CITY OF CAPE TOWN
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CAPE TOWN WATER OUTLOOK

Edition 11

March 2024

Water and Sanitation Directorate

City of Cape Town

Making progress possible. Together.

Previous editions of the Water Outlook

Edition 1: January 2018

Edition 2: March 2018

Edition 3: April 2018

Edition 4: May 2018

Edition 5: July 2018

Edition 6: September 2018

Edition 7: December 2018

Edition 8: October 2020

Edition 9: March 2022

Edition 10: March 2023

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Queries and updates

Technical queries on the content of this document may be addressed to Water.Stakeholders@capetown.gov.za. Future updates of this publication will be published at the City's website, see: www.capetown.gov.za/thinkwater.

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1 Introduction

Water security remains a critical priority for Cape Town, and the lessons learned from the drought continue to be implemented to ensure Cape Town reduces the threat of a possible 'Day Zero' again. Since 2019, when the Council approved the Cape Town Water Strategy (2019)[1] much has changed, not least the economic risks and significant global instability. These have resulted in dramatic increases in the costs of building new infrastructure and the need to ensure affordability of the services provided to the citizens of Cape Town. Despite these challenges, the Water Strategy continues to be implemented, and the City's commitment to 300MLD of additional water by 2030 remains in place. This annual 'Water Outlook' aims to keep stakeholders informed on the current status of Cape Town's water supply and the progress that is being made to build resilience and provide an outlook on the future water security of Cape Town. This edition of the Cape Town Water Outlook focuses on the following topics:

- Current status of the water supply system
- Risks to Cape Town's bulk water supply system
- Update on Committed Water Augmentation Programme
    - Groundwater and managed aquifer recharge
    - Water reuse and desalination
    - Improved management of water resources
- Progress on the development of the 'Adaptable Programme'
- Cape Town's short, medium, and long-term water security outlook

Figure 1 Theewaterskloof Dam at the peak of the drought in July 2017

[1] The 2019 Water Strategy is available online: Click here

2 The current status of Cape Town's water supply system

The Western Cape Water Supply System (WCWSS) remains the primary source of Cape Town's water supply. This will remain the case until the New Water Programme and subsequent Adaptable Programme diversifies Cape Town's water resources. During the 2022/2023 hydrological year (ending 30 October 2023), the WCWSS experienced above-average rainfall. This included two significant storm events which resulted in flooding across the Western Cape (Section 3.1.2) and the activation of the Provincial Disaster Management Centre. As a result of the significant rainfall, all the dams in the Western Cape Water Supply System were filled and overflowed – with Wemmershoek Dam spilling approximately 50% of its capacity in June 2023 alone.

2.1 Seasonal forecast

Seasonal forecasts need to be considered with caution. Therefore, the City carefully and continuously monitors, amongst other aspects, the climate trends, performance of the Western Cape Water Supply System dams, and long-term weather forecasts. At the time of publishing the Water Outlook (2023), the long-term forecasts predicted a dry winter. A month later, the forecasts were reviewed to show a wet winter (which was experienced, as shown in Figure 2). In light of this inherent uncertainty, and learning from the drought, the City continues to take a conservative approach to ensure that early interventions are made.

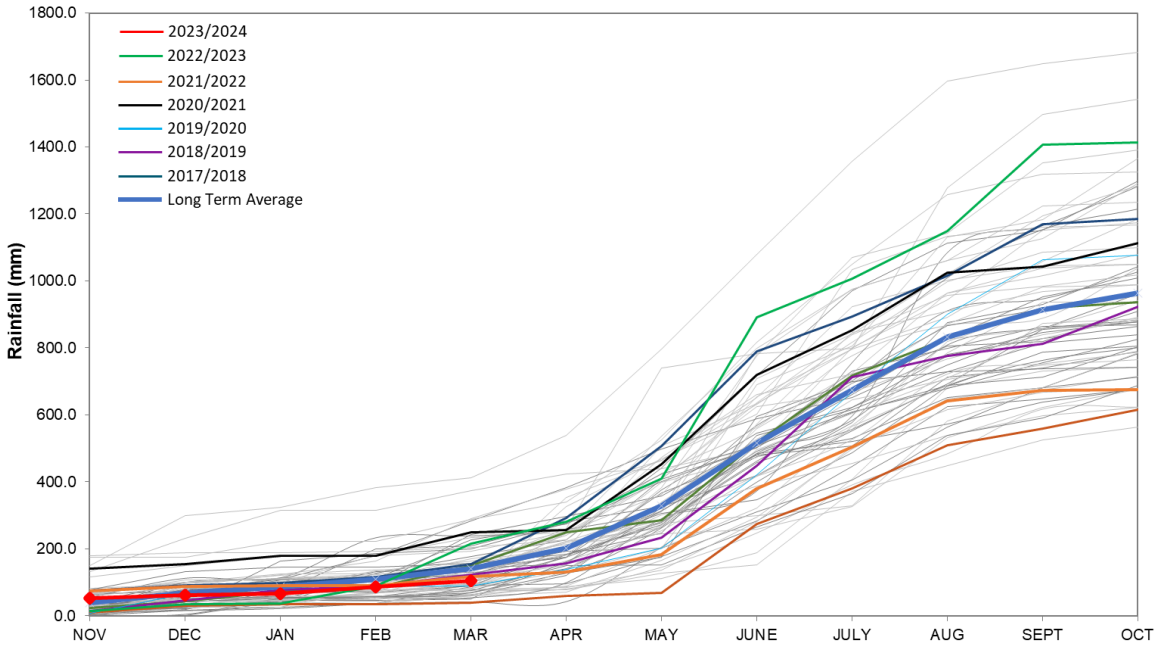

Figure 2: Rainfall at Wemmershoek dam

Currently, based on the latest long-term forecasts, including from the South African Weather Service[2] indicate potentially drier than normal season.

Following a review of the current storage in the Western Cape Water Supply System, the City sees no immediate reason for concern. The City will continue to monitor and provide updates on the Water Dashboard released weekly[3]. However, we continue to advocate for 'water wise use' and encourage's residents to use water as efficiently as possible.

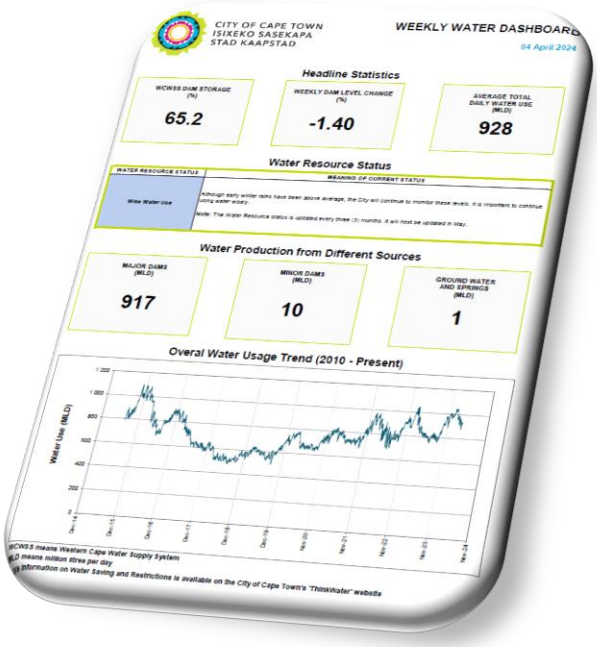

Figure 3 Weekly Water Dashboard

2.2 Cape Town's current and future water demand

Cape Town's total water demand has increased steadily from a low point of 500 million litres per day in June 2018 (Figure 4). Total water supplied during peak summer demand (December – February) increased by 6.5% compared to the 2021/22 financial year. Interestingly, however, the peak week demand did not increase, but the duration of peak demand was almost a month long – Figure 5. Figure 5 shows the seasonal trends, and while there has been an increase in the winter demand, it is evident that the total summer demand has increased and the increase is being sustained for longer periods. This could in part be due to the last year's summer having been significantly hotter, with less rainfall that in 2022/2023 as noted in Figure 5. Either way, summer demand is the greatest driver of the overall growth in annual demand despite the peak demand not having increased. Furthermore, the difference between summer and winter demand – an indication of outdoor water use - remains approximately 200MLD. For the second year (see Water Outlook (2023)[4]), it implies that the ability to restrict without needing to reduce indoor water usage has reduced to a maximum of 20% during summer.

