5

SURFACE WATER STORAGE

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5.1 National Storage

The surface water storage volume is expressed as a percentage of a combined volume: full supply capacity (FSC) of 221 dams being monitored nationally. The national dam levels for the past five hydrological years are presented in Figure 5.1 below.

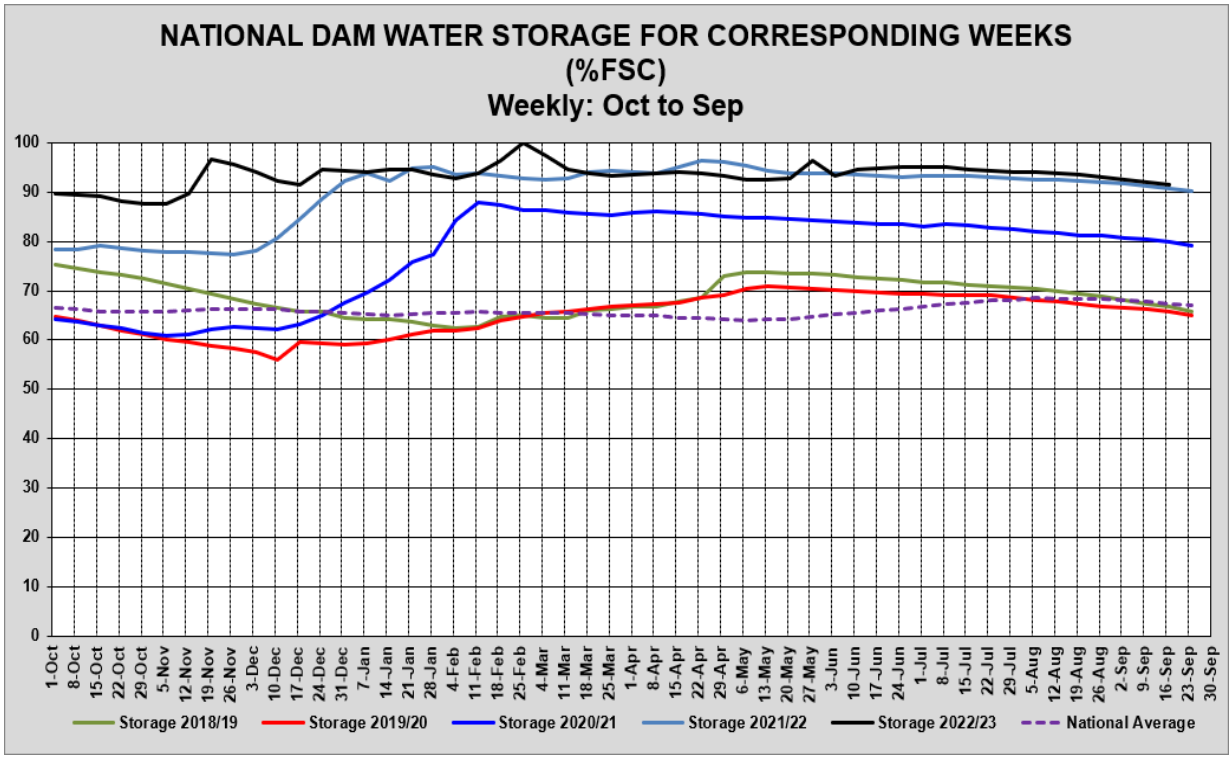


Figure 5.1 National Dam storage levels for the past five years compared to a national average.

The national dam storage levels for the 2021/22 and 2022/23 hydrological years, were the highest for most of the months in the past five hydrological years, especially after the beginning of summer rainfalls received between November and February 2023 for the eastern parts of the country.

Given in Table 5-1 is the classification of surface storage levels for Provinces ranging from critical storage levels, closer to dead storage of the dams (<10% of FSC); at risk of non-supply (>10% - <50% of FSC); optimal water levels for supply operations (>50% -<100%); and >100% of FSC (Full or spilling dams).

At the end of the hydrological year (September 2023), **1%** of the dams were at critical storage levels, **4%** were at risk storage levels, and **29%** were either spilling or at optimal storage levels.

