries sharing Water Resources with RSA	FSC million m^3	Total No. of Dams	Number of Dams per Province/ Country				% of Full capacity		
			<10 (% of FSC)	10 - <50 (% of FSC)	50 - <100 (% of FSC)	≥100 (% of FSC)	Last Year 27/10/2024	Last Week 20/10/2025	This Week 27/10/2025
Kingdom of Eswatini	333.75	1			1		74.7	87.1	86.1 ↓
Eastern Cape	1 727.66	46		6	37	3	80.0	77.7	76.9 ↓
Free State	15 656.90	21		2	16	3	74.4	96.9	96.3 ↓
Gauteng	128.08	5			1	4	85.4	100.6	100.4 ↓
KwaZulu-Natal	4 909.66	19			14	5	78.9	93.4	93.2 ↓
Kingdom of Lesotho	2 362.63	2			2		78.8	94.5	94.8 ↑
Limpopo	1 484.64	29	1	3	18	7	70.5	81.2	80.2 ↓
Mpumalanga	2 538.20	22		1	19	2	80.2	93.1	92.6 ↓
Northern Cape	146.33	5			4	1	76.6	90.7	85.4 ↓
North West	866.23	28		1	18	9	58.4	89.7	89.3 ↓
Western Cape - Other Rainfall	269.61	22		8	14		88.6	52.4	50.9 ↓
Western Cape - Winter Rainfall	1 596.80	22			20	2	94.2	86.9	85.6 ↓
Western Cape - Total	1 866.41	44	0	8	34	2	93.4	81.9	80.6 ↓
Grand Total:	**32 020.50**	**222**	**1**	**21**	**164**	**36**	**76.7**	**92.9**	**92.4 ↓**