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[2] Seasonal Climate Watch April to July 2024 can be accessed online: Click Here

[3] The Weekly Water Dashboard can be accessed online: Click Here

[4] The Water Outlook 2023 is available online: Click here

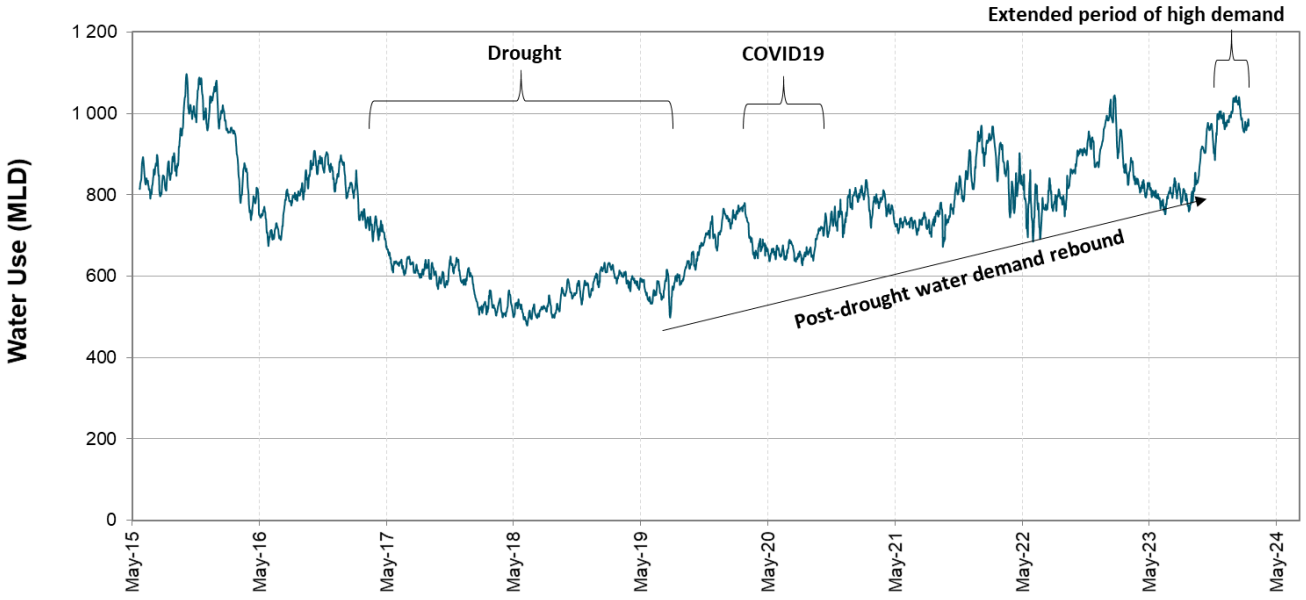

Figure 4: Overall Water Use by the City of Cape Town (Million litres per day)

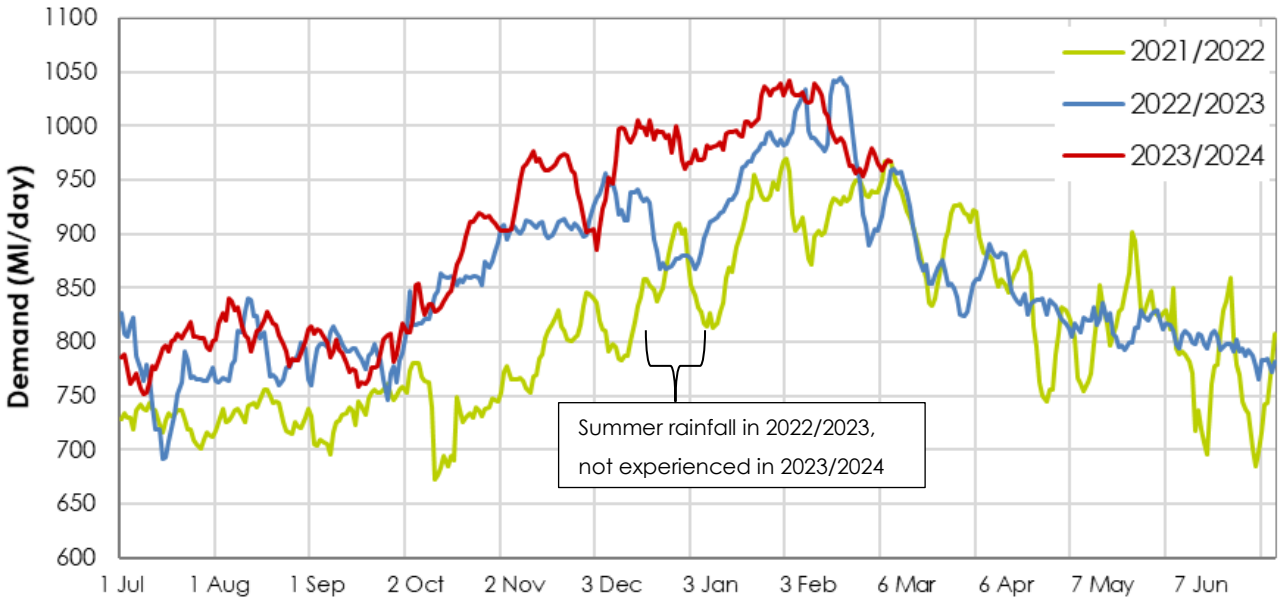

Figure 5: Seasonal Trends 2021-2024

It is also interesting to note in Figure 6, that the growth in demand remains above the projected 2% after the rebound, yet population growth[5] between 2011 and 2022 was approximately 2% and is expected to continue at approximately that level (1.6-2%). Figure 6 highlights that the rebound adopted in the Water Strategy assumed a full rebound within three (3) years and then

[5] According to StatsSA – Link 1 Link 2

immediately, demand would increase in line with the City's growth. It would appear, therefore, that either the rebound has not ended (most likely), the population figures are underestimated, due to higher temperatures, or there is an increase in system losses, which is considered unlikely. The City will carefully monitor water demand over the next twelve (12) months to see whether the growth in water demand tends towards the population growth rate. Should the growth in demand remain above what was projected, it will be necessary to revise the timing of the new water programme, revision of the planning assumptions, or accept a higher risk of restrictions.

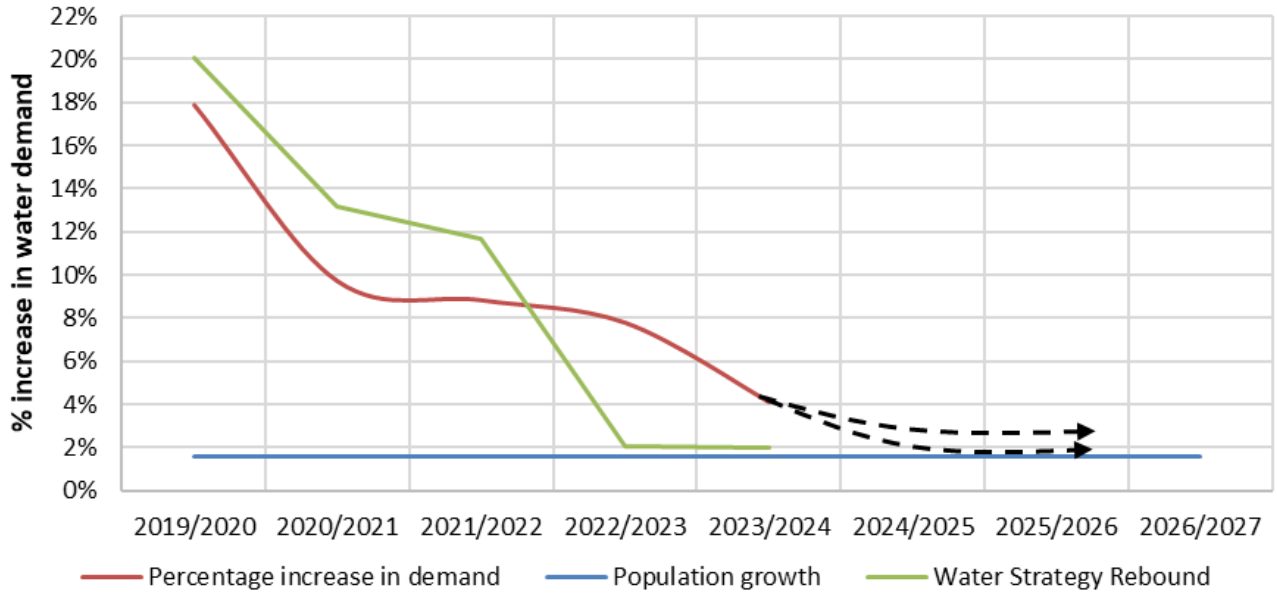

Figure 6: Overall Water Use by the City of Cape Town (Million litres per day)

3 Risks to Water Supply

The 2015-2017 drought highlighted the importance of monitoring, mitigating and managing risk to Cape Town's bulk water supply. The City is actively managing these potential risks and in doing so, the City aims to ensure a robust and reliable water supply system through a proactive approach that identifies and addresses vulnerabilities.

3.1 Climate Change

There is uncertainty as to the exact scale of the impact that climate change will have on the water resources on which Cape Town relies. It remains to be seen whether climate change will be 'gradual' or be a "step-change". It is, however, clear that:

- Temperatures will increase, resulting in an increased risk of fires and driving increased water demand.
- Evaporation and evapotranspiration will increase.
- Rainfall may decrease, impacting the yield of the Western Cape Water Supply System
- Rainfall could also intensify as the Western Cape Water Supply System experiences more extreme events and consequent flooding. This will require, amongst others, the following:
    - The effective management of the Western Cape Water Supply System at all times as rainfall patterns become potentially more erratic and uncertain.
    - Infrastructure will need to be optimally maintained by all stakeholders to ensure this is possible.
    - In line with the operating rules of the Western Cape Water Supply Systems, the City will at all times aiming to maximise storage of raw water.
    - The development of additional infrastructure to ensure the negative impacts of flooding (Section 3.1.2) do not threaten water security.