Table 5-1 Surface storage at the end of September 2023

Provinces/ Countries sharing Water Resources with RSA	FSC million m^3	Total	Number of Dams per Province/Country			
			<10%	>=10%<50%	>=50%<100%	>=100%
Kingdom of Eswatini	333.75	1			1	
Eastern Cape	1729.39	46	1	4	28	13
Free State	15656.69	21			20	1
Gauteng	128.08	5			2	3
KwaZulu-Natal	4909.66	19		1	18	
Kingdom of Lesotho	2362.63	2			2	
Limpopo	1480.06	28	1		21	6
Mpumalanga	2538.57	22			20	2
Northern Cape	146.32	5			2	3
North West	867.29	28			21	7
Western Cape - Other Rainfall	271.35	22		3	8	11
Western Cape - Winter Rainfall	1596.80	22			5	17
Western Cape - Total	1868.15	44		3	13	28
Grand Total:	**32020.59**	**221**	**2**	**8**	**148**	**63**

The dams that were at critical storage conditions at the end of the reporting period were each from Eastern Cape, and Limpopo. The list of dams at critical low storage levels (<10% of FSC) is given in Table 5-2. Most dams still full or spilling at the end of the reporting period were in Eastern Cape (21%), Limpopo (10%), North West (11%), and Western Cape (44%).

Table 5-2 Dams below 10% of FSC September 2023

Reservoir	River	Province	25 September 2023 (% FSC)
Middle-Letaba Dam	Middle-Letaba River	Limpopo	3.9
Nuwejaars Dam	Nuwejaarspruit River	Eastern Cape	4.6

The dam storage levels classifications depicted with four colour codes integrated with the water supply systems areas are presented in Figure 5.2. Dam levels were between 50 to 100% of FSC for most water supply systems, spilling dams were observed in the Crocodile West, IVRS; Crocodile/Komati, Amathole, Algoa and the Western Cape. However, at the end of the hydrological year, dams with storage levels below 50% of FSC could still be observed in the Umngeni and Algoa in the Eastern Cape.