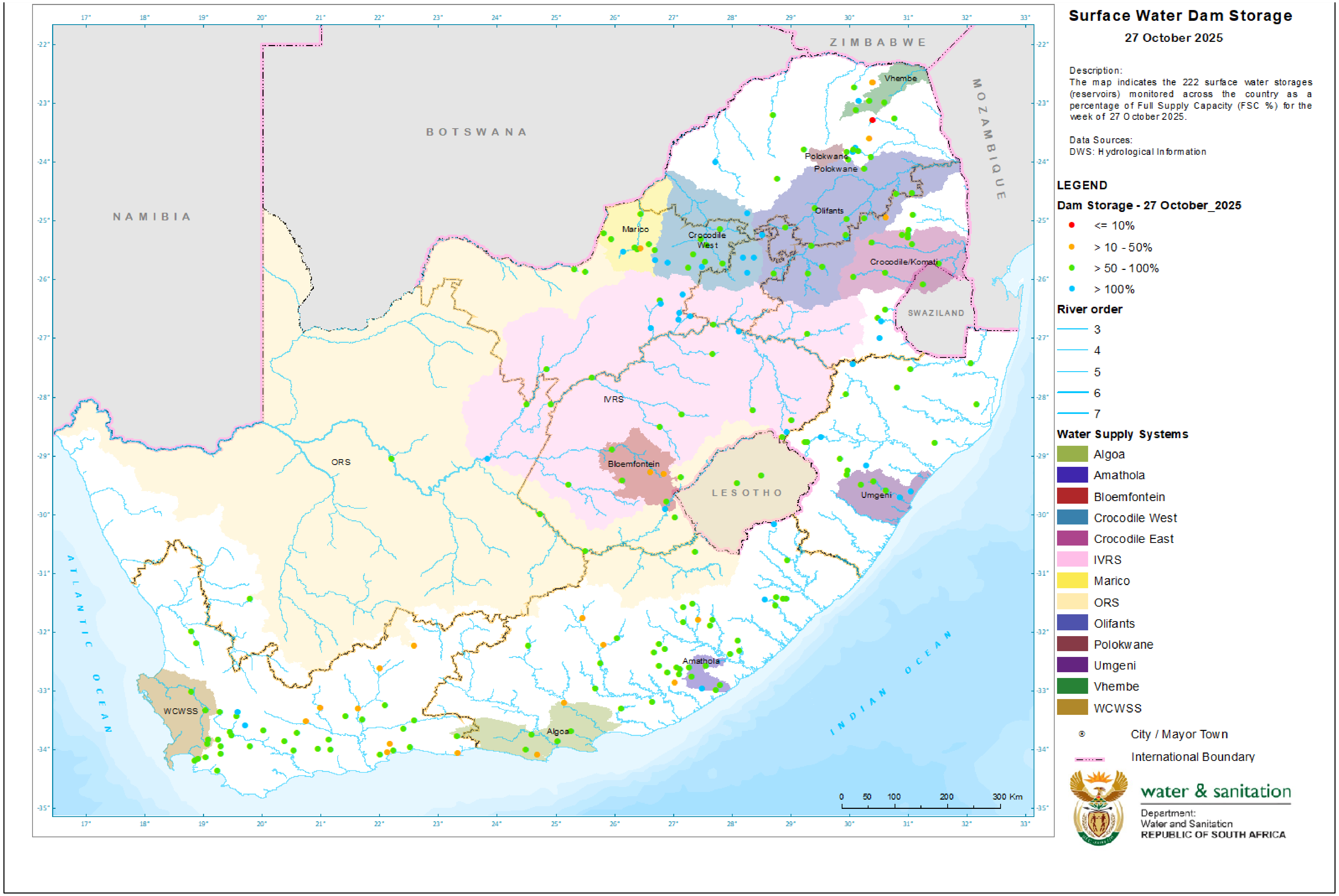

Figure 6: Surface Water Storage Levels – October 2025

The comparison of the storage levels per province (plus the Kingdoms of Eswatini and Lesotho) for October 2024 and October 2025 is graphically presented in Figure 7. North West is showing the most significant increase of 30.9%, year-on-year. The increase in the overall dam storage indicates higher-than-normal stream flows, as a result of above-normal rainfall received during the past hydrological year. The other notable increases were observed in Free State (+21.9%), Gauteng (+15%), and KwaZulu Natal (+14.3%) and Mpumalanga (+12.4%) of FSC. The Kingdoms of Eswatini and Lesotho experienced increases of 11.4% and 16%, respectively, compared to the previous year.

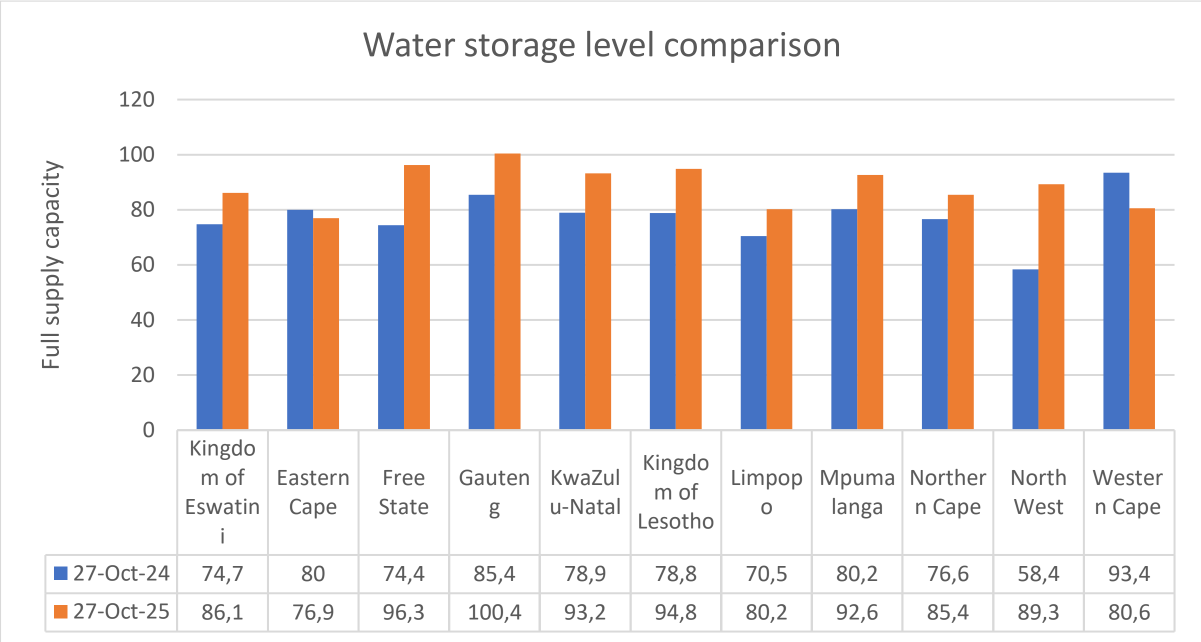

Figure 7: Water Storage Levels October 2024 vs. October 2025.

The comparison between October 2024 and October 2025 of the country's five largest dam storage is presented in Table 3.

Table 3: Storage Levels comparison for the Five Largest storage dams (by volume).