3.1.1 Reduction of inflows into WCWSS Dams

The City continues to plan for a 25% reduction in yield (available water) by 2045. However, it is essential to highlight that should it be evident that the WCWSS is experiencing a step change in climate (Sudden onset), it will mean:

- The City will not be able to supply water at a 1: 200-year level of supply assurance.
- In the case of a severe drought, restrictions in the order of 30% initially will be required, which will get progressively less as NWP Schemes come online.

- Achieving 30% restrictions will prove challenging due to the current low household outdoor water use which is estimated to be less than 20%.
- TMG Phase 2 and Phase 3 from the committed programme must be brought forward.

3.1.2 Flooding

The Western Cape experienced significant rainfall in June 2023, with the Wemmershoek Dam experiencing the most rainfall in June in the last 70 years. Between the 12-20th of June 2023, 281mm of rainfall was recorded at the Wemmershoek dam and is in the order of a 1 in 20-year event. This resulted in one of the three sluice gates almost fully opening and releasing 207 m^3/s. This was followed by another significant event in September 2023. While the June rainfall saw the Western Cape Water Supply System dams fill up and spill, with significant flooding throughout the region, the September event and associated flooding posed the greatest risk to water supply.

During this event, for which the South African Weather Service issued a Level 9 warning, significant wash-a-ways occurred in the catchments of the Western Cape Water Supply System dams, resulting in a significant deterioration in raw water quality as shown in Figure 7. This impacted the water treatment process which required adjustment in dosing and, consequently, a significant increase in the cost of producing SANS 241:2015-compliant water.

Figure 7 (Left) Kleinplaas Dam howing the 'normal' water in the background and the highly turbid water in the foreground. (Right) Highly turbid water flowing into Wemmershoek Dam

Climate Change is expected to result in more extreme events, and consequently, there is a risk that the raw water quality fluctuations experienced in 2023 may become more frequent, or in the worst case, the norm.

The City has, therefore, begun initiating detailed reviews of all existing plants to ensure all the City's Water Treatment Works are in a position to manage any flood-related impacts that may occur in future, and the budget has been set aside, as discussed in Section 3.3, for investing in the refurbishment and upgrade of existing infrastructure.

3.2 Energy Security

Load shedding continues to pose direct and indirect risks to water supply. Currently, bulk water supply is directly impacted as only four of the twelve water treatment plants (these account for 80% of total treatment capacity) generate their own hydropower. However, the City of Cape Town Energy Strategy[6] recognises the critical role that reliable energy plays in Cape Town's future. The Strategy's top priority is ending load-shedding to create a more stable environment for businesses and job creation. To achieve this, the Strategy outlines a multi-pronged approach to deliver significant progress by 2026, including protecting against four load-shedding stages through 650 megawatts of independent power to the energy mix within five years.

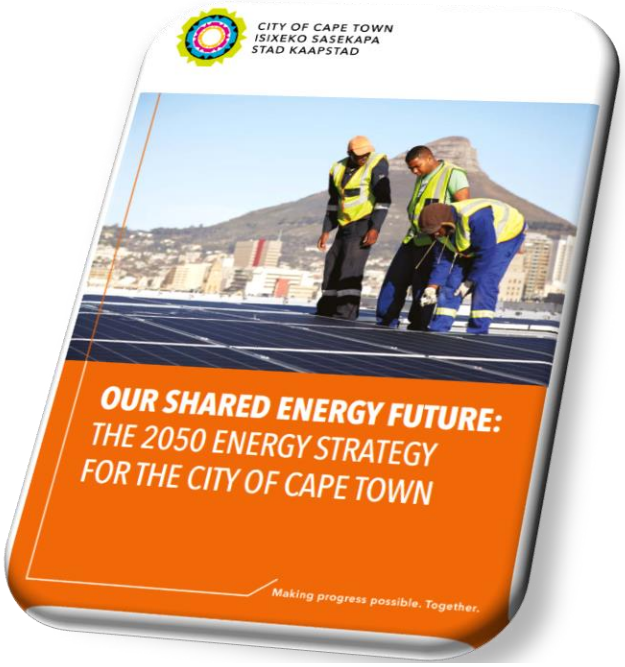

Figure 8 Cape Town Energy Strategy

The Energy Strategy, and reduced levels of load shedding will significantly benefit water security within the City. It is also worth noting that all new schemes, as part of both the New Water Programme and Adaptable Programme, are considering their energy requirements and how these are secured.

[6] Cape Town Energy Strategy is available online: Click Here

3.3 Infrastructure Stability Programme

While the City's New Water Programme will ensure adequate water is available to meet demand, the Bulk Water Master Planning has identified several backlogs, capacity challenges and constraints in the short, medium and long term. Addressing these challenges is equally important as developing new infrastructure to ensure long-term water supply resilience in Cape Town. To address these challenges, an Infrastructure Stability Programme has been developed that includes:

- The refurbishment of key pipelines, some of which are more than 100 years old.
- The refurbishment of the City's five main Water Treatment Plants to recover their full design capacity. Faure, the newest of these Water Treatment Plants has not had a major refurbishment since construction in 1994. Ensuring that all existing Water Treatment Plants can operate at their original design capacity has been identified in the Bulk Water Master Plan (Section 5.1) as critical for the City to meet Peak Week water demand by 2035.
- Development of additional infrastructure interventions to ensure the flexibility and robustness of the bulk water supply system to ensure the supply to certain areas are not constrained to individual water treatment plants.

Initial scoping has indicated that the Infrastructure Stability Programme will require funding in the order of R2 billion over the next 10 years, which has already been incorporated into the budget and work implementation of some projects will begin in the 2024/2025 Financial Year. These projects will address the identified backlogs, capacity challenges and constraints.

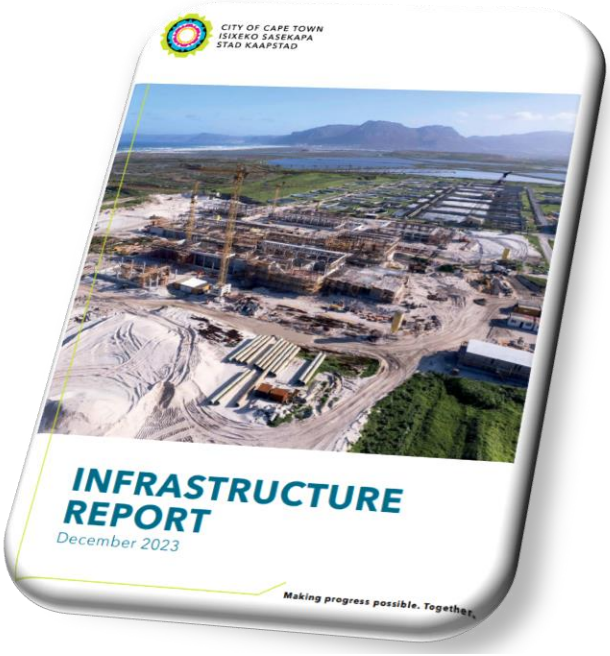

Figure 9 Infrastructure Report 2023

3.4 Affordability of Tariffs

Since 2019, when the Council approved the Cape Town Water Strategy (2019)[7] economic uncertainties and global instability have driven up costs for new infrastructure projects. Within this context, ensuring the affordability of water services for Cape Town residents without compromising water security remains a top priority. The City's commitment to the Water Strategy's target of 300 million litres per day of additional water treatment capacity by 2030 remains steadfast. Therefore, the City is investigating the possibility of developing both the desalination and Faure New Water Schemes through a Public-Private Partnership. These investigations are advancing but may impact on the target dates for delivering water from certain schemes.

The New Water Programme was predicated on a change in how water tariffs would be set with an expected increase in the tariffs expected. The Council-approved Water Strategy (2019) states that: "*The tariff related to the volume of water used will be set at the cost of providing new water supplies or wastewater treatment (including the related bulk infrastructure). In the long term, this tariff will be set at the cost of adding new water supply. Overall, the revenues will at least need to meet actual costs, including the cost of replacing aging infrastructure.*" This change in the tariff has not yet been fully realised, but as new schemes come online, the impact will be apparent in an increase in the tariff.

[7] The 2019 Water Strategy is available online: Click here

4 Update on Committed Water Augmentation Programme

Cape Town receives water from the Western Cape Water Supply System (WCWSS). This regional scheme is managed by the National Department of Water and Sanitation (DWS) in partnership with the municipalities and agriculture. The WCWSS is currently entirely reliant on surface water, sourced from six large dams (Theewaterskloof, Wemmershoek, Voëlvlei, Berg River, and Steenbras Upper and Lower). In light of the seasonal forecast (Section 2.1) supply from the WCWSS may become constrained, and is likely to continue to be constrained in a projected drier future. As such, the City has committed to taking action to diversify and augment Cape Town's water supply and increase water security through investment in new water programmes.