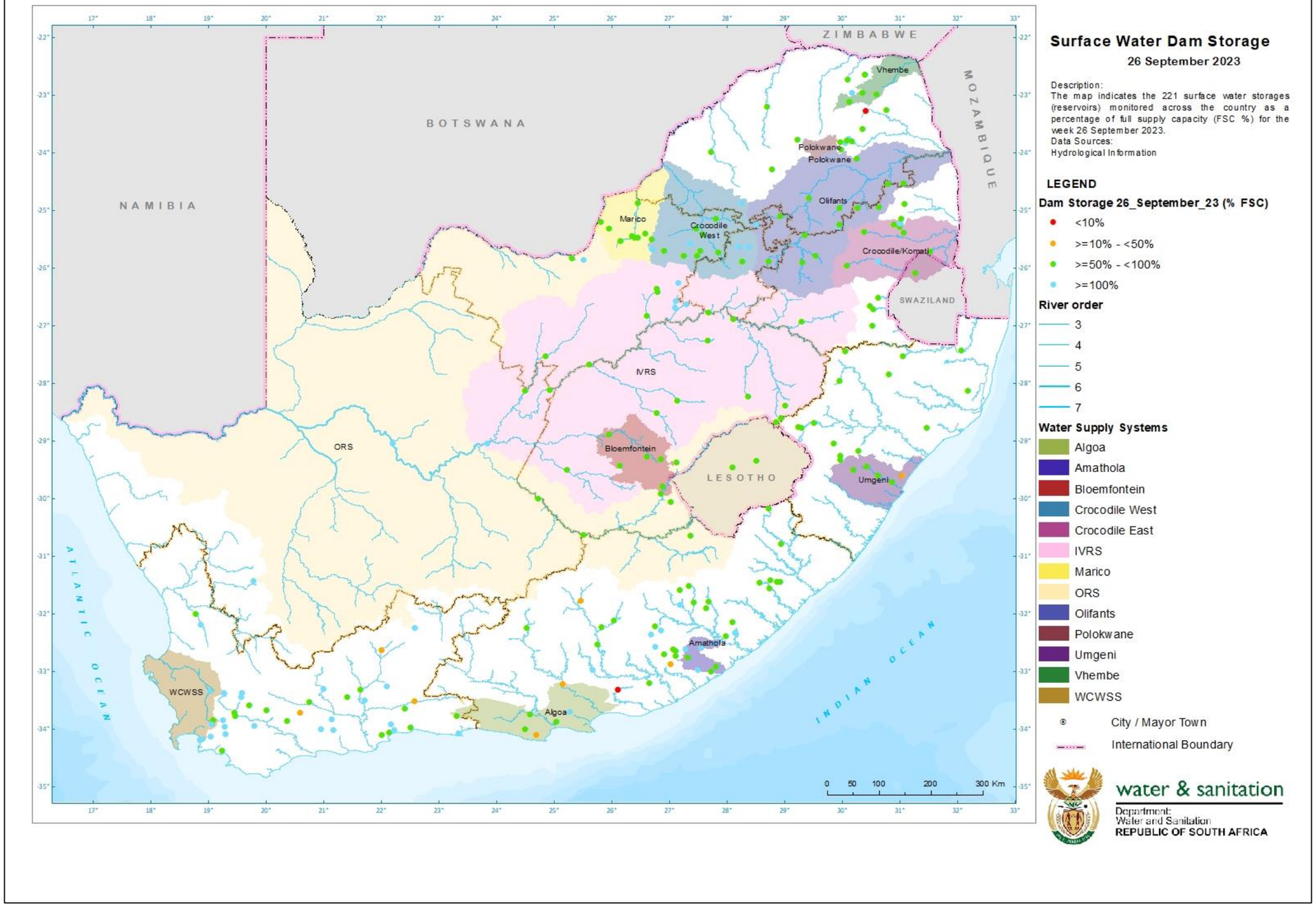


Figure 5.2 Water Supply System and dam storage – end September 2023.

5.2 Provincial Storage

The comparison of the long-term median storage for each province during the 2022/23 hydrological year, compared with the previous hydrological year is presented in Figure 5.3 below.

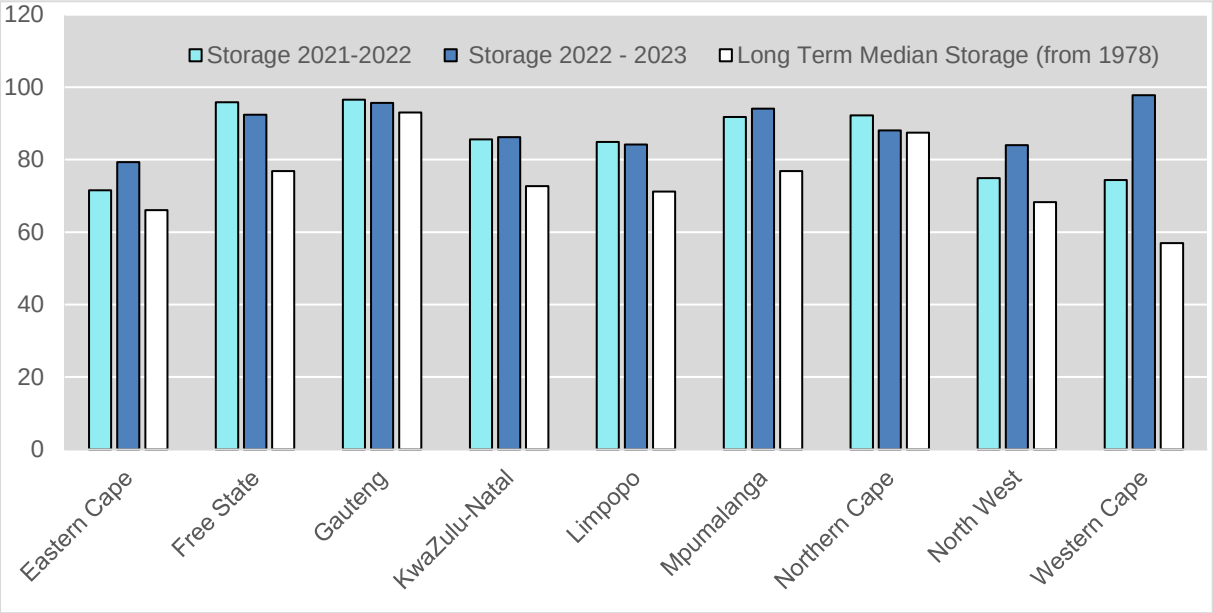


Figure 5.3 The storage situation in each Province during 2022/2023, compared with the previous hydrological year and the median.