Reservoir	River	Province	Full Supply Capacity (Mm3)	27 October 2024 (% FSC)	29 October 2025 (% FSC)	Difference (%)
Gariep Dam	Orange River	Free State	4 903.45	69	94.8	+25.8
Vanderkloof Dam	Orange River	Free State & Northern Cape	3 136.93	94.4	95.2	+0.8
Sterkfontein Dam	Nuwejaarspruit River	Free State	2 616.90	97.9	99	+1,1
Vaal Dam	Vaal River	Free State	2 560.97	35	101	+66
Pongolapoort Dam	Phongolo River	KwaZulu-Natal	2 395.24	72.6	92.6	+20

The surface water storage levels at the five major dams in the country exceed 90%, with Gariep and Vaal Dam showing increases of 25.8% and 66%, respectively, compared to the previous year. Earlier this year, the Vaal Dam's storage levels dropped to 24.1% of FSC. However, by the end of October 2025, the dam's capacity reached 101% of FSC, exceeding last year's levels by more than 50%.

Another year-on-year improvement was observed in the critical level category at the Middle-Letaba Dam in Limpopo, which rose from below 0.8 to 5.2% of FSC at the end of October 2025 (Table 4).

Table 4: Dam below 10% of FSC compared to last year

Reservoir	River	Province	Full Supply Capacity (Mm3)	27 October 2024 % FSC)	27 October 2025 (% FSC)	Difference (%)
Middel-Letaba Dam	Middel-Letaba River	Limpopo	171.93	0.8	5.2	+4.2

Figure 8 presents the 24-month Standardised Precipitation Index (SPI) analysed at the end of September 2025. The SPI drought map shows that a small part of the Sarah Baartman DM in the Eastern Cape is indicating extreme drought in the last 24 months. While small parts Ehlanzeni and City of Cape Town District Municipalities are indicating severe drought status.

District Municipalities

The year-on-year comparison of water storage levels per district municipality is presented in Figure 9. Ngaka Modiri Molema DM, and Sedibeng DM experienced the most significant increases (>60%) in dam storage levels in October 2025, followed by Capricon DM (>40%). Also noteworthy, the Central Karoo district municipality experienced a significant annual decline (>-40%) in dam levels.