4.1 Surface Water

The Berg River to Voëlvlei Augmentation Scheme (BRVAS) is a crucial project for Cape Town's long-term water security. BRVAS will pump surplus winter water from the Berg River to the Voelvlei Dam to achieve this. The project aims to increase the water supply in Voëlvlei Dam by 23 million cubic meters annually. This leverages existing infrastructure, including the dam, water treatment plants, and pipelines owned by Cape Town and the West Coast District Municipality.

Figure 10 Voelvlei WTP and Dam

The project is being implemented by the Trans-Caledon Tunnel Authority (TCTA) – a state-owned entity charged with financing and implementing bulk raw water infrastructure projects. The core components of BRVAS include a low-level weir and pump station on the Berg River, a 6.3 kilometre pipeline connecting the river to Voëlvlei Dam, and a design that allows for water releases from the dam during the summer months to support downstream municipal and agricultural users, while also prioritising the ecological water needs of the Berg River estuary.

The City of Cape Town approved a water supply agreement with the Department of Water and Sanitation (DWS) in December 2022. The agreements with all other users were concluded in July 2023. The, currently, anticipated water delivery from BRVAS remains June 2027.

4.2 Sustainable Groundwater Management

4.2.1 Scheme Specific Updates

Groundwater is a critical component of the City's strategy to diversify its water resources. It is also an essential resource for developing drought resilience. Over the last year, the City has continued with the development and commissioning of all three (3) groundwater schemes, namely Table Mountain Group Aquifer (TMG), Cape Flats Aquifer (CFA) and Atlantis Aquifer. These developments are highlighted below:

- **Table Mountain Group Aquifer**
    - The National Department of Water and Sanitation issued the City with a new water use licence, which replaced and superseded the previous authorisation issued for the Steenbras wellfield abstraction.
    - A further production borehole has been fully equipped and is ready for trial operations.
    - The electrical and mechanical equipping of a further 4 boreholes in the Steenbras Wellfield is currently underway and due for completion in August 2024.
    - Drilling has commenced on drilling a further 2 core boreholes in the Steenbras area and is due for completion in September 2024.
    - Additional 2 core boreholes have been drilled in the Groenlandberg area for exploration purposes.

Figure 11 Strandfontein West Water Treatment Plant

- **Cape Flats Aquifer**
  - The 6Ml/day Strandfontein West WTP is in the commissioning stage, with performance testing of key equipment and control systems at an advanced stage. Drilling of the last 2 production boreholes is planned for completion in May 2024, followed by the equipment and commissioning.
  - Construction on the 10Ml/day Phillipi WTP is anticipated to commence in June 2024 with borehole drilling and pipeline construction underway.
  - Drilling of a further series of Injection boreholes to support Aquifer Storage and Recovery has also commenced.
  - Construction of the CFA: MAR advanced treatment plant is close to completion, having achieved roof installation for all major buildings. The site works comprising services and roads is due for completion in September 2024. The electrical-mechanical component is anticipated to commence in July 2024.

- **Atlantis Aquifer**
  - Equipping of 16 boreholes in the Witzands wellfield is underway, with three (3) boreholes commissioned and ready for trial operations. A further three (3) will follow when electrical power is connected. Commissioning of the remaining 10 is anticipated to be completed in August 2024.
  - Drilling a further tranche of boreholes in the Silwerstroom wellfield is underway and is anticipated to be completed in June 2024.
  - Construction of a 2 x 5Ml groundwater storage reservoir is underway at Witzands Softening Plant.
  - Construction works are underway to improve the functioning of aquifer recharge basins, which assists in improving the recharge water quality maximising scheme yield.

4.2.2 Development of a groundwater guideline and regulatory tool

The drought saw a significant decrease in outdoor water use – a large proportion of which is assumed to be from groundwater. This does not appear to have decreased following the drought with outdoor water usage remaining around 20% of peak summer demand (as discussed in Section 2.2). This, coupled with the significant investment the City is making into groundwater schemes and the potential impacts associated with proposed developments within the City of Cape Town, has necessitated a review of the regulatory framework for groundwater

management within the local government context. Whilst the National Water Act (Act 36 of 1998) is an excellent piece of legislation used for groundwater management and protection in the regional and national context, it does not comprehensively address groundwater management at the local and aquifer scales.

The City of Cape Town has embarked on determining the best approach that will assist in groundwater management on a local scale. This process will assist in defining a consolidated approach to groundwater usage and management that incorporates the various legislations, including the National Water Act (Act 36 of 1998), Water Services Act (Act 108 of 1996) and existing laws.

The outcome of the process will inform the City's direction in managing groundwater and could recommend, amongst others, a policy, a by-law, or recommendations for National Government's consideration. The outcome may include a combination of these. The First phase of this work will be completed in October 2024, and an update will be provided in the following Water Outlook.

4.2.3 Stakeholder Engagements

The City has continued to host the Cape Flats Aquifer and Table Mountain Group Aquifer monitoring committee on a biannual basis. These Monitoring Committees are primarily focused on overseeing the implementation of the aquifer monitoring programmes, assess the effectiveness of applied monitoring to protect the water resources and make recommendations to improve the monitoring for the consideration and approval of the Department of Water and Sanitation (as the National custodian of the Nations water resources), and implementation by the City (as part of its scheme development). These committees consist of multiple stakeholders including governmental departments, non-profit organisations, farmers associations and academic institutions.

The City has also commenced the process of establishing a Strandfontein Aquifer Nature Reserve to bring awareness of the Cape Flats Aquifer. There is a potential to include groundwater awareness as part of the current biodiversity education programme which is aimed at educating the CCT citizens on groundwater management and protection.

4.2.4 BRGM (French Geological Survey) Collaboration Project

The City of Cape Town has collaborated with the French Geological Survey (BRGM), through a funding agreement facilitated by the French Development Agency (AFD) to assist in developing groundwater forecasting tools (example shown in Figure 12) for the Cape Flats and Table Mountain Group (Steenbras wellfield) aquifer as well assistance with the evaluation and characterisation of Contaminants of emerging concern in stormwater that could impact on groundwater quality. This collaboration included developing short-term forecasting models and training on the use of the forecasting tool and the use of the decision support tool for water level forecasting.

Short-term forecasting of groundwater levels using the tools developed as part of the training has been done for Cape Flats and Table Mountain Group (Steenbras wellfield) aquifers. Monitoring equipment was installed to improve our monitoring capabilities and allow for real-time transmission of groundwater level data for improved forecasting.

Water quality monitoring data was also shared with our research partners, who will assist in the characterisation of Contaminants of Emerging Concern (CEC) in stormwater through non-targeted screening analysis techniques. The entire project is set to be completed by May 2024 with the option for future collaboration.

This collaboration has provided the City with tools for better monitoring and managing the various aquifers. These tools are now being incorporated into and part of the Decision Support System (Section 4.4.2).

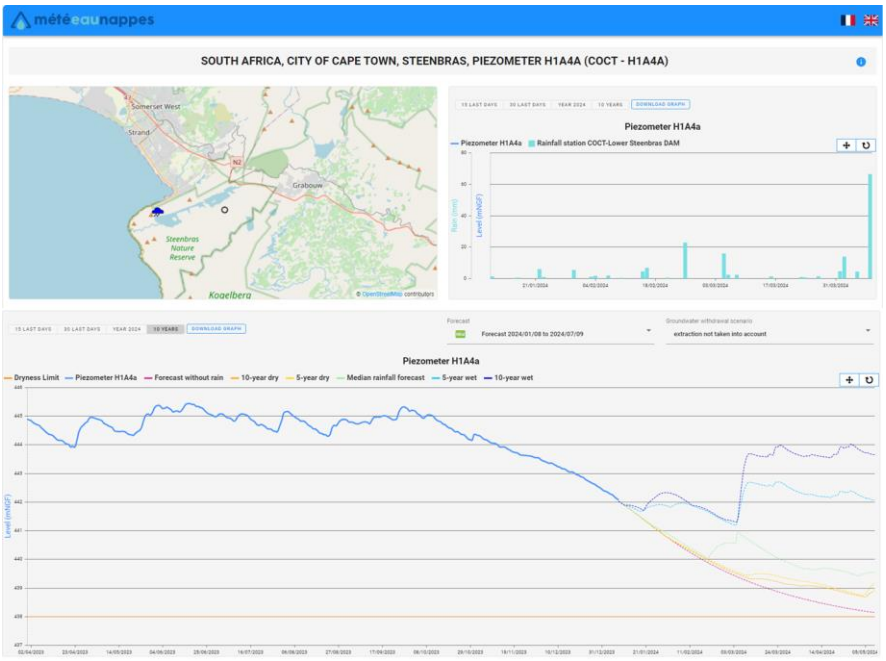

Figure 12 Example of the groundwater level forecast tool displayed in model

4.3 Advanced Water Treatment

4.3.1 Independent Advisory Panels (IAP)

As the City diversifies its water resources, it plans to adopt new and advanced water treatment methods. To ensure the success of these new schemes, the City of Cape Town established two Independent Advisory Panels (IAPs) to provide expert oversight and recommendations for the Faure New Water Scheme and Desalination projects. The South African Water Research Commission was appointed to assemble the IAPs, comprising international and local water reuse specialists.