For the hydrological year 2022/23, the dam levels for all provinces were above the long-term median storage levels. Notably, all median storages for the 2022/23 hydrological year were higher than the previous hydrological year. A significant recovery from last year is observed for the Western Cape Province, due to high rainfalls received in June 2023.

5.3 Water Management Area storage

The comparison of the long-term historical median storage levels (2016-2022) of WMAs and the past two hydrological years' median storage is presented in Figure 5.4.

The 2022/23 storages have been above the historical median for all water management areas, which is indicative of a hydrological year which was characterised by above-normal rainfall for almost all parts of the country with major dams. A similar pattern was observed for the previous hydrological year (2021/22) for all WMAs.

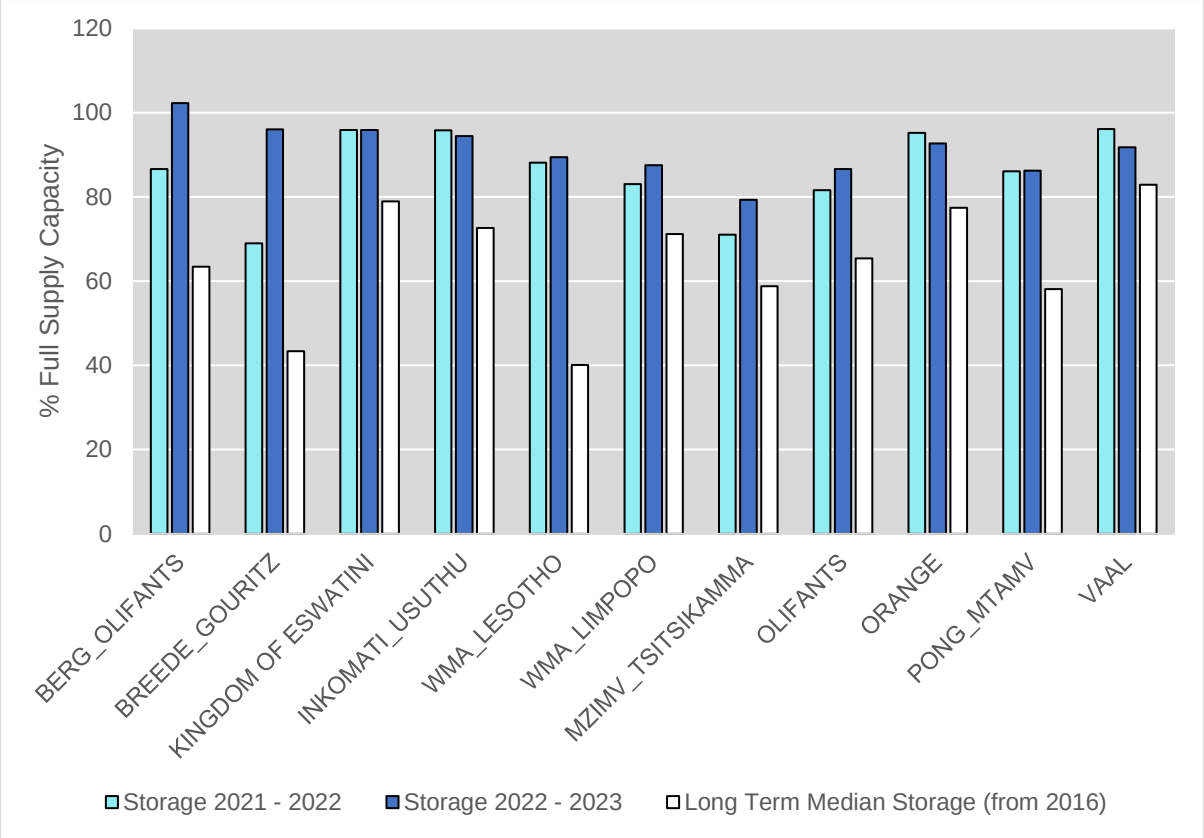


Figure 5.4 The storage situation in each WMA during 2022/23, compared with the previous hydrological year and the median.

Notably, all median storages for the 2022/23 hydrological year are higher than the previous year for all WMAs, apart from the Inkomati-Usuthu, Orange and Vaal WMAs. However, the dam storage levels in these three WMAs remained higher than the long-term median dam levels.