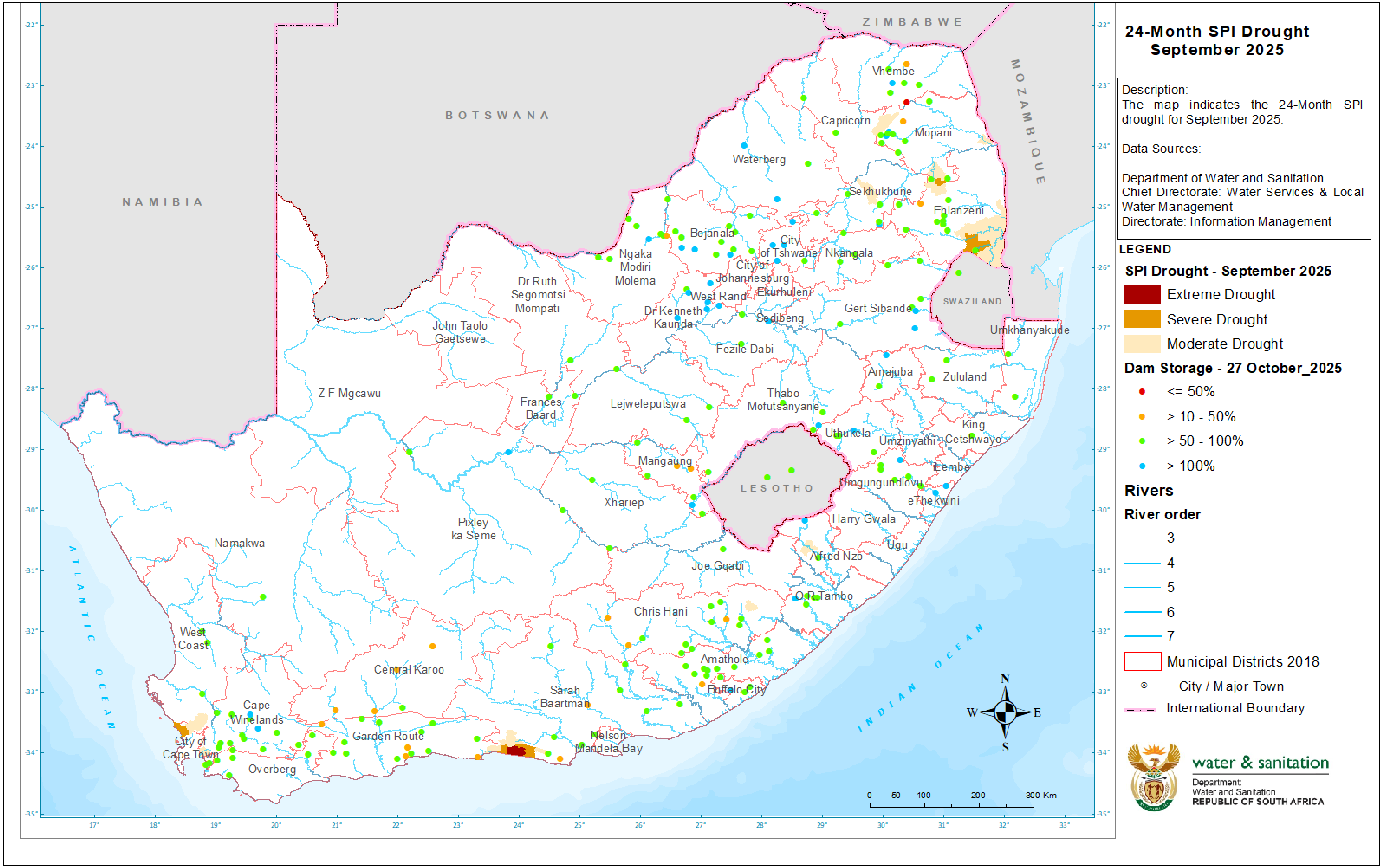

Figure 8: 24-Month Standardised Precipitation Index (SPI) – September 2025, including dam levels - October 2025.