The IAPs have actively engaged in both projects through dedicated workshops and reviewed and recommended various critical aspects of the schemes. These included:

- **Stakeholder and Public Engagement**: Ensuring transparent communication addressing public concerns and highlighting the need for improved communication on the New Water Programme in general2.
- **Project Design and Public Health**: Reviewing the design with a focus on safeguarding public health.
- **Water Quality Management**: Establishing stringent water quality criteria for all stages of treatment from source to tap.
- **Water Quality Monitoring Program**: Developing a robust water quality sampling and testing program throughout the project lifecycle.
- **Catchment Control and Management**: Formulating a strategic plan for catchment management that involves relevant departments.
- **Technical Design Review**: The IAP's reviewed the designs to ensure the alignment with international best practice.

The specialised advice and input offered by the IAP's highlighted the value long-term input would offer. The City is, therefore, pursuing a Memorandum of Agreement (MOA) extension with the Water Research Commission (WRC) to leverage the IAP's continued guidance throughout the Faure New Water Scheme (FNWS) project lifecycle.

4.3.2 Stakeholder Engagement

The City has communicated widely about the new water programme through media releases and interactive information sessions with key stakeholders including academics, faith groups and water-related regulatory bodies in the Western Cape.

A recent survey conducted from April – May 2023 indicated that only approximately 10% of the sampled population had heard of any plans by the City to increase drinking water supply to meet the needs of all citizens. Also, on average, 40% of participants remained neutral or indecisive about their willingness to drink water from alternative sources, which was proven to be good quality.

International experience, and input received from the IAPs, advises that awareness, context, trust, accessible and transparent communication are critical factors that influence public acceptance of alternative water solutions. In light of this, the Water and Sanitation directorate revised its stakeholder engagement strategy.

A more intensive education and awareness programme is underway, involving interactive collaboration with youth and school education drives, new water taste testing with the medical fraternity and one-on-one engagements with influential community groups including policy makers, teachers, agriculturalists, scientists and religious leaders.

Traditional and social media campaigns are also in development, to raise public awareness about the objectives of the New Water Programme, specifically water reuse and desalination safety, technology in use and legislated public participation comment periods.

The City is also preparing to distribute educational materials about the New Water Programme, produced in alignment with the governing principles and guidelines of the new ISO 24495 Plain Language standard, which seeks to relay information in a simple manner, putting readers first. It considers what readers want and need to know, their level of interest, expertise and literacy skills, as well as the context in which readers will use each document. There are also brochures, leaflets, videos and FAQs about the Faure New Water Scheme and desalination are available online[8].

[8] Additional information relating to reuse and the City's plans are available online: Click Here

4.3.3 International Water Re-use Conversation

In November 2023, the Mayor of the City of Cape Town hosted the International Water Re-Use Conversation. This event brought together mayors and officials from seven international cities: Perth, Nairobi, Los Angeles, Wulpen, Windhoek, Beaufort West, and George. The objective was to foster knowledge exchange on water reuse practices. This forms part of the City's commitment – at the highest level – to collaborate, share knowledge, and learn from others' experiences implementing advanced water treatment practices.

Discussions included representatives from various cities sharing their experiences with water reuse technologies. They highlighted the critical role water reuse will play in the future, the need for a paradigm shift in our approach to water as a resource, and the need for long-term sustainability in the provision of water services globally.

Figure 13 *Mayor Geordin Hill-Lewis and mayors and officials from Perth, Nairobi, Los Angeles, Wulpen, Windhoek, Beaufort West, and George at the International Water Reuse Conversation*

In March 2025, the City will again host leaders in the Water Reuse field when delegates arrive for the 14th IWA International Conference on Water Reclamation and Reuse. The Conference is being organised by the Water Research Commission (WRC) and the International Water Association's Water Reuse Specialist Group (WRSG) with the theme of "*Water Reuse: Building Water Supply Resilience*". This will be yet another opportunity to learn from the experiences of others who are already implementing reuse around the world.

4.3.4 Faure New Water Scheme – Scheme update

The Faure New Water Scheme (FNWS) is a critical project that will increase Cape Town's water security. With a maximum treatment capacity of 70 million litres per day (Ml/d), the FNWS will utilise feed water from the upgraded Zandvliet Wastewater Treatment Works. An advanced water treatment process will ensure the effluent meets all required drinking water standards. The treated water will then be blended with existing water sources before distribution throughout Cape Town.

A rigorous design review process was undertaken by the City. This involved an Independent Advisory Panel and internal workshops. The Independent Advisory Panel conducted a dedicated five-day workshop in December 2023 to comprehensively review the design, water safety planning, catchment control strategies, and monitoring protocols.

As outlined in the Water Outlook – March 2023, the initial plan was to determine if the City would manage FNWS operations internally or outsource them through a management contract. This involved a Section 78 process under the Municipal Systems Act (MSA). However, recent concerns around the affordability of capital expenditure (CAPEX) within the Medium-Term Revenue and Expenditure Framework (MTREF) timeframe have required the Water and Sanitation Directorate to reprioritise the CAPEX budget for the 2026/27 and 2027/28 financial years. With FNWS representing a significant budgetary element, it is preferred that the FNWS be implemented in the operational expenditure budget (OPEX). This can be achieved by seeking external financing and/or implementing the Scheme via a Public Private Partnership (PPP). Should the project be implemented as a PPP the timelines need to be finalised and this may impact on the target dates.

In January 2024, the Executive Mayor, in collaboration with the Mayoral Committee (MAYCO), authorised the inclusion of various financing, implementation, and operational options within the ongoing Section 78 process for the project. This ensures a comprehensive evaluation of all potential delivery models for the FNWS. The outcome of this process will be provided in the next Water Outlook.

4.3.5 Desalination – Scheme update

Following the conclusion of an agreement with National Treasury: Government Technical Advisory Centre (GTAC), they undertook to provide transaction and specialist advisory services to the City to determine the optimal implementation method for desalination plant.

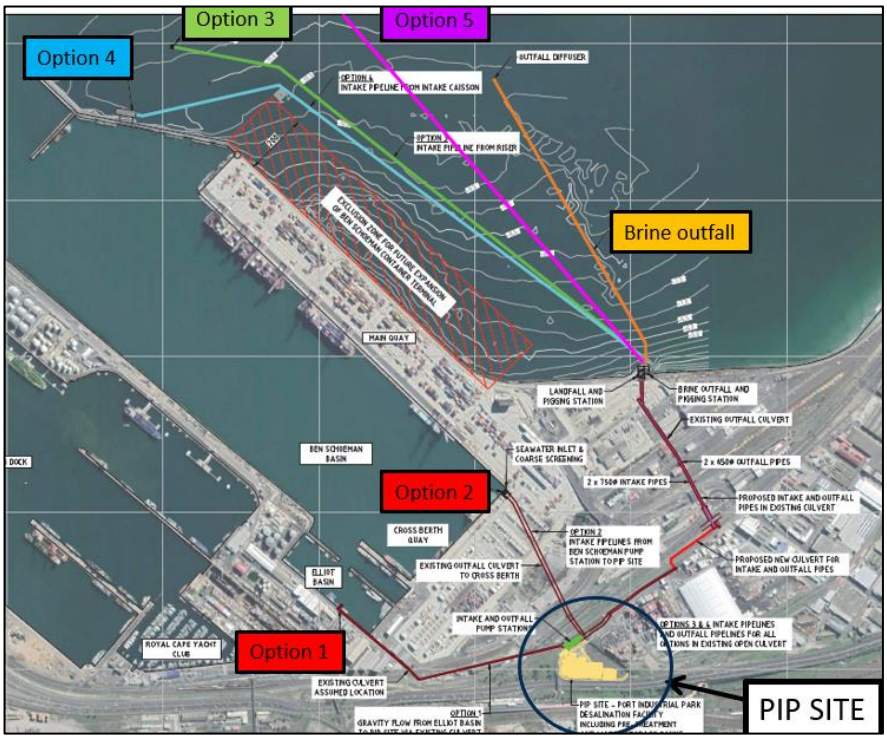

Figure 14 Intake options for proposed desalination site.

The transaction advisors considered the viability of the proposed site and compared it to one of the sites planned for the Adaptable Programme. After which, they reviewed the various mechanisms than can be used to implement this scheme and assessed the City's internal capacity to implement and operate the Desalination Plant in terms of Section 78(1) of the Municipal Systems Act (MSA).

The finding of the Section 78(1) assessment were shared with Council in March 2024 and Council granted approval in terms of Section 78(2) of the MSA to proceed with a detailed feasibility study of alternative options for the implementation and operation of the City's first Permanent Desalination Plant (in compliance with Section 78(3) of the MSA). The transaction advisor is currently busy with this detailed feasibility study of the alternative options (including Public Private Partnership). The detailed feasibility study also includes a financial assessment of the different implementation mechanisms. Should the project be implemented as a PPP the timelines need to be finalised and this may impact on the target dates

The environmental impact assessment process has been initiated, and the project remains on track to deliver approximately 70 mega litres per day by 2030.