5.4 District Municipality Storage

The dam storage levels comparison per District Municipality (DM) is presented in Figure . Namakwa DM, Sarah Baartman DM, Central Karoo DM, Garden Route DM, and Overberg DM have experienced a significant increase compared to last year. In contrast, the uMgungundlovu DM, Zululand DM, Sedibeng DM, Alfred Nzo DM, Amajuba DM, Fezile Dabi DM, Capricon DM, Pixley ka Seme DM and Francis Baard DM experienced the worst decline in dam levels compared to last hydrological year.

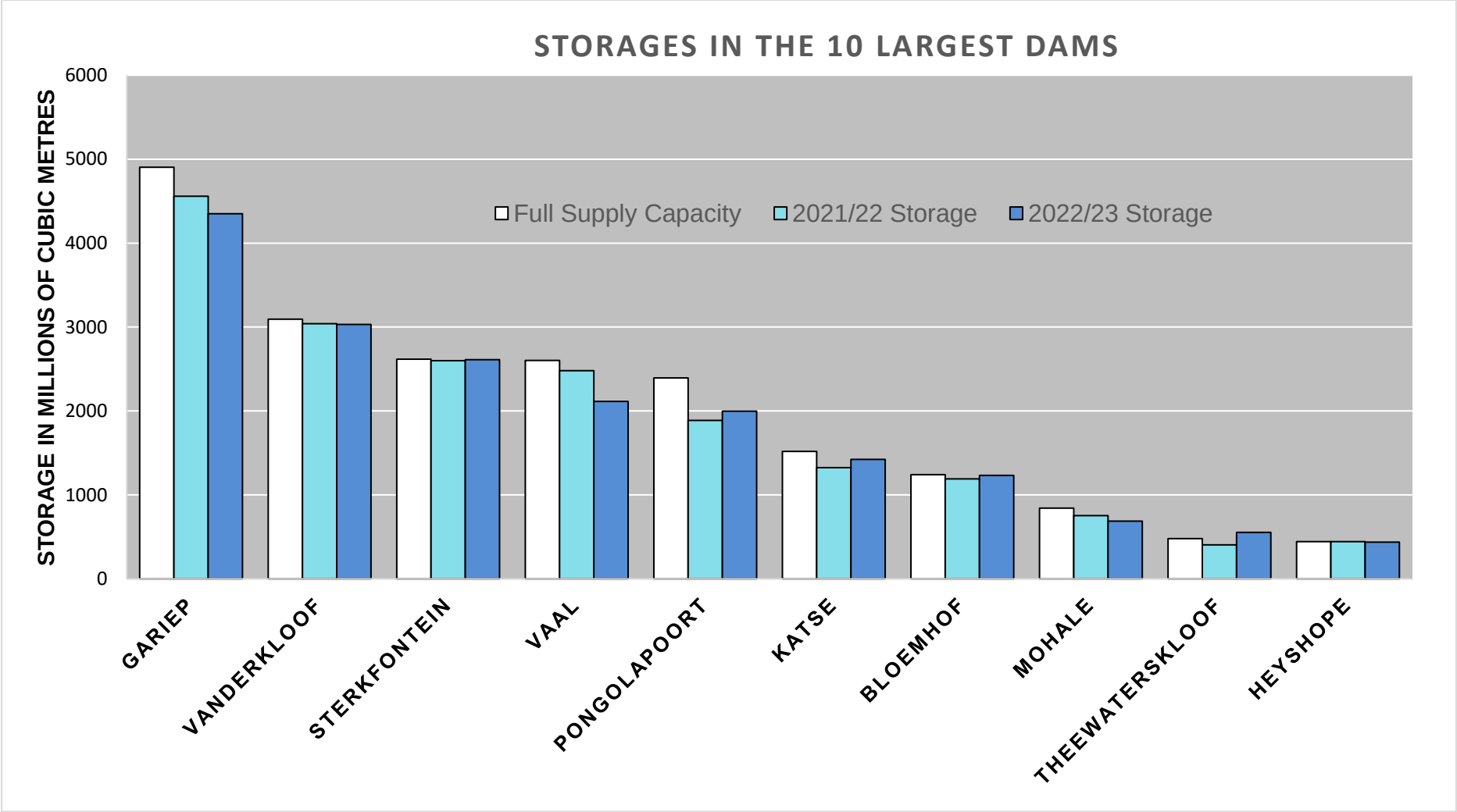


Figure 5.5: Storage volume comparison 2021/22 & 2022/23 of the ten largest dams, as at the end of September 2023.