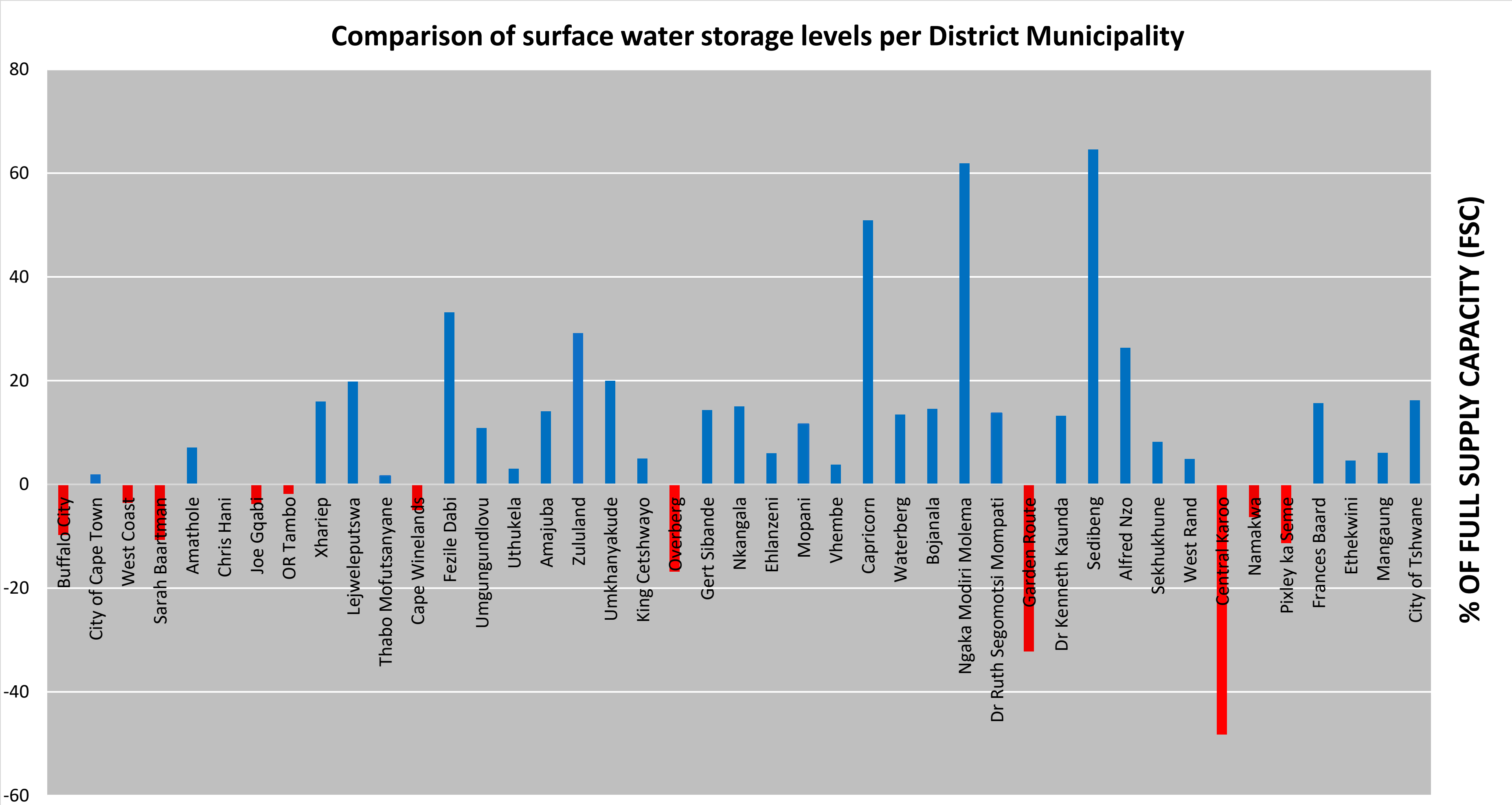

Figure 9: Comparison of water storage levels per District Municipality, October 2024 vs October 2025.

Water Supply Restrictions

The water supply systems and their respective restrictions are given in Table 5. Due to infrastructure limitations, permanent restrictions are applicable for the Polokwane and Bloemfontein Water Supply Systems.

Table 5: Water Supply Systems with Restrictions

System Name	Areas	Water Users	% Restrictions	Gazette Information	Next Review
Algoa WSS	Kromme subsystem	NMBM & Kouga LM Irrigation	23% domestic & industrial 43% irrigation	Recommended but not gazetted	Nov' 2025
Mangaung WSS	Caledon-Modder	Mangaung Metro	25% domestic & industrial when below 95%	13 Sep' 2024 Gazette no.5200	May 2025
Liebensbergvlei River	Run-off River abstractions Free State towns and irrigation	Towns of Bethlehem, Reitz, Tweeling within Dihlabeng, Mafube and Nketoana Local Municipalities	Irrigation users to abstract water on an alternative day basis Municipalities to use water sparingly	20 Sep' 2024 Gazette no. 5223	Once off until the end of the LHWP tunnel shutdown for the planned maintenance
Middle Letaba/ Nsami	Middle Letaba/ Nsami	Irrigation Mopani Municipality	100% irrigation 25% domestic	28 Jun' 2024	May 2025
Mutshedzi Dam	Mutshedzi Dam	Makhado Municipality	35% domestic		May 2025
Nzhelele	Nzhelele	Nzhelele Government Irrigation Scheme Nzhelele Regional Scheme	20% domestic 20% irrigation	28 Jun' 2024	May 2025
Nwanedi/ Luphephe	Nwanedi/ Luphephe	Mutale Local Municipality Irrigation	20% D&I 45% irrigation	28 Jun' 2024	May 2025
Polokwane Water Supply System **Letaba System**	Seshego, Mashashane, Houtrivier and Chuniespoort Dams Ebenezer and Groot Letaba System	Capricorn District, Polokwane Local Municipality Groot Letaba Water Users Association, Mopani Municipality	30% domestic & industrial water uses 27% agricultural use	28 Jun' 2024	May 2025

Table 6 presents the dam storage levels of South Africa's National Water Supply Systems. The Integrated Vaal River System (IVRS) is the largest and most economically vital system in the country, consisting of 14 dams with a combined capacity exceeding 10,620 Mm^3. At the end of October 2025, the IVRS was at 97.4% of FSC, down 0.2% from September 2025 but reflecting a substantial annual increase of 24.2% from October 2024. The Orange Water Supply System, the second-largest, comprises only two dams yet holds over 7,996 Mm^3. At the end of October 2025, the storage level of the Orange System was at 94.9% of FSC, down 1% from September 2025 and up 16% increase from from October 2024. These significant improvements in dam levels are largely attributed to the above-average rainfall received earlier this year.