4.4 Improved management of the water supply system

The Water Strategy committed the City to investing in several initiatives that would improve resilience, improve decision-making, ensure water quality, and ensure a new relationship with water is realised. This section proved brief updates on a selection of these initiatives.

4.4.1 Alien Invasive Plants

Clearing alien invasive plants remains a cost-effective and sustainable method for building resilience and improving Cape Town's water security. Further, it has proven social, economic, and environmental benefits. The business case and background to the City's investment in the clearance of alien invasive plants can be found in the Water Strategy (2019)[9], Water Outlook (2022)[10], and Water Outlook (2023)[11].

In 2021, the City invested R50 million over 2 years through the Greater Cape Town Water Fund and in light of the success in clearing alien invasive plants in the catchments supplying Cape Town, the City committed another R25 million to continue the clearing efforts in the 2023/2024 Financial Year. This will continue in the 2024/2025 and 2025/2026 Financial years. This commitment demonstrates the City's commitment to ensuring the proper management of the catchments supplying Cape Town.

Figure 15: High altitude sites requiring the clearance of Alien Invasive Plants (photo© Roshni Lodhia)

[9] The 2019 Water Strategy is available online: Click here

[10] The Water Outlook 2022 is available online: Click here

[11] The Water Outlook 2023 is available online: Click here

4.4.2 Decision Support System (DSS)

The DSS is designed to support decision-making for Bulk Water operations in Cape Town. It integrates data from various sources to provide a holistic view of Cape Town's Water Supply system from the regional to the site scale. Since its first implementation three (3) years ago the system has been developed on an ongoing basis. Key functionalities of the DSS include:

- **Data Handling**: The system can handle data from diverse sources, including real-time data from SCADA systems, manually captured operational data, and scientific analysis results.
- **Model Integration**: The DSS integrates with hydraulic networks, water resource, and groundwater models. This allows for real-time and forecast simulations and scenario planning.
- **Reporting and Analytics**: The system generates reports and facilitates business intelligence tasks to support informed decision-making.
- **Notification Pipelines**: The DSS can trigger alerts and notifications based on pre-defined conditions.
- **Infield Data Collection**: Applications have been developed internally to allow for the capturing and analysis of data as well as to streamline business processes. These include a metering application, an infrastructure assessment and reporting application, a dam safety application etc.

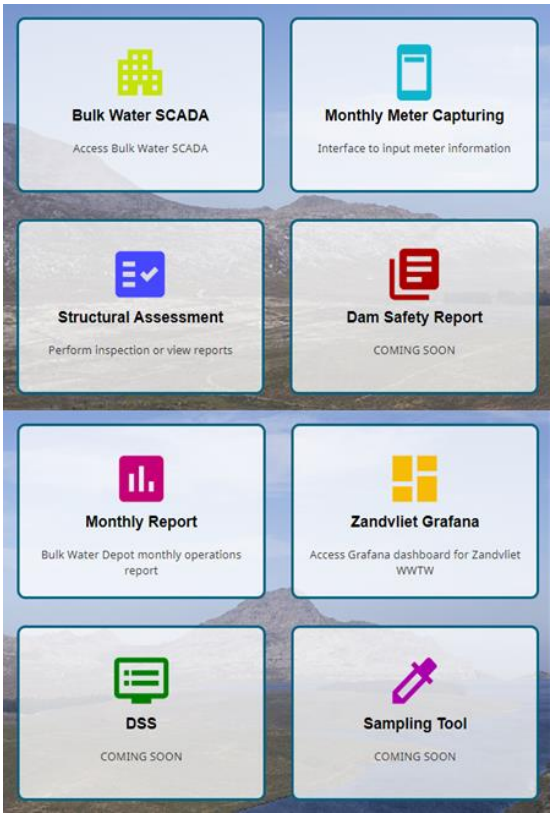

Figure 16 Selection of tools included in the Decision Support System

- **Recent Development**: Addition of an online logbook, integration across business units, incorporation of a Chabot for querying data in real time, and the use of Business Intelligence software for analysis of Asset information.

These functionalities make the DSS a valuable tool for monitoring Critical Control Points (CCPs) throughout the water value chain. By integrating real-time and historical data, the DSS can support ongoing compliance with water quality standards through improved decision-making and business efficiency.

The system is intentionally designed to be, as far as possible, open architecture, adaptable and scalable. This will help to ensure the DSS remains aligned with evolving business needs and technological advancements.

4.4.3 Future Water Demand study

The 'Future Water Demand Study', described in the Water Outlook (2023), analysed a scenario approach based on 'possible, plausible, probable and preferable' demand scenarios to inform operational planning and long-term water resource planning. The Study highlighted the future becoming increasingly more volatile, uncertain, complex, and ambiguous (VUCA)[12], and the future that needs to be planned for is far more uncertain than traditional methods allow for. Developments through digitalisation, big data, artificial intelligence, (de) globalisation, terrorism, financial crises, climate change and global shifts in power increased volatility, uncertainty, complexity, and ambiguity that exists in the world.

The first stage of the investigation concluded with a tool that allowed for:

- Modelling of future demand scenarios for the City in an increasingly VUCA environment for each of the city's subzones
- The model has been developed to calculate water demands for the following three pre-set scenarios per subzone that are considered plausible future scenario.
- The model has been developed so that the curtailment potential is calculated for each of the three scenarios described above. The curtailment potential is a crucial operational tool for the management of demand during times of water demand constraint.

It is anticipated that going forward the tool will be utilised to undertake a City wide analysis to better inform master planning, and integrated into the Water DSS to ensure near real time updates of demand forecasts to inform operations. The modelling tool has the potential to help with understanding Non-Revenue Water and will inform the Bulk Water Master Plan.

[12] More information on VUCA can be found online: Click Here

4.4.4 ISO 22000 Accreditation

The City of Cape Town's Bulk Water Branch continues to actively pursue continuous improvement in water quality systems. On World Quality Day, three of its twelve Water Treatment Plants (WTPs) were awarded ISO 22000 certification by the South African Bureau of Standards (SABS) for. These plants are:

- **Brooklands WTP**: Situated within the Cape Peninsula Mountains, this WTP was constructed in 1974 with a design capacity of 5.2 million litres per day (Ml/d).
- **Blackheath WTP**: Located in the western Saxenberg agricultural area, this WTP was commissioned in 1983 and has a design capacity of 430 Ml/d.
- **Voëlvlei WTP**: Established in 1972 within the Cape Nature Reserve, this WTP has a design capacity of 270 Ml/d.

Figure 17 Voelvlei Water Treatment Plant Staff

Figure 18 Blackheath Water Treatment Plant Staff

Figure 19 Brooklands Water Treatment Plant Staff

This internationally recognised standard is employed by organisations within the food industry to ensure consistent control over manufacturing processes, adherence to quality and safety standards, and compliance with relevant regulations. The ISO 22000 standard complements a suite of existing management standards already implemented by the WSD. These include ISO 9001, and achieving Blue Drop Status – Where Faure Water Treatment Plant received the highest Technical Score in the recent assessment. Achieving these standards sets an important benchmark as the City progresses towards implementing advanced water treatment (desalination and reuse).

5 Update on Adaptable Water Augmentation Programme

The Council Approved Water Strategy (2019)[13] set the goal for Cape Town to develop a new relationship with water in response to the drought. It states: "*It's time for a new approach, one that takes our water management into the next generation and ensures that it keeps flowing in the future for generations to come. We must make decisions that have the community in mind. Everything the City does must help every citizen, especially the most vulnerable.*"

The Water Strategy also committed the Water and Sanitation Department to developing 300 mega-litres a day of new capacity from diverse water resources before 2030 – the "Committed Programme". As highlighted in Section 4, the Directorate is on track to achieve this target by 2030. However, planning has begun for the next phase of infrastructure – the Adaptable Programme – which will further diversify the City's water resources and enhance its resilience to future droughts. This is being achieved through various key studies of the feasibility of specific schemes (to ascertain whether they are viable) as well as the review of the Bulk Water Master Plan, which focuses on integrating the individual schemes with the bulk water distribution and storage system.

5.1 Bulk Water Master Plan

The "Bulk Water Master Plan" was last updated in 2015 before the drought. Since 2015, several planning variables have changed, including the availability of water resources, the diversity of planned water resources, the spatial and temporal distribution of water demand, and the economic pressures facing South Africa. The 2024 "Bulk Water Masterplan", will consolidate three (3) years of detailed analysis of the bulk water supply system, incorporating the Committed and Adaptable Augmentation Programmes to develop the most robust bulk water supply system possible.

The 2024 "Bulk Water Masterplan" has identified several important including, amongst others, the following: a need to optimise existing water treatment plants; the need to plan for refurbishing bulk pipelines and the addition of strategic bulk pipelines; the need to incorporate infrastructure that adds to the supply system's resilience to shocks and stresses; and that in future the majority of resources will likely be from desalination or water reuse. Each of these components are discussed below.