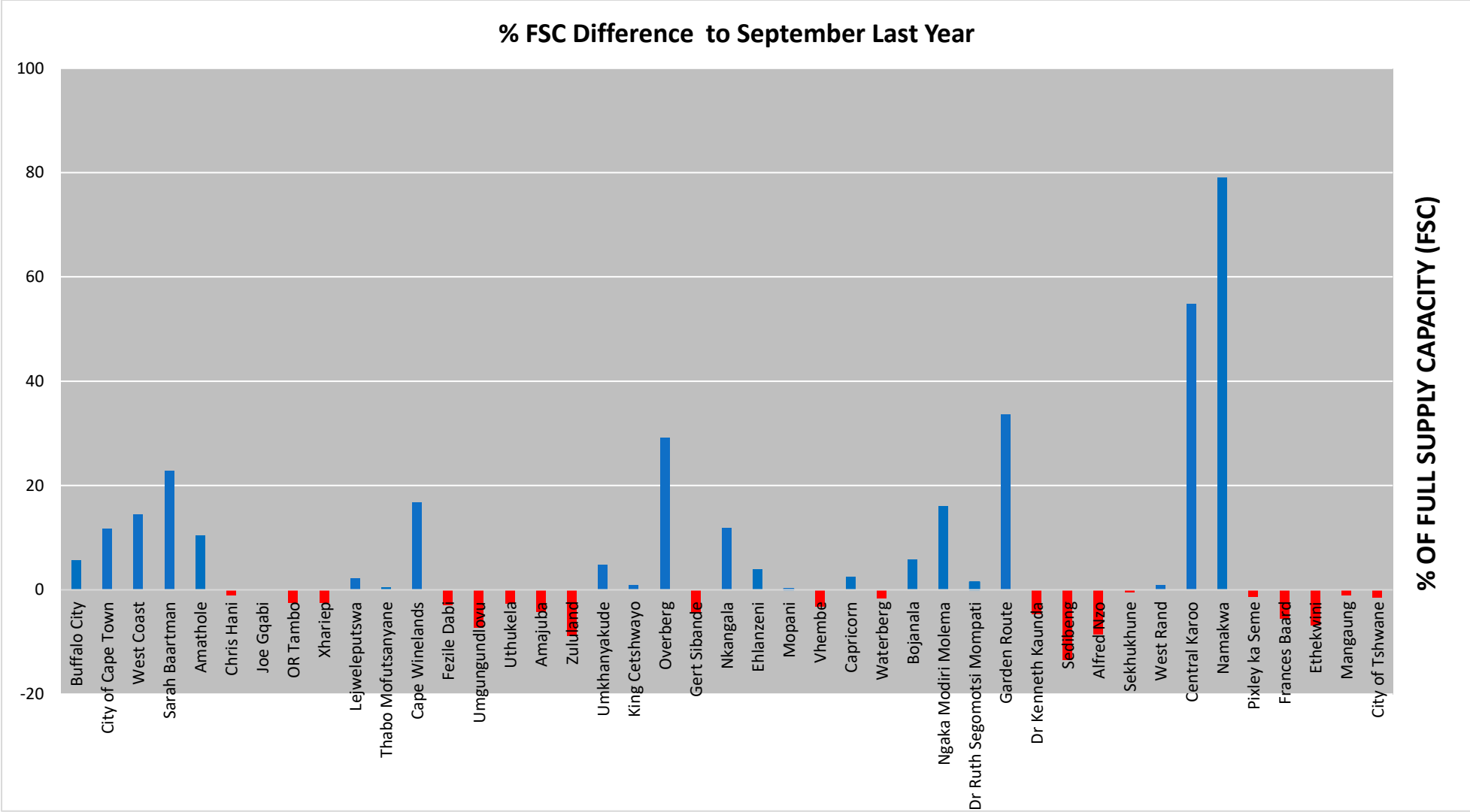


Figure 5.6 Difference in Water Storage Levels per District Municipality September 2022 vs September 2023.

5.5 Water Supply Systems and Restrictions

The dam storage levels in water supply systems (WSSs) at the end of the HY 2021/22 and 2022/23 are presented in Table 5-3, and the applicable restrictions are given in Table 5-4.