Table 6: Water Supply Systems storage levels October comparisons

Water Supply Systems/ Clusters	Capacity in 106m3	29 Sept 2024 (% FSC)	22 Sept 2025 (% FSC)	29 Sept 2025 (% FSC)	System Description
Algoa System	192	77.4	60.8	60	5 dams serve the Nelson Mandela Bay Metro, Sarah Baartman (SB) DM, Kouga LM and Gamtoos Irrigation: 1. Kromrivier Dam 2. Impofu Dam 3. Kouga Dam 4. Loerie Dam 5. Groendal Dam
Amathole System	241	100.9	95.3	94.9	6 dams serve Bisho & Buffalo City, East London: 1. Laing Dam 2. Rooikrans Dam 3. Bridle Drift Dam 4. Nahoon Dam 5. Gubu Dam 6. Wriggleswade Dam
Klipplaat System	57	95.3	98.1	96.8	3 dams serve Queenstown (Chris Hani DM, Enoch Ngijima LM): 1. Boesmanskrantz Dam 2. Waterdown Dam 3. Oxkraal Dam
Butterworth System	14	80.1	97.6	97.2	Xilinxa Dam and Gcuwa weirs serve Butterworth
Integrated Vaal River System	10 620	73.2	97.8	97.4	14 dams serve Gauteng, Sasol, and ESKOM: 1. Vaal Dam 2. Grootdraai Dam 3. Sterkfontein Dam 4. Bloemhof Dam 5. Katse Dam 6. Mohale Dam 7. Woodstock Dam 8. Zaaihoek Dam 9. Jericho Dam 10. Westoe Dam 11. Morgenstond Dam 12. Heyshope Dam 13. Nooitgedacht Dam 14. Vygeboom Dam
Luvuvhu	215	89	88.2	87.5	3 dams serve Thohoyandou: 1. Albasini Dam 2. Vondo Dam 3. Nandoni Dam
Bloemfontein	184	78	79.5	79.3	4 dams serve Bloemfontein, Botshabelo and Thaba Nchu: 1. Rustfontein Dam 2. Groothoek Dam 3. Welbedacht Dam 4. Knellpoort Dam

Water Supply Systems/ Clusters	Capacity in 106m3	29 Sept 2024 (% FSC)	22 Sept 2025 (% FSC)	29 Sept 2025 (% FSC)	System Description
Polokwane	257	79.7	95.2	94.6	2 dams serve Polokwane 1. Flag Boshielo Dam 2. Ebenezer Dam
Crocodile West	438	75.4	84.4	84.4	7 dams serve Tshwane up to Rustenburg: 1. Hartbeespoort Dam 2. Rietvlei Dam 3. Bospoort Dam 4. Roodeplaat Dam 5. Klipvoor Dam 6. Vaalkop Dam 7. Roodekopjes Dam
uMgeni System	905	84	92.7	92.7	5 dams serve Ethekwini, iLembe & Msunduzi: 1. Midmar Dam 2. Nagle Dam 3. Albert Falls Dam 4. Inanda Dam 5. Spring Grove Dam
Cape Town System	742	98.7	89.4	88.1	6 dams serve the City of Cape Town: 1. Voelvlei Dam 2. Wemmershoek Dam 3. Berg River Dam 4. Steenbras-Lower Dam 5. Steenbras-Upper Dam 6. Theewaterskloof Dam
Crocodile East	159	68	81.2	79.2	Kwena Dam supplies Nelspruit, Kanyamazane, Matsulu, Malelane and Komatipoort areas & Surroundings
Orange	7 988	78.9	95.5	94.9	2 dams service parts of the Free State, Northern and Eastern Cape Provinces: 1. Gariep Dam 2. Vanderkloof Dam
uMhlathuze	297	89.9	95.1	94.9	Goedertrouw Dam supplies Richards Bay, Empangeni Towns, small towns, surrounding rural areas, industries and irrigators, supported by lakes and transfer from Thukela River

Groundwater

PROPOSED REGULATIONS FOR THE PROTECTION AND MANAGEMENT OF GROUNDWATER RESOURCES

1. Background

South Africa receives an average annual rainfall of about 465 mm, which is around 46% below the global average of 860 mm. This makes it one of the driest countries in the world. The National Water Resource Strategy 3 (2023) acknowledges groundwater as a vital component of the overall water mix, essential for balancing national water supply and demand.

In recent years, disruptions in water supply—linked to surface water shortages and scheduled infrastructure maintenance—have become increasingly frequent, particularly in urban areas. Additionally, rising water costs have made municipal supply less attractive. Consequently, many communities have begun installing boreholes on their properties to access groundwater for regular domestic and communal use.

To manage this, the Groundwater Regulations project was initiated by the Department of Water and Sanitation during the 2023/2024 financial year, in accordance with Section 26(1) of the National Water Act 36 of 1998, which mandates the Minister to develop regulations governing water use. The project is also influenced by National Groundwater Strategy (2016) and supported by National Groundwater Archive.