[13] The 2019 Water Strategy is available online: Click here

5.1.1 Optimising Existing Water Treatment Plants (WTWs)

Hydraulic modelling conducted for the study emphasises the importance of maximising the overall system capacity by optimising existing water treatment plants as the efficiency of operations will significantly impact future infrastructure development decisions. Currently due to several reasons the available water treatment capacity is approximately 75% of the design capacity of 1600 mega litres a day. As noted in Section 3.3, the Bulk Water Branch is embarking on an 'Infrastructure Stability Programme' to ensure all existing plants can operate at their design capacity. If this programme had not been initiated or is not followed through, the lower-than-anticipated water treatment capacities would have necessitated the earlier implementation of alternative water supply options and water resource development.

5.1.2 Bulk Water Pipeline Network

Existing bulk water pipelines are projected to have sufficient capacity to meet anticipated water demands until at least 2035. However, the aging bulk water pipeline network, where some pipelines are over 100 years old requires refurbishment or replacement in the short to medium term. The most critical pipelines identified for refurbishment include the bulk pipelines from the Steenbras Water Treatment Plant, Voëlvlei pipeline, and several other sections of Bulk pipeline.

The feasibility of refurbishing these bulk water pipelines is contingent upon alternative water supplies' availability and the possibility of temporarily taking pipelines out of service. For this to happen, all water treatment plants must be able to operate at their design capacities (Sections 3.3 and 5.1.1) so that demand can be shifted and areas supplied via alternative routes, which may place demand on different water treatment plants.

Beyond 2035, most new pipeline recommendations are associated with securing additional water sources.

5.1.3 Desalination and Water Reuse Strategies

The Bulk Water Master Plan highlights that non-surface water options will dominate future water resources – particularly desalination and water reuse. The master plan assessing possible desalination sites on the West Coast, including Melkbosstrand and Witzands. This assessment includes the requirements for additional infrastructure (Reservoirs, pipelines and pump stations) and what benefits each of the locations offer in terms of scalability and resilience for the City's bulk water supply system. Furthermore, and based on the outcomes of the Strategic Water Reuse Study, options for reuse are also being assessed.

5.1.4 Enhancing System Resilience

Predicting water demand and availability becomes particularly challenging during periods of high volatility. In Cape Town's case, recent experiences like urbanisation and the post-drought (2015-2018) rebound in water consumption present unique challenges. In response to this uncertainty, the Bulk Water Master Plan has explored a broad range of options, including options that will add resilience to the system. While the Bulk Water Master Plan is due to conclude by 30 June 2024, current options which add resilience to Cape Town's bulk water supply include, amongst others, the following:

- Enlargement of the Blackheath Upper Reservoir
- Addition of a reservoir linked to Steenbras Water Treatment Plant, possibly within the Heldeberg water supply area
- Delineation of a Northern Water Supply zone, including a link pipeline between the Wemmershoek and Voelvlei pipelines and a new Windmeul reservoir.

Several key factors, including future water demand projections and the optimisation of existing Water Treatment Works operations, will heavily influence the selection of future bulk water infrastructure projects. Continuous monitoring and analysis of these factors will be crucial for guiding future decision-making processes.

5.2 Status of potential schemes

The Water Outlook 2023[14] highlighted that various schemes are under investigation as part of the Adaptable Augmentation Programme (schemes being scheduled for implementation after 2030). These investigations feed into the National Department of Water and Sanitation's Reconciliation process which reviews further schemes and aims to ensure that all users in the Western Cape Water Supply System have a sustainable supply of water.

While many of these projects are still at the feasibility stage and may take as long as 10-years before they are implemented, it is critical from a long-term infrastructure and financial planning perspective that these studies are undertaken and options that are feasible for implementation identified so that planning and design of these schemes can begin.

This section highlights the outcome of two (2) feasibility studies that have been concluded.

5.2.1 Lourens River Pre-feasibility study

In 2002, the City initiated an Integrated Water Resource Planning Study to investigate alternative options to meet the future demand for water in the Cape Metropolitan Area. The scope of the study included the investigation of the Lourens River Diversion Scheme (LRDS) as a potential water supply option. Given the significant development in the catchment area over the last 20 years and in line with "*diversification of sources and adaptability*" as promoted in the Water Strategy (2019), the City commissioned a study to review the feasibility of the Lourens River Diversion Scheme (LRDS).

The review indicated a reduced yield from the scheme for the various alternative design options, and that the yield of the scheme is highly sensitive to the Environmental Water Requirements (EWR). The current viability of the scheme is, in part, dependent on the EWR. The study has recommended further investigations including more detailed long-term monitoring of water quality and sediment loads while queries around the EWR and the modelling thereof are resolved.

[14] The Water Outlook 2023 is available online: Click here

5.2.2 Strategic Water Reuse Study

The City remains committed to maximizing the reuse of wastewater to meet current and future water demands. This is in keeping with the City's objective of creating a water-sensitive city that seeks to maximize integration of the urban water cycle that both builds resilience and protects Cape Town's sensitive natural ecosystems. Water reuse offers significant potential for helping to achieve these goals.

The City therefore initiated The Water Reuse Strategic Study (the Study). This Study is intended to inform the Adaptable Augmentation Programme. The Study's main objective is to assess the various other water reuse opportunities available to the City and to develop a strategy for the adoption of water reuse at the City. It aims to identify potential water reuse schemes at the pre-feasibility stages for further refinement.

Thus far the Study has evaluated various the potential for Direct Potable Reuse (DPR) and Indirect Potable Reuse (IPR). It has highlighted that ten (10) sites have potential for reuse, while a further 16 were excluded due to the high proportion of industrial influent; the WWTWs are too small to be a viable source (2.5 ML/d capacity); there is no available surplus effluent (i.e., all treated effluent already committed to other uses).

The study has also highlighted the need for the City needs to balance the demand for treated effluent for non-potable use and using the treated effluent as a source water for advanced water treatment at an advanced water treatment plant.

Figure 20 Overview of WWTW's identified as potential sites for reuse (IPR and DPR) – (Preliminary)

6 Cape Town Water Outlook

6.1 Update of Water Strategy

The City of Cape Town annually reviews the long-term water balance between available supply and projected water demand. Table 1 provides the latest timing, and Figure 21 shows the water balance as of March 2024. The actual demand has fairly closely followed the projected "bounce-back" curve post the low demands during the recent drought, albeit over a longer period. Section 2.2 highlighted that there is uncertainty as to whether the demand will continue to rebound, or the increase in demand is purely reflective of base water demand. If the growth in demand does not slow in the next Financial Year, and inflect onto the low demand curve it will be necessary to choose between: bringing schemes forward with the associated affordability concerns, reducing the targeted assurance of supply, reducing the allowance for climate change, or a combination of these measures or imposing low level restrictions earlier and possibly more often. Figure 21 demonstrates this clearly with the low demand curve just above the available supply when plotted assuming a 1 in 200-year assurance of supply and a 25% reduction in yield due to climate change – as per the Water Strategy (2019). Figure 21 further demonstrates (see circles in purple) that for two period, should demand exceed the low demand curve there may be a shortfall in supply.

Table 1: City of Cape Town New Water Programme

Description	Water Strategy	Revision 3 (Nov 2020)	Revision5 (Nov 2023)	Revision 5 Capacity (Ml/d)
Clearing Invasive Alien Plants	2019	20-Jul	26-Jun	30
Table Mountain Steenbras P1	2020	20-Jul	23-Jun	25
Table Mountain Nuweberg P2	2022	26-Dec	Jun-40	15
Table Mountain Groenlandberg P3	2022	28-Jan	Jun-40	12
CFA Strandfontein West	2020	21-Jul	24-Jun	6
CFA Hanover Park	2021	24-Jun	26-Jun	4.8
CFA Strandfontein N & E	2021	25-Dec	30-Jun	18
CFA Philippi	2021	26-Jun	27-Dec	7.2
CFA Mitchells Plain WTP	2021	27-Jun	30-Jun	24
Atlantis Aquifer	2021	24-Jun	26-Jun	16
Berg Voelvlei River Augmentation Scheme (BVRAS)	2023	24-Jun	27-Jun	40
Faure New Water Scheme Ph1	2024	26-Jun	29-Dec	70
Desalination Phase1	2026	28-Jun	Feb-30	70