Some parts of the country are still experiencing dry conditions, for example, the southern parts of the Eastern Cape, parts of the Northern Cape, and the southwestern parts of the Western Cape Province. The Department implements water use restrictions in these areas that are experiencing dry conditions, which affect dam storage levels in stand-alone dams or dams within a WSS or cluster to avoid the risk of failure of water supply or non-supply to the various water use sectors, including users with a high assurance of water supply such as strategic users in the power generation industries.

The Algoa WSS remain with water restrictions in response to the low water storage levels. Notably, restrictions have been lifted for the Amathole WSS as the system recovered. Due to infrastructure limitations, permanent restrictions are still applicable for the Polokwane WSS in Limpopo and Bloemfontein WSS in the Free State Province.

Table 5-3 Water Supply Systems storage levels

Water Supply Systems/clusters	Capacity in 10^6m^3	25 September 2022 (% FSC)	25 September 2023 (% FSC)	System Description
Algoa System	282	19	49.8	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	84.2	99.7	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	100.6	100.7	The following 3 dams serve Queenstown (Chris Hani DM, Enoch Ngijima LM): Boesmanskrantz Dam, Waterdown Dam, Oxkraal Dam
Luvuvhu	225	100.6	97.7	The following 3 dams serve Thohoyandou etc: Albasini Dam, Vondo Dam, Nandoni Dam
Bloemfontein	219	100.1	95.5	The following 4 dams serve Bloemfontein, Botshabelo and Thaba Nchu: Rustfontein Dam, Groothoek Dam, Welbedacht Dam, Knellpoort Dam
Butterworth System	14	100.2	100.2	Xilinxa Dam and Gcuwa weirs serve Butterworth
Integrated Vaal River System	10 546	94.6	91.6	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	97.5	96.8	The following 2 dams serve Polokwane: Flag Boshielo Dam, Ebenezer Dam
Crocodile West	444	91.4	94.5	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	95.3	87.5	The following 5 dams serve Ethekwini, iLembe & Msunduzi: Midmar Dam, Nagle Dam, Albert Falls Dam, Inanda Dam, Spring Grove Dam
Cape Town System	889	85.3	109.4	The following 6 dams serve the City of Cape Town: Voelvlei Dam, Wemmershoek Dam, Berg River Dam, Steenbras-Lower

Water Supply Systems/clusters	Capacity in 10^6m^3	25 September 2022 (% FSC)	25 September 2023 (% FSC)	System Description
				Dam, Steenbras-Upper Dam, Theewaterskloof Dam
Crocodile East	159	93.8	92.6	Kwena Dam supplies Nelspruit, KaNyamazane, Matsulu, Malelane and Komatipoort areas and Surroundings
Orange	7 996	94.8	92.3	The Following two dams service parts of the Free State, Northern and Eastern Cape Provinces: Gariep Dam, Vanderkloof Dam
uMhlathuze	301	97.8	98.7	Goedertrouw Dam supplies Richards Bay, Empangeni Towns, small towns, surrounding rural areas, industries and irrigators, supported by lakes and transfer from Thukela River

Table 5-4 Water Supply Systems with Restrictions

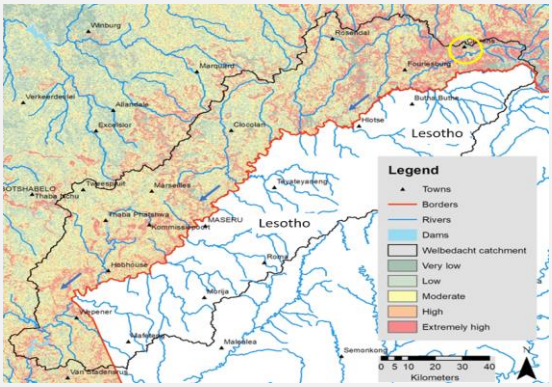
Water Supply Systems/clusters	Restrictions
Algoa	The decision date was changed from 1 June to 1 November, therefore new AOA were conducted, and water restrictions imposed as from 1 November 2023, Urban (Domestic and Industrial) = 5%, Irrigation = 15% for Kouga Subsystem and Urban (Domestic and Industrial) = 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