2. Purpose

The purpose of the Regulations is to implement aspects of the National Groundwater Management Strategy by:

- Enhancing the management of groundwater resources through improved data collection, including the registration of geosites for both existing and new users, the registration of drillers and pump installers, and the systematic recording of borehole drilling information.
- Safeguarding the quantity and quality of groundwater through the imposition of restrictions and the prohibition of certain activities to ensure sustainable and regulated use.
- Protecting and managing sensitive aquifers to preserve their ecological integrity and sustainability.

Through these regulations, the Department seeks to develop a comprehensive national inventory of geosites and encourage best practices in borehole drilling and sustainable groundwater abstraction.

3. Progress to date

The Department has undertaken internal engagements across various platforms to ensure alignment. The Draft Regulations are currently being routed for management signatures, in preparation for gazetting and public consultation over a 60-day period. During this time, external stakeholder consultations will be conducted in line with the approved stakeholder engagement plan. Furthermore, the Presidency has endorsed the initial Socio-Economic Impact Assessment System (SEIAS), recommending that the Department proceed with the final phase of the assessment.

The Department plans to finalise and publish the regulations during the 2025/2026 financial year.

4. Conclusion

Groundwater, as a hidden and resilient resource, offers a critical buffer against surface water shortages and costs. However, its sustainable use requires robust regulation, accurate data collection, and active stakeholder engagement. Strengthening groundwater governance through initiatives such as borehole registration, improved monitoring, and protection of sensitive aquifers is essential. By understanding how much groundwater is being extracted, where, and by whom, authorities and users alike can work together to protect and preserve one of South Africa's most vital reservoirs.

For technical input and inquiries:
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Chemical Impacts of Microplastics on Water Quality and Aquatic Life

Microplastics are tiny plastic particles smaller than 5 mm in size that have become an increasingly important concern in aquatic environments worldwide (*Du et al*., 2021). They originate from both primary and secondary sources. Primary microplastics are intentionally manufactured small particles, such as microbeads, used in cosmetics, personal care products, cleaning agents and industrial abrasives. However, most microplastics arise from the breakdown of larger plastic items. Common polymers used in the manufacturing of plastics include polyethylene, polypropylene, polystyrene, and polyethylene terephthalate. These polymers are large molecules made up of repeating units called monomers and are widely used in packaging, textiles, electronics, and many everyday products.

The chemical aspects of microplastic pollution are among the most complex and concerning aspects of their behaviour in the environment. Microplastics are not chemically inert; they function both as sources and sinks for chemical pollutants in aquatic systems (Koelmans *et al*., 2016). Their impact arises from their chemical composition, surface reactivity, and their ability to transport adsorbed pollutants. In a Water Research Commission Report titled *The Establishment of a Knowledge Hub for Contaminants of Emerging Concern in South African Water Resources* (No. 3105/1/23, 2023), it was reported that, in a dataset of emerging pollutants of concern, most data entries originated from personal care products, followed by microplastics (Figure 10).

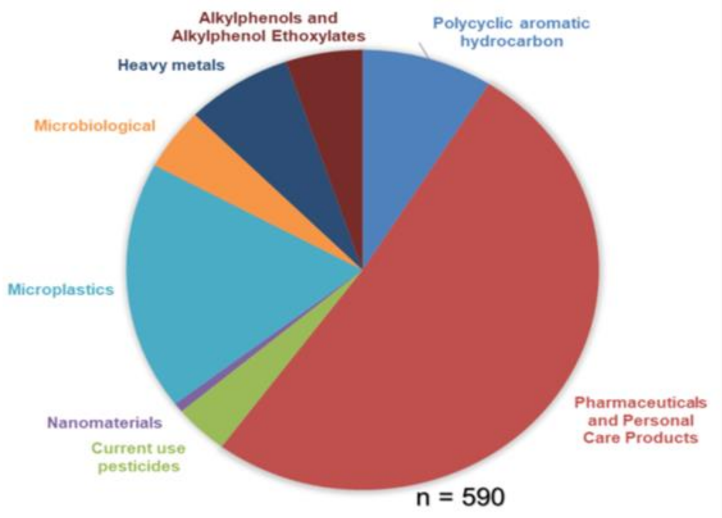

Figure 10:The frequency of terms of all contaminants listed in the Contaminants of Emerging Concern Knowledge Hub (WRC Report No. 3105/1/23, 2023).