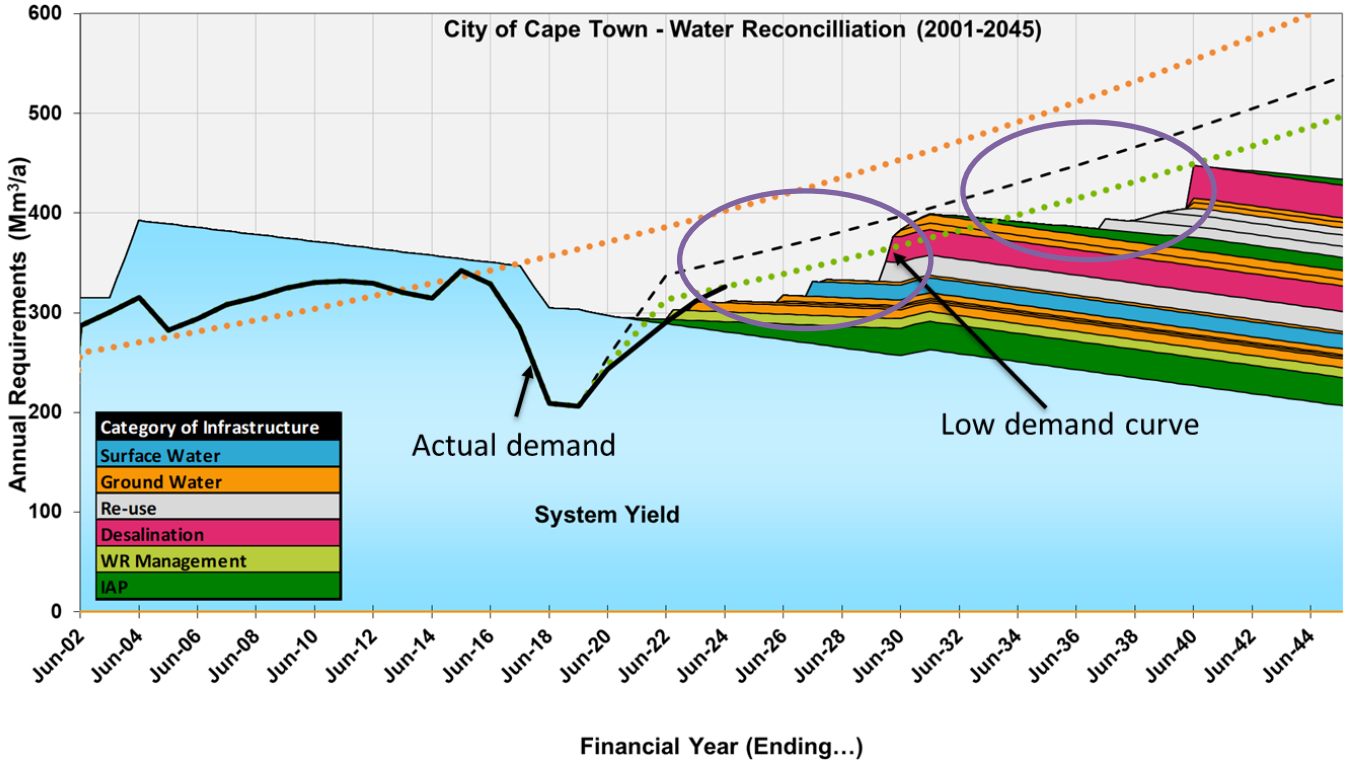

Figure 21: City of Cape Town water balance, including the New Water Programme (as per the Water Strategy with a 1 in 200 year assurance of supply and 90-percentile impact of climate change)

Figure 22, a scenario with a reduced assurance of supply (to the pre-drought level) and the reduced allowance for climate change, indicates that the system is in approximately in balance with the 'average' demand curve. This highlights the balance that needs to be struck between the assumptions and commitments in the Water Strategy and the affordability constraints. It also highlights the importance of Cape Town's focus on reducing water losses (e.g., leaks) to ensure that demand is not artificially high. However, in assessing these risk the City will continue to consider the economic costs that water stress will have on the City. The recently completed 'Hydro-economic Study'[15] conducted by the World Bank highlighted the costs and benefits of how water resources within the Western Cape Water Supply System are managed.

Essentially the City will need to make a decision between risk and affordability and how the City's impact on the Western Cape Water Supply System is managed. This may include imposing low-level restrictions earlier and more frequently to avoid the risks of more severe restrictions.

[15] The Hydro-Economic Study is available online: Click Here

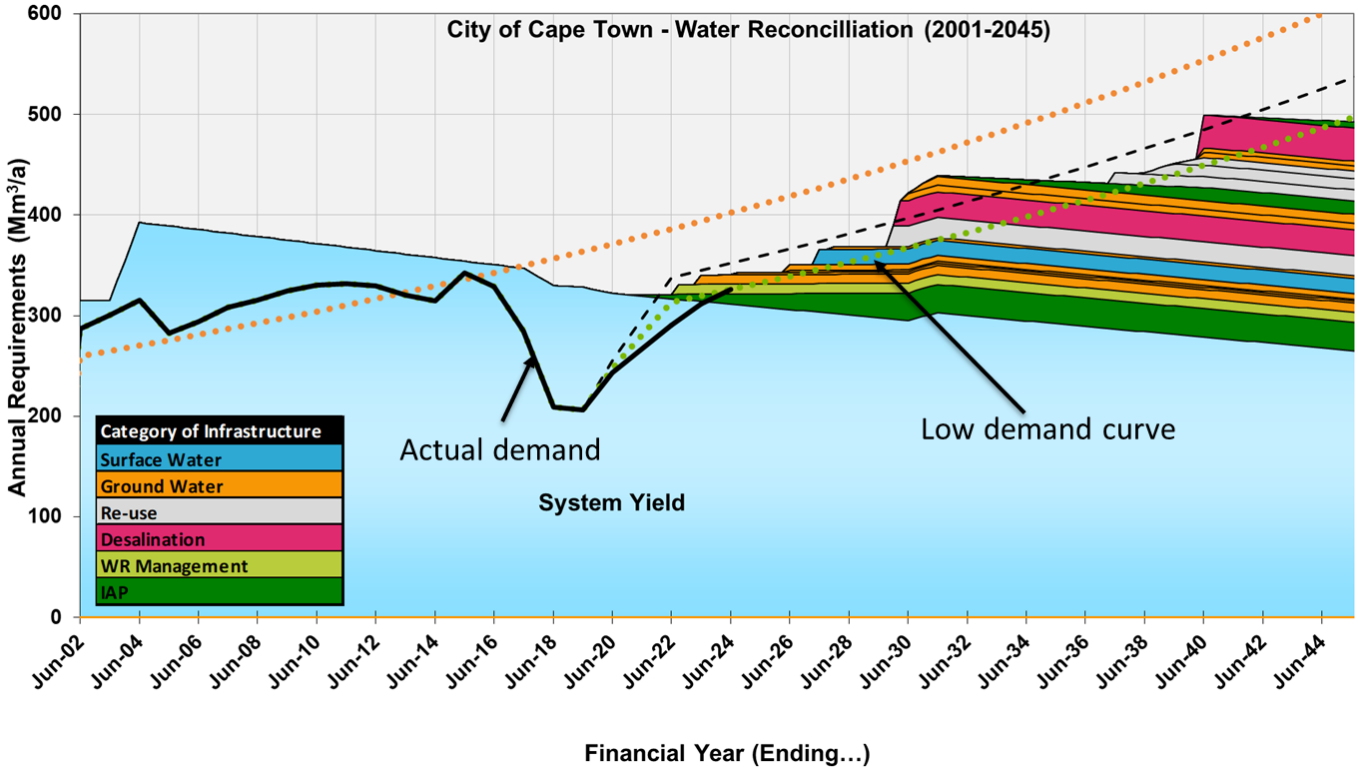

Figure 22: City of Cape Town water balance, including the New Water Programme (with a 1 in 50 year assurance of supply and 50-percentile impact of climate change)

6.2 Risk of Imposing Water Restrictions

The City continues to monitor the risk of restriction and the potential for a new drought cycle compounded by gradual climate change. Should Cape Town experience a step-change in climate, planned water schemes must be accelerated with the associated rapid increase in tariffs (See Section 3.4), to ensure a secure water supply to Cape Town. Further, due to the long timelines for implementation, intensive water conservation and demand management remain vital to ensuring water security.

Should demand continue to increase and exceed the Low Demand Curve the City will need to: bring schemes forward with an increased water tariff (See Section 3.4), reduce the targeted assurance of supply, reduce the allowance for climate change, or a combination of these measures. The risk and severity of possible restrictions will increase unless schemes are brought forward. Furthermore, the City will need to be conservative and ensure restrictions are implemented as early as possible to minimise the severity of restrictions should a drought happen.

Restrictions may also be required in instances of plant malfunctions and breakdowns or due to reduced water treatment plant performance due to declining raw water quality. While measures

are being put in place to mitigate these risks (see Section 3.3) these measure will take several years to show benefit.

In addition, budget constraints linked to affordability may require the imposition of restrictions. This is particularly true in the case of treatment chemicals, electricity, and maintenance, where costs are increasing significantly higher than inflation.

6.3 Conclusions

Based on the forgoing, the following conclusions are drawn:

- Delays in implementing the New Water Programme will increase the probability of imposing water restrictions, and the City will not deliver 300 mega liters a day by 2030.
- The likelihood of restrictions, in the short to medium term exists due to concerns surrounding aging infrastructure and possible to changes in raw water quality. This risk will take several years to address.
- The growth in water demand needs to be carefully monitored over the next 12 months. Should demand growth not reduce, schemes will need to be brought forward, or adjustments will need to be made to the targeted assurance of supply and the allowance for climate change and the implementation of the Adaptable Programme adjusted accordingly.
- Water Reuse and Desalination are critical to ensure long term water security of Cape Town. The City will continue to ensure implementation readiness for these schemes.
    - Based on the outcome of the Strategic Water Reuse Study further feasibility studies will need to be undertaken for specific schemes.
    - Work should continue on investigations into the feasibility of desalination at the additional sites identified for future development.
- Balancing water security and affordability requires careful management and further analysis.