Navigating Climate Challenges: A Case Study on Welbedacht Dam Catchment Climate Adaptation through Siltation Management

The highly erodible catchment of the Welbedacht Dam on the highveld is situated on the Caledon River near Wepener in the Free State in quaternary D23J (De Villiers & Basson, 2007). Welbedacht dam has long been a vital water source for both agricultural and urban communities, sustaining the backbone of the country's economy through mining and industrial activities (Hirji, 2002). For the quaternary catchment that Clarens falls in, the climate is largely dry sub-humid with a high erodibility index. The land cover is largely grassland (81%) followed by cultivation (7%) (Nhlabathi N et al., 2023). However, the region's susceptibility to siltation is exacerbated by climate change impacts (Le Roux, 2014), prompting a comprehensive climate adaptation strategy centred around sustainable siltation management practices to be implemented.

To tackle the problem, the Department of Water and Sanitation (DWS), through the Water Research Commission (WRC), initiated a programme targeting the source and impact of the issue. The National Dam Siltation Management Programme, implemented by the Water Research Commission, has developed a draft dam siltation management strategy to manage national water resources more sustainably. This strategy enables effective decision-making in addressing siltation challenges. The approach is systematic and focuses on integrated dam catchment prioritisation. The systematic approach looks at interventions in the catchment and river to reduce soil erosion and its transfer, as well as in the reservoir, which could involve releasing, bypassing, or extracting sediment. The integrated approach includes both engineering and socio-ecological interventions that target the sediment source, sediment transfer, and sink zones. The strategy promotes the implementation of appropriate sustainable land management principles and ecosystem rehabilitation interventions at the source, transfer, and sink zones to reduce erosion and sediment transfer in the catchment and implement adaptive interventions in the reservoir.

The Caledon River drains the catchment area that is mostly situated on the Highveld of South Africa and the Western Maluti Mountains in Lesotho. The soils in this catchment area are highly susceptible to erosion, and due to prolonged grazing and agriculture, the vegetation cover in significant parts of the catchment has greatly deteriorated and changed. This can be seen in a map below, where the project site is. clearly indicated with a yellow circle. The primary objective of the project was to implement siltation management practices to mitigate the impacts of high sediment concentrations that have impacted the water capacity. The secondary objectives were to reduce sediment yield, improve the resilience of ecosystems to climate change, enhance vegetation cover, and implement practical interventions to stabilize and monitor the riverbanks.



Water erosion risk for the Welbedacht Dam catchment

Soil degradation near a wetland

Based on site observations and spatial mapping, it has been identified that certain areas within the Clarens project site are experiencing overgrazing and have poor or low vegetation cover, resulting in degraded wetlands and actively eroding gullies. Additionally, invasive alien vegetation is outcompeting grasses on hillslopes and riparian reaches, leaving the soil bare.

The methodology used involved conducting a needs analysis for the catchment and the community, stakeholders & community engagement, ecosystem services mapping with the community, using aerial imagery, making on-site observations, capacity building and knowledge sharing workshops, implementing interventions, and monitoring activities. A spatial plan was developed to indicate where activities and interventions would be implemented, taking into consideration the rainy season.

The adaptation journey of Welbedacht Dam Catchment is a long-term project that requires ongoing work to improve the climate resilience of the catchment. There are significant challenges such as funding constraints and the need for continuous community engagement. Innovative financing models need to be developed to improve vegetation management. The lessons learned from this project highlight the importance of ongoing monitoring, flexible adaptation strategies, and collaboration between stakeholders. As the Caledon River system is transboundary, the Welbedacht dam catchment is essential for both South Africa and Lesotho. Therefore, this project can be replicated in other areas within the catchment for improved water resource management in the transboundary area.

This case study highlights the importance of proactive and integrated approaches to protect essential water resources from the challenges brought by climate change and siltation. The project's participatory and collaborative approach emphasises that sustainable siltation management requires a broader engagement, moving beyond the roles of users, stakeholders, policymakers, and regulators to cooperation, partnership, and stewardship. This requires the development of robust and practical management tools, along with effective communication and capacity building. The case study also provides an excellent example of how managing siltation to adapt to climate change can have positive socioeconomic impacts on communities. In this project, eleven local youths were employed and trained, and community members established nurseries to procure seedlings. This initiative not only helped to stimulate the local economy but also created opportunities for skill development and community involvement.