Chemical Composition of Plastics/Leaching of Additives and Monomers

Plastics contain various chemical additives to enhance their performance during manufacturing. These include:

- Plasticisers such as phthalates (e.g. dibutyl phthalate) are added to make plastics flexible.
- Heat stabilisers such as lead (Pb) and cadmium (Cd) compounds are added to prevent degradation.
- Flame retardants such as polybrominated diphenyl ethers are added to reduce the risk of fire, especially in materials used for electronics, building materials, textiles, furniture and vehicles.

- UV stabilisers such as benzotriazoles to absorb harmful UV radiation before it can damage the polymer chains.
- Colourants and fillers such as titanium dioxide and carbon black to modify the properties of the final plastic product.

Over time, environmental factors such as UV radiation, high temperatures, mechanical abrasion, and microbial activity degrade the polymer matrix, releasing these additives into the surrounding water. These substances act as endocrine disruptors and carcinogens, interfering with hormonal balance in aquatic organisms (Luo *et al*., 2022). For example:

- Bisphenol A ($C_{15}H_{16}O_2$), which is used to make polycarbonate plastics, mimics the hormone oestrogen, leading to reproductive and developmental disorders in fish and amphibians.
- Phthalates, used in polyvinyl chloride (PVC) products, are associated with impaired reproduction and reduced growth rates in aquatic species.
- Heavy metal stabilisers leached from microplastics increase the bioavailability of toxic metals in aquatic sediments.

Thus, microplastics serve as sources of chemical emissions, contributing directly to the load of dissolved pollutants in aquatic environments.

Adsorption and Transport of Environmental Pollutants

Due to their large specific surface area, hydrophobic surfaces, and electrostatic binding sites that readily attract metal ions, microplastic particles act as sorbents for a wide range of persistent environmental contaminants (Menendez-Pedriza *et al*., 2020). These include:

- Persistent organic pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs), and organochlorine pesticides.
- Heavy metals such as lead, cadmium, zinc (Zn), and mercury (Hg).
- Nutrients and pharmaceuticals, including antibiotics and endocrine-active compounds.

Once adsorbed, these contaminants can be transported over long distances, effectively transforming microplastics into mobile pollutant carriers. They can then desorb in new environments where conditions (e.g. pH, salinity, temperature) differ, introducing toxins into previously uncontaminated ecosystems.

Vector for Bioaccumulation and Biomagnification

When aquatic organisms ingest microplastics contaminated with adsorbed pollutants, these hydrophobic pollutants transfer from the plastic into the organism's lipid-rich tissues. This leads to bioaccumulation of pollutants within individual species and biomagnification through food webs as predators consume contaminated prey. For example, PCBs and PAHs adsorbed to polyethylene microplastics have been shown to accumulate in fish liver tissues, altering enzyme activity and causing oxidative stress (Menendez-Pedriza et al., 2020). This causes impaired growth, reduced reproductive success, and increased mortality in fish populations. Over time, these toxic substances ascend the food chain, ultimately reaching humans through the consumption of seafood and freshwater fish.

Chemical Transformation and Ageing/Weathering of Microplastics

As microplastics "age" in the environment, their surface properties change (Xu *et al*., 2022). Processes such as photo-oxidation and hydrolysis alter their chemical reactivity:

- Photo-oxidation introduces carbonyl and hydroxyl functional groups, increasing surface polarity and adsorption potential.
- Oxidative degradation can release nanoplastics, which have even greater reactivity and biological uptake potential.

These ageing processes make microplastics not only more chemically active but also more difficult to remove or monitor.

Conclusion

Microplastics are powerful carriers of pollution that worsen water quality and pose a threat to aquatic life. They release harmful additives, attract toxic chemicals and metals, and become more reactive over time. Acting like chemical sponges, microplastics spread contaminants through water and food chains, exposing both organisms and humans to long-lasting toxins. Therefore, addressing the chemical impacts of microplastics is essential for protecting ecosystem health and ensuring water quality.

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Glossary

Term	Definition
DM	District Municipality
DWS	Department of Water and Sanitation
ENSO	El Niño-Southern Oscillation
FSC	Full Storage Capacity
IVRS	Integrated Vaal River System
PAHs	Polycyclic aromatic hydrocarbons
PCBs	Polychlorinated biphenyls
SAWS	South African Weather Services
SEIAS	Socio-Economic Impact Assessment System
SPI	Standardized Precipitation Index. 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
WSS	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 a needed water treatment system